E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Trimble County*
Unit: *1*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation

Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***No new technology is required***. *Existing SCR can meet the new NOx compliance limit of 0.11 lb/MBtu*	☐ Yes ☐ No
SO_2	***No new technology is required***. *Existing WFGD can meet the new SO_2 compliance limit of 0.25 lb/MBtu*	☐ Yes ☐ No
PM	***No new technology is required*** *for PM as current ESP is capable of meeting 0.03 lb/MBTU emissions.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU* *(Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new full size PJFF.***	☐ Yes ☐ No
HCl	***No new technology selected.*** *Existing WFGD can meet the new HCl compliance limit of 0.002 lb/MBtu*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection*** *and new Pulse Jet Fabric Filter (PJFF) required to meet the compliance requirements.*	☐ Yes ☐ No

Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

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E.ON Comments:

Under the "Special Considerations" section for Hg, B&V discusses the use of adding a booster fan or upgrading the ID fan. The plant would prefer to upgrade the existing ID Fan motors which will need to be replaced or rewound. Modifications will need to be made to the ID Fans which may include replacement of the fans.

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Plant: ***Trimble County***
Unit: ***1***

Pollutant: NO_x

Feasible Control Options:

- **No new NO_x control technology is required**. The unit is currently equipped with state of the art SCR that can meet future target NOx emissions level of 0.11 lb/MBtu.

Pollutant: SO_2

Feasible Control Options:

- **No new SO_2 control technology is required**. The unit is currently equipped with wet FGD technology that can meet future target SO2 emissions level of 0.25 lb/MBtu.

Pollutant: Particulate (PM)

Feasible Control Options:

- **No new PM control technology is required** to meet the 0.03 lb/MBTU emissions limit.

Special Considerations:

- A new PJFF will be required to meet mercury control using PAC. The existing ESP alone will not be capable of meeting the mercury compliance emissions using PAC.

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- *Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.*

Pollutant: Mercury (Hg)

Feasible Control Options:

- **New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF** can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a

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continuous basis and hence is the most feasible control technology. The existing cold-side dry ESP will not be capable to removing 90% mercury with PAC injection and hence not recommended for cost considerations.

Special Considerations:

- Full size PJFF.
- *PAC to be injected downstream of the existing ESP but upstream of new PJFF.*
- <u>Location</u>: A PJFF would be required downstream of the PAC injection system.
- <u>Real Estate Constraints</u> – No space is available at grade level to install the new PJFF. Therefore the new PJFF will need to be constructed at an elevation above grade level, probably above the existing ESP with Booster fan or ID fan upgrades.
- <u>Construction Issues</u> – Electrical manhole and electrical duct banks running underground between the existing ID fans and scrubber inlet duct will need to be avoided or relocated to make real estate available.
    - Array of I-beam structures (currently supporting no equipment) located between the existing ID fans and scrubber inlet needs to be demolished.
    - New PJFF will be installed at a higher elevation needing heavy support columns that need to be landing outside the existing ESP foundations.

Pollutant: Hydrogen Chloride (HCl)

<u>Feasible Control Options</u>:

- **<u>No new control technology is required</u>** as the unit is currently meeting target emission level of 0.002 lb/MBtu HCL emissions with an existing Wet FGD.

Pollutant: Dioxin/Furan

<u>Feasible Control Options</u>:

- The **<u>new PAC injection with new PJFF considered for mercury control</u>** can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

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Plant: *Trimble County*
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Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Green River

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Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *3*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new NO_x compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Circulating Dry Scrubber (CDS) Desulfurization is required*** *to meet the new SO_2 compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) which is part of the CDS technology for SO_2 removal is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU* *(Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu.*	☐ Yes ☐ No
HCl	***New CDS technology*** *can meet the new HCl compliance limit of 0.002 lb/MBtu.*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu.*	☐ Yes ☐ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

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Technology Options

Plant: *Green River*
Unit: *3*

and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- New ID Fans, Air Heater and dry carbon steel Stack required for Unit 3.
- Underground aux electric duct banks need to be avoided during foundations for future AQC equipment.

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Plant: ***Green River***
Unit: ***3***

E.ON Comments:

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Plant: *Green River*
Unit: *3*

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NO_x compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NO_x emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NO_x emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NO_x reduction including future requirements.
- Likely require SO_3 mitigate system.
- New ID fan installation is needed.
- Existing air heater will be demolished and used as SCR ductwork.
- New air heater.
- New economizer bypass will be built
- Location: SCR would be required downstream of the existing economizer and upstream of the new air heater. New air heater to be located straight under the new SCR.

Pollutant: SO_2

Feasible Control Options:

- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:

- Both WFGD and Semi-Dry FGD systems will be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu on a continuous basis on high sulfur fuels. However for small size boilers like Unit 3, it would be economically feasible to build a semi-dry FGD or CDS system than Wet FGD system. The CDS system will offer more operational flexibility compared to the two other technologies when load flexibility is an issue. The CDS technology will incorporate an internal flue

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Plant: *Green River*
Unit: *3*

gas recycle to maintain the lime bed during low load operations. Hence CDS is the most feasible control technology considered for SO_2 reduction based on the size of the unit.

- New ID fan installation is needed.
- Existing ID fans will be demolished
- Location: CDS would be required downstream of the new air heater and upstream of the new ID fans.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold Side Dry ESP
- COHPAC^{TM}.
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation is needed.
- Existing ESP will be retired in place. This will not be demolished. Exhaust gas stream will bypass the existing ESP.
- Location: A new PJFF for Unit 3 will be located downstream of the new CDS and upstream of the new ID fans.
- Existing ID fans will be demolished.
- New Air Heater will be installed straight under the new SCR.

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Plant: ***Green River***
Unit: ***3***

Pollutant: CO

Feasible Control Options:

- ***No feasible and proven technology is available for this type and size of unit*** to meet the 0.02 lb/MBtu emission limit.
- Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1 x 10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing cold-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- A new full size PJFF for Unit 3 is recommended in conjunction with PAC injection.
- PAC to be injected downstream of the new air heater but upstream of CDS FGD system for Unit 3

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:

- WFGD, Semi-Dry FGD, and CDS systems will be able to achieve the new HCl compliance limit of 0.002 lb/MBtu on a continuous basis.
- However, since a new CDS system will be installed for SO_2 control, it will also control HCl. Therefore, no new HCl control technology is required beyond the proposed CDS. The new CDS technology with PJFF will remove the HCl to the compliance levels of 0.002 lb/MBtu.

E.ON US
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Technology Options

Plant: ***Green River***
Unit: ***3***

Pollutant: Dioxin/Furan

Feasible Control Options:

- PAC injection with new CDS and PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

E.ON US
Coal-Fired Fleet Wide
Air Quality Control Technology Assessment
Technology Options

Plant: *Green River*
Unit: *4*

The following AQC control technologies comprise the recommended technologies to control unit pollutant emissions to the targeted emission levels. As summarized on the following pages, the recommended technologies are based on the known technology limitations, future expanding capability, arrangement or site fatal flaws, constructability challenges, unit off-line schedule requirements or site-specific considerations developed or understood during the field work conducted during the week of May 10th, as well as information provided by E.ON. B&V will analyze costs for the one selected/approved technology for each applicable pollutant.

AQC Technology Recommendation		
Pollutant	AQC Equipment	E.ON Approval to Cost*
NO_x	***New Selective Catalytic Reduction (SCR) is required*** *to meet the new* NO_x *compliance limit of 0.11 lb/MBtu.*	☐ Yes ☐ No
SO_2	***New Circulating Dry Scrubber (CDS) Desulfurization is required*** *to meet the new* SO_2 *compliance limit of 0.25 lb/MBtu.*	☐ Yes ☐ No
PM	***New full size Pulse Jet Fabric Filter (PJFF) which is part of the CDS technology for*** SO_2 ***removal is required*** *to meet the new PM compliance limit of 0.03 lb/MBtu.*	☐ Yes ☐ No
CO	***No feasible and proven technology is available.*** *Existing combustion controls cannot meet the new CO compliance limit of 0.02 lb/MBTU (Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu)*	☐ Yes ☐ No
Hg	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new Hg compliance limit of* 1×10^{-6} *lb/MBtu.*	☐ Yes ☐ No
HCl	***New CDS technology*** *can meet the new HCl compliance limit of 0.002 lb/MBtu.*	☐ Yes ☐ No
Dioxin/Furan	***New Powdered Activated Carbon (PAC) Injection required with new CDS and Pulse Jet Fabric Filter (PJFF)*** *to meet the new dioxin/furan compliance limit of* 15×10^{-18} *lb/MBtu.*	☐ Yes ☐ No
Note: If E.ON does not approve a specific technology, an explanation can be included in the following section--comments by E.ON on specific issues regarding control equipment		

E.ON US
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Technology Options

Plant: ***Green River***
Unit: ***4***

and a decision to approve a technology should be described in detail.

E.ON to return written approval and comments sections to B&V.

Special Considerations Summary:

- New ID Fans and dry carbon steel Stack required for Unit 4. Booster fans options to be evaluated.
- Relocate existing power lines and tower.
- Will require demolition of abandoned Unit 1 and Unit 2 ID fans, scrubber and stack to make room for Unit 4 new AQC equipment.

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Air Quality Control Technology Assessment
Technology Options

Plant: ***Green River***
Unit: ***4***

E.ON Comments:

- Under Special Considerations Summary, the Unit 1 and Unit 2 ID fan statement is incorrect. There is only one fan and it is a booster fan that was originally used for the scrubber.
- For the entire station, there is no extra Aux Power. Any estimate has to include and upgrade to that system as the current system cannot handle any additional power requirements.
- For the SCR considerations for Units 3 and 4, the estimate should include new, enamel air heater baskets as discussed during the site visits.
- The estimate should include ductwork replacement as the current ductwork is in poor condition.
- In the Green River Unit 4 template, on page 4 of 7, it should read, "Unit 4" instead of "Unit 3" under the Special Consideration's section.

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Technology Options

Plant: ***Green River***
Unit: ***4***

Pollutant: NO_x

Feasible Control Options:

- Selective Non Catalytic Reduction (SNCR) / Selective Catalytic Reduction (SCR) Hybrid
- Selective Catalytic Reduction (SCR)

Special Considerations:

- SNCR/SCR Hybrid systems may be able to achieve the new NOx compliance limit of 0.11 lb/MBtu but it will not provide a long term consistent solution for NOx emissions less than 0.11 lb/MBtu.
- SCR can consistently achieve NOx emissions of 0.11 lb/MBtu on a continuous basis and has a capability to expand to meet the NOx emissions even lower than 0.11 lb/MBtu. Hence SCR is the most feasible and expandable control technology considered for NOx reduction including future requirements.
- Likely require SO_3 mitigate system.
- New ID fan installation is needed if booster fans do not make sense.
- Existing air heater will be used
- New economizer bypass will be built
- Location: SCR would be required downstream of the existing hot-side ESP and upstream of the existing air heater.

Pollutant: SO_2

Feasible Control Options:

- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:

- Both WFGD and Semi-Dry FGD systems will be able to achieve the new SO_2 compliance limit of 0.25 lb/MBtu on a continuous basis on high sulfur fuels. However for small size boilers like Unit 3, it would be economically feasible to build a semi-dry FGD or CDS system than Wet FGD system. The CDS system will offer more operational flexibility compared to the two other technologies when load flexibility is an issue. The CDS technology will incorporate an internal flue gas recycle to maintain the lime bed during low load operations. Hence CDS is

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Plant: *Green River*
Unit: *4*

the most feasible control technology considered for SO_2 reduction based on the size of the unit.

- New ID fan installation is needed if booster fans do not make sense.
- Existing ID fans will be retired in place if new ID fans are used in lieu of booster fans.
- Location: CDS would be required downstream of the existing air heater and upstream of the new ID fans. Existing ID fans located at higher elevation will either be retired in place if new ID fans are selected or reused when new booster fans are added CDS with new dry carbon steel stack.

Pollutant: Particulate (PM)

Feasible Control Options:

- Cold Side Dry ESP
- COHPAC^{TM}.
- Pulse Jet Fabric Filter (PJFF).

Special Considerations:

- Both dry cold-side ESP and COHPAC combination may be able to achieve the new PM compliance limit of 0.03 lb/MBtu but it is not considered a long term solution for PM emissions less than 0.03 lb/MBtu. However a full size PJFF offers more direct benefits or co-benefits of removing future multi-pollutants using some form of injection upstream when compared to dry ESPs. Hence either ESPs or COHPAC combination is not recommended.
- A full-size PJFF can consistently achieve PM emissions of less than 0.03 lb/MBtu on a continuous basis and has a capability to expand to meet the PM emissions lower than 0.03 lb/MBtu. Hence a full size PJFF is the most feasible and expandable control technology considered for PM reduction including future requirements.
- New ID fan installation is needed if booster fans do not make sense.
- Existing hot side ESP to be kept to minimize the arrangement challenges for new SCR. The existing ESP will remain functional (energized) and used for additional PM filtration.
- Location: A new PJFF for Unit 4 will be located downstream of the new CDS and upstream of the new ID fans.
- Existing ID fans will be retired in place if new ID fans are used in lieu of booster fans.

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Technology Options

Plant: ***Green River***
Unit: ***4***

Pollutant: CO

Feasible Control Options:

- ***<u>No feasible and proven technology is available for this type and size of unit</u>*** to meet the 0.02 lb/MBtu emission limit.
- Note: Please confirm CO emission level is 0.02 and not 0.20 lb/MBtu.

Pollutant: Mercury (Hg)

Feasible Control Options:

- New Powdered Activated Carbon (PAC) Injection in conjunction new PJFF can meet the new Hg compliance limit of 1×10^{-6} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

- The existing hot-side dry ESP will not be capable of removing 90% mercury with PAC injection and hence not recommended for cost considerations.
- Full size PJFF for Unit 4.
- *PAC to be injected downstream of the existing air heater but upstream of CDS FGD system for Unit 4*

Pollutant: Hydrogen Chloride (HCl)

Feasible Control Options:

- Wet Flue Gas Desulfurization (WFGD)
- Semi-Dry Flue Gas Desulfurization (FGD)
- Circulating Dry Scrubber (CDS)

Special Considerations:

- WFGD, Semi-Dry FGD, and CDS systems will be able to achieve the new HCl compliance limit of 0.002 lb/MBtu on a continuous basis.
- However, since a new CDS system will be installed for SO_2 control, it will also control HCl. Therefore, no new HCl control technology is required beyond the proposed CDS. The new CDS technology with PJFF will remove the HCl to the compliance levels of 0.002 lb/MBtu.

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Plant: ***Green River***
Unit: ***4***

Pollutant: Dioxin/Furan

Feasible Control Options:

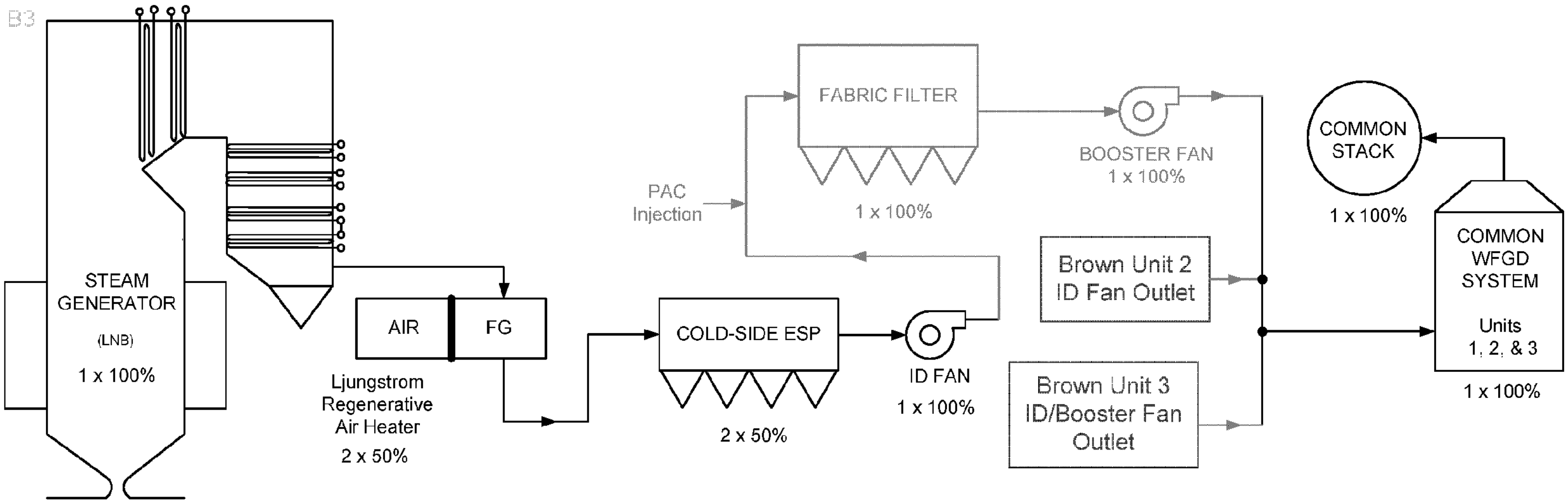
- PAC injection with new CDS and PJFF considered for mercury control can meet the dioxin/furan compliance limit of 15 x 10^{-18} lb/MBtu or lower on a continuous basis and hence is the most feasible control technology.

Special Considerations:

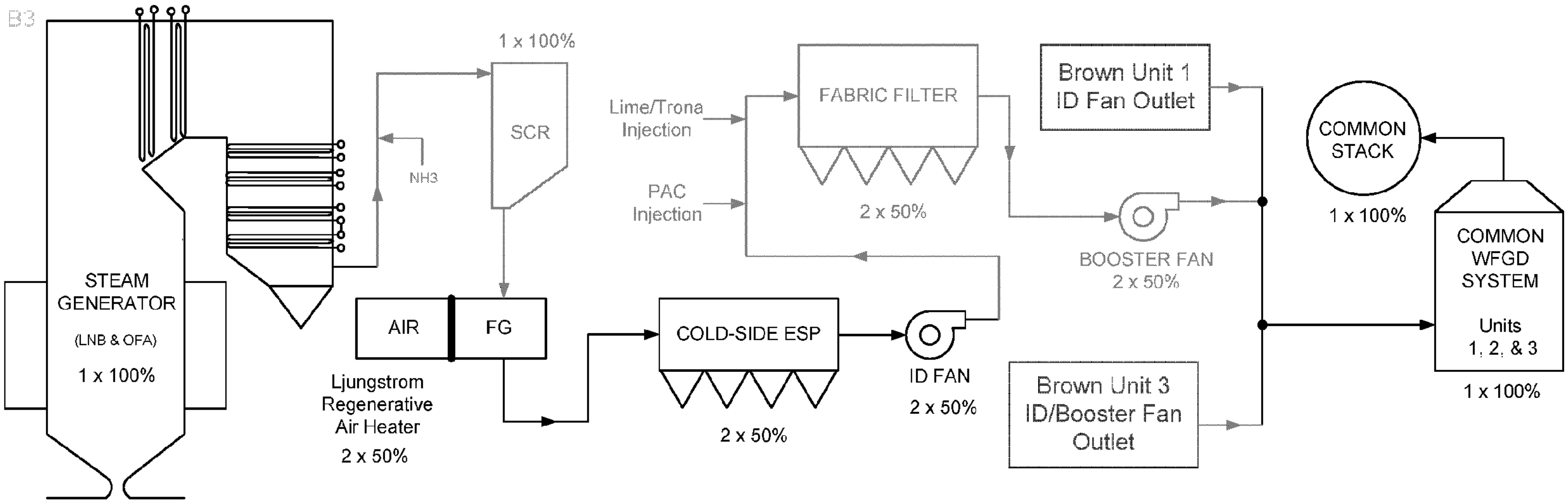
- Dioxin and Furan removal will be a co-benefit with targeted mercury emissions removal and additional PAC consumption beyond mercury removal will be required.

Appendix F
Process Flow Diagrams

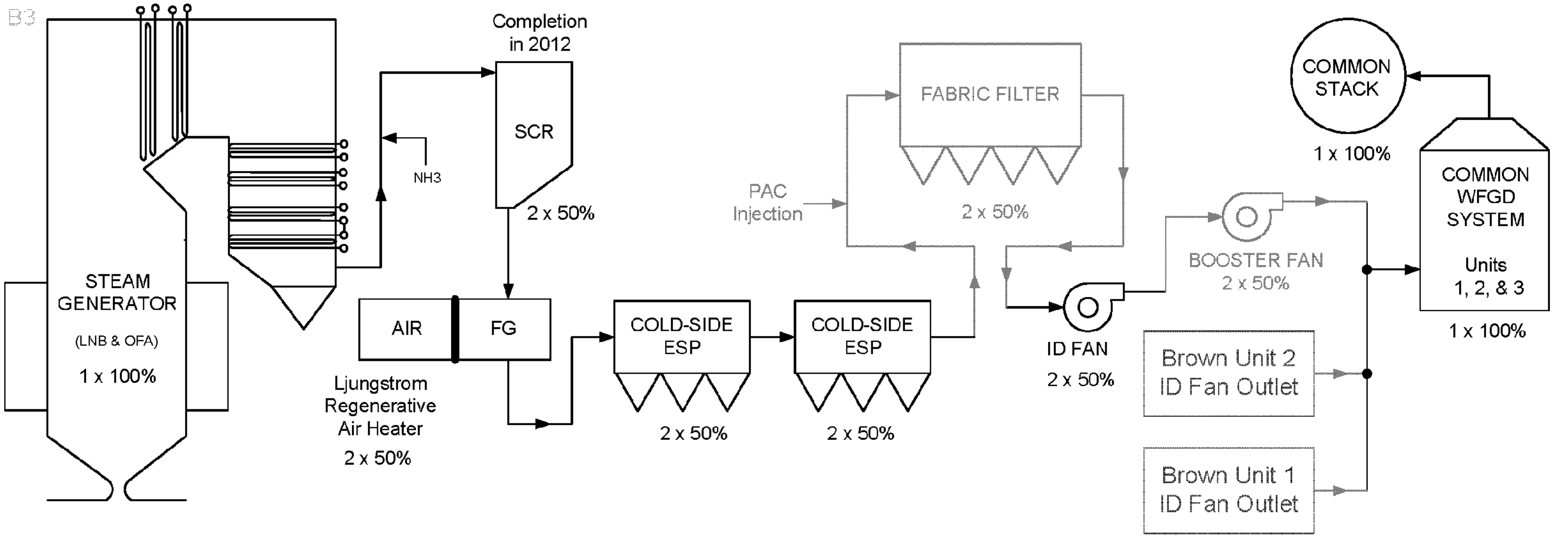
E.W. Brown



Brown Unit 1: Future
110 MW

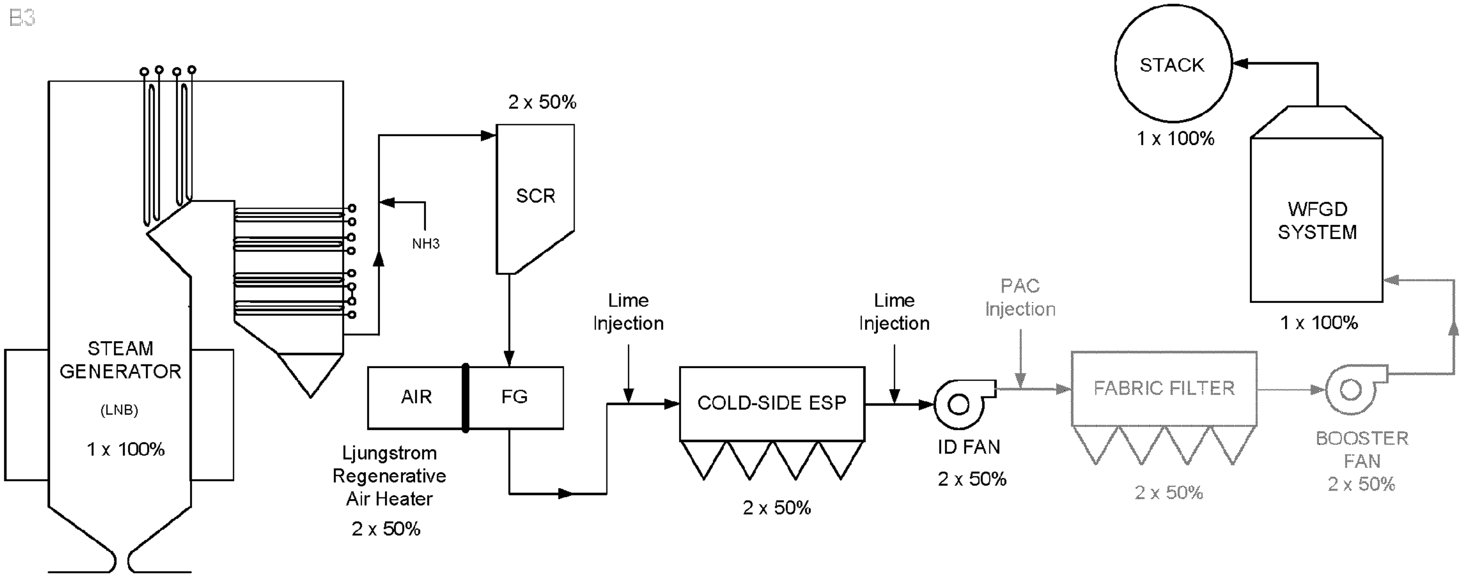


Brown Unit 2: Future
180 MW

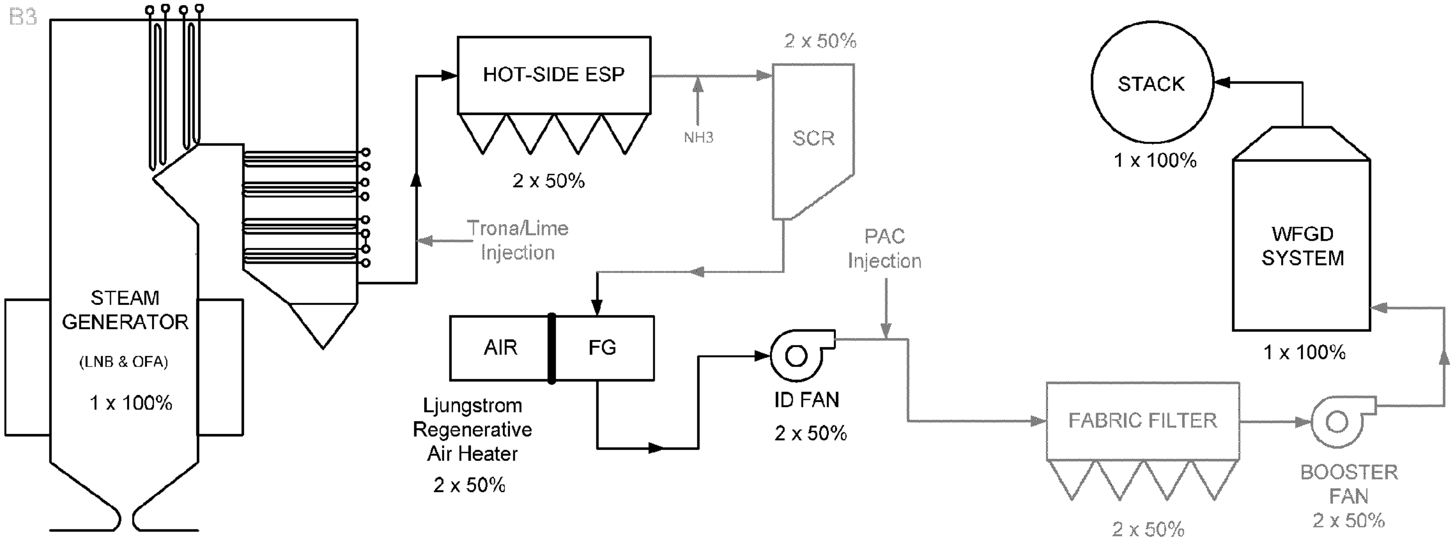


Brown Unit 3: Future
457 MW

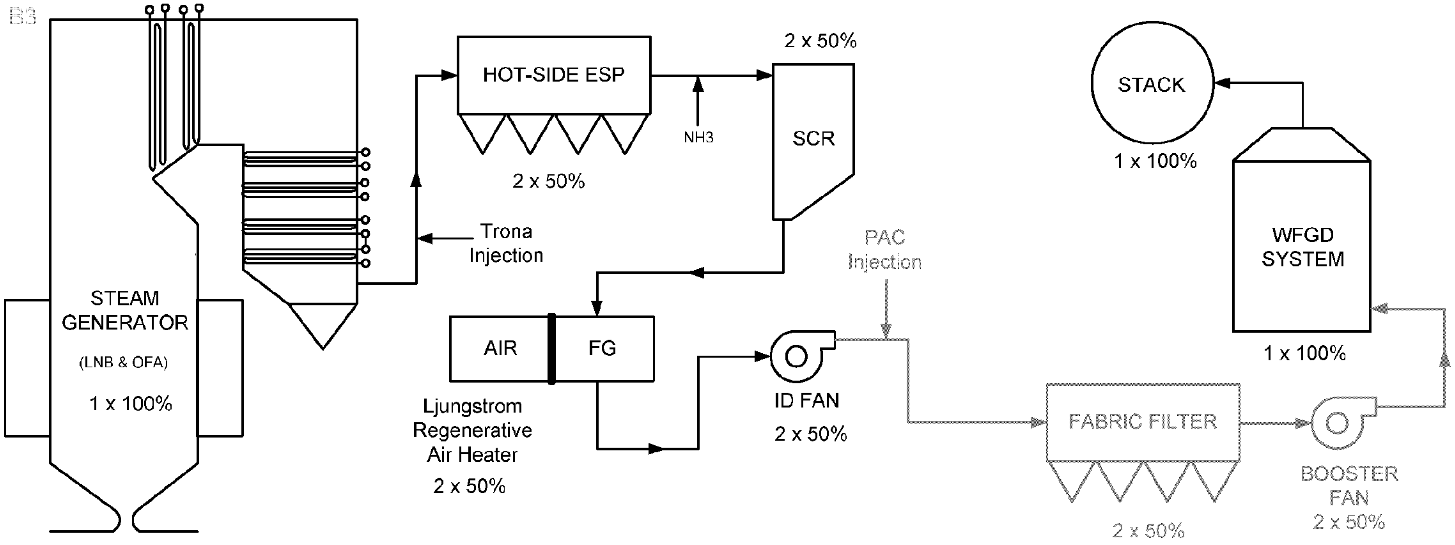
Ghent



Ghent Unit 1: Future

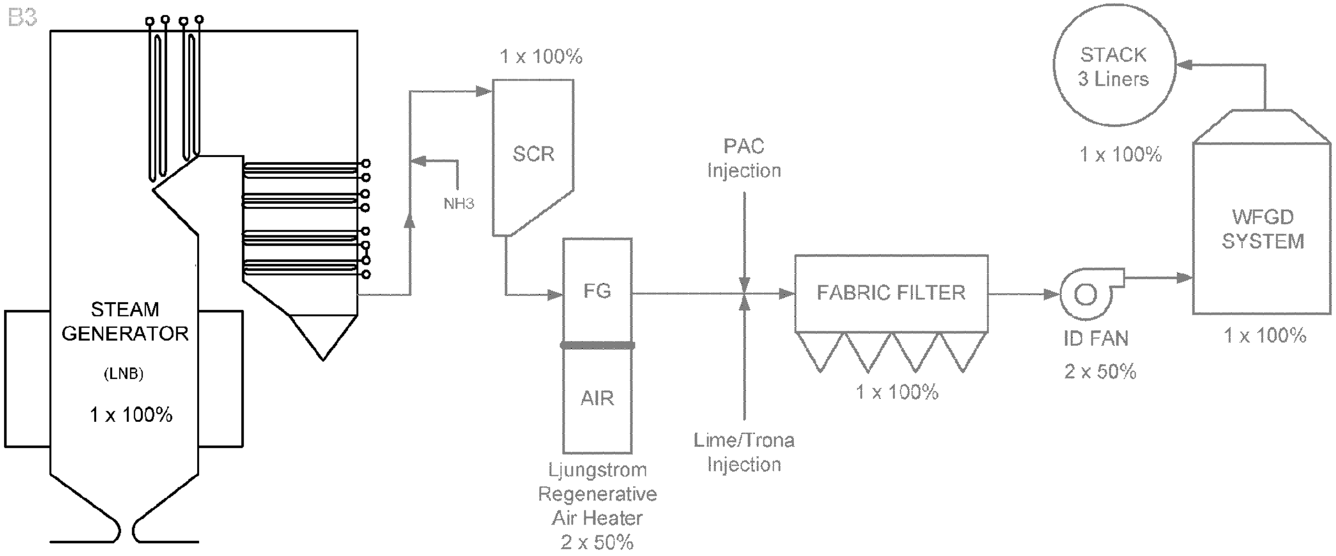


Ghent Unit 2: Future

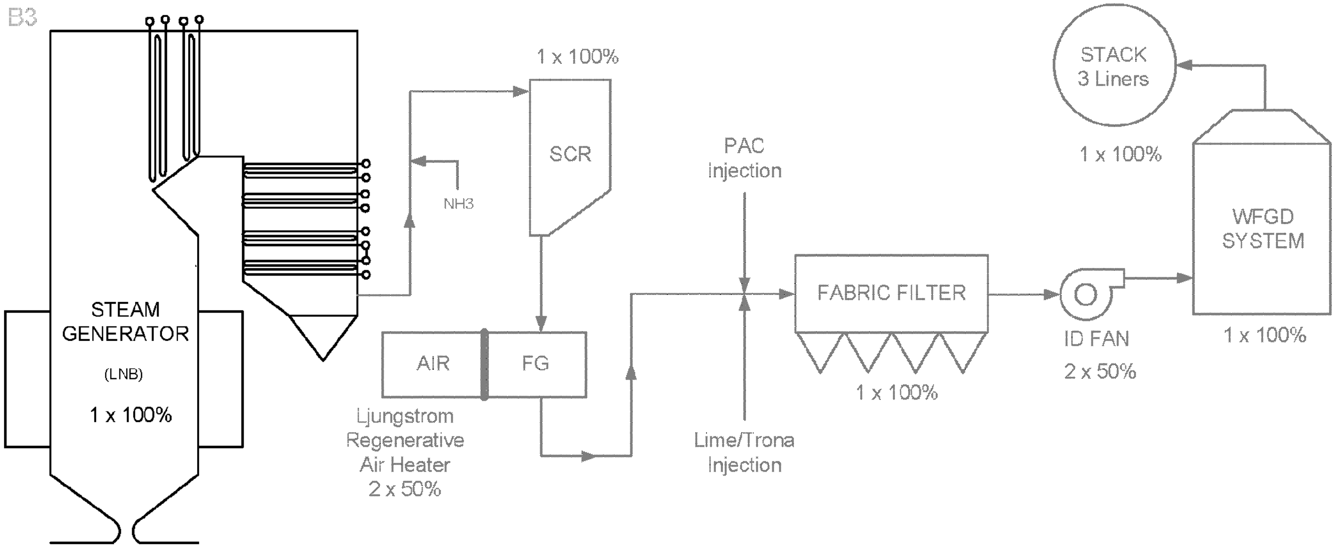


Ghent Unit 3/4: Future

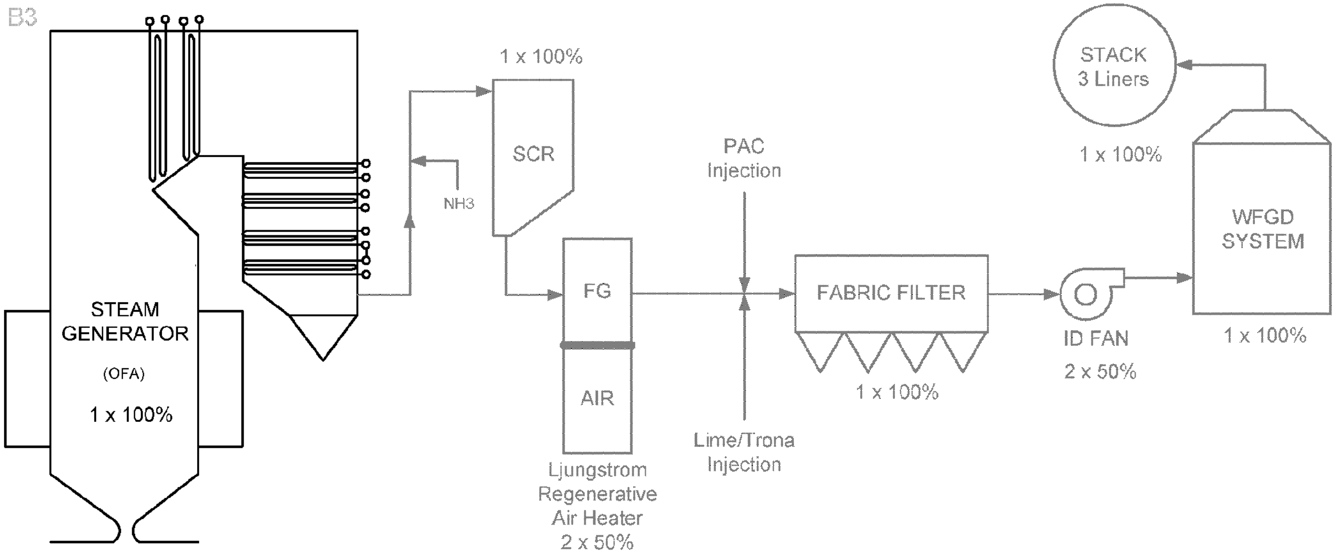
Cane Run



Cane Run Unit 4: Future
168 MW

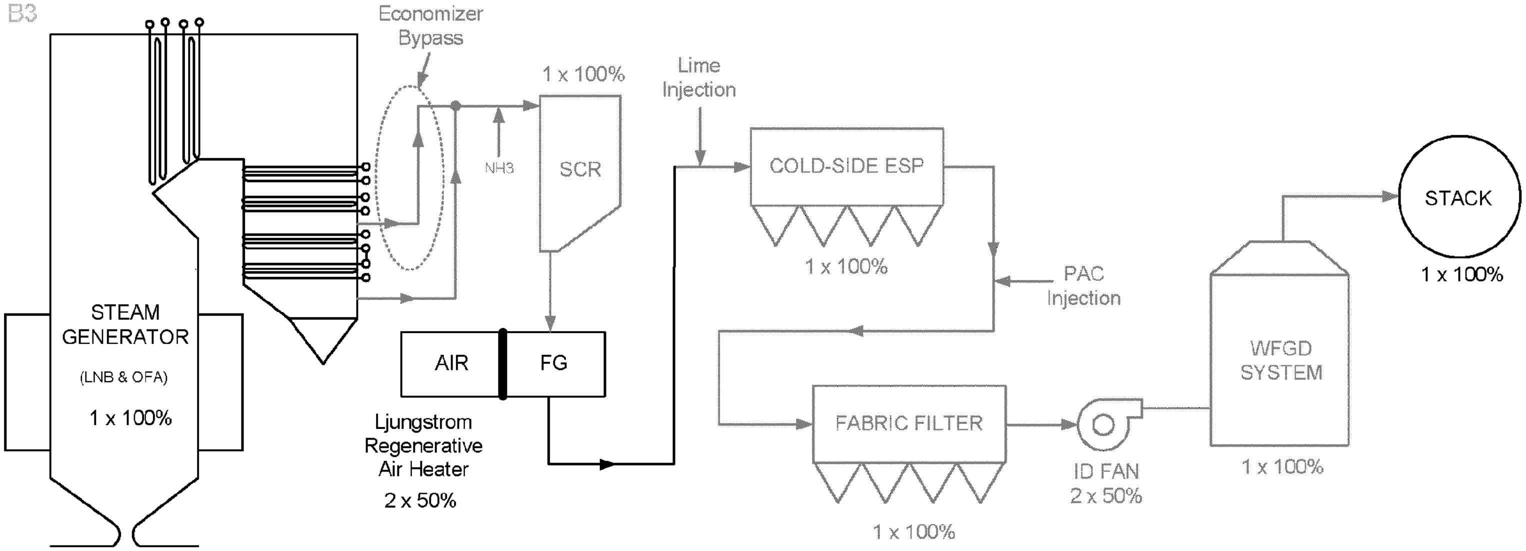


Cane Run Unit 5: Future
181 MW

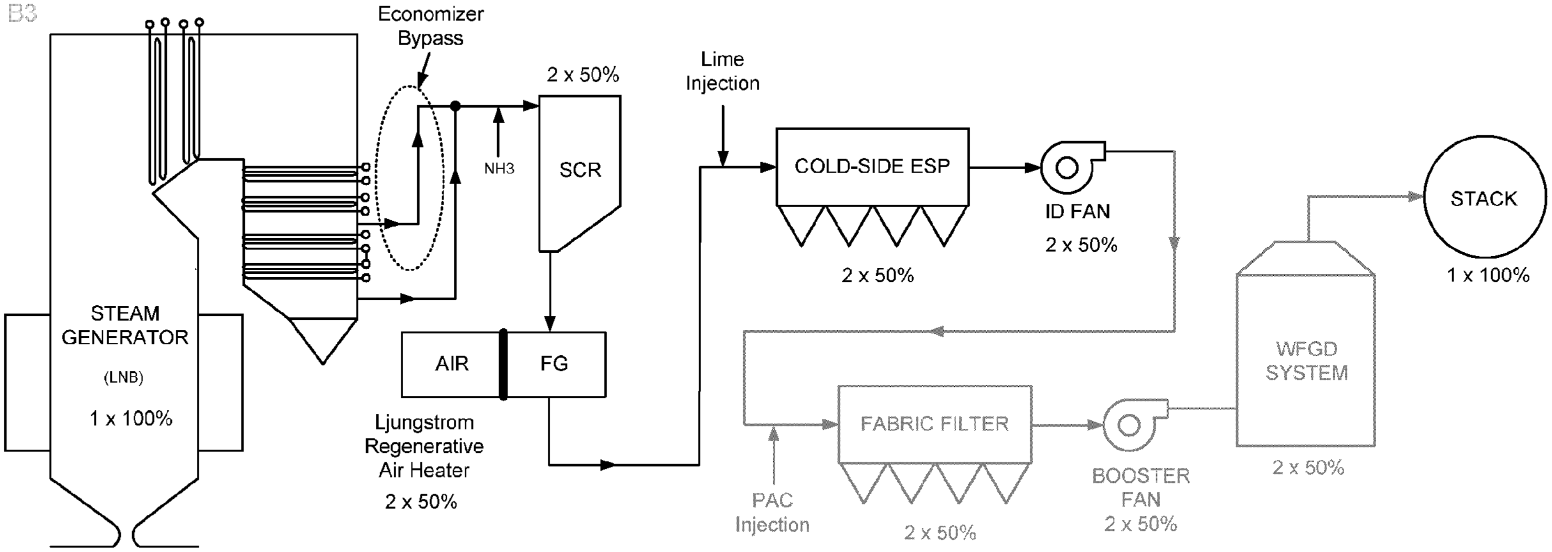


Cane Run Unit 6: Future
261 MW

Mill Creek



Mill Creek Unit 1/2: Future
Unit 1: 330 MW
Unit 2: 330 MW

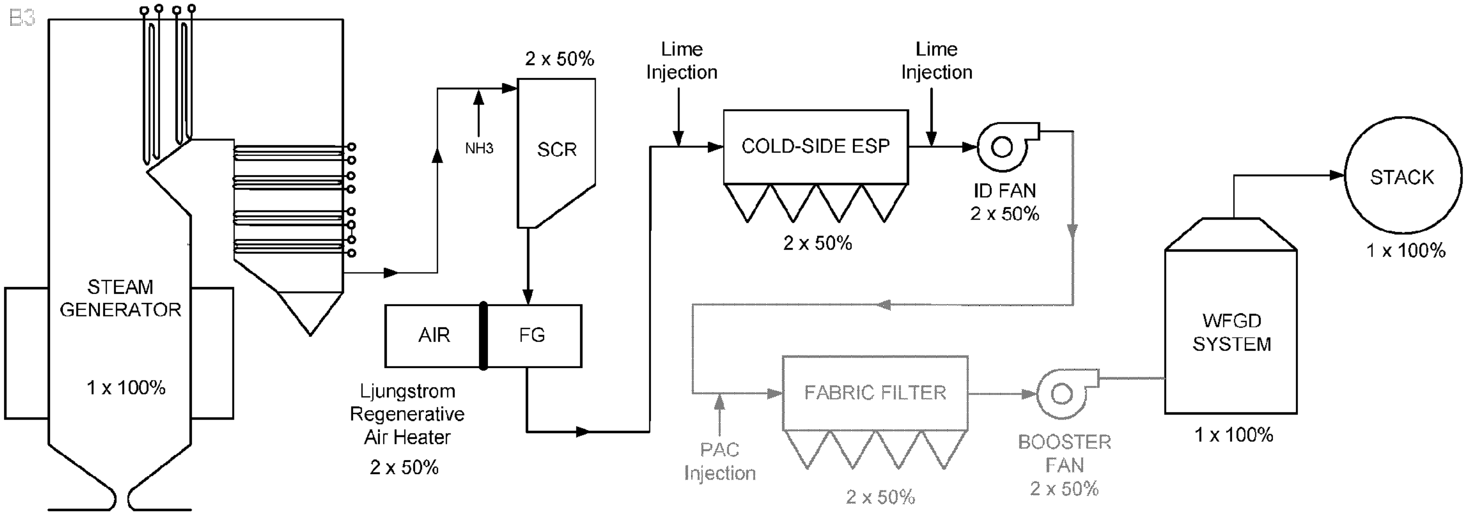


Mill Creek Unit 3/4: Future

Unit 3: 423 MW

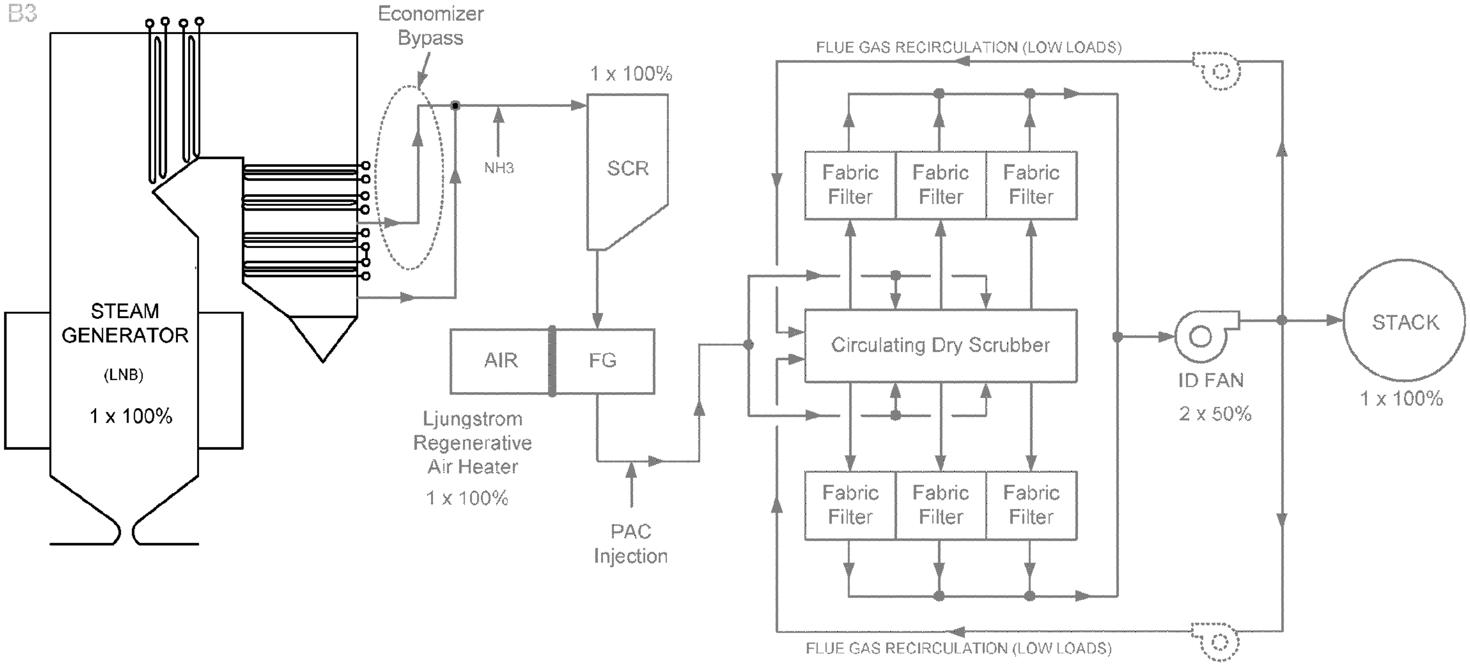
Unit 4: 525 MW

Trimble County

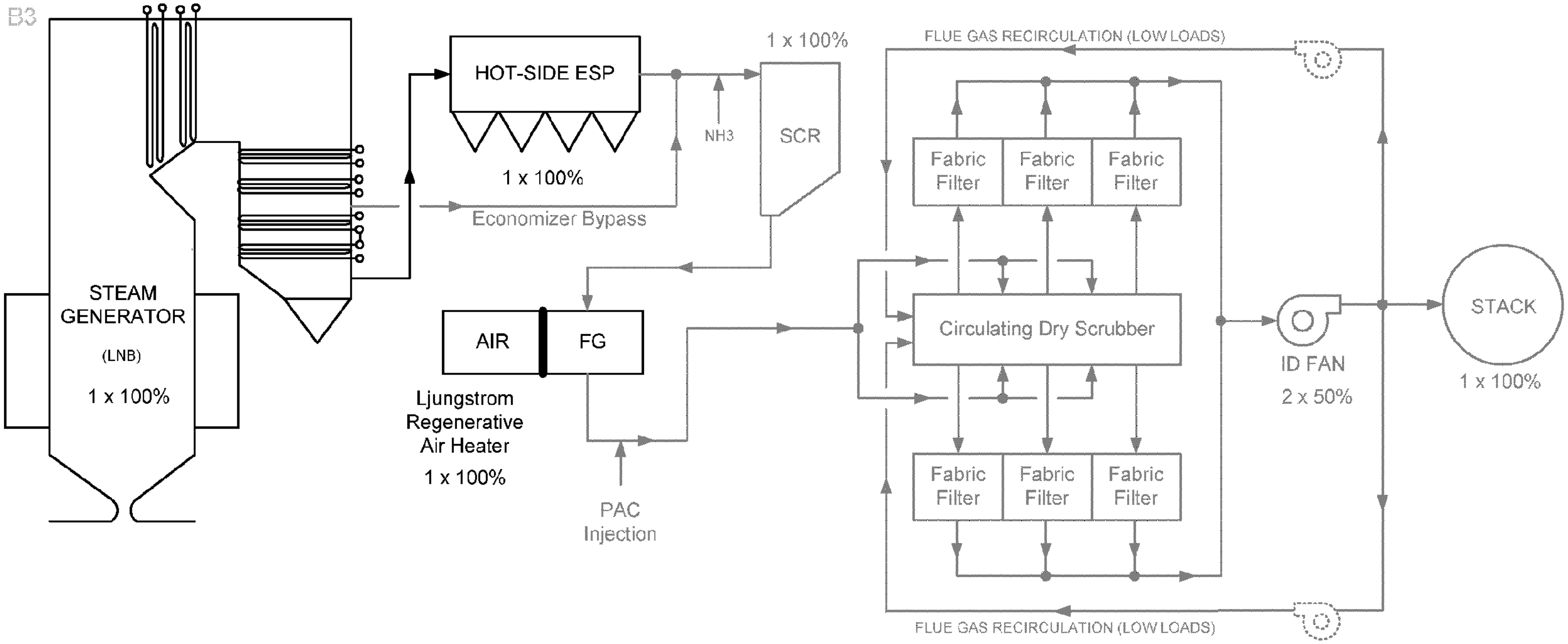


Trimble County Unit 1: Future

Green River



Green River Unit 3: Future
71 MW



Green River Unit 4: Future
109 MW

Appendix G
Air Quality Control Equipment Arrangement Drawings

E.W. Brown

E.W. Brown Units 1 & 2
Constructability Challenges

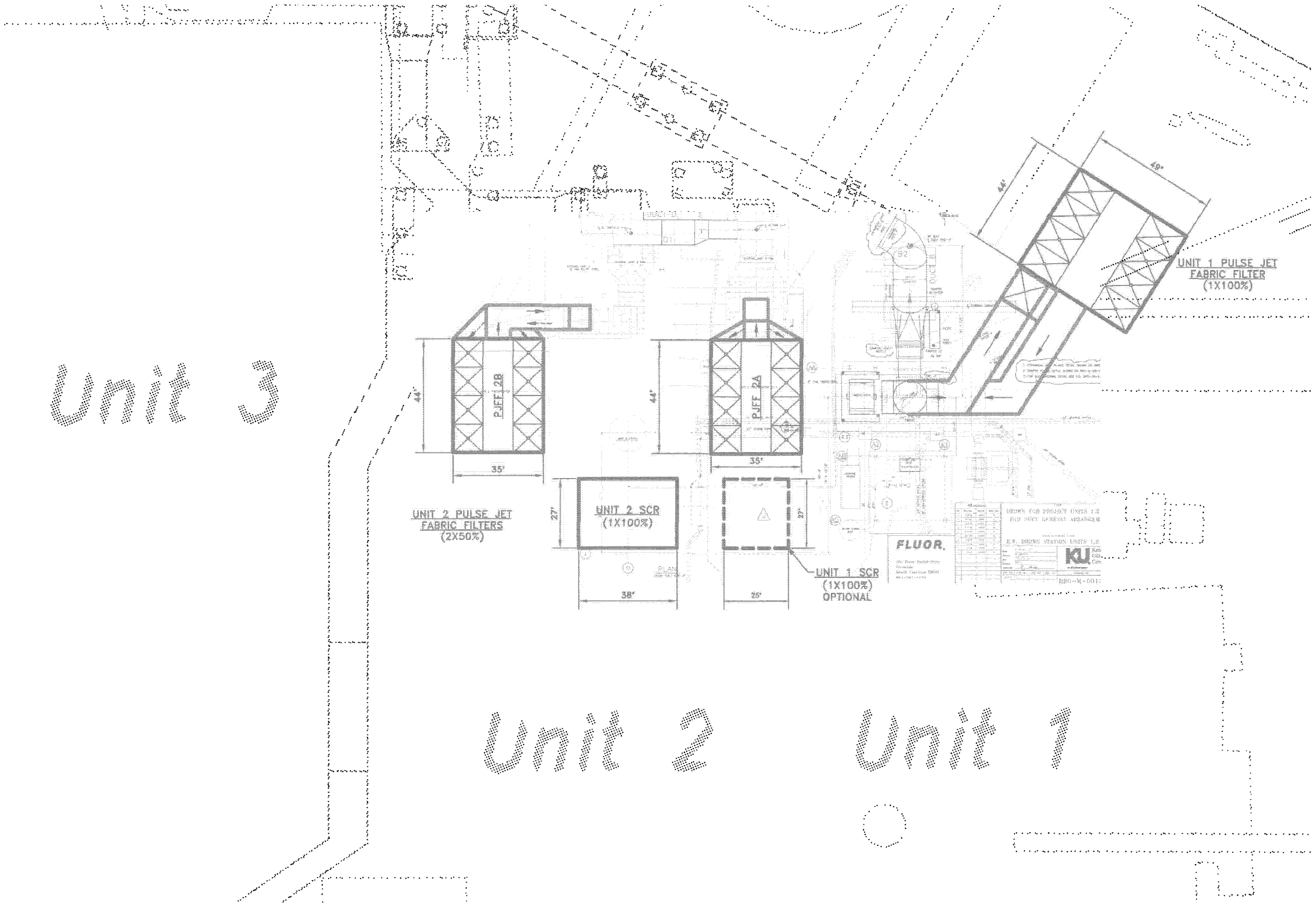
SCR Constructability Challenges

- Real estate constraints for Unit 1 & Unit 2 SCR
- The new SCR duct tie-ins to the existing Unit 1 Air Heater inlet duct will require extensive relocation of existing plant components:
    1. Rotate Secondary Air Heater Duct
    2. Modify boiler building structural steel bracing and girts to accommodate ductwork
    3. Relocate 440V Switchgear 1A and 1B
- The new SCR duct tie-ins to the existing Unit 2 Air Heater inlet duct will require boiler building structural steel bracing and girts to be modified to accommodate ductwork
- The new Unit 2 SCR support structure and reactor box will require extensive relocation/demolition of existing plant components:
    1. Relocate or protect field fabricated tank located in base of abandoned Unit 2 chimney shell
    2. Demolish Unit 2 chimney
    3. Demolish the dust collection ductwork located along the northeast exterior wall of Unit 2 boiler building
    4. Relocate Unit 2 Auxiliary Transformer located outside of the northeast exterior wall of Unit 2 boiler building
- The existing coal conveyor and ductwork block crane access to the northeast side of Unit 2 boiler house. This will require Unit 2 SCR structure to be constructed using a large tonnage crane with extended reach capabilities, or by extending the structural support frame system to the east and using a pick and slide execution method to erect the SCR and fabric filter modules

PJFF Constructability Challenges

- Real estate constraints for Unit 2 PJFF
- Elevated PJFF for Unit 2
- Extensive underground investigation will be required to identify operating utilities prior to installing new foundations for Unit 2 fabric filter structural steel support frame.
- The existing coal conveyor and ductwork block crane access to the northeast side of Unit 2 boiler house. This will require Unit Fabric Filter structure to be constructed using a large tonnage crane with extended reach capabilities, or by extending the structural support frame system to the east and using a pick and slide execution method to erect the SCR and fabric filter modules
- Heavy foundations required on the outer ends of Unit 2 ESP's for construction of Unit 2 PJFF.
- Difficult to stage construction equipment for ductwork support frame & associated foundations near ID fans of Unit 1 & Unit 2

LEGEND:
NEW EQUIPMENT= ▬
NEW DUCTWORK= ▬



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1"=200'

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CORPORATION

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E.ON.
E W BROWN UNITS 1 & 2 SCR

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER	REV
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AREA	

E.W. Brown Unit 3

Constructability Challenges

- Relocate ductwork and associated support steel for tie-in.
- Relocate underground utilities

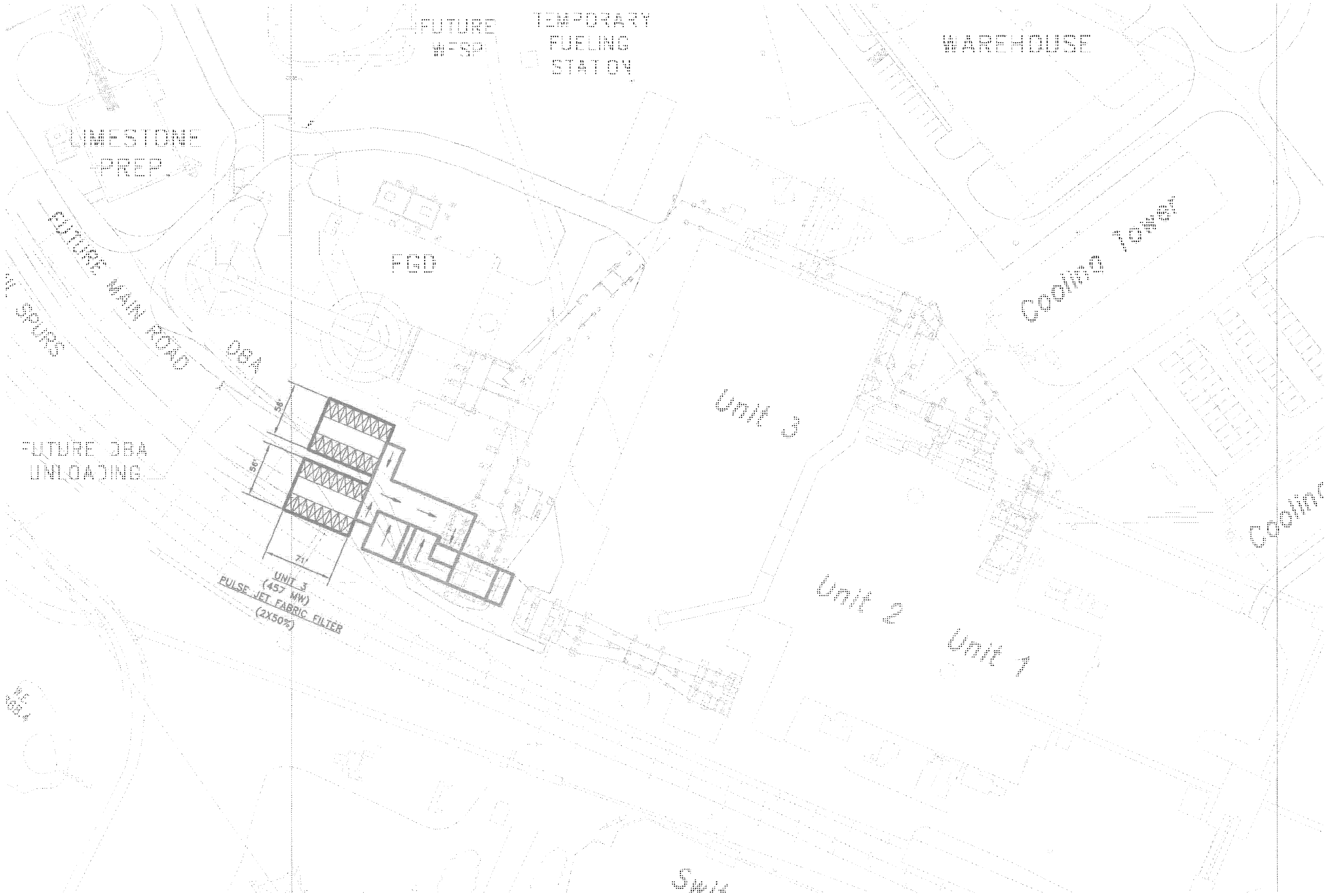
AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT= ▬

NEW DUCTWORK= ▬



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1"=500'

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ENGINEER
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E.ON.
E W BROWN UNITS 1, 2 & 3

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER
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REV 0
CODE
AREA

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Ghent

Ghent Unit 1

Constructability Challenges

- Real estate constraints
- Elevated New Pulse Jet Fabric Filter
- Crane access is difficult at Unit 1 due to low overhead pipe rack on the roadways around the cooling towers. Some piping bridges on the northeast side of the cooling tower and access roads to Unit 1 will need to be temporarily taken down or permanently relocated. Lattice boom crawler crane booms will need to be final assembled at the working location.
- Access lanes around Unit 1 are also the maintenance lanes for the cooling towers. Cranes and construction equipment will block access on these roads at various periods during project execution. Careful crane placement will be required in order to provide operations access to the cooling tower area.

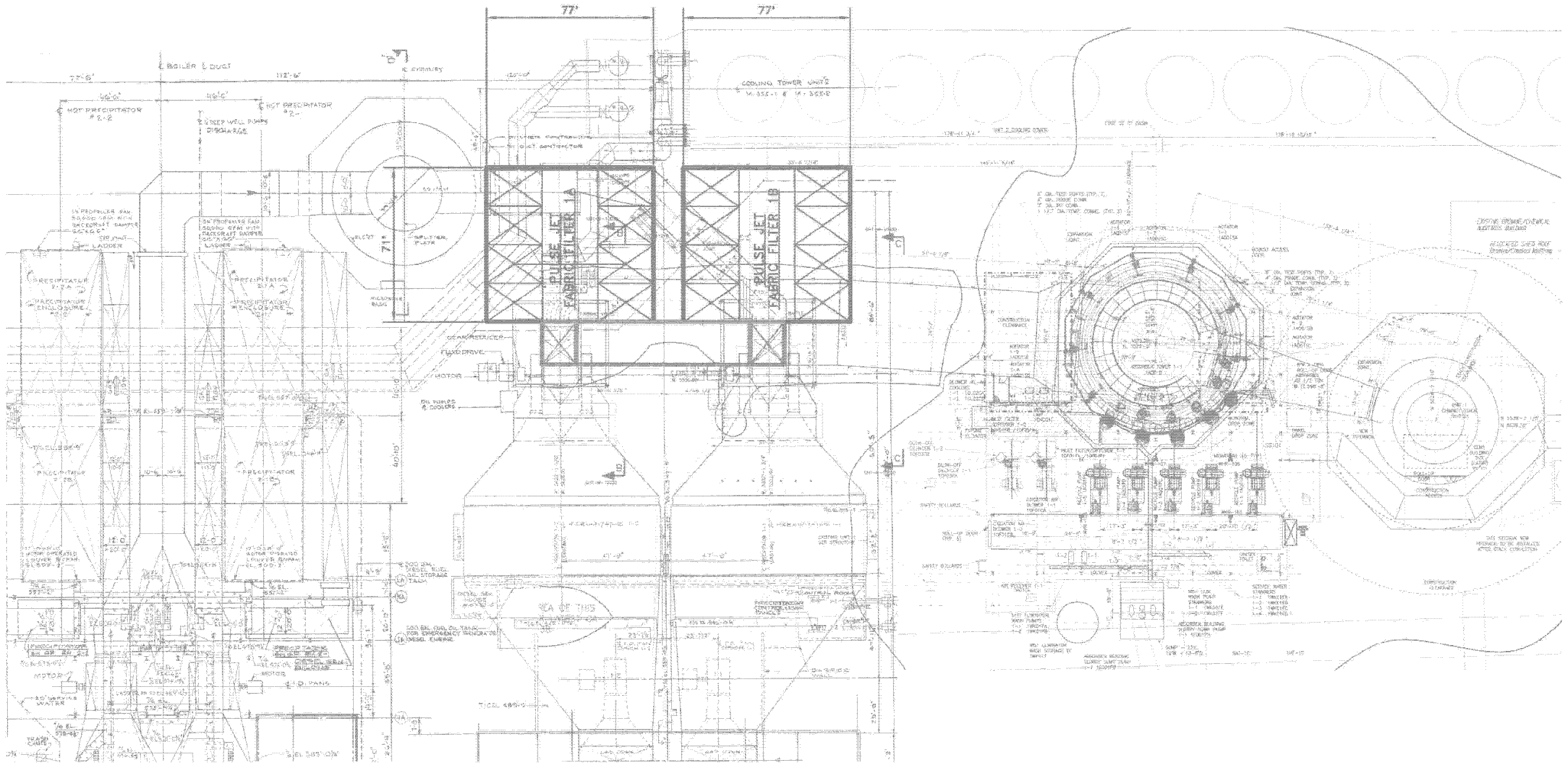
AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT= ▬

NEW DUCTWORK= ▬



PULSE JET FABRIC FILTERS
(2X50%)

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1"=300'

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CORPORATION

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E.ON.
GHENT – UNIT 1

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER	REV
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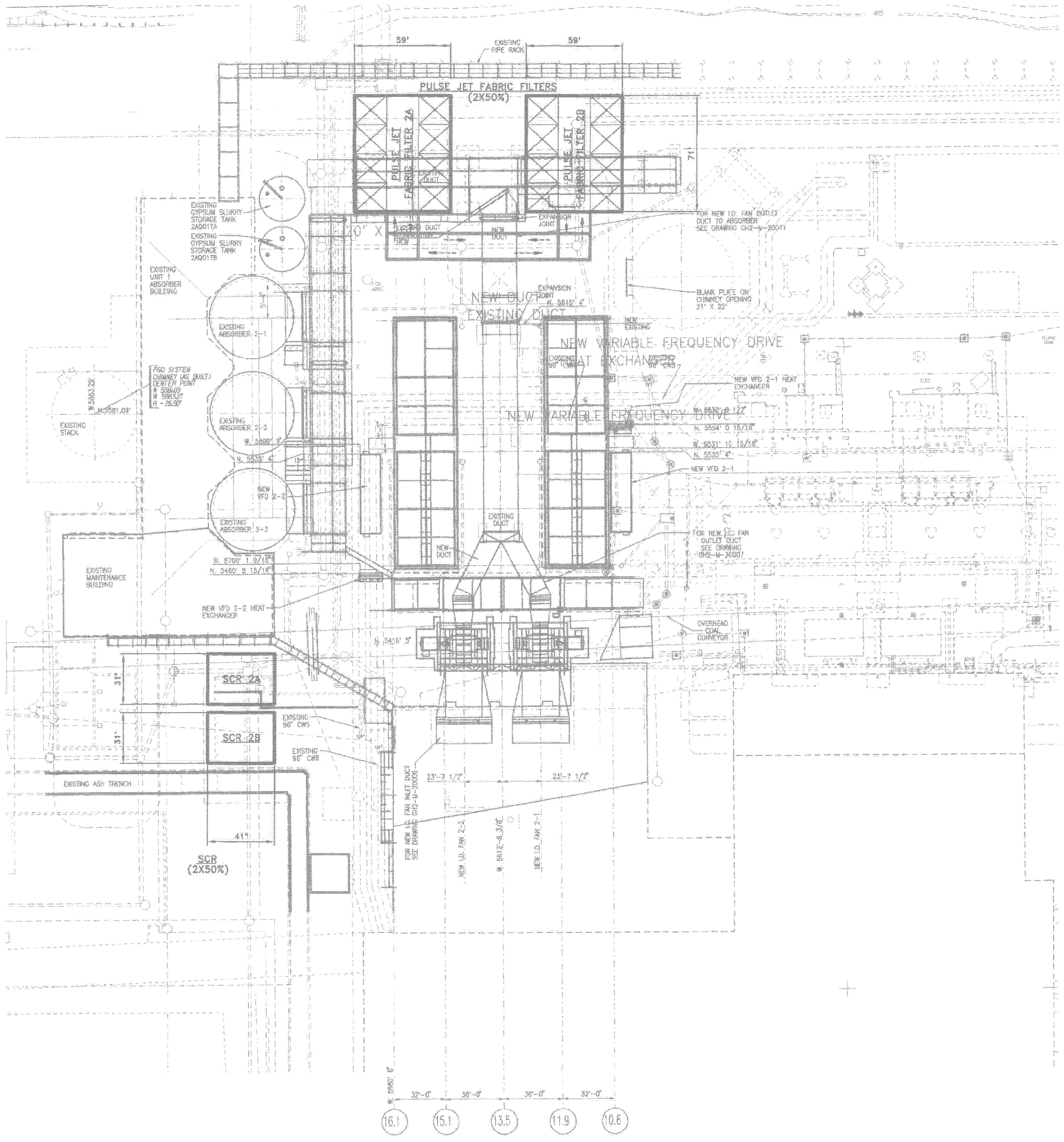

PLAN VIEW

EL. 480'-0" THRU 550'-0"

Ghent Unit 2 Pulse Jet Fabric Filter

Constructability Challenges

- Real estate constraints
- Elevated Pulse Jet Fabric Filter
- Crane access is difficult at Unit 2 due to low overhead pipe rack on the roadways around the cooling towers. Some piping bridges on the northeast side of the cooling tower and access roads to Unit 1 will need to be temporarily taken down or relocated. Lattice boom crawler crane booms will need to be final assembled at the working location.
- Access lanes around Unit 2 are also the maintenance lanes for the cooling towers. Cranes and construction equipment will block access on these roads at various periods during project execution. Careful crane placement will be required in order to provide operations access to the cooling tower area.
- Current arrangement for Unit 2 fabric filters require a section of by-pass ductwork to be installed in order to isolate/demolish existing ductwork/duct supports and provide the required footprint for the new equipment. Tie in portions of this work scope must be accomplished during early plant outages.

Ghent Unit 2 SCR

Constructability Challenges

- Erection of Unit 2 SCR will require construction material and equipment to be lifted over areas of high personnel traffic.
- Demolition of overhead walkway.
- Possible use of tower crane for final assembly of SCR
- Demolition & Relocation of pipe rack.

AQC Technology and Equipment

- Selective Catalyst Reduction
- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT= ▬

NEW DUCTWORK= ▬

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1"=300'

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CORPORATION

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E.ON.
GHENT – UNIT 2

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER
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AREA

Ghent Units 3&4

Constructability Challenges

- Current arrangement for Unit 3 fabric filters requires an extensive length of inlet/outlet ductwork to be routed above and across the existing Unit 3 & 4 ESP's. Access around the footprint of the ESP's is restricted, and it will be difficult to stage the construction equipment necessary to erect the ductwork support frame and associated foundations.
- Crane access will be restricted around the tie in for Unit 3 fabric filter inlet/outlet ductwork.
- Existing underground electrical manholes, water wells, storm sewer boxes and piping, and circulating cooling water piping all run in the proposed footprint for Unit 4 fabric filter. The electrical manholes, water wells, and storm sewer piping will need to be relocated in order to install the foundations for the Unit 4 fabric filter structural frame.

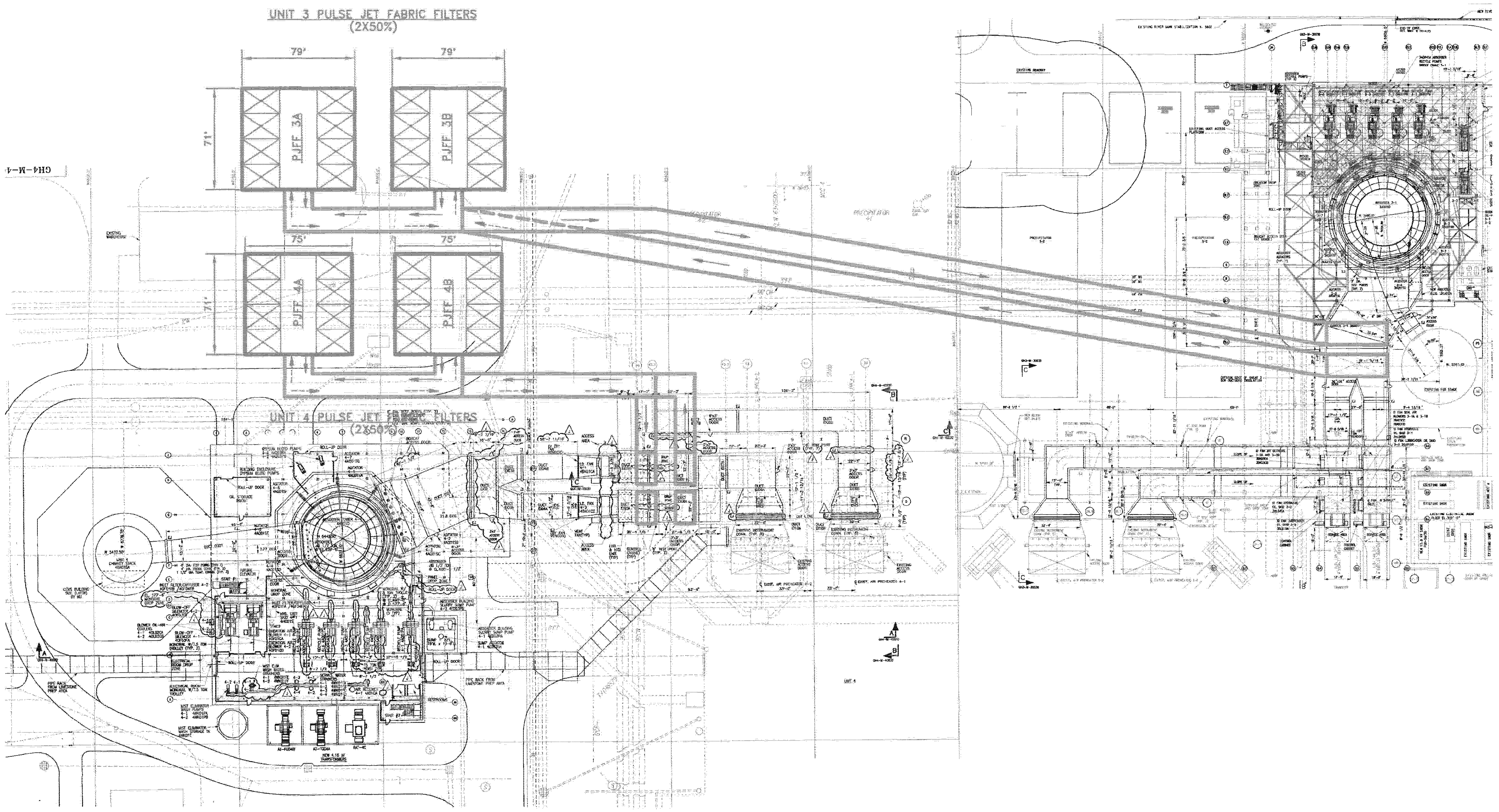
AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:

NEW EQUIPMENT= ▬

NEW DUCTWORK= ▬



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1"=400'

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CORPORATION

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E.ON.
GHENT – UNITS 3 & 4

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

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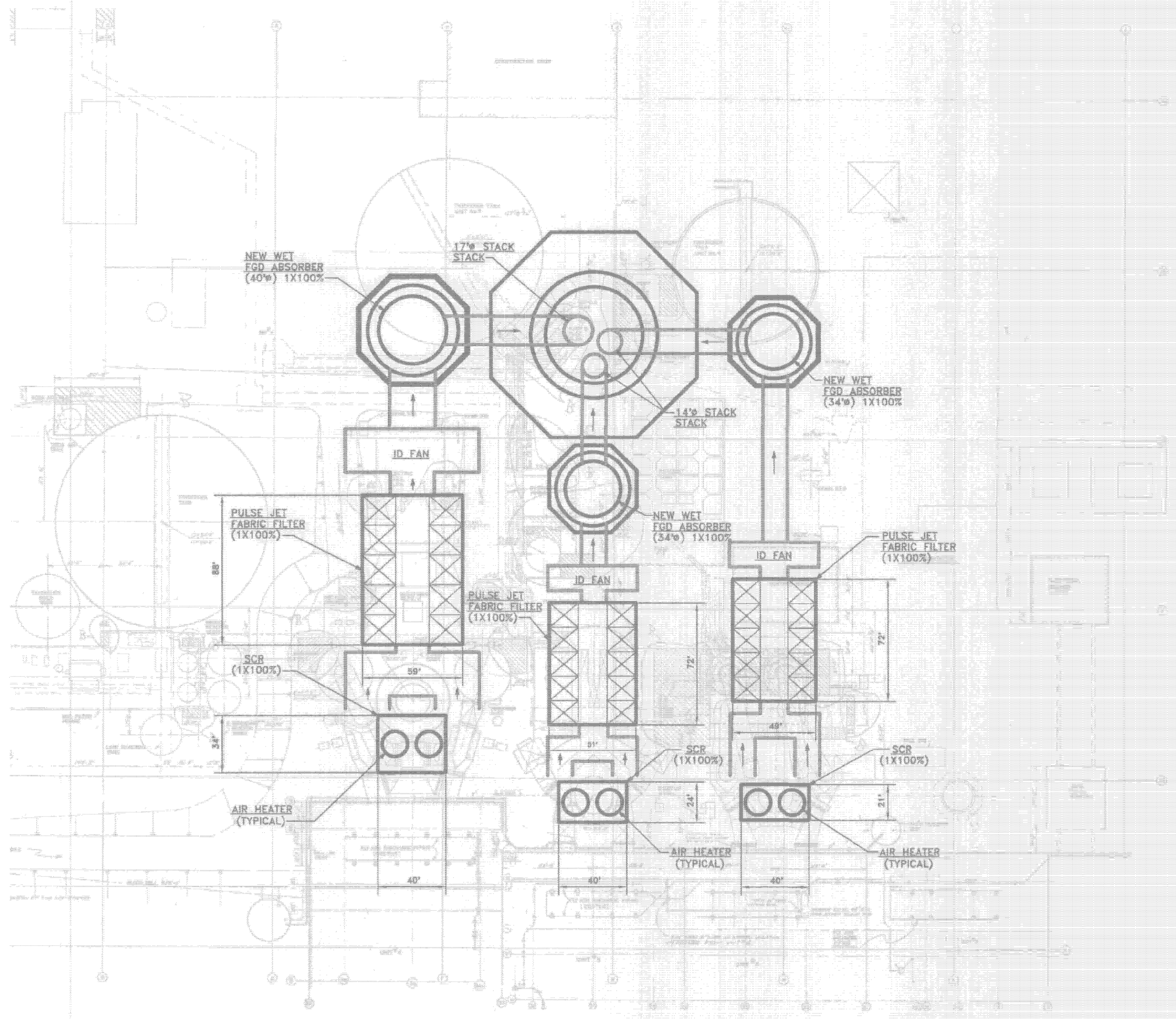
Cane Run



Cane Run Units 4, 5 & 6

Constructability Challenges

- Ingress from highways - Multiple power lines need to be raised to accommodate high loads.
- Barge unloading is not economically feasible.
- Existing overhead power lines are routed over ach unit and must be relocated for crane access.
- 4kv building and CT switchyard needs to be relocated.
- Entire unit #5 "back-end" must be dismantled prior to starting any work on unit #4.
- There is a need for multiple mob/demob/outages for tie-ins and access to build new AQCS equipment.
- Underground utility interferences/relocations.
- Above ground utility interferences/relocations.
- Need for areas to build ammonia storage, ASH handling systems, limestone handling, Reagant Prep, Dewatering (Ancillary Systems)
- Extended outages (entire plant) needed to accommodate construction of new AQCS Systems.
- Demolition must be performed in multiple phases followed by extensive earthwork activities to bring existing site up to proper elevation.
- Soils must be tested and stabilized for heavy lift crane operations.
- Space is very limited around units; the most efficient use of modularization will be compromised.

AQC Technology and Equipment

- Selective Catalytic Reduction
- Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization
- Stack
- Air heater

LEGEND:
NEW EQUIPMENT= ▬
NEW DUCTWORK= ▬

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1"=300'

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CORPORATION
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E.ON.
CANE RUN UNITS 4, 5 & 6
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER
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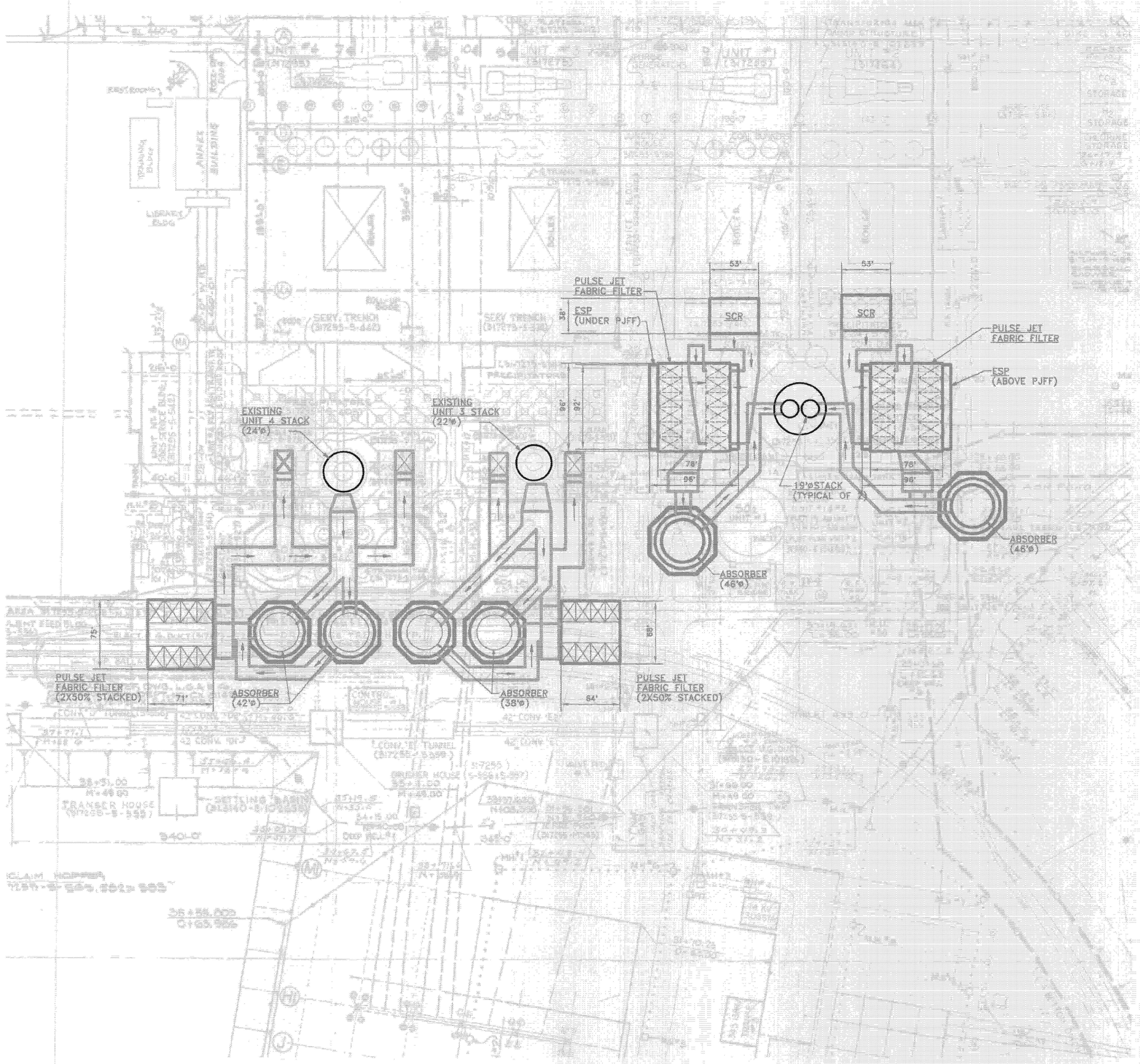
CODE
AREA

Mill Creek



Mill Creek Units 1, 2, 3 & 4

Constructability Challenges

- Real estate constraints for all the units.
- Unit 1 & Unit 2 ESP elevated.
- Unit 3 & Unit 4 PJFF (2x50%) stacked one above another.
- Barge unloading is not economically feasible.
- Overhead power lines and @ least 2 transmission towers must be moved.
- Numerous underground utility interferences/relocations
- Numerous above ground utility interferences/relocations
- Very limited access around units due to existing AQCS Systems.
- Multiple mob/demob (very selective) dismantling operations are needed to insure tie-in work is accomplished efficiently.
- Building between units 1 & 3 from unit #1 work will present logistical problems for both plant work and construction. Access/height restrictions will dictate the magnitude of modularization that can be utilized.
- Warehouse and loading dock on unit #2 side must be relocated.
- High complexity of ancillary systems routing to avoid interference with existing AQCS systems.
- Ground stability will need to be verified, modified to accommodate heavy lift cranes.
- Multiple plant outages will be needed for tie-ins because we are utilizing existing scrubbers, etc…through out project.
- Ductwork routing is more extensive due to the lay out of the existing plant and existing AQCS systems in use. Space will be a premium for excavations/foundations/duct steel erection.
- Large existing concrete foundations will need to be removed to accommodate equipment.
- Outage windows are very short and limited.
- Site constraints due to existing rail road tracks.

AQC Technology and Equipment Units 1 & 2

- Selective Catalyst Reduction.
- Electrostatic Precipitator and Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization

AQC Technology and Equipment Units 3 & 4

- Pulse Jet Fabric Filter
- Wet Flue Gas Desulfurization

LEGEND:

NEW EQUIPMENT=
NEW DUCTWORK=
EXISTING EQUIPMENT=

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1"=500'

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E.ON.
MILL CREEK UNITS 1, 2, 3 & 4
FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER 167987–CAQC–M1008
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AREA

Trimble County

Trimble County Unit 1

Constructability Challenges

- Real estate constraints
- Elevated Pulse Jet Fabric Filter
- Extensive underground investigation will be required to identify operating utilities prior to installing new foundations
- An existing abandoned tower crane foundation and multiple runs of electrical duct bank cover a large percentage of the area within the footprint proposed to install foundations for the Unit 1 fabric filter support frame.

AQC Technology and Equipment

- Pulse Jet Fabric Filter

LEGEND:
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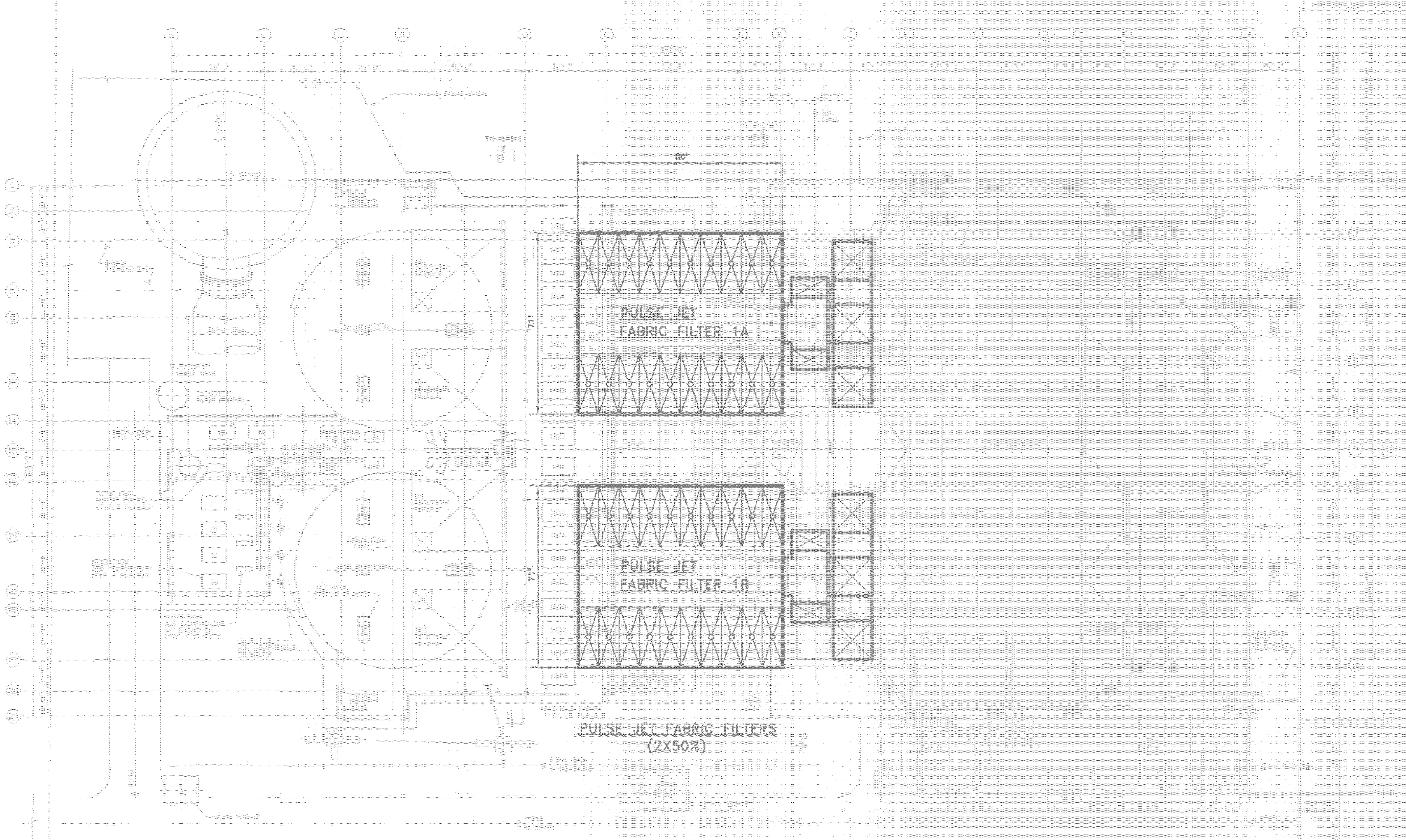
NEW DUCTWORK= ▬



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1"=200'

BLACK & VEATCH CORPORATION

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E.ON.
TRIMBLE COUNTY UNIT 1

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT
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CODE
AREA

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Green River

Green River Units 3 & 4

Constructability Challenges

- Overhead power lines and one tower needs to be relocated.
- Underground utility interferences/relocations
- Above ground utility interferences/relocations

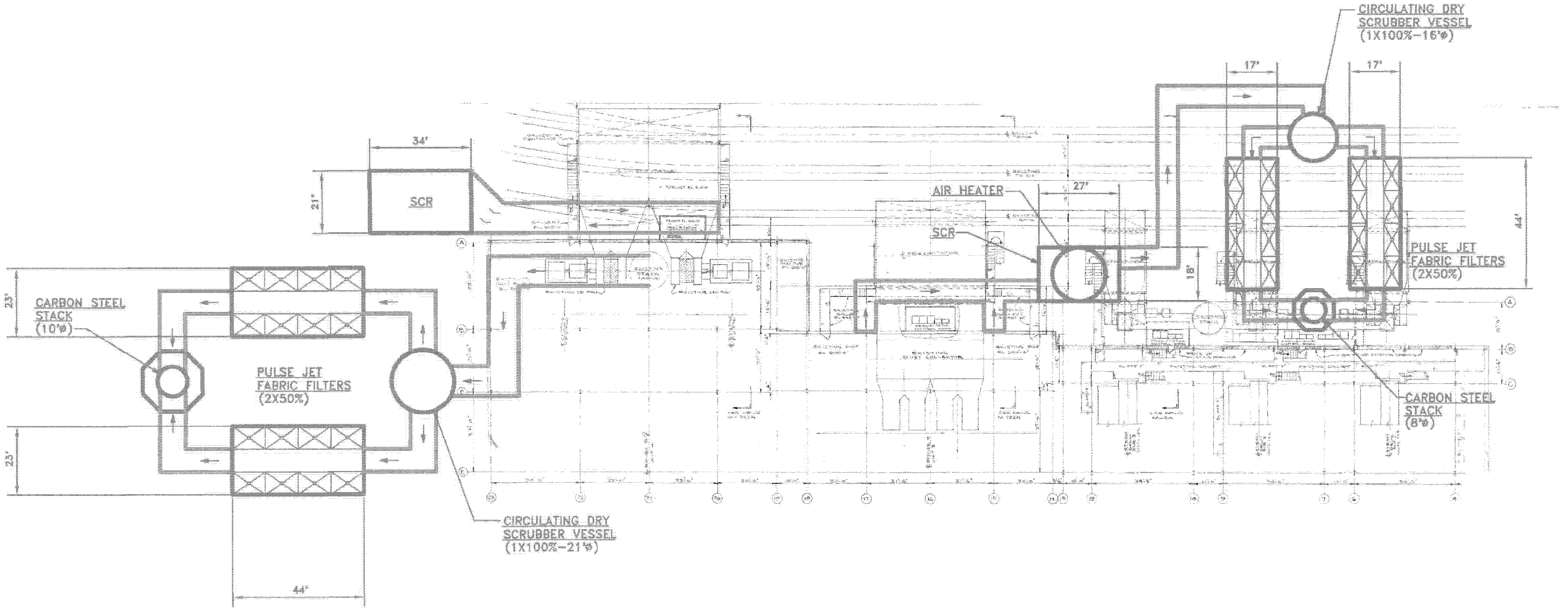
AQC Technology and Equipment

- Selective Catalyst Reduction
- Circulating Dry Scrubber
- Pulse Jet Fabric Filter
- Stack
- Air Heater

LEGEND:

NEW EQUIPMENT=

NEW DUCTWORK=



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ENGINEER

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E.ON.
GREEN RIVER UNITS 3 & 4

FUTURE AQC TECHNOLOGY
CONCEPTUAL PLOT PLAN

PROJECT DRAWING NUMBER 167987-CAQC-M1007

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AREA

Appendix H
Air Quality Control Technology Costs

E.W. Brown

Plant Name: Brown
Unit: 1
MW 110
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$40,000,000	$364	$1,477,000	$6,345,000
PAC Injection	$1,599,000	$15	$614,000	$809,000
Overfire Air	$767,000	$7	$132,000	$225,000
Low NOx Burners	$1,156,000	$11	$0	$141,000
Neural Networks	$500,000	$5	$50,000	$111,000
Total	$44,022,000	$400	$2,273,000	$7,631,000

BROWN UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts				
Civil/Structural	$1,969,000			
Mechanical - Balance of Plant (BOP)	$5,641,000			
Electrical - Equipment, Raceway, Switchgears, MCC	$119,000			
Control - DCS Instrumentation	$133,000			
ID Fans	$1,166,000	Engineering Estimates		
Subtotal Purchase Contract	**$9,028,000**			
Construction Contracts				
Civil/Structural Construction - Super Structures	$1,752,000			
Civil/Structural Construction - Sub-Structures	$666,000			
Mechanical/Chemical Construction	$6,664,000			
Electrical/Control Construction	$2,250,000			
Service Contracts & Construction Indirects	$109,000			
Demolition Costs	$5,000,000	Engineering Estimates		
Subtotal Construction Contracts	**$16,441,000**			
Construction Difficulty Costs	**$11,508,700**	Engineering Estimates		
Total Direct Costs	**$36,977,700**			
Indirect Costs				
Engineering Costs (Includes G&A & Fee)	$1,426,000			
EPC Construction Management (Includes G&A & Fee)	$933,000			
Startup Spare Parts (Included)	$0			
Construction Utilites (Power & Water) - Included	$0			
Project Insurance	$141,000			
Sales Taxes	$50,000			
Project Contingency - 18%	$526,000			
Total Indirect Costs	**$3,076,000**			
Total Contracted Costs	$40,000,000			
Cost Effectiveness	*$364 /kW*			

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	44%	
Maintenance labor and materials	$1,200,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$1,200,000**			
Variable Annual Costs				
Byproduct disposal	$6,000	210 lb/hr and	15	$/ton
Bag replacement cost	$91,000	2,740 bags and	100	$/bag
Cage replacement cost	$46,000	2,740 cages and	50	$/cage
ID fan power	$117,000	710 kW and	0.04266	$/kWh
Auxiliary power	$17,000	105 kW and	0.04266	$/kWh
Subtotal Variable Annual Costs	$277,000			
Total Annual Costs	$1,477,000			
Levelized Capital Costs	**$4,868,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$6,345,000			

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis
CAPITAL COST		
Direct Costs		
Purchased equipment costs		
Long-term storage silo (with truck unloading sys.)	$92,670	Ratio from Brown Unit 3 BACT Analysis
Short-term storage silo	$60,897	Ratio from Brown Unit 3 BACT Analysis
Air blowers	$84,726	Ratio from Brown Unit 3 BACT Analysis
Rotary feeders	$10,591	Ratio from Brown Unit 3 BACT Analysis
Injection system	$39,716	Ratio from Brown Unit 3 BACT Analysis
Ductwork modifications, supports, platforms	$0	
Electrical system upgrades	$254,179	Ratio from Brown Unit 3 BACT Analysis
Instrumentation and controls	$13,239	Ratio from Brown Unit 3 BACT Analysis
Subtotal capital cost (CC)	$556,018	
Freight	$14,000	(CC) X 2.5%
Total purchased equipment cost (PEC)	$570,000	
Direct installation costs		
Foundation & supports	$57,000	(PEC) X 10.0%
Handling & erection	$114,000	(PEC) X 20.0%
Electrical	$57,000	(PEC) X 10.0%
Piping	$29,000	(PEC) X 5.0%
Insulation	$11,000	(PEC) X 2.0%
Painting	$29,000	(PEC) X 5.0%
Demolition	$0	(PEC) X 0.0%
Relocation	$0	(PEC) X 0.0%
Total direct installation costs (DIC)	$297,000	
Site preparation	$0	N/A
Buildings	$75,000	Engineering estimate
Total direct costs (DC) = (PEC) + (DIC)	$942,000	
Indirect Costs		
Engineering	$113,000	(DC) X 12.0%
Owner's cost	$113,000	(DC) X 12.0%
Construction management	$94,000	(DC) X 10.0%
Start-up and spare parts	$14,000	(DC) X 1.5%
Performance test	$100,000	Engineering estimate
Contingencies	$188,000	(DC) X 20.0%
Total indirect costs (IC)	$622,000	
Allowance for Funds Used During Construction (AFDC)	$35,000	[(DC)+(IC)] X 4.50% 1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$1,599,000	
Cost Effectiveness	*$15 /kW*	
ANNUAL COST		
Direct Annual Costs		
Fixed annual costs		
Maintenance labor and materials	$28,000	(DC) X 3.0%
Operating labor	$123,000	1 FTE and 123,325 $/year Estimated manpower
Total fixed annual costs	$151,000	
Variable annual costs		44 % capacity factor
Reagent (BPAC)	$445,000	105 lb/hr and 2200 $/ton
Byproduct disposal cost	$3,000	105 lb/hr and 15 $/ton
Auxiliary power	$15,000	90 kW and 0.04266 $/kWh
Total variable annual costs	$463,000	
Total direct annual costs (DAC)	$614,000	
Indirect Annual Costs		
Cost for capital recovery	$195,000	(TCI) X 12.17% CRF
Total indirect annual costs (IDAC)	$195,000	
Total Annual Cost (TAC) = (DAC) + (IDAC)	$809,000	

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: Overfire Air System Operation

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis		
CAPITAL COST				
Direct Costs				
Purchased equipment costs				
Neuco NOx optimization package	$13,000	B&V cost estimate		
NOx monitoring equipment	$40,000	B&V cost estimate		
Water cannon system	$317,000	B&V cost estimate		
Subtotal capital cost (CC)	$370,000			
Freight	$19,000	(CC) X	5.0%	
Total purchased equipment cost (PEC)	$389,000			
Direct installation costs				
Foundation & supports	$0	(PEC) X	0.0%	
Handling & erection	$78,000	(PEC) X	20.0%	
Electrical	$58,000	(PEC) X	15.0%	
Piping	$8,000	(PEC) X	2.0%	
Insulation	$0	(PEC) X	0.0%	
Painting	$0	(PEC) X	0.0%	
Demolition	$10,000	(PEC) X	2.5%	
Relocation	$0	(PEC) X	0.0%	
Total direct installation costs (DIC)	$154,000			
Site preparation	$0	N/A		
Buildings	$0	N/A		
Total direct costs (DC) = (PEC) + (DIC)	$543,000			
Indirect Costs				
Engineering	$54,000	(DC) X	10.0%	
Owner's cost	$11,000	(DC) X	2.0%	
Construction management	$27,000	(DC) X	5.0%	
Start-up and spare parts	$11,000	(DC) X	2.0%	
Performance test	$50,000	Engineering estimate		
Contingencies	$54,000	(DC) X	10.0%	
Total indirect costs (IC)	$207,000			
Allowance for Funds Used During Construction (AFDC)	$17,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$767,000			
Cost Effectiveness	*$7 /kW*			
ANNUAL COST				
Direct Annual Costs				
Fixed annual costs				
Maintenance materials	$10,000	B&V cost estimate		
Maintenance labor	$14,000	B&V cost estimate, 6 man weeks/yr		
Total fixed annual costs	$24,000			
Variable annual costs				
Replacement power due to efficiency hit	$108,000	Engineering estimates, 0.2% efficiency drop, and 0.05 $/kWh		
Total variable annual costs	$108,000			
Total direct annual costs (DAC)	$132,000			
Indirect Annual Costs				
Cost for capital recovery	$93,000	(TCI) X	12.17%	CRF
Total indirect annual costs (IDAC)	$93,000			
Total Annual Cost (TAC) = (DAC) + (IDAC)	$225,000			

EW Brown Unit 1
110 MW
High Level Emissions Control Study

Technology: Upgraded Low NOx Burners

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
New coal elbow, nozzle with air vane, fuel injector barrel, air zone swirler and coal piping	$602,000				
Subtotal capital cost (CC)	$602,000				
Freight	$30,000	(CC) X	5.0%		
Total purchased equipment cost (PEC)	$632,000				
Direct installation costs					
Foundation & supports	$0	(PEC) X	0.0%		
Handling & erection	$126,000	(PEC) X	20.0%		
Electrical	$63,000	(PEC) X	10.0%		
Piping	$0	(PEC) X	0.0%		
Insulation	$0	(PEC) X	0.0%		
Painting	$0	(PEC) X	0.0%		
Demolition	$16,000	(PEC) X	2.5%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$205,000				
Site preparation	$0	N/A			
Buildings	$0	N/A			
Total direct costs (DC) = (PEC) + (DIC)	$837,000				
Indirect Costs					
Engineering	$84,000	(DC) X	10.0%		
Owner's cost	$17,000	(DC) X	2.0%		
Construction management	$42,000	(DC) X	5.0%		
Start-up and spare parts	$17,000	(DC) X	2.0%		
Performance test	$50,000	Engineering estimate			
Contingencies	$84,000	(DC) X	10.0%		
Total indirect costs (IC)	$294,000				
Allowance for Funds Used During Construction (AFDC)	$25,000	[(DC)+(IC)] X	4.50%		1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$1,156,000**				
Cost Effectiveness	***$11 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
N/A	$0	Similar annual costs as current LNB			
Total fixed annual costs	$0				
Variable annual costs					
N/A	$0	Similar annual costs as current LNB			
Total variable annual costs	$0				
Total direct annual costs (DAC)	$0				
Indirect Annual Costs					
Cost for capital recovery	$141,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$141,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$141,000**				

Plant Name:	Brown
Unit:	2
MW	180
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$92,000,000	$511	$3,278,000	$14,474,000
Fabric Filter	$51,000,000	$283	$1,959,000	$8,166,000
Lime Injection	$2,739,000	$15	$1,155,000	$1,488,000
PAC Injection	$2,476,000	$14	$1,090,000	$1,391,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$148,715,000	$826	$7,532,000	$25,630,000

BROWN UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$4,636,000	
Ductwork and Breeching	$3,580,000	
Mechanical - Balance of Plant (BOP)	$1,173,000	
Electrical - Equipment, Raceway	$1,339,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$468,000	
Control - DCS Instrumentation	$151,000	
Air Heater Modifications	$0	Engineering Estimates
ID Fans	$1,158,000	Engineering Estimates
Catalyst	$1,883,000	
Selective Catalytic Reduction System (Including Ammonia System)	$1,643,000	
Subtotal Purchase Contract	**$16,531,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$2,854,000	
Civil/Structural Construction - Sub-Structures	$742,000	
Mechanical/Chemical Construction	$8,971,000	
Electrical/Control Construction	$4,103,000	
Service Contracts & Construction Indirects	$14,331,000	
Demolition Costs	$6,500,000	Engineering Estimates
Subtotal Construction Contracts	**$37,501,000**	
Construction Difficulty Costs	**$26,250,700**	Engineering Estimates
Total Direct Costs	**$80,282,700**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$2,696,000
EPC Construction Management (Includes G&A & Fee)	$1,691,000
Startup Spare Parts (Included)	$0
Construction Utilites (Power & Water) - Included	$0
Project Insurance	$444,000
Sales Taxes	$627,000
Project Contingency	$6,326,000
Total Indirect Costs	**$11,784,000**
Total Contracted Costs	**$92,000,000**
Capital Cost Effectiveness	***$511 /kW***

ANNUAL COST

Capacity Factor = 62%

Fixed Annual Costs

Operating labor	$123,000	1 FTE and	123,325	$/year
Maintenance labor & materials	$2,408,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,581,000**			

Variable Annual Costs

Reagent	$309,000	215 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$186,000	940 kW and	0.03646	$/kWh
Catalyst replacement	$202,000	50 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$697,000**			
Total Annual Costs	**$3,278,000**			
Levelized Capital Costs	**$11,196,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$14,474,000**			

BROWN UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,646,000	
Mechanical - Balance of Plant (BOP)	$7,580,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$161,000	
Control - DCS Instrumentation	$178,000	
ID Fans	$535,000	Engineering Estimates
Subtotal Purchase Contract	**$11,100,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,355,000	
Civil/Structural Construction - Sub-Structures	$895,000	
Mechanical/Chemical Construction	$8,956,000	
Electrical/Control Construction	$3,024,000	
Service Contracts & Construction Indirects	$146,000	
Demolition Costs	$5,000,000	Engineering Estimates
Subtotal Construction Contracts	**$20,376,000**	
Construction Difficulty Costs	**$14,263,200**	Engineering Estimates
Total Direct Costs	**$45,739,200**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$2,334,000	
EPC Construction Management (Includes G&A & Fee)	$1,527,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$231,000	
Sales Taxes	$82,000	
Project Contingency - 18%	$860,000	
Total Indirect Costs	**$5,034,000**	
Total Contracted Costs	$51,000,000	
Cost Effectiveness	*$283 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%
Maintenance labor and materials	$1,530,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$1,530,000**		
Variable Annual Costs			
Byproduct disposal	$5,000	120 lb/hr and	15 $/ton
Bag replacement cost	$129,000	3,880 bags and	100 $/bag
Cage replacement cost	$65,000	3,880 cages and	50 $/cage
ID fan power	$200,000	1,010 kW and	0.03646 $/kWh
Auxiliary power	$30,000	150 kW and	0.03646 $/kWh
Subtotal Variable Annual Costs	$429,000		
Total Annual Costs	$1,959,000		
Levelized Capital Costs	**$6,207,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$8,166,000		

Brown Unit 2
180 MW
High Level Emissions Control Study

Technology: Lime Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis					
CAPITAL COST							
Direct Costs							
Purchased equipment costs							
Long-term storage silo (with truck unloading sys.)	$133,800	From Previous Mill Creek BACT Study					
Short-term storage silo	$88,800	From Previous Mill Creek BACT Study					
Air blowers	$121,800	From Previous Mill Creek BACT Study					
Rotary feeders	$19,800	From Previous Mill Creek BACT Study					
Injection system	$80,400	From Previous Mill Creek BACT Study					
Ductwork modifications, supports, platforms	$0						
Electrical system upgrades	$526,800	From Previous Mill Creek BACT Study					
Instrumentation and controls	$25,200	From Previous Mill Creek BACT Study					
Subtotal capital cost (CC)	$996,600						
Freight	$45,000	(CC) X		4.5%			
Total purchased equipment cost (PEC)	$1,042,000						
Direct installation costs							
Foundation & supports	$104,000	(PEC) X		10.0%			
Handling & erection	$208,000	(PEC) X		20.0%			
Electrical	$104,000	(PEC) X		10.0%			
Piping	$52,000	(PEC) X		5.0%			
Insulation	$21,000	(PEC) X		2.0%			
Painting	$52,000	(PEC) X		5.0%			
Demolition	$0	(PEC) X		0.0%			
Relocation	$0	(PEC) X		0.0%			
Total direct installation costs (DIC)	$541,000						
Site preparation	$0	N/A					
Buildings	$75,000	Engineering estimate					
Total direct costs (DC) = (PEC) + (DIC)	$1,658,000						
Indirect Costs							
Engineering	$199,000	(DC) X		12.0%			
Owner's cost	$199,000	(DC) X		12.0%			
Construction management	$166,000	(DC) X		10.0%			
Start-up and spare parts	$25,000	(DC) X		1.5%			
Performance test	$100,000	Engineering estimate					
Contingencies	$332,000	(DC) X		20.0%			
Total indirect costs (IC)	$1,021,000						
Allowance for Funds Used During Construction (AFDC)	$60,000	[(DC)+(IC)] X		4.50%	1	years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$2,739,000**						
Cost Effectiveness	***$15 /kW***						
ANNUAL COST							
Direct Annual Costs							
Fixed annual costs							
Maintenance labor and materials	$50,000	(DC) X		3.0%			
Operating labor	$123,000		1	FTE and	123,325	$/year	Estimated manpower
Total fixed annual costs	$173,000						
Variable annual costs					62	%	capacity factor
Lime	$754,000		2,100	lb/hr and	132.19	$/ton	
Byproduct disposal cost	$208,000		2,400	lb/hr and	15	$/ton	
Auxiliary power	$20,000		100	kW and	0.03646	$/kWh	
Total variable annual costs	$982,000						
Total direct annual costs (DAC)	$1,155,000						
Indirect Annual Costs							
Cost for capital recovery	$333,000	(TCI) X		12.17%	CRF		
Total indirect annual costs (IDAC)	$333,000						
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$1,488,000**						

Brown Unit 2
180 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$151,641	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$99,650	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$138,643	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$17,330	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$64,989	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$415,930	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$21,663	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$909,847				
Freight	$23,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$933,000				
Direct installation costs					
Foundation & supports	$93,000	(PEC) X	10.0%		
Handling & erection	$187,000	(PEC) X	20.0%		
Electrical	$93,000	(PEC) X	10.0%		
Piping	$47,000	(PEC) X	5.0%		
Insulation	$19,000	(PEC) X	2.0%		
Painting	$47,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$486,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$1,494,000				
Indirect Costs					
Engineering	$179,000	(DC) X	12.0%		
Owner's cost	$179,000	(DC) X	12.0%		
Construction management	$149,000	(DC) X	10.0%		
Start-up and spare parts	$22,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$299,000	(DC) X	20.0%		
Total indirect costs (IC)	$928,000				
Allowance for Funds Used During Construction (AFDC)	$54,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,476,000				
Cost Effectiveness	*$14 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$45,000	(DC) X	3.0%		
Operating labor	$123,000		1 FTE and	123,325 $/year	Estimated manpower
Total fixed annual costs	$168,000				
Variable annual costs				62 %	capacity factor
Reagent (BPAC)	$896,000		150 lb/hr and	2200 $/ton	
Byproduct disposal cost	$6,000		150 lb/hr and	15 $/ton	
Auxiliary power	$20,000		100 kW and	0.03646 $/kWh	
Total variable annual costs	$922,000				
Total direct annual costs (DAC)	$1,090,000				
Indirect Annual Costs					
Cost for capital recovery	$301,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$301,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,391,000				

Plant Name:	Brown
Unit:	3
MW	457
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$61,000,000	$133	$3,321,000	$10,745,000
PAC Injection	$5,426,000	$12	$2,330,000	$2,990,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$67,426,000	$148	$5,751,000	$13,957,000

BROWN UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,628,000	
Mechanical - Balance of Plant (BOP)	$13,257,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$281,000	
Control - DCS Instrumentation	$312,000	
ID Fans	$1,930,000	Engineering Estimates
Subtotal Purchase Contract	**$20,408,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,118,000	
Civil/Structural Construction - Sub-Structures	$1,565,000	
Mechanical/Chemical Construction	$15,663,000	
Electrical/Control Construction	$5,289,000	
Service Contracts & Construction Indirects	$255,000	
Demolition Costs	$500,000	Engineering Estimates
Subtotal Construction Contracts	**$27,390,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$47,798,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$5,925,000	
EPC Construction Management (Includes G&A & Fee)	$3,877,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$586,000	
Sales Taxes	$209,000	
Project Contingency - 18%	$2,183,000	
Total Indirect Costs	**$12,780,000**	
Total Contracted Costs	$61,000,000	
Cost Effectiveness	*$133*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	57%
Maintenance labor and materials	$1,830,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$1,830,000**		
Variable Annual Costs			
Byproduct disposal	$11,000	290 lb/hr and	15 $/ton
Bag replacement cost	$588,000	17,630 bags and	100 $/bag
Cage replacement cost	$294,000	17,630 cages and	50 $/cage
ID fan power	$460,000	2,540 kW and	0.03624 $/kWh
Auxiliary power	$138,000	760 kW and	0.03624 $/kWh
Subtotal Variable Annual Costs	$1,491,000		
Total Annual Costs	$3,321,000		
Levelized Capital Costs	**$7,424,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$10,745,000		

EW Brown Unit 3
457 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$350,000	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$230,000	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$320,000	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$40,000	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$150,000	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$960,000	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$50,000	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,100,000				
Freight	$53,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,153,000				
Direct installation costs					
Foundation & supports	$215,000	(PEC) X	10.0%		
Handling & erection	$431,000	(PEC) X	20.0%		
Electrical	$215,000	(PEC) X	10.0%		
Piping	$108,000	(PEC) X	5.0%		
Insulation	$43,000	(PEC) X	2.0%		
Painting	$108,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,120,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,348,000				
Indirect Costs					
Engineering	$402,000	(DC) X	12.0%		
Owner's cost	$402,000	(DC) X	12.0%		
Construction management	$335,000	(DC) X	10.0%		
Start-up and spare parts	$50,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$670,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,959,000				
Allowance for Funds Used During Construction (AFDC)	$119,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$5,426,000**				
Cost Effectiveness	***$12 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$100,000	(DC) X	3.0%		
Operating labor	$123,000		1 FTE and	123,325 $/year	Estimated manpower
Total fixed annual costs	$223,000				
Variable annual costs				57 %	capacity factor
Reagent (BPAC)	$2,060,000		375 lb/hr and	2200 $/ton	
Byproduct disposal cost	$14,000		375 lb/hr and	15 $/ton	
Auxiliary power	$33,000		180 kW and	0.03624 $/kWh	
Total variable annual costs	$2,107,000				
Total direct annual costs (DAC)	$2,330,000				
Indirect Annual Costs					
Cost for capital recovery	$660,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$660,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$2,990,000**				

Ghent

Plant Name:	Ghent
Unit:	1
MW	541
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$131,000,000	$242	$5,888,000	$21,831,000
PAC Injection	$6,380,000	$12	$4,208,000	$4,984,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$138,380,000	$256	$10,196,000	$27,037,000

GHENT UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$5,121,000	
Mechanical - Balance of Plant (BOP)	$14,669,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$311,000	
Control - DCS Instrumentation	$345,000	
ID Fans	$2,493,000	Engineering Estimates
Subtotal Purchase Contract	**$22,939,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$4,557,000	
Civil/Structural Construction - Sub-Structures	$1,732,000	
Mechanical/Chemical Construction	$17,332,000	
Electrical/Control Construction	$5,853,000	
Service Contracts & Construction Indirects	$283,000	
Demolition Costs	$6,000,000	Engineering Estimates
Subtotal Construction Contracts	**$35,757,000**	

Construction Difficulty Costs	**$57,211,200**	Engineering Estimates
Total Direct Costs	**$115,907,200**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$7,014,000
EPC Construction Management (Includes G&A & Fee)	$4,590,000
Startup Spare Parts (Included)	$0
Construction Utilites (Power & Water) - Included	$0
Project Insurance	$693,000
Sales Taxes	$247,000
Project Contingency - 18%	$2,585,000
Total Indirect Costs	**$15,129,000**
Total Contracted Costs	$131,000,000
Cost Effectiveness	*$242 /kW*

ANNUAL COST

Fixed Annual Costs Capacity Factor = 81%

Maintenance labor and materials	$3,930,000	(DC) X 3.0%
Subtotal Fixed Annual Costs	**$3,930,000**	

Variable Annual Costs

Byproduct disposal	$0	0 lb/hr and	15 $/ton
Bag replacement cost	$786,000	23,590 bags and	100 $/bag
Cage replacement cost	$393,000	23,590 cages and	50 $/cage
ID fan power	$600,000	3,400 kW and	0.02487 $/kWh
Auxiliary power	$179,000	1,015 kW and	0.02487 $/kWh
Subtotal Variable Annual Costs	$1,958,000		

Total Annual Costs	$5,888,000	
Levelized Capital Costs	**$15,943,000**	(TCI) X 12.17% CRF
Levelized Annual Costs	$21,831,000	

Ghent Unit 1
514 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis
CAPITAL COST		
Direct Costs		
Purchased equipment costs		
Long-term storage silo (with truck unloading sys.)	$414,333	Ratio from Brown Unit 3 BACT Analysis
Short-term storage silo	$272,276	Ratio from Brown Unit 3 BACT Analysis
Air blowers	$378,818	Ratio from Brown Unit 3 BACT Analysis
Rotary feeders	$47,352	Ratio from Brown Unit 3 BACT Analysis
Injection system	$177,571	Ratio from Brown Unit 3 BACT Analysis
Ductwork modifications, supports, platforms	$0	
Electrical system upgrades	$1,136,455	Ratio from Brown Unit 3 BACT Analysis
Instrumentation and controls	$59,190	Ratio from Brown Unit 3 BACT Analysis
Subtotal capital cost (CC)	$2,485,996	
Freight	$62,000	(CC) X 2.5%
Total purchased equipment cost (PEC)	$2,548,000	
Direct installation costs		
Foundation & supports	$255,000	(PEC) X 10.0%
Handling & erection	$510,000	(PEC) X 20.0%
Electrical	$255,000	(PEC) X 10.0%
Piping	$127,000	(PEC) X 5.0%
Insulation	$51,000	(PEC) X 2.0%
Painting	$127,000	(PEC) X 5.0%
Demolition	$0	(PEC) X 0.0%
Relocation	$0	(PEC) X 0.0%
Total direct installation costs (DIC)	$1,325,000	
Site preparation	$0	N/A
Buildings	$75,000	Engineering estimate
Total direct costs (DC) = (PEC) + (DIC)	$3,948,000	
Indirect Costs		
Engineering	$474,000	(DC) X 12.0%
Owner's cost	$474,000	(DC) X 12.0%
Construction management	$395,000	(DC) X 10.0%
Start-up and spare parts	$59,000	(DC) X 1.5%
Performance test	$100,000	Engineering estimate
Contingencies	$790,000	(DC) X 20.0%
Total indirect costs (IC)	$2,292,000	
Allowance for Funds Used During Construction (AFDC)	$140,000	[(DC)+(IC)] X 4.50% 1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,380,000	
Cost Effectiveness	*$12 /kW*	
ANNUAL COST		
Direct Annual Costs		
Fixed annual costs		
Maintenance labor and materials	$118,000	(DC) X 3.0%
Operating labor	$121,000	1 FTE and 121,000 $/year Estimated manpower
Total fixed annual costs	$239,000	
Variable annual costs		81 % capacity factor
Reagent (BPAC)	$3,903,000	500 lb/hr and 2200 $/ton
Byproduct disposal cost	$27,000	500 lb/hr and 15 $/ton
Auxiliary power	$39,000	220 kW and 0.02487 $/kWh
Total variable annual costs	$3,969,000	
Total direct annual costs (DAC)	$4,208,000	
Indirect Annual Costs		
Cost for capital recovery	$776,000	(TCI) X 12.17% CRF
Total indirect annual costs (IDAC)	$776,000	
Total Annual Cost (TAC) = (DAC) + (IDAC)	$4,984,000	

Plant Name:	Ghent
Unit:	2
MW	517
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$227,000,000	$439	$7,078,000	$34,704,000
Fabric Filter	$120,000,000	$232	$5,002,000	$19,606,000
Lime Injection	$5,483,000	$11	$2,775,000	$3,442,000
PAC Injection	$6,109,000	$12	$2,880,000	$3,623,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$359,592,000	$696	$17,835,000	$61,597,000

GHENT UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$8,731,000	
Ductwork and Breeching	$6,743,000	
Mechanical - Balance of Plant (BOP)	$2,208,000	
Electrical - Equipment, Raceway	$2,522,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$882,000	
Control - DCS Instrumentation	$284,000	
Air Heater Modifications	$0	Engineering Estimates
ID Fans	$2,858,000	Engineering Estimates
Catalyst	$3,547,000	
Selective Catalytic Reduction System (Including Ammonia System)	$3,094,000	
Subtotal Purchase Contract	**$31,369,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$5,375,000	
Civil/Structural Construction - Sub-Structures	$1,397,000	
Mechanical/Chemical Construction	$16,896,000	
Electrical/Control Construction	$7,727,000	
Service Contracts & Construction Indirects	$26,991,000	
Demolition Costs	$9,000,000	Engineering Estimates
Subtotal Construction Contracts	**$67,386,000**	
Construction Difficulty Costs	**$94,340,400**	Engineering Estimates
Total Direct Costs	**$193,095,400**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$7,743,000	
EPC Construction Management (Includes G&A & Fee)	$4,858,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$1,275,000	
Sales Taxes	$1,800,000	
Project Contingency	$18,169,000	
Total Indirect Costs	**$33,845,000**	
Total Contracted Costs	**$227,000,000**	
Capital Cost Effectiveness	***$439***	***/kW***

ANNUAL COST

Capacity Factor = 71%

Fixed Annual Costs

Operating labor	$121,000	1 FTE and	121,000 $/year
Maintenance labor & materials	$5,793,000	(DC) X 3.0%	
Yearly emissions testing	$25,000	Engineering Estimates	
Catalyst activity testing	$5,000	Engineering Estimates	
Fly ash sampling and analysis	$20,000	Engineering Estimates	
Subtotal Fixed Annual Costs	**$5,964,000**		

Variable Annual Costs

Reagent	$459,000	285 lb/hr and	517.55 $/ton
Auxiliary and ID fan power	$355,000	2,320 kW and	0.02459 $/kWh
Catalyst replacement	$300,000	65 m3 and	6,500 $/m3
Subtotal Variable Annual Costs	**$1,114,000**		
Total Annual Costs	**$7,078,000**		
Levelized Capital Costs	**$27,626,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$34,704,000**		

GHENT UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,984,000	
Mechanical - Balance of Plant (BOP)	$14,275,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$302,000	
Control - DCS Instrumentation	$336,000	
ID Fans	$1,319,000	Engineering Estimates
Subtotal Purchase Contract	**$21,216,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,435,000	
Civil/Structural Construction - Sub-Structures	$1,686,000	
Mechanical/Chemical Construction	$16,866,000	
Electrical/Control Construction	$5,695,000	
Service Contracts & Construction Indirects	$275,000	
Demolition Costs	$6,000,000	Engineering Estimates
Subtotal Construction Contracts	**$34,957,000**	
Construction Difficulty Costs	**$48,939,800**	Engineering Estimates
Total Direct Costs	**$105,112,800**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,703,000	
EPC Construction Management (Includes G&A & Fee)	$4,386,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$662,000	
Sales Taxes	$236,000	
Project Contingency - 18%	$2,470,000	
Total Indirect Costs	**$14,457,000**	
Total Contracted Costs	$120,000,000	
Cost Effectiveness	*$232*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	71%
Maintenance labor and materials	$3,600,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$3,600,000**		
Variable Annual Costs			
Byproduct disposal	$5,000	115 lb/hr and	15 $/ton
Bag replacement cost	$592,000	17,770 bags and	100 $/bag
Cage replacement cost	$296,000	17,770 cages and	50 $/cage
ID fan power	$392,000	2,560 kW and	0.02459 $/kWh
Auxiliary power	$117,000	765 kW and	0.02459 $/kWh
Subtotal Variable Annual Costs	$1,402,000		
Total Annual Costs	$5,002,000		
Levelized Capital Costs	**$14,604,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$19,606,000		

Ghent Unit 2
517 MW
High Level Emissions Control Study

Technology: **Sorbent Injection** **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$279,493	From Previous Mill Creek BACT Study			
Short-term storage silo	$185,493	From Previous Mill Creek BACT Study			
Air blowers	$254,427	From Previous Mill Creek BACT Study			
Rotary feeders	$41,360	From Previous Mill Creek BACT Study			
Injection system	$167,947	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,100,427	From Previous Mill Creek BACT Study			
Instrumentation and controls	$52,640	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$2,081,787				
Freight	$94,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$2,176,000				
Direct installation costs					
Foundation & supports	$218,000	(PEC) X	10.0%		
Handling & erection	$435,000	(PEC) X	20.0%		
Electrical	$218,000	(PEC) X	10.0%		
Piping	$109,000	(PEC) X	5.0%		
Insulation	$44,000	(PEC) X	2.0%		
Painting	$109,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,133,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,384,000				
Indirect Costs					
Engineering	$406,000	(DC) X	12.0%		
Owner's cost	$406,000	(DC) X	12.0%		
Construction management	$338,000	(DC) X	10.0%		
Start-up and spare parts	$51,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$677,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,978,000				
Allowance for Funds Used During Construction (AFDC)	$121,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$5,483,000**				
Cost Effectiveness	***$11 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$102,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	
Total fixed annual costs	$223,000				
Variable annual costs				71 %	capacity factor
Lime	$2,233,000		5,450 lb/hr and	131.78 $/ton	
Byproduct disposal	$291,000		6,230 lb/hr and	15 $/ton	
Auxiliary power	$28,000		180 kW and	0.02459 $/kWh	
Total variable annual costs	$2,552,000				
Total direct annual costs (DAC)	$2,775,000				
Indirect Annual Costs					
Cost for capital recovery	$667,000	(TCI) X	12.17% CRF		
Total indirect annual costs (IDAC)	$667,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$3,442,000**				

Ghent Unit 2
517 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$395,952	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$260,197	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$362,013	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$45,252	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$169,694	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,086,039	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$56,565	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,375,711				
Freight	$59,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,435,000				
Direct installation costs					
Foundation & supports	$244,000	(PEC) X	10.0%		
Handling & erection	$487,000	(PEC) X	20.0%		
Electrical	$244,000	(PEC) X	10.0%		
Piping	$122,000	(PEC) X	5.0%		
Insulation	$49,000	(PEC) X	2.0%		
Painting	$122,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,268,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,778,000				
Indirect Costs					
Engineering	$453,000	(DC) X	12.0%		
Owner's cost	$453,000	(DC) X	12.0%		
Construction management	$378,000	(DC) X	10.0%		
Start-up and spare parts	$57,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$756,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,197,000				
Allowance for Funds Used During Construction (AFDC)	$134,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,109,000				
Cost Effectiveness	*$12 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$113,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	Estimated manpower
Total fixed annual costs	$234,000				
Variable annual costs				71 %	capacity factor
Reagent (BPAC)	$2,600,000		380 lb/hr and	2200 $/ton	
Byproduct disposal cost	$18,000		380 lb/hr and	15 $/ton	
Auxiliary power	$28,000		180 kW and	0.02459 $/kWh	
Total variable annual costs	$2,646,000				
Total direct annual costs (DAC)	$2,880,000				
Indirect Annual Costs					
Cost for capital recovery	$743,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$743,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$3,623,000				

Plant Name:	Ghent
Unit:	3
MW	523
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$138,000,000	$264	$6,122,000	$22,917,000
PAC Injection	$6,173,000	$12	$4,134,000	$4,885,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$145,173,000	$278	$10,356,000	$28,024,000

GHENT UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$10,036,000	
Mechanical - Balance of Plant (BOP)	$14,374,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$305,000	
Control - DCS Instrumentation	$338,000	
ID Fans	$2,654,000	Engineering Estimates
Subtotal Purchase Contract	**$27,707,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$8,931,000	
Civil/Structural Construction - Sub-Structures	$3,395,000	
Mechanical/Chemical Construction	$16,984,000	
Electrical/Control Construction	$5,735,000	
Service Contracts & Construction Indirects	$277,000	
Demolition Costs	$1,500,000	Engineering Estimates
Subtotal Construction Contracts	**$36,822,000**	
Construction Difficulty Costs	**$58,915,200**	Engineering Estimates
Total Direct Costs	**$123,444,200**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,781,000	
EPC Construction Management (Includes G&A & Fee)	$4,437,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$670,000	
Sales Taxes	$239,000	
Project Contingency - 18%	$2,499,000	
Total Indirect Costs	**$14,626,000**	
Total Contracted Costs	$138,000,000	
Cost Effectiveness	*$264 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	78%
Maintenance labor and materials	$4,140,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$4,140,000**		
Variable Annual Costs			
Byproduct disposal	$4,000	85 lb/hr and	15 $/ton
Bag replacement cost	$799,000	23,960 bags and	100 $/bag
Cage replacement cost	$399,000	23,960 cages and	50 $/cage
ID fan power	$601,000	3,455 kW and	0.02544 $/kWh
Auxiliary power	$179,000	1,030 kW and	0.02544 $/kWh
Subtotal Variable Annual Costs	$1,982,000		
Total Annual Costs	$6,122,000		
Levelized Capital Costs	**$16,795,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$22,917,000		

Ghent Unit 3
523 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$400,547	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$263,217	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$366,214	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$45,777	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$171,663	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,098,643	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$57,221	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,403,282				
Freight	$60,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,463,000				
Direct installation costs					
Foundation & supports	$246,000	(PEC) X	10.0%		
Handling & erection	$493,000	(PEC) X	20.0%		
Electrical	$246,000	(PEC) X	10.0%		
Piping	$123,000	(PEC) X	5.0%		
Insulation	$49,000	(PEC) X	2.0%		
Painting	$123,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,280,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,818,000				
Indirect Costs					
Engineering	$458,000	(DC) X	12.0%		
Owner's cost	$458,000	(DC) X	12.0%		
Construction management	$382,000	(DC) X	10.0%		
Start-up and spare parts	$57,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$764,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,219,000				
Allowance for Funds Used During Construction (AFDC)	$136,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$6,173,000				
Cost Effectiveness	*$12 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$115,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	Estimated manpower
Total fixed annual costs	$236,000				
Variable annual costs				78 %	capacity factor
Reagent (BPAC)	$3,833,000		510 lb/hr and	2200 $/ton	
Byproduct disposal cost	$26,000		510 lb/hr and	15 $/ton	
Auxiliary power	$39,000		225 kW and	0.02544 $/kWh	
Total variable annual costs	$3,898,000				
Total direct annual costs (DAC)	$4,134,000				
Indirect Annual Costs					
Cost for capital recovery	$751,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$751,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$4,885,000				

Plant Name:	Ghent
Unit:	4
MW	526
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$117,000,000	$222	$5,363,000	$19,602,000
PAC Injection	$6,210,000	$12	$3,896,000	$4,652,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$124,210,000	$236	$9,359,000	$24,476,000

GHENT UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$5,035,000	
Mechanical - Balance of Plant (BOP)	$14,424,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$306,000	
Control - DCS Instrumentation	$339,000	
ID Fans	$2,574,000	Engineering Estimates
Subtotal Purchase Contract	**$22,678,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,481,000	
Civil/Structural Construction - Sub-Structures	$1,703,000	
Mechanical/Chemical Construction	$17,042,000	
Electrical/Control Construction	$5,755,000	
Service Contracts & Construction Indirects	$278,000	
Demolition Costs	$1,500,000	Engineering Estimates
Subtotal Construction Contracts	**$30,759,000**	
Construction Difficulty Costs	**$49,214,400**	Engineering Estimates
Total Direct Costs	**$102,651,400**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,820,000	
EPC Construction Management (Includes G&A & Fee)	$4,463,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$674,000	
Sales Taxes	$240,000	
Project Contingency - 18%	$2,513,000	
Total Indirect Costs	**$14,710,000**	
Total Contracted Costs	$117,000,000	
Cost Effectiveness	*$222*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	77%
Maintenance labor and materials	$3,510,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$3,510,000**		
Variable Annual Costs			
Byproduct disposal	$0	0 lb/hr and	15 $/ton
Bag replacement cost	$758,000	22,730 bags and	100 $/bag
Cage replacement cost	$379,000	22,730 cages and	50 $/cage
ID fan power	$551,000	3,280 kW and	0.0249 $/kWh
Auxiliary power	$165,000	980 kW and	0.0249 $/kWh
Subtotal Variable Annual Costs	$1,853,000		
Total Annual Costs	$5,363,000		
Levelized Capital Costs	**$14,239,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$19,602,000		

Ghent Unit 4
526 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$402,845	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$264,726	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$368,315	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$46,039	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$172,648	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,104,945	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$57,549	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,417,068				
Freight	$60,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,477,000				
Direct installation costs					
Foundation & supports	$248,000	(PEC) X	10.0%		
Handling & erection	$495,000	(PEC) X	20.0%		
Electrical	$248,000	(PEC) X	10.0%		
Piping	$124,000	(PEC) X	5.0%		
Insulation	$50,000	(PEC) X	2.0%		
Painting	$124,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,289,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,841,000				
Indirect Costs					
Engineering	$461,000	(DC) X	12.0%		
Owner's cost	$461,000	(DC) X	12.0%		
Construction management	$384,000	(DC) X	10.0%		
Start-up and spare parts	$58,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$768,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,232,000				
Allowance for Funds Used During Construction (AFDC)	$137,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$6,210,000**				
Cost Effectiveness	***$12 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$115,000	(DC) X	3.0%		
Operating labor	$121,000		1 FTE and	121,000 $/year	Estimated manpower
Total fixed annual costs	$236,000				
Variable annual costs				77 %	capacity factor
Reagent (BPAC)	$3,599,000		485 lb/hr and	2200 $/ton	
Byproduct disposal cost	$25,000		485 lb/hr and	15 $/ton	
Auxiliary power	$36,000		215 kW and	0.0249 $/kWh	
Total variable annual costs	$3,660,000				
Total direct annual costs (DAC)	$3,896,000				
Indirect Annual Costs					
Cost for capital recovery	$756,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$756,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$4,652,000**				

Cane Run

Plant Name: Cane Run
Unit: 4
MW 168
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$63,000,000	$375	$2,219,000	$9,886,000
WFGD	$152,000,000	$905	$8,428,000	$26,926,000
Fabric Filter	$33,000,000	$196	$1,924,000	$5,940,000
Lime Injection	$2,569,000	$15	$983,000	$1,296,000
PAC Injection	$2,326,000	$14	$1,087,000	$1,370,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$253,395,000	$1,508	$14,691,000	$45,529,000

CANE RUN UNIT 4 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,448,000	
Ductwork and Breeching	$3,435,000	
Mechanical - Balance of Plant (BOP)	$1,125,000	
Electrical - Equipment, Raceway	$1,285,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$449,000	
Control - DCS Instrumentation	$145,000	
Air Heater	$2,910,000	Engineering Estimates
ID Fans	$1,717,000	Engineering Estimates
Catalyst	$1,807,000	
Selective Catalytic Reduction System (Including Ammonia System)	$1,576,000	
Subtotal Purchase Contract	**$19,397,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,738,000	
Civil/Structural Construction - Sub-Structures	$712,000	
Mechanical/Chemical Construction	$8,607,000	
Electrical/Control Construction	$3,937,000	
Service Contracts & Construction Indirects	$13,750,000	
Demolition Costs	$2,754,000	Engineering Estimates
Subtotal Construction Contracts	**$32,498,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$51,895,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$2,516,000	
EPC Construction Management (Includes G&A & Fee)	$1,579,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$414,000	
Sales Taxes	$585,000	
Project Contingency	$5,904,000	
Total Indirect Costs	**$10,998,000**	
Total Contracted Costs	**$63,000,000**	
Capital Cost Effectiveness	***$375***	***/kW***

ANNUAL COST

Capacity Factor = 60%

Fixed Annual Costs				
Operating labor	$127,000	1 FTE and	126,882 $/year	
Maintenance labor & materials	$1,557,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$1,734,000**			
Variable Annual Costs				
Reagent	$202,000	145 lb/hr and	530.03 $/ton	
Auxiliary and ID fan power	$146,000	965 kW and	0.0288 $/kWh	
Catalyst replacement	$137,000	35 m3 and	6,500 $/m3	
Subtotal Variable Annual Costs	**$485,000**			
Total Annual Costs	**$2,219,000**			
Levelized Capital Costs	**$7,667,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$9,886,000**			

CANE RUN UNIT 4 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$1,712,000	
Ductwork and Breeching	$2,638,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$56,758,000	
Electrical - Equipment, Raceway	$6,304,000	
VFDs, Motors and Couplings	$3,705,000	
Switchgear and MCCs	$3,825,000	
Control - DCS Instrumentation	$3,537,000	
ID Fans	$1,189,000	Engineering Estimates
Subtotal Purchase Contract	**$79,668,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$6,373,000	
Civil/Structural Construction - Sub-Structures	$621,000	
Mechanical/Chemical Construction	$14,560,000	
Electrical/Control Construction	$5,969,000	
Service Contracts & Construction Indirects	$11,344,000	
Subtotal Construction Contracts	**$38,867,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$118,535,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,849,000	
EPC Construction Management (Includes G&A & Fee)	$6,369,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$653,000	
Sales Taxes	$26,000	
Project Contingency	$21,236,000	
Total Indirect Costs	**$33,133,000**	
Total Contracted Costs	$152,000,000	
Cost Effectiveness	*$905 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	60%
Operating labor	$2,538,000	20 FTE and	126,882 $/year
Maintenance labor and materials	$3,556,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$6,094,000**		
Variable Annual Costs			
Reagent	$479,000	15,795 lb/hr and	11.54 $/ton
Byproduct disposal	$1,071,000	27,170 lb/hr and	15 $/ton
Auxiliary and ID fan power	$607,000	4,010 kW and	0.03 $/kWh
Water	$177,000	280 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$2,334,000		
Total Annual Costs	$8,428,000		
Levelized Capital Costs	**$18,498,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$26,926,000		

CANE RUN UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$2,539,000		
Mechanical - Balance of Plant (BOP)	$7,272,000		
Electrical - Equipment, Raceway, Switchgears, MCC	$154,000		
Control - DCS Instrumentation	$171,000		
ID Fans	$793,000	Engineering Estimates	
Subtotal Purchase Contract	**$10,929,000**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$2,259,000		
Civil/Structural Construction - Sub-Structures	$859,000		
Mechanical/Chemical Construction	$8,592,000		
Electrical/Control Construction	$2,901,000		
Service Contracts & Construction Indirects	$140,000		
Demolition Costs	$2,754,000	Engineering Estimates	
Subtotal Construction Contracts	**$17,505,000**		
Construction Difficulty Costs	**$0**	Engineering Estimates	
Total Direct Costs	**$28,434,000**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$2,178,000		
EPC Construction Management (Includes G&A & Fee)	$1,425,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$215,000		
Sales Taxes	$77,000		
Project Contingency - 18%	$803,000		
Total Indirect Costs	**$4,698,000**		
Total Contracted Costs	$33,000,000		
Cost Effectiveness	*$196 /kW*		

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	60%
Maintenance labor and materials	$990,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$990,000**		
Variable Annual Costs			
Byproduct disposal	$551,000	13,975 lb/hr and	15 $/ton
Bag replacement cost	$134,000	4,030 bags and	100 $/bag
Cage replacement cost	$67,000	4,030 cages and	50 $/cage
ID fan power	$159,000	1,050 kW and	0.03 $/kWh
Auxiliary power	$23,000	155 kW and	0.03 $/kWh
Subtotal Variable Annual Costs	$934,000		
Total Annual Costs	$1,924,000		
Levelized Capital Costs	**$4,016,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$5,940,000		

Cane Run Unit 4
168 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$124,880	From Previous Mill Creek BACT Study			
Short-term storage silo	$82,880	From Previous Mill Creek BACT Study			
Air blowers	$113,680	From Previous Mill Creek BACT Study			
Rotary feeders	$18,480	From Previous Mill Creek BACT Study			
Injection system	$75,040	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$491,680	From Previous Mill Creek BACT Study			
Instrumentation and controls	$23,520	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$930,160				
Freight	$42,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$972,000				
Direct installation costs					
Foundation & supports	$97,000	(PEC) X	10.0%		
Handling & erection	$194,000	(PEC) X	20.0%		
Electrical	$97,000	(PEC) X	10.0%		
Piping	$49,000	(PEC) X	5.0%		
Insulation	$19,000	(PEC) X	2.0%		
Painting	$49,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$505,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$1,552,000				
Indirect Costs					
Engineering	$186,000	(DC) X	12.0%		
Owner's cost	$186,000	(DC) X	12.0%		
Construction management	$155,000	(DC) X	10.0%		
Start-up and spare parts	$23,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$310,000	(DC) X	20.0%		
Total indirect costs (IC)	$960,000				
Allowance for Funds Used During Construction (AFDC)	$57,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,569,000				
Cost Effectiveness	*$15 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$47,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$174,000				
Variable annual costs				60 %	capacity factor
Lime	$702,000		2,020 lb/hr and	132.19 $/ton	
Byproduct disposal	$91,000		2,310 lb/hr and	15 $/ton	
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh	
Total variable annual costs	$809,000				
Total direct annual costs (DAC)	$983,000				
Indirect Annual Costs					
Cost for capital recovery	$313,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$313,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,296,000				

Cane Run Unit 4
168 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$141,532	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$93,007	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$129,400	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$16,175	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$60,656	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$388,201	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$20,219	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$849,190				
Freight	$21,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$870,000				
Direct installation costs					
Foundation & supports	$87,000	(PEC) X	10.0%		
Handling & erection	$174,000	(PEC) X	20.0%		
Electrical	$87,000	(PEC) X	10.0%		
Piping	$44,000	(PEC) X	5.0%		
Insulation	$17,000	(PEC) X	2.0%		
Painting	$44,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$453,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$1,398,000				
Indirect Costs					
Engineering	$168,000	(DC) X	12.0%		
Owner's cost	$168,000	(DC) X	12.0%		
Construction management	$140,000	(DC) X	10.0%		
Start-up and spare parts	$21,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$280,000	(DC) X	20.0%		
Total indirect costs (IC)	$877,000				
Allowance for Funds Used During Construction (AFDC)	$51,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,326,000				
Cost Effectiveness	*$14 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$42,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$169,000				
Variable annual costs				60 %	capacity factor
Reagent (BPAC)	$896,000		155 lb/hr and	2200 $/ton	
Byproduct disposal	$6,000		155 lb/hr and	15 $/ton	
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh	
Total variable annual costs	$918,000				
Total direct annual costs (DAC)	$1,087,000				
Indirect Annual Costs					
Cost for capital recovery	$283,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$283,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,370,000				

Plant Name:	Cane Run
Unit:	5
MW	181
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$66,000,000	$365	$2,421,000	$10,453,000
WFGD	$159,000,000	$878	$8,789,000	$28,139,000
Fabric Filter	$35,000,000	$193	$2,061,000	$6,321,000
Lime Injection	$2,752,000	$15	$1,089,000	$1,424,000
PAC Injection	$2,490,000	$14	$1,120,000	$1,423,000
Neural Networks	$500,000	$3	$50,000	$111,000
Total	$265,742,000	$1,468	$15,530,000	$47,871,000

CANE RUN UNIT 5 - SCR COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$4,651,000	
Ductwork and Breeching	$3,592,000	
Mechanical - Balance of Plant (BOP)	$1,176,000	
Electrical - Equipment, Raceway	$1,344,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$470,000	
Control - DCS Instrumentation	$151,000	
Air Heater	$3,135,000	Engineering Estimates
ID Fans	$1,864,000	Engineering Estimates
Catalyst	$1,890,000	
Selective Catalytic Reduction System (Including Ammonia System)	$1,648,000	
Subtotal Purchase Contract	**$20,421,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$2,864,000	
Civil/Structural Construction - Sub-Structures	$744,000	
Mechanical/Chemical Construction	$9,001,000	
Electrical/Control Construction	$4,117,000	
Service Contracts & Construction Indirects	$14,379,000	
Demolition Costs	$2,967,000	Engineering Estimates
Subtotal Construction Contracts	**$34,072,000**	

Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$54,493,000**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$2,711,000
EPC Construction Management (Includes G&A & Fee)	$1,701,000
Startup Spare Parts (Included)	$0
Construction Utilites (Power & Water) - Included	$0
Project Insurance	$446,000
Sales Taxes	$630,000
Project Contingency	$6,361,000
Total Indirect Costs	**$11,849,000**

Total Contracted Costs	**$66,000,000**
Capital Cost Effectiveness	***$365 /kW***

ANNUAL COST

Capacity Factor = 62%

Fixed Annual Costs

Operating labor	$127,000	1 FTE and	126,882	$/year
Maintenance labor & materials	$1,635,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$1,812,000**			

Variable Annual Costs

Reagent	$273,000	190 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$155,000	1,005 kW and	0.02835	$/kWh
Catalyst replacement	$181,000	45 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$609,000**			

Total Annual Costs	**$2,421,000**	
Levelized Capital Costs	**$8,032,000**	(TCI) X 12.17% CRF
Levelized Annual Costs	**$10,453,000**	

CANE RUN UNIT 5 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$1,791,000	
Ductwork and Breeching	$2,759,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$59,354,000	
Electrical - Equipment, Raceway	$6,592,000	
VFDs, Motors and Couplings	$3,874,000	
Switchgear and MCCs	$4,000,000	
Control - DCS Instrumentation	$3,698,000	
ID Fans	$1,291,000	Engineering Estimates
Subtotal Purchase Contract	**$83,359,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$6,665,000	
Civil/Structural Construction - Sub-Structures	$649,000	
Mechanical/Chemical Construction	$15,226,000	
Electrical/Control Construction	$6,242,000	
Service Contracts & Construction Indirects	$11,862,000	
Subtotal Construction Contracts	**$40,644,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$124,003,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$5,147,000	
EPC Construction Management (Includes G&A & Fee)	$6,760,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$693,000	
Sales Taxes	$27,000	
Project Contingency	$22,541,000	
Total Indirect Costs	**$35,168,000**	
Total Contracted Costs	**$159,000,000**	
Cost Effectiveness	***$878 /kW***	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%
Operating labor	$2,538,000	20 FTE and	126,882 $/year
Maintenance labor and materials	$3,720,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$6,258,000**		
Variable Annual Costs			
Reagent	$542,000	17,310 lb/hr and	11.54 $/ton
Byproduct disposal	$1,216,000	29,850 lb/hr and	15 $/ton
Auxiliary and ID fan power	$617,000	4,010 kW and	0.03 $/kWh
Water	$156,000	240 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$2,531,000		
Total Annual Costs	**$8,789,000**		
Levelized Capital Costs	**$19,350,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$28,139,000**		

CANE RUN UNIT 5 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,655,000	
Mechanical - Balance of Plant (BOP)	$7,605,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$161,000	
Control - DCS Instrumentation	$179,000	
ID Fans	$861,000	Engineering Estimates
Subtotal Purchase Contract	**$11,461,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,362,000	
Civil/Structural Construction - Sub-Structures	$898,000	
Mechanical/Chemical Construction	$8,985,000	
Electrical/Control Construction	$3,034,000	
Service Contracts & Construction Indirects	$146,000	
Demolition Costs	$2,967,000	Engineering Estimates
Subtotal Construction Contracts	**$18,392,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$29,853,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$2,347,000	
EPC Construction Management (Includes G&A & Fee)	$1,536,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$232,000	
Sales Taxes	$83,000	
Project Contingency - 18%	$865,000	
Total Indirect Costs	**$5,063,000**	
Total Contracted Costs	$35,000,000	
Cost Effectiveness	*$193*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	62%
Maintenance labor and materials	$1,050,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$1,050,000**		
Variable Annual Costs			
Byproduct disposal	$624,000	15,315 lb/hr and	15 $/ton
Bag replacement cost	$134,000	4,030 bags and	100 $/bag
Cage replacement cost	$67,000	4,030 cages and	50 $/cage
ID fan power	$162,000	1,050 kW and	0.03 $/kWh
Auxiliary power	$24,000	155 kW and	0.03 $/kWh
Subtotal Variable Annual Costs	$1,011,000		
Total Annual Costs	$2,061,000		
Levelized Capital Costs	**$4,260,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$6,321,000		

Cane Run Unit 5
181 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$134,543	From Previous Mill Creek BACT Study			
Short-term storage silo	$89,293	From Previous Mill Creek BACT Study			
Air blowers	$122,477	From Previous Mill Creek BACT Study			
Rotary feeders	$19,910	From Previous Mill Creek BACT Study			
Injection system	$80,847	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$529,727	From Previous Mill Creek BACT Study			
Instrumentation and controls	$25,340	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$1,002,137				
Freight	$45,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$1,047,000				
Direct installation costs					
Foundation & supports	$105,000	(PEC) X	10.0%		
Handling & erection	$209,000	(PEC) X	20.0%		
Electrical	$105,000	(PEC) X	10.0%		
Piping	$52,000	(PEC) X	5.0%		
Insulation	$21,000	(PEC) X	2.0%		
Painting	$52,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$544,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$1,666,000				
Indirect Costs					
Engineering	$200,000	(DC) X	12.0%		
Owner's cost	$200,000	(DC) X	12.0%		
Construction management	$167,000	(DC) X	10.0%		
Start-up and spare parts	$25,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$333,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,025,000				
Allowance for Funds Used During Construction (AFDC)	$61,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$2,752,000**				
Cost Effectiveness	***$15 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$50,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$177,000				
Variable annual costs				62 %	capacity factor
Lime	$793,000		2,210 lb/hr and	132.19 $/ton	
Byproduct disposal	$103,000		2,530 lb/hr and	15 $/ton	
Auxiliary power	$16,000		105 kW and	0.0288 $/kWh	
Total variable annual costs	$912,000				
Total direct annual costs (DAC)	$1,089,000				
Indirect Annual Costs					
Cost for capital recovery	$335,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$335,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$1,424,000**				

Cane Run Unit 5
181 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis
CAPITAL COST		
Direct Costs		
Purchased equipment costs		
Long-term storage silo (with truck unloading sys.)	$152,484	Ratio from Brown Unit 3 BACT Analysis
Short-term storage silo	$100,204	Ratio from Brown Unit 3 BACT Analysis
Air blowers	$139,414	Ratio from Brown Unit 3 BACT Analysis
Rotary feeders	$17,427	Ratio from Brown Unit 3 BACT Analysis
Injection system	$65,350	Ratio from Brown Unit 3 BACT Analysis
Ductwork modifications, supports, platforms	$0	
Electrical system upgrades	$418,241	Ratio from Brown Unit 3 BACT Analysis
Instrumentation and controls	$21,783	Ratio from Brown Unit 3 BACT Analysis
Subtotal capital cost (CC)	$914,902	
Freight	$23,000	(CC) X 2.5%
Total purchased equipment cost (PEC)	$938,000	
Direct installation costs		
Foundation & supports	$94,000	(PEC) X 10.0%
Handling & erection	$188,000	(PEC) X 20.0%
Electrical	$94,000	(PEC) X 10.0%
Piping	$47,000	(PEC) X 5.0%
Insulation	$19,000	(PEC) X 2.0%
Painting	$47,000	(PEC) X 5.0%
Demolition	$0	(PEC) X 0.0%
Relocation	$0	(PEC) X 0.0%
Total direct installation costs (DIC)	$489,000	
Site preparation	$0	N/A
Buildings	$75,000	Engineering estimate
Total direct costs (DC) = (PEC) + (DIC)	$1,502,000	
Indirect Costs		
Engineering	$180,000	(DC) X 12.0%
Owner's cost	$180,000	(DC) X 12.0%
Construction management	$150,000	(DC) X 10.0%
Start-up and spare parts	$23,000	(DC) X 1.5%
Performance test	$100,000	Engineering estimate
Contingencies	$300,000	(DC) X 20.0%
Total indirect costs (IC)	$933,000	
Allowance for Funds Used During Construction (AFDC)	$55,000	[(DC)+(IC)] X 4.50% 1 years (project time length X 1/2)
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$2,490,000	
Cost Effectiveness	*$14 /kW*	
ANNUAL COST		
Direct Annual Costs		
Fixed annual costs		
Maintenance labor and materials	$45,000	(DC) X 3.0%
Operating labor	$127,000	1 FTE and 126,882 $/year Estimated manpower
Total fixed annual costs	$172,000	
Variable annual costs		62 % capacity factor
Reagent (BPAC)	$926,000	155 lb/hr and 2200 $/ton
Byproduct disposal	$6,000	155 lb/hr and 15 $/ton
Auxiliary power	$16,000	105 kW and 0.0288 $/kWh
Total variable annual costs	$948,000	
Total direct annual costs (DAC)	$1,120,000	
Indirect Annual Costs		
Cost for capital recovery	$303,000	(TCI) X 12.17% CRF
Total indirect annual costs (IDAC)	$303,000	
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,423,000	

Plant Name:	Cane Run
Unit:	6
MW	261
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$86,000,000	$330	$2,793,000	$13,259,000
WFGD	$202,000,000	$774	$10,431,000	$35,014,000
Fabric Filter	$45,000,000	$172	$2,672,000	$8,149,000
Lime Injection	$3,873,000	$15	$1,367,000	$1,838,000
PAC Injection	$3,490,000	$13	$1,336,000	$1,761,000
Neural Networks	$500,000	$2	$50,000	$111,000
Total	$340,863,000	$1,306	$18,649,000	$60,132,000

CANE RUN UNIT 6 - SCR COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$5,794,000		
Ductwork and Breeching	$4,475,000		
Mechanical - Balance of Plant (BOP)	$1,465,000		
Electrical - Equipment, Raceway	$1,673,000		
VFDs, Motors and Couplings	$500,000	Engineering Estimates	
Switchgear and MCCs	$585,000		
Control - DCS Instrumentation	$189,000		
Air Heater	$4,700,000	Engineering Estimates	
ID Fans	$2,349,000	Engineering Estimates	
Catalyst	$2,354,000		
Selective Catalytic Reduction System (Including Ammonia System)	$2,053,000		
Subtotal Purchase Contract	**$26,137,000**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$3,567,000		
Civil/Structural Construction - Sub-Structures	$927,000		
Mechanical/Chemical Construction	$11,211,000		
Electrical/Control Construction	$5,128,000		
Service Contracts & Construction Indirects	$17,911,000		
Demolition Costs	$4,279,000	Engineering Estimates	
Subtotal Construction Contracts	**$43,023,000**		
Construction Difficulty Costs	**$0**	Engineering Estimates	
Total Direct Costs	**$69,160,000**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$3,909,000		
EPC Construction Management (Includes G&A & Fee)	$2,453,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$644,000		
Sales Taxes	$909,000		
Project Contingency	$9,172,000		
Total Indirect Costs	**$17,087,000**		
Total Contracted Costs	**$86,000,000**		
Capital Cost Effectiveness	***$330***	***/kW***	

ANNUAL COST

Capacity Factor = 54%

Fixed Annual Costs			
Operating labor	$127,000	1 FTE and	126,882 $/year
Maintenance labor & materials	$2,075,000	(DC) X 3.0%	
Yearly emissions testing	$25,000	Engineering Estimates	
Catalyst activity testing	$5,000	Engineering Estimates	
Fly ash sampling and analysis	$20,000	Engineering Estimates	
Subtotal Fixed Annual Costs	**$2,252,000**		
Variable Annual Costs			
Reagent	$207,000	165 lb/hr and	530.03 $/ton
Auxiliary and ID fan power	$194,000	1,360 kW and	0.03018 $/kWh
Catalyst replacement	$140,000	40 m3 and	6,500 $/m3
Subtotal Variable Annual Costs	**$541,000**		
Total Annual Costs	**$2,793,000**		
Levelized Capital Costs	**$10,466,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$13,259,000**		

CANE RUN UNIT 6 - WFGD COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$2,231,000		
Ductwork and Breeching	$3,437,000		
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$73,931,000		
Electrical - Equipment, Raceway	$8,211,000		
VFDs, Motors and Couplings	$4,826,000		
Switchgear and MCCs	$4,983,000		
Control - DCS Instrumentation	$4,607,000		
ID Fans	$1,626,000	Engineering Estimates	
Subtotal Purchase Contract	**$103,852,000**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$8,302,000		
Civil/Structural Construction - Sub-Structures	$809,000		
Mechanical/Chemical Construction	$18,966,000		
Electrical/Control Construction	$7,775,000		
Service Contracts & Construction Indirects	$14,776,000		
Subtotal Construction Contracts	**$50,628,000**		
Construction Difficulty Costs	**$0**	Engineering Estimates	
Total Direct Costs	**$154,480,000**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$6,898,000		
EPC Construction Management (Includes G&A & Fee)	$9,060,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$929,000		
Sales Taxes	$36,000		
Project Contingency	$30,210,000		
Total Indirect Costs	**$47,133,000**		
Total Contracted Costs	**$202,000,000**		
Cost Effectiveness	***$774 /kW***		

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	54%
Operating labor	$2,538,000	20 FTE and	126,882 $/year
Maintenance labor and materials	$4,634,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$7,172,000**		
Variable Annual Costs			
Reagent	$696,000	25,510 lb/hr and	11.54 $/ton
Byproduct disposal	$1,560,000	43,980 lb/hr and	15 $/ton
Auxiliary and ID fan power	$799,000	5,595 kW and	0.03 $/kWh
Water	$204,000	360 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$3,259,000		
Total Annual Costs	**$10,431,000**		
Levelized Capital Costs	**$24,583,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$35,014,000**		

CANE RUN UNIT 6 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$3,307,000	
Mechanical - Balance of Plant (BOP)	$9,473,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$201,000	
Control - DCS Instrumentation	$223,000	
ID Fans	$1,084,000	Engineering Estimates
Subtotal Purchase Contract	**$14,288,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$2,943,000	
Civil/Structural Construction - Sub-Structures	$1,119,000	
Mechanical/Chemical Construction	$11,192,000	
Electrical/Control Construction	$3,779,000	
Service Contracts & Construction Indirects	$182,000	
Demolition Costs	$4,279,000	Engineering Estimates
Subtotal Construction Contracts	**$23,494,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$37,782,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$3,384,000	
EPC Construction Management (Includes G&A & Fee)	$2,214,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$334,000	
Sales Taxes	$119,000	
Project Contingency - 18%	$1,247,000	
Total Indirect Costs	**$7,298,000**	
Total Contracted Costs	$45,000,000	
Cost Effectiveness	*$172*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	54%
Maintenance labor and materials	$1,350,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$1,350,000**		
Variable Annual Costs			
Byproduct disposal	$801,000	22,570 lb/hr and	15 $/ton
Bag replacement cost	$188,000	5,630 bags and	100 $/bag
Cage replacement cost	$94,000	5,630 cages and	50 $/cage
ID fan power	$208,000	1,460 kW and	0.03 $/kWh
Auxiliary power	$31,000	215 kW and	0.03 $/kWh
Subtotal Variable Annual Costs	$1,322,000		
Total Annual Costs	$2,672,000		
Levelized Capital Costs	**$5,477,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$8,149,000		

Cane Run Unit 6
261 MW
High Level Emissions Control Study

Technology: Lime Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$194,010	From Previous Mill Creek BACT Study			
Short-term storage silo	$128,760	From Previous Mill Creek BACT Study			
Air blowers	$176,610	From Previous Mill Creek BACT Study			
Rotary feeders	$28,710	From Previous Mill Creek BACT Study			
Injection system	$116,580	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$763,860	From Previous Mill Creek BACT Study			
Instrumentation and controls	$36,540	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$1,445,070				
Freight	$65,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$1,510,000				
Direct installation costs					
Foundation & supports	$151,000	(PEC) X	10.0%		
Handling & erection	$302,000	(PEC) X	20.0%		
Electrical	$151,000	(PEC) X	10.0%		
Piping	$76,000	(PEC) X	5.0%		
Insulation	$30,000	(PEC) X	2.0%		
Painting	$76,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$786,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$2,371,000				
Indirect Costs					
Engineering	$285,000	(DC) X	12.0%		
Owner's cost	$285,000	(DC) X	12.0%		
Construction management	$237,000	(DC) X	10.0%		
Start-up and spare parts	$36,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$474,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,417,000				
Allowance for Funds Used During Construction (AFDC)	$85,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$3,873,000				
Cost Effectiveness	*$15 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$71,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$198,000				
Variable annual costs				54 %	capacity factor
Lime	$1,019,000		3,260 lb/hr and	132.19 $/ton	
Byproduct disposal	$132,000		3,730 lb/hr and	15 $/ton	
Auxiliary power	$18,000		125 kW and	0.03018 $/kWh	
Total variable annual costs	$1,169,000				
Total direct annual costs (DAC)	$1,367,000				
Indirect Annual Costs					
Cost for capital recovery	$471,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$471,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,838,000				

Cane Run Unit 6
261 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$219,880	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$144,492	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$201,033	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$25,129	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$94,234	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$603,098	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$31,411	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$1,319,278				
Freight	$33,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$1,352,000				
Direct installation costs					
Foundation & supports	$135,000	(PEC) X	10.0%		
Handling & erection	$270,000	(PEC) X	20.0%		
Electrical	$135,000	(PEC) X	10.0%		
Piping	$68,000	(PEC) X	5.0%		
Insulation	$27,000	(PEC) X	2.0%		
Painting	$68,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$703,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$2,130,000				
Indirect Costs					
Engineering	$256,000	(DC) X	12.0%		
Owner's cost	$256,000	(DC) X	12.0%		
Construction management	$213,000	(DC) X	10.0%		
Start-up and spare parts	$32,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$426,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,283,000				
Allowance for Funds Used During Construction (AFDC)	$77,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$3,490,000				
Cost Effectiveness	*$13 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$64,000	(DC) X	3.0%		
Operating labor	$127,000		1 FTE and	126,882 $/year	Estimated manpower
Total fixed annual costs	$191,000				
Variable annual costs				54 %	capacity factor
Reagent (BPAC)	$1,119,000		215 lb/hr and	2200 $/ton	
Byproduct disposal	$8,000		215 lb/hr and	15 $/ton	
Auxiliary power	$18,000		125 kW and	0.03018 $/kWh	
Total variable annual costs	$1,145,000				
Total direct annual costs (DAC)	$1,336,000				
Indirect Annual Costs					
Cost for capital recovery	$425,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$425,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$1,761,000				

Mill Creek

Plant Name: Mill Creek
Unit: 1
MW 330
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$97,000,000	$294	$3,366,000	$15,171,000
WFGD	$297,000,000	$900	$14,341,000	$50,486,000
Fabric Filter	$81,000,000	$245	$3,477,000	$13,335,000
Electrostatic Precipitator	$32,882,000	$100	$3,581,000	$7,583,000
Lime Injection	$4,480,000	$14	$2,024,000	$2,569,000
PAC Injection	$4,412,000	$13	$2,213,000	$2,750,000
Neural Networks	$1,000,000	$3	$100,000	$222,000
Total	$517,774,000	$1,569	$29,102,000	$92,116,000

MILL CREEK UNIT 1 - SCR COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$6,669,000	
Ductwork and Breeching	$5,151,000	
Mechanical - Balance of Plant (BOP)	$1,687,000	
Electrical - Equipment, Raceway	$1,926,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$674,000	
Control - DCS Instrumentation	$217,000	
Air Heater Modifications	$1,704,000	Engineering Estimates
ID Fans	$3,262,000	Engineering Estimates
Catalyst	$2,709,000	
Selective Catalytic Reduction System (Including Ammonia System)	$2,363,000	
Subtotal Purchase Contract	**$26,862,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$4,106,000	
Civil/Structural Construction - Sub-Structures	$1,067,000	
Mechanical/Chemical Construction	$12,906,000	
Electrical/Control Construction	$5,902,000	
Service Contracts & Construction Indirects	$20,617,000	
Demolition Costs	$4,104,000	Engineering Estimates
Subtotal Construction Contracts	**$48,702,000**	

Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$75,564,000**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$4,942,000
EPC Construction Management (Includes G&A & Fee)	$3,101,000
Startup Spare Parts (Included)	$0
Construction Utilites (Power & Water) - Included	$0
Project Insurance	$814,000
Sales Taxes	$1,149,000
Project Contingency	$11,597,000
Total Indirect Costs	**$21,603,000**
Total Contracted Costs	**$97,000,000**
Capital Cost Effectiveness	***$294 /kW***

ANNUAL COST

Capacity Factor = 68%

Fixed Annual Costs

Operating labor	$133,000	1 FTE and	132,901	$/year
Maintenance labor & materials	$2,267,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,450,000**			

Variable Annual Costs

Reagent	$418,000	265 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$233,000	1,815 kW and	0.02156	$/kWh
Catalyst replacement	$265,000	60 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$916,000**			

Total Annual Costs	**$3,366,000**	
Levelized Capital Costs	**$11,805,000**	(TCI) X 12.17% CRF
Levelized Annual Costs	**$15,171,000**	

MILL CREEK UNIT 1 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,568,000	
Ductwork and Breeching	$3,956,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$85,104,000	
Electrical - Equipment, Raceway	$9,452,000	
VFDs, Motors and Couplings	$5,555,000	
Switchgear and MCCs	$5,736,000	
Control - DCS Instrumentation	$5,303,000	
ID Fans	$2,510,000	Engineering Estimates
Subtotal Purchase Contract	**$120,184,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$9,556,000	
Civil/Structural Construction - Sub-Structures	$931,000	
Mechanical/Chemical Construction	$21,832,000	
Electrical/Control Construction	$8,950,000	
Service Contracts & Construction Indirects	$17,009,000	
Demolition Costs	$12,313,000	Engineering Estimates
Subtotal Construction Contracts	**$70,591,000**	
Construction Difficulty Costs	**$49,414,000**	Engineering Estimates
Total Direct Costs	**$240,189,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$8,322,000	
EPC Construction Management (Includes G&A & Fee)	$10,930,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$1,121,000	
Sales Taxes	$44,000	
Project Contingency	$36,445,000	
Total Indirect Costs	**$56,862,000**	
Total Contracted Costs	$297,000,000	
Cost Effectiveness	*$900*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	68%
Operating labor	$2,658,000	20 FTE and	132,901 $/year
Maintenance labor and materials	$7,206,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$9,864,000**		
Variable Annual Costs			
Reagent	$713,000	31,765 lb/hr and	7.54 $/ton
Byproduct disposal	$2,444,000	54,715 lb/hr and	15 $/ton
Auxiliary and ID fan power	$963,000	7,495 kW and	0.02156 $/kWh
Water	$357,000	500 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$4,477,000		
Total Annual Costs	$14,341,000		
Levelized Capital Costs	**$36,145,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$50,486,000		

MILL CREEK UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,568,000	
Mechanical - Balance of Plant (BOP)	$13,085,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$277,000	
Control - DCS Instrumentation	$308,000	
ID Fans	$1,757,000	Engineering Estimates
Subtotal Purchase Contract	**$19,995,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,065,000	
Civil/Structural Construction - Sub-Structures	$1,545,000	
Mechanical/Chemical Construction	$15,460,000	
Electrical/Control Construction	$5,221,000	
Service Contracts & Construction Indirects	$252,000	
Demolition Costs	$4,104,000	Engineering Estimates
Subtotal Construction Contracts	**$30,647,000**	
Construction Difficulty Costs	**$21,452,900**	Engineering Estimates
Total Direct Costs	**$72,094,900**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,279,000	
EPC Construction Management (Includes G&A & Fee)	$2,800,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$423,000	
Sales Taxes	$151,000	
Project Contingency - 18%	$1,577,000	
Total Indirect Costs	**$9,230,000**	
Total Contracted Costs	$81,000,000	
Cost Effectiveness	*$245*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	68%		
Maintenance labor and materials	$2,430,000	(DC) X 3.0%			
Subtotal Fixed Annual Costs	**$2,430,000**				
Variable Annual Costs					
Byproduct disposal	$0	0	lb/hr and	15	$/ton
Bag replacement cost	$471,000	14,140	bags and	100	$/bag
Cage replacement cost	$236,000	14,140	cages and	50	$/cage
ID fan power	$262,000	2,040	kW and	0.02156	$/kWh
Auxiliary power	$78,000	610	kW and	0.02156	$/kWh
Subtotal Variable Annual Costs	$1,047,000				
Total Annual Costs	$3,477,000				
Levelized Capital Costs	**$9,858,000**	(TCI) X 12.17%	CRF		
Levelized Annual Costs	$13,335,000				

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: Electrostatic Precipitator (ESP) **Date:** 6/16/2010

Cost Item	$	Remarks		
CAPITAL COST				
Direct Costs				
Purchased equipment costs				
ESP	$7,399,831	From Previous Study		
Ash handling system	$538,703	From Previous Study		
ID fan	$501,831	Apportioned Engineering Estimate		
Flue gas ductwork	$2,000,000	Engineering Estimate		
Subtotal capital cost (CC)	$10,440,365			
Instrumentation and controls	$209,000	(CC) X	2.0%	
Taxes	$731,000	(CC) X	7.0%	
Freight	$522,000	(CC) X	5.0%	
Total purchased equipment cost (PEC)	$11,902,000			
Direct installation costs				
Foundation & supports	$1,785,000	(PEC) X	15.0%	
Handling & erection	$1,190,000	(PEC) X	10.0%	
Electrical	$2,380,000	(PEC) X	20.0%	
Piping	$298,000	(PEC) X	2.5%	
Insulation	$238,000	(PEC) X	2.0%	
Painting	$60,000	(PEC) X	0.5%	
Demolition	$2,052,000	Engineering Estimate		
Relocation	$1,000	(PEC) X	0.01%	
Total direct installation costs (DIC)	$8,004,000			
Site preparation	$200,000	Estimate		
Total direct costs (DC) = (PEC) + (DIC)	$20,106,000			
Indirect Costs				
Engineering	$2,413,000	(DC) X	12.0%	
Owners Cost	$603,000	(DC) X	3.0%	
Construction and field expenses	$2,011,000	(DC) X	10.0%	
Contractor fees	$2,011,000	(DC) X	10.0%	
Start-up	$603,000	(DC) X	3.0%	
Performance test	$40,000	(DC) X	0.2%	
Contingencies	$3,016,000	(DC) X	15.0%	
Total indirect costs (IC)	$10,697,000			
Allowance for Funds Used During Construction (AFDC)	$2,079,000	[(DC)+(IC)] X	4.50%	3 years (project time length)
Total Capital Investment (TCI) = (DC) + (IC)	**$32,882,000**			
Cost Effectiveness	***$100 /kW***			
ANNUAL COST				
Direct Annual Costs				
Fixed annual costs				
Maintenance labor and materials	$2,155,000	Engineering Estimates		
Total fixed annual costs	$2,155,000			
Variable annual costs			68 %	capacity factor
Byproduct disposal	$1,255,000	28,100 lb/hr and	15 $/ton	
ID fan power	$103,000	800 kW and	0.02156 $/kWh	
Auxiliary power	$68,000	530 kW and	0.02156 $/kWh	
Total variable annual costs	$1,426,000			
Total direct annual costs (DAC)	$3,581,000			
Indirect Annual Costs				
Cost for capital recovery	$4,002,000	(TCI) X	12.17%	CRF
Total indirect annual costs (IDAC)	$4,002,000			
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$7,583,000**			

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: Lime Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis					
CAPITAL COST							
Direct Costs							
Purchased equipment costs							
Long-term storage silo (with truck unloading sys.)	$223,000	From Previous Mill Creek BACT Study					
Short-term storage silo	$148,000	From Previous Mill Creek BACT Study					
Air blowers	$203,000	From Previous Mill Creek BACT Study					
Rotary feeders	$33,000	From Previous Mill Creek BACT Study					
Injection system	$134,000	From Previous Mill Creek BACT Study					
Ductwork modifications, supports, platforms	$26,000	Ratio from Brown Unit 3 BACT Analysis					
Electrical system upgrades	$878,000	From Previous Mill Creek BACT Study					
Instrumentation and controls	$42,000	From Previous Mill Creek BACT Study					
Subtotal capital cost (CC)	$1,687,000						
Freight	$76,000	(CC) X		4.5%			
Total purchased equipment cost (PEC)	$1,763,000						
Direct installation costs							
Foundation & supports	$176,000	(PEC) X		10.0%			
Handling & erection	$353,000	(PEC) X		20.0%			
Electrical	$176,000	(PEC) X		10.0%			
Piping	$88,000	(PEC) X		5.0%			
Insulation	$35,000	(PEC) X		2.0%			
Painting	$88,000	(PEC) X		5.0%			
Demolition	$0	(PEC) X		0.0%			
Relocation	$0	(PEC) X		0.0%			
Total direct installation costs (DIC)	$916,000						
Site preparation	$0	N/A					
Buildings	$75,000	Engineering estimate					
Total direct costs (DC) = (PEC) + (DIC)	$2,754,000						
Indirect Costs							
Engineering	$330,000	(DC) X		12.0%			
Owner's cost	$330,000	(DC) X		12.0%			
Construction management	$275,000	(DC) X		10.0%			
Start-up and spare parts	$41,000	(DC) X		1.5%			
Performance test	$100,000	Engineering estimate					
Contingencies	$551,000	(DC) X		20.0%			
Total indirect costs (IC)	$1,627,000						
Allowance for Funds Used During Construction (AFDC)	$99,000	[(DC)+(IC)] X		4.50%	1	years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$4,480,000**						
Cost Effectiveness	***$14 /kW***						
ANNUAL COST							
Direct Annual Costs							
Fixed annual costs							
Maintenance labor and materials	$83,000	(DC) X		3.0%			
Operating labor	$133,000		1	FTE and	132,901	$/year	Estimated manpower
Total fixed annual costs	$216,000						
Variable annual costs					68	%	capacity factor
Lime	$1,428,000		4,060	lb/hr and	118.13	$/ton	
Byproduct disposal cost	$360,000		4,640	lb/hr and	15	$/ton	
Auxiliary power	$20,000		155	kW and	0.02156	$/kWh	
Total variable annual costs	$1,808,000						
Total direct annual costs (DAC)	$2,024,000						
Indirect Annual Costs							
Cost for capital recovery	$545,000	(TCI) X		12.17%	CRF		
Total indirect annual costs (IDAC)	$545,000						
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$2,569,000**						

Mill Creek Unit 1
330 MW
High Level Emissions Control Study

Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$278,009	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$182,691	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$254,179	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$31,772	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$119,147	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$23,829	Ratio from Brown Unit 3 BACT Analysis			
Electrical system upgrades	$762,538	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$39,716	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$1,691,882				
Freight	$42,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$1,734,000				
Direct installation costs					
Foundation & supports	$173,000	(PEC) X	10.0%		
Handling & erection	$347,000	(PEC) X	20.0%		
Electrical	$173,000	(PEC) X	10.0%		
Piping	$87,000	(PEC) X	5.0%		
Insulation	$35,000	(PEC) X	2.0%		
Painting	$87,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$902,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$2,711,000				
Indirect Costs					
Engineering	$325,000	(DC) X	12.0%		
Owner's cost	$325,000	(DC) X	12.0%		
Construction management	$271,000	(DC) X	10.0%		
Start-up and spare parts	$41,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$542,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,604,000				
Allowance for Funds Used During Construction (AFDC)	$97,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,412,000				
Cost Effectiveness	*$13 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$81,000	(DC) X	3.0%		
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower
Total fixed annual costs	$214,000				
Variable annual costs				68 %	capacity factor
Reagent (BPAC)	$1,966,000		300 lb/hr and	2200 $/ton	
Byproduct disposal cost	$13,000		300 lb/hr and	15 $/ton	
Auxiliary power	$20,000		155 kW and	0.02156 $/kWh	
Total variable annual costs	$1,999,000				
Total direct annual costs (DAC)	$2,213,000				
Indirect Annual Costs					
Cost for capital recovery	$537,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$537,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,750,000				

Plant Name: Mill Creek
Unit: 2
MW 330
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$97,000,000	$294	$3,401,000	$15,206,000
WFGD	$297,000,000	$900	$14,604,000	$50,749,000
Fabric Filter	$81,000,000	$245	$3,518,000	$13,376,000
Electrostatic Precipitator	$32,882,000	$100	$3,664,000	$7,666,000
Lime Injection	$4,480,000	$14	$2,117,000	$2,662,000
PAC Injection	$4,412,000	$13	$2,340,000	$2,877,000
Neural Networks	$1,000,000	$3	$100,000	$222,000
Total	$517,774,000	$1,569	$29,744,000	$92,758,000

MILL CREEK UNIT 2 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$6,669,000	
Ductwork and Breeching	$5,151,000	
Mechanical - Balance of Plant (BOP)	$1,687,000	
Electrical - Equipment, Raceway	$1,926,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$674,000	
Control - DCS Instrumentation	$217,000	
Air Heater Modifications	$1,704,000	Engineering Estimates
ID Fans	$3,262,000	Engineering Estimates
Catalyst	$2,709,000	
Selective Catalytic Reduction System (Including Ammonia System)	$2,363,000	
Subtotal Purchase Contract	**$26,862,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,106,000	
Civil/Structural Construction - Sub-Structures	$1,067,000	
Mechanical/Chemical Construction	$12,906,000	
Electrical/Control Construction	$5,902,000	
Service Contracts & Construction Indirects	$20,617,000	
Demolition Costs	$4,104,000	Engineering Estimates
Subtotal Construction Contracts	**$48,702,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$75,564,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,942,000	
EPC Construction Management (Includes G&A & Fee)	$3,101,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$814,000	
Sales Taxes	$1,149,000	
Project Contingency	$11,597,000	
Total Indirect Costs	**$21,603,000**	
Total Contracted Costs	**$97,000,000**	
Capital Cost Effectiveness	***$294***	***/kW***

ANNUAL COST

Capacity Factor = 70%

Fixed Annual Costs				
Operating labor	$133,000	1 FTE and	132,901	$/year
Maintenance labor & materials	$2,267,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$2,450,000**			
Variable Annual Costs				
Reagent	$431,000	265 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$247,000	1,860 kW and	0.02169	$/kWh
Catalyst replacement	$273,000	60 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$951,000**			
Total Annual Costs	**$3,401,000**			
Levelized Capital Costs	**$11,805,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$15,206,000**			

MILL CREEK UNIT 2 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,568,000	
Ductwork and Breeching	$3,956,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$85,104,000	
Electrical - Equipment, Raceway	$9,452,000	
VFDs, Motors and Couplings	$5,555,000	
Switchgear and MCCs	$5,736,000	
Control - DCS Instrumentation	$5,303,000	
ID Fans	$2,510,000	Engineering Estimates
Subtotal Purchase Contract	**$120,184,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$9,556,000	
Civil/Structural Construction - Sub-Structures	$931,000	
Mechanical/Chemical Construction	$21,832,000	
Electrical/Control Construction	$8,950,000	
Service Contracts & Construction Indirects	$17,009,000	
Demolition Costs	$12,313,000	Engineering Estimates
Subtotal Construction Contracts	**$70,591,000**	
Construction Difficulty Costs	**$49,414,000**	Engineering Estimates
Total Direct Costs	**$240,189,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$8,322,000	
EPC Construction Management (Includes G&A & Fee)	$10,930,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$1,121,000	
Sales Taxes	$44,000	
Project Contingency	$36,445,000	
Total Indirect Costs	**$56,862,000**	
Total Contracted Costs	$297,000,000	
Cost Effectiveness	*$900 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	70%
Operating labor	$2,658,000	20 FTE and	132,901 $/year
Maintenance labor and materials	$7,206,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$9,864,000**		
Variable Annual Costs			
Reagent	$754,000	32,620 lb/hr and	7.54 $/ton
Byproduct disposal	$2,584,000	56,195 lb/hr and	15 $/ton
Auxiliary and ID fan power	$1,023,000	7,695 kW and	0.02169 $/kWh
Water	$379,000	515 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$4,740,000		
Total Annual Costs	$14,604,000		
Levelized Capital Costs	**$36,145,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$50,749,000		

MILL CREEK UNIT 2 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$4,568,000	
Mechanical - Balance of Plant (BOP)	$13,085,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$277,000	
Control - DCS Instrumentation	$308,000	
ID Fans	$1,757,000	Engineering Estimates
Subtotal Purchase Contract	**$19,995,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,065,000	
Civil/Structural Construction - Sub-Structures	$1,545,000	
Mechanical/Chemical Construction	$15,460,000	
Electrical/Control Construction	$5,221,000	
Service Contracts & Construction Indirects	$252,000	
Demolition Costs	$4,104,000	Engineering Estimates
Subtotal Construction Contracts	**$30,647,000**	
Construction Difficulty Costs	**$21,452,900**	Engineering Estimates
Total Direct Costs	**$72,094,900**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,279,000	
EPC Construction Management (Includes G&A & Fee)	$2,800,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$423,000	
Sales Taxes	$151,000	
Project Contingency - 18%	$1,577,000	
Total Indirect Costs	**$9,230,000**	
Total Contracted Costs	$81,000,000	
Cost Effectiveness	*$245 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	70%
Maintenance labor and materials	$2,430,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$2,430,000**		
Variable Annual Costs			
Byproduct disposal	$0	0 lb/hr and	15 $/ton
Bag replacement cost	$484,000	14,520 bags and	100 $/bag
Cage replacement cost	$242,000	14,520 cages and	50 $/cage
ID fan power	$279,000	2,095 kW and	0.02169 $/kWh
Auxiliary power	$83,000	625 kW and	0.02169 $/kWh
Subtotal Variable Annual Costs	$1,088,000		
Total Annual Costs	$3,518,000		
Levelized Capital Costs	**$9,858,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$13,376,000		

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: Electrostatic Precipitator (ESP) **Date:** 6/16/2010

Cost Item	$	Remarks		
CAPITAL COST				
Direct Costs				
Purchased equipment costs				
ESP	$7,399,831	From Previous Study		
Ash handling system	$538,703	From Previous Study		
ID fan	$501,831	Apportioned Engineering Estimate		
Flue gas ductwork	$2,000,000	Engineering Estimate		
Subtotal capital cost (CC)	$10,440,365			
Instrumentation and controls	$209,000	(CC) X	2.0%	
Taxes	$731,000	(CC) X	7.0%	
Freight	$522,000	(CC) X	5.0%	
Total purchased equipment cost (PEC)	$11,902,000			
Direct installation costs				
Foundation & supports	$1,785,000	(PEC) X	15.0%	
Handling & erection	$1,190,000	(PEC) X	10.0%	
Electrical	$2,380,000	(PEC) X	20.0%	
Piping	$298,000	(PEC) X	2.5%	
Insulation	$238,000	(PEC) X	2.0%	
Painting	$60,000	(PEC) X	0.5%	
Demolition	$2,052,000	Engineering Estimate		
Relocation	$1,000	(PEC) X	0.01%	
Total direct installation costs (DIC)	$8,004,000			
Site preparation	$200,000	Estimate		
Total direct costs (DC) = (PEC) + (DIC)	$20,106,000			
Indirect Costs				
Engineering	$2,413,000	(DC) X	12.0%	
Owners Cost	$603,000	(DC) X	3.0%	
Construction and field expenses	$2,011,000	(DC) X	10.0%	
Contractor fees	$2,011,000	(DC) X	10.0%	
Start-up	$603,000	(DC) X	3.0%	
Performance test	$40,000	(DC) X	0.2%	
Contingencies	$3,016,000	(DC) X	15.0%	
Total indirect costs (IC)	$10,697,000			
Allowance for Funds Used During Construction (AFDC)	$2,079,000	[(DC)+(IC)] X	4.50%	3 years (project time length)
Total Capital Investment (TCI) = (DC) + (IC)	**$32,882,000**			
Cost Effectiveness	***$100 /kW***			
ANNUAL COST				
Direct Annual Costs				
Fixed annual costs				
Maintenance labor and materials	$2,155,000	Engineering Estimates		
Total fixed annual costs	$2,155,000			
Variable annual costs			70 %	capacity factor
Byproduct disposal	$1,327,000	28,860 lb/hr and	15 $/ton	
ID fan power	$110,000	825 kW and	0.02169 $/kWh	
Auxiliary power	$72,000	545 kW and	0.02169 $/kWh	
Total variable annual costs	$1,509,000			
Total direct annual costs (DAC)	$3,664,000			
Indirect Annual Costs				
Cost for capital recovery	$4,002,000	(TCI) X	12.17%	CRF
Total indirect annual costs (IDAC)	$4,002,000			
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$7,666,000**			

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: Lime Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$223,000	From Previous Mill Creek BACT Study			
Short-term storage silo	$148,000	From Previous Mill Creek BACT Study			
Air blowers	$203,000	From Previous Mill Creek BACT Study			
Rotary feeders	$33,000	From Previous Mill Creek BACT Study			
Injection system	$134,000	From Previous Mill Creek BACT Study			
Ductwork modifications, supports, platforms	$26,000	Ratio from Brown Unit 3 BACT Analysis			
Electrical system upgrades	$878,000	From Previous Mill Creek BACT Study			
Instrumentation and controls	$42,000	From Previous Mill Creek BACT Study			
Subtotal capital cost (CC)	$1,687,000				
Freight	$76,000	(CC) X	4.5%		
Total purchased equipment cost (PEC)	$1,763,000				
Direct installation costs					
Foundation & supports	$176,000	(PEC) X	10.0%		
Handling & erection	$353,000	(PEC) X	20.0%		
Electrical	$176,000	(PEC) X	10.0%		
Piping	$88,000	(PEC) X	5.0%		
Insulation	$35,000	(PEC) X	2.0%		
Painting	$88,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$916,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$2,754,000				
Indirect Costs					
Engineering	$330,000	(DC) X	12.0%		
Owner's cost	$330,000	(DC) X	12.0%		
Construction management	$275,000	(DC) X	10.0%		
Start-up and spare parts	$41,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$551,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,627,000				
Allowance for Funds Used During Construction (AFDC)	$99,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$4,480,000				
Cost Effectiveness	*$14 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$83,000	(DC) X	3.0%		
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower
Total fixed annual costs	$216,000				
Variable annual costs				70 %	capacity factor
Lime	$1,510,000		4,170 lb/hr and	118.13 $/ton	
Byproduct disposal cost	$370,000		4,770 lb/hr and	15 $/ton	
Auxiliary power	$21,000		155 kW and	0.02169 $/kWh	
Total variable annual costs	$1,901,000				
Total direct annual costs (DAC)	$2,117,000				
Indirect Annual Costs					
Cost for capital recovery	$545,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$545,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$2,662,000				

Mill Creek Unit 2
330 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$278,009	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$182,691	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$254,179	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$31,772	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$119,147	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$23,829	Ratio from Brown Unit 3 BACT Analysis			
Electrical system upgrades	$762,538	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$39,716	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$1,691,882				
Freight	$42,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$1,734,000				
Direct installation costs					
Foundation & supports	$173,000	(PEC) X	10.0%		
Handling & erection	$347,000	(PEC) X	20.0%		
Electrical	$173,000	(PEC) X	10.0%		
Piping	$87,000	(PEC) X	5.0%		
Insulation	$35,000	(PEC) X	2.0%		
Painting	$87,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$902,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$2,711,000				
Indirect Costs					
Engineering	$325,000	(DC) X	12.0%		
Owner's cost	$325,000	(DC) X	12.0%		
Construction management	$271,000	(DC) X	10.0%		
Start-up and spare parts	$41,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$542,000	(DC) X	20.0%		
Total indirect costs (IC)	$1,604,000				
Allowance for Funds Used During Construction (AFDC)	$97,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$4,412,000**				
Cost Effectiveness	***$13 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$81,000	(DC) X	3.0%		
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower
Total fixed annual costs	$214,000				
Variable annual costs				70 %	capacity factor
Reagent (BPAC)	$2,091,000		310 lb/hr and	2200 $/ton	
Byproduct disposal cost	$14,000		310 lb/hr and	15 $/ton	
Auxiliary power	$21,000		155 kW and	0.02169 $/kWh	
Total variable annual costs	$2,126,000				
Total direct annual costs (DAC)	$2,340,000				
Indirect Annual Costs					
Cost for capital recovery	$537,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$537,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$2,877,000**				

Plant Name: Mill Creek
Unit: 3
MW 423
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
WFGD	$392,000,000	$927	$18,911,000	$66,617,000
Fabric Filter	$114,000,000	$270	$4,923,000	$18,797,000
PAC Injection	$5,592,000	$13	$3,213,000	$3,894,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$512,592,000	$1,212	$27,147,000	$89,530,000

MILL CREEK UNIT 3 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,980,000	
Ductwork and Breeching	$4,591,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$98,775,000	
Electrical - Equipment, Raceway	$10,970,000	
VFDs, Motors and Couplings	$6,447,000	
Switchgear and MCCs	$6,657,000	
Control - DCS Instrumentation	$6,155,000	
ID Fans	$2,445,000	Engineering Estimates
Subtotal Purchase Contract	**$139,020,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$11,091,000	
Civil/Structural Construction - Sub-Structures	$1,080,000	
Mechanical/Chemical Construction	$25,339,000	
Electrical/Control Construction	$10,387,000	
Service Contracts & Construction Indirects	$19,741,000	
Demolition Costs	$15,784,000	Engineering Estimates
Subtotal Construction Contracts	**$83,422,000**	
Construction Difficulty Costs	**$100,106,000**	Engineering Estimates
Total Direct Costs	**$322,548,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$10,150,000	
EPC Construction Management (Includes G&A & Fee)	$13,332,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$1,367,000	
Sales Taxes	$54,000	
Project Contingency	$44,453,000	
Total Indirect Costs	**$69,356,000**	
Total Contracted Costs	**$392,000,000**	
Cost Effectiveness	***$927 /kW***	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%
Operating labor	$2,658,000	20 FTE and	132,901 $/year
Maintenance labor and materials	$9,676,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$12,334,000**		
Variable Annual Costs			
Reagent	$1,027,000	41,470 lb/hr and	7.54 $/ton
Byproduct disposal	$3,520,000	71,435 lb/hr and	15 $/ton
Auxiliary and ID fan power	$1,518,000	9,910 kW and	0.02331 $/kWh
Water	$512,000	650 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$6,577,000		
Total Annual Costs	**$18,911,000**		
Levelized Capital Costs	**$47,706,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$66,617,000**		

MILL CREEK UNIT 3 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$5,302,000	
Mechanical - Balance of Plant (BOP)	$15,187,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$322,000	
Control - DCS Instrumentation	$357,000	
ID Fans	$1,467,000	Engineering Estimates
Subtotal Purchase Contract	**$22,635,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$4,718,000	
Civil/Structural Construction - Sub-Structures	$1,793,000	
Mechanical/Chemical Construction	$17,944,000	
Electrical/Control Construction	$6,059,000	
Service Contracts & Construction Indirects	$292,000	
Demolition Costs	$5,262,000	Engineering Estimates
Subtotal Construction Contracts	**$36,068,000**	
Construction Difficulty Costs	**$43,282,000**	Engineering Estimates
Total Direct Costs	**$101,985,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$5,485,000	
EPC Construction Management (Includes G&A & Fee)	$3,589,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$542,000	
Sales Taxes	$193,000	
Project Contingency - 18%	$2,021,000	
Total Indirect Costs	**$11,830,000**	
Total Contracted Costs	$114,000,000	
Cost Effectiveness	*$270 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%
Maintenance labor and materials	$3,420,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$3,420,000**		
Variable Annual Costs			
Byproduct disposal	$5,000	95 lb/hr and	15 $/ton
Bag replacement cost	$635,000	19,040 bags and	100 $/bag
Cage replacement cost	$317,000	19,040 cages and	50 $/cage
ID fan power	$420,000	2,745 kW and	0.02331 $/kWh
Auxiliary power	$126,000	820 kW and	0.02331 $/kWh
Subtotal Variable Annual Costs	$1,503,000		
Total Annual Costs	$4,923,000		
Levelized Capital Costs	**$13,874,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$18,797,000		

Mill Creek Unit 3
423 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$356,357	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$234,177	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$325,812	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$40,726	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$152,724	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$30,545	Ratio from Brown Unit 3 BACT Analysis			
Electrical system upgrades	$977,435	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$50,908	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,168,685				
Freight	$54,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,223,000				
Direct installation costs					
Foundation & supports	$222,000	(PEC) X	10.0%		
Handling & erection	$445,000	(PEC) X	20.0%		
Electrical	$222,000	(PEC) X	10.0%		
Piping	$111,000	(PEC) X	5.0%		
Insulation	$44,000	(PEC) X	2.0%		
Painting	$111,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,155,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,453,000				
Indirect Costs					
Engineering	$414,000	(DC) X	12.0%		
Owner's cost	$414,000	(DC) X	12.0%		
Construction management	$345,000	(DC) X	10.0%		
Start-up and spare parts	$52,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$691,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,016,000				
Allowance for Funds Used During Construction (AFDC)	$123,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$5,592,000**				
Cost Effectiveness	***$13 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$104,000	(DC) X	3.0%		
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower
Total fixed annual costs	$237,000				
Variable annual costs				75 %	capacity factor
Reagent (BPAC)	$2,927,000		405 lb/hr and	2200 $/ton	
Byproduct disposal cost	$20,000		405 lb/hr and	15 $/ton	
Auxiliary power	$29,000		190 kW and	0.02331 $/kWh	
Total variable annual costs	$2,976,000				
Total direct annual costs (DAC)	$3,213,000				
Indirect Annual Costs					
Cost for capital recovery	$681,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$681,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$3,894,000**				

Plant Name:	Mill Creek
Unit:	4
MW	525
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
WFGD	$455,000,000	$867	$21,775,000	$77,149,000
Fabric Filter	$133,000,000	$253	$5,804,000	$21,990,000
PAC Injection	$6,890,000	$13	$3,858,000	$4,697,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$595,890,000	$1,135	$31,537,000	$104,058,000

MILL CREEK UNIT 4 - WFGD COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$3,392,000	
Ductwork and Breeching	$5,227,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$112,444,000	
Electrical - Equipment, Raceway	$12,488,000	
VFDs, Motors and Couplings	$7,339,000	
Switchgear and MCCs	$7,578,000	
Control - DCS Instrumentation	$7,007,000	
ID Fans	$5,018,313	Engineering Estimates
Subtotal Purchase Contract	**$160,493,313**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$12,626,000	
Civil/Structural Construction - Sub-Structures	$1,230,000	
Mechanical/Chemical Construction	$28,846,000	
Electrical/Control Construction	$11,825,000	
Service Contracts & Construction Indirects	$22,473,000	
Demolition Costs	$19,590,000	Engineering Estimates
Subtotal Construction Contracts	**$96,590,000**	
Construction Difficulty Costs	**$115,908,000**	Engineering Estimates
Total Direct Costs	**$372,991,313**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$12,065,000	
EPC Construction Management (Includes G&A & Fee)	$15,847,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$1,625,000	
Sales Taxes	$64,000	
Project Contingency	$52,840,000	
Total Indirect Costs	**$82,441,000**	
Total Contracted Costs	$455,000,000	
Cost Effectiveness	*$867 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%
Operating labor	$2,658,000	20 FTE and	132,901 $/year
Maintenance labor and materials	$11,190,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$13,848,000**		
Variable Annual Costs			
Reagent	$1,250,000	50,465 lb/hr and	7.54 $/ton
Byproduct disposal	$4,284,000	86,935 lb/hr and	15 $/ton
Auxiliary and ID fan power	$1,770,000	12,055 kW and	0.02235 $/kWh
Water	$623,000	790 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$7,927,000		
Total Annual Costs	$21,775,000		
Levelized Capital Costs	**$55,374,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$77,149,000		

MILL CREEK UNIT 4 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$6,036,000	
Mechanical - Balance of Plant (BOP)	$17,289,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$366,000	
Control - DCS Instrumentation	$407,000	
ID Fans	$3,010,988	Engineering Estimates
Subtotal Purchase Contract	**$27,108,988**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$5,371,000	
Civil/Structural Construction - Sub-Structures	$2,042,000	
Mechanical/Chemical Construction	$20,427,000	
Electrical/Control Construction	$6,898,000	
Service Contracts & Construction Indirects	$333,000	
Demolition Costs	$6,530,000	Engineering Estimates
Subtotal Construction Contracts	**$41,601,000**	
Construction Difficulty Costs	**$49,921,000**	Engineering Estimates
Total Direct Costs	**$118,630,988**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$6,807,000	
EPC Construction Management (Includes G&A & Fee)	$4,454,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$673,000	
Sales Taxes	$240,000	
Project Contingency - 18%	$2,508,000	
Total Indirect Costs	**$14,682,000**	
Total Contracted Costs	$133,000,000	
Cost Effectiveness	*$253*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	75%
Maintenance labor and materials	$3,990,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$3,990,000**		
Variable Annual Costs			
Byproduct disposal	$1,000	30 lb/hr and	15 $/ton
Bag replacement cost	$768,000	23,050 bags and	100 $/bag
Cage replacement cost	$384,000	23,050 cages and	50 $/cage
ID fan power	$509,000	3,325 kW and	0.02331 $/kWh
Auxiliary power	$152,000	995 kW and	0.02331 $/kWh
Subtotal Variable Annual Costs	$1,814,000		
Total Annual Costs	$5,804,000		
Levelized Capital Costs	**$16,186,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$21,990,000		

Mill Creek Unit 4
##
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$442,287	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$290,646	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$404,376	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$50,547	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$189,551	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$37,910	Ratio from Brown Unit 3 BACT Analysis			
Electrical system upgrades	$1,213,129	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$63,184	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,691,630				
Freight	$67,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,759,000				
Direct installation costs					
Foundation & supports	$276,000	(PEC) X	10.0%		
Handling & erection	$552,000	(PEC) X	20.0%		
Electrical	$276,000	(PEC) X	10.0%		
Piping	$138,000	(PEC) X	5.0%		
Insulation	$55,000	(PEC) X	2.0%		
Painting	$138,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,435,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$4,269,000				
Indirect Costs					
Engineering	$512,000	(DC) X	12.0%		
Owner's cost	$512,000	(DC) X	12.0%		
Construction management	$427,000	(DC) X	10.0%		
Start-up and spare parts	$64,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$854,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,469,000				
Allowance for Funds Used During Construction (AFDC)	$152,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$6,890,000**				
Cost Effectiveness	***$13 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$128,000	(DC) X	3.0%		
Operating labor	$133,000		1 FTE and	132,901 $/year	Estimated manpower
Total fixed annual costs	$261,000				
Variable annual costs				75 %	capacity factor
Reagent (BPAC)	$3,541,000		490 lb/hr and	2200 $/ton	
Byproduct disposal cost	$24,000		490 lb/hr and	15 $/ton	
Auxiliary power	$32,000		220 kW and	0.02235 $/kWh	
Total variable annual costs	$3,597,000				
Total direct annual costs (DAC)	$3,858,000				
Indirect Annual Costs					
Cost for capital recovery	$839,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$839,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$4,697,000**				

Trimble County

E-ON Fleetwide Study Black & Veatch Cost Estimates 167987

Plant Name: Trimble County
Unit: 1
MW 547
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Fabric Filter	$128,000,000	$234	$5,782,000	$21,360,000
PAC Injection	$6,451,000	$12	$4,413,000	$5,198,000
Neural Networks	$1,000,000	$2	$100,000	$222,000
Total	$135,451,000	$248	$10,295,000	$26,780,000

TRIMBLE COUNTY UNIT 1 - PJFF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$6,186,000	
Mechanical - Balance of Plant (BOP)	$17,720,000	
Electrical - Equipment, Raceway, Switchgears, MCC	$375,000	
Control - DCS Instrumentation	$417,000	
ID Fans	$2,493,000	Engineering Estimates
Subtotal Purchase Contract	**$27,191,000**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$5,505,000	
Civil/Structural Construction - Sub-Structures	$2,092,000	
Mechanical/Chemical Construction	$20,936,000	
Electrical/Control Construction	$7,070,000	
Service Contracts & Construction Indirects	$341,000	
Demolition Costs	$3,050,000	Engineering Estimates
Subtotal Construction Contracts	**$38,994,000**	
Construction Difficulty Costs	**$46,793,000**	Engineering Estimates
Total Direct Costs	**$112,978,000**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$7,092,000	
EPC Construction Management (Includes G&A & Fee)	$4,641,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$701,000	
Sales Taxes	$250,000	
Project Contingency - 18%	$2,613,000	
Total Indirect Costs	**$15,297,000**	
Total Contracted Costs	$128,000,000	
Cost Effectiveness	*$234*	*/kW*

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	85%	
Maintenance labor and materials	$3,840,000	(DC) X 3.0%		
Subtotal Fixed Annual Costs	**$3,840,000**			
Variable Annual Costs				
Byproduct disposal	$0	0 lb/hr and	15	$/ton
Bag replacement cost	$785,000	23,550 bags and	100	$/bag
Cage replacement cost	$393,000	23,550 cages and	50	$/cage
ID fan power	$588,000	3,395 kW and	0.02325	$/kWh
Auxiliary power	$176,000	1,015 kW and	0.02325	$/kWh
Subtotal Variable Annual Costs	$1,942,000			
Total Annual Costs	$5,782,000			
Levelized Capital Costs	**$15,578,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	$21,360,000			

Trimble County Unit 1
547 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$418,928	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$275,295	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$383,020	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$47,877	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$179,540	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0				
Electrical system upgrades	$1,149,059	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$59,847	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$2,513,567				
Freight	$63,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$2,577,000				
Direct installation costs					
Foundation & supports	$258,000	(PEC) X	10.0%		
Handling & erection	$515,000	(PEC) X	20.0%		
Electrical	$258,000	(PEC) X	10.0%		
Piping	$129,000	(PEC) X	5.0%		
Insulation	$52,000	(PEC) X	2.0%		
Painting	$129,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$1,341,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$3,993,000				
Indirect Costs					
Engineering	$479,000	(DC) X	12.0%		
Owner's cost	$479,000	(DC) X	12.0%		
Construction management	$399,000	(DC) X	10.0%		
Start-up and spare parts	$60,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$799,000	(DC) X	20.0%		
Total indirect costs (IC)	$2,316,000				
Allowance for Funds Used During Construction (AFDC)	$142,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$6,451,000**				
Cost Effectiveness	***$12 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$120,000	(DC) X	3.0%		
Operating labor	$132,000		1 FTE and	132,491 $/year	Estimated manpower
Total fixed annual costs	$252,000				
Variable annual costs				85 %	capacity factor
Reagent (BPAC)	$4,095,000		500 lb/hr and	2200 $/ton	
Byproduct disposal cost	$28,000		500 lb/hr and	15 $/ton	
Auxiliary power	$38,000		220 kW and	0.02325 $/kWh	
Total variable annual costs	$4,161,000				
Total direct annual costs (DAC)	$4,413,000				
Indirect Annual Costs					
Cost for capital recovery	$785,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$785,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$5,198,000**				

Green River

Plant Name:	Green River
Unit:	3
MW	71
Project description	High Level Emissions Control Study
Revised on:	05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$29,000,000	$408	$1,040,000	$4,569,000
CDS-FF	$38,000,000	$535	$6,874,000	$11,499,000
PAC Injection	$1,112,000	$16	$323,000	$458,000
Neural Networks	$500,000	$7	$50,000	$111,000
Total	$68,612,000	$966	$8,287,000	$16,637,000

GREEN RIVER UNIT 3 - SCR COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$2,126,000	
Ductwork and Breeching	$1,642,000	
Mechanical - Balance of Plant (BOP)	$538,000	
Electrical - Equipment, Raceway	$614,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$215,000	
Control - DCS Instrumentation	$69,000	
Air Heater	$1,638,000	Engineering Estimates
ID Fans	$718,534	Engineering Estimates
Catalyst	$864,000	
Selective Catalytic Reduction System (Including Ammonia System)	$753,000	
Subtotal Purchase Contract	**$9,677,534**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$1,309,000	
Civil/Structural Construction - Sub-Structures	$340,000	
Mechanical/Chemical Construction	$4,113,000	
Electrical/Control Construction	$1,881,000	
Service Contracts & Construction Indirects	$6,571,000	
Demolition Costs	$395,000	Engineering Estimates
Subtotal Construction Contracts	**$14,609,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$24,286,534**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$1,063,000	
EPC Construction Management (Includes G&A & Fee)	$667,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$175,000	
Sales Taxes	$247,000	
Project Contingency	$2,495,000	
Total Indirect Costs	**$4,647,000**	
Total Contracted Costs	**$29,000,000**	
Capital Cost Effectiveness	***$408***	***/kW***

ANNUAL COST

Capacity Factor = 26%

Fixed Annual Costs				
Operating labor	$122,000	1 FTE and	121,547	$/year
Maintenance labor & materials	$729,000	(DC) X 3.0%		
Yearly emissions testing	$25,000	Engineering Estimates		
Catalyst activity testing	$5,000	Engineering Estimates		
Fly ash sampling and analysis	$20,000	Engineering Estimates		
Subtotal Fixed Annual Costs	**$901,000**			
Variable Annual Costs				
Reagent	$60,000	100 lb/hr and	530.03	$/ton
Auxiliary and ID fan power	$37,000	470 kW and	0.03433	$/kWh
Catalyst replacement	$42,000	25 m3 and	6,500	$/m3
Subtotal Variable Annual Costs	**$139,000**			
Total Annual Costs	**$1,040,000**			
Levelized Capital Costs	**$3,529,000**	(TCI) X 12.17%	CRF	
Levelized Annual Costs	**$4,569,000**			

GREEN RIVER UNIT 3 - CDS-FF COSTS

CAPITAL COST

Purchase Contracts			
Civil/Structural	$863,000		
Ductwork and Breeching	$554,000		
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$114,000		
Electrical - Equipment, Raceway	$660,000		
Cable Bus	$180,000		
Switchgear and MCCs	$252,000		
Control - DCS Instrumentation	$166,000		
CDS Fabric Filter	$9,704,000		
ID Fans	$663,263	Engineering Estimates	
Subtotal Purchase Contract	**$13,156,263**		
Construction Contracts			
Civil/Structural Construction - Super Structures	$2,627,000		
Civil/Structural Construction - Sub-Structures	$1,780,000		
Mechanical/Chemical Construction	$3,996,000		
Electrical/Control Construction	$1,517,000		
Service Contracts & Construction Indirects	$7,004,000		
Subtotal Construction Contracts	**$16,924,000**		
Construction Difficulty Costs	**$0**	Engineering Estimates	
Total Direct Costs	**$30,080,263**		
Indirect Costs			
Engineering Costs (Includes G&A & Fee)	$2,623,000		
EPC Construction Management (Includes G&A & Fee)	$1,038,000		
Startup Spare Parts (Included)	$0		
Construction Utilites (Power & Water) - Included	$0		
Project Insurance	$272,000		
Sales Taxes	$502,000		
Project Contingency	$3,858,000		
Total Indirect Costs	**$8,293,000**		
Total Contracted Costs	$38,000,000		
Cost Effectiveness	*$535 /kW*		

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	26%
Operating labor	$1,459,000	12 FTE and	121,547 $/year
Maintenance labor and materials	$902,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$2,361,000**		
Variable Annual Costs			
Reagent	$3,431,000	22,790 lb/hr and	132.19 $/ton
Byproduct disposal	$914,000	53,535 lb/hr and	15 $/ton
Auxiliary and ID fan power	$138,000	1,760 kW and	0.03433 $/kWh
Water	$30,000	110 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$4,513,000		
Total Annual Costs	$6,874,000		
Levelized Capital Costs	**$4,625,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$11,499,000		

Green River Unit 3
71 MW
High Level Emissions Control Study

Technology: PAC Injection **Date:** 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$60,000	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$39,000	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$55,000	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$7,000	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$26,000	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0	From Ductwork Cost Calc			
Electrical system upgrades	$164,000	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$9,000	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$360,000				
Freight	$9,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$369,000				
Direct installation costs					
Foundation & supports	$37,000	(PEC) X	10.0%		
Handling & erection	$74,000	(PEC) X	20.0%		
Electrical	$37,000	(PEC) X	10.0%		
Piping	$18,000	(PEC) X	5.0%		
Insulation	$7,000	(PEC) X	2.0%		
Painting	$18,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$191,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$635,000				
Indirect Costs					
Engineering	$76,000	(DC) X	12.0%		
Owner's cost	$76,000	(DC) X	12.0%		
Construction management	$64,000	(DC) X	10.0%		
Start-up and spare parts	$10,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$127,000	(DC) X	20.0%		
Total indirect costs (IC)	$453,000				
Allowance for Funds Used During Construction (AFDC)	$24,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	**$1,112,000**				
Cost Effectiveness	***$16 /kW***				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$19,000	(DC) X	3.0%		
Operating labor	$122,000		1 FTE and	121,547 $/year	Estimated manpower
Total fixed annual costs	$141,000				
Variable annual costs				26 %	capacity factor
Reagent (BPAC)	$175,000		70 lb/hr and	2200 $/ton	
Byproduct disposal	$1,000		70 lb/hr and	15 $/ton	
Auxiliary power	$6,000		75 kW and	0.03433 $/kWh	
Total variable annual costs	$182,000				
Total direct annual costs (DAC)	$323,000				
Indirect Annual Costs					
Cost for capital recovery	$135,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$135,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	**$458,000**				

Plant Name: Green River
Unit: 4
MW 109
Project description High Level Emissions Control Study
Revised on: 05/28/10

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
SCR	$42,000,000	$385	$1,442,000	$6,553,000
CDS-FF	$54,000,000	$495	$10,289,000	$16,861,000
PAC Injection	$1,583,000	$15	$515,000	$708,000
Neural Networks	$500,000	$5	$50,000	$111,000
Total	$98,083,000	$900	$12,296,000	$24,233,000

GREEN RIVER UNIT 4 - SCR COSTS

CAPITAL COST

Purchase Contracts

Civil/Structural	$3,138,000	
Ductwork and Breeching	$2,423,000	
Mechanical - Balance of Plant (BOP)	$794,000	
Electrical - Equipment, Raceway	$906,000	
VFDs, Motors and Couplings	$500,000	Engineering Estimates
Switchgear and MCCs	$317,000	
Control - DCS Instrumentation	$102,000	
Air Heater	$1,638,000	Engineering Estimates
ID Fans	$1,207,000	Engineering Estimates
Catalyst	$1,275,000	
Selective Catalytic Reduction System (Including Ammonia System)	$1,112,000	
Subtotal Purchase Contract	**$13,412,000**	

Construction Contracts

Civil/Structural Construction - Super Structures	$1,932,000	
Civil/Structural Construction - Sub-Structures	$502,000	
Mechanical/Chemical Construction	$6,072,000	
Electrical/Control Construction	$2,777,000	
Service Contracts & Construction Indirects	$9,700,000	
Demolition Costs	$606,000	Engineering Estimates
Subtotal Construction Contracts	**$21,589,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$35,001,000**	

Indirect Costs

Engineering Costs (Includes G&A & Fee)	$1,632,000	
EPC Construction Management (Includes G&A & Fee)	$1,024,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$269,000	
Sales Taxes	$380,000	
Project Contingency	$3,831,000	
Total Indirect Costs	**$7,136,000**	
Total Contracted Costs	**$42,000,000**	
Capital Cost Effectiveness	***$385***	***/kW***

ANNUAL COST

Capacity Factor = 32%

Fixed Annual Costs

Operating labor	$122,000	1 FTE and	121,547 $/year
Maintenance labor & materials	$1,050,000	(DC) X 3.0%	
Yearly emissions testing	$25,000	Engineering Estimates	
Catalyst activity testing	$5,000	Engineering Estimates	
Fly ash sampling and analysis	$20,000	Engineering Estimates	
Subtotal Fixed Annual Costs	**$1,222,000**		

Variable Annual Costs

Reagent	$93,000	125 lb/hr and	530.03 $/ton
Auxiliary and ID fan power	$65,000	725 kW and	0.03187 $/kWh
Catalyst replacement	$62,000	30 m3 and	6,500 $/m3
Subtotal Variable Annual Costs	**$220,000**		
Total Annual Costs	**$1,442,000**		
Levelized Capital Costs	**$5,111,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	**$6,553,000**		

GREEN RIVER UNIT 4 - CDS-FF COSTS

CAPITAL COST

Purchase Contracts		
Civil/Structural	$1,190,000	
Ductwork and Breeching	$764,000	
Mechanical - Balance of Plant (BOP) (includes reagent prep and dewatering systems)	$158,000	
Electrical - Equipment, Raceway	$910,000	
Cable Bus	$249,000	
Switchgear and MCCs	$348,000	
Control - DCS Instrumentation	$229,000	
CDS Fabric Filter	$13,384,000	
ID Fans	$1,114,350	Engineering Estimates
Subtotal Purchase Contract	**$18,346,350**	
Construction Contracts		
Civil/Structural Construction - Super Structures	$3,623,000	
Civil/Structural Construction - Sub-Structures	$2,454,000	
Mechanical/Chemical Construction	$5,511,000	
Electrical/Control Construction	$2,092,000	
Service Contracts & Construction Indirects	$9,660,000	
Subtotal Construction Contracts	**$23,340,000**	
Construction Difficulty Costs	**$0**	Engineering Estimates
Total Direct Costs	**$41,686,350**	
Indirect Costs		
Engineering Costs (Includes G&A & Fee)	$4,027,000	
EPC Construction Management (Includes G&A & Fee)	$1,593,000	
Startup Spare Parts (Included)	$0	
Construction Utilites (Power & Water) - Included	$0	
Project Insurance	$418,000	
Sales Taxes	$770,000	
Project Contingency	$5,923,000	
Total Indirect Costs	**$12,731,000**	
Total Contracted Costs	$54,000,000	
Cost Effectiveness	*$495 /kW*	

ANNUAL COST

Fixed Annual Costs		Capacity Factor =	32%
Operating labor	$1,459,000	12 FTE and	121,547 $/year
Maintenance labor and materials	$1,251,000	(DC) X 3.0%	
Subtotal Fixed Annual Costs	**$2,710,000**		
Variable Annual Costs			
Reagent	$5,726,000	30,905 lb/hr and	132.19 $/ton
Byproduct disposal	$1,526,000	72,600 lb/hr and	15 $/ton
Auxiliary and ID fan power	$265,000	2,970 kW and	0.03187 $/kWh
Water	$62,000	185 gpm and	2 $/1,000 gal
Subtotal Variable Annual Costs	$7,579,000		
Total Annual Costs	$10,289,000		
Levelized Capital Costs	**$6,572,000**	(TCI) X 12.17%	CRF
Levelized Annual Costs	$16,861,000		

Green River Unit 4
109 MW
High Level Emissions Control Study

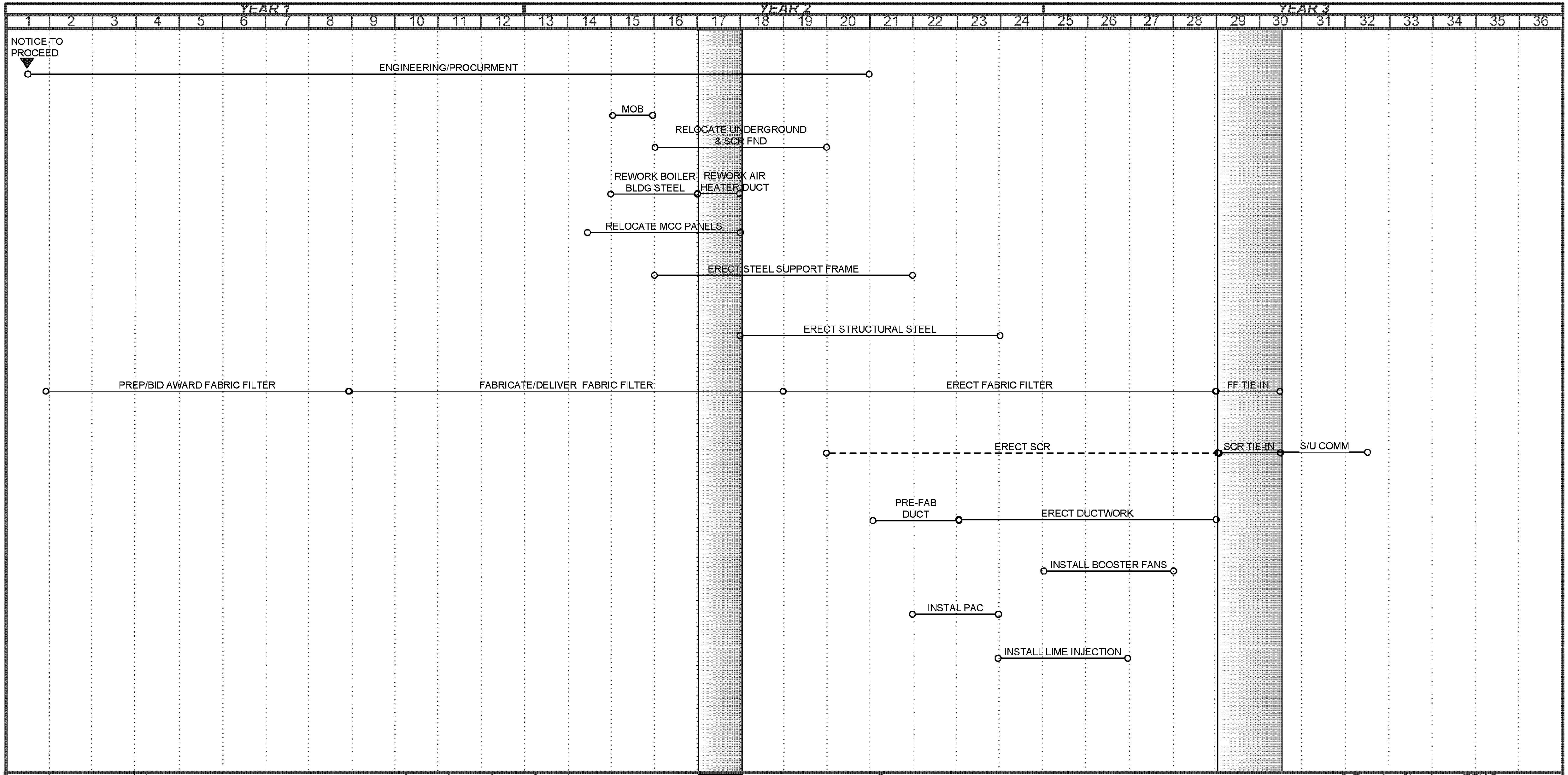
Technology: PAC Injection

Date: 6/16/2010

Cost Item	$	Remarks/Cost Basis			
CAPITAL COST					
Direct Costs					
Purchased equipment costs					
Long-term storage silo (with truck unloading sys.)	$92,000	Ratio from Brown Unit 3 BACT Analysis			
Short-term storage silo	$60,000	Ratio from Brown Unit 3 BACT Analysis			
Air blowers	$84,000	Ratio from Brown Unit 3 BACT Analysis			
Rotary feeders	$10,000	Ratio from Brown Unit 3 BACT Analysis			
Injection system	$39,000	Ratio from Brown Unit 3 BACT Analysis			
Ductwork modifications, supports, platforms	$0	From Ductwork Cost Calc			
Electrical system upgrades	$252,000	Ratio from Brown Unit 3 BACT Analysis			
Instrumentation and controls	$13,000	Ratio from Brown Unit 3 BACT Analysis			
Subtotal capital cost (CC)	$550,000				
Freight	$14,000	(CC) X	2.5%		
Total purchased equipment cost (PEC)	$564,000				
Direct installation costs					
Foundation & supports	$56,000	(PEC) X	10.0%		
Handling & erection	$113,000	(PEC) X	20.0%		
Electrical	$56,000	(PEC) X	10.0%		
Piping	$28,000	(PEC) X	5.0%		
Insulation	$11,000	(PEC) X	2.0%		
Painting	$28,000	(PEC) X	5.0%		
Demolition	$0	(PEC) X	0.0%		
Relocation	$0	(PEC) X	0.0%		
Total direct installation costs (DIC)	$292,000				
Site preparation	$0	N/A			
Buildings	$75,000	Engineering estimate			
Total direct costs (DC) = (PEC) + (DIC)	$931,000				
Indirect Costs					
Engineering	$112,000	(DC) X	12.0%		
Owner's cost	$112,000	(DC) X	12.0%		
Construction management	$93,000	(DC) X	10.0%		
Start-up and spare parts	$14,000	(DC) X	1.5%		
Performance test	$100,000	Engineering estimate			
Contingencies	$186,000	(DC) X	20.0%		
Total indirect costs (IC)	$617,000				
Allowance for Funds Used During Construction (AFDC)	$35,000	[(DC)+(IC)] X	4.50%	1 years (project time length X 1/2)	
Total Capital Investment (TCI) = (DC) + (IC) + (AFDC)	$1,583,000				
Cost Effectiveness	*$15 /kW*				
ANNUAL COST					
Direct Annual Costs					
Fixed annual costs					
Maintenance labor and materials	$28,000	(DC) X	3.0%		
Operating labor	$122,000		1 FTE and	121,547 $/year	Estimated manpower
Total fixed annual costs	$150,000				
Variable annual costs				32 %	capacity factor
Reagent (BPAC)	$355,000		115 lb/hr and	2200 $/ton	
Byproduct disposal	$2,000		115 lb/hr and	15 $/ton	
Auxiliary power	$8,000		90 kW and	0.03187 $/kWh	
Total variable annual costs	$365,000				
Total direct annual costs (DAC)	$515,000				
Indirect Annual Costs					
Cost for capital recovery	$193,000	(TCI) X	12.17%	CRF	
Total indirect annual costs (IDAC)	$193,000				
Total Annual Cost (TAC) = (DAC) + (IDAC)	$708,000				

Appendix I
Level 1 Schedules

E.W. Brown



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Engineer
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Checked T. VANGILDER
Date JUNE 07, 2010

E.W. BROWN UNIT 1
OPTIONAL SCR & FABRIC FILTER

LEVEL 1 SCHEDULE

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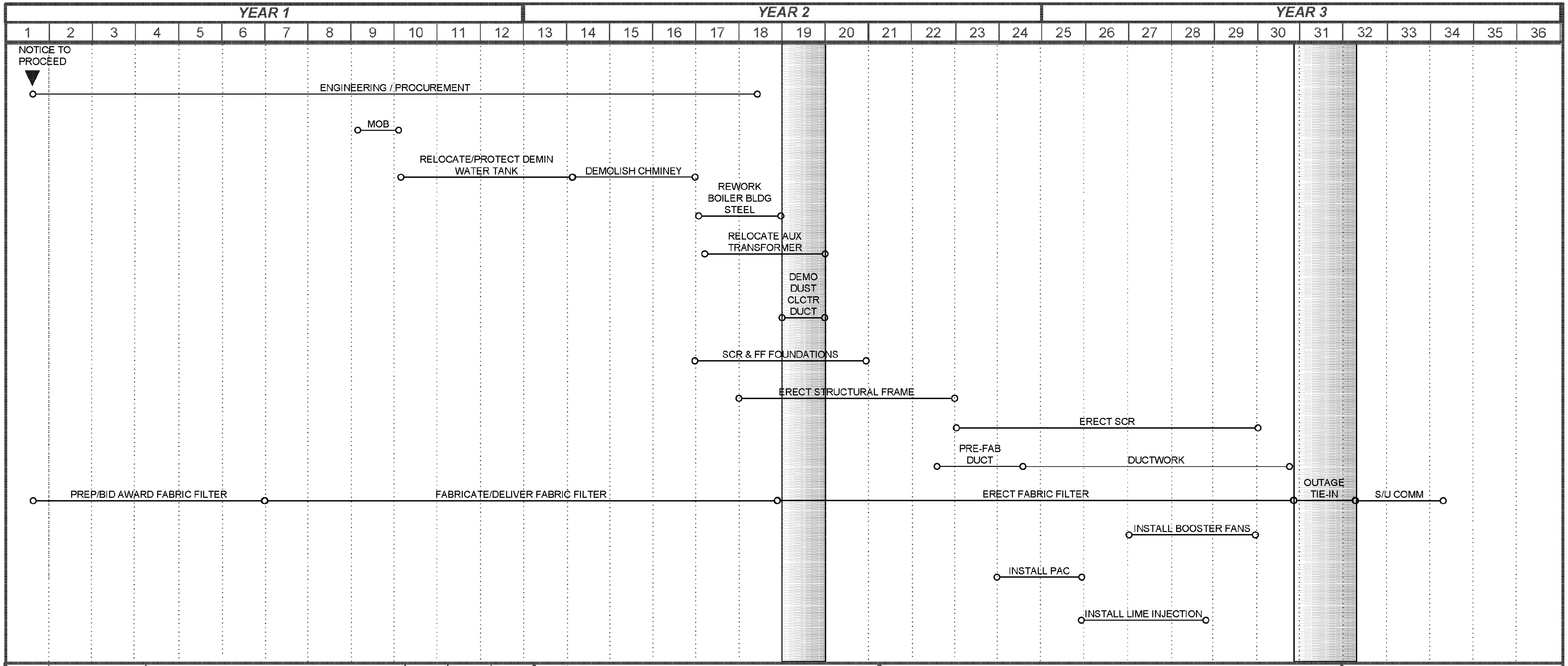

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E.W. BROWN UNIT 2
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LEVEL 1 SCHEDULE

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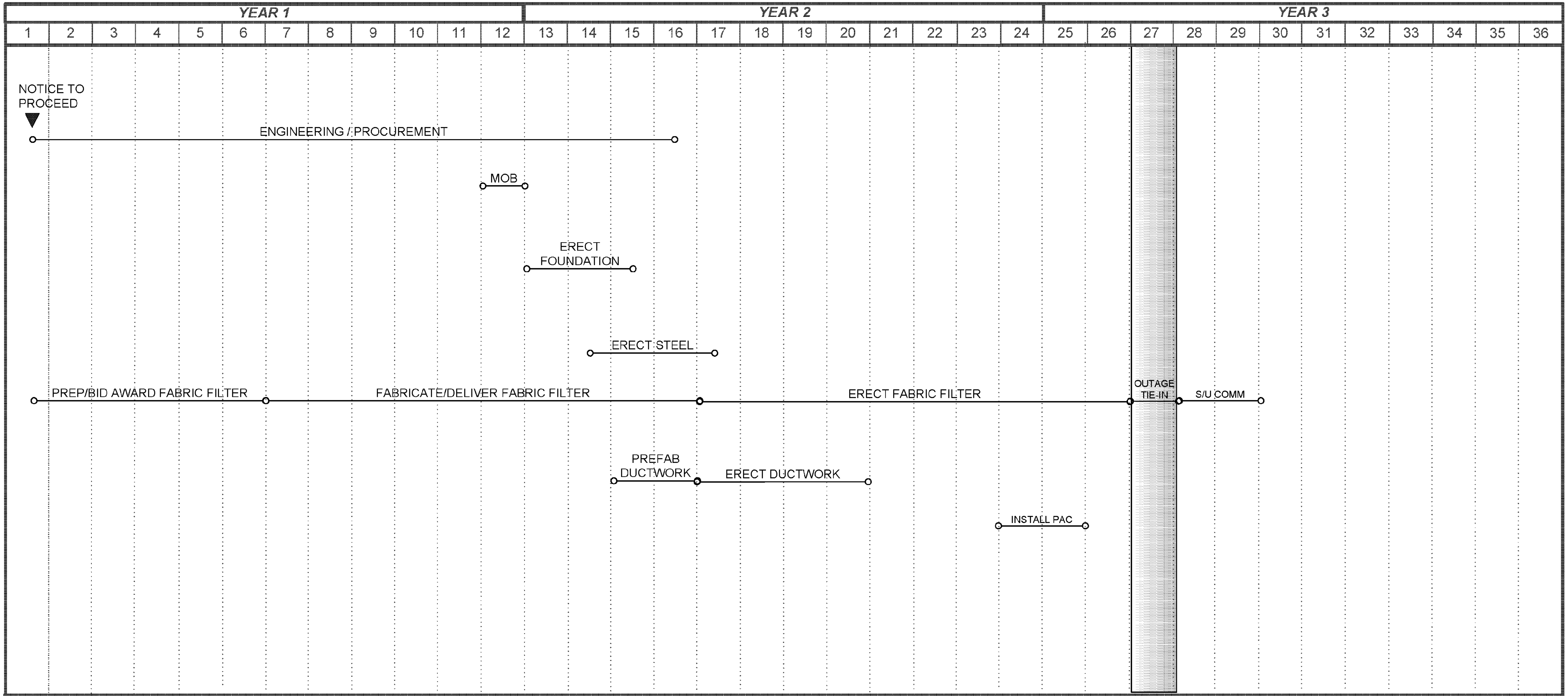

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E.W. BROWN UNIT 3
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LEVEL 1 SCHEDULE

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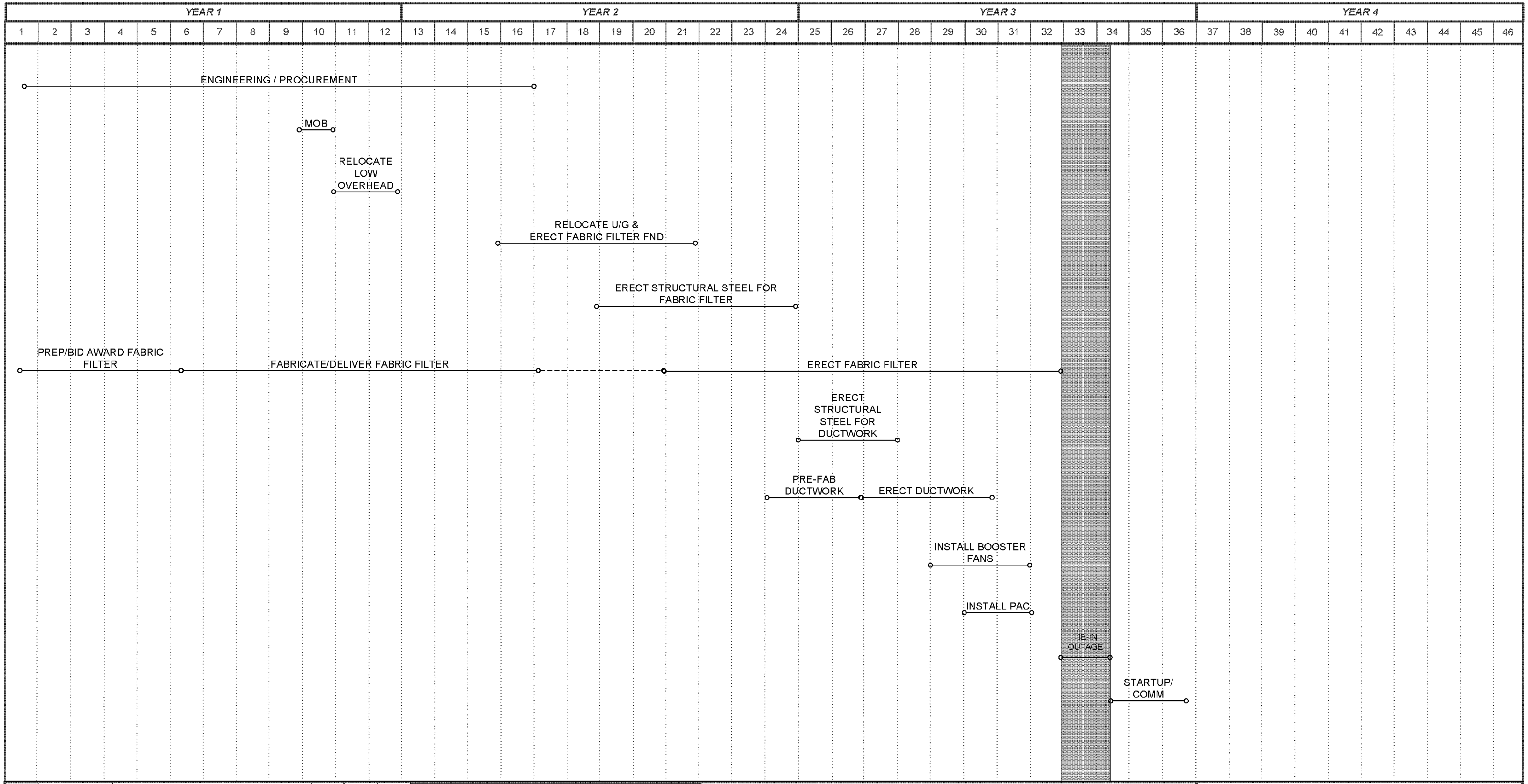

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FABRIC FILTER

LEVEL 1 SCHEDULE

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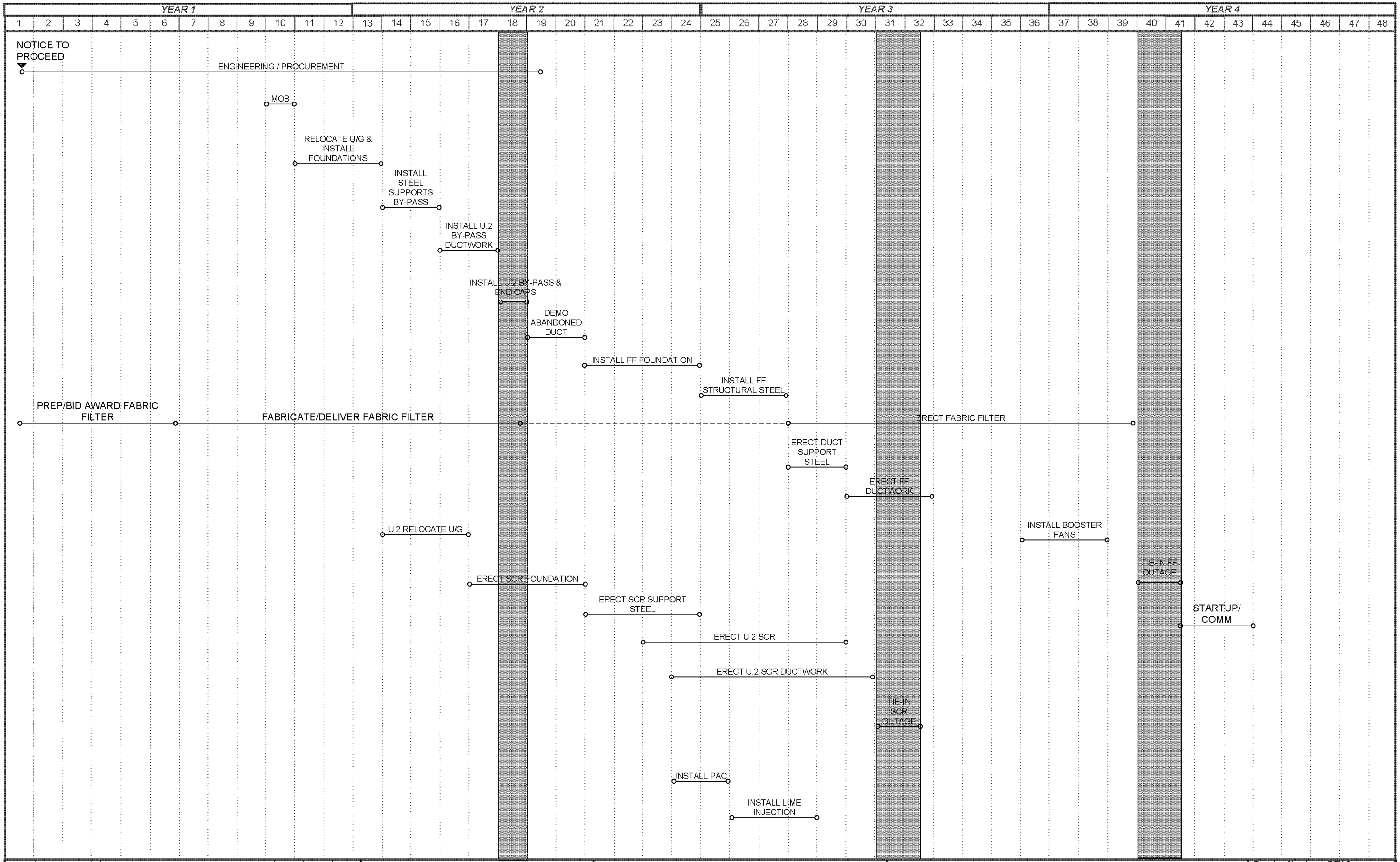

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LEVEL 1 SCHEDULE

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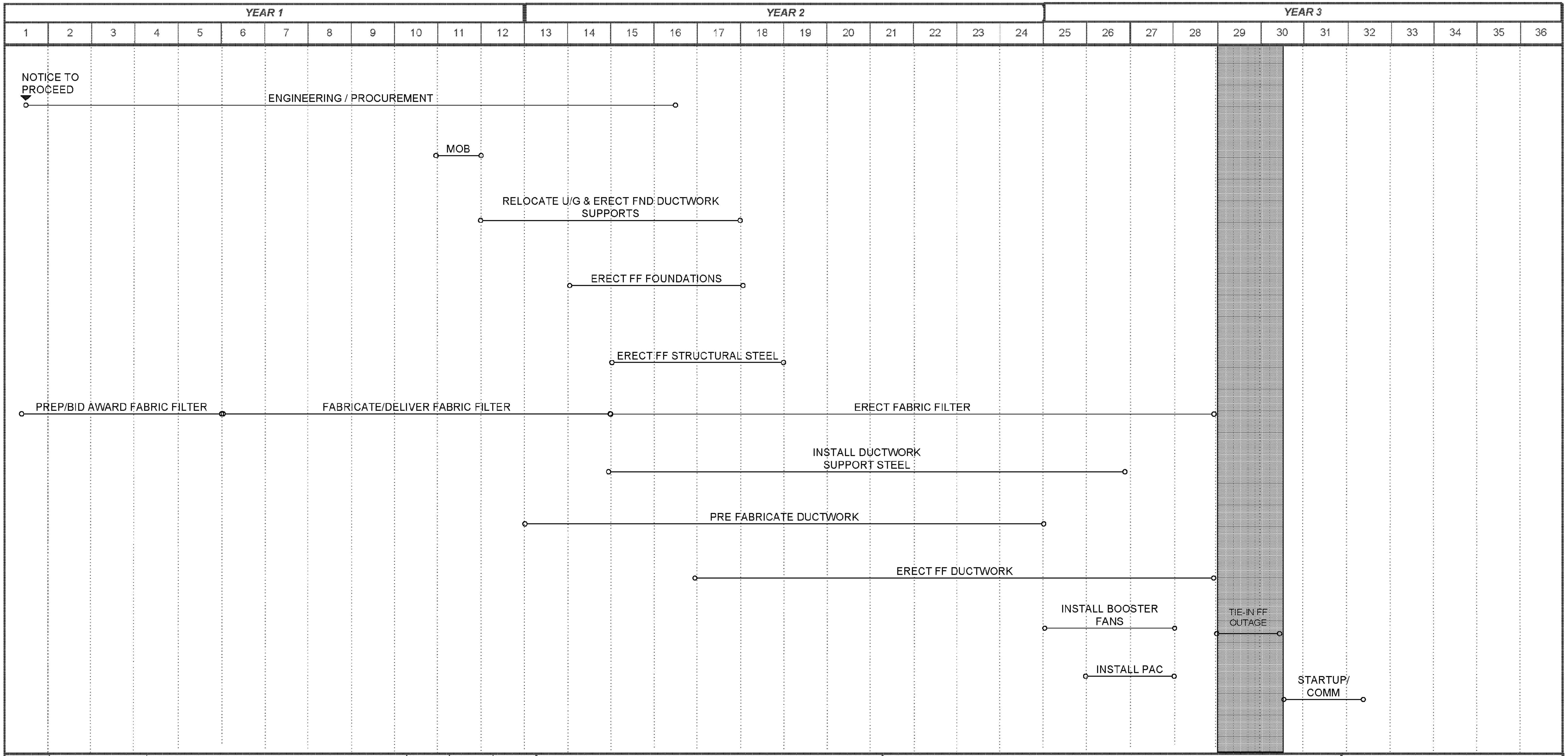

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Engineer

Drawn S. CARUTHERS

Checked T. VANGILDER

Date JUNE 07, 2010

GHENT UNIT 3
FABRIC FILTER

LEVEL 1 SCHEDULE

Drawing Number - REV 0

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Area

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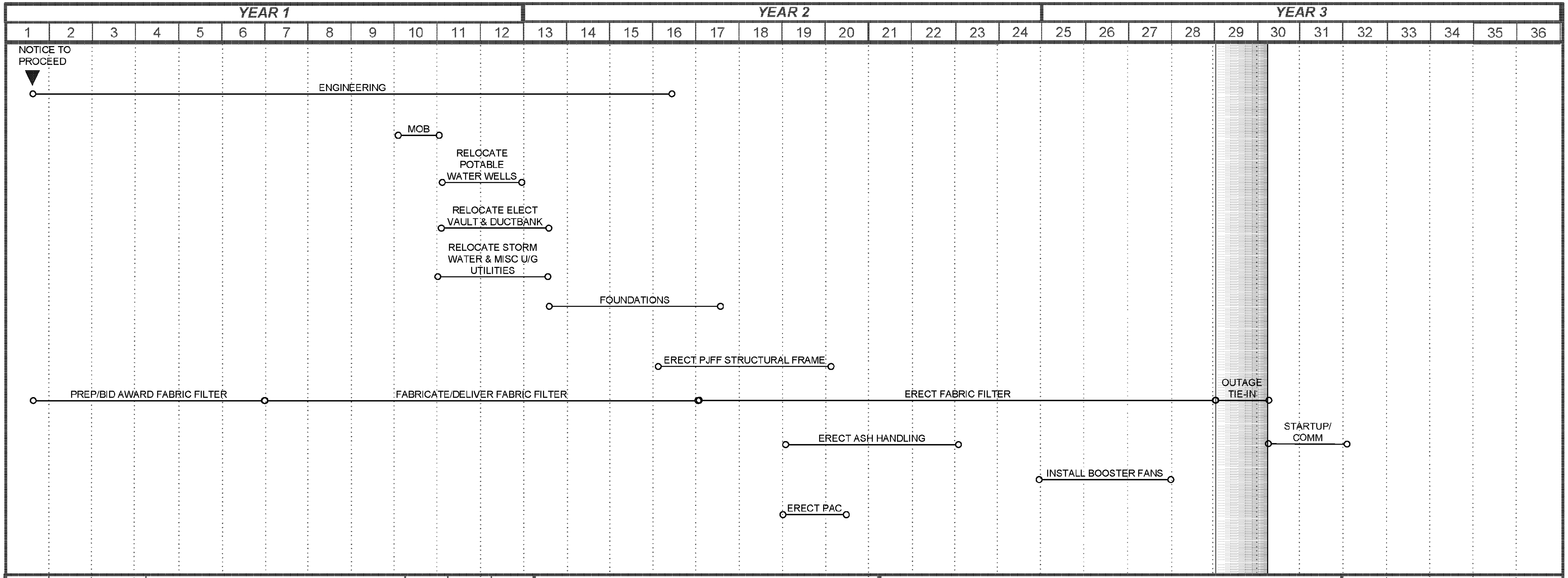

No.	Date	Revisions & Record of Issue	Dwn	Chk	Appd
0	06/16/2010	PHASE 1			

BLACK & VEATCH

Engineer

Drawn S. CARUTHERS

Checked T. VANGILDER

Date JUNE 07, 2010

GHENT UNIT 4
PAC & FABRIC FILTER

LEVEL 1 SCHEDULE

Code

Area

Page 1 of 1

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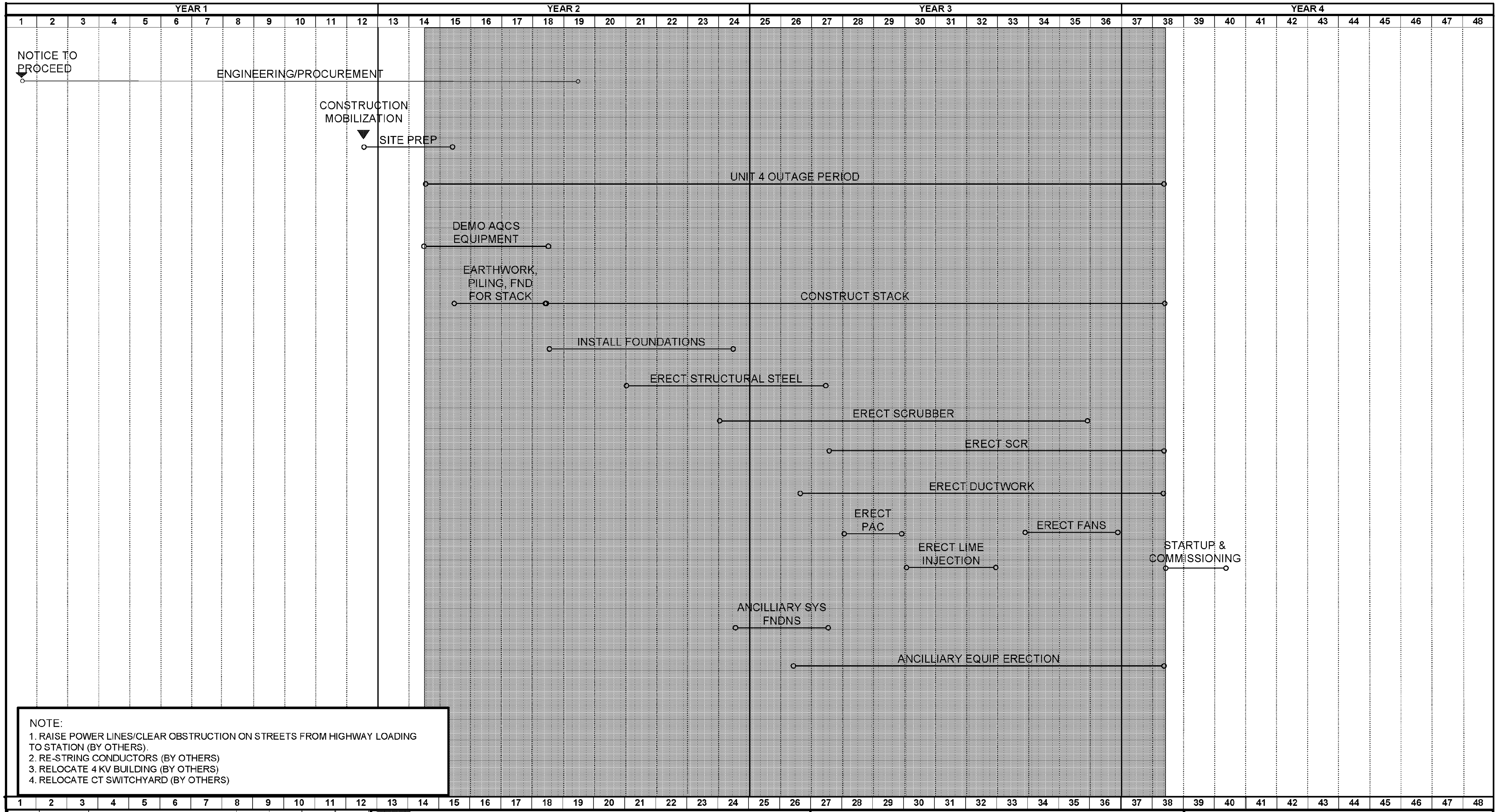
Cane Run



NOTE:
1. RAISE POWER LINES/CLEAR OBSTRUCTION ON STREETS FROM HIGHWAY LOADING TO STATION (BY OTHERS).
2. RE-STRING CONDUCTORS (BY OTHERS)
3. RELOCATE 4 KV BUILDING (BY OTHERS)
4. RELOCATE CT SWITCHYARD (BY OTHERS)

FILE NAME

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CANE RUN UNIT 4
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER
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AREA

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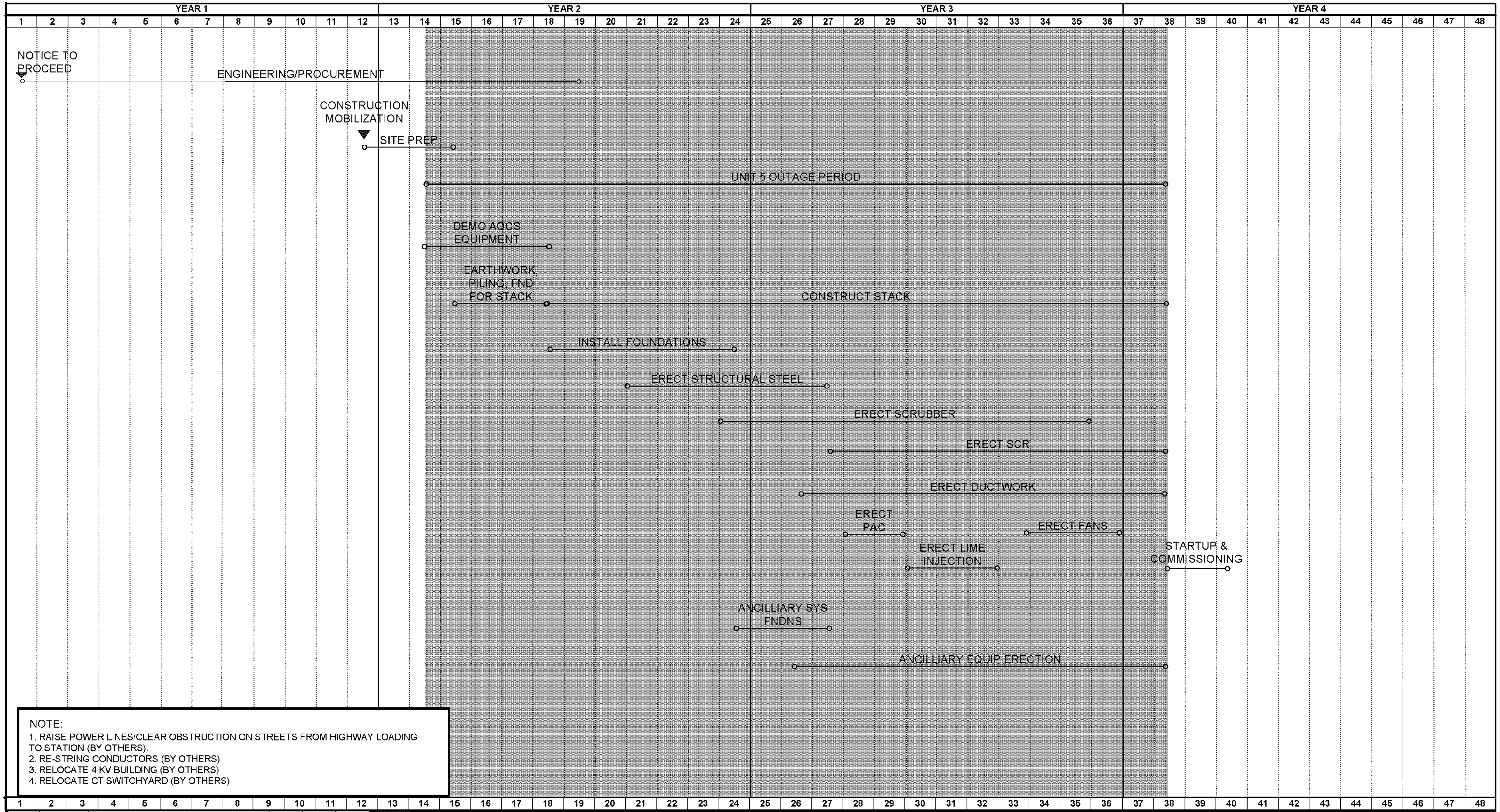

NOTE:
1. RAISE POWER LINES/CLEAR OBSTRUCTION ON STREETS FROM HIGHWAY LOADING TO STATION (BY OTHERS).
2. RE-STRING CONDUCTORS (BY OTHERS)
3. RELOCATE 4 KV BUILDING (BY OTHERS)
4. RELOCATE CT SWITCHYARD (BY OTHERS)

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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CANE RUN UNIT 5
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER
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AREA
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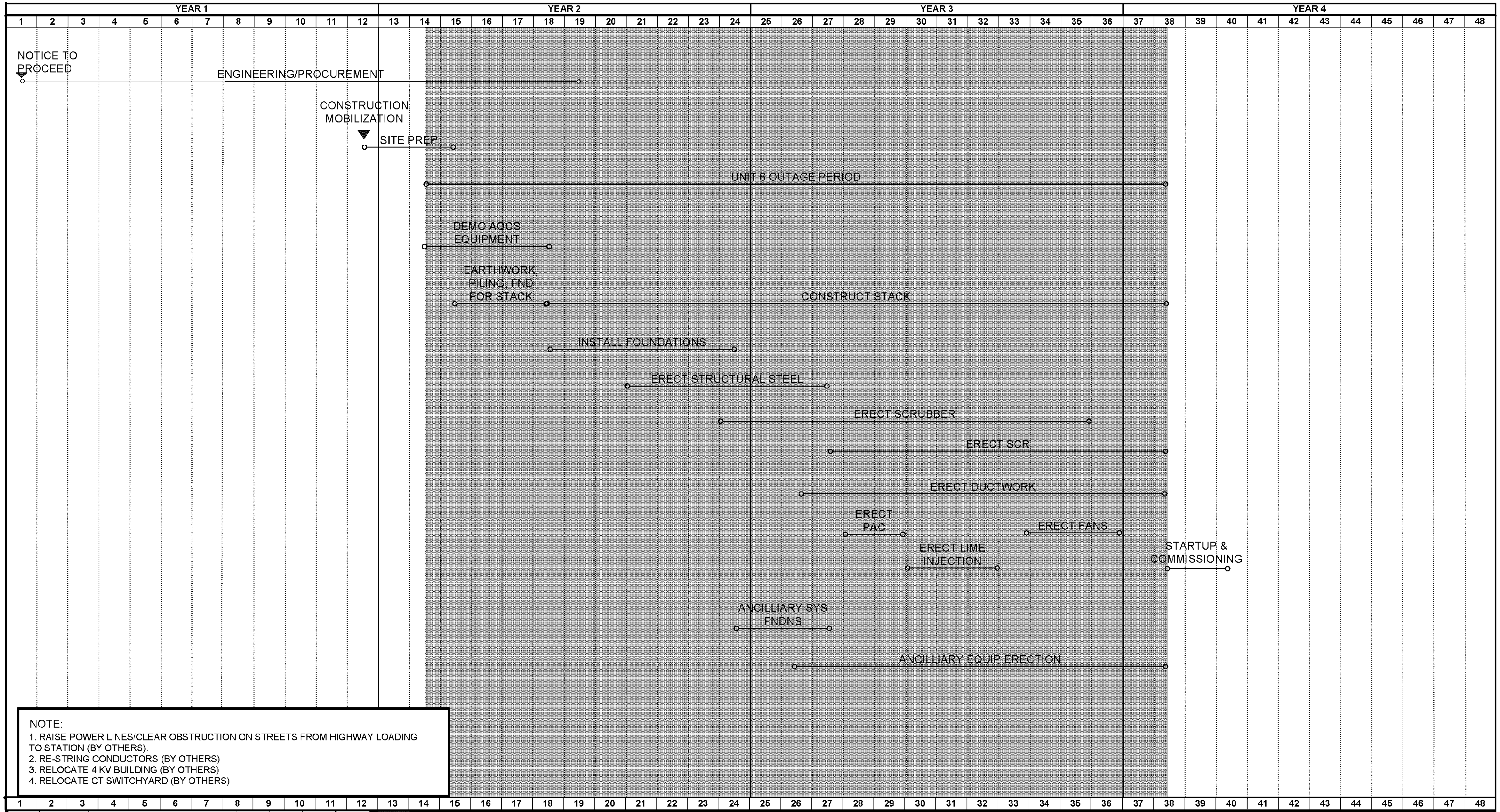

NOTE:
1. RAISE POWER LINES/CLEAR OBSTRUCTION ON STREETS FROM HIGHWAY LOADING TO STATION (BY OTHERS).
2. RE-STRING CONDUCTORS (BY OTHERS)
3. RELOCATE 4 KV BUILDING (BY OTHERS)
4. RELOCATE CT SWITCHYARD (BY OTHERS)

FILE NAME:

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CANE RUN UNIT 6
SCR & SCRUBBER

LEVEL 1 SUMMARY SCHEDULE

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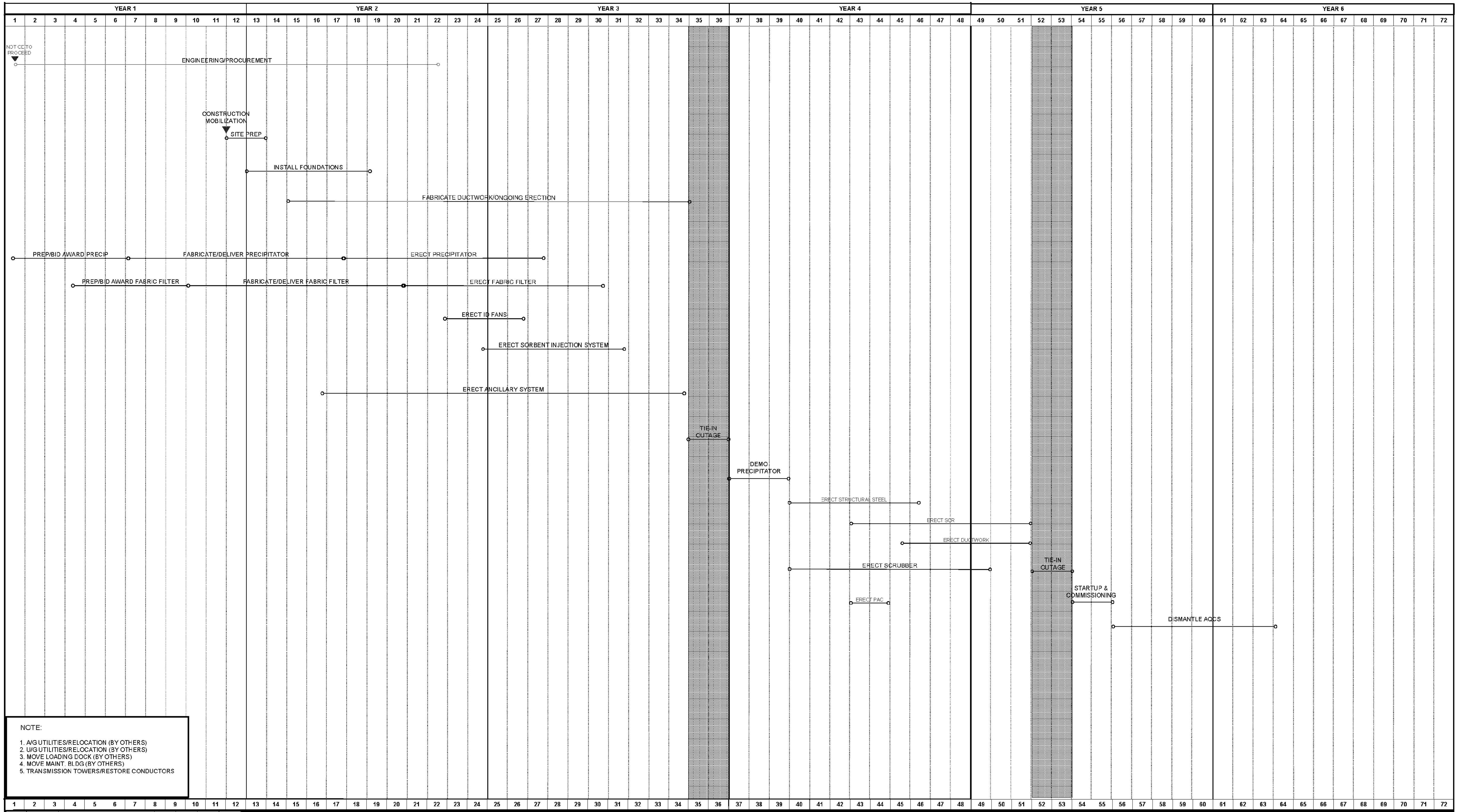
Mill Creek



NOTE:

1. A/G UTILITIES/RELOCATION (BY OTHERS)
2. U/G UTILITIES/RELOCATION (BY OTHERS)
3. MOVE LOADING DOCK (BY OTHERS)
4. MOVE MAINT. BLDG (BY OTHERS)
5. TRANSMISSION TOWERS/RESTORE CONDUCTORS

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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MILL CREEK UNIT 1
SCRUBBER, ESP, FABRIC FILTER, & SCR

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER REV 0

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AREA

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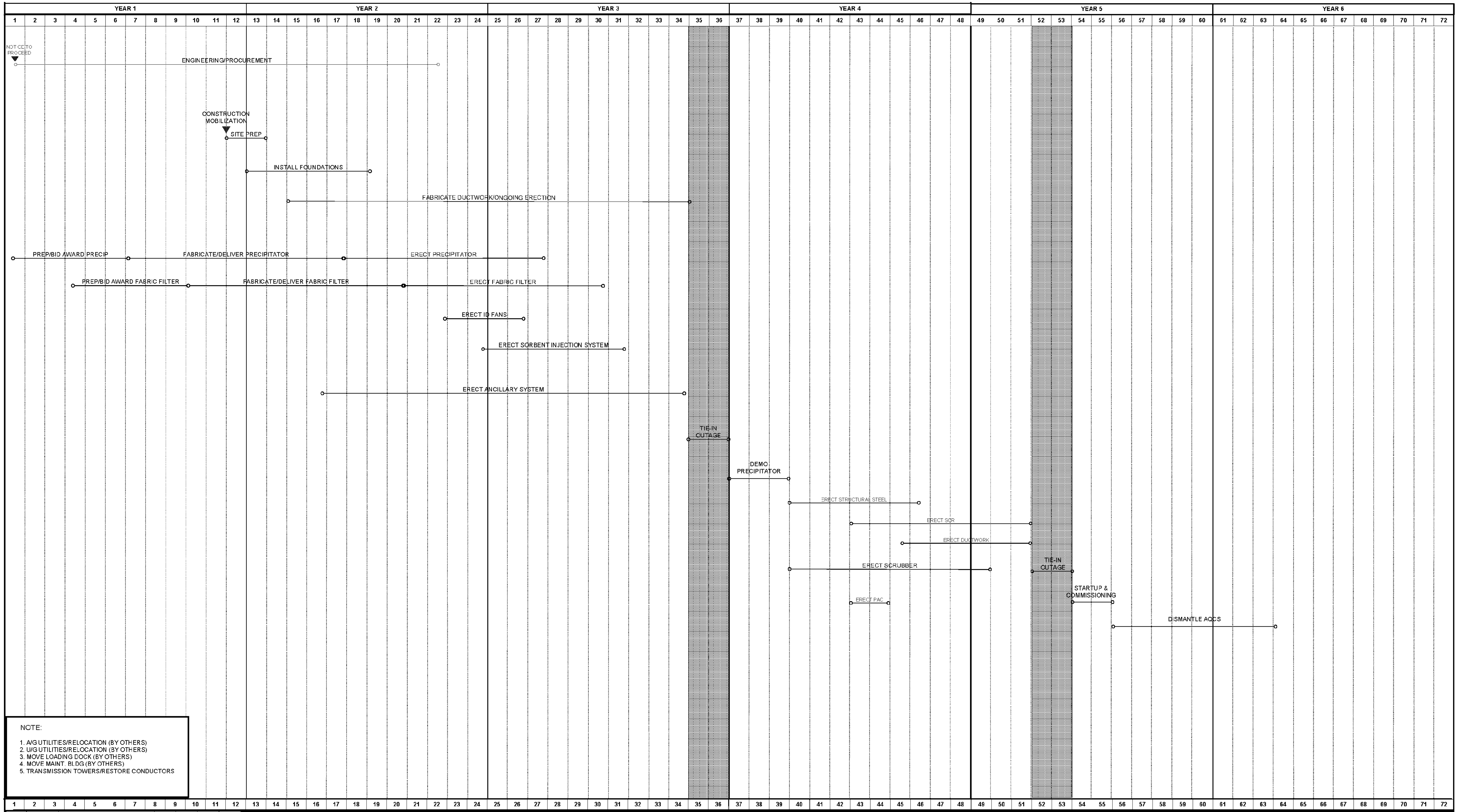

NOTE:

1. A/G UTILITIES/RELOCATION (BY OTHERS)
2. U/G UTILITIES/RELOCATION (BY OTHERS)
3. MOVE LOADING DOCK (BY OTHERS)
4. MOVE MAINT. BLDG (BY OTHERS)
5. TRANSMISSION TOWERS/RESTORE CONDUCTORS

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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MILL CREEK UNIT 2
SCRUBBER, ESP, FABRIC FILTER, & SCR

LEVEL 1 SUMMARY SCHEDULE

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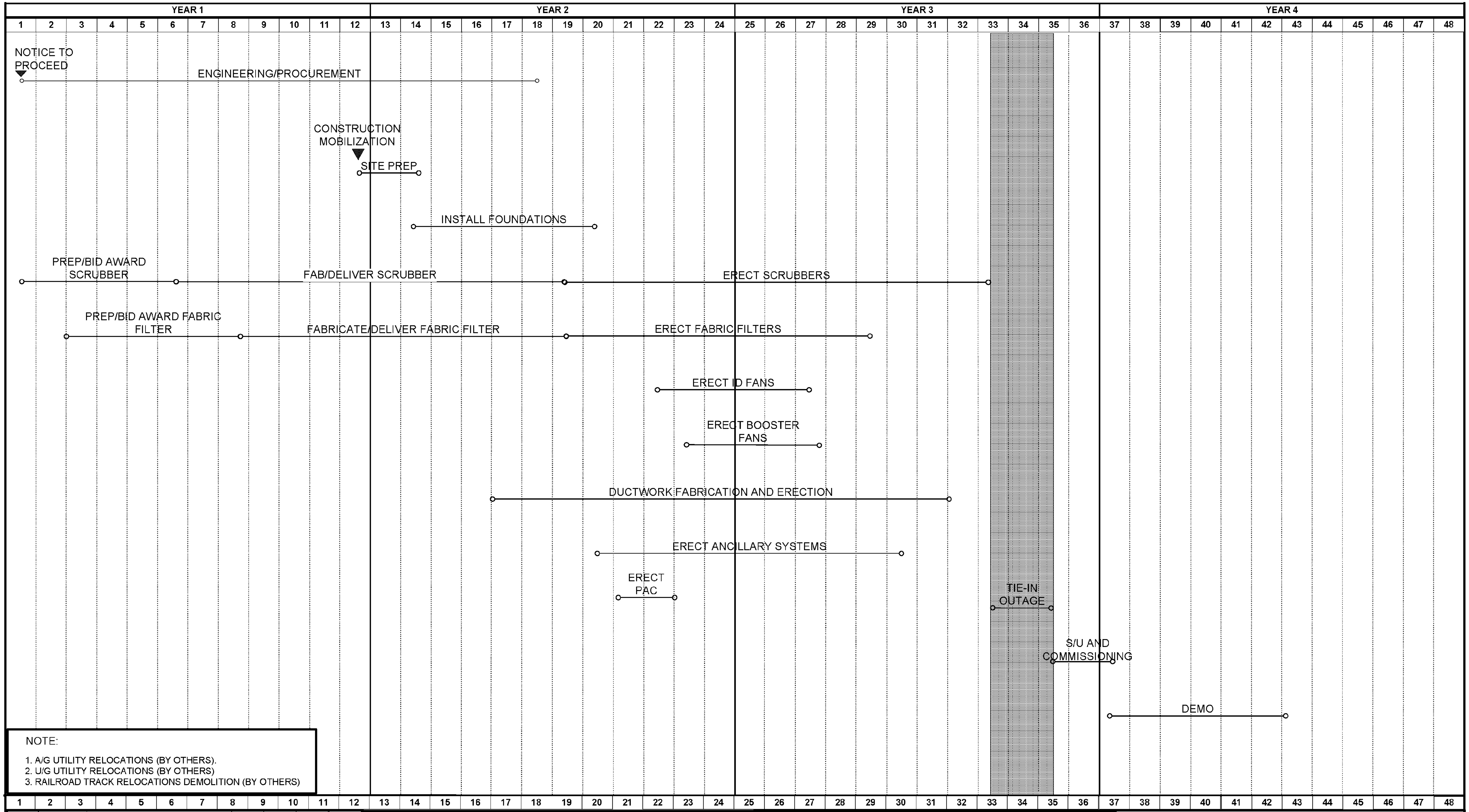

NOTE:

1. A/G UTILITY RELOCATIONS (BY OTHERS).
2. U/G UTILITY RELOCATIONS (BY OTHERS)
3. RAILROAD TRACK RELOCATIONS DEMOLITION (BY OTHERS)

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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MILL CREEK UNIT 3
SCRUBBER & FABRIC FILTER

LEVEL 1 SUMMARY SCHEDULE

DRAWING NUMBER
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AREA
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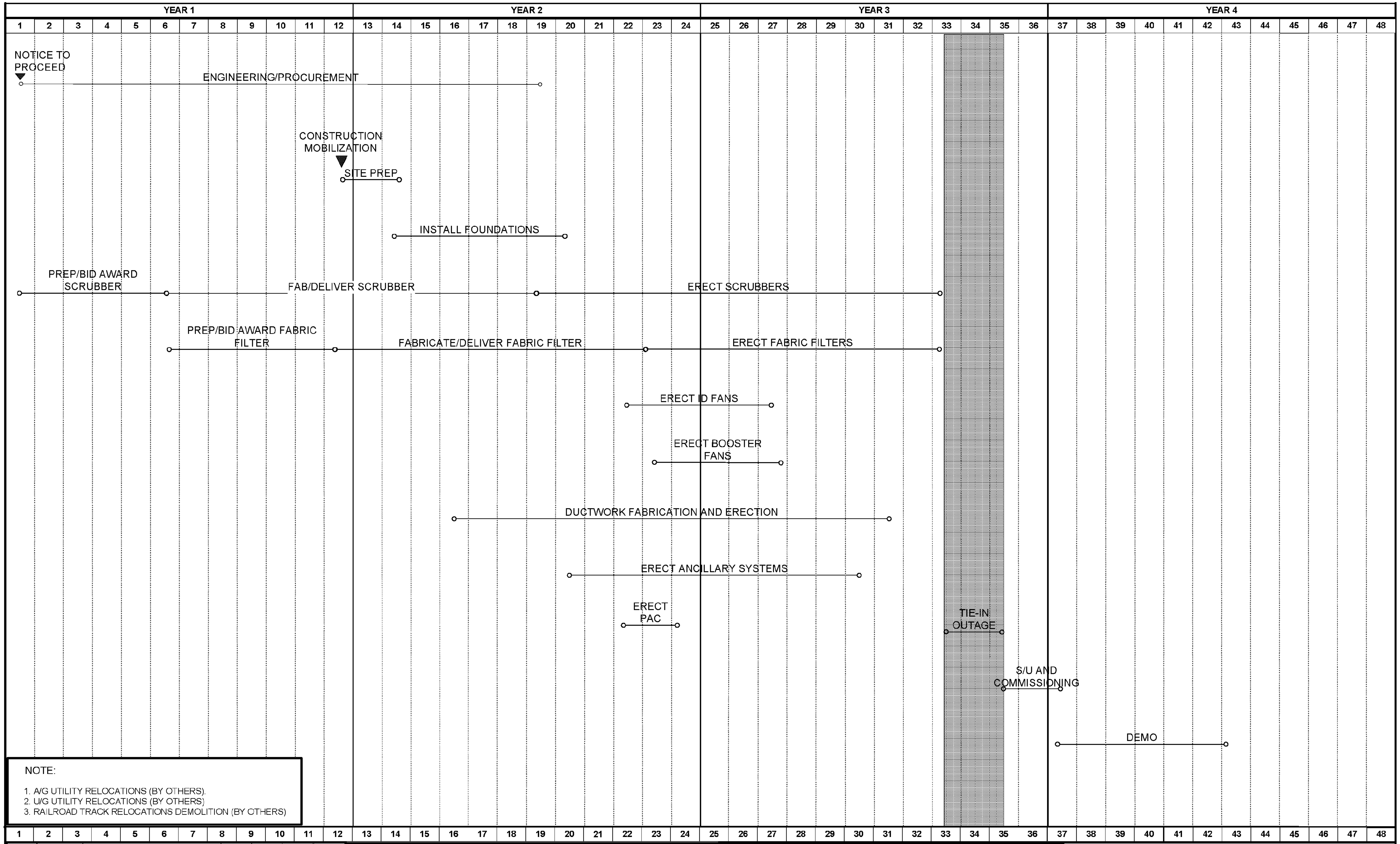

NOTE:

1. A/G UTILITY RELOCATIONS (BY OTHERS).
2. U/G UTILITY RELOCATIONS (BY OTHERS)
3. RAILROAD TRACK RELOCATIONS DEMOLITION (BY OTHERS)

NO.	DATE	REVISIONS & RECORD OF ISSUE	DWN	CHK	APP	FLM
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MILL CREEK UNIT 4
SCRUBBER & FABRIC FILTER

LEVEL 1 SUMMARY SCHEDULE

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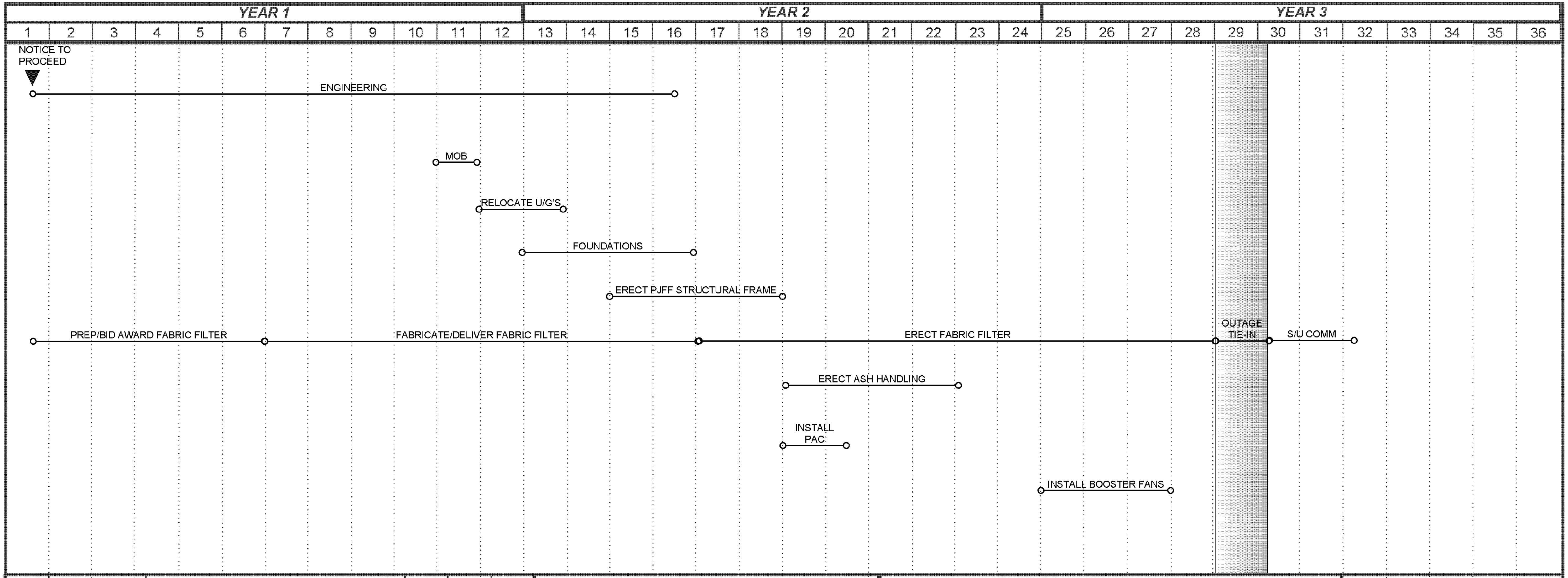
Trimble County



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	S. CARUTHERS
Checked	**Date**
T. VANGILDER	JUNE 07, 2010

TRIMBLE COUNTY UNIT 1
PAC & FABRIC FILTER

LEVEL 1 SCHEDULE

Code	Area

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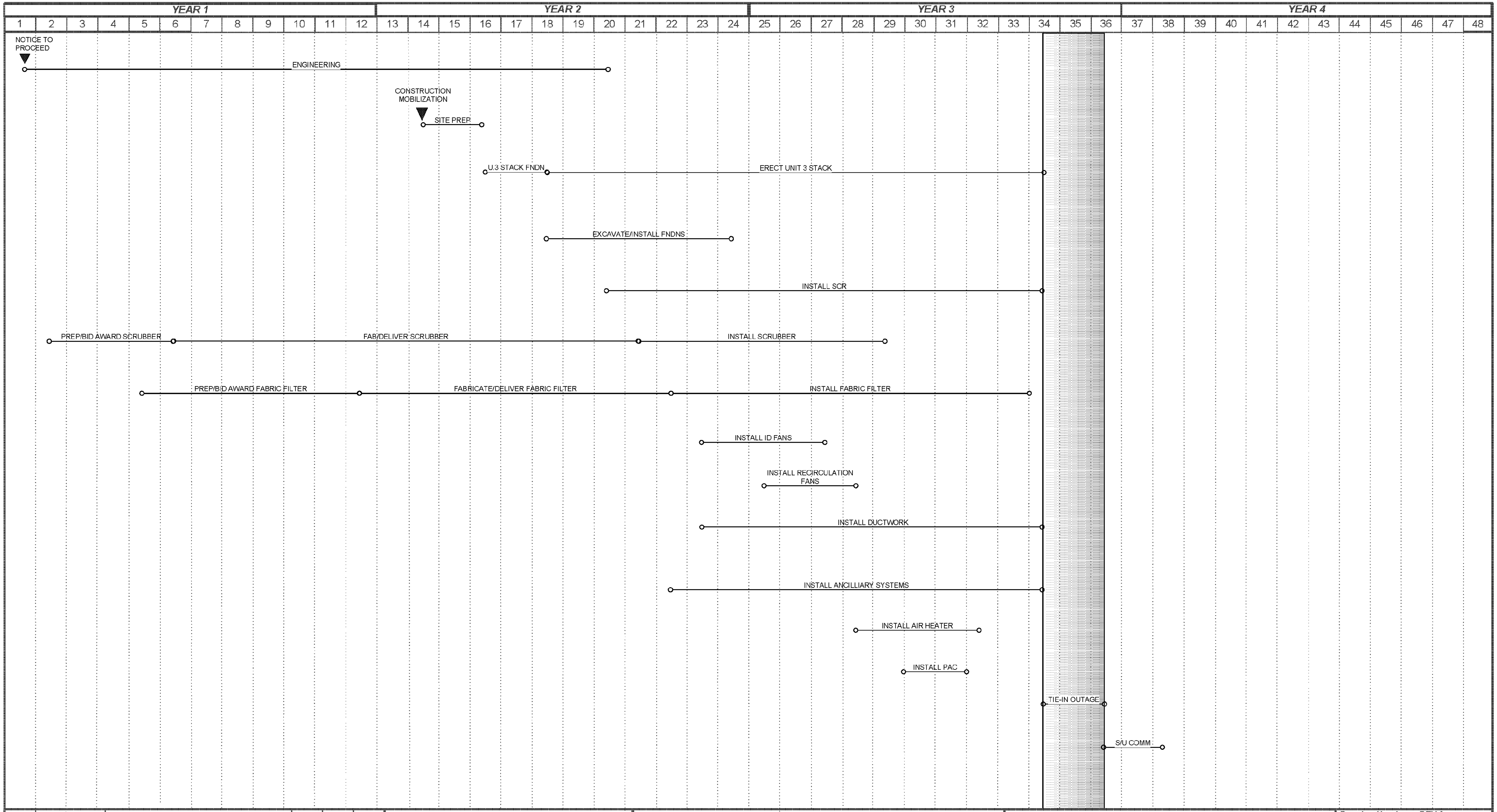
Green River



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Engineer
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Checked T. VANGILDER
Date JUNE 07, 2010

GREEN RIVER UNIT 3
SCR, SCRUBBER & FABRIC FILTER

LEVEL 1 SCHEDULE

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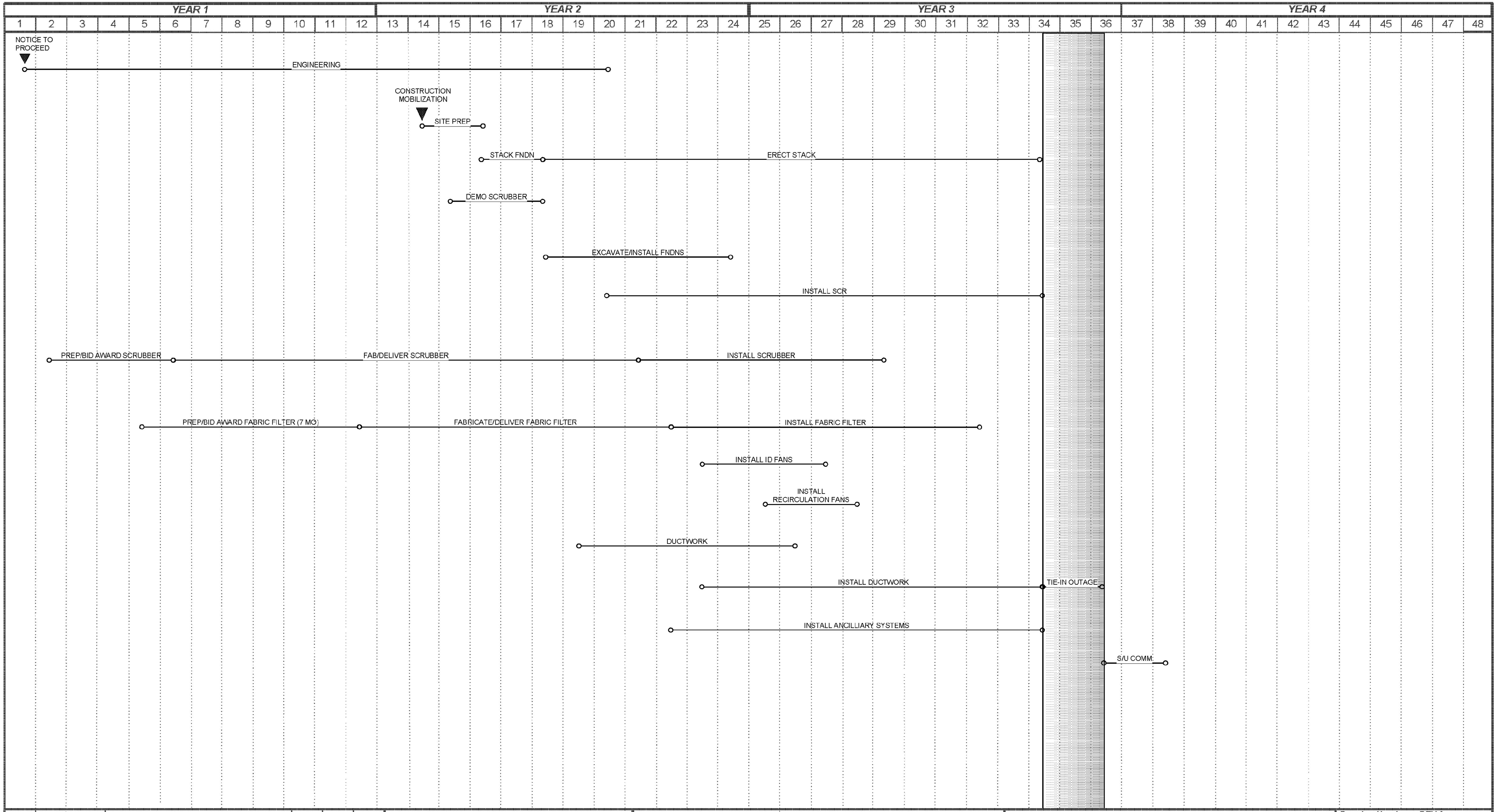

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4:55:21 PM
6/16/2010

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Engineer

Drawn S. CARUTHERS

Checked T. VANGILDER

Date JUNE 07, 2010

GREEN RIVER UNIT 4
SCR, SCRUBBER & FABRIC FILTER

LEVEL 1 SCHEDULE

Drawing Number - REV 0

Code

Area

Page 1 of 1

From:	Saunders, Eileen
To:	Wilson, Stuart
CC:	Voyles, John; Bowling, Ralph; Straight, Scott; Kirkland, Mike; Hudson, Rusty
Sent:	6/25/2010 3:37:08 PM
Subject:	FW: 167987.26.0000 100625-New AQC Scenarios at MC
Attachments:	Draft Mill Creek Costs - Option 1&2 062510.pdf

Stuart,

As discussed, please find revised numbers for the WFGD portion of the Mill Creek proposed AQCS compliance strategy. Project Engineering will continue to work with B&V to refine the costs on MC and the other facilities.

Thank you,

Eileen

From: Lucas, Kyle J. [mailto:LucasKJ@bv.com]
Sent: Friday, June 25, 2010 1:43 PM
To: Saunders, Eileen
Cc: Hillman, Timothy M.; Mahabaleshwarkar, Anand
Subject: 167987.26.0000 100625-New AQC Scenarios at MC

Eileen,
Attached please find the draft cost summary for the following two Mill Creek scenarios for the WFGD options. The detailed cost and subsequent support information will be included within the report document.

1. Modification of Mill Creek 3 and 4 scrubbers from a 2-50% module configuration to a single 100% module configuration each. The scenario will not consider potential space limitations as a fatal flaw due to the rail/road access and will also not include the costs for moving the rail.

2. Modification of Mill Creek 1 and 2 scrubbers from two single separate modules to a one single combined larger scrubber module located near the roadway. The exhaust gas from each unit will pass through the "approved" AQC technology as presented in the draft report but merge into the single scrubber then back to the existing stack.

Regards,

Kyle

Kyle Lucas | Environmental Permitting Manager
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-9062** | Fax: **(913) 458-9062**
Email: **lucaskj@bv.com**

From: Saunders, Eileen [mailto:Eileen.Saunders@eon-us.com]
Sent: Monday, June 21, 2010 4:07 PM
To: Lucas, Kyle J.
Cc: Hillman, Timothy M.; Mahabaleshwarkar, Anand; Straight, Scott
Subject: RE: 167987.10.0100 100621-New AQC Scenarios

Kyle,

After the call, Scott and I reviewed the S&L report from 1999 and discovered that the ESP's were moved to the side not the SCRs. Therefore, Scott said it didn't make sense for me to forward those drawings on to you. You do not need to relocate the SCRs.

Your other assumptions are correct. Please proceed.

Thank you,

Eileen

From: Lucas, Kyle J. [mailto:LucasKJ@bv.com]
Sent: Monday, June 21, 2010 4:20 PM
To: Saunders, Eileen
Cc: Hillman, Timothy M.; Mahabaleshwarkar, Anand
Subject: 167987.10.0100 100621-New AQC Scenarios

Eileen,
From our conference call today, EON requested additional AQC scenarios be reviewed and costs developed beyond those scenarios assumed in the draft AQC study. The scenarios requested include the following:

Modification of Mill Creek 3 and 4 scrubbers from a 2-50% module configuration to a single 100% module configuration each. The scenario will not consider potential space limitations as a fatal flaw due to the rail/road access and will also not include the costs for moving the rail. This scenario will be looked at separately as an additional AQC option for Units 3 and 4.

Also, we reviewed the original scenario data and found that this scenario was only partially completed before it was modified to the 2-50% module configuration. Thus, B&V can revisit and provide the draft costs data by Friday 6/25 COB with approval today.

Modification of Mill Creek 1 and 2 scrubbers from two single separate modules to a one single combined larger scrubber module located near the roadway or off to the side of unit. The exhaust gas from each unit will pass through the "approved" AQC technology as presented in the draft report but merge into the single scrubber then back to the existing stack. This scenario will be looked at separately as an additional AQC option for Units 1 and 2.

B&V can provide the draft costs data by Friday 6/25 COB with approval today.

Move Mill Creek 1 and 2 SCRs to the location on the side of the units as described in the S&L report from 1999 which will be provided by EON. It is assumed that the "approved" AQC technology as presented in the draft report will remain and the only change is the movement of the SCR location. This scenario will be looked at separately as an additional AQC option for Units 1 and 2.

Remove Mill Creek 1 and 2 dry ESPs and only use the proposed PJFFs. It is assumed that the "approved" AQC technology as presented in the draft report will remain and the only change is the removal of the dry ESP and associated repositioning of the PJFF (elevated) and duct work. This scenario will be looked at separately as an additional AQC option for Units 1 and 2.

Modification of Brown 1 and 2 PJFF from two single separate PJFF to a one single combined PJFF. The exhaust gas from each unit will pass through the "approved" AQC technology as presented in the draft report (note that Unit 1 is has LNB and OFA for NOx control) but merge into the single PJFF and then to the combined scrubber and stack. This scenario will be looked at separately as an additional AQC option for Units 1 and 2.

ase review the aforementioned scenarios provide an e-mail authorization for us to proceed with developing the cost information for each scenario. If needed, please modify the scenarios to clarify specific requirements. It is our understanding that the same level of detail for each scenario as presented within the draft AQC report will be provided for these scenarios. Upon receipt of your authorization and clarification of the scenarios, B&V will transmit the technology selection sheets for the updated scenario(s) for EON's review and approval along with a man-hour estimate and schedule for completion.

ase feel free to contact me with any questions.

gards,
le

Kyle Lucas | Environmental Permitting Manager
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-9062** | Fax: **(913) 458-9062**
Email: **lucaskj@bv.com**

E.ON Mill Creek Draft Costs 6/25/2010

New AQCS Cost Estimates

AQC Equipment	Total Capital Cost	$/kW	O&M Cost	Levelized Annual Costs
Combined Units 1 & 2 WFGD	$509,000,000	$771	$24,301,000	$86,246,000
Combined Units 3 WFGD	$335,000,000	$792	$17,199,000	$57,969,000
Combined Units 4 WFGD	$390,000,000	$743	$19,826,000	$67,289,000

Savings in Cost

AQC Equipment	Capital Cost (CC)	% Savings (CC)	O&M Cost	Levelized Annual Costs
Combined Units 1 & 2 WFGD	$85,000,000	14.31%	$4,644,000	$14,989,000
Combined Units 3 WFGD	$57,000,000	14.54%	$1,712,000	$8,648,000
Combined Units 4 WFGD	$65,000,000	14.29%	$1,949,000	$9,860,000
Total Savings	$207,000,000	--	$8,305,000	$33,497,000

From:	Straight, Scott
To:	Hudson, Rusty; Schram, Chuck; Wilson, Stuart; Saunders, Eileen
CC:	Voyles, John; Bowling, Ralph
Sent:	6/29/2010 10:33:54 AM
Subject:	2011 MTP B&V Study vs. Env Scenario Planning
Attachments:	2011 MTP Environmental Summay - B&V vs Env Scenario Planning.xlsx

Rusty, is this what you were looking for?

To All, please provide comments to this draft comparison table that identifies the unit, technology and cost of the 2011 MTP B&V Study to the Environmental Scenario Planning.

Scott Straight
Director Project Engineering
E.ON U.S. LLC
O 502-627-2701
F 502-214-2040
scott.straight@eon-us.com

	A	B	C	D	E	F	G
1							
2							
3			**2011 MTP Black & Veatch Study**	**(x $1,**	**Environmental Scenario Planning (x $1,000)**		
4							
5	**Brown**						
6	Brown 1 - SCR		59,000				
7	Brown 1 - SNCR				11,000		
8	Brown 1 - Baghouse		34,000				
9	Brown 1 - PAC Injection		1,599				
10	Brown 1 - Hg Control				3,000		
11	Brown 1 - Neural Networks		500				
12	Brown 1 - SAM Mitigation		4,000				
13	Brown 1 - Escalation		21,238				
14	Brown 1 - CO2				3,000		
15	Total Brown 1		**120,337**		**17,000**		
16							
17	Brown 2 - SCR		92,000				
18	Brown 2 - SCNR				11,000		
19	Brown 2 - Baghouse		34,000				
20	Brown 2 - PAC Injection		2,476				
21	Brown 2 - Hg Control				3,000		
22	Brown 2 - Neural Networks		500				
23	Brown 2 - Lime Injection		2,739				
24	Brown 2 - SAM Mitigation		4,000				
25	Brown 2 - Escalation		48,799				
26	Brown 2 - CO2				5,000		
27	Total Brown 2		**184,514**		**19,000**		
28							
29	Brown 3 - Baghouse		61,000				
30	Brown 3 - PAC Injection		5,426				
31	Brown 3 - Hg Control				4,000		
32	Brown 3 - Neural Networks		1,000				
33	Brown 3 - Escalation		16,952				
34	Brown 3 - CO2				13,000		
35	Total Brown 3		**84,378**		**17,000**		
36							
37	**Total Brown**		**389,229**		**53,000**		
38							
39	**Ghent**						
40	Ghent 1 - Baghouse		131,000				
41	Ghent 1 - PAC Injection		6,380				
42	Ghent 1 - Hg Control				77,000		
43	Ghent 1 - Neural Networks		1,000				

	A	B	C	D	E	F	G
44	Ghent 1 - Escalation		22,965				
45	Ghent 1 - CO2				15,000		
46	Total Ghent 1		**161,345**		**92,000**		
47							
48	Ghent 2 - SCR		227,000		152,000		
49	Ghent 2 - Baghouse		120,000				
50	Ghent 2 - PAC Injection		6,109				
51	Ghent 2 - Hg Control				7,000		
52	Ghent 2 - Lime Injection		5,483				
53	Ghent 2 - Neural Networks		1,000				
54	Ghent 2 - Escalation		57,338				
55	Ghent 2 - CO2				15,000		
56	Total Ghent 2		**416,930**		**174,000**		
57							
58	Ghent 3 - Baghouse		138,000				
59	Ghent 3 - PAC Injection		6,173				
60	Ghent 3 - Hg Control				77,000		
61	Ghent 3 - Neural Networks		1,000				
62	Ghent 3 - Escalation		33,368				
63	Ghent 3 - CO2				15,000		
64	Total Ghent 3		**178,541**		**92,000**		
65							
66	Ghent 4 - Baghouse		117,000				
67	Ghent 4 - PAC Injection		6,210				
68	Ghent 4 - Hg Control				77,000		
69	Ghent 4 - Neural Networks		1,000				
70	Ghent 4 - Escalation		28,313				
71	Ghent 4 - CO2				15,000		
72	Total Ghent 4		**152,523**		**92,000**		
73							
74	**Total Ghent**		**909,338**		**450,000**		
75							
76							
77	**Mill Creek**						
78	Mill Creek 1 - FGD		297,000		20,000		
79	Mill Creek 1 - SCR		97,000		121,000		
80	Mill Creek 1 - Baghouse		81,000				
81	Mill Creek 1 - Electrostatic Precipitator		32,882				
82	Mill Creek 1 - PAC Injection		4,412				
83	Mill Creek 1 - Hg Control				60,000		
84	Mill Creek 1 - SAM Mitigation		8,000				
85	Mill Creek 1 - Lime Injection		4,480				
86	Mill Creek 1 - Neural Networks		1,000				
87	Mill Creek 1 - Escalation		120,469				
88	Mill Creek 1 - CO2				10,000		

	A	B	C	D	E	F	G
89	Total Mill Creek 1		**646,243**		**211,000**		
90							
91	Mill Creek 2 - FGD		297,000		20,000		
92	Mill Creek 2 - SCR		97,000		121,000		
93	Mill Creek 2 - Baghouse		81,000				
94	Mill Creek 2 - Electrostatic Precipitator		32,882				
95	Mill Creek 2 - PAC Injection		4,412				
96	Mill Creek 2 - Hg Control				60,000		
97	Mill Creek 2 - SAM Control		8,000				
98	Mill Creek 2 - Lime Injection		4,480				
99	Mill Creek 2 - Neural Networks		1,000				
100	Mill Creek 2 - Escalation		101,752				
101	Mill Creek 2 - CO2				10,000		
102	Total Mill Creek 2		**627,526**		**211,000**		
103							
104	Mill Creek 3 - FGD		392,000		20,000		
105	Mill Creek 3 - Baghouse		114,000				
106	Mill Creek 3 - PAC Injection		5,592				
107	Mill Creek 3 - Hg Control				69,000		
108	Mill Creek 3 - Neural Networks		1,000				
109	Mill Creek 3 - Escalation		111,307				
110	Mill Creek 3 - CO2				12,000		
111	Total Mill Creek 3		**623,899**		**101,000**		
112							
113	Mill Creek 4 - FGD		455,000		20,000		
114	Mill Creek 4 - Baghouse		133,000				
115	Mill Creek 4 - PAC Injection		6,890				
116	Mill Creek 4 - Hg Control				77,000		
117	Mill Creek 4 - Neural Networks		1,000				
118	Mill Creek 4 - Escalation		157,787				
119	Mill Creek 4 - CO2				15,000		
120	Total Mill Creek 4		**753,677**		**112,000**		
121							
122	**Total Mill Creek**		**2,651,346**		**635,000**		
123							
124							
125	**Trimble**						
126	Trimble 1 - Baghouse		128,000				
127	Trimble 1 - PAC Injection		6,451				
128	Trimble 1 - Hg Control				4,000		
129	Trimble 1 - Neural Networks		1,000				
130	Trimble 1 - Escalation		30,738				
131	Trimble 1 - CO2				16,000		
132	Total Trimble 1		**166,189**		**20,000**		
133							

	A	B	C	D	E	F	G
134	**Total Trimble**		**166,189**		**20,000**		
135							
136	**Total Environmental Compliance Air - Main Plan**		**4,116,101**		**1,158,000**		
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152	**Sensitivities**						
153	**Green River**						
154	Green River 3 - SCR		29,000				
155	Green River 3 - CDS-FF		38,000				
156	Green River 3 - PAC Injection		1,112				
157	Green River 3 - Neural Networks		500				
158	Green River 3 - Escalation		17,899				
159	Total Green River 3		**86,511**				
160							
161	Green River 4 - SCR		42,000				
162	Green River 4 - CDS-FF		54,000				
163	Green River 4 - PAC Injection		1,583				
164	Green River 4 - Neural Networks		500				
165	Green River 4 - Escalation		20,877				
166	Total Green River 4		**118,960**				
167							
168	**Total Green River**		**205,471**				
169							
170							
171	**Cane Run**						
172	Cane Run 4 - FGD		152,000				
173	Cane Run 4 - SCR		63,000				
174	Cane Run 4 - Baghouse		33,000				
175	Cane Run 4 - PAC Injection		2,326				
176	Cane Run 4 - Lime Injection		2,569				
177	Cane Run 4 - Neural Networks		500				
178	Cane Run 4 - Escalation		45,571				

	A	B	C	D	E	F	G
179	Total Cane Run 4		**298,966**				
180							
181	Cane Run 5 - FGD		159,000				
182	Cane Run 5 - SCR		66,000				
183	Cane Run 5 - Baghouse		35,000				
184	Cane Run 5 - PAC Injection		2,490				
185	Cane Run 5 - Lime Injection		2,752				
186	Cane Run 5 - Neural Networks		500				
187	Cane Run 5 - Escalation		59,628				
188	Total Cane Run 5		**325,370**				
189							
190	Cane Run 6 - FGD		202,000				
191	Cane Run 6 - SCR		86,000				
192	Can Rune 6 - Baghouse		45,000				
193	Cane Run 6 - PAC Injection		3,490				
194	Cane Run 6 - Lime Injection		3,873				
195	Cane Run 6 - Neural Networks		500				
196	Cane Run 6 - Escalation		60,222				
197	Total Can Run 6		401,085				
198							
199	**Total Cane Run**		**1,025,422**				
200							
201	**Total Environmental Compliance Air - Sensitivities**		**1,230,892**				
202							
203							
204	**Grand Total Environmental Compliance Air**		**5,346,993**				

	A	B	C	D	E
1	Black & Veatch Study Cost Estimates				
2					
3					
4					
5			**MW**		**$/kW**
6	**BROWN**				
7	Brown 1 - Low NOx Burners				$536
8	Brown 1 - Baghouse				$309
9	Brown 1 - PAC Injection				$15
10	Brown 1 - Neural Networks				$5
11	Brown 1 - Overfire Air				$193
12	Total Brown 1		110		**$1,058**
13					
14	Brown 2 - SCR				$511
15	Brown 2 - Baghouse				$189
16	Brown 2 - PAC Injection				$14
17	Brown 2 - Neural Networks				$3
18	Brown 2 - Lime Injection				$15
19	Total Brown 2		180		**$732**
20					
21	Brown 3 - Baghouse				$133
22	Brown 3 - PAC Injection				$12
23	Brown 3 - Neural Networks				$2
24	Total Brown 3		457		**$148**
25					
26	**Total Brown**		**747**		**$521**
27					
28					
29	**GHENT**				
30	Ghent 1 - Baghouse				$242
31	Ghent 1 - PAC Injection				$12
32	Ghent 1 - Neural Networks				$2
33	Total Ghent 1		541		**$256**
34					
35	Ghent 2 - SCR				$439
36	Ghent 2 - Baghouse				$232
37	Ghent 2 - PAC Injection				$12
38	Ghent 2 - Lime Injection				$11
39	Ghent 2 - Neural Networks				$2
40	Total Ghent 2		517		**$696**
41					
42	Ghent 3 - Baghouse				$264
43	Ghent 3 - PAC Injection				$12
44	Ghent 3 - Neural Networks				$2
45	Total Ghent 3		523		**$278**
46					

	A	B	C	D	E
47	Ghent 4 - Baghouse				$222
48	Ghent 4 - PAC Injection				$12
49	Ghent 4 - Neural Networks				$2
50	Total Ghent 4		526		$236
51					
52	**Total Ghent**		**2,107**		**$432**
53					
54					
55					
56	**GREEN RIVER**				
57	Green River 3 - SCR				$408
58	Green River 3 - CDS-FF				$535
59	Green River 3 - PAC Injection				$16
60	Green River 3 - Neural Networks				$7
61	Total Green River 3		71		**$966**
62					
63	Green River 4 - SCR				$385
64	Green River 4 - CDS-FF				$495
65	Green River 4 - PAC Injection				$15
66	Green River 4 - Neural Networks				$5
67	Total Green River 4		109		**$900**
68					
69	**Total Green River**		**180**		**$1,142**
70					
71					
72	**CANE RUN**				
73	Cane Run 4 - FGD				$905
74	Cane Run 4 - SCR				$375
75	Cane Run 4 - Baghouse				$196
76	Cane Run 4 - PAC Injection				$14
77	Cane Run 4 - Lime Injection				$15
78	Cane Run 4 - Neural Networks				$3
79	Total Cane Run 4		168		**$1,508**
80					
81	Cane Run 5 - FGD				$878
82	Cane Run 5 - SCR				$365
83	Cane Run 5 - Baghouse				$193
84	Cane Run 5 - PAC Injection				$14
85	Cane Run 5 - Lime Injection				$15
86	Cane Run 5 - Neural Networks				$3
87	Total Cane Run 5		181		**$1,468**
88					
89	Cane Run 6 - FGD				$774
90	Cane Run 6 - SCR				$330
91	Can Rune 6 - Baghouse				$172
92	Cane Run 6 - PAC Injection				$13

	A	B	C	D	E
93	Cane Run 6 - Lime Injection				$15
94	Cane Run 6 - Neural Networks				$2
95	Total Can Run 6		261		$1,306
96					
97	**Total Cane Run**		**610**		**$1,681**
98					
99					
100	**Mill Creek**				
101	Mill Creek 1 - FGD				$900
102	Mill Creek 1 - SCR				$294
103	Mill Creek 1 - Baghouse				$245
104	Mill Creek 1 - Electrostatic Precipitator				$100
105	Mill Creek 1 - PAC Injection				$13
106	Mill Creek 1 - Lime Injection				$14
107	Mill Creek 1 - Neural Networks				$3
108	Total Mill Creek 1		330		**$1,569**
109					
110	Mill Creek 2 - FGD				$900
111	Mill Creek 2 - SCR				$294
112	Mill Creek 2 - Baghouse				$245
113	Mill Creek 2 - Electrostatic Precipitator				$100
114	Mill Creek 2 - PAC Injection				$13
115	Mill Creek 2 - Lime Injection				$14
116	Mill Creek 2 - Neural Networks				$3
117	Total Mill Creek 2		330		**$1,569**
118					
119	Mill Creek 3 - FGD				$927
120	Mill Creek 3 - Baghouse				$270
121	Mill Creek 3 - PAC Injection				$13
122	Mill Creek 3 - Neural Networks				$2
123	Total Mill Creek 3		423		**$1,212**
124					
125	Mill Creek 4 - FGD				$867
126	Mill Creek 4 - Baghouse				$253
127	Mill Creek 4 - PAC Injection				$13
128	Mill Creek 4 - Neural Networks				$2
129	Total Mill Creek 4		525		**$1,135**
130					
131	**Total Mill Creek**		**1,608**		**$1,649**
132					
133					
134	**TRIMBLE**				
135	Trimble 1 - Baghouse				$234
136	Trimble 1 - PAC Injection				$12
137	Trimble 1 - Neural Networks				$2
138	Total Trimble 1		547		$248

	A	B	C	D	E
139					
140	**Total Trimble**		**547**		**$248**
141					
142					
143	**Grand Total**		**5,799**		**$922**

From: Straight, Scott
To: Kuhl, Megan
CC: Hudson, Rusty; Saunders, Eileen; Clements, Joe; Ritchey, Stacy; Raque, Gary; Mooney, Mike (BOC 3); Voyles, John; Bowling, Ralph
Sent: 8/17/2010 12:53:57 PM
Subject: 2011 MTP Air Compliance Level I Engineering Project Sanction Request - August IC Meeting
Attachments: 2011 MTP Level I Engineering - Air Compliance Projects.docx

Megan,

Here is the paper requesting approval of a project to continue studying air compliance projects and a sole source to Black & Veatch Engineers for the August 26th Investment Committee meeting. Gary Raque will provide you the project numbers for the heading of the paper.

Scott Straight, P.E.
Project Engineering - E.ON U.S.
Director, Project Engineering
O (502) 627-2701
F (502) 217-2040
scott.straight@eon-us.com

Investment Proposal for IC:	August XX, 2010
Project Name:	MTP Engineering – Air Compliance Projects
Total Expenditures:	$2,000K
Project Number:	XXXXXX – LG&E YYYYYY - KU
Business Unit/Line of Business:	LG&E and KU Coal-Fired Generation
Prepared/Presented By:	Eileen Saunders/Scott Straight

Executive Summary

This request seeks authorization of $2,000K to continue refining the scopes, implementation schedules and cost estimates of projects identified in the development of the 2011 MTP as necessary for compliance with proposed or final local, State and Federal air compliance regulations through 2016.

In addition to requesting approval of a new engineering project that will continue refining the 2011 MTP air compliance scope, this request also seeks approval of a sole source award to Black &Veatch (B&V) engineering firm. B&V will perform the majority of studies included in the $2 million project sanction request; however, smaller valued contracts will be awarded to various technology firms to perform miscellaneous reviews of the LG&E and KU existing air pollution control technologies for potential upgrades to their performance.

Background

Starting this year and continuing for the next two years, the United States Environmental Protection Agency (USEPA) will be developing and implementing several new environmental regulations. These new regulations will significantly impact our coal-fired electric generating units and will affect all environmental areas of air, water and land. The pollutants targeted in three of the new air regulations are SO_2 and NO_x. There is a recent new 1-hour National Ambient Air Quality Standard (NAAQS) for SO_2 and NO_x that will require lower emission rates at several of the stations and the CAIR rule is proposed to be replace by a new Clean Air Transport Rule (CATR). Each will require additional reductions in SO_2 and NO_x. In 2011, the USEPA is expected to propose and finalize an Electric Utility Maximum Achievable Control Technology Rule (MACT). The MACT rule will require significant reductions in hazardous air pollutants such as mercury and acid gases (i.e., SO_3/H_2SO_4 emissions) which are also emitted from the LG&E and KU coal-fired electric generation fleet.

In May of 2010, Project Engineering was asked to investigate the technological and financial impacts of new environmental air regulations on the KU and LG&E coal-fired units. B&V was hired through a competitive bid process at a contract valued at $149K and given six weeks to provide a high level estimate based on site visits, data collection from the plants and industry experience. As a result of this Phase I effort, approximately $4 billion (escalated) of Air

Emissions Mitigation System additions and retrofits were identified as possible scenarios for bringing the fleet into compliance with the projected standards.

Through the approval of this investment/contract proposal, B&V will be contracted with to continue with Phase II of the engineering and estimating effort. This effort will provide a facility-specific project definition consisting of conceptual designs and budgetary cost estimates for selected air quality control technologies. This effort will result in a Level 1 Engineering assessment for Mill Creek, Ghent and EW Brown. The work for each facility will be staggered with the Mill Creek effort commencing first.

Award of the Phase II work to B&V will provide continuity to the initial study work. The contract will be on a time and material basis, not-to-exceed sole source contract, with a value of $1.6M. Black and Veatch will keep their original team in place to gain efficiencies for the Phase II work. The scope of their work will include activities/deliverables such as the following:

- Kick-Off Meetings at each facility
- Conceptual Design
- Building and Plant Arrangements
- Technology Screening
- Constructability Plans
- Project Cost Estimates including Cash Flows
- Refined Implementation Schedules

The remainder of the investment funding will cover costs of internal labor and expenses and the use of other external engineering /construction firms to review existing air pollution control technology performance enhancement options. Two examples of this would be hiring Riley Power (the original SCR technology firm) to review/model NOx emission reduction improvements on the existing Mill Creek 4 SCR that they originally design in 2002 and their review of improvements to the Mill Creek FGDs similar to the improvements they designed for TC1's FGD improvements as part of the TC2 Project.

Project timeline:

Level I Engineering	**Begin**	**Complete**
Mill Creek	August 2010	March 2011
Ghent	October 2010	April 2011
Brown	January 2011	May 2011

Economic Analysis and Risks

No economic or risk analyses have been performed as this request seeks only sanction to continue refining and developing the scopes, schedules and cost estimates for projects throughout the coal-fired fleet within LG&E and KU to comply with pending air regulations. Each project identified in this continuance of studies will seek sanction independent of this sanction and thus will have economic and risk analyses performed specifically for each project or coal-fired unit.

Assumptions

Assumptions that will be used as a basis for the continuance of analyses performed within this sanction are the Energy Services 2011 MTP Assumptions.

Financial Summary ($000s)

None performed. This sanction will be capitalized and spread pro-rata across the air compliance projects that are sanctioned in the future.

Cash Flow Comparison ($000s)

Project Expenditures ($000s)	2010	2011	Total
2010 MTP/LTP	$0.0	$0.0	$0.0
Current Proposal	$.75	$1.25	$2.0

Sensitivities

None performed.

Risks

The 2011 draft MTP includes some $4 billion in air compliance projects identified with scope identification, schedules and cost estimates based on minimum (much less than Level I Engineering) engineering analyses. Disapproving this sanction will result in the continuance of generation planning for compliance with pending or proposed air regulations with scopes, schedules and estimates that have a significant margin of error.

Other Alternatives Considered

None

Conclusions and Recommendation

It is the recommendation of Project Engineering and Power Production to approve the continuance of studying and analyzing the scopes and options necessary to comply with pending or proposed air compliance regulations for the KU and LG&E coal-fired generating units. The continuance of these studies will lead to better definition of scopes, implementation schedules and cost estimates of major capital projects to comply with the air regulations that will be incorporated into the 2011 and 2012 MTP plans. Approval is also requested to award B&V a sole source award on a time-and-material basis for Phase II of the Air Compliance portion of the 2011 MTP.

Eileen Saunders
Manager Major Capital Projects

Scott Straight
Director Project Engineering

John Voyles
VP Transmission & Gen. Services

Ralph Bowling
VP Power Production

Paul Thompson
SVP Energy Services

Brad Rives
Chief Financial Officer

From: Heun, Jeff
To: Straight, Scott; Voyles, John; Bowling, Ralph; Fraley, Jeffrey; Hudson, Rusty; Bellar, Lonnie; Conroy, Robert
CC: Heun, Jeff; Williams, John; Gregory, Ronald
Sent: 9/8/2010 1:53:31 PM
Subject: BR Landfill - Final Justification Paper and PowerPoint
Attachments: BR Landfill Justification (08-Sep-10).docx; BR Landfill Justification (08-Sep-10).pptx

All,

Attached is the updated BR Landfill Justification Paper and PowerPoint based on feedback received from various departments. If you have any questions or concerns contact me at your convenience.

Thanks,
Jeffrey B. Heun, P.E.
E.ON U.S.
Project Engineering
Sr Civil Engineer
(502) 627-4525 (Louisville Office)
(859) 367-1254 (Brown Office)
(502) 592-2421 (Mobile)
(502) 217-2678 (FAX)
jeff.heun@eon-us.com

PROJECT ENGINEERING

E.W. Brown CCR Storage Evaluation
Continue Main Pond Project vs. Conversion to Landfill

September 08, 2010

Executive Summary

On June 21, 2010 the EPA issued a proposed Coal Combustion Residual (CCR) ruling that establishes federal guidelines for CCR storage. In light of the EPA's proposed CCR ruling, Project Engineering (PE) reviewed the CCR storage project (i.e., Main Ash Pond Project) at E.W. Brown (BR) that is under construction to evaluate what effects the EPA's proposed CCR rules potentially imposed on long-term wet storage of CCR at BR.

Significant work has been completed on the BR CCR Project, including detailed engineering and permitting for all phases of the project, as well as the physical work of relocating the transmission lines that cross the ash pond, ash handling upgrades and construction of the Auxiliary (Aux) Pond to elevation 880'. In addition to the completed tasks, construction of the Main Pond Starter Dike (elevation 902') is in progress but has been suspended by PE pending direction on the path forward for long-term CCR storage at BR.

As of June 2010, Phase I spend is $53.3M of the approved $73.1M sanction. Construction of Aux Pond elevation 900' (Phase II of II) is currently in progress and will proceed per the original plan or on an accelerated scheduled to support CCR storage requirements based on the path forward.

Project Engineering and the BR Station recommend the implementation of Case A to convert the Main Pond into a Landfill to meet the EPA's proposed CCP Ruling. This option has the lowest NPV and NPVRR of the Cases reviewed while maximizing the landfill footprint. Maximizing the landfill footprint also maximizes future vertical expansion opportunities and eliminates future cost and issues associated with Station operations while dewatering and closing the pond post-EPA CCR Ruling. It is important to note that both options proposed by the EPA for CCR storage are for long-term dry storage (i.e., landfill). Therefore, not converting the Main Pond Project to a dry landfill project now will not eliminate the requirement to convert all CCR storage to a dry landfill should either of the EPA proposed regulations become final.

Project Background

In 2005, PE was tasked with evaluating storage options to meet the future CCR storage requirements at BR to 2030. The evaluation process consisted of an Initial Siting study, Conceptual Design phase, and Detailed Design of the Main Pond and Aux Pond. The Initial Siting study evaluated potential storage options for BR Station and recommended an on-site storage facility as the least cost option.

The Conceptual Design was built upon the Initial Siting Study and focused on potential storage options available on-site. Options evaluated included ponds, landfills, and a combination of ponds and landfills; with the final evaluation considering three ponds and two landfill options. Pond Option #1 was a vertical upstream expansion of the existing Main Ash Pond, Pond Option #2 was a vertical upstream expansion of the existing Main Ash Pond and a new Gypsum Stack, and Pond Option #3 was a vertical upstream expansion of the existing Ash Pond and a new Bottom Ash Pond. The two landfill options were based on a common footprint; however Landfill Option #1 was based on conventional dry CCR handling and mechanical placement while Landfill Option #2 was based on wet CCR handling and dense slurry placement. Based on Net Present Value (NPV) evaluations of the (5) five options in 2005, the least-cost alternative was Pond Option #3 consisting of a new Aux Pond for bottom ash storage and the vertical upstream expansion of the existing Ash Pond for flyash and non-marketed gypsum storage. Option #3 capital costs (Phase I and II of five Phases) of $98M were approved for Environment Cost Recovery by the Kentucky Public Service Commission (KYPSC) in 2005 and again in 2009.

Upon completion of the Conceptual Design, Detailed Design of the new Aux Pond and vertical upstream expansion of the Main Pond was initiated. Detailed Design included engineering for the ponds, transmission line relocations, station mechanical upgrades, development & submittal of the Dam Safety and 404/401 permits, and several environmental studies to support the permitting process. Detailed Design for the Aux Pond was completed in 2006 followed by the Main Pond in 2007. The original design basis in 2006 was to provide 20-years (until year 2030) of CCR storage based on the following production rates:

CCR	Annual Production (yd^3)	20-Year Production (yd^3)
Gypsum	500,000	10,000,000
Fly Ash	221,000	4,420,000
Bottom Ash	55,000	1,100,000
Totals	**776,000**	**15,520,000**

Current Project Status

Phase I of Pond Option #3 CCR expansion began in 2006 with Detailed Design. The design consists of an expanded Main Ash Pond embankment, construction of an Aux Ash Pond, transmission line relocations, and ash handling upgrades. The Aux Pond is currently in operation at its initial height of elevation 880'. It provides an alternate location to treat bottom ash and fly ash in the area south of the existing Main Pond while the Main Pond Starter Dike (Starter Dike) is under construction. If the Pond Option #3 design progresses to final completion, the Main Pond will have been constructed to elevation 962' and the Aux Pond to elevation 900'.

Aux Pond

The construction sequence of the Aux Pond was designed with a two phase approach, separated by the construction duration of the Main Pond Starter Dike. Construction of the first phase, designated at Aux Pond elevation 880', commenced in October of 2006 and was placed into operation in June 2008. The second phase of construction, designated Aux Pond elevation 900', will expand the pond to the final design elevation. The second phase commenced in June 2010 and is currently planned to reach completion in mid-2013.

During the construction of Aux Pond elevation 880', the FGD facility was under construction and gypsum was not in production; therefore, the first phase of the Aux Pond was constructed of clay and rock sourced from on-site borrow. The 47-acre site was stripped and grubbed, karst features were investigated and treated, and a riser outfall structure was constructed to provide outlet control, and the facility's liner system was installed incorporating 60-mil reinforced polypropylene flexible membrane liner (FML). The FGD facility was placed into operation in June 2010, thereby adding gypsum to the by-product stream. The Aux Pond elevation 900' phase incorporates gypsum as the primary constructible fill material.

Main Pond

In June 2008, the Aux Pond was placed into operation at elevation 880'. Shortly thereafter, the Main Ash Pond was taken out of service. To date, excavation and pumping operations of the Main Pond have been performed to drain the low-lying areas allowing the existing ash surface to be stabilized and re-graded. A bi-axial geo-grid reinforced working platform and a starter dike were constructed utilizing shot rock that comprises the foundation for future phased elevation expansions. Also completed is the new riser structure, a storm water runoff system, clay borrow and bottom ash stockpiling, and liner system procurement.

In light of impending EPA regulations that were published in June of 2010, PE suspended most of the work on the Starter Dike contract in an effort to minimize construction of embankments that may not be required should the recommendation to convert the pond project to a landfill is approved. Only shared construction activities between the Starter Dike design and the projected design of a future landfill within the same footprint continue. In suspending the Starter Dike project, the liner system and embankment material can be utilized in the design of the landfill and also utilized to accelerate the construction of the Aux Pond elevation 900' Phase II, thus minimizing approximately $6.5 million of spend on construction that would be stranded.

Transmission Relocation

Early site construction included the relocation of approximately 13,000 linear feet of overhead electric transmission lines and associated poles and towers to accommodate the expansion of the Main Ash Pond and the construction of the Auxiliary Ash Pond. This phase of the construction effort was initiated in mid-2006 and was completed in 2007.

Ash Handling Upgrades

Multiple plant upgrades to the wet ash handling system resulted from the Main Pond expansion and Aux Pond construction. New higher capacity fly ash and bottom ash sluice pumps, servicing all three units, were required to overcome the added height of the Main Ash Pond embankment and the distance to the Aux Pond.

Phase I Financials

The following table depicts the Phase I expenditures to date verses the Phase I sanction amount.

Cost Through June '10 ($000)	
Engineering	$4,728
Transmission Line Relocation	$18,017
Ash Handling Upgrades	$5,947
Aux Pond 900'	$8,442
Main Pond Starter Dike	$13,202
E.ON U.S./Other	$2,947
Sub-Total	**$53,283**
ECR/Sanction Approved	$73,100
Remaining Budget	**$19,817**

EPA's Proposed CCR Ruling

As a result of the December 2008 ash pond failure at TVA's Kingston's Generating Station, the EPA issued a proposed CCR ruling on June 21, 2010 that would establish federal guidelines for CCR storage. The proposal had three options to govern the storage of CCR, Subtitle "C" – Hazardous, Subtitle "D" – Non-Hazardous, and Subtitle "D" Prime – Non-Hazardous.

Subtitle "C" – Hazardous

The Aux Pond and Main Pond at BR would not comply with the proposed ruling due to strict siting requirements and not having a composite liner. As a result the ponds would have to be closed per one of the two options below:

1. Prior to the ruling becoming effective, BR could cease operation of the ponds and close them under current KY Division of Waste Management regulations. Existing ponds would not be grandfathered in.
2. Once the ruling becomes effective, the ponds would have to stop receiving CCR within 5-years and close within 2-years thereafter. New Subtitle "C" permits would be required in addition to run-on & run-off controls, groundwater monitoring, corrective action plans, closure/post-closure care plan, and financial assurance per the ruling.

Subtitle "D" – Non-Hazardous

The Aux Pond could potentially comply with Subtitle "D" requirements but is highly unlikely as the liner consists of 18" of clay overtopped by an FML while the regulations calls for 24" of clay overtopped by an FML. Without changing our current design plans, the Main Pond at BR would not comply with the proposed ruling due to not having a composite liner and meeting strict siting requirements. As a result, the ponds would have to be closed per one of the two options below:

1. Prior to the ruling becoming effective, BR could cease operation of the ponds and close them under current KY Division of Waste Management regulations. Existing ponds would not be grandfathered in.
2. Once the ruling becomes effective, the ponds would have to stop receiving CCR within 5-years and close within 2-years thereafter. New Subtitle "D" permits would be required in addition to run-on & run-off controls, groundwater monitoring, corrective action plans, and closure/post-closure care plan per the ruling.

Subtitle "D" Prime – Non-Hazardous

Under Subtitle "D" Prime the current elevation of the Aux Pond and Main Pond at the effective date of the ruling would be grandfathered in and allowed to operate for their remaining useful life. However, any future vertical or horizontal expansion would fall under the new regulations and require a new permit, strict siting requirements, composite liner, run-on & run-off controls, groundwater monitoring, corrective action plan, and closure/post-closure care plan per the ruling. These requirements would preclude moving forward because the Main Pond (1) will not provide the required storage volume for CCR due to not being constructed to its final design elevation prior to the rules becoming effective because of both lack of gypsum or rock to construct the berm and insufficient time; and (2) the Main Pond, once placed into operation and filled with water, cannot be retrofitted with the required composite liner to comply with the strict siting requirements.

Under Subtitle "C" the EPA would effectively force the closure of all existing impoundments and eliminate impoundments for future CCR storage as a result of siting restriction, tighter water treatment standards, and cost to implement all technical requirements as set forth. Under Subtitle "D" existing impoundments that do not meet the proposed requirements would be forced to close. However, under Subtitle "D" new impoundments that are designed and constructed with a composite liner, groundwater monitoring, and in compliance with all performance standards would be allowed.

The EPA's proposed ruling will be considered in determining the path forward for the BR CCR project and its effects on the project will be discussed in later sections.

Design Basis Moving Forward

As a result of the EPA's proposed CCR Ruling, PE has reevaluated long-term CCR storage at BR as the current Main Pond design will no longer meet the 2030 storage requirement. The analyses are based on an assumption that the proposed ruling becomes effective on January 2012. The January 2012 effective date was based on the proposed ruling being approved in 2010, and accounted for one year of litigation before the ruling became effective. The 3 options available are summarized below:

- **Base Case** – Continue with construction of the Aux Pond to elevation 900' and the Main Pond to 962' per the original design.
- **Case A** – Stop construction of the Main Pond Starter Dike immediately and convert the Main Pond into a landfill prior to the effective date of the CCR Ruling and prior to placing wet CCR in the Main Pond. Complete construction of the Aux Pond 900' project utilizing rock in lieu of gypsum to accelerate construction completion prior to the rules becoming effective. The Aux Pond will eventually be closed per the new regulations once the landfill is placed into service.
- **Case B** – Continue construction of the Main Pond Starter Dike and Aux Pond 900' per the original design. Once the CCR Ruling becomes effective, take the Main Pond out of service, close and cap it per the new regulations, and then construct a landfill similar to Case A on top of the newly constructed Main Pond Starter Dike. As with Case A, once the landfill is placed into service the Aux Pond will be closed per the regulations.
- **Case C** – Modify the design of the Main Pond and install a composite liner per Subtitle "D" requirements. Complete the Aux Pond 900' project as originally designed.

Each case was evaluated based on the most recent forecast of CCR production rates as provided by Generation Planning. In the third quarter of 2009, Generation Planning issued updated CCR production rates based on the projected 2010 MTP generation plan. The CCR production rates for BR modeled in 2009 were significantly lower than the original production rates utilized in 2005. This is attributed to a significant reduction in the station's capacity factor from 77 percent to 54 percent due to shifting generation to other stations. Comparison of the average annual CCR production rates are provided below:

CCP	Average Annual Production Rates (yd^3)			
	2005 Design Basis	**2010 MTP**	**Δ**	**% Reduction**
Bottom Ash	55,000	35,879	(19,121)	35%
Fly Ash	221,000	143,516	(77,484)	35%
Gypsum	500,000	290,000	(210,000)	42%
Totals	**776,000**	**469,395**	**(306,605)**	**47%**

The required CCR storage capacity till 2030 using the 2010 MTP production rates is now 7M yd^3 based on an in-service date of January 2014. If utilizing the original 2005 design volume of

15.5M yd^3 the storage, the facility would have a design life of approximately 38-years (2048), well beyond BR's needs.

Moving forward, the CCR storage facility at BR for both viable Cases A and B will provide a minimum storage capacity of 7M yd^3 and will allow for future expansion if necessary. As described below, the Base Case of continuing to construct the Main Pond and utilize it until 2030 will not be allowed under either scenario in the proposed regulations. In other words, the CCR landfill for both Cases will be designed and permitted with the maximum footprint available and the height of the facility will be adjusted to meet potential changing capacity requirements.

Base Case

The Base Case is the plan currently being implemented and is in-line with the approved ECR & 2006-2010 MTP/LTP plans. Phase I included the design & permitting of the Aux Pond and Main Pond, relocation of the transmission lines, wet ash handling upgrades, Aux Pond 880' construction, and Main Pond Starter Dike construction. All items except the Main Pond Starter Dike construction (in suspension) have been completed. Phase II includes Aux Pond 900' (its final elevation) and Main Pond 912' construction utilizing gypsum. Under the EPA's proposed CCR Ruling, neither pond will meet either of the proposed requirements and will be required to close per the timeframe outlined in the ruling. As a result, moving forward with the Base Case based on the current plan and liner design will not provide BR the required storage through 2030, even at the lower 2009 model production rates.

Base Case Design Issues

The EPA has proposed three options to manage CCR. If the EPA moves forward with Subtitle "C", this option will effectively eliminate all wet CCR storage and would require all existing ponds to retroactively meet the design criteria or cease operation and close per the requirements set forth under Subtitle "C". The Main Pond at BR would not comply with the proposed ruling due to siting requirements, land disposal restrictions (waste treatment), and not having a composite liner & leachate collection system along with other minor issues. A composite liner and leachate collection system could be installed; however the siting requirements and land disposal restriction would remain an issue.

Under Subtitle "D", the EPA is more open to wet storage of CCR. However, several issues remain such as siting requirements (karst, seismic, proximity to wetland & adjacent property owners, etc), composite liner & leachate collection system, and requiring ponds to retroactively meet the design criteria or cease operation and close per the requirements set forth under Subtitle "D". Prior to the effective date of the EPA's ruling, the Main Pond could be constructed to its ultimate elevation of 928' using rock (if a source of sufficient rock quantity can be found) in-lieu of gypsum and include a composite liner with leachate collection. However, the Main Pond would still be subject to the siting requirements under Subtitle "D". By using rock in-lieu of gypsum, the design life of the pond will be reduced by 8 years as the gypsum eventually produced that would have been used to construct the dike would instead be stored in the pond. To complete construction prior to the effective date, embankment must be placed at 12,000 yd^3 per day when normal average construction is

3,000-5,000 yd^3 per day. In addition, close proximity land would have to be purchased to supply the quantity of clay required to construct the composite liner and to supply the rock necessary to construct the embankments. Compliant rock and clay currently sourced from the Houp Property is becoming limited. Based on production rates from the existing quarry, an additional 200 acres would be required to supply the 2.2M yd^3 of rock needed to complete the Aux Pond to an elevation of 900' and the Main Pond to an elevation of 928'. The purchase of 200 acres for additional borrow sources would add $2.0M (2010 dollars) to the project based on cost data gathered on the Ghent Landfill Project. Assuming the new quarry is located less than 5 miles from the plant and utilizing 40-ton articulated trucks, the additional hauling cost would be approximately $10.25M (2010 dollars) based on 2010 RS Means estimating manuals. These additional costs have not been included in the NPV or PVRR analysis.

Construction of the Main Pond could continue by modifying its design to comply with the proposed technical requirements at a significant cost increase and risk to the company. The technical requirements as proposed could change prior to the final ruling and the pond would no longer be in compliance. The EPA is trying to eliminate ponds and move towards dry landfills; therefore, constructing a new pond for long term CCR storage carries significant risk.

Under Subtitle "D" Prime the current elevation of the Main Pond, at the effective date of the ruling, would be grandfathered in and allowed to operate for the remainder of its useful life. However, any future vertical or horizontal expansion would fall under the new regulations and require a new permit, compliance with strict siting requirements, composite liner, run-on & run-off controls, groundwater monitoring, corrective action plan, and closure/post-closure care plan per the ruling. Prior to the effective date of the EPA's ruling the Main Pond could be constructed to its ultimate elevation of 928' as described above. However, there is significant risk as Subtitle "D" Prime is the least likely alternative to be approved as the EPA is trying to eliminate ponds and move towards dry landfills.

Based on the revised 2010 MTP CCR production rates requiring the reduced storage of 7M yd^3, the Main Pond's maximum elevation has been lowered from 962' to 928'. Moving forward, cost data provided for the Base Case will be based on a final elevation of 928'. The following table reflects the NPV, PVRR, and capital cost cash flows for the Base Case option as currently included in the 2011 MTP/LTP draft of July, 2010.

Base Case Capital Cost ($000) for 7M yd^3											
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**NPV**	**PVRR**	**Total Project**
$19,300	$6,700	$4,153	$6,365	$3,424	$8,951	$2,637	$2,699	$3,813	$103,720	$127,799	$121,687

Case A

Case A consists of immediately terminating construction of the Main Pond Starter Dike (excluding site close out activities such as dust control and reclamation), accelerating the construction of the Aux Pond utilizing rock already blasted that has been recently placed in the Main Pond Starter Dike (thus reducing stranded investments), continued ash grading, Main Pond cap/closure, Landfill engineering and permitting, converting all station ash handling systems from wet to dry, and constructing the initial phase of a Landfill. Based on recent projects, the anticipated duration to perform these activities is 3.5 years with an in-service date of January 2014.

Design and construction of the Landfill would begin prior to final approval of the EPA's proposed CCR Ruling; however the Landfill liner requirements for both Subtitle "D" Non-Hazardous and "C" Hazardous options are the same and will become the basis of design. By terminating construction of the Main Pond Starter Dike, material already purchased and/or stockpiled, such as FML, Filter Fabric, Clay, Rock, and Bottom Ash, will be utilized in the construction of the Landfill thereby minimizing the cost impacts from the approximately $6.5 million stranded cost for the materials purchased or quarried. Additionally, by utilizing rock already blasted and placed in the Main Pond Starter Dike, the footprint of the landfill will be optimized to approximately 100 acres thereby reducing the final height of the landfill and maximizing the future vertical expansion opportunities up to approximately 18M yd^3.

All Plant effluents and CCR will continue to be directed to the Aux Pond during the design, permitting, and construction of the landfill for approximately 3.5 years in order to keep BR in operation. Based on a recent bathymetric survey conducted by MACTEC, and utilizing the 2010 CCR Production Rates, the Aux Pond has enough remaining capacity to store all the CCR generated through January 2015. This is a conservative estimate and provides one year of project float. The following table reflects the NPV, PVRR, and capital cost cash flows for Case A as reflected in the notes to the 2011 MTP/LTP as Landfill Option #1.

Case A Capital Cost ($000)											
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**NPV**	**PVRR**	**Total Project**
$9,051	$14,262	$26,722	$24,064	$0	$0	$0	$0	$9,321	$126,322	$181,791	$154,939

Case B

Case B consists of completing the Main Pond Starter Dike and Aux Pond 900' projects as designed and permitted prior to final approval of the EPA's proposed CCR Ruling. Upon approval of the EPA's proposed CCR Ruling, the Main Pond would be taken out of service; the Main Pond would then be dewatered, followed by ash grading, Main Pond cap/closure, Landfill engineering, permitting, wet to dry ash handling conversion, and the initial phase of construction of the Landfill. Based on recent projects, the anticipated duration to perform these activities is 5.5 years with an in-service date of January 2016.

If the construction of the Main Pond Starter Dike were to continue to completion and the EPA's proposed ruling was approved, material already purchased and/or stockpiled such as FML, Filter Fabric, Clay, Rock, and Bottom Ash *cannot* be salvaged or otherwise made available for the construction of the Landfill resulting in the need to purchase additional land for approximately $2M to develop new borrow sources and liner material at future market values. Design and construction of a landfill would begin after final approval of the EPA's proposed CCR Ruling which would be the basis of design. By continuing with the construction of the Main Pond Starter Dike, the footprint of the landfill would be approximately 80 acres, some 20 acres less than Case A, thus reducing the potential for future vertical expansion, approximate maximum capacity 13.25M yd^3. Case B also would involve having to develop an operation plan for the Brown Station that would enable it to remain in operation while the recently constructed Main Pond was taken back out of service and dewatered to allow construction of the Landfill. **These operational costs are not included in the total project cost shown in the table below as they are difficult to estimate at the time of preparing this paper; however, they are expected to be significant**.

During the design and permitting of the landfill, both the Aux Pond and Main Pond will be used to store CCR material. During construction, a duration of approximately 2 years, all CCR generated will be stored in the existing Aux Pond. Based on a recent bathymetric survey conducted by MACTEC, and utilizing the 2010 CCR Production Rates, the Aux Pond has enough remaining capacity to store all the CCR generated for 2 years starting January 2014. The following table reflects the NPV, PVRR, and capital cost cash flows for Case A as reflected in the notes to the 2011 MTP/LTP as Landfill Option #2.

Case B Capital Cost ($000)											
2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**NPV**	**PVRR**	**Total Project**
$19,350	$2,907	$3,605	$10,786	$31,135	$31,387	$0	$0	$0	$143,980	$204,633	$193,567

NOTE: Case B values do not include the estimated $2.0M for land purchase for additional clay borrow source.

Case C

Case C consisted of completing the Aux Pond 900' project as designed and modifies the Main Pond Starter Dike to include a composite liner system. With the addition of 24" of clay the Main Pond could comply with Subtitle "D"; however, the Main Pond would not comply with Subtitle "C" and does not comply with the EPA intent to eliminate ponds for storage. Case C was eliminated because (1) it is not possible to source clay and rock from the existing station property in the quantities required; (2) it is not economically feasible to source clay from the surrounding area and the time required to locate and acquire a farm with sufficient quantities within the timeframe required is deemed marginal at best; and (3) to design and construct the composite liner will only allow compliance with subtitle "D" and not "C". Based on this no further consideration was given to Case C.

Schedule Impacts

If the decision is made to convert the Main Pond into a Landfill there are several items that will impact the schedule. They include engineering/design, permitting, a new or updated ECR/CPCN filing, and initial landfill construction. Based on experience from previous projects the engineering/design will take approximately 3-4-months and will include development of the landfill drawings, specifications, stability analysis, groundwater monitoring plan, and permit application.

Permitting will take approximately 18-months and should only include the KY Division of Waste Management permit as the remaining permits were obtained during the original Main

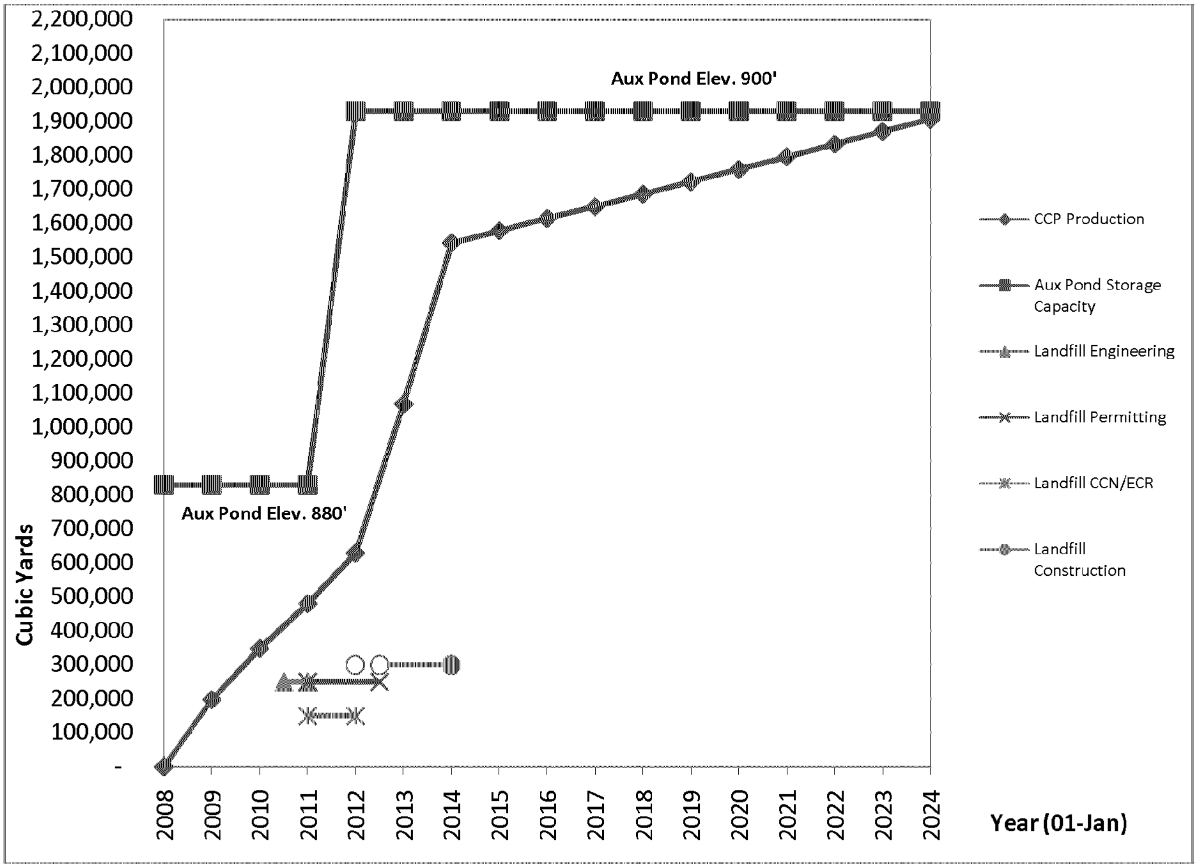
Pond project permitting. The updated or new ECR/CPCN filing will take approximately 6-months and would be submitted in parallel with the engineering/design and permitting process.

The initial landfill construction timeline will be dependent on the chosen option, but will take between 18-24 months to complete. Based on the above, PE performed an analysis to ensure the Aux Pond had enough storage capacity remaining to support the conversion of the Main Pond into a Landfill. Results of the storage analysis are provided below and indicate that the Aux Pond has enough capacity to support either Case A or Case B.

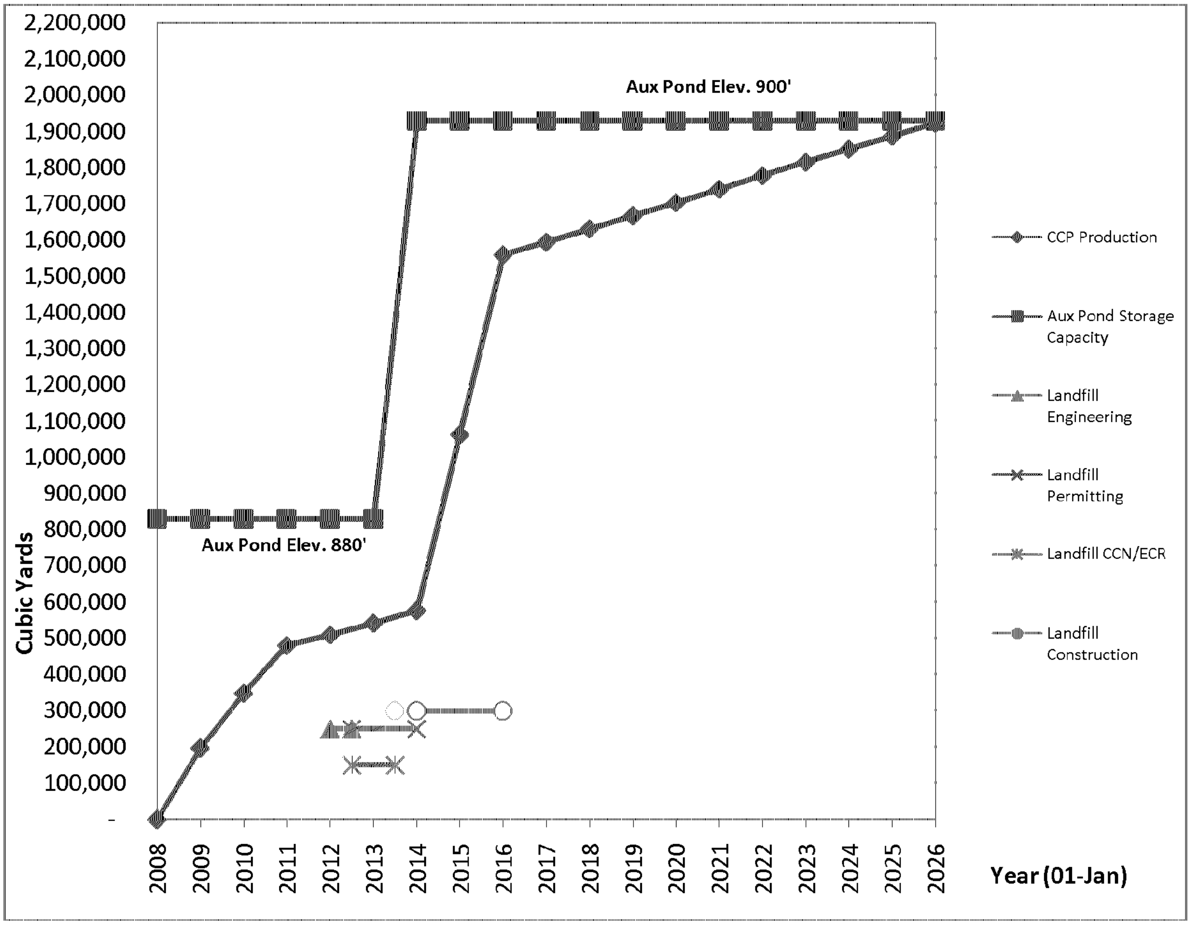
A summary of the schedule is shown below.

Project Timeline		
Task	**Date**	**Duration**
Informal Meeting w/the PSC	October 2010	1 Day
Engineering	September 2010	3-4 Months
File Permits	December 2010	18 Months
CPCN/ECR Filing	December 2010	6 Months
Construction	May 2012	18 Months

Aux Pond Stage Storage Graph (Case A) – Stop Main Pond Starter Dike & Accelerate Aux Pond 900' Construction



Aux Pond Stage Storage Graph (Case B) – Complete Main Pond Starter Dike & Aux Pond 900’ per Original Schedule



Financials

Considering the factors referenced above, PE with the assistance of MACTEC, developed capital cost estimates for Case A and B which were based on a horizontal expansion of the landfill. Additional engineering is required to determine if a horizontal or vertical expansion approach is the best alternative. Timing of cash flows would be affected if a vertical expansion approach is chosen. The ECR approved cost estimate is the basis for the 2011 MTP/LTP and is provided for reference only. The Base Case is a modification of the ECR approved option which provides 7M yd^3 of storage and is no longer a viable long term solution for CCR storage as the current design of the Main Pond will not comply with the EPA’s proposed CCR Ruling. *Case A or B are the only long term storage solutions.*

Cost Estimate Comparison

Option	Life	Capacity	2010	2011	2012	2013	2014	2015	NPV	PVRR	Total Project
ECR Approved	2054	15.5M yd^3	$25,233	$10,220	$8,777	$4,865	$5,463	$6,945	$143,394	$158,684	$200,132
Base Case	2030	7M yd^3	$19,300	$6,700	$4,153	$6,365	$3,424	$8,951	$103,720	$127,799	$121,687
Case A	2030	7M yd^3	$9,051	$14,262	$26,722	$24,064	$0	$0	$126,322	$181,791	$154,939
Case B	2030	7M yd^3	$19,350	$2,907	$3,605	$10,786	$31,135	$31,387	$143,980	$204,633	$193,567

NOTE: Case B values do not include the estimated $2.0M for land purchase for additional clay borrow source.

Recommendation

Project Engineering and the Brown Station recommend the immediate implementation of Case A to convert the Main Pond into a Landfill to meet the EPA's proposed CCP Ruling. This option has the lowest NPV & PVRR, is the least cost, maximizes the landfill footprint, maximizes future vertical expansion opportunities to accommodate changes in production, and eliminates the difficult and costly issues associated with maintaining station operations while dewatering and closing the pond post EPA CCR Ruling while the landfill is being constructed.

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EW Brown CCR Storage Evaluation

Continue Main Pond Project vs. Landfill Conversion

September 8, 2010

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Current Plan (Base Case – Modified ECR Approved Scope)

Scope

Detailed engineering and permitting for all phases, completed 2006

Relocation of transmission lines, completed 2007

Ash handling upgrades, completed

Construction of Aux Pond to elevation 880' (Phase I), completed June 2008

Schedule

Aux Pond elevation 900' construction (Phase II of II), in progress

- Will continue via original plan (completion mid-2013) or accelerated schedule to support CCR storage requirements to support landfill development.

Construction of Main Pond Starter Dike, elevation 902', 75-80% complete

- Currently suspended pending direction of path forward (Landfill or Pond)

- Accelerate construction of the Aux and Main Ponds based on working one shift, 7 days a week, at 4,000 yd^3 per day using rock and gypsum. Very aggressive schedule
  - Aux Pond constructed to final elevation of 900'
  - Main Pond constructed to an elevation of approximately 912'

Financials

Phase I:	$53.3M of approved $73.1M spent through June 2010
Phase II:	$24.9M approved

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Proposed CCR Rulings: Impact to Current Plan

Subtitle “C” (Hazardous)

Aux Pond and Main Pond – as currently designed, they are not compliant due to lack of composite liner and may not meet siting requirements relative to Karst terrain.

Result: Will required the closing of both ponds or retrofit with new liner design as grandfathering is not an option.

Subtitle “D” (Non-Hazardous)

Aux Pond – compliance unlikely due to current 18” clay liner vs. required 24”.
Main Pond – as currently designed, not compliant due to lack of composite liner and may not meet siting requirements relative to Karst terrain.

Result: Will require the closing of both ponds or retrofit with new liner system.

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Proposed CCR Rulings: Impact to Current Plan

Subtitle “D” Prime (Non-Hazardous)

The Aux and Main Pond elevations at effective date of ruling will be grandfathered in; thus allowing the ponds to be operated for their remaining life.

Any future vertical/horizontal expansion subject to new regulations which will require re-permitting, siting assessment, composite liner, run-on/off controls, groundwater monitoring, corrective action plans, and closure/post-closure care plans.

Result: Effective date likely to result in lack of fully constructed Main Pond, thus new regulations will require closing Main Pond down and constructing new designed pond or landfill.

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Base Case – 20 Year Storage Capacity

- Based on the current ECR approved plan adjusted to provide storage until 2030

- Phase I – ECR approved 2005
  - Design & permitting of the Aux and Main Ponds - Completed
  - Transmission Line Relocation - Completed
  - Ash handling upgrades - Completed
  - Aux Pond 880' construction - Completed
  - Main Pond starter dike (902') construction – Construction has been suspended

- Phase II – ECR approved 2009
  - Aux Pond 900' construction – Under Construction
  - Main Pond 912' construction

- Phase III – future ECR filing
  - Original ECR scope reduced to match current CCR production rates
  - Main Pond 928' construction versus original 962'

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Landfill – Case A (Convert Now Prior to Placing Main Pond In-service)

Main Pond Starter Dike

Stop construction immediately.

EPA's proposed ruling used as the basis of design.

Convert Main Pond to a Landfill prior to effective date of CCR Ruling and prior to placing wet CCR in Main Pond.

- Landfill liner requirements same among Subtitle "D" and "C"
- Utilize material already purchased and/or stockpiled for the intended Main Pond Starter Dike
- Minimize costs from stranded materials purchased or quarried (~$6.5M)
- Landfill footprint approximately 100 acres within Main Pond footprint, this reduces final height of landfill while maximizing future vertical expansion opportunities up to 18M yd^3.

Aux Pond 900'

Accelerated completion of project utilizing rock and gypsum.

After Landfill is placed into operation, close per regulations and modify with new design for management of process water.

Anticipated duration of activities

3.5 years, in service date of January 2014

Landfill – Case B (Convert Pond to Landfill Post Regulations)

Main Pond Starter Dike

Continue construction per original design.

- Material used for pond liner will not be available for landfill construction.
- Will require new off-site quarry at an estimated cost of $2.0M (due to consuming existing quarry for Main and Aux Pond construction), as well significant purchase of new liner material.
- Landfill footprint approximately 80 acres, 20 acres smaller than Case A due to Main Pond utilization consuming space; thus reducing future storage to 13.25M yd^3 due to reduced vertical expansion.

Once anticipated ruling becomes effective:

Main Pond required to be taken out of service

New Landfill will be required

Operation plan needed to maintain Brown Station's operation while Main Pond is taken out of service, dewatered , and landfill constructed. This is anticipated to be a significant impact on the station, a detailed plan of how to accomplish this has not been developed, nor included in the financial comparison.

Aux Pond 900'

Continue construction per original design

After Landfill is placed into operation, close per regulations and modify with new design for management of process water.

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Schedule

Project Timeline

Task	Start Date	Duration
Informal Meeting with PSC	October 2010	1 Day
Engineering	September 2010	3-4 Months
File Permits	December 2010	18 Months
CPCN/ECR Filing	December 2010	6 Months
Construction	May 2012	18 Months

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Financial Comparison

Cost Estimate Comparison

Option	Life	Capacity	NPV	PVRR	Total Project
ECR Approved	2054*	15.5M yd^3	$135,467k	N/A	$272,831
Base Case	2030	7.0M yd^3	$100,966k	$127,799	$118,718
Case A	2030	7.0M yd^3	$126,322k	$181,791	$154,939
Case B	2030	7.0M yd^3	$143,980k	$204,633	$193,567k

NOTES:

1. If regulations become final for Hazardous or Non-Hazardous, Base Case will not be viable as the new regulations will require the closing of the newly constructed Ponds.
2. For ECR Approved Case, the original life was 2030 based on 2005 production models. The 2009 production models have shifted generation away from Brown, thus life extended to 2054 if Main Pond developed to original design height.
3. The interim operational and capital cost associated with Case B are not included in the number above. Given Case B is not least-cost in comparison to Case A, the estimate was not performed.
4. $2.0M to purchase additional land to establish clay borrow for Case B only is not included in the above financial analysis.

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Recommendation

Immediate implementation of Case A (convert to Landfill prior to Main Pond In-service)

- Lower NPV & PVRR than Case B
- Lower escalated capital cost than Case B
- Maximizes landfill footprint and future storage capacities than Case B
- Maximizes future vertical expansion opportunities than Case B
- Eliminates difficult and costly issues associated with maintaining station operations while dewatering and closing the Main Pond post-EPA CCR Ruling while landfill is being constructed.

This recommendation will require modifying the approved ECR project.
This recommendation will require Landfill permitting.
This recommendation will require PSC notification.

From:	Sturgeon, Allyson
To:	'Howard, Dennis (KYOAG)'; Spenard, David (KYOAG); 'Cook, Larry (KYOAG)'
CC:	Bellar, Lonnie; Voyles, John; Conroy, Robert
Sent:	11/5/2010 3:16:08 PM
Subject:	RE: EPA Regulations
Attachments:	Description of Environmental Control Equipment.docx; LG&E - KU Generating Stations.pdf

Thanks Dennis. I'll get together with some folks around here and see what we can do. In response to your requests yesterday, I am attaching a portion of John Malloy's testimony from an ECR compliance plan case which I think will address your questions about the functionality of the environmental controls, along with a map of the state showing the location of our generating stations. Please let me know if I can provide additional assistance. Allyson

Allyson K. Sturgeon
Senior Corporate Attorney
LG&E and KU Energy LLC
220 West Main Street
Louisville, Kentucky 40202
Phone: (502) 627-2088
Cell: (502) 489-0989
Fax: (502) 217-4995
allyson.sturgeon@lge-ku.com

From: Howard, Dennis (KYOAG) [mailto:dennis.howard@ag.ky.gov]
Sent: Friday, November 05, 2010 12:04 PM
To: Sturgeon, Allyson
Cc: Bellar, Lonnie; Voyles, John
Subject: EPA Regulations

Allyson

Thank you and the rest of the LG&E/KU contingency very much for taking the time to speak with us yesterday. In addition to the items which we requested during the meeting, I would like to beg upon you for the following. Do you have a PowerPoint or other presentation which is more condensed and at a higher level? Specifically, while all the information is very informative, I would like to have something that shows the number of people (all classes) served by LG&E/KU as well as the anticipated impact on their utility bills (all classes).

Taken even further I would like the trickledown effect as best as we can surmise in general terms. On this point, how does it translate to water bills, sewer bills, etc.? The answer might be possible by using either KAWC, LWC or MSD with some assistance from them.

We know the impact is even greater from the above when we look at groceries, etc. but this may be most difficult to extrapolate.

Ultimately I anticipate approaching the rest of the big five electricity suppliers in Kentucky for their information as well. Of course, ideally, it would be nice to have one presentation from all of you, if possible.

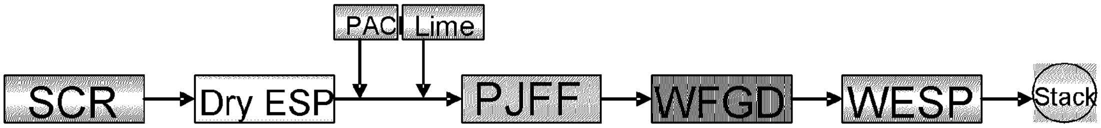
To summarize, you have my attention and now I would like to have some more of yours please. If I can make anything happen to lessen the impact on citizens' costs, I need some assistance.

Thanks in advance.

Dennis Howard, II
Acting Director
Office of Rate Intervention
Office of the Attorney General
1024 Capital Center Drive, Suite 200
Frankfort, Kentucky 40601
502.696.5453
dennis.howard@ag.ky.gov

Q. Please describe Project 18 in the LG&E 2006 Environmental Compliance Plan.

A. Project 18 is comprised of the Air Quality Control System ("AQCS") equipment necessary to operate Trimble County Unit 2 within the environmental limitations as set forth in the EPA Title V Operating Permit: V-02-043. Trimble County Unit 2 was granted a CCN on November 1, 2005 in Case 2004-00507[1]. The proposed AQCS equipment for the unit consists of a Selective Catalytic Reduction System ("SCR"), a Dry Electrostatic Precipitator ("DESP"), a pulverized activated carbon ("PAC") injection system for mercury control, a hydrated lime injection system, a Pulse Jet Fabric Filter ("PJFF"), a Limestone Forced Oxidation Wet Flue Gas Desulfurization System ("WFGD"), and a Wet Electrostatic Precipitator ("WESP"). The following provides a brief description of each component of the AQCS associated with Project 18:



Selective Catalytic Reduction System

The SCR is being installed to ensure compliance with NO_x limitations. Situated between the economizer outlet and the air pre-heater inlet, the SCR converts NO_x and ammonia to water and nitrogen. As part of the SCR project, low conversion catalyst and sorbent injection technology will be installed to mitigate the high SO_2 to SO_3 conversion problems associated with SCR operation

Dry Electrostatic Precipitator

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[1] In the Matter of: *Joint Application of Louisville Gas and Electric Company and Kentucky Utilities Company for a Certificate of Public Convenience and Necessity, and a Site Compatibility Certificate, for the Expansion of the Trimble County Generating Station*

The DESP is guaranteed to remove 90% of the particulate matter in the flue gas stream. The DESP uses electrical current to charge particles contained in the flue gas by passing them over discharge electrodes. The charged particles are then placed in an electrostatic field that drives them to collection plates (or curtains). After an increment of build-up, the collection surface plates are rapped to knock the particles into a hopper below for final byproduct disposal.

Pulverized Activated Carbon Injection

An activated carbon injection system will be installed to ensure Trimble Co. Unit 2 meets the mercury emission permit limitations across a full range of specified fuels. The PAC will be injected between the DESP and the PJFF. The PAC system is guaranteed to remove 90% of the total mercury and meet the permitted mercury emission limitation of 13×10^{-6} Lb/MWH.

Hydrated Lime Injection

Due to the range of fuels and operating parameters specified there are conditions in which condensation of sulfur trioxide (SO_3) may occur in the PJFF. To address the corrosion and operational issues related to sulfuric acid mist (H_2SO_4) in the PJFF and to comply with relevant regulatory obligations a hydrated lime injection system will be installed. The sorbent will be directly injected in the flue gas stream upstream of the baghouse to chemically react with SO_3 and H_2SO_4 to produce filterable compounds which are then efficiently collected in a baghouse.

Pulse Jet Fabric Filter

Trimble County Unit 2 will be supplied with one PJFF system to control particulate matter and mercury emissions. The PJFF is comprised of two fields each containing six compartments. Each compartment contains 1,140 bags for a total of 13,680 bags in the PJFF. Flue gas with boiler fly ash, PAC and hydrated lime enter an inlet plenum and is distributed to each of the individual compartments. Flue gas enters the compartments and is evenly distributed via a baffle to the filter bag socks. The particle laden flue gas flows through the sides of the filters (where the particles collect and form a filter cake on the outside of the bags) and clean flue gas exits the top of the filter. In order to clean the filters, a pulse of air is directed into the top of the filters, causing a pressure change and dislodging the cake from the filter so that it falls into the collection hopper for disposal. Each filter bag is supported on a wire cage; the bags and cages are independently suspended from the top of each compartment.

There are numerous filter bag material alternatives for a baghouse. However, due to the high sulfur content of the coal to be burned, a degradation resistant fabric filter material will be required for this particular application.

The PJFF is designed and guaranteed for a filterable particulate matter emission rate of 0.015 lbs/mmBtu. This is tested at the outlet of the PJFF.

Wet Flue Gas Desulphurization

A WFGD system will be installed to ensure permitted sulfur dioxide emission limitations are met. The WFGD is designed to remove 99% of the SO_2 in the flue gas without the added costs of reaction enhancing chemicals. The WFGD is also effective in removing particulate matter, fluorides and oxidized mercury.

The WFGD consists of one absorber tower with two dual flow trays designed to treat 100% of the flue gas generated from the boiler. The absorber contains six limestone slurry spray levels and is designed to achieve 99% SO_2 removal with five spray levels in service; the sixth spray level is a spare. The WFGD system is designed for 5.5 lbs SO_2/mmBtu loading and 99% SO_2 removal.

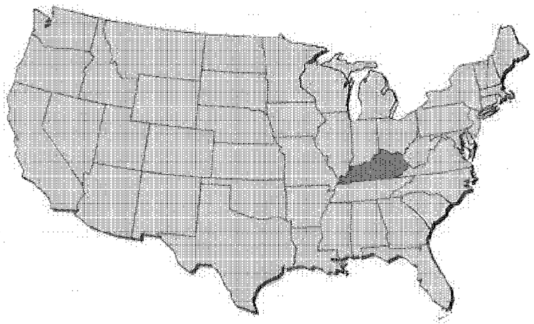
Wet Electrostatic Precipitator

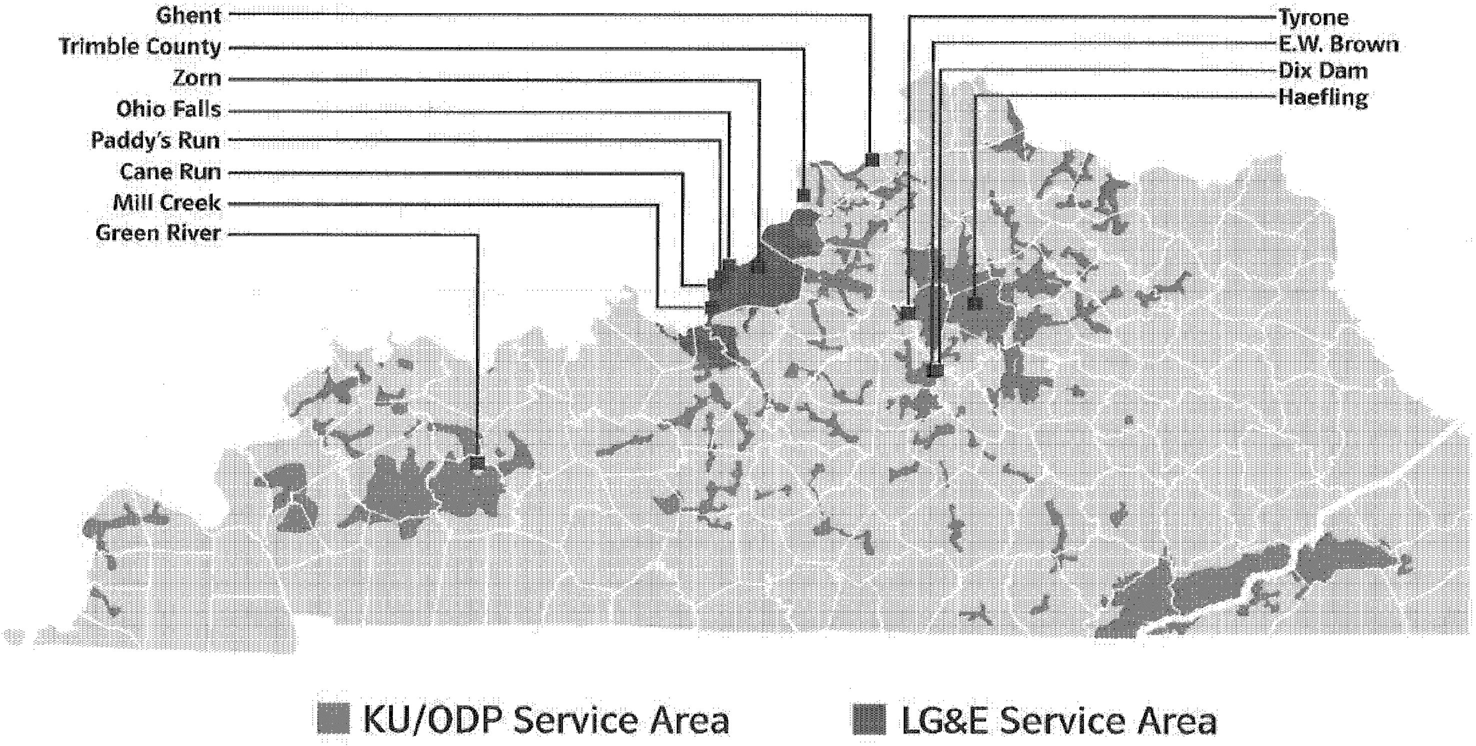
A WESP will be installed to ensure compliance with permitted particulate matter emission limitations. The WESP is designed to meet the permitted level of 0.0036 lbs/mmBtu of sulfuric acid at the stack. The WESP is also effective in removing many types of particulates, including acid mist, oil and tar based condensed aerosols, filterable particulates, and oxidized mercury.

A WESP charges particles in the flue gas by passing the particles over energized electrodes. The electrostatically charged particles then flow through an electrostatic field that drives them to oppositely charged collecting plates. The collection plates are continuously irrigated by an overhead washing system to eliminate concerns relating to contaminant build-up. The particle saturated water flows down the plates to the bottom of the WESP and to the reaction tank of the WFGD system.

The WESP is anticipated to have a removal impact on all particulate matter, both filterable and condensable. From the WESP, the flue gas flows to the stack and exits into the atmosphere. At the stack, the guaranteed total (filterable and condensable) particulate matter emission rate is 0.015 lbs/mmBtu.

Location of Generating Facilities





From:	Sturgeon, Allyson
To:	'Spenard, David (KYOAG)'; Howard, Dennis (KYOAG); Cook, Larry (KYOAG)
CC:	Bellar, Lonnie; Voyles, John; Conroy, Robert
Sent:	11/12/2010 11:32:36 AM
Subject:	RE: EPA Regulations
Attachments:	CCR Proposed Rule.pdf; EPA Emissions.pdf

Dennis, Larry and David –

Attached is a power point presentation that is at a little higher level with pictures to illustrate various points. This presentation provides some high level cost impact information, without getting into specific rate impact projections by class, because of the uncertainty of what the final regulations will look like. In addition, we don't have any specific data related to impact to water or sewer bills.

I am also attaching a link to the EPA cost estimates which relate to the Transport Rule as well as a copy of the EPA cost estimates for the CCR rule. I hope this information helps. Thanks, Allyson

http://www.gpo.gov/fdsys/pkg/FR-2010-08-02/pdf/2010-17007.pdf#page=1

Allyson K. Sturgeon
Senior Corporate Attorney
LG&E and KU Energy LLC
220 West Main Street
Louisville, Kentucky 40202
Phone: (502) 627-2088
Cell: (502) 489-0989
Fax: (502) 217-4995
allyson.sturgeon@lge-ku.com

From: Spenard, David (KYOAG) [mailto:david.spenard@ag.ky.gov]
Sent: Friday, November 05, 2010 4:25 PM
To: Sturgeon, Allyson; Howard, Dennis (KYOAG); Cook, Larry (KYOAG)
Cc: Bellar, Lonnie; Voyles, John; Conroy, Robert
Subject: RE: EPA Regulations

Allyson,

Good afternoon.

As part of its rule-making with regard to drinking water, the US EPA does estimate the costs of implementing its rules. For example, with regard to the Disinfectants and Disinfection Byproducts; Final Rule (16 December 1998) in which the EPA (in providing a summary of costs under Stage 1 DBPR) estimated "Total Capital Costs" for implementing the rule ("All systems") at $2,323,292,000. (Federal Register, Vol. 63, No. 241/Wednesday, 16 December 1998, 69437) With the note that there are some groups that are not necessarily comfortable with the EPA's estimates (The Arsenic Rule, for example, has been a bit of a lightning rod), has the EPA projected estimates for implementing the various rules that we covered yesterday? (And the obvious follow-up, if yes, what do the numbers look like?)

Cordially,

David

From: Sturgeon, Allyson [mailto:Allyson.Sturgeon@lge-ku.com]
Sent: Friday, November 05, 2010 3:16 PM
To: Howard, Dennis (KYOAG); Spenard, David (KYOAG); Cook, Larry (KYOAG)
Cc: Bellar, Lonnie; Voyles, John; Conroy, Robert
Subject: RE: EPA Regulations

Thanks Dennis. I'll get together with some folks around here and see what we can do. In response to your requests yesterday, I am attaching a portion of John Malloy's testimony from an ECR compliance plan case which I think will address your questions about the functionality of the environmental controls, along with a map of the state showing the location of our generating stations. Please let me know if I can provide additional assistance. Allyson

Allyson K. Sturgeon
Senior Corporate Attorney
LG&E and KU Energy LLC
220 West Main Street
Louisville, Kentucky 40202
Phone: (502) 627-2088
Cell: (502) 489-0989
Fax: (502) 217-4995
allyson.sturgeon@lge-ku.com

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From: Howard, Dennis (KYOAG) [mailto:dennis.howard@ag.ky.gov]
Sent: Friday, November 05, 2010 12:04 PM
To: Sturgeon, Allyson
Cc: Bellar, Lonnie; Voyles, John
Subject: EPA Regulations

Allyson

Thank you and the rest of the LG&E/KU contingency very much for taking the time to speak with us yesterday. In addition to the items which we requested during the meeting, I would like to beg upon you for the following. Do you have a PowerPoint or other presentation which is more condensed and at a higher level? Specifically, while all the information is very informative, I would like to have something that shows the number of people (all classes) served by LG&E/KU as well as the anticipated impact on their utility bills (all classes).

Taken even further I would like the trickledown effect as best as we can surmise in general terms. On this point, how does it translate to water bills, sewer bills, etc.? The answer might be possible by using either KAWC, LWC or MSD with some assistance from them.

We know the impact is even greater from the above when we look at groceries, etc. but this may be most difficult to extrapolate.

Ultimately I anticipate approaching the rest of the big five electricity suppliers in Kentucky for their information as well. Of course, ideally, it would be nice to have one presentation from all of you, if possible.

To summarize, you have my attention and now I would like to have some more of yours please. If I can make anything happen to lessen the impact on citizens' costs, I need some assistance.

Thanks in advance.

Dennis Howard, II
Acting Director
Office of Rate Intervention
Office of the Attorney General
1024 Capital Center Drive, Suite 200
Frankfort, Kentucky 40601
502.696.5453
dennis.howard@ag.ky.gov

NOTE: The extension for all E.ON U.S. e-mail addresses has changed from @eon-us.com to @lge-ku.com. Please update your address book accordingly.

NATIONAL ARCHIVES AND RECORDS ADMINISTRATION
1985

Federal Register

Monday,
June 21, 2010

Part II

Environmental Protection Agency

40 CFR Parts 257, 261, 264 et al.

Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities; Proposed Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 257, 261, 264, 265, 268, 271 and 302

[EPA–HQ–RCRA–2009–0640; FRL–9149–4]

RIN–2050–AE81

Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities

AGENCY: Environmental Protection Agency (EPA).

ACTION: Proposed rule.

SUMMARY: The Environmental Protection Agency (EPA or Agency) is proposing to regulate for the first time, coal combustion residuals (CCRs) under the Resource Conservation and Recovery Act (RCRA) to address the risks from the disposal of CCRs generated from the combustion of coal at electric utilities and independent power producers. However, the Agency is considering two options in this proposal and, thus, is proposing two alternative regulations. Under the first proposal, EPA would reverse its August 1993 and May 2000 Bevill Regulatory Determinations regarding coal combustion residuals (CCRs) and list these residuals as special wastes subject to regulation under subtitle C of RCRA, when they are destined for disposal in landfills or surface impoundments. Under the second proposal, EPA would leave the Bevill determination in place and regulate disposal of such materials under subtitle D of RCRA by issuing national minimum criteria. Under both alternatives EPA is proposing to establish dam safety requirements to address the structural integrity of surface impoundments to prevent catastrophic releases.

EPA is not proposing to change the May 2000 Regulatory Determination for beneficially used CCRs, which are currently exempt from the hazardous waste regulations under Section 3001(b)(3)(A) of RCRA. However, EPA is clarifying this determination and seeking comment on potential refinements for certain beneficial uses. EPA is also not proposing to address the placement of CCRs in mines, or non-minefill uses of CCRs at coal mine sites in this action.

DATES: Comments must be received on or before September 20, 2010. EPA will provide an opportunity for a public hearing on the rule upon request. Requests for a public meeting should be submitted to EPA's Office of Resource Conservation and Recovery by July 21, 2010. *See* the **FOR FURTHER INFORMATION CONTACT** section for contact information. Should EPA receive requests for public meetings within this timeframe, EPA will publish a document in the **Federal Register** providing the details of such meetings.

ADDRESSES: Submit your comments, identified by Docket ID No. EPA–HQ–RCRA–2009–0640, by one of the following methods:

- *http://www.regulations.gov:* Follow the on-line instructions for submitting comments.
- *E-mail:* Comments may be sent by electronic mail (e-mail) to *rcra-docket@epa.gov,* Attention Docket ID No. EPA–HQ–RCRA–2009–0640. In contrast to EPA's electronic public docket, EPA's e-mail system is not an "anonymous access" system. If you send an e-mail comment directly to the Docket without going through EPA's electronic public docket, EPA's e-mail system automatically captures your e-mail address. E-mail addresses that are automatically captured by EPA's e-mail system are included as part of the comment that is placed in the official public docket, and made available in EPA's electronic public docket.
- *Fax:* Comments may be faxed to 202–566–0272; Attention Docket ID No. EPA–HQ–RCRA–2009–0640.
- *Mail:* Send your comments to the Hazardous Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities Docket, Attention Docket ID No., EPA–HQ–RCRA–2009–0640, Environmental Protection Agency, *Mailcode:* 5305T, 1200 Pennsylvania Ave., NW., Washington, DC 20460. Please include a total of two copies.
- *Hand Delivery:* Deliver two copies of your comments to the Hazardous Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities Docket, Attention Docket ID No., EPA–HQ–RCRA–2009–0640, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC 20460. Such deliveries are only accepted during the Docket's normal hours of operation, and special arrangements should be made for deliveries of boxed information.

Instructions: Direct your comments to Docket ID No. EPA–HQ–RCRA–2009–0640. EPA's policy is that all comments received will be included in the public docket without change and may be made available online at *http://www.regulations.gov,* including any personal information provided, unless the comment includes information claimed to be Confidential Business Information (CBI) or other information whose disclosure is restricted by statute. Do not submit information that you consider to be CBI or otherwise protected through *http://www.regulations.gov* or e-mail. The *http://www.regulations.gov* Web site is an "anonymous access" system, which means EPA will not know your identity or contact information unless you provide it in the body of your comment. If you send an e-mail comment directly to EPA without going through *http://www.regulations.gov,* your e-mail address will be automatically captured and included as part of the comment that is placed in the public docket and made available on the Internet. If you submit an electronic comment, EPA recommends that you include your name and other contact information in the body of your comment and with any disk or CD–ROM you submit. If EPA cannot read your comment due to technical difficulties and cannot contact you for clarification, EPA may not be able to consider your comment. Electronic files should avoid the use of special characters, any form of encryption, and be free of any defects or viruses. For additional information about EPA's public docket, visit the EPA Docket Center homepage at *http://www.epa.gov/epahome/dockets.htm.* For additional instructions on submitting comments, go to the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: All documents in the docket are listed in the *http://www.regulations.gov* index. Although listed in the index, some information is not publicly available, *e.g.,* CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, will be publicly available only in hard copy. Publicly available docket materials are available either electronically in *http://www.regulations.gov* or in hard copy at the Hazardous Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities Docket, EPA/DC, EPA West, Room 3334, 1301 Constitution Ave., NW., Washington, DC 20460. This Docket Facility is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The Docket telephone number is (202) 566–0270. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744.

FOR FURTHER INFORMATION CONTACT: Alexander Livnat, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5304P; *telephone number:* (703) 308–7251; *fax number:* (703) 605–0595; *e-mail address: livnat.alexander@epa.gov,* or Steve Souders, Office of Resource Conservation and Recovery, Environmental Protection Agency, 5304P; *telephone number:* (703) 308–8431; *fax number:* (703) 605–0595; *e-mail address: souders.steve@epa.gov.* For technical information on the CERCLA aspects of this rule, contact Lynn Beasley, Office of Emergency Management, Regulation and Policy Development Division (5104A), U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW., Washington, DC 20460, [*E-mail address and telephone number: Beasley.lynn@epa.gov* (202–564–1965).]

For more information on this rulemaking please visit *http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/index.htm.*

SUPPLEMENTARY INFORMATION:

A. Does this action apply to me?

The proposed rule would apply to all coal combustion residuals (CCRs) generated by electric utilities and independent power producers. However, this proposed rule does not address the placement of CCRs in minefills. The U. S. Department of Interior (DOI) and EPA will address the management of CCRs in minefills in a separate regulatory action(s), consistent with the approach recommended by the National Academy of Sciences, recognizing the expertise of DOI's Office of Surface Mining Reclamation and Enforcement in this area.[1] In addition, under either alternative proposal, EPA is not proposing to affect the current status of coal combustion residuals that are beneficially used.[2] (*See* section IV. D for further details on proposed clarifications of beneficial use.) CCRs from non-utility boilers burning coal are not included within today's proposed rule. EPA will decide on an appropriate action for these wastes after completing this rulemaking effort.

The proposed rule may affect the following entities: electric utility facilities and independent power producers that fall under the North American Industry Classification System (NAICS) code 221112, and hazardous waste treatment and disposal facilities that fall under NAICS code 562211. The industry sector(s) identified above may not be exhaustive; other types of entities not listed could also be affected. The Agency's aim is to provide a guide for readers regarding those entities that potentially could be affected by this action. To determine whether your facility, company, business, organization, etc., is affected by this action, you should refer to the applicability criteria contained in section IV of this preamble. If you have any questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

B. What should I consider as I prepare my comments for EPA?

1. *Submitting confidential business information (CBI).* Do not submit information that you consider to be CBI through *http://www.regulations.gov* or by e-mail. Send or deliver information identified as CBI only to the following address: RCRA CBI Document Control Officer, Office of Resource Conservation and Recovery (5305P), U.S. EPA, 1200 Pennsylvania Avenue, NW., Washington DC 20460, Attention Docket No, EPA–HQ–RCRA–2009–0640. You may claim information that you submit to EPA as CBI by marking any part or all of the information as CBI (if you submit CBI on a disk or CD ROM, mark the outside of the disk or CD ROM as CBI and then identify electronically within the disk or CD ROM the specific information that is claimed as CBI). Information so marked will not be disclosed, except in accordance with the procedures set forth in 40 CFR part 2. In addition to one complete version of the comment that includes information claimed as CBI, a copy of the comment that does not contain the information claimed as CBI must be submitted for inclusion in the public docket. If you submit the copy that does not contain CBI on disk or CD ROM, mark the outside of the disk or CD ROM clearly that it does not contain CBI. Information not marked as CBI will be included in the public docket and EPA's electronic public docket without prior notice. If you have questions about CBI or the procedures for claiming CBI, please contact: LaShan Haynes, Office of Resource Conservation and Recovery (5305P), U.S. Environmental Protection Agency, 1200 Pennsylvania Avenue, NW., Washington DC 20460–0002, telephone (703) 605–0516, e-mail address *haynes.lashan@epa.gov.*

2. *Tips for Preparing Your Comments.* When submitting comments, remember to:

- Identify the rulemaking by docket number and other identifying information (subject heading, **Federal Register** date and page number).
- Follow directions—The Agency may ask you to respond to specific questions or organize comments by referencing a Code of Federal Regulations (CFR) part or section number.
- Explain why you agree or disagree, suggest alternatives, and substitute language for your requested changes, and explain your interest in the issue you are attempting to address.
- Describe any assumptions and provide any technical information and/or data that you used.
- If you estimate potential costs or burdens, explain how you arrived at your estimate in sufficient detail to allow for it to be reproduced.
- Provide specific examples to illustrate your concerns, and suggest alternatives.
- Explain your views as clearly as possible.
- Make sure to submit your comments by the comment period deadline identified.

3. *Docket Copying Costs.* The first 100-copied pages are free. Thereafter, the charge for making copies of Docket materials is 15 cents per page.

C. Definitions, Abbreviations and Acronyms Used in This Preamble (Note: Any term used in this proposed rulemaking that is not defined in this section will either have its normal dictionary meaning, or is defined in 40 CFR 260.10.)

Acre-foot means the volume of one acre of surface area to a depth of one foot.

Beneficial Use of Coal Combustion Products (CCPs) means the use of CCPs that provides a functional benefit; replaces the use of an alternative material, conserving natural resources that would otherwise need to be obtained through practices such as extraction; and meets relevant product specifications and regulatory standards (where these are available). CCPs that are used in excess quantities (*e.g.,* the field-applications of FGD gypsum in amounts that exceed scientifically-supported quantities required for enhancing soil properties and/or crop

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[1] The National Research Council (NRC) Committee on Mine Placement of Coal Combustion Wastes stated: "The committee believes that OSM and its SMCRA state partners should take the lead in developing new national standards for CCR use in mines because the framework is in place to deal with mine-related issues." National Academy of Sciences. Managing Coal Combustion Residues in Mines; The National Academies Press, Washington, DC, 2006.

[2] The NRC committee recommended "that secondary uses of CCRs that pose minimal risks to human health and the environment be strongly encouraged." *Ibid.*

yields), placed as fill in sand and gravel pits, or used in large scale fill projects, such as for restructuring the landscape, are excluded from this definition.

Boiler slag means the molten bottom ash collected at the base of slag tap and cyclone type furnaces that is quenched with water. It is made up of hard, black, angular particles that have a smooth, glassy appearance.

Bottom ash means the agglomerated, angular ash particles, formed in pulverized coal furnaces that are too large to be carried in the flue gases and collect on the furnace walls or fall through open grates to an ash hopper at the bottom of the furnace.

CCR Landfill means a disposal facility or part of a facility where CCRs are placed in or on land and which is not a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit. For purposes of this proposed rule, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

CCR Surface Impoundment or *impoundment* means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of CCRs containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons. CCR surface impoundments are used to receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

Cenospheres are lightweight, inert, hollow spheres comprised largely of silica and alumina glass.

Coal Combustion Products (CCPs) means fly ash, bottom ash, boiler slag, or flue gas desulfurization materials, that are beneficially used.

Coal Combustion Residuals (CCRs) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials destined for disposal. CCRs are also known as coal combustion wastes (CCWs) and fossil fuel combustion (FFC) wastes, when destined for disposal.

Electric Power Sector (Electric Utilities and Independent Power Producers) means that sector of the power generating industry that comprises electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public.

Existing CCR Landfill means a landfill which was in operation or for which construction commenced prior to the effective date of the final rule. A CCR landfill has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which cannot be cancelled or modified without substantial loss—for physical construction of the CCR landfill to be completed within a reasonable time.

Existing CCR Surface Impoundment means a surface impoundment which was in operation or for which construction commenced prior to the effective date of the final rule. A CCR surface impoundment has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which can not be cancelled or modified without substantial loss—for physical construction of the CCR surface impoundment to be completed within a reasonable time.

Flue Gas Desulfurization (FGD) material means the material produced through a process used to reduce sulfur dioxide (SO_2) emissions from the exhaust gas system of a coal-fired boiler. The physical nature of these materials varies from a wet sludge to a dry powdered material, depending on the process, and their composition comprises either sulfites, sulfates or a mixture thereof.

Fly ash means the very fine globular particles of silica glass which is a product of burning finely ground coal in a boiler to produce electricity, and is removed from the plant exhaust gases by air emission control devices.

Hazard potential means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a dam (or impoundment) or mis-operation of the dam or appurtenances.[3]

High hazard potential surface impoundment means a surface impoundment where failure or mis-operation will probably cause loss of human life.

Significant hazard potential surface impoundment means a surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns.

Low hazard potential surface impoundment means a surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Less than low hazard potential surface impoundment means a surface impoundment not meeting the definitions for High, Significant, or Low Hazard Potential.

Independent registered professional engineer or hydrologist means a scientist or engineer who is not an employee of the owner or operator of a CCR landfill or surface impoundment who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill, or existing CCR surface impoundment made after the effective date of the final rule.

Maximum Contaminant Level (MCL) means the highest level of a contaminant that is allowed in drinking water under the Safe Drinking Water Act (SDWA). MCLs are set as close to the MCL goals as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards for drinking water.

Minefill means a project involving the placement of CCRs in coal mine voids for use as fill, grouting, subsidence control, capping, mine sealing, and

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[3] The Hazard Potential Classification System for Dams was developed by the U.S. Army Corps of Engineers for the National Inventory of Dams (*see https://rsgis.crrel.usace.army.mil/apex/f?p=397:1:913698079375545*). Hazard potential ratings do not provide an estimate of the probability of failure or mis-operation, but rather what the consequences of such a failure or mis-operation would be.

treating acid mine drainage, whether for purposes of disposal or for beneficial use, such as mine reclamation.

Natural water table means the natural level at which water stands in a shallow well open along its length and penetrating the surficial deposits just deeply enough to encounter standing water at the bottom. This level is uninfluenced by groundwater pumping or other engineered activities.

Organosilanes are organic compounds containing at least one carbon to silicon bond, and are typically used to promote adhesion.

Potential damage case means those cases with documented MCL exceedances that were measured in ground water beneath or close to the waste source. In these cases, while the association with CCRs has been established, the documented exceedances had not been demonstrated at a sufficient distance from the waste management unit to indicate that waste constituents had migrated to the extent that they could cause human health concerns.

Pozzolanic material means primarily vitreous siliceous materials, such as many types of CCRs that, when combined with calcium hydroxide and in the presence of water, exhibit cementitious properties.

Proven damage case means those cases with (i) Documented exceedances of primary maximum contaminant levels (MCLs) or other health-based standards measured in ground water at sufficient distance from the waste management unit to indicate that hazardous constituents have migrated to the extent that they could cause human health concerns, and/or (ii) where a scientific study provides documented evidence of another type of damage to human health or the environment (*e.g.,* ecological damage), and/or (iii) where there has been an administrative ruling or court decision with an explicit finding of specific damage to human health or the environment. In cases of co-management of CCRs with other industrial waste types, CCRs must be clearly implicated in the reported damage.

Sand and gravel pit, and/or quarry means an excavation for the commercial extraction of aggregate for use in construction projects. CCRs have historically been used to fill sand and gravel pits and quarries. CCRs are not known to be used to fill metal mines.

Secondary Drinking Water Standards are non-enforceable federal guidelines regarding cosmetic effects (such as tooth or skin discoloration) or aesthetic effects (such as taste, odor, or color) of drinking water.

Special Wastes means any of the following wastes that are managed under the modified subtitle C requirements: CCRs destined for disposal.

Surface Water means all water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Uniquely associated wastes means low-volume wastes other than those defined as CCRs that are related to the coal combustion process. Examples of uniquely associated wastes are precipitation runoff from coal storage piles at the electric utility, waste coal or coal mill rejects that are not of sufficient quality to burn as a fuel, and wastes from cleaning boilers used to generate steam.

CCPs	Coal Combustion Products
CCRs	Coal Combustion Residuals
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
EPA	U.S. Environmental Protection Agency
EPCRA	Emergency Planning and Community Right-to-Know Act
MCL	Maximum Contaminant Level
m/L	milligrams per liter
NPDES	National Pollutant Discharge Elimination System
NRC	National Response Center
PDWS	Primary Drinking Water Standard
OSM	Office of Surface Mining Reclamation and Enforcement, U.S. Department of the Interior
RCRA	Resource Conservation and Recovery Act (42 USCA 6901)
RQ	Reportable Quantity
SDWS	Secondary Drinking Water Standard
SMCRA	Surface Mining Control and Reclamation Act
µg/L	micrograms per liter
WQC	Federal water quality criteria

D. The Contents of This Preamble Are Listed in the Following Outline

I. Background

A. Why is EPA proposing two options?

1. Basis of Why EPA Is Proceeding With Today's Co-Proposals

EPA is revisiting its regulatory determination for CCRs under the Bevill amendment. This decision is driven in part by the failure of a surface impoundment retaining wall in Kingston, TN in December 2009. Deciding upon the appropriate course of action to address over 100 million tons per year of CCRs is an extremely important step. In developing this proposal, EPA conducted considerable data gathering and analysis. While the public was able to comment on significant portions of our analyses in August 2007, as part of a Notice of Data Availability, there are differing views regarding the meaning of EPA's information and what course of action EPA should take. In part, the differing views are fueled by the complex data, analyses, legislation, implications of available options, possible unintended consequences, and a decision process, all of which pose considerations that could justify EPA selecting a RCRA subtitle C approach or selecting a RCRA subtitle D approach.

Deciding whether or not to maintain the Bevill exemption for CCRs, entails an evaluation of the eight RCRA Section 8002(n) study factors:

- Source and volumes of CCRs generated per year
- Present disposal and utilization practices
- Potential danger, if any, to human health and the environment from the disposal and reuse of CCRs
- Documented cases in which danger to human health or the environment from surface runoff or leachate has been proved
- Alternatives to current disposal methods
- The cost of such alternatives
- The impact of the alternatives on the use of coal and other natural resources
- The current and potential utilization of CCRs

Ultimately, the approach selected will need to ensure that catastrophic releases such as occurred at the Tennessee Valley Authority's (TVA's) Kingston, Tennessee facility do not occur and that other types of damage cases associated with CCR surface impoundments and landfills are prevented. Thus, this process requires EPA to balance the eight factors, which ultimately rests on a policy judgment. This is further complicated in this case because the facts identified under each of the individual factors are even subject to widely varying perspectives. For example, in considering the alternatives to current disposal methods, some claim that RCRA subtitle C would significantly lessen beneficial use while others *see* beneficial use expanding as disposal becomes more costly; some *see* damage cases as substantial, while others note very few incidences of significant off-site contamination.

Given the inherently discretionary nature of the decision, the complexities of the scientific analyses, and the controversy of the issue, EPA wants to ensure that the ultimate decision is based on the best available data, and is taken with the fullest possible extent of public input. As discussed in section IV in greater detail, there are a number of issues on which additional or more recent information would be useful in allowing the Agency to reach a final decision. In the absence of this information, EPA has not yet reached a conclusion as to how to strike the appropriate balance among these eight factors and so is presenting two proposals for federal regulation of CCRs.

As EPA weighs the eight Bevill study factors to reach our ultimate decision, EPA will be guided by the following principles, which are reflected in the discussions throughout this preamble. The first is that EPA's actions must ultimately be protective of human health and the environment. Second, any decision must be based on sound science. Finally, in conducting this rulemaking, EPA wants to ensure that our decision processes are transparent and encourage the greatest degree of public participation. Consequently, to further the public's understanding and ability to comment on all the issues facing the Agency, within this proposal, EPA identifies a series of scientific, economic, and materials management issues on which we are seeking comment from the public to strengthen our knowledge of the impact of EPA's decision.

There are three key areas of analyses where EPA is seeking comment: The extent of existing damage cases, the extent of the risks posed by the mismanagement of CCRs, and the adequacy of State programs to ensure proper management of CCRs (*e.g.,* is groundwater monitoring required of CCR landfills and surface impoundments). Since the 2007 NODA, EPA received new reports from industry and environmental and citizen groups regarding damage cases. Industry provided information indicating that many of EPA's listed proven damage cases do not meet EPA's criteria for a damage case to be proven. Environmental and citizen groups, on the other hand, reported that there are additional damage cases of which EPA is unaware. EPA's analysis, as well as the additional information from industry and environmental and citizen groups, which is in the docket for this proposal, needs to undergo public review, with the end result being a better understanding of the nature and number of damage cases. In addition, as discussed at length in sections II and IV, a number of technical questions have been raised regarding EPA's quantitative groundwater risk assessment. The Agency would implement similar technical controls under RCRA subtitle C or D. Therefore, a central issue is the adequacy of State programs. Under either regulatory approach, State programs will have key implementation roles. This is a very complex area to evaluate. For example, as EPA reports that 36% of the States do not have minimum liner requirements for CCR landfills, and 67% do not have liner requirements for CCR surface impoundments, we also observe that nearly all new CCR landfills and surface impoundments are constructed with liners. It should also be recognized that while states currently have considerable expertise in their State dam safety programs, those programs do not tend to be part of State solid waste or clean water act programs, and so, oversight may not be adequately captured in EPA's existing data. In several areas, there are these types of analytical tensions that warrant careful consideration by the public and EPA. This proposal requests states and others to provide further information on state programs, including the prevalence of groundwater monitoring at existing facilities (an area where our information is nearly 15 years old) and why state programs may address groundwater monitoring and risks differently for surface impoundments located proximate to rivers.

The results of the risk analysis demonstrate significant risks from surface impoundments. A common industry practice, however, is to place surface impoundments right next to water bodies. While the Agency's population risk assessment analysis accounted for adjacent water bodies, the draft risk assessment that presents individual risk estimates does not account for the presence of adjacent water bodies in the same manner that the population risk assessment did. EPA is requesting public comment on the exact locations of CCR waste management units so that the Agency can more fully account for water bodies that may exist between a waste management unit and a drinking water well (and thus, could potentially intercept a contaminated groundwater plume). EPA is also requesting comments on how the risk assessment should inform the final decision.

While the Agency believes the analyses conducted are sound, today's co-proposal of two options reflects our commitment to use the public process fully to ensure the best available scientific and regulatory impact analyses are considered in our decision. The final course of action will fully consider these legitimate and complex issues, and will result in the selection of a regulatory structure that best addresses the eight study factors identified in section 8002(n) of RCRA, and ensures protection of human health and the environment.

2. Brief Description of Today's Co-Proposals

a. Summary of Subtitle C Proposal

In combination with its proposal to reverse the Bevill determination for CCRs destined for disposal, EPA is proposing to list as a special waste, to be regulated under the RCRA subtitle C regulations, CCRs from electric utilities and independent power producers when destined for disposal in a landfill or surface impoundment. These CCRs would be regulated from the point of their generation to the point of their final disposition, including during and after closure of any disposal unit. This would include the generator and transporter requirements and the requirements for facilities managing CCRs, such as siting, liners (with modification), run-on and run-off controls, groundwater monitoring, fugitive dust controls, financial assurance, corrective action, including facility-wide corrective action, closure of units, and post-closure care (with certain modifications). In addition, facilities that dispose of, treat, or, in many cases, store, CCRs also would be required to obtain permits for the units in which such materials are disposed, treated, and stored. The rule would also regulate the disposal of CCRs in sand and gravel pits, quarries, and other large fill operations as a landfill.

To address the potential for catastrophic releases from surface impoundments, we also are proposing requirements for dam safety and stability for impoundments that, by the effective date of the final rule, have not closed consistent with the requirements. We are also proposing land disposal restrictions and treatment standards for CCRs, as well as a prohibition on the disposal of treated CCRs below the natural water table.

b. Summary of Subtitle D Proposal

In combination with today's proposal to leave the Bevill determination in place, EPA is proposing to regulate CCRs disposed of in surface impoundments or landfills under RCRA subtitle D requirements which would establish national criteria to ensure the safe disposal of CCRs in these units. The units would be subject to, among other things, location standards, composite liner requirements (new landfills and surface impoundments would require composite liners; existing surface impoundments without liners would have to retrofit within five years, or cease receiving CCRs and close); groundwater monitoring and corrective action standards for releases from the unit; closure and post-closure care requirements; and requirements to address the stability of surface impoundments. We are also soliciting comments on requiring financial assurance. The rule would also regulate the disposal of CCRs in sand and gravel pits, quarries, and other large fill operations as a landfill. The rule would not regulate the generation, storage or treatment of CCRs prior to disposal. Because of the scope of subtitle D authority, the rule would not require permits, nor could EPA enforce the requirements. Instead, states or citizens could enforce the requirements under RCRA citizen suit authority; the states could also enforce any state regulation under their independent state enforcement authority.

EPA is also considering a potential modification to the subtitle D option, called "D prime" in the following table. Under this option, existing surface impoundments would not have to close or install composite liners but could continue to operate for their useful life. In the "D prime" option, the other elements of the subtitle D option would remain the same.

3. Summary of Estimated Regulatory Costs and Benefits

For the purposes of comparing the estimated regulatory compliance costs to the monetized benefits for each regulatory option, the Regulatory Impact Analysis (RIA) computed two comparison indicators: Net benefits (*i.e.,* benefits minus costs), and benefit/cost ratio (*i.e.,* benefits divided by costs). Table 1 below provides a summary of estimated regulatory costs and benefits for three regulatory options, based on the 7% discount rate base case and the 50-year period-of-analysis applied in the RIA. Furthermore, this benefit and cost summary table displays ranges of net benefit and benefit/cost results across three different scenarios concerning the potential impacts of each option on the future annual beneficial use of CCRs under each option. The first scenario presents the potential impact scenario that assumes that the increased future annual cost of RCRA-regulated CCR disposal will induce coal-fired electric utility plants to increase beneficial use of CCRs. The second scenario presents a potential market stigma effect under the subtitle C option which will induce a decrease in future annual CCR beneficial use. The third scenario assumed that beneficial use of CCRs continues according to its recent trend line without any future change as a result of any of the regulatory options. The RIA estimates both the first and second scenario incrementally in relation to the third scenario no change trend line. Table 1 shows the range of impacts and associated ranges of net benefits and benefit-cost ratios across these three beneficial use scenarios for each regulatory option. While each of these three scenario outcomes may be possible, EPA's experience with the RCRA program indicates that industrial generators of RCRA-regulated wastes are often able to increase recycling and materials recovery rates after a subtitle C regulation. Section XII in this preamble provides additional discussion of these estimates.

TABLE 1—SUMMARY TABLE COMPARISON OF REGULATORY BENEFITS TO COSTS—RANGING OVER ALL THREE BENEFICIAL USE SCENARIOS

[$Millions @ 2009$ prices and @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

	Subtitle C "Special waste"	Subtitle D	Subtitle "D prime"
A. Present Values:			
1. Regulatory Costs:	$20,349	$8,095	$3,259.
2. Regulatory Benefits:	$87,221 to $102,191	$34,964 to $41,761	$14,111 to $17,501.
3. Net Benefits (2–1)	($251,166) to $81,842	($6,927) to $33,666	($2,666) to $14,242.
4. Benefit/Cost Ratio (2/1)	(11.343) to 5.022	0.144 to 5.159	0.182 to 5.370.
B. Average Annualized Equivalent Values:[*]			
1. Regulatory Costs	$1,474	$587	$236.
2. Regulatory Benefits:	$6,320 to $7,405	$2,533 to $3,026	$1,023 to $1,268.
3. Net Benefits (2–1)	($18,199) to $5,930	($502) to $2,439	($193) to $1,032.
4. Benefit/Cost Ratio (2/1)	(11.347) to 5.022	0.145 to 5.159	0.182 to 5.370.

[*] **Note:** Average annualized equivalent values calculated by multiplying 50-year present values by a 50-year 7% discount rate "capital recovery factor" of 0.07246.

B. What is the statutory authority for this action?

These regulations are being proposed under the authority of sections 1008(a), 2002(a), 3001, 3004, 3005, and 4004 of the Solid Waste Disposal Act of 1970, as amended by the Resource Conservation and Recovery Act of 1976 (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984 (HSWA), 42 U.S.C. 6907(a), 6912(a), 6921,6924, 6925 and 6944. These statutes, combined, are commonly referred to as "RCRA."

RCRA section 1008(a) authorizes EPA to publish "suggested guidelines for solid waste management." 42 U.S.C. 6907(a). Such guidelines must provide a technical and economic description of the level of performance that can be achieved by available solid waste management practices that provide for protection of human health and the environment.

RCRA section 2002 grants EPA broad authority to prescribe, in consultation with federal, State, and regional authorities, such regulations as are necessary to carry out the functions under federal solid waste disposal laws. (42 U.S.C. 6912(a)).

RCRA section 3001(b) requires EPA to list particular wastes that will be subject to the requirements established under subtitle C. (42 U.S.C. 6921(b)). The regulation listing such wastes must be based on the listing criteria established pursuant to section 3001(a), and codified at 40 CFR 261.11.

Section 3001(b)(3)(A) of RCRA established a temporary exemption for fly ash waste, bottom ash waste, slag waste, and flue gas emission control waste generated primarily from the combustion of coal or other fossil fuels, among others, and required the Agency to conduct a study of those wastes and, after public hearings and an opportunity for comment, determine whether these wastes should be regulated pursuant to subtitle C requirements (42 U.S.C. 6921 (b)(3)(A)).

Section 3004 of RCRA generally requires EPA to establish standards applicable to the treatment, storage, and disposal of hazardous waste to ensure that human health and the environment are protected. 42 U.S.C. 6924. Sections

3004(c) and (d) prohibit free liquids in hazardous waste landfills. Sections 3004(g) and (m) prohibit land disposal of hazardous wastes, unless, before disposal, those wastes meet treatment standards established by EPA that will "substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats are minimized." (42 U.S.C. 6924(c), (d), (g), and (m)).

RCRA section 3004(x) allows the Administrator to tailor certain specified requirements for particular categories of wastes, including those that are the subject of today's proposal, namely "fly ash waste, bottom ash waste, and flue gas emission control wastes generated primarily from the combustion of coal or other fossil fuels" (42 U.S.C. 6924(x)). EPA is authorized to modify the requirements of sections 3004 (c), (d), (e), (f), (g), (o), and (u), and section 3005(j), to take into account the special characteristics of the wastes, the practical difficulties associated with implementation of such requirements, and site-specific characteristics, including but not limited to the climate, geology, hydrology and soil chemistry at the site. EPA may only make such modifications, provided the modified requirements assure protection of human health and the environment. (42 U.S.C. 6924(x)).

RCRA section 3005 generally requires any facility that treats, stores, or disposes of wastes identified or listed under subtitle C, to have a permit. 42 U.S.C. 6925(a). This section also generally imposes requirements on facilities that become newly subject to the permitting requirements as a result of regulatory changes, and so can continue to operate for a period until they obtain a permit—*i.e.,* "interim status facilities." 42 U.S.C. 6925(e), (i), (j). Congress imposed special requirements on interim status surface impoundments in section 3005(j). In order to continue receiving wastes, interim status surface impoundments are generally required to retrofit the impoundment within 4 years, to install a double liner, with a leachate collection system, and groundwater monitoring. 42 U.S.C. 6925(j)(6). In addition, wastes disposed into interim status surface impoundments must meet the land disposal restrictions in EPA's regulations, or the unit must be annually dredged. 42 U.S.C. 6925(j)(11).

RCRA Section 4004 generally requires EPA to promulgate regulations containing criteria for determining which facilities shall be classified as sanitary landfills (and not open dumps) so that there is no reasonable probability of adverse effects on health or the environment from disposal of solid wastes at such facilities.

C. Regulation of Wastes Under RCRA Subtitle C

Solid wastes may become subject to regulation under subtitle C of RCRA in one of two ways. A waste may be subject to regulation if it exhibits certain hazardous properties, called "characteristics," or if EPA has specifically listed the waste as hazardous. *See* 42 U.S.C. 6921(a). EPA's regulations in the Code of Federal Regulations (40 CFR) define four hazardous waste characteristic properties: Ignitability, corrosivity, reactivity, or toxicity (*See* 40 CFR 261.21–261.24). All generators must determine whether or not a waste exhibits any of these characteristics by testing the waste, or by using knowledge of the process that generated the waste (*see* § 262.11(c)). While not required to sample the waste, generators will be subject to enforcement actions if found to be improperly managing wastes that exhibit one or more of the characteristics.

EPA may also conduct a more specific assessment of a waste or category of wastes and "list" them if they meet the criteria set out in 40 CFR 261.11. Under the third criterion, at 40 CFR 261.11(a)(3), a waste will be listed if it contains hazardous constituents identified in 40 CFR part 261, Appendix VIII, and if, after considering the factors noted in this section of the regulations, we "conclude that the waste is capable of posing a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." We place a chemical on the list of hazardous constituents on Appendix VIII only if scientific studies have shown a chemical has toxic effects on humans or other life forms. When listing a waste, we also add the hazardous constituents that serve as the basis for listing the waste to 40 CFR part 261, Appendix VII.

The regulations at 40 CFR 261.31 through 261.33 contain the various hazardous wastes that EPA has listed to date. Section 261.31 lists wastes generated from non-specific sources, known as "F-wastes," that are usually generated by various industries or types of facilities, such as "wastewater treatment sludges from electroplating operations" (*see* EPA Hazardous Waste No. F006). Section 261.32 lists wastes generated from specific industry sources, known as "K-wastes," such as "Spent potliners from primary aluminum production" (*see* EPA Hazardous Waste No. K088). Section 261.33 contains lists of commercial chemical products and other materials, known as "P-wastes" or "U-wastes," that become hazardous wastes when they are discarded or intended to be discarded.

As discussed in greater detail later in this proposal, EPA is considering whether to codify a listing of CCRs that are disposed of in landfills or surface impoundments, in a new section of the regulations, as "Special Wastes." EPA is considering creating this new category of wastes, in part, to reflect the fact that these wastes would be subject to modified regulatory requirements using the authority provided under section 3004(x) of RCRA (*e.g.,* the modified CCR landfill and surface impoundment liner and leak detection system requirements, the effective dates for the land disposal restrictions, and the surface impoundment retrofit requirements).

If a waste exhibits a hazardous characteristic or is listed under subtitle C, then it is subject to the requirements of RCRA subtitle C, and the implementing regulations found in 40 CFR parts 260 through 268, parts 270 to 279, and part 124. These requirements apply to persons who generate, transport, treat, store or dispose of such waste and establish rules governing every phase of the waste's management from its generation to its final disposition and beyond. Facilities that treat, store or dispose of hazardous wastes require a permit which incorporates all of the design and operating standards established by EPA rules, including standards for piles, landfills, and surface impoundments. Under RCRA subtitle C requirements, land disposal of hazardous waste is prohibited unless the waste is first treated to meet the treatment standards (or meets the treatment standards as generated) established by EPA that minimize threats to human health and the environment posed by the land disposal of the waste, or unless the waste is disposed in a unit from which there will be no migration of hazardous constituents for as long as the waste remains hazardous. In addition, RCRA subtitle C facilities are required to clean up any releases of hazardous waste or constituents from solid waste management units at the facility, as well as beyond the facility boundary, as necessary to protect human health and the environment. RCRA subtitle C also requires that permitted facilities demonstrate that they have adequate financial resources (*i.e.,* financial assurance) for obligations, such as closure, post-closure care, necessary clean up, and any liability from facility operations.

The RCRA subtitle C requirements are generally implemented under state programs that EPA has authorized to operate in lieu of the federal program, based upon a determination that the state program is no less stringent than the federal program. In a state that operates under an authorized program, any revisions made to EPA requirements are generally effective as part of the federal RCRA program in that state only after the state adopts the revised requirement, and EPA authorizes the state requirement. The exception applies with respect to requirements implementing statutory provisions added to subtitle C by the 1984 Hazardous and Solid Waste Amendments to RCRA; such requirements are immediately effective in all states, and are enforced by EPA.

All RCRA hazardous wastes are also hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as defined in section 101(14)(C) of the CERCLA statute. This applies to wastes listed in §§ 261.31 through 261.33, as well as any wastes that exhibits a RCRA hazardous characteristic. Table 302.4 at 40 CFR 302.4 lists the CERCLA hazardous substances along with their reportable quantities (RQs). Anyone spilling or releasing a hazardous substance at or above its RQ must report the release to the National Response Center, as required in CERCLA Section 103. In addition, Section 304 of the Emergency Planning and Community Right-to-Know Act (EPCRA) requires facilities to report the release of a CERCLA hazardous substance at or above its RQ to State and local authorities. Today's rule proposes an approach for estimating whether released CCRs exceed an RQ. Wastes listed as special wastes will generally be subject to the same requirements under RCRA subtitle C and CERCLA as are hazardous wastes, although as discussed elsewhere in this preamble, EPA is proposing to revise certain requirements under the authority of section 3004(x) of RCRA to account for the large volumes and unique characteristics of these wastes.

D. Regulation of Solid Wastes Under RCRA Subtitle D

Solid wastes that are neither a listed and/or characteristic hazardous waste are subject to the requirements of RCRA subtitle D. Subtitle D of RCRA establishes a framework for Federal, State, and local government cooperation in controlling the management of nonhazardous solid waste. The federal role in this arrangement is to establish the overall regulatory direction, by providing minimum nationwide standards for protecting human health and the environment, and to providing technical assistance to states for planning and developing their own environmentally sound waste management practices. The actual planning and direct implementation of solid waste programs under RCRA subtitle D, however, remains a state and local function, and the act authorizes States to devise programs to deal with State-specific conditions and needs. That is, EPA has no role in the planning and direct implementation of solid waste programs under RCRA subtitle D.

Under the authority of sections 1008(a)(3) and 4004(a) of subtitle D of RCRA, EPA first promulgated the Criteria for Classification of Solid Waste Disposal Facilities and Practices (40 CFR part 257) on September 13, 1979. These subtitle D Criteria establish minimum national performance standards necessary to ensure that "no reasonable probability of adverse effects on health or the environment" will result from solid waste disposal facilities or practices. Practices not complying with the criteria constitute "open dumping" for purposes of the Federal prohibition on open dumping in section 4005(a). EPA does not have the authority to enforce the prohibition directly (except in situations involving the disposal or handling of sludge from publicly-owned treatment works, where Federal enforcement of POTW sludge-handling facilities is authorized under the CWA). States and citizens may enforce the prohibition on open dumping using the authority under RCRA section 7002. EPA, however, may act only if the handling, storage, treatment, transportation, or disposal of such wastes may present an imminent and substantial endangerment to health or the environment (RCRA 7003). In addition, the prohibition may be enforced by States and other persons under section 7002 of RCRA.

In contrast to subtitle C, RCRA subtitle D requirements relate only to the disposal of the solid waste, and EPA does not have the authority to establish requirements governing the generation, transportation, storage, or treatment of such wastes prior to disposal. Moreover, EPA would not have administrative enforcement authority to enforce any RCRA subtitle D criteria for CCR facilities, authority to require states to issue permits for them or oversee those permits, nor authority for EPA to determine whether any state permitting program for CCR facilities is adequate. Subtitle D of RCRA also provides less extensive authority to establish requirements relating to the cleanup (or corrective action) and financial assurance at solid waste facilities.

EPA regulations affecting RCRA subtitle D facilities are found at 40 CFR parts 240 through 247, and 255 through 258. The existing part 257 criteria include general environmental performance standards addressing eight major topics: Floodplains (§ 257.3–1), endangered species (§ 257.3–2), surface water (§ 257.3–3), ground water (§ 257.3–4), land application (§ 257.35), disease (§ 257.3–6), air (§ 257.3–7), and safety (§ 257.3–8). EPA has also established regulations for RCRA subtitle D landfills that accept conditionally exempt small quantity generator hazardous wastes, and household hazardous wastes (*i.e.*, "municipal solid waste") at 40 CFR Part 258, but these are of limited relevance to CCRs, which fall into neither category of wastes.

E. Summary of the 1993 and 2000 Regulatory Determinations

Section 3001(b)(3)(A)(i) of RCRA (known as the Bevill exclusion or exemption) excluded certain large-volume wastes generated primarily from the combustion of coal or other fossil fuels from being regulated as hazardous waste under subtitle C of RCRA, pending completion of a Report to Congress required by Section 8002(n) of RCRA and a determination by the EPA Administrator either to promulgate regulations under RCRA subtitle C or to determine that such regulations are unwarranted.

In 1988, EPA published a Report to Congress on Wastes from the Combustion of Coal by Electric Utility Power Plants (EPA, 1988). The report, however, did not address co-managed utility CCRs, other fossil fuel wastes that are generated by utilities, and wastes from non-utility boilers burning any type of fossil fuel. Further, because of other priorities, EPA did not complete its Regulatory Determination on fossil fuel combustion (FFC) wastes at that time.

In 1991, a suit was filed against EPA for failure to complete a Regulatory Determination on FFC wastes (*Gearhart* v. *Reilly* Civil No. 91–2345 (D.D.C.), and on June 30, 1992, the Agency entered into a Consent Decree that established a schedule for EPA to complete the Regulatory Determinations for all FFC wastes. Specifically, FFC wastes were divided into two categories: (1) Fly ash, bottom ash, boiler slag, and flue gas emission control waste from the combustion of coal by electric utilities and independent commercial power producers, and (2) all remaining wastes subject to RCRA Sections 3001(b)(3)(A)(i) and 8002(n)—that is, large volume coal combustion wastes generated at electric utility and independent power producing facilities that are co-managed together with certain other coal combustion wastes; coal combustion wastes generated at non-utilities; coal combustion wastes generated at facilities with fluidized bed combustion technology; petroleum coke combustion wastes; wastes from the combustion of mixtures of coal and other fuels (*i.e.,* co-burning of coal with other fuels where coal is at least 50% of the total fuel); wastes from the combustion of oil; and wastes from the combustion of natural gas.

On August 9, 1993, EPA published its Regulatory Determination for the first category of wastes (58 FR 42466, *http://www.epa.gov/epawaste/nonhaz/industrial/special/mineral/080993.pdf*), concluding that regulation under subtitle C of RCRA for these wastes was not warranted. To make an appropriate determination for the second category, or "remaining wastes," EPA concluded that additional study was necessary. Under the court-ordered deadlines, the Agency was required to complete a Report to Congress by March 31, 1999, and issue a Regulatory Determination by October 1, 1999.

In keeping with its court-ordered schedule, and pursuant to the requirements of Section 3001(b)(3)(A)(i) and Section 8002(n) of RCRA, EPA prepared a Report to Congress on the remaining FFC wastes in March 1999 (*http://www.epa.gov/epaoswer/other/fossil/volume_2.pdf*). The report addresses the eight study factors required by Section 8002(n) of RCRA for FFC wastes (*see* discussion in section IV. B).

On May 22, 2000, EPA published its Regulatory Determination on wastes from the combustion of fossil fuels for the remaining wastes (65 FR 32214, *http://www.epa.gov/fedrgstr/EPA-WASTE/2000/May/Day-22/f11138.htm*). In its Regulatory Determination, EPA concluded that the remaining wastes were largely identical to the high-volume monofilled wastes, which remained exempt based on the 1993 Regulatory Determination. The high volume wastes simply dominate the waste characteristics even when co-managed with other wastes, and thus the May 2000 Regulatory Determination addressed not only the remaining wastes, but effectively reopened the decision on CCRs that went to monofills.

EPA concluded that these wastes could pose significant risks if not properly managed, although the risk information was limited. EPA identified and discussed a number of documented proven damage cases, as well as cases indicating at least a potential for damage to human health and the environment, but did not rely on its quantitative groundwater risk assessment, as EPA concluded that it was not sufficiently reliable. However, EPA concluded that significant improvements were being made in waste management practices due to increasing state oversight, although gaps remained in the current regulatory regime. On this basis, the Agency concluded to retain the Bevill exemption, and stated we would issue a regulation under subtitle D of RCRA, establishing minimum national standards. Those subtitle D standards have not yet been issued. (Today's proposal could result in the development of the subtitle D standards consistent with the May 2000 Regulatory Determination, or with a revision of the determination, or the issuance of subtitle C standards under RCRA.)

EPA also explicitly stated in the May 2000 Regulatory Determination that the Agency would continue to review the issues, and would reconsider its decision that subtitle C regulations were unwarranted based on a number of factors. EPA noted that its ongoing review would include (1) "the extent to which [the wastes] have caused damage to human health or the environment;" (2) the adequacy of existing regulation of the wastes; (3) the results of an NAS report regarding the adverse human health effects of mercury;[4] and (4) "risk posed by managing coal combustion solid wastes if levels of mercury or other hazardous constituents change due to any future Clean Air Act air pollution control requirements for coal burning utilities" and that these efforts could result in a subsequent revision to the Regulatory Determination. For a further discussion of the basis for the Agency's determination, *see* section IV below.

F. What are CCRs?

CCRs are residuals from the combustion of coal. For purposes of this proposal, CCRs are fly ash, bottom ash, boiler slag (all composed predominantly of silica and aluminosilicates), and flue gas desulfurization materials (predominantly Ca-SO_X compounds) that were generated from processes intended to generate power.

Fly ash is a product of burning finely ground coal in a boiler to produce electricity. Fly ash is removed from the plant exhaust gases primarily by electrostatic precipitators or baghouses and secondarily by wet scrubber systems. Physically, fly ash is a very fine, powdery material, composed mostly of silica. Nearly all particles are spherical in shape.

Bottom ash is comprised of agglomerated coal ash particles that are too large to be carried in the flue gas. Bottom ash is formed in pulverized coal furnaces and is collected by impinging on the furnace walls or falling through open grates to an ash hopper at the bottom of the furnace. Physically, bottom ash is coarse, with grain sizes spanning from fine sand to fine gravel, typically grey to black in color, and is quite angular with a porous surface structure.

Boiler slag is the molten bottom ash collected at the base of slag tap and cyclone type furnaces that is quenched with water. When the molten slag comes in contact with the quenching water, it fractures, crystallizes, and forms pellets. This boiler slag material is made up of hard, black, angular particles that have a smooth, glassy appearance.

Flue Gas Desulfurization (FGD) material is produced through a process used to reduce sulfur dioxide (SO_2) emissions from the exhaust gas system of a coal-fired boiler. The physical nature of these materials varies from a wet sludge to a dry powdered material, depending on the process. The wet sludge generated from the wet scrubbing process using a lime-based reagent is predominantly calcium sulfite, while the wet sludge generated from the wet scrubbing process using a limestone-based reagent is predominantly calcium sulfate. The dry powdered material from dry scrubbers that is captured in a baghouse consists of a mixture of sulfites and sulfates.

CCRs are managed in either wet or dry disposal systems. In wet systems, materials are generally sluiced via pipe to a surface impoundment. The material can be generated wet, such as FGD, or generated dry and water added to facilitate transport (*i.e.* sluiced) through pipes. In dry systems, CCRs are transported in its dry form to landfills for disposal.

1. Chemical Constituents in CCRs

The chemical characteristics of CCRs depend on the type and source of coal, the combustion technology, and the pollution control technology employed. For the 1999 Report to Congress and the May 2000 Regulatory Determination, EPA developed an extensive database

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[4] Toxicological Effects of Methylmercury, National Academy of Sciences, July 2000 (*http://books.nap.edu/catalog.php?record_id=9899#toc*). EPA has not taken any actions regarding the May 2000 Regulatory Determination as a result of the NAS report.

on the leaching potential of CCR constituents using the toxicity characteristic leaching procedure (TCLP) from a number of sources. More recent data on the composition of CCRs, including their leaching potential, have been collected and are discussed in the next sub-section. The CCR constituent database (available in the docket to this proposal) contains data on more than 40 constituents. Table 2 presents the median compositions of trace element TCLP leachates of each of the main four types of large volume CCRs (fly ash, bottom ash, boiler slag, and FGD gypsum). (Additional information, including the range of TCLP values, is available in the docket or on-line in the documents identified in the footnotes to the following table.)

Table 2—TCLP Median Compositions of Coal-Fired Utility Large-Volume CCRs[5] (mg/L)

Constituent	Fly ash	Bottom ash	Boiler slag	FGD
As	0.066	0.002	0.002	0.290
Ba	0.289	0.290	0.260	0.532
B	0.933	0.163	n/a	—
Cd	0.012	0.005	0.0018	0.010
Cr^{VI}	0.203	0.010	0.003	0.120
Cu	n/a	n/a	0.050	n/a
Pb	0.025	0.005	0.0025	0.120
Hg	0.0001	0.0001	0.0002	0.0001
Se	0.020	0.0013	0.0025	0.280
Ag	0.005	0.0050	0.0001	0.060
V	0.111	0.0050	0.010	—
Zn	0.285	0.015	0.075	—

n/a = data not available.
-- = too few data points to calculate statistics.
Source: Data from supporting documentation to the 1993 Regulatory Determination; values below the detection limit were treated as one-half the detection limit.

The composition of FGD gypsum depends on the position within the air emissions control system where the SO_2 component is subject to scrubbing: If scrubbing takes place up stream of the removal of fly ash particulates, the FGD would actually comprise a mix of both components. Table 3 presents mean TCLP trace element compositions of FGD gypsum generated by a scrubbing operation that is located down stream from the particulate collection elements of the air emissions control system; it therefore represents an 'end member' FGD gypsum.

Table 3—FGD Gypsum TCLP Compositions (mg/L) From: (1) Two Ohio Power Plants *[6] (Mean Data); (2) 12 Samples of Commercial Wallboard Produced From Synthetic Gypsum **[7](Median Data)

Constituent	Cardinal Plant*	Bruce Mansfield Plant*	Synthetic Gypsum**
As	<0.006	0.0075	0.00235
Ba	0.373	0.270	0.043
B	0.137	0.0255	n/a
Cd	0.00167	0.00055	0.00145
Cr	0.00587	0.00575	0.0047
Cu	<0.001	<0.001	n/a
Pb	<0.003	<0.003	0.0006
Hg	1.8×10^{-5}	2.6×10^{-6}	<0.0003
Se	0.0123	<0.011	0.044
V	<0.001	0.002	n/a
Zn	0.170	0.0560	n/a
Ag	n/a	n/a	<0.00005

n/a = data not available.

The contaminants of most environmental concern in CCRs are antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver and thallium. Although these metals rarely exceed the RCRA hazardous waste toxicity characteristic (TC), because of the mobility of metals and the large size of typical disposal units, metals (especially arsenic) have leached at levels of concern from unlined landfills and surface impoundments. In addition, it should also be noted that since the Agency announced its May 2000 Regulatory Determination, EPA has revised the maximum contaminant level (MCL) for arsenic,[8] without a corresponding revision of the TC. As a result, while arsenic levels are typically well below the TC, drinking water risks from contaminated groundwater due to releases from landfills and impoundments may still be high. Also, as discussed below, a considerable body of evidence has emerged indicating that the TCLP alone is not a good predictor

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[5] Compiled from Tables 3–1, 3–3, 3–5 and 3–7, in: Technical Background Document for the Report to Congress on Remaining Wastes from Fossil Fuel Combustion: Waste Characteristics, March 15, 1999 (*http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/ffc2_399.pdf*).

[6] Compiled from: Table 3–5, in: An Evaluation of Flue Gas Desulfurization Gypsum for Abandoned Mine Land Reclamation, Rachael A. Pasini, Thesis, The Ohio State University, 2009.

[7] Compiled from: Table 10, in: Fate of Mercury in Synthetic Gypsum Used for Wallboard Production, J. Sanderson *et al.*, USG Corporation, Final Report prepared for NETL, June 2008.

of the mobility of metals in CCRs under a variety of different conditions. This issue is further discussed in the following subsection.

From Tables 2 and 3 above, it is evident that each of the main four types of CCRs, when subjected to a TCLP leach test, yields a different amount of trace element constituents. EPA is soliciting public comments on whether, in light of these differences in the mobility of hazardous metals between the four major types of CCRs, regulatory oversight should be equally applied to each of these CCR types when destined for disposal.

2. Recent EPA Research on Constituent Leaching From CCRs

Changes to fly ash and other CCRs are expected to occur as a result of increased use and application of advanced air pollution control technologies in coal-fired power plants. These technologies include flue gas desulfurization (FGD) systems for SO_2 control, selective catalytic reduction (SCR) systems for NO_X control, and activated carbon injection systems for mercury control. These technologies are being installed or are expected to be installed in response to federal regulations, state regulations, legal consent decrees, and voluntary actions taken by industry to adopt more stringent air pollution controls. Use of more advanced air pollution control technology reduces air emissions of metals and other pollutants in the flue gas of a coal-fired power plant by capturing and transferring the pollutants to the fly ash and other air pollution control residues. The impact of changes in air pollution control on the characteristics of CCRs and the leaching potential of metals is the focus of ongoing research by EPA's Office of Research and Development (ORD). This research is being conducted to identify any potential cross-media transfers of mercury and other metals and to meet EPA's commitment in the Mercury Roadmap (*http://www.epa.gov/hg/roadmap.htm*) to report on the fate of mercury and other metals from implementation of multi-pollutant control at coal-fired power plants.

Over the last few years, in cooperation with Electric Power Research Institute (EPRI) and the utility industry, EPA obtained 73 different CCRs from 31 coal-fired boilers spanning a range of coal types and air pollution control configurations. Samples of CCRs were collected to evaluate differences in air pollution control, such as addition of post-combustion NO_X controls (*i.e.,* selective catalytic reduction), FGD scrubbers, and enhanced sorbents for mercury capture. A series of reports have been developed to document the results from the ORD research: The first report (Characterization of Mercury-Enriched Coal Combustion Residuals from Electric Utilities Using Enhanced Sorbents for Mercury Control, EPA–600/R–06/008, February 2006; *http://www.epa.gov/ORD/NRMRL/pubs/600r06008/600r06008.pdf*) was developed to document changes in fly ash resulting from the addition of sorbents for enhanced mercury capture. The second report (Characterization of Coal Combustion Residuals from Electric Utilities Using Wet Scrubbers for Multi-Pollutant Control; EPA–600/R–08/077, July 2008, *http://www.epa.gov/nrmrl/pubs/600r08077/600r08077.pdf*) was developed to evaluate residues from the expanded use of wet scrubbers. The third report (Characterization of Coal Combustion Residues from Electric Utilities—Leaching and Characterization Data, EPA–600/R–09/151, December 2009, *http://www.epa.gov/nrmrl/pubs/600r09151/600r09151.html*) updates the data in the earlier reports and provides data on an additional 40 samples to cover the range of coal types and air pollution control configurations, including some not covered in the two previous reports.

Data from these studies is being used to identify potential trends in the composition and leaching behavior of CCRs resulting from changes in air pollution controls. Summary data on the higher volume CCRs is provided for 34 fly ashes (Table 4) and 20 FGD gypsum samples (Table 5). The report provides analysis of other types of CCRs (*i.e.,* non-gypsum scrubber residues (primarily scrubber sludge containing calcium sulfite), blended CCRs (non-gypsum scrubber residues, fly ash, and lime), and wastewater treatment filter cake). For each of the metals that are reported (Sb, As, Ba, B, Cd Cr, Co, Hg, Pb, Mo, Se, and Tl) from the leaching test results, "box and whisker" plots have been developed comparing the different materials and providing comparison to field leachate data.

The purpose of this research was to try to understand how power plant air pollution control residues, and their leaching potential, are likely to change with the increased use of multi-pollutant and mercury controls, anticipated in response to new Clean Air Act regulations. An initial focus was to identify appropriate leach testing methods to assess leaching potential under known or expected CCR management conditions (beneficial use or disposal). The EPA's Science Advisory Board and the National Academy of Sciences have in the past raised concerns over the use of single-point pH tests that do not reflect the range of actual conditions under which wastes are plausibly managed.[9] Because metal leaching rates change with changing environmental conditions (especially pH), single point tests may not be the most accurate predictor of potential environmental release of mercury or other metals because they do not provide estimates of leaching under some disposal or reuse conditions that can plausibly occur.

In response to these concerns, a review of available leaching test methods was conducted. A leaching test method[10] based on research conducted at Vanderbilt University in the United States and the Energy Research Center of the Netherlands, among others, was selected to address some of these concerns.

While EPA/ORD's research relied on the Vanderbilt method, similar methods (i.e, tests evaluating leaching at different plausible disposal pH values) have been used to evaluate the leaching behavior and support hazardous waste listings of other materials as well.[11] Because of their general utility, the research methods have been drafted into the appropriate format and are being evaluated for inclusion in EPA's waste analytical methods guidance, SW–846[12]

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[8] *See http://www.epa.gov/safewater/arsenic/regulations.html.*

[9] National Academy of Sciences, Managing Coal Combustion Residues in Mines; The National Academies Press, Washington, DC, 2006.

[10] Kosson, D.S.; Van Der Sloot, H.A.; Sanchez, F.; Garrabrants, A.C., An Integrated Framework for Evaluating Leaching in Waste Management and Utilization of Secondary Materials. Environmental Engineering Science 2002, 19, 159–204.

[11] *See* 65 FR 67100 (November 8, 2000) for a discussion of EPA's use of multi-pH leach testing in support of listing a mercury-bearing sludge from VCM–A production, and EPA/600/R–02/019, September 2001, *Stabilization and Testing of Mercury Containing Wastes: Borden Catalyst.*

[12] Five different methods have been developed for use depending upon the information needed and the waste form.

1. Draft Method 1313—Liquid-Solid Partitioning as a Function of Eluate pH using a Parallel Batch Extraction Test
2. Draft Method 1314—Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio Using an Up-flow Column Test
3. Draft Method 1315—Mass Transfer in Monolithic or Compacted Granular Materials Using a Semi-dynamic Tank Leach Test
4. Draft Method 1316—Liquid-Solid Partitioning as a Function of Liquid-Solid Ratio Using a Parallel Batch Test
5. Draft Method 1317—Concise Test for Determining Consistency in Leaching Behavior

The test methods were developed to identify differences in the constituent leaching rate resulting from the form of the tested material, as well as the effects of pH and the liquid/solid ratio. Fine grained

Continued

to facilitate their routine use for evaluating other wastes or reuse materials (*http://www.epa.gov/osw/hazard/testmethods/sw846/index.htm*).

For the ORD research, equilibrium batch test methods that identify changes in leaching at different pH and liquid/solid ratio values were used to evaluate CCRs resulting from different air pollution controls at coal-fired power plants. This allowed evaluation of leaching potential over a range of field conditions under which CCRs are anticipated to be managed during either disposal or beneficial use applications. Landfill field leachate data from EPA[13] and EPRI[14] studies were used to establish the range of pH conditions expected to be found in actual disposal. From this data set, and excluding the extreme values (below 5th percentile and above 95th percentile), a pH range of 5.4 and 12.4 was determined to represent the range of plausible management conditions (with regard to pH) for CCRs. This means that approximately 5% of the values had a pH below 5.4 and approximately 5% of the values had a pH greater than 12.4. However, it is important to note that 9 of the 34 fly ash samples generated a pH in deionized water (*i.e.,* the pH generated by the tested material itself) below pH 5.4. Therefore, these results might understate CCR leaching potential if actual field conditions extend beyond the pH range of 5.4 and 12.4.

In Tables 4 and 5, the total metals content of the fly ash and FGD gypsum samples evaluated is provided along with the leach test results. Reference indicators (*i.e.,* MCL,[15] TC,[16] and DWEL[17]) are also provided to provide some context in understanding the leach results. It is critical to bear in mind that the leach test results represent a distribution of potential constituent release from the material as disposed or used on the land. The data presented do not include any attempt to estimate the amount of constituent that may reach an aquifer or drinking water well. Leachate leaving a landfill is invariably diluted in ground water to some degree when it reaches the water table, or constituent concentrations are attenuated by sorption and other chemical reactions in groundwater and sediment. Also, groundwater pH may be different from the pH at the site of contaminant release, and so the solubility and mobility of leached contaminants may change when they reach groundwater. None of these dilution or attenuation processes is incorporated into the leaching values presented. That is, no dilution and attenuation factor, or DAF,[18] has been applied to these results. Thus, comparisons with regulatory health values, particularly drinking water values, must be done with caution. Groundwater transport and fate modeling would be needed to generate an assessment of the likely risk that may result from the CCRs represented by these data.

In reviewing the data and keeping these caveats in mind, conclusions to date from the research include:

(1) Review of the fly ash and FGD gypsum data (Tables 4 and 5) show a range of total constituent concentration values that vary over a much broader range than do the leach data. This much greater range of leaching values only partially illustrates what more detailed review of the data shows: That for these CCRs, the rate of constituent release to the environment is affected by leaching conditions (in some cases dramatically so), and that leaching evaluation under a single set of conditions may, to the degree that single point leach tests fail to consider actual management conditions, lead to inaccurate conclusions about expected leaching in the field.

(2) Comparison of the ranges of totals values and leachate data from the complete data set supports earlier conclusions 51[19] [20] [21] that the rate of constituent leaching cannot be reliably estimated based on total constituent concentration alone.

(3) From the more complete data in Report 3, distinctive patterns in leaching behavior have been identified over the range of pH values that would plausibly be encountered for CCR disposal, depending on the type of material sampled and the element. This reinforces the above conclusions based on the summary data.

(4) Based on the data (summarized in Table 4), on the leach results from evaluation of 34 fly ashes across the plausible management pH range of 5.4 to 12.4,

○ The leach results at the upper end of the leachate concentration range exceed the TC values for As, Ba, Cr, and Se (indicated by the shading in the table).

(5) Based on the data (summarized in Table 5), on the leach results from evaluation of 20 FGD gypsums across the plausible management pH range of 5.4 to 12.4,

○ The leach results at the upper end of the leachate concentration ranges exceed the TC value for Se.

(6) The variability in total content and the leaching of constituents within a material type (*e.g.,* fly ash, gypsum) is such that, while leaching of many samples exceeds one or more of the available health indicators, many of the other samples within the material type may be lower than the available regulatory or health indicators.

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materials (e.g., particle sizes of 2 mm or less) will have greater contact with leaching solutions (in a lab test) or rainfall (in the environment) than will solid materials such as concrete or CCRs that are pozzolanic when exposed to water. In applying these methods to CCRs or other materials, batch tests that are designed to reach equilibrium are used with fine-grained or particle-size reduced materials. For solid materials, the tests were designed to evaluate constituent leaching from the exposed surface (leaching of constituents that are either at the surface, or that have migrated over time to the surface), can be used. Testing at equilibrium provides an upper bound estimate of constituent leaching at each set of conditions tested. In some instances, these results may represent the real situation, since when rainfall percolation through a material in the environment is slow, the constituent concentration in the water passing through the materials may reach, or nearly reach equilibrium. Testing of solid (or "monolithic") materials evaluates constituent leaching from materials of low permeability for which most rainfall flows around the material rather than percolating through it. This results in less contact between the rainfall and the material, and so typically, a lower rate of constituent leaching. For monolithic materials, both the equilibrium and monolith tests are conducted to understand the likely initial rates of leaching from the monolith (while it remains solid), and the upper bound on likely leaching, when the monolith degrades over time, exposing more surface area to percolating rainwater, and typically, higher constituent leaching rates. It may also be possible to avoid the cost of testing solid, monolithic materials, if the material leaches at low constituent concentrations under the equilibrium testing conditions.

[13] U.S. EPA (2000) Characterization and evaluation of landfill leachate. Draft Report. 68–W6–0068, Sept 2000.

[14] EPRI (2006) Characterization of Field Leachates at Coal Combustion Product Management Sites: Arsenic, Selenium, Chromium, and Mercury Speciation, EPRI Report Number 1012578. EPRI, Palo Alto, CA and U.S. Department of Energy, Pittsburgh, PA.

[15] MCL is the maximum concentration limit for contaminants in drinking water.

[16] TC is the toxicity characteristic and is a threshold for hazardous waste determinations.

[17] DWEL is the drinking water equivalent level to be protective for non-carcinogenic endpoints of toxicity over a lifetime of exposure. DWEL was developed for chemicals that have a significant carcinogenic potential and provides the risk manager with evaluation on non-cancer endpoints, but infers that carcinogenicity should be considered the toxic effect of greatest concern (*http://www.epa.gov/safewater/pubs/gloss2.html#D*).

[18] For example, EPA used a generic DAF values of 100 in the Toxicity Characteristic final regulation. (*See:* 55 FR 11827, March 29, 1990)

[19] Senior, C; Thorneloe, S.; Khan, B.; Goss, D. Fate of Mercury Collected from Air Pollution Control Devices; EM, July 2009, 15–21.

[20] U.S. EPA, Characterization of Mercury-Enriched Coal Combustion Residuals from Electric Utilities Using Enhanced Sorbents for Mercury Control, EPA–600/R–06/008, Feb. 2006; *http://www.epa.gov/ORD/NRMRL/pubs/600r06008/600r06008.pdf.*

[21] U.S. EPA, Characterization of Coal Combustion Residuals from Electric Utilities Using Wet Scrubbers for Multi-Pollutant Control; EPA–600/R–08/077, July 2008, *http://www.epa.gov/nrmrl/pubs/600r08077/600r08077.pdf.*

Additional or more refined assessment of the dataset may allow some distinctions regarding release potential to be made among particular sources of some CCRs, which may be particularly useful in evaluating CCRs in reuse applications.

EPA anticipates development of a fourth report that presents such additional analysis of the leaching data to provide more insight into constituent release potential for a wider range of CCR management scenarios, including beneficial use applications. This will include calculating potential release rates over a specified time for a range of management scenarios, including use in engineering and commercial applications using probabilistic assessment modeling (Sanchez and Kosson, 2005).[22] This report will be made publicly available when completed.

Finally, the Agency recognizes that this research has generated a substantial amount of data, and believes this data set can be useful as a reference for assessing additional CCR samples in the future. The docket for today's rule therefore includes the full dataset, in the form of a database to provide easier access to EPA's updated leach data.[23]

Table 4. Preliminary Leach Results for 5.4<pH< 12.4 and at "own pH" from Evaluation of Thirty-Four Fly Ashes.

	Hg	Sb	As	Ba	B	Cd	Cr	Co	Pb	Mo	Se	TI
Total in Material (mg/kg)	0.01 – 1.5	3 - 14	17 - 510	590 – 7,000	NA	0.3 – 1.8	66 - 210	16 - 66	24 - 120	6.9 - 77	1.1 - 210	0.72 - 13
Leach results (ug/L)	<0.01- 0.50	<0.3 – 11,000	0.32 – 18,000	50 – 670,000	210 – 270,000	<0.1 - 320	<0.3 – 7,300	<0.3- 500	<0.2 - 35	<0.5 – 130,000	5.7 – 29,000	<0.3 - 790
TC (ug/L)	200	-	5,000	100,000	-	1,000	5,000	-	5,000	-	1,000	-
MCL (ug/L)	2	6	10	2,000	7,000 DWEL	5	100	-	15	200 DWEL	50	2

Note: The dark shading is used to indicate where there could be a potential concern for a metal when comparing the leach results to the MCL, DWEL, or concentration level used to determine the TC. Note that MCL and DWEL values are intended to represent concentrations at a well and the point of exposure; leachate dilution and attenuation processes that would occur in groundwater before leachate reaches a well are not accounted for, and so MCL and DWEL values cannot be directly compared with leachate values.

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[22] Sanchez, F., and D. S. Kosson, 2005. Probabilistic approach for estimating the release of contaminants under field management scenarios. *Waste Management* 25(5), 643–472 (2005).

[23] The database, called "Leach XS Lite" can be used to estimate the leaching potential of CCRs under any specified set of pH or infiltration conditions that may occur in the field. While the database is presented as a "Beta" version, and may be further developed, the data presented in the data base are final data, from the three EPA research reports cited above.

Table 5. Preliminary Leach Results for 5.4<pH< 12.4 and at "own pH" from Evaluation of Twenty FGD Gypsums.

	Hg	Sb	As	Ba	B	Cd	Cr	Co	Pb	Mo	Se	TI
Total in Material (mg/kg)	0.01 – 3.1	0.14 – 8.2	0.95 - 10	2.4 - 67	NA	0.11 – 0.61	1.2 – 20	0.77 – 4.4	0.51 - 12	1.1 - 12	2.3 - 46	0.24 – 2.3
Leach results (ug/L)	<0.01- 0.66	<0.3 – 330	0.32 – 1,200	30 - 560	12 – 270,000	<0.2 - 370	<0.3 – 240	<0.2 – 1,100	<0.2 - 12	0.36 – 1,900	3.6 – 16,000	<0.3 – 1,100
TC (ug/L)	200	-	5,000	100,000	-	1,000	5,000	-	5,000	-	1,000	-
MCL (ug/L)	2	6	10	2,000	7,000 DWEL	5	100	-	15	200 DWEL	50	2

Note: The dark shading is used to indicate where there could be a potential concern for a metal when comparing the leach results to the MCL, DWEL, or concentration level used to determine the TC. Note that MCL and DWEL values are intended to represent concentrations at a well and the point of exposure; leachate dilution and attenuation processes that would occur in groundwater before leachate reaches a well are not accounted for, and so MCL and DWEL values cannot be directly compared with leachate values.

G. Current Federal Regulations or Standards Applicable to the Placement of CCRs in Landfills and Surface Impoundments.

CCR disposal operations are typically regulated by state solid waste management programs, although in some instances, surface impoundments are regulated under the states water programs. However, there are limited regulations of CCRs at the federal level.

The discharge of pollutants from CCR management units to waters of the United States are regulated under the National Pollutant Discharge Elimination System (NPDES) at 40 CFR Part 122, authorized by the Clean Water Act (CWA). NPDES permits generally specify an acceptable level of a pollutant or pollutant parameter in a discharge. NPDES permits ensure that a state's mandatory standards for clean water and the federal minimums are being met. A number of the damage cases discussed in the preamble also involved surface water contamination, which were violations of the NPDES permit requirements.

II. New Information on the Placement of CCRs in Landfills and Surface Impoundments

A. New Developments Since the May 2000 Regulatory Determination.

Since publication of the May 2000 Regulatory Determination, new information and data have become available, including additional damage cases, risk modeling, updated information on current management practices and state regulations associated with the disposal of CCRs, petitions from environmental and citizens groups for EPA to develop rules for the management of CCRs, an industry voluntary agreement on how they would manage CCRs, and a proposal from environmental and citizens groups for a CCR rule. Much of this new information was made available to the public in August 2007 through a Notice of Data Availability (NODA) at 72 FR 49714 (*http://www.epa.gov/fedrgstr/EPA-WASTE/2007/August/Day-29/f17138.pdf*). EPA has received extensive comments from environmental groups, industry, states and others in response to the NODA and as we have moved toward rulemaking. All of the comments and subsequent information we have received are included in the docket to this proposal. The new information on risks and the damage cases are discussed briefly below and in more detail in subsequent sections of this proposed rule; a more detailed discussion of this new information is discussed in other sections of the preamble.

At the time of the May 2000 Regulatory Determination, the Agency was aware of 14 cases of proven damages [24] and 36 cases of potential damages resulting from the disposal of

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[24] As discussed later in the preamble, 11 of these documented cases of damage were to human health and the environment, while four of these cases were cases of ecological damage, one of which has now been reclassified as a potential damage case.

CCRs. The Agency has since learned of an additional 13 cases of proven damages and 4 cases of potential damages, including a catastrophic release of CCRs from a disposal unit at the Tennessee Valley Authority (TVA) Kingston facility in Harriman, Tennessee in December 2008. In total, EPA has documented 27 cases of proven damages and 40 cases of potential damages resulting from the disposal of CCRs. Proven damage cases have been documented in 12 states, and potential damage cases—in 17 states. *See* section II.C. and the Appendix to this proposal for more detailed discussions of EPA's CCR damage cases.

As part of the process for making the May 2000 Regulatory Determination for CCRs, EPA prepared a draft quantitative risk assessment. However, because of time constraints, the Agency was unable to address public comments on the draft risk assessment in time for the Regulatory Determination. Between 2000 and 2006, EPA addressed the public comments and updated the quantitative risk assessment for the management of CCR in landfills and surface impoundments. The revised risk assessment was made available for public comment in the August 2007 draft report titled "Human and Ecological Risk Assessment of Coal Combustion Wastes."

In the May 2000 Regulatory Determination, the Agency concluded that the utility industry had made significant improvements in its waste management practices for new landfills and surface impoundments since the practices reflected in the 1999 Report to Congress, and that most state regulatory programs had similarly improved. To verify its conclusion, in 2005, the U.S. Department of Energy (DOE) and EPA conducted a joint study to collect more recent information on the management practices for CCRs by the electric power industry, and state programs in 11 states. The results of the study were published in the report titled "Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994–2004." Additionally, we are aware of at least one state (Maryland) that has recently amended its regulatory requirements for the management of CCRs.

In February 2004, 125 environmental and citizens groups petitioned the EPA Administrator for a rulemaking prohibiting the disposal of coal power plant wastes into groundwater and surface water until such time as EPA promulgates federally enforceable regulations pursuant to RCRA. A copy of the petition is available at *http://www.regulations.gov/fdmspublic/component/main?/main=DocumentDetail&o=09000064801cf8d1.*

In October 2006, the utility industry through their trade association, the Utility Solid Waste Activities Group (USWAG) submitted to EPA a "Utility Industry Action Plan for the Management of Coal Combustion Products." The plan outlines the utility industry's commitment to adopt groundwater performance standards and monitoring, conduct risk assessments prior to placement of CCRs in sand and gravel pits, and to consider dry-handling prior to constructing new disposal units.

In January 2007, environmental and citizens groups submitted to EPA a "Proposal for the Federal Regulation of Coal Combustion Waste." The proposal provides a framework for comprehensive regulation under subtitle D of RCRA for waste disposed of in landfills and surface impoundments generated by coal-fired power plants. Then in July 2009, environmental and citizens groups filed a second petition requesting that the EPA Administrator promulgate regulations that designate CCRs as hazardous waste under subtitle C of RCRA.[25] In support of their petition, the environmental groups cited "numerous reports and data produced by the Agency since EPA's final Regulatory Determination * * * which quantify the waste's toxicity, threat to human health and the environment, inadequate state regulatory programs, and the damage caused by mismanagement." A copy of the petition is available in the docket to this proposal. The Agency has, as yet, not made a decision as to whether to lift the Bevill exemption, and, while it has determined that federal regulation is appropriate, it has not made a determination as to whether regulations should be promulgated under subtitles C or D of RCRA. Consequently, EPA is deferring its response to the petitioner. However, the preamble discusses the issues raised in these petitions at length. In addition, the Agency is deferring its proposed response to the petitioners' request regarding the placement of CCRs in minefills as the Agency will work with OSM to address the management of CCRs in minefills in a separate rulemaking action. (*See* discussion in other parts of the preamble for the Agency's basis for its decisions.)

In August 2007, EPA published a NODA (72 FR 49714, *http://www.epa.gov/fedrgstr/EPA-WASTE/2007/August/Day-29/f17138.htm*) which made public, and sought comment on, the new information we received since the May 2000 Regulatory Determination through 2007, except for the July 2009 petition entitled, *Petition for Rulemaking Pursuant to Section 7004(a) of the Resource Conservation and Recovery Act Concerning the Regulation of Coal Combustion Waste and the Basis for Reconsideration of the 2000 Regulatory Determination Concerning Wastes from the Combustion of Fossil Fuels.* The new information included the joint DOE and EPA report entitled: *Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994–2004;* the draft risk assessment; and EPA's damage case assessment. EPA also included in the docket to the NODA the February 2004 Petition for Rulemaking submitted by a number of environmental and citizens' groups to prohibit the placement or disposal of CCRs into ground water and surface water; and two suggested approaches for managing CCRs in landfills and surface impoundments. One approach is the Voluntary Action Plan that was formulated by the electric utility industry. The second approach was the January 2007 framework prepared by a number of environmental and citizens' groups proposing federal regulation under subtitle D of RCRA for CCRs generated by U.S. coal-fired power plants and disposed of in landfills and surface impoundments. The Agency received a total of 396 comments on the NODA from 375 citizens and citizen and environmental groups, 16 industry groups, and 5 state and local government organizations. In general, citizens, citizens groups, and environmental groups commented that state regulations are inadequate and called on EPA to develop enforceable regulations for the disposal of CCRs under the hazardous waste provisions of RCRA. Industry groups, on the other hand, stated that the significant recent improvement in industry management and state regulatory oversight of CCR disposal demonstrates that the conditions that once led EPA to determine that federal subtitle D regulations were warranted no longer exist and therefore, further development of subtitle D regulations is no longer necessary. In September 2008, the Environmental Council of the States (ECOS) issued a resolution that states already have regulations in place that apply to CCRs, and a federal regulation is not necessary. The 2008 ECOS resolution was revised in March 2010 and calls upon EPA to conclude that

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[25] This rulemaking petition was filed by: Earthjustice; the Sierra Club; the Environmental Integrity Project; the Natural Resources Defense Council; the Southern Environmental Law Center; and Kentucky Resources Council.

additional federal CCR regulations would be duplicative of most state programs, are unnecessary, and should not be adopted, but if adopted must be developed under RCRA subtitle D rather than RCRA subtitle C (*see http://www.ecos.org/files/4018_file_Resolution_08_14_2010_version.doc*). Comments on the NODA are available in the docket to the NODA at *http://www.regulations.gov,* docket number EPA–HQ–RCRA–2006–0796.

Finally, in July and August of 2008, EPA conducted a peer review of the 2007 draft risk assessment "Human and Ecological Risk Assessment of Coal Combustion Wastes." The peer review was conducted by a team of five experts in groundwater modeling, environmental fate and transport modeling, and human health and ecological risk assessment. EPA has revised its risk assessment based on the peer review comments. Results of the peer review and the revised risk assessment are included in the docket to this proposal. Also, *see* section II.B. below and the document titled "What Are the Environmental and Health Effects Associated with Disposing of CCRs in Landfills and Surface Impoundments?" available from the docket to this notice for more detailed discussions of the risk assessment.

In summary, since the May 2000 Regulatory Determination, the Agency has (1) Documented an additional 17 cases of damage from the disposal of CCRs (13 proven and 3 potential); (2) gathered additional information on industry practices; (3) revised its risk assessment, based on comments received on the 1999 Report to Congress, conducted a peer review of the revised risk assessment, and further revised its risk assessment based on peer review comments and comments received on the August 2007 NODA; (4) received a voluntary action plan from the utility industry; (5) received two petitions for rulemaking from environmental and citizens groups; and (6) received a proposal for regulating the management of CCRs in landfills and surface impoundments from environmental and citizens groups. EPA has considered all of this information in making the decisions on the proposals in this notice.

B. CCR Risk Assessment

In making the May 2000 Regulatory Determination for CCRs, EPA prepared a draft quantitative risk assessment based on groundwater modeling. However, commenters from all sides raised fundamental scientific questions with the study, and raised issues that went beyond groundwater modeling capability at the time. EPA was unable to address these issues in the available time, and therefore did not rely on the draft risk assessment as part of its basis in making its May 2000 Regulatory Determination; rather we relied on the damage cases identified, as well as other information. In this regard, it is worth noting that EPA did not conclude that the available information regarding the extent or nature of the risks were equivocal. Rather, EPA noted that we had not definitively assessed the ground water risks, due to the criticisms of our draft risk assessment, but still concluded that there were "risks from arsenic that we cannot dismiss." Largely what drove the risks in the original risk assessment were the old units that lacked liners and ground water monitoring (for landfills, only 57% of the units had liners and 85% of the units had ground water monitoring, while for surface impoundments, only 26% of the units had liners and only 38% of the units had ground water monitoring).

Between 2000 and 2006, EPA addressed public comments and updated the quantitative risk assessment for the management of CCRs in landfills and surface impoundments. The purpose of the risk assessment is to identify CCR constituents, waste types, liner types, receptors, and exposure pathways with potential risks and to provide information that EPA can use as we continue to evaluate the risks posed by CCRs disposed of in landfills and surface impoundments. The risk assessment was designed to develop national human and ecological risk estimates that are representative of onsite CCR management settings throughout the United States. A revised draft risk assessment was made available to the public through the August 2007 NODA (which is discussed in other sections of the preamble) and is available at *http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=090000648027b9cc.*

EPA submitted the revised draft risk assessment report, together with public comments on the report in response to the 2007 NODA, to a peer review panel. EPA completed the risk assessment, taking into account peer review comments, in a final report titled "Human and Ecological Risk Assessment of Coal Combustion Wastes," (September 2009). The report, peer review comments, and EPA's response to the peer review comments are available in the docket for this proposal.

For purposes of this rulemaking, EPA defined the target level of protection for human health to be an incremental lifetime cancer risk of no greater than one in 100,000 (10^{-5}) for carcinogenic chemicals and a hazard quotient of 1.0 for noncarcinogenic chemicals. The hazard quotient is the ratio of an individual's chronic daily dose of a constituent to the reference dose for that constituent, where the reference dose is an estimate of the daily dose that is likely to be without appreciable risk of deleterious effects over a lifetime. These are the target levels that EPA typically uses in its listing decisions. (*See,* for example, the final rule for Nonwastewaters From Productions of Dyes, Pigments, and Food, Drug, and Cosmetic Colorants (70 FR 9144) at *http://www.epa.gov/wastes/laws-regs/state/revision/frs/fr206.pdf.*)

The results of this risk assessment provide further confirmation of the high risks presented in the mismanagement of CCRs disposed in landfills and surface impoundments. The assessment does confirm that there are methods to manage CCRs safely, although it calls into question the reliability of clay liners, especially in surface impoundments, and it points to very high potential risks from unlined surface impoundments.

Specifically, the revised draft CCR risk assessment presents results at a typical exposure (50th percentile), as well as a high-end exposure (90th percentile) risk based on a probabilistic analysis. The revised draft CCR risk assessment results at the 90th percentile suggest that the management of CCRs in unlined or clay-lined waste management units (WMUs) result in risks greater than the risk criteria of 10^{-5} for excess cancer risk to humans or an HQ greater than 1 for noncancer effects to both human and ecological receptors which are the criteria generally used in EPA's listing determination procedure.[26] While still above the criteria, clay-lined units tended to have lower risks than unlined units. However, it was the composite-lined units that effectively reduced risks from all pathways and constituents below the risk criteria. More specifically:

○ For humans exposed via the groundwater-to-drinking-water pathway, estimated risks from clay-lined landfills that dispose of CCRs or

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[26] EPA's hazardous waste listing determination policy is described in the notice of proposed rulemaking for wastes from the dye and pigment industries at 59 FR 66075–66077 *available at http://www.epa.gov/fedrgstr/EPA-WASTE/1994/December/Day-22/pr-98.html* and in the final rule for Nonwastewaters From Productions of Dyes, Pigments, and Food, Drug, and Cosmetic Colorants (70 FR 9144) at *http://www.epa.gov/wastes/laws-regs/state/revision/frs/fr206.pdf.*

CCRs co-managed with coal refuse are lower than those for unlined landfills. However, the 90th percentile risk estimates, for arsenic that leaks from clay-lined landfills are still above the risk criteria—as high as 1 in 5,000 individual lifetime excess cancer risk.[27] When landfills are unlined, estimated risks above the criteria occur for antimony and molybdenum, as well as arsenic (as high as 1 in 2,000 individual lifetime excess cancer risk). In addition to arsenic, clay-lined fluidized bed combustion (FBC) landfills also presented estimated 90th percentile risks above the criteria for antimony. However, unlined FBC landfills differed in that they were estimated to exceed the risk criteria only for arsenic.[28] At the 50th percentile, only trivalent arsenic from CCRs codisposed with coal refuse was estimated to exceed the risk criteria with cancer risks of 1 in 50,000.

○ Arsenic and cobalt were the constituents with the highest estimated risks for surface impoundments. Clay-lined surface impoundments were estimated to present 90th percentile risks above the criteria for arsenic, boron, cadmium, cobalt, molybdenum, and nitrate. The 90th percentile clay-lined impoundment estimated risks and hazard quotients (HQs) were as follows: for arsenic, the estimated risk was as high as 1 in 140; cobalt's estimated HQ as high as 200, while the estimated HQs for boron, cadmium, molybdenum and nitrate ranged from 2 to 20. The 90th percentile unlined surface impoundment estimates were above the criteria for constituents that include arsenic, lead, cobalt and selenium: estimated arsenic cancer risks are as high as 1 in 50, and non-cancer effects estimates for cobalt ranged from an estimated HQ of 0.9 to 500 depending on whether CCRs were co-managed with coal refuse. At the 50th percentile, the only surface impoundment results estimated to exceed the risk criteria were arsenic and cobalt: unlined impoundments had estimated arsenic cancer risks as high as 6 in 10,000, while clay-lined impoundments had estimated arsenic cancer risks as high as 1 in 5,000. The 50th percentile noncancer HQs due to cobalt in drinking water were estimated to be as high as 20 and 6 for unlined and clay-lined surface impoundments, respectively.

○ Composite liners, as modeled in this assessment, effectively reduce risks from all constituents to below the risk criteria for both landfills and surface impoundments at the 90th and 50th percentiles.

○ The model generally predicts that groundwater risks will occur centuries later for landfills than for surface impoundments. For the groundwater-to-drinking water pathway for unlined landfills, arrival times of the peak concentrations at a receptor well peaked in the hundreds or thousands of years, while unlined surface impoundment risks typically peaked within the first 100 years. Clay liners resulted in later arrival of peak risks, nearly always in the thousands of years for landfills but still in the first few hundred years for surface impoundments. Finally, while composite liners often resulted in a failure of the plume to reach groundwater wells, composite-lined landfills with plumes that were estimated to reach groundwater wells eventually had peak arsenic-in-groundwater concentrations at approximately 10,000 years, while composite-lined surface impoundments' plumes peaked in the thousands of years.

○ For humans exposed via the groundwater-to-surface-water (fish consumption) pathway, unlined and clay-lined surface impoundments were estimated to pose risks above the criteria at the 90th percentile. For CCRs managed alone in surface impoundments, these exceedances came from selenium (estimated HQs of 3 and 2 for unlined and clay-lined units, respectively). For CCRs co-managed with coal refuse, these exceedences came from arsenic (3 in 100,000 and 2 in 100,000 estimated excess cancer risks for unlined and clay-lined units, respectively). All 50th percentile surface impoundment risks are estimated to be below the risk criteria. No constituents pose estimated risks above the risk criteria for landfills (including FBC landfills) at the 90th or 50th percentile.

○ EPA also conducted a separate draft fugitive dust screening assessment which indicates that, without fugitive dust controls, there could be exceedances of the National Ambient Air Quality Standards for fine particulate matter in the air at residences near CCR landfills.[29] The 1998 risk assessment[30] also showed risks from inhalation of chromium in fugitive dust but at levels below the criteria.[31]

EPA recognizes that there are significant uncertainties in national risk assessments of this nature, although it did attempt to address potential uncertainties through Monte Carlo and sensitivity analyses. Uncertainties discussed in the revised risk assessment include:

- The locations and characteristics of currently operating facilities;
- The failure to account for direct discharges to surface water;
- Changing conditions over the 10,000-year period modeled;
- Shifting populations and ecological receptors;
- Additive risks from multiple constituents or multiple pathways;
- Clean closure of surface impoundments;
- The speciation and bioavailability of constituents;
- The effect of compacting CCRs before disposal;
- The assumption that all disposal units are above the water table;
- Full mixing of the groundwater plume;
- The choice of iron sorbent in the soil;
- The appropriateness of the leachate data used and the treatment of nondetects;
- The distance to receptor wells and surface water bodies; and
- The potential conservativeness of human health benchmarks.

The Agency, however, does solicit comment on several specific aspects of the underlying risk assessment. In particular, EPA requests comment on whether clay liners designed to meet a $1x10^{-7}$ cm/sec hydraulic conductivity might perform differently in practice than modeled in the risk assessment. Thus, EPA solicits specific data on the hydraulic conductivity of clay liners associated with CCR disposal units. In addition to the effectiveness of various liner systems, the hydraulic conductivity of coal ash can be reduced with the appropriate addition of moisture followed by compaction to attain 95% of the standard Proctor

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[27] Excess cancer risk means risk in addition to pre-existing, "background" risk from other exposures.

[28] Unlined FBC landfills showed less risk as modeled; note that the number of FBC landfills modeled was very small (seven).

[29] EPA's decision to address fugitive dust was based on a peer review comment to the draft Risk Assessment, stakeholder NODA comments, photographic documentation of fugitive dust associated with the hauling and disposal of CCRs, Agency efforts to control fugitive dust emissions from the TVA Kingston spill (see e.g., *http://www.epakingstontva.com/EPA%20Air%20Audits%20and%20Reviews/Kingston%20Fly%20Ash%20-%20EPA%20Audit.pdf*), and OSHA's requirement for MSDS sheets for coal ash.

[30] Non-Groundwater Pathways, Human Health and Ecological Risk Analysis for Fossil Fuel Combustion Phase 2 (FFC2): Draft Final Report (*http://www.epa.gov/osw/nonhaz/industrial/special/fossil/ngwrsk1.pdf*).

[31] All chromium present in the particulate matter was assumed to be in the more toxic, hexavalent form.

maximum dry density value.[32] This concept, it has been reported, could potentially be taken further with the use of compaction coupled with the addition of organosilanes. According to recent studies, organosilanes could take the hydraulic conductivity to zero.[33] EPA solicits comments on the effectiveness of such additives, including any analysis that would reflect long-term performance, as well as the appropriateness of a performance standard that would allow such control measures in lieu of composite liners. EPA has also observed that surface impoundments are often placed right next to surface water bodies which may present complex subsurface environments not considered by the groundwater model, and therefore EPA seeks data on the distance of surface impoundments to water bodies, site specific groundwater risk analysis which accounts for the presence of a nearby surface water body, and groundwater monitoring data associated with such sites.

In characterizing CCRs and utilizing such data for the risk analysis, EPA gathered a variety of data over a long period of time. As a general matter, EPA finds these data to be an accurate characterization, and that the values are in line with recent studies EPA has conducted to characterize new air pollution controls. However, with respect to a few of the highest surface impoundment porewater concentrations (for arsenic in particular), questions have been raised regarding the representativeness of these individual data points. In one case, a facility with the highest arsenic pore water concentration (86.0 mg/L) involved values that were measured in a section of a surface impoundment where coal refuse (defined as coal waste from coal handling, crushing, and sizing operations) was disposed of at the water surface. Pore water samples taken in the coal ash sediment beneath the coal refuse involved concentrations of arsenic as low as 0.003 mg/L. Thus, there is the question of whether those pore water samples measured in the coal refuse represent what leaches out of the bottom of the surface impoundment.

The next highest arsenic values (an average of 5.37 mg/L over 4 samples with the highest concentration being 15.5 mg/L) came from site CASJ (known as SJA in the EPRI report). The concern is that arsenic in the pore water was orders of magnitude higher than in the pond water. That type of change doesn't appear to occur for other constituents in these samples or for arsenic in samples from other surface impoundments. EPA recently attempted to obtain further information that could assist us to better characterize these specific data, but the data are old, the impoundment is no longer in operation, and there are apparently no additional records upon which to draw conclusions.

Additional high concentration values, especially for lead, are associated with ash data provided by Freeman United Mining, which acquired ash for a minefilling project. None of this ash data is associated with electric utilities, but rather with other coal combusters such as John Deere, American Cyanamid, and Washington University in St. Louis, Missouri. The Agency is uncertain whether the high lead levels are associated with lead levels in the source coal, the operations at these facilities, or whether other wastes were mixed with the CCRs.

While these concerns are associated with a small fraction of the data, these data reflect the highest concentrations, and thus can be important considerations in the risk analysis. Based on the above concerns, EPA solicits comment on several questions.

- For the highest concentrations in EPA's database, such as the examples mentioned above, are there values that do not appropriately represent leaching to groundwater, and if so, why not?
- Are there any additional data that are representative of CCR constituents in surface impoundment or landfill leachate (from literature, state files, industry or other sources) that EPA has not identified?
- EPA understands that the disposal practices associated with coal refuse in surface impoundments may have improved based on the development of an industry guide.[34] EPA solicits information on the degree to which coal refuse management practices have changed since the issuance of the guide and the impacts of those changes (*e.g.*, have concentrations of arsenic been reduced in leach samples that have been taken at facilities operating in concert with the industry guide).
- For CCR surface impoundments, are there any examples of pore water concentrations for arsenic increasing orders of magnitude over pond water concentrations?

For more detailed discussions of the CCR risk assessment, *see* the document titled: "What Are the Environmental and Health Effects Associated with Disposing of CCRs in Landfills and Surface Impoundments?" and the report titled "Human and Ecological Risk Assessment of Coal Combustion Wastes" which are included in the docket to this notice.

C. Damage Cases

Under the Bevill Amendment for the "special waste" categories of RCRA, EPA was statutorily required to examine "documented cases in which danger to human health or the environment from surface runoff or leachate has been proved" from the disposal of coal combustion wastes (RCRA Section 8002(n)). The criteria used to determine whether danger to human health and the environment has been proven are described in detail in the May 2000 Regulatory Determination at 65 FR 32224.[35]

At the time of the May 2000 Regulatory Determination, the Agency was aware of 11 documented cases of proven damage to ground water and 36 cases of potential damage to human health and the environment from the improper management of CCRs in landfills and surface impoundments. Additionally, the Agency determined that another four cases were documented cases of ecological damages.[36] However, for the May 2000 Regulatory Determination, EPA did not consider these ecological damage cases because all involved some form of discharge from waste management units to nearby lakes or creeks that would be subject to the Clean Water Act regulations. Moreover, EPA concluded that the threats in those cases were not substantial enough to cause large scale, system level ecological disruptions. On review, EPA has concluded that the ecological damage cases are appropriate for consideration because, while they might involve CWA violations, they nevertheless reflect damages from CCR disposal that might be handled under RCRA controls. And, while they may or may not have involved "systems-level"

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[32] The standard and modified Proctor compaction tests (ASTM D 698 and D 1557 respectively) are used to determine the maximum achievable density of soils and aggregates by compacting the soil or aggregate in a standardized mould at a standardized compactive force. The maximum dry density value (or maximum achievable dry density value) is determined by dividing the mass of the compacted material (weight divided by the gravitational force) by the volume of the compacted material.

[33] "Organo-silane Chemistry: A Water Repellant Technology for Coal Ash and Soils," John L. Daniels, Mimi S. Hourani, and Larry S. Harper, 2009 World of Coal Ash Conference. *Available at http://www.flyash.info/2009/025-daniels2009.pdf* and in the docket to this proposal.

[34] Guidance for Comanagement of Mill Rejects at Coal-Fired Power Plants, Electric Power Research Institute, 1999. Available in the docket to this proposal.

[35] For definition of "proven damage case," see section C in the Supplementary Information section.

[36] Ecological damages are damages to mammals, amphibians, fish, benthic layer organisms and plants.

disruption, they were significant enough to lead to state response actions, *e.g.*, fish advisories. EPA now believes that ecological damages warranting state environmental response are generally appropriate for inclusion as damage cases, and to fail to include them would lead to an undercounting of real and recognized damages. Accordingly, at the time of the May 2000 Regulatory Determination, in total, 15 cases of proven damages had occurred. Subsequently, one of the 15 proven damage cases has been reclassified as a potential damage case, resulting in a total of 14 proven cases of damage, as of the May 2000 Regulatory Determination.

Since the May 2000 Regulatory Determination, additional damage cases, including ecological damage cases, have occurred, and were discussed in the August 2007 NODA. Specifically, EPA has gathered or received information on 135 alleged damage cases. Six of the alleged damage cases have been excluded from this analysis because they involved minefills, a management method which is outside the scope of this proposal, while sixty-two of the damage cases have not been further assessed because there was little or no information supporting the concerns identified. Of the remaining 67 damage cases evaluated, EPA determined that 24 were proven cases of damage (which includes the 14 proven damage cases from the May 2000 Regulatory Determination); of the 24 damage cases, eight were determined to be proven damages to surface water and sixteen were determined to be proven damages to ground water, with four of the cases to groundwater being from unlined landfills, five coming from unlined surface impoundments, one was from a surface impoundment where it was unclear whether it was lined, and the remaining six cases coming from unlined sand and gravel pits. Another 43 cases (which includes the 36 potential damage cases from the May 2000 Regulatory Determination) were determined to be potential damages to groundwater or surface water; however, four of the potential damage cases were attributable to oil combustion wastes and thus are outside the scope of this proposal; therefore, resulting in 39 CCR potential damage cases. The remaining 10 alleged damage cases were not considered to be proven or potential damage cases due to a lack of evidence that damages were uniquely associated with CCRs; therefore, they were not considered to be CCR damage cases.

Finally, within the last couple of years, EPA has learned of an additional five cases of claimed damage. Two of the cases involve the structural failure of the surface impoundment; *i.e.*, dam safety and structural integrity issues, a pathway which EPA did not consider at the time of the May 2000 Regulatory Determination. These cases are (1) a 0.5 million cubic yard release of water and fly ash to the Delaware River at the Martin's Creek Power Plant in Pennsylvania in 2005, leading to a response action costing $37 million, and (2) the catastrophic failure of a dike at TVA's Kingston, Tennessee facility, leading to the release of 5.4 million cubic yards of fly ash sludge over an approximately 300 acre area and into a branch of the Emory River, followed by a massive cleanup operation overseen by EPA and the state of Tennessee. EPA classifies these as proven damage cases. Another case involved the failure of a discharge pipe at the TVA Widows Creek plant in Stevenson, Alabama, resulting in a 6.1 million gallon release from an FGD pond, leading to $9.2 million in cleanup costs. EPA did not classify this as a damage case, because samples at relevant points of potential exposure did not exceed applicable standards. Two other cases involved the placement of coal ash in large scale fill operations. The first case, the BBBS Sand and Gravel Quarries in Gambrills, Maryland, involved the disposal of fly ash and bottom ash (beginning in 1995) in two sand and gravel quarries. EPA considers this site a proven damage case, because groundwater samples from residential drinking wells near the site include heavy metals and sulfates at or above groundwater quality standards, and the state of Maryland is overseeing remediation. The second case is the Battlefield Golf Course in Chesapeake, Virginia where 1.5 million yards of fly ash were used as fill and for contouring of a golf course. Groundwater contamination above drinking water levels has been found at the edges and corners of the golf course, but not in residential wells. An EPA study in April 2010 established that residential wells near the site were not impacted by the fly ash and, therefore, EPA does not consider this site a proven damage case. However, due to the onsite groundwater contamination, EPA considers this site to be a potential damage case. Thus, the Agency has classified three of the five new cases as proven damage cases, one as a potential damage case, and the other as not being a damage case (*i.e.*, not meeting the criteria to be considered either a proven or potential damage case). This brings the total number of proven damage cases to 27 and 40 potential cases of damage from the mismanagement of CCRs being disposed.

The Martins Creek and TVA Kingston fly ash impoundment failures underscore the need for surface impoundment integrity requirements. In the case of the Martins Creek failure, 0.5 million cubic yards of fly ash slurry was released into the Delaware River when a dike failed. Fortunately, there are no homes in the path of the release and all the damage was confined to power plant property and the Delaware River. On the other hand, the 5.4 million cubic yards of fly ash sludge released as a result of the TVA Kingston impoundment failure covered an area of approximately 300 acres, flowed into a branch of the Emory River, disrupted power, ruptured a gas line, knocked one home off its foundation and damaged others. Fortunately, there were no injuries.

While much of our risk modeling deals with ground water contamination, based on historical facts, EPA recognizes that failures of large CCR impoundments can lead to catastrophic environmental releases and large cleanup costs. It is critical to understand as well, however, that the structural integrity requirements and the requirements for conversion or retrofitting of existing or new impoundments are designed to avoid such releases and that the benefits of avoiding such catastrophic failures are very significant. As discussed in more detail in Section XII of today's proposal and as fully explained in our Regulatory Impact Analysis (RIA), EPA estimated the benefits of avoiding the future cleanup costs of or impoundment failures. Depending on the regulatory option chosen, the annualized benefits range from $29 million to $1,212 million per year, and the net present value of these ranges from $405 million to $16,732 million. In addition, the RIA did not quantify or monetize several other additional benefits consisting of future avoided social costs associated with ecological and socio-economic damages. These include avoided damages to natural resources, damages to property and physical infrastructure, avoided litigation costs associated with such events, and reduction of toxic chemical-contaminated effluent discharges from impoundments to surface waters.

In December 2009, EPA received a new report from EPRI challenging our conclusions on many of the proven damage cases often noting that there was not significant off-site contamination.

The report, "Evaluation of Coal Combustion Product Damage Cases (Volumes 1 and 2), Draft Report, November 2009," is available in the docket to this proposal. EPA solicits comments on EPRI's report and welcomes additional data regarding the proven damage cases identified by EPA, especially the degree to which there was off-site contamination.

EPA notes that several stakeholders have very recently identified additional claimed damage cases, and the agency has not had the time to review them closely.[37] Similarly, other stakeholders have recently provided valuable information on CCR risks, costs of different possible options, and characterization data, which EPA has also not had time to review in detail or to respond to. Generally, these reports include information that is relevant to today's proposal. EPA will review this information carefully as we proceed to a final rule, and we encourage commenters on the proposal to consider this material, which EPA has placed in the rulemaking docket, as they prepare comments.

For a more detailed discussion of the damage cases, *see* the Appendix to this notice, the table "Summary of Proven Cases with Damages to Groundwater and to Surface Water" at the end of the Appendix, and the document "Coal Combustion Wastes Damage Case Assessments" available at *http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&d=EPA-HQ-RCRA-2006-0796-0015.*

III. Overview and Summary of the Bevill Regulatory Determination and the Proposed Subtitle C and Subtitle D Regulatory Options

In today's notice, EPA is reevaluating its August 1993 and May 2000 Bevill Regulatory Determinations regarding CCRs generated at electric utilities and independent power producers. In the May 2000 determination, EPA concluded that disposal of CCRs did not warrant regulation under RCRA subtitle C as a hazardous waste, but did warrant federal regulation as a solid waste under subtitle D of RCRA. However, EPA never issued federal regulations under subtitle D of RCRA for CCRs. (As noted previously, today's proposal could result in the development of subtitle D standards consistent with the May 2000 Regulatory Determination, or with a revision of the determination, or the issuance of subtitle C standards under RCRA.) Today, EPA is reconsidering this determination, and is soliciting comments on two alternative options: (1) to reverse the Bevill determination (with respect to disposal of CCRs in surface impoundments and landfills), and regulate such CCRs as special wastes under RCRA subtitle C, and (2) to leave the Bevill determination in place and regulate CCRs going to disposal under federal RCRA subtitle D standards. Today's co-proposal provides regulatory text for both options.

In determining whether or not to exclude a Bevill waste from regulation under RCRA subtitle C, EPA must evaluate and weigh eight factors. In section IV. B. of this preamble, EPA discusses CCRs from electric utilities in light of these factors, and we highlight the considerations that might lead us to reversing the August 1993 and May 2000 Regulatory Determinations (and therefore regulate CCR disposal under RCRA subtitle C), or to leave the determination in place (and regulate CCR disposal under RCRA subtitle D).

At the same time, EPA continues to believe the Bevill exclusion should remain in place for CCRs going to certain beneficial uses, because of the important benefits to the environment and the economy from these uses, and because the management scenarios for these products are very different from the risk case being considered for CCR disposal in surface impoundments and landfills. EPA makes it clear that CCRs in sand and gravel pits, quarries, and other large fill operations is not beneficial use, but disposal. As such, it would be regulated under whichever option is finalized. EPA solicits comments, however, on whether unencapsulated uses of CCRs warrant tighter federal control.

A. Summary of Subtitle C Proposal

In combination with its proposal to reverse the Bevill determination for CCRs destined for disposal, EPA is proposing to list as a special waste, CCRs from electric utilities and independent power producers when destined for disposal in a landfill or surface impoundment. These CCRs would be regulated under the RCRA subtitle C rules (as proposed to be amended here) from the point of their generation to the point of their final disposition, which includes both during and after closure of any disposal unit. In addition, EPA is proposing that all existing units that have not closed in accordance with the criteria outlined in this proposal, by the effective date of the final rule, would be subject to all of the requirements of subtitle C, including the permitting requirements at 40 CFR parts 124 and 270. As such, persons who generate, transport and treat, store or dispose of CCRs would be subject to the existing cradle-to-grave subtitle C waste management requirements at 40 CFR parts 260 through 268, parts 270 to 279, and part 124 including the generator and transporter requirements and the requirements for facilities managing CCRs, such as siting, liners (with modification), run-on and run-off controls, groundwater monitoring, fugitive dust controls, financial assurance, corrective action, including facility-wide corrective action, closure of units, and post-closure care (with certain modifications). In addition, facilities that dispose of, treat, or, in many cases, store, CCRs also would be required to obtain permits for the units in which such materials are disposed, treated, and stored. EPA is also considering and seeking comment on a modification, which would not require the closure or installation of composite liners in existing surface impoundments; rather, these surface impoundments could continue to operate for the remainder of their useful life. The rule would also regulate the disposal of CCRs in sand and gravel pits, quarries, and other large fill operations as a landfill.

To address the potential for catastrophic releases from surface impoundments, we also are proposing requirements for dam safety and stability for impoundments that, by the effective date of the final rule, have not closed consistent with the requirements. Finally, we are proposing land disposal restrictions and treatment standards for CCRs, as well as a prohibition on the disposal of treated CCRs below the natural water table.

B. Summary of Subtitle D Proposal

In combination with its proposal to leave the Bevill determination in place, EPA is proposing to regulate CCRs disposed of in surface impoundments or landfills under the RCRA subtitle D requirements, which would establish national criteria to ensure the safe disposal of CCRs in these units. The units would be subject to, among other things, location standards, composite liner requirements (new landfills and surface impoundments would require composite liners; existing surface impoundments without liners would have to retrofit within five years, or cease receiving CCRs and close); groundwater monitoring and corrective action for releases from the unit standards; closure and post-closure care requirements; and requirements to address the stability of surface impoundments. We solicit comments on requiring financial assurance and on

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[37] On February 24, the Environmental Integrity Project and EarthJustice issued a report on 31 'new' alleged CCRs damage cases which is available at: *http://www.environmentalintegrity.org/news_reports/documents/OutofControl-MountingDamagesFromCoalAshWasteSites.pdf.*

how the requirements apply to surface impoundments that continue to receive CCRs after the effective date of the rule; specifically, EPA is requesting comment on an alternative under which existing surface impoundments would be allowed to continue to operate without requiring the facility to retrofit the unit to install a composite liner. The rule would also regulate the disposal of CCRs in sand and gravel pits, quarries, and other large fill operations as a landfill. The rule would not regulate the generation, storage or treatment of CCRs prior to disposal. Because of the scope of subtitle D authority, the rule would not require permits, nor could EPA enforce the requirements. Instead, states or citizens could enforce the requirements under RCRA citizen suit authority; the states could also enforce any state regulation under their independent state enforcement authority.

EPA is also considering, and is seeking comment on, a potential modification to the subtitle D option, called "D prime." Under the "D prime" option, existing surface impoundments would not have to close or install composite liners but could continue to operate for their useful life. In the "D prime" option, the other elements of the subtitle D option would remain the same.

IV. Bevill Regulatory Determination Relating to CCRs From Electric Utilities

As discussed in the preceding sections, EPA originally conditioned its May 2000 Regulatory Determination on continued review of, among other factors, "the extent to which [the wastes] have caused damage to human health or the environment; and the adequacy of existing regulation of the wastes." (*See* 65 FR 32218.) Review of the information developed over the past ten years has confirmed EPA's original risk concerns, and has raised significant questions regarding the accuracy of the Agency's predictions regarding anticipated improvements in management and state regulatory oversight of these wastes. Consequently, the Agency has determined that reconsideration of its May 2000 Regulatory Determination is appropriate, and is revaluating whether regulation of CCRs under RCRA subtitle C is necessary in light of the most recent information. The scientific analyses, however, are complex and present legitimate questions for comment and further consideration. Thus, while EPA has concluded that federal regulation of this material is necessary, the Agency has yet not reached a conclusion as to whether the Bevill determination should be revised, or whether regulation under RCRA subtitle C or D is appropriate, but is soliciting comments on the two options described in the previous section.

As stated earlier, EPA's application of its discretion in weighing the eight Bevill factors—and consequently our ultimate decision—will be guided by the following principles. The first is that EPA's actions must be protective of human health and the environment. Second, any decision must be based on sound science. Finally, in conducting this rulemaking, EPA will ensure that its decision processes are transparent, and encourage the greatest degree of public participation. Consequently, to further the public's understanding and ability to comment on the issues facing the Agency, EPA provides an extensive discussion of the technical issues associated with the available information, as well as the policy considerations and the key factors that will weigh in the Agency's ultimate decision.

A. Basis for Reconsideration of May 2000 Regulatory Determination

EPA decided in May 2000 that regulation under RCRA subtitle C was not warranted in light of the trends in present disposal and utilization practices, the current and potential utilization of the wastes, and the concerns expressed against duplication of efforts by other federal and state agencies. In addition, EPA noted that the utility industry has made significant improvements in its waste management practices with respect to new management units over recent years, and most state regulatory programs are similarly improving. In particular, EPA noted that, of the new units constructed between 1985 and 1995, 60% of the new surface impoundments were lined and 65% had groundwater monitoring. Further, the risk information available was limited, although we also noted that we expected that the limited number of damage cases identified in the Regulatory Determination was an underestimate. However, EPA did not conclude that the available information regarding the extent or nature of the risks were equivocal. However, the Agency noted that "* * * we identified a potential for risks from arsenic that we cannot dismiss * * *."[38] EPA further noted that "[i]n the absence of a more complete groundwater risk assessment, we are unable at this time to draw quantitative conclusions regarding the risks due to arsenic or other contaminants posed by improper waste management." Existing older units that lacked liners and groundwater monitoring (for surface impoundments, only 26% of all units had liners and only 38% of all units had groundwater monitoring) were the major risk drivers in the study.

As discussed in greater detail in section II.B, EPA has revised the draft quantitative risk assessment made available when it solicited public comment on the 1999 Report to Congress to account for the concerns raised by the public during the public comment period. The results of these risk analyses show that certain management practices—the disposal of both wet and dry CCRs in unlined waste management units, but particularly in unlined surface impoundments, and the prevalence of wet handling, can pose significant risks to human health and the environment from releases of CCR toxic constituents to ground water and surface water. The Agency has estimated that there are approximately 300 CCR landfills and 584 CCR surface impoundments or similar management units in use at roughly 495 coal-fired power plants. (Data also indicate that a small number of utilities dispose of CCRs off-site, typically near the generating utility.) Many of these units—particularly surface impoundments—lack liners and groundwater monitoring systems. EPA's revised CCR risk assessment[39] estimated the cancer risk from arsenic[40] that leaches into groundwater from CCRs managed in units without composite liners to exceed EPA's typical risk thresholds of 10^{-4} to 10^{-6}. For example, depending on various assumptions about disposal practices (*e.g.*, whether CCRs are co-disposed with coal refuse), groundwater interception and arsenic speciation, the 90th percentile risks from unlined surface impoundments ranged from 2×10^{-2} to 1×10^{-4}. The risks from clay-lined surface impoundments ranged from 7×10^{3} to 4×10^{-5}. Similarly, estimated risks from unlined landfills ranged between 5×10^{-4} to 3×10^{-6}, and

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[38] *See* 65 FR 32216 at *http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/ff2f-fr.pdf.*

[39] "Human and Ecological Risk Assessment of Coal Combustion Wastes," (April 2010).

[40] The risk estimates for arsenic presented in the revised risk assessment are based on the existing cancer slope factor of 1.5 mg/kg/d^{-1} in EPA's Integrated Risk Information System (IRIS). However, EPA is currently evaluating the arsenic cancer slope factor and it is likely to increase. In addition, the National Resources Council (NRC) of the National Academy of Sciences (NAS) made new recommendations regarding new toxicity information in the NRC document, "Arsenic in Drinking Water, 2001 Update." Using this NRC data analysis, EPA calculated a new cancer slope factor of 26 mg/kg/d^{-1} which would increase the individual risk estimates by about 17 times.

from 2×10^{-4} to 5×10^{-9} for clay-lined landfills. EPA's risk assessment also estimated HQs above 1 for other metals, including selenium and lead in unlined and clay-lined units. EPA also notes in this regard that recent research indicates that traditional leach procedures (*e.g.,* TCLP and SPLP) may underestimate the actual leach rates of toxic constituents from CCRs under different field conditions.

Recent events also have demonstrated that, if not properly controlled, these wastes have caused greater damage to human health and the environment than EPA originally estimated in its risk assessments. On December 22, 2008, a failure of the northeastern dike used to contain fly ash occurred at the dewatering area of the TVA's Kingston Fossil Plant in Harriman, Tennessee. Subsequently, approximately 5.4 million cubic yards of fly ash sludge was released over an approximately 300 acre area. The ash slide disrupted power, ruptured a gas line, knocked one home off its foundation and damaged others. A root-cause analysis report developed for TVA, accessible at *http://www.tva.gov/kingston/rca/index.htm,* established that the dike failed because it was expanded by successive vertical additions, to a point where a thin, weak layer of fly ash ('slime') on which it had been founded, failed by sliding. The direct costs to clean up the damage from the TVA Kingston incident are well into the billions, and is currently estimated to exceed $1.2 billion.[41]

Although the TVA spill was the largest, it was not the only damage case to involve impoundment stability. A smaller, but still significant incident occurred in August 2005, when a gate in a dam confining a 40-acre CCR surface impoundment in eastern Pennsylvania failed. The dam failure, a violation of the facility's state-issued solid waste disposal permit and Section 402 of the Clean Water Act, resulted in the discharge of 0.5 million cubic yards of coal-ash and contaminated water into the Oughoughton Creek and the Delaware River.

Moreover, documented cases of the type of damage that EPA originally identified to result from improper management of CCR have continued to occur, leading EPA to question whether the risks that EPA originally identified have been sufficiently mitigated since our May 2000 Regulatory Determination. As discussed in more detail below, and in materials contained in the docket, there is a growing record of proven damage cases to groundwater and surface water, as well as a large number of potential damage cases. Since the May 2000 Regulatory Determination, EPA has documented an additional 13 proven damage cases and 4 potential damage cases.

Further, recently collected information regarding the existing state regulatory programs[42] calls into question whether those programs, in the absence of national minimum standards, have sufficiently improved to address the gaps that EPA had identified in its May 2000 Regulatory Determination such that EPA can continue to conclude that in the absence of federal oversight, the management of these wastes will be adequate to protect human health and the environment. Many state regulatory programs for the management of CCRs, including requirements for liners and groundwater monitoring, are lacking, and while industry practices may be improving, EPA continues to see cases of inappropriate management or cases in which key protections (*e.g.,* groundwater monitoring at existing units) are absent. Although the joint DOE and EPA study entitled, Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994–2004, indicates that most new units appear to be better designed, in that they are lined and have installed groundwater monitoring systems, and therefore the total percentages of unprotected units have decreased, it appears that a large amount of waste is still being disposed into units that lack the necessary protections of liners, and groundwater monitoring. Furthermore, while corrective action has generally been taken at the proven damage cases, the RCRA regulatory program is designed to prevent contamination in the first place, if at all practicable, rather than one in which contamination is simply remedied after discovery.[43] This information also highlights that EPA still lacks details regarding the manner and degree to which states are regulating the management of this material. All of these factors emphasize the need for prompt federal rulemaking and have led EPA to reconsider its May 2000 Regulatory Determination.

In sum, as a result of the significant new information accumulated on two of the four considerations specifically identified in the May 2000 Regulatory Determination (65 FR 32218), the Agency has determined that reevaluation of its original conclusions in light of all of the RCRA Section 8002(n) study factors is necessary. Based on its consideration of these statutory factors, EPA has not yet reached a decision on whether to revise the Bevill Regulatory Determination. Rather, EPA has summarized the information available for each of the factors, and identifies those considerations on which EPA believes that critical information is lacking. Accordingly, EPA is soliciting further information and public input on each of these considerations that will factor into the Agency's determination as to whether regulation under RCRA subtitle C or D is warranted.

As stated previously and as fully explained in Section XII of today's proposal and in our Regulatory Impact Analysis, our proposed requirements for surface impoundment structural stability and conversion or retrofitting of units, will have substantial benefits in avoided future clean up costs.

B. RCRA Section 8002(n) Study Factors

Section 8002(n) of RCRA requires the Administrator to conduct a detailed and comprehensive study and submit a report on the adverse effects on human health and the environment, if any, of the disposal and utilization of fly ash waste, bottom ash waste, slag waste, flue gas emission control waste, and other by-product materials generated primarily from the combustion of coal or other fossil fuels. The study was to include an analysis of the eight factors required under section 8002(n) of RCRA. EPA addressed these study factors in the 1988 and 1999 Reports to

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[41] $3.0 billion is EPA's "social cost" estimate assigned in the April 2010 RIA to the December 2008 TVA Kingston, TN impoundment release event. Social cost represents the opportunity costs incurred by society, not just the monetary costs for cleanup. OMB's 2003 "Circular A–4: Regulatory Analysis" (page 18) instructs Federal agencies to estimate "opportunity costs" for purpose of valuing benefits and costs in RIAs. This $3.0 billion social cost estimate is larger than TVA's $933 million to $1.2 billion cleanup cost estimate (i.e., TVA's estimate as of 03 Feb 2010), because EPA's social cost estimate consists of three other social cost elements in addition to TVA's cleanup cost estimate: (a) TVA cleanup cost, (b) response, oversight and ancillary costs associated with local, state, and other Federal agencies, (c) ecological damages, and (d) local (community) socio-economic damages. Appendix Q to the April 2010 RIA provides EPA's documentation and calculation of these four cost elements, which total $3.0 billion in social cost.

[42] ASTSWMO Survey Conducted Feb.—Mar. 2009 (Excel spreadsheet) available in the docket for this proposal.

[43] As noted in Appendix I on Damage Cases, of the 16 proven cases of damages to groundwater, the Agency has been able to confirm that corrective actions have been completed in seven cases and are ongoing in the remaining nine cases. Corrective action measures at these CCR management units vary depending on site specific circumstances and include formal closure of the unit, capping, re-grading of ash and the installation of liners over the ash, groundwater treatment, ground-water monitoring, installation of a barrier wall, and combinations of these measures.

Congress. The findings of these two Reports to Congress were the basis for our decisions in the August 1993 and the May 2000 Regulatory Determinations to maintain the Bevill exemption for CCRs. In considering whether to retain or to reverse the August 1993 and May 2000 Regulatory Determinations regarding the Bevill exemption of CCRs destined for disposal, we have reexamined the RCRA section 8002(n) study factors against the data on which we made the May 2000 Regulatory Determination, as well as the most recent data we have available.

1. *Source and volumes of CCR generated per year:* In the mid-1990s, according to various sources, between 62 and 71 million tons of CCRs were generated by coal-fired electric power plants.[44] In comparison, much larger volumes are being generated now (primarily due to the increase in coal-fired power plants), with 136 million tons of CCRs generated by coal-fired electric power plants in 2008.[45]

2. *Present disposal and utilization practices:* In 2008, 34% (46 million tons) of CCRs were landfilled, 22% (29.4 million tons) were disposed into surface impoundments,[46] nearly 37% (50.1 million tons) were beneficially used (excluding minefill operations), and nearly 8% (10.5 million tons) were placed in mines. This compares to approximately 23% (26.2 million tons) landfilled, 46% (53.2 million tons) disposed of into surface impoundments, 23% beneficially used (excluding minefill operations), and 8% (9 million tons) placed in mines in 1995. Thus, while the overall volume of CCRs going to disposal in surface impoundments and landfills has remained relatively constant, the total volume going to surface impoundments has decreased, and the total volume going to landfills has increased.

The Agency has estimated that there are approximately 300 CCR landfills and 584 CCR surface impoundments or similar management units in use at roughly 495 coal-fired power plants. The age of the disposal units varies considerably. For example, while there are new surface impoundments, 75% are greater than 25 years old, with 10% being greater than 50 years old. Similarly, information from an EPRI survey used in the 1999 Report to Congress indicates that the average planned life expectancy of a landfill is approximately 31 years, with about 12% having planned life expectancy over 50 years (with one planning for over 100 years). Many of these units—particularly surface impoundments, lack liners and ground water monitoring systems. EPA has estimated that in 2004, 31% of the CCR landfills and 62% of the CCR surface impoundments lacked liners, and 10% of the CCR landfills and 58% of the CCR surface impoundments lacked groundwater monitoring.[47] In the mid-1990s, there were approximately 275 CCR landfills and 286 CCR surface impoundments in use.[48] EPA does not believe the increased number of surface impoundments identified in today's rule reflects an actual change of practice, but rather more stringent definitions, as well as possibly, the greater availability of more accurate information. For example, much of the increase in surface impoundments likely results from counting units that receive wastewater that has been in contact with even small amounts of coal ash, and thus includes many units which were not included in EPA's mid-1990 estimates.

a. *Existing State Regulatory Oversight.* The results of the joint DOE and EPA study entitled, Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994–2004 indicates that of the states evaluated in this report, state regulations have generally improved since 2000. In addition, it would appear that the industry itself is changing and improving its management practices. For example, all new surface impoundments and nearly all new landfills (97%) identified in the survey that were constructed between 1994 and 2004 were constructed with liners. Regarding the prevalence of groundwater monitoring at new units, the joint DOE/EPA study suggests that nearly all new landfills (98%) and most new surface impoundments (81%) constructed between 1994 and 2004 were constructed with groundwater monitoring systems. Moreover, the frequency of dry handling in landfills appears to have increased; approximately two-thirds of the new units are landfills, while the remaining one-third are surface impoundments. The number of new units from 1994 to 2004 was 56. Assuming that replacement continued at a rate of 5.6 per year since 2004, we would have an additional 34 new units, but it would still be decades at this rate to replace the large collection of older units.

The DOE/EPA study also identifies significant gaps that remain under existing state regulation. For example, only 19% (3 out of 19) of the surveyed surface impoundment unit permits included requirements addressing groundwater protection standards (*i.e.*, contaminant concentrations that cannot be exceeded) or closure/post-closure care, and only 12% (2 out of 12) of surveyed units were required to obtain bonding or financial assurance. The EPA/DOE report also concluded that approximately 30 percent of the net disposable CCRs generated is potentially entirely exempt from the state solid waste permitting requirements[49] (EPA/DOE Report at pages 45–46). For example, Alabama does not currently regulate CCR disposal under any state waste authority and does not currently have a dam safety program (although the state has an initiative to develop one). Texas (the largest coal ash producer) does not require permits for waste managed on-site.[50] Tennessee currently does not regulate surface impoundments under its waste authority, but is now reconsidering this, in light of the TVA spill. Finally, a number of states only regulate surface impoundments under Clean Water Act authorities, and consequently primarily address the risks from effluent discharges to navigable waters, but do not require liners or groundwater monitoring.

The Agency recognizes that these statistics may be difficult to interpret due to the limitations of the study. The study focused on only eleven states, which account for approximately half the CCRs generated in the U.S., and it may not address all of the existing regulatory requirements that states may or could impose through other authorities to control these units. As one example, the DOE/EPA report notes that four of the six states that do not require solid waste permits rely on other state authorities to regulate these units: "In

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[44] Cited in "Technical Background Document for the Report to Congress on Remaining Wastes from Fossil Fuel Combustion: Industry Statistics and Waste Management Practices," March 1999.

[45] ACAA (American Coal Ash Association). 2009. *2008 Coal Combustion Product (CCP) Production & Use Survey Report. http://acaa.affiniscape.com/associations/8003/files/2008 ACAA CCP Survey Report FINAL 100509.*

[46] Estimated from the 2009 ACAA survey and Energy Information Administration 2005 F767 Power Plant database.

[47] Estimated from the 1995 data reported in the May 2000 Regulatory Determination and the data for new units from 1994 to 2004 reported in the 2006 DOE/EPA report *"Coal Combustion Waste Management at Landfills and Surface Impoundments, 1994–2004."*

[48] Technical Background Document, Ibid.

[49] 38.7 million tons of out of 129 million tons generated CCRs (Based on DOE/EIA 2004 data).

[50] In Texas, on-site means the same or geographically contiguous property which may be divided by public or private rights-of-way, provided the entrance and exit between the properties is at a cross-roads intersection, and access is by crossing, as opposed to going along, the right-of-way. Noncontiguous properties owned by the same person but connected by a right-of-way which he controls and to which the public does not have access, is also considered on-site property. (Title 30 TAC 335.1)

Florida, if CCWs are disposed in an on-site landfill at a coal-fired electric generating plant authorized under the Florida Power Plant Siting Act (PPSA), no separate permits, including solid waste construction and operation permits, are required. Instead, the entire facility is covered under the PPSA certification, which will contain the same substantive requirements as would otherwise have been imposed by other permits." (EPA/DOE Report at page 46). The DOE/EPA report identified whether states tightened, relaxed, or were neutral with regard to program changes. From the time of the 1999 Report to Congress to 2005, most all programs were neutral, with a couple of programs tightening requirements and none relaxing requirements. Going back to the period of the 1988 Report to Congress to 2005, two states (Alabama and Florida) are reported to have relaxed portions of their standards, while not tightening any other portions of their program. Part of the difficulty in interpreting this information stems from the fact that the survey responses contained little or no details of the state requirements; rather, the responses merely indicated (by checking a box) whether states imposed some sort of requirement relating to the issue. Consequently, the Agency lacks detailed information on the content of the requirements, and whether, for example, performance based requirements or other state programs are used to address the risks from these units. EPA also received detailed comments on this report authored by several environmental groups, who criticized several of the general conclusions. These comments are included in the rule docket (*see* comment attachment submitted by Marty Rustan on behalf of Lisa Evans, Attorney, Earthjustice; EPA–HQ–RCRA–2006–0796–0446.5).

A more recent survey conducted by the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) seems to support the view that the states still have not yet adequately implemented regulatory programs over CCR management units, although like the DOE/EPA study, it lacks details on the substance of the state requirements. According to a 2009 ASTSWMO survey of states with coal ash generation [51] (available in the docket), of the 42 states with coal fired utilities, at least 36 have permit programs for landfills used to manage CCRs, and of the 36 states that have CCR surface impoundments, 25 have permit programs. Permitting is particularly important to provide oversight and to approve implementation plans such as the placement of groundwater monitoring wells. Without a state permit program, regulatory flexibility is limited, and certification by an independent registered professional engineer is necessary. With regard to liner requirements, 36% (15 of the 42 states that responded to this question) do not have minimum [52] liner requirements for CCR landfills, while 67% (24 of the 36 states that responded to this question) do not have CCR liner requirements for surface impoundments. Similarly, 19% (8 of the 42 states that responded to this question) do not have minimum groundwater monitoring requirements for landfills and 61% (22 of the 36 states that responded to this question) do not have groundwater monitoring requirements for surface impoundments.[53] These findings are particularly significant as groundwater monitoring for these kinds of units is a minimum for any credible regulatory regime. The 2009 ASTSWMO survey also indicates that only 36 percent of the states regulate the structural stability of surface impoundments, and only 31 percent of the states require financial assurance for surface impoundments. Because structural stability of surface impoundments is largely regulated by state dam safety programs which are separate from state solid waste programs, EPA recognizes that information from the dam safety programs would be a much more meaningful measure of state regulation of the structural stability of surface impoundments, and solicits such information.

Thus, while the states seem to be regulating landfills to a greater extent, given the significant risks associated with surface impoundments, these results suggest that there continue to be significant gaps in state regulatory programs for the disposal of CCRs. (*See* Letter from ASTSWMO to Matt Hale dated April 1, 2009, a copy of which is in the docket to today's proposed rule for complete results of the survey.)

EPA is also aware of some additional information from ASTSWMO. There are 15 states (Colorado, Florida, Indiana, Iowa, Kansas, Kentucky, Maryland, Minnesota, Mississippi, Montana, New York, North Carolina, Ohio, Pennsylvania, and Virginia) that were considering changes to their CCR regulations at the time of the ASTSWMO survey (February 2009). In late November 2009, ASTSWMO also identified 15 states (Arizona, Delaware, Georgia, Idaho, Iowa, Kansas, Louisiana, Maryland, Mississippi, North Dakota, South Carolina, Tennessee, Washington, Wisconsin, and West Virginia) that had revised their CCR requirements since 2000. Finally, ASTSWMO identified 8 states (Georgia, Illinois, Indiana, Iowa, Montana, Ohio, Pennsylvania, and South Carolina) which are requiring groundwater monitoring at existing facilities that previously did not have groundwater monitoring.

Several issues complicate this assessment, however. As noted previously, EPA lacks any real details regarding how states, in practice, oversee the management of these materials when treated as wastes. For example, some states may use performance based standards or implement requirements to control CCR landfills and surface impoundments under other state programs. Also, most of the new data primarily focuses on the requirements applicable to *new* management units, which represent approximately 10% of the disposal units. EPA has little, if any information, that describes the extent to which states and utilities have implemented requirements—such as groundwater monitoring, for existing units, for the many landfills and surface impoundments that receive CCRs. The information currently in the record with respect to existing units is fifteen years old. EPA expects that it would be unlikely that states would have required existing units to install liners, states would have been more likely to have imposed groundwater monitoring for such units over the last 15 years. Finally, as discussed in the next section, the fact that many of the surface impoundments are located adjacent to water bodies—which is not accounted for in EPA's groundwater risk assessment—may affect our assessment of the extent of the liner and groundwater monitoring requirements that would be necessary. Therefore, EPA solicits detailed comments specifically on the current management practices of state programs, not only under state waste authorities, but under other authorities as well. The adequacy of state regulation is one of the key issues before the Agency, as it will address some of the more significant questions remaining regarding the extent of the

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[51] ASTSWMO Survey Conducted Feb.–Mar. 2009 (Excel spreadsheet).

[52] For both landfills and surface impoundments, most of the states that responded to questions addressing their liner and groundwater monitoring program provisions had less stringent requirements, e.g., allowing variance, exemption, or a case-by-case evaluation. In the absence of state-specific information, we are unable to translate these statistics into a concrete number of affected waste units.

[53] Additionally, the July 2009 Petition pointed out deficiencies in state regulatory programs.

risks presented by the disposal of CCRs. Accordingly, the Agency specifically solicits information, whether from state regulatory authorities or from members of the public, regarding details on the entire state regulatory structure, including the specific requirements that states have in place to regulate CCRs, and to provide oversight of these units. EPA would also welcome more detailed information regarding the states' historic practice in implementing its existing requirements, including for example, the states' record of enforcement and its practice in providing for public participation in the development and implementation of any existing permitting requirements. EPA is particularly interested in information on the extent to which states have implemented requirements applicable to the older, existing units, which represent the majority of the units into which CCRs are currently disposed (approximately 90%). EPA also requests information on the extent to which EPA's current information adequately reflects changes in industry practices, adopted independent of state requirements.

b. *Beneficial Use.* In the May 2000 Regulatory Determination, EPA stated: "The Agency has concluded that no additional regulations are warranted for coal combustion wastes that are used beneficially (other than for minefilling) and for oil and gas combustion wastes. We do not wish to place any unnecessary barriers on the beneficial use of fossil fuel combustion wastes so that they can be used in applications that conserve natural resources and reduce disposal costs." (65 FR 32214) (*See* separate discussion regarding minefilling in section IV. E of this preamble.) EPA identified specific beneficial uses as covered by the May 2000 determination. In particular, EPA stated that: "Beneficial purposes include waste stabilization, beneficial construction applications (*e.g.,* cement, concrete, brick and concrete products, road bed, structural fill, blasting grit, wall board, insulation, roofing materials), agricultural applications (*e.g.,* as a substitute for lime) and other applications (absorbents, filter media, paints, plastics and metals manufacture, snow and ice control, waste stabilization)." (*See* 65 FR 32229) These beneficial uses are described in more detail in EPA's Report to Congress on Wastes from the Combustion of Fossil Fuels in March 1999 (*see* Volume 2, Section 3.3.5).

Since EPA's Regulatory Determination in May 2000, there has been a significant increase in the use of CCRs and the development of established commercial sectors that utilize and depend on the beneficial use of CCRs. Additional uses have been identified; for example, the use of CCRs as ingredients in specific products, such as resin-bound products or mineral filler in asphalt. New applications of CCRs have been developed, which may hold great green house gas (GHG) benefits (for example, fly ash bricks and a process to use CO_2 emissions to produce cement). Further, EPA expects that uses could shift in the future because the composition and characteristics of CCRs are likely to change due to the addition of new air pollution controls at coal-fired utilities. (*See* section IV. D. below for a more detailed discussion on the beneficial use of CCRs.)

3. Potential danger, if any, to human health and the environment from the disposal and reuse of CCRs:

a. *From Disposal.* The contaminants of concern in CCRs include antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver and thallium. Potential human exposure pathways for these contaminants from the disposal of CCRs are ground water ingestion, inhalation, and the consumption of fish exposed to contaminants. Ecological impacts include surface water contamination, contamination of wetlands, and aquatic life exposure to contaminants of concern. As discussed in section II. B, V., and the Regulatory Impact Analysis, the risks modeled for the 2010 risk assessment often exceeded EPA's typical regulatory levels of concern. With very few exceptions, the risks modeled for the 2010 risk assessment correspond with ground water exceedances of constituents observed in EPA's damage case assessments (*e.g.,* arsenic, boron, cadmium, lead, molybdenum, and selenium were modeled and found to exceed the risk criteria in at least some instances, and were also found in at least some of the damage cases). Additionally, as discussed in section I.F.2, the potential exists for the chemical characteristics of certain CCRs (*e.g.,* fly ash and FGD) to increase, which could result in increases in releases from management units, particularly if such wastes are placed in old unlined units, as a result of the increased use and application of advanced air pollution control technologies in coal-fired power plants. Further details on the results of EPA's quantitative groundwater risk assessment, and the technical issues that remain to be addressed, and on the unquantified human and ecological risks can be found in section II and in the Regulatory Impact Analysis for today's proposal.

EPA also conducted a population risk assessment for the groundwater-arsenic pathway, as a complement to the individual risk analysis. While the RCRA program necessarily focuses on individual risks, and individual risks have been the basis of previous Bevill and hazardous waste determinations, the population risk estimate provides perspective, and was used to develop the Agency's cost benefit analyses of different regulatory approaches (discussed in section XII.A of this preamble). In this analysis, EPA calculated a best estimate that current risks from arsenic via the groundwater used as drinking water pathway are 2,509 total excess cancers, over a 75-year period.[54] (A 75-year period was used in this analysis to capture peak risk while the RIA generally covers 50 years.) These estimates are based on a cancer slope factor which represents the most recent science derived from a 2001 National Resources Council review of arsenic toxicity. It should be noted that the analysis did not include risks from other pathways or constituents, as explained in section 5A of the Regulatory Impact Analysis for this proposal.

Of the approximately 584 surface impoundments currently operating in the United States, a certain percentage of these have a great potential for loss of human life and environmental damage in the event of catastrophic failure. Based on the information collected from EPA's recent CERCLA 104(e) information request letters 109 impoundments have either a high or significant hazard potential rating,[55] thirteen of which were not designed by a professional engineer. Of the total universe of surface impoundments, approximately 186 of these units were not designed by a professional engineer. Surface impoundments are generally designed to last the typical operating life of coal-fired boilers, on the order of 40 years. However, many impoundments are aging: 56 units are older than 50 years, 96 are older than 40 years, and 340 are between 26 and 40 years old. In recent years, problems have continued to arise from these units, which appear to be related to the aging infrastructure, and the fact that many units may be nearing the end of

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[54] Chapter 5, Page 121 of the Regulatory Impact Analysis for this proposal.

[55] 429 of these impoundments currently have no rating. Thus, the Agency expects the number of surface impoundments with a high or significant hazard rating may increase as additional impoundments are assigned ratings. See the definitions in the Summary section of this notice for the definitions of high and significant hazard potential.

their useful lives. For example, as a result of the administrative consent order issued after the December 2008 spill, TVA conducted testing which showed that another dike at TVA's Kingston, Tennessee plant had significant safety deficiencies. Further, in response to EPA's CERCLA 104(e) information request letter, a total of 35 units at 25 facilities reported historical releases. These range from minor spills to a spill of 0.5 million cubic yards of water and fly ash. Additional details regarding these releases can be found in the docket for this rulemaking. EPA continues its assessments of CCR surface impoundments. The most recent information on these can be found on EPA's internet site at *http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/surveys2/index.htm#surveyresults.*

b. *From Beneficial Use.* The risks associated with the disposal of CCRs stem from the specific nature of that activity and the specific risks it involves; that is, the disposal of CCRs in (often unlined) landfills or surface impoundments, with hundreds of thousands, if not millions, of tons placed in a single concentrated location. And in the case of surface impoundments, the CCRs are managed with water, under a hydraulic head, which promotes more rapid leaching of contaminants into neighboring groundwater than do landfills. The beneficial uses identified as excluded under the Bevill amendment for the most part present a significantly different picture, and a significantly different risk profile.

In 1999 EPA conducted a risk assessment of certain agricultural uses of CCRs,[56] since the use of CCRs in this manner was considered the most likely to raise concerns from a human health and environmental point of view. EPA's risk assessment estimated the risks associated with such uses to be within the range of 1×10^{-6}. The results of the risk assessment, as well as EPA's belief that the use of CCRs in agricultural settings was the most likely use to raise concerns, resulted in EPA concluding that none of the identified beneficial uses warranted federal regulation, because "we were not able to identify damage cases associated with these types of beneficial uses, nor do we now believe that these uses of coal combustion wastes present a significant risk to human health or the environment." (65 FR 32230, May 22, 2000.) EPA also cited the importance of beneficially using secondary materials and of resource conservation, as an alternative to disposal.

To date, EPA has still seen no evidence of damages from the beneficial uses of CCRs that EPA identified in its original Regulatory Determination. For example, there is wide acceptance of the use of CCRs in encapsulated uses, such as wallboard, concrete, and bricks because the CCRs are bound into products. The Agency believes that such beneficial uses of CCRs offer significant environmental benefits.

As we discuss in other sections of this preamble, there are situations where large quantities of CCRs have been used indiscriminately as unencapsulated, general fill. The Agency does not consider this a beneficial use under today's proposal, but rather considers it waste management.

Environmental Benefits

The beneficial use of CCRs offers significant environmental benefits, including greenhouse gas (GHG) reduction, energy conservation, reduction in land disposal (*i.e.*, avoidance of potential CCR disposal impacts), and reduction in the need to mine and process virgin materials and the associated environmental impacts. Specifically:

Greenhouse Gas and Energy Benefits. The beneficial use of CCRs reduces energy consumption and GHG emissions in a number of ways. One of the most widely recognized beneficial applications of CCRs is the use of coal fly ash as a substitute for Portland cement in the manufacture of concrete. Reducing the amount of cement produced by beneficially using fly ash as a substitute for cement leads to large supply chain-wide reductions in energy use and GHG emissions.[57] For example, fly ash typically replaces between 15 and 30 percent of the cement in concrete, although the percentages can and have been higher. However, assuming a 15 to 30 percent fly ash to cement replacement rate, and considering the approximate amount of cement that is produced each year, would result in a reduction of GHG emissions by approximately 12.5 to 25 million tons of CO_2 equivalent and a reduction in oil consumption by 26.8 to 53.6 million barrels of oil.[58] This estimate is likely to underestimate the total benefits that can be achieved. As an added benefit, the use of fly ash generally makes concrete stronger and more durable. This results in a longer lasting material, thereby marginally reducing the need for future cement manufacturing and corresponding avoided emissions and energy use.

Benefits From Reducing the Need To Mine and Process Virgin Materials. CCRs can be substituted for many virgin materials that would otherwise have to be mined and processed for use. These virgin materials include limestone to make cement, and Portland cement to make concrete; mined gypsum to make wallboard, and aggregate, such as stone and gravel for uses in concrete and road bed. Using virgin materials for these applications requires mining and processing them, which can impair wildlife habitats and disturb otherwise undeveloped land. It is beneficial to use secondary materials—provided it is done in an environmentally sound manner—that would otherwise be disposed of, rather than to mine and process virgin materials, while simultaneously reducing waste and environmental footprints. Reducing mining, processing and transport of virgin materials also conserves energy, avoids GHG emissions, and reduces impacts on communities.

Benefits From Reducing the Disposal of CCRs. Beneficially using CCRs instead of disposing of them in landfills and surface impoundments also reduces the need for additional landfill space and any risks associated with their disposal. In particular, the U.S. disposed of over 75 million tons of CCRs in landfills and surface impoundments in 2008, which is equivalent to the space required of 26,240 quarter-acre home sites under 8 feet of CCRs.

While the Agency recognizes the need for regulations for the management of CCRs in landfills and surface impoundments, we strongly support the beneficial use of CCRs in an environmentally sound manner because of the significant environmental benefits that accrue both locally and globally. As discussed below in section XII.A, the current beneficial use of CCRs as a replacement for industrial raw materials (*e.g.*, Portland cement, virgin stone aggregate, lime, gypsum) provides substantial annual life cycle environmental benefits for these industrial applications. Specifically,

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[56] 1998 Draft Final Report; Non-groundwater Pathways, Human Health and Ecological Risk Analysis for Fossil Fuel Combustion Phase 2 (FFC2) and its appendices (A through J); available at *http://www.epa.gov/osw/nonhaz/industrial/special/fossil/fsltech.htm.*

[57] Waste and Materials-Flow Benchmark Sector Report: Beneficial Use of Secondary Materials—Coal Combustion Products, February 12, 2008.

[58] Avoided GHG and energy saving estimates based on energy and environmental benefits estimates in the EPA report entitled, "Study on Increasing the Usage of Recovered Mineral Components in Federally Funded Projects Involving Procurement of Cement or Concrete" available at *http://www.epa.gov/osw/conserve/tools/epg/pdf/rtc/report4-08.pdf.*

beneficially using CCRs as a substitute for industrial raw materials contributes (a) $4.89 billion per year in energy savings, (b) $0.081 billion per year in water savings, (c) $0.239 billion per year in GHG[59] (*i.e.*, carbon dioxide and methane) emissions reduction, and (d) $17.8 billion per year in other air pollution reduction. In addition, these applications also result in annual material and disposal cost savings of approximately $2.93 billion. All together, the beneficial use of CCRs provides $25.9 billion in annual national economic and environmental benefits (relative to 2005 tonnage).[60]

However, as discussed in the next section, there are cases where large quantities of CCRs have been "used" indiscriminately as unencapsulated "fill," *e.g.*, to fill sand and gravel pits or quarries, or as general fill (*e.g.*, Pines, Indiana and the Battlefield Golf Course in Chesapeake, Virginia[61]). Although EPA does not consider these practices to be legitimate beneficial uses, others classify them as such. In any case, EPA has concluded that these practices raise significant environmental concerns.

4. *Documented cases in which danger to human health or the environment from surface runoff or leachate has been proved:* As described previously, EPA has identified 27 proven damage cases: 17 cases of damage to groundwater, and ten cases of damage to surface water, seven of which are ecological damage cases. Sixteen of the 17 proven damage cases to groundwater involved disposal in unlined units—for the one additional unit, it is unknown whether there was a liner. We have also identified 40 potential damage cases to groundwater and surface water. These numbers compare to 14 proven damage cases and 36 potential cases of damage when the Agency announced its Regulatory Determination in May 2000. The Agency believes that these numbers likely underestimate the number of proven and potential damage cases and that it is likely that additional cases of damage would be found if a more comprehensive evaluation was conducted, particularly since much of this waste has been (and continues to be) managed in unlined disposal units.

Several of the new damage cases involve activities that differ from prior damage cases, which were focused on groundwater contamination from landfills and surface impoundments. These new cases present additional risk concerns that EPA did not evaluate in the May 2000 Regulatory Determination. Specifically, some of the recent proven damage cases involved the catastrophic release due to the structural failure of CCR surface impoundments, such as the dam failures that occurred in Martins Creek, Pennsylvania and Kingston, Tennessee.

In addition, a number of proven damage cases involve the large-scale placement, akin to disposal, of CCRs, under the guise of "beneficial use." The "beneficial use" in these cases involved the filling of old, unlined quarries or gravel pits, or the regrading of landscape with large quantities of CCRs. For example, the 216-acre Battlefield Golf Course was contoured with 1.5 million yards of fly ash to develop the golf course. In late 2008, groundwater and surface water sampling was conducted. There were exceedances of primary drinking water standards in on-site groundwater for contaminants typically found in fly ash. In addition, there were exceedances of secondary drinking water standards in both on-site and off-site groundwater (in nine residential wells); however, the natural levels of both manganese and iron in the area's shallow aquifer are very high (0.14 mg/L to 0.24.mg/L and 5.0 mg/L to 13.0 mg/L, respectively), and, thus, it could not be ruled out that the elevated levels of manganese and iron are a result of the natural background levels of these two contaminants. Surface water samples showed elevated levels of aluminum, chromium, iron, lead, manganese, and thallium in one or more on-site samples. The lone off-site surface water sample had elevated levels of aluminum, iron, and manganese. In April 2010 EPA issued a Final Site Inspection Report[62] which concluded that (i) metals contaminants were below MCLs and Safe Drinking Water Act action levels in all residential wells that EPA tested; (2) the residential well data indicate that metals are not migrating from the fly ash to residential wells; and (iii) there are no adverse health effects expected from human exposure to surface water or sediments on the Battlefield Golf Course site as the metal concentrations were below the ATSDR standards for drinking water and soil. Additionally, the sediments samples in the ponds were below EPA Biological Technical Assistance Group screening levels and are not expected to pose a threat to ecological receptors. Similarly, beginning in 1995, the BBBS sand and gravel quarries in Gambrills, Maryland, used fly ash and bottom ash from two Maryland power plants to fill excavated portions of two sand and gravel quarries. Groundwater samples collected in 2006 and 2007 from residential drinking water wells near the site indicated that, in certain locations, contaminants, including heavy metals and sulfates, were present at or above groundwater quality standards. Private wells in 83 homes and businesses in areas around the disposal site were tested. MCLs were exceeded in 34 wells [arsenic (1), beryllium (1), cadmium (6), lead (20),[63] and thallium (6)]. SMCLs were exceeded in 63 wells [aluminum (44), manganese (14), and sulfate (5)]. The state concluded that leachate from the placement of CCRs at the site resulted in the discharge of pollutants to waters of the state.

Further details on these additional damage cases are provided in section II. C (above), and in the Appendix to this notice.

As mentioned in section II.C, during the development of this proposal, EPA received new reports from industry and citizen groups regarding damage cases. Industry provided information that, they suggested, shows that many of EPA's listed proven damage cases do not meet EPA's criteria for a damage case to be proven. On the other hand, citizen groups recently identified additional alleged damage cases. The Agency has not yet had an opportunity to evaluate this additional information. EPA's analysis, as well as the additional information from industry and citizen groups, all of which is available in the docket to this proposed rule, would

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[59] The RIA monetizes the annual tonnage of greenhouse gas effects associated with the CCR beneficial use life cycle analysis, based on the 2009 interim social cost of carbon (i.e., interim SCC) of Table III.II.6–3, page 29617 of the joint EPA and DOT–NHTSA "Proposed Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards," **Federal Register**, Volume 74, No. 186, 28 Sept 2009. The value applied in the RIA is the $19.50 per ton median value from the $5 to $56 per ton range displayed in the 2007 column in that source. Furthermore, the RIA updated the 2007$ median value from 2007 to 2009 dollars using the NASA Gross Domestic Product Deflator Inflation Calculator at *http://cost.jsc.nasa.gov/inflateGDP.html*. EPA is aware that final SCC values were published on March 9, 2010 in conjunction with a Department of Energy final rule. EPA intends to use the final SCC values for the CCR final rule RIA. The final SCC values are published in the Department of Energy, Energy Efficiency & Renewable Energy Building Technologies Program, "Small Electric Motors Final Rule Technical Support Document: Chapter 16—Regulatory Impact Analysis," March 9, 2010 at *http://www1.eere.energy.gov/buildings/appliance_standards/commercial/sem_finalrule_tsd.html*).

[60] These benefits estimates are further discussed in Chapter 5C of the RIA which is available in the docket for this proposal.

[61] These instances are associated with 7 proven damage cases and 1 potential damage case.

[62] *http://www.epa.gov/reg3hwmd/CurrentIssues/finalr-battlefield_golf_club_site/redacted_DTN_0978_Final_Battlefield_SI_Report.pdf.*

[63] It is uncertain whether lead exceedances were due to CCRs or lead in the plumbing and water holding tanks.

benefit from public input and further review, in the interest of reaching a more complete understanding of the nature and number of damage cases. EPA encourages commenters to consider all of these analyses in developing their comments.

5. *Alternatives to current disposal methods:* There are no meaningful disposal alternatives other than land disposal. Improved disposal management practices are practical (*e.g.*, liners, groundwater monitoring, dust control), although EPA has not identified meaningful or practical treatment options prior to disposal, other than dewatering. (There are, however, available technologies, or technologies under development, to process CCRs now likely destined for disposal so that they can effectively be converted to appropriate beneficial uses.) The beneficial use of these materials as products continues to be an important alternative to disposal.

6. *The cost of such alternative disposal methods:* The Agency has estimated the nationwide costs to the electric utility industry (or to electric rate payers) for each alternative considered for this proposal. These estimates are discussed in the regulatory impact analysis presented within section XII.A of this preamble.

7. *The impact of the alternative disposal methods on the use of coal and other natural resources:* The alternative disposal methods mentioned above are not expected to impact the use of coal or other natural resources. However, we would note that some surface impoundments at coal-fired utilities are also used as wastewater treatment systems for other non-CCR wastewaters. Therefore, if facilities switch from wet to dry handling of CCRs, construction of alternative wastewater treatment systems could become necessary for other non-CCR wastewaters, especially if they involved acidic wastes that are currently neutralized by the coal ash. (Note that the issue of beneficial uses of CCRs is discussed below; if the effect of a subtitle C approach is to increase beneficial uses, it could lead to a decrease in the use of virgin materials like ingredients in cement making, aggregate, mined gypsum, etc. On the other hand, if the effect of that approach were to decrease beneficial uses, as some commenters suggested, it would have the opposite effect on the use of natural resources.)

8. *The current and potential utilization of CCRs:* In 2008, nearly 37% (50.1 million tons) of CCRs were beneficially used (excluding minefill operations) and nearly 8% (10.5 million tons) were placed in minefills. (This compares to 23% of CCRs that were beneficially used, excluding minefilling, at the time of the May 2000 Regulatory Determination, and represents a significant increase.)

Parties have commented that any regulation of CCRs under RCRA subtitle C will impose a crippling stigma on their beneficial use, and eliminate or significantly curtail these uses, even if EPA were to regulate only CCRs destined for disposal, without modifying the regulatory status of beneficial reuse. On the other hand, other parties have commented that increasing the cost of disposal of CCRs through regulation under subtitle C will actually increase their usage in non-regulated beneficial uses, simply as a result of the economics of supply and demand. States, at the same time, have commented that, by operation of state law, the beneficial use of CCRs would be prohibited under the states' beneficial use programs, if EPA designated CCRs as hazardous waste when disposed of in landfills or surface impoundments. At the time of the May 2000 Regulatory Determination, commenters had raised this similar concern, and without agreeing that regulation under RCRA subtitle C would necessarily affect the beneficial reuse of this material, EPA nevertheless strongly expressed concern that beneficial use not be adversely affected.

EPA is interested in additional information supporting the claims that "stigma" will drive people away from the use of valuable products, or that states will prohibit the reuse of CCRs under their beneficial use programs if EPA regulates any aspect of CCR management under subtitle C. Specifically, the Agency requests that commenters provide analyses and other data and information that demonstrate this to be the case. To date, we have received statements and declarations that regulation under subtitle C will have devastating effects on beneficial uses of CCRs. In addition, for those commenters who suggest that regulating CCRs under subtitle C of RCRA would raise liability issues, EPA requests that commenters describe the types of liability and the basis, data, and information on which these claims are based. The issue of beneficial use and stigma are more fully discussed in section VI, where we discuss the alternative of regulating CCRs under subtitle C of RCRA. EPA would also be interested in suggestions on methods by which the Agency could reduce any stigmatic impact that might indirectly arise as a result of regulation of CCRs destined for disposal as a "special" waste under RCRA subtitle C.

C. Preliminary Bevill Conclusions and Impact of Reconsideration

The Agency is proposing two different approaches to regulating CCRs: Regulation as a "special" waste listed under RCRA subtitle C if EPA decides to lift the Bevill exemption with respect to disposal; and regulation as a solid waste under RCRA subtitle D, if the Bevill exemption is retained for disposal. Under both of these approaches, requirements for liners and groundwater monitoring would be established, although there are differences with respect to the other types of requirements that can be promulgated by EPA under RCRA subtitle C and D. In addition, as discussed in greater detail below, one of the primary differences between the various approaches relates to the degree and extent of federal oversight, as this varies considerably between the alternatives. As noted previously, EPA has not yet reached a decision on whether to regulate CCRs under RCRA subtitle D or C, but continues to evaluate each of these options in light of the 8002(n) factors.

In determining the level of regulation appropriate for the management of CCRs, several considerations weigh heavily with the Agency; information on these issues will therefore be important for commenters to consider as they prepare their comments. One particularly critical question relates to the extent of the risks posed by the current management of this material, along with the corresponding degree of Federal oversight and control necessary to protect human health and the environment. As discussed in the preceding sections, since EPA's Regulatory Determination in May 2000, new information has called into question EPA's original assessment of the risks posed by the current management of CCRs that are disposed of. In summary, this includes (1) The results of EPA's 2010 risk assessment, which indicates that certain management practices—particularly units without composite liners and the prevalence of wet handling can pose significant risks; (2) the growing record of proven damage cases to ground water and surface water, as well as a large number of potential damage cases; (3) recent events, which have demonstrated that these wastes have caused greater damage to human health and the environment than originally estimated (*i.e.*, catastrophic environmental impacts from surface impoundment breaches, and damage resulting from "sham beneficial uses"); and (4) questions regarding the adequacy of state regulatory programs for the management of CCRs, as many states appear to lack key protective requirements for liners and groundwater monitoring and a permitting program to ensure that such provisions are being properly implemented, even though overall industry practices appear to be improving. All of these considerations illustrate that in many cases CCRs have not been properly managed. The question is whether federal regulation is more appropriate under subtitle C or subtitle D of RCRA.

Several significant uncertainties remain with respect to all of the identified considerations. For example, as discussed previously, the data and analyses associated with this proposal are complex, and several uncertainties remain in EPA's quantitative risk analysis. One of these uncertainties is the evolving character/composition of CCRs due to electric utility upgrades and retrofits needed to comply with the emerging CAA requirements, which could present new or otherwise unforeseen contaminant issues (*e.g.,* hexavalent chromium from post-NO_X controls). Other uncertainties relate to the extent to which some sampled data with high concentrations used in the risk assessment accurately reflect coal ash leaching from landfills or surface impoundments, and the extent to which releases from surface impoundments located in close proximity to water bodies intercept drinking water wells. For example, as explained earlier in the preamble, some data reflected pore water taken in the upper section of a surface impoundment where coal refuse was placed. There were acid generating conditions and high concentrations of arsenic, but the data demonstrated that the underlying coal ash neutralized the acid conditions and greatly reduced the arsenic which leached from the bottom of the impoundment. There are also technical issues associated with releases from surface impoundments located in close proximity to water bodies which intercept drinking water wells. For example, surface impoundments are commonly placed next to rivers, which can intercept the leachate plume and prevent contamination of drinking water wells on the other side of the river. Also, in such circumstances the direction of groundwater flow on both sides of the river may be towards the river; thus, the drinking water well on the opposite side of a river may not be impacted.

As mentioned previously, EPA has received additional reports on damage cases, one from industry and one from citizen groups. Closer analyses of these reports could have the potential to significantly affect the Agency's conclusions.

An equally significant component of the overall picture, if not more so, relates to how effectively state regulatory programs address the risks associated with improper management of this material. As discussed earlier in this preamble, the continued damage cases and the reports on state regulatory programs call into question whether the trend in improving state regulatory regimes that EPA identified in May 2000 has materialized to the degree anticipated in the Regulatory Determination. Although recent information indicates that significant gaps remain, EPA continues to lack substantial details regarding the full extent of state regulatory authority over these materials, and the manner in which states have in practice, implemented this oversight. Nevertheless, based on the information made available on state programs, the Agency is reticent to establish a regulatory program without any federal oversight. Thus, EPA seeks additional details on regulation of CCRs by states to ensure that EPA's understanding of state programs is as complete as possible. While EPA recognizes that the extent of regulation of CCRs varies between states, EPA is not yet prepared to draw overall conclusions on the adequacy of state programs, as a general matter. EPA is, therefore, requesting that commenters, and particularly state regulatory authorities, provide detailed information regarding the extent of available state regulatory authorities, and the manner in which these have been, and are currently implemented. In this regard, EPA notes that "survey" type information that does not provide these details is unlikely to be able to resolve the concerns arising from the recent information developed since the May 2000 Regulatory Determination. EPA is also soliciting comments on the extent to which the information currently available to the Agency reflects current industry practices at both older and new units. For example, EPA would be particularly interested in information that indicates how many facilities currently have groundwater monitoring systems in place, how those systems are designed and monitored, and what, if anything, they have detected.

EPA has identified several issues that will be relevant as it continues to evaluate the overall adequacy of state regulatory programs. Specifically, EPA intends to consider how state regulatory programs have, in practice, evaluated and imposed requirements to address: (1) Leachate collection; (2) groundwater monitoring; (3) whether a unit must be lined, and the type of liner needed; (4) the effectiveness of existing management units as opposed to new management units; (5) whether the state requires routine analysis of CCRs; (6) whether financial responsibility requirements are in place for the management of CCRs; (7) the extent of permit requirements, including under what authorities these disposal units are permitted, the types of controls that are included in permits, and the extent of oversight provided by the states, (8) whether state programs include criteria for siting new units; (9) the extent of requirements for corrective action, post-closure monitoring and maintenance; (10) the state's pattern of active enforcement and public involvement; and (11) whether or not these facilities have insurance against catastrophic failures.

Directly related to the level of risk presented by improper management of CCRs, EPA is also weighing the differing levels of Federal oversight and control, and the practical implementation challenges, associated with the level and type of regulation under RCRA subtitles C and D. In the interest of furthering the public understanding of this topic, EPA presents an extensive discussion of the differences and concerns raised between regulation under subtitles C and D of RCRA, including a comparison of the advantages and disadvantages of each.

The subtitle C approach proposed today would provide full national cradle-to-grave control over CCRs destined for disposal, consistently managed under federally enforceable standards and through federal permits, or permits issued by the states that EPA has authorized to regulate CCRs in lieu of EPA. Permits can be a particularly important mechanism, because they allow the regulatory Agency to scrutinize the design of disposal units and the management practices of the permit applicant. They also allow the regulator to tailor the permit conditions to the facility site conditions, including the ability to impose additional specific conditions where it deems current or proposed facility practices to be inadequate to protect human health or the environment, pursuant to the omnibus authority in RCRA section 3005(c). Additionally, permitting processes provide the public and the local community the opportunity to participate in regulatory decisions. The combined requirements under subtitle C would effectively phase-out all wet handling of CCRs and prohibit the disposal of CCRs in surface impoundments. Moreover, the subtitle C approach is the only approach that allows direct federal enforcement of the rule's requirements. The many damage cases, including more recent damage cases, suggest the value of control and oversight at the federal level.

At the same time, EPA acknowledges concerns with a subtitle C approach on the part of states, the utilities, and users of CCR-derived products. The states have expressed concern that any federal approach, including a subtitle D approach, has the potential to cause disruption to the states' implementation of CCR regulatory programs under their own authority. For example, the state of Maryland has recently upgraded its disposal standards for CCRs under its state solid waste authority, and the new state regulations address the major points in today's proposal (except the stability requirement for impoundments and the prohibition against surface impoundments). The state has expressed concern about having to revise its regulations again, and re-permit disposal units under subtitle C of RCRA. A subtitle D approach, as described in today's proposal, would eliminate or significantly reduce these concerns. EPA acknowledges these concerns, and certainly does not wish to force the states to go through unnecessary process steps. EPA nevertheless solicits comment on this issue, including more specifics on the potential for procedural difficulties for state programs, and measures that EPA might adopt to try to mitigate these effects.

Two additional substantive concerns with regulation of CCRs under subtitle C have been raised by commenters: the effect of listing CCRs as hazardous waste under RCRA on beneficial uses, and the availability of existing subtitle C landfill capacity to manage CCRs. As explained previously, EPA shares the concern that beneficial uses not be inadvertently adversely affected by the regulation of CCRs destined for disposal. EPA continues to believe that certain beneficial use, when performed properly, is the environmentally preferable destination for these materials and, therefore, wants to address any potential stigma that might arise from designating CCRs as hazardous wastes. Thus, EPA is seeking data and information, including detailed analyses, of why the subtitle C regulation outlined in today's proposal will have the impact that some commenters have identified. As explained at length in section VI of this preamble, EPA believes it can generally address the concerns that have been raised regarding the effect of subtitle C regulation on legitimate beneficial uses in today's proposal through several of the actions outlined in today's proposal. The most important of these is that EPA is not proposing to revise its May 2000 Regulatory Determination that beneficial uses retain the Bevill exemption and do not warrant federal regulation. Nevertheless, EPA agrees that "stigma" is an important consideration in the Agency's decision, and solicits information and data that will help the Agency quantify the potential effects of any stigma arising from association with CCR disposal regulated under subtitle C.

On the question of hazardous waste disposal capacity, EPA believes that management patterns of CCRs will continue: That landfills and surface impoundments currently receiving CCRs will obtain interim status and convert to RCRA subtitle C status, and that the proposal will not shift disposal patterns in a way that substantially increases the disposal of CCRs off-site from generating utilities to commercial hazardous waste landfills. Therefore, EPA's regulatory analysis assumes disposal patterns will remain generally the same. As commenters have pointed out, CCRs do, in theory, have the potential to overwhelm the current hazardous waste capacity in the United States. EPA's Biennial Report indicates that approximately two million tons of hazardous waste are disposed of annually in hazardous waste landfills, and EPA estimates that the current total national commercial hazardous waste landfill disposal capacity is between 23.5 and 30.3 million tons, while the annual amount of CCRs currently going to land disposal is 46 million tons (with an additional 29.4 million tons going to surface impoundments).[64] These figures illustrate the very large volume of CCR material involved, and how it could overwhelm existing subtitle C disposal capacity. While a DOE survey reports that 70% of disposal involves "company on-site" disposal units and 30% involves "off-site" disposal units, DOE indicated that off-site disposal capacity can be company owned or commercial disposal units. In communications with USWAG, they indicated, in some cases smaller facilities may send ash to a commercial operation, but believed that is in no way representative of the industry as a whole. In some cases, the disposal facility may be operated by a contractor for the utility, and the landfill is a captive facility that does not receive other industrial wastes. At the same time, EPA points out that, to the extent that new capacity is needed, the implementation of today's rule, if the subtitle C alternative is selected, will take place over a number of years, providing time for industry and state permitting authorities to address the issue. However, this is an issue on which EPA would find further information to be helpful. Therefore, EPA solicits detailed information on this topic, to aid in further quantifying the extent to which existing capacity may be insufficient. For example, EPA is interested in detailed information on the volume of CCRs now going off-site for disposal; the nature of off-site disposal sites (*e.g.,* commercial subtitle D landfills versus dedicated CCR landfills owned by the utility); and the amount of available land on utility sites for added disposal capacity.

Finally, the states have expressed concern that the RCRA subtitle C requirements will be considerably more expensive for them to implement than a RCRA subtitle D regulation, without providing commensurate benefits. For example, the states have reported that regulation under RCRA subtitle C, versus subtitle D, would cost them an additional $17 million per year to implement. EPA acknowledges the concern that the RCRA subtitle C requirements can be costly to implement, and could put more pressure on diminishing state budgets. However, were states to utilize the subtitle D requirements of today's proposal, the cost of implementing a RCRA subtitle D program will also be expensive. Thus, EPA is aware of the pressures on state budgets and will consider potential impacts when making a final determination for this rulemaking. Nevertheless, in the event that EPA determines that RCRA subtitle C regulation is warranted, it will be because EPA has determined that there are serious environmental and human health risks that can only be remedied by regulation under subtitle C. Further, under the subtitle C scenario, we believe that most states should be able to address any shortfalls through hazardous waste generator or disposal fees. EPA specifically solicits comments from states as to the extent to which such fees would be able to offset the costs of administering permit, inspection, and enforcement programs.

EPA notes that its estimates of costs of compliance with the subtitle C requirements have increased since its estimates in the 1999 Report to Congress; as explained later in this preamble, EPA believes these costs are commensurate with the benefits to be derived from the controls, and that the costs of regulation under RCRA subtitle D are substantial as well. For example,

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[64] These figures reflect the total current capacity, not annual capacity. The annual capacity is significantly less: modifications to annual capacity would require modifications to existing permits.

one of the major potential costs under either the subtitle C or subtitle D option is associated with the required closure of all existing surface impoundments that do not meet the rule's technical requirements, which EPA is proposing under both the subtitle C and subtitle D co-proposals. Further, the technical unit design and groundwater monitoring requirements that will effectively protect human health and the environment under either option are quite similar. Finally, EPA is proposing to modify certain aspects of the RCRA subtitle C framework to address some of the practical implementation challenges associated with applying the existing regulatory framework to these wastes. However, commenters have suggested that EPA has underestimated the costs of compliance under the subtitle C requirements upstream of surface impoundments and landfills (*e.g.,* for storage). Commenters, however, have not provided specific cost estimates associated with storage of CCRs. EPA specifically solicits substantiating detail from commenters.

One disadvantage of a RCRA subtitle C approach, compared to a RCRA subtitle D approach, is that the subtitle C approach, in most states, will not go into effect as quickly as subtitle D. That is, the subtitle C regulations require an administrative process before they become effective and federally enforceable (except in the two states that are not authorized to manage the RCRA program). The RCRA hazardous waste implementation and authorization process is described in detail in sections VII and VIII of this preamble. But to summarize, federal regulations under subtitle C would not go into effect and become federally enforceable until RCRA-authorized states[65] have adopted the requirements under their own state laws, and EPA has authorized the state revisions. Under the RCRA subtitle C regulations, when EPA promulgates more stringent regulations, states are required to adopt those rules within one year, if they can do so by regulation, and two years if required by legislative action. If a state does not adopt new regulations promptly, EPA's only recourse is to withdraw the entire state hazardous waste program. If EPA determines that a subtitle C rule is warranted, the Agency will place a high priority on ensuring that states promptly pick up the new rules and become authorized, and EPA will work aggressively toward this end. Three decades of history in the RCRA program, however, suggest that this process will take two to five years (if not longer) for rules to become federally enforceable.[66]

At the same time, EPA believes there may be benefits in a RCRA subtitle D approach that establishes specific self-implementing requirements that utilities and others managing regulated CCRs would have to comply with, even in the absence of permitting or direct regulatory oversight. EPA recognizes that many of the states have regulatory programs in place, albeit with varying requirements, for the disposal of CCRs, and that industry practices have been improving. The RCRA subtitle D approach would complement existing state programs and practices by filling in gaps, and set forth criteria for disposing of CCRs to meet the national minimum standards that are designed to address key risks identified in damage cases and the risk assessment—including the risk of surface impoundment failure, which has been identified as a concern appropriate for control.

The co-proposed RCRA subtitle D option is less costly than the co-proposed RCRA subtitle C option, according to EPA's Regulatory Impact Assessment. The main differences in the costs are based on the assumption that there will be less compliance, or slower compliance, under a RCRA subtitle D option. In addition, the industry and state commenters suggested that a RCRA subtitle D approach would eliminate two of their concerns: (1) That a RCRA subtitle C approach would inappropriately stigmatize uses of CCRs that provide significant environmental or economic benefits, or that (according to those commenters) hold significant potential promise, and (2) that the volume of CCR wastes generated—particularly if requirements of a RCRA subtitle C regulation led to more off-site disposal—would overwhelm existing subtitle C capacity based on the large volumes of CCRs that are generated and would need to be disposed of. It would also reduce or eliminate expressed industry concerns about the effect of RCRA subtitle C requirements on plant operations, and state concerns related to the burden of the RCRA subtitle C permitting process. Related to the capacity issue, these same commenters have also suggested that, under the RCRA subtitle C regulations, future cleanup of poorly sited or leaking disposal sites (including historical or legacy sites) would be considerably more expensive, especially where off-site disposal was chosen as the option. (EPA's RIA does not quantify this last issue, but the RIA does discuss two recent cases as examples; EPA solicits more detailed comment on this issue, preferably with specific examples.) As stated earlier, EPA does not have sufficient information to conclude that regulation under RCRA subtitle C will stigmatize CCRs destined for beneficial use, for the reasons discussed elsewhere in today's preamble, and the Agency does not at this point have reason to assume that use of off-site commercial disposal of CCRs will increase significantly.

EPA also notes that many of the requirements discussed above would go into effect more quickly under RCRA subtitle D. Under subtitle D of RCRA, EPA would set a specific nationwide compliance date and industry would be subject to the requirements on that date, although as discussed elsewhere in today's preamble, EPA's ability to enforce those requirements is limited. (Of course, certain requirements, such as closure of existing surface impoundments, would have a delayed compliance date set to reflect practical compliance realities, but other requirements, for example, groundwater monitoring or the requirement that new surface impoundments be constructed with composite liners could be imposed substantially sooner than under a RCRA subtitle C rule.) The possible exception would be if EPA decided to establish financial assurance requirements through a regulatory process currently underway that would establish financial assurance requirements for several industries pursuant to CERCLA 108(b), including the Electric Power Generation, Transmission and Distribution Industry. For a more detailed discussion of these issues *see* section IX.

However, there are also disadvantages to any approach under RCRA subtitle D. Subtitle D provides no Federal oversight of state programs as it relates to CCRs. It establishes a framework for Federal, state, and local government cooperation in controlling the management of nonhazardous solid waste. The Federal role in this arrangement is to establish the overall regulatory direction, by providing minimum nationwide standards for protecting human health and the environment, and to provide technical assistance to states for planning and developing their own environmentally sound waste management practices. The co-proposed subtitle D alternative in this proposal would establish national minimum

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[65] Currently, all but two states are authorized for the base RCRA program.

[66] In addition, existing facilities would generally operate under self-implementing interim status provisions until the state issued a RCRA permit, which is a several year process, although presumably the facility might remain under state solid waste permits, depending on state law.

standards specifically for CCRs for the first time. The actual planning and direct implementation of solid waste programs under RCRA subtitle D, however, remain state and local functions, and the act authorizes states to devise programs to deal with state-specific conditions and needs.

In further contrast to subtitle C, RCRA subtitle D requirements would regulate only the disposal of solid waste, and EPA does not have the authority to establish requirements governing the transportation, storage, or treatment of such wastes prior to disposal. Under RCRA sections 4004 and 4005(a), EPA cannot require that facilities obtain a permit for these units. EPA also does not have the authority to determine whether any state permitting program for CCR facilities is adequate. This complicates the Agency's ability to develop regulations that can be effectively implemented and tailored to individual site conditions. Moreover, EPA does not have the authority to enforce the regulations, although, the "open dumping" prohibition may be enforced by states and citizens under section 7002 of RCRA.

D. EPA Is Not Reconsidering the Regulatory Determination Regarding Beneficial Use

As noted previously, in the May 2000 Regulatory Determination, EPA concluded that federal regulation was not warranted for the beneficial uses identified in the notice, because: "(a) We have not identified any other beneficial uses that are likely to present significant risks to human health or the environment; and (b) no documented cases of damage to human health or the environment have been identified. Additionally, we do not want to place any unnecessary barriers on the beneficial uses of coal combustion wastes so they can be used in applications that conserve natural resources and reduce disposal costs." (*See* 65 FR 32221) EPA did not conduct specific risk assessments for the beneficial use of these materials, except as noted below and elsewhere in this preamble. Instead, it generally described the uses and benefits of CCRs, and cited the importance of beneficially using secondary materials and of resource conservation, as an alternative to disposal. However, EPA did conduct a detailed risk assessment of certain agricultural uses of CCRs,[67] since the use of CCRs in this manner is most likely to raise concerns from an environmental point of view. Overall, EPA concluded at the time that the identified uses of CCRs provided significant benefits (environmental and economic), that we did not want to impose an unnecessary stigma on these uses and therefore, we did not see a justification for regulating these uses at the federal level.

Since EPA's Regulatory Determination in May 2000, the Agency has gathered additional information. In addition to the evolving character/composition of CCRs due to electric utility upgrades and retrofits needed to comply with the emerging CAA requirements, which could present new or otherwise unforeseen contaminant issues (*e.g.,* hexavalent chromium from post-NO_X controls), changes include: (1) A significant increase in the use of CCRs, and the development of established commercial sectors that utilize and depend on the beneficial use of CCRs, (2) the recognition that the beneficial use of CCRs (and, in particular, specific beneficial uses of CCRs, such as using fly ash as a substitute for Portland cement in the production of concrete) provide significant environmental benefits, including the reduction of GHG emissions, (3) the development of new applications of CCRs, which may hold even greater GHG benefits (for example, fly ash bricks and a process to use CO_2 emissions to produce cement), (4) new research by EPA and others indicating that the standard leach tests—*e.g.,* the Toxicity Characteristic Leaching Procedure (TCLP) that have generally been used may not accurately represent the performance of varying types of CCRs under variable field conditions, (5) new studies and research by academia and federal agencies on the use of CCRs, including studies on the performance of CCR-derived materials in concrete, road construction,[68] and agriculture,[69] and studies of the risks that may or may not be associated with the different uses of CCRs, including uses of unencapsulated CCRs, and (6) the continuing development of state "beneficial use" regulatory programs under state solid waste authorities.

Some of these changes confirm or strengthen EPA's Regulatory Determination in May 2000 (*e.g.,* the growth and maturation of state beneficial use programs and the growing recognition that the beneficial use of CCRs is a critical component in strategies to reduce GHG emissions); other developments raise critical questions regarding this determination (*e.g.,* the potentially changing composition of CCRs as a result of improved air pollution control and the new science on metals leaching). EPA solicits information and data on these developments and how the beneficial use of CCRs will be affected (*e.g.,* increased use of fly ash in cement and concrete).

However, on balance, after considering all of these issues and the information available to us at this time, EPA believes that the most appropriate approach toward beneficial use is to leave the May 2000 Regulatory Determination in place, as the Agency, other federal agencies, academia, and society more broadly investigate these critical questions and clarify the appropriate beneficial use of these materials. This section provides EPA's basis for leaving the Bevill exemption in place for these beneficial uses, although as discussed throughout this section, EPA is also soliciting comment on unencapsulated uses of CCRs and whether they should continue to be exempted as a beneficial use under the Bevill exemption.

EPA is proposing this approach in recognition that some uses of CCRs, such as encapsulated uses in concrete, and use as an ingredient in the manufacture of wallboard, provide benefits and raise minimal health or environmental concerns. That is, from information available to date, EPA believes that encapsulated uses of CCR, as is common in many consumer products, does not merit regulation. On the other hand, unencapsulated uses have raised concerns and merit closer attention. For example, the placement of unencapsulated CCRs on the land, such as in road embankments or in agricultural uses, presents a set of issues, which may pose similar concerns as those that are causing the Agency to propose to regulate CCRs destined for disposal. Still, the amounts and, in some cases, the manner in which they are used—*i.e.,* subject to engineering specifications and material requirements rather than landfilling techniques—are very different from land disposal. EPA also notes that stakeholders, such as Earthjustice have petitioned EPA to ban particular uses of CCR; for example, the placement of CCRs in direct contact with water bodies.

Due to such issues as the changing characteristics of CCRs, as a result of more widespread use of air pollution control technologies and the new information becoming available on the

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[67] Draft Final Report; Non-groundwater Pathways, Human Health and Ecological Risk Analysis for Fossil Fuel Combustion Phase 2 (FFC2) and its appendices (A through J); available at *http://www.epa.gov/osw/nonhaz/industrial/special/fossil/fsltech.htm.*

[68] *See http://www.epa.gov/osw/partnerships/c2p2/cases/index.htm.*

[69] *See http://www.epa.gov/osw/partnerships/c2p2/pubs/fgd-fs.pdf.*

leaching of metals from CCRs, we are considering approaches such as, better defining beneficial use or developing detailed guidance on the beneficial use of CCRs to supplement the regulations. The Agency solicits information and data on these and other approaches that EPA could take in identifying when uses of CCRs constitute a "beneficial use," and consequently will remain exempt.

Other alternative approaches—for example, to regulate the beneficial use of CCRs under the regulations that apply to "use constituting disposal," to prohibit unencapsulated uses outright, including CCRs used in direct contact with water matrices, including the seasonal high groundwater table, or to require front-end CCR and site characterization through the use of leach tests adapted for specific uses of CCR, prior to CCR management decisions—could address concerns that have been expressed over the land placement of CCRs. However, EPA is trying to balance concerns that proposing one or more of these alternatives might have the effect of stifling economic activities and innovation in areas that have potential for environmental benefits, while also providing adequate protection of human health and the environment.

At the same time, EPA recognizes that seven proven damage cases involving the large-scale placement, akin to disposal, of CCRs has occurred under the guise of "beneficial use"—the "beneficial" use being the filling up of old quarries or gravel pits, or the regrading of landscape with large quantities of CCRs. EPA did not consider this type of use as a "beneficial" use in its May 2000 Regulatory Determination, and does not consider this type of use to be covered by the exclusion. Therefore, today's proposed rule explicitly removes these types of uses from the category of beneficial use, such that they would be subject to the management standards that EPA finally promulgates. EPA also seeks information and data on whether it should take a similar approach in today's proposal to unencapsulated uses of CCRs, such as the placement of unencapsulated CCRs on the land—*e.g.,* agricultural uses. Alternatively, EPA is also soliciting comment on whether the Agency should promulgate standards allowing such uses, on a site-specific basis, based on a site specific risk assessment, taking into consideration, inter alia, the CCRs character and composition, their leaching potential under the range of conditions under which CCRs will be managed, and the context in which the CCRs will be applied, such as location, volume, rate of application, and proximity to water.

Before getting into a detailed discussion of the materials in question, EPA would reiterate that CCRs, when beneficially used will conserve resources, provide improved material properties, reduce GHG emissions, lessen the need for waste disposal units, and provide significant domestic economic benefits (as noted above in section XII). At the same time, EPA recognizes that there are important issues and uncertainties associated with specific uses of specific CCRs, that there has been considerable recent and ongoing research on these uses, and that the composition of CCRs are likely changing as a result of more aggressive air pollution controls. EPA is particularly concerned that we avoid the possibility of cross-media transfers stemming from CAA regulations requiring the removal of hazardous air pollutants (*e.g.,* arsenic, mercury, selenium) from utility stacks being released back into the soil and groundwater media through inappropriate "beneficial" uses.

EPA has received numerous comments on specific uses of CCRs, and we have been working with states to help them develop effective beneficial use programs (which apply to a wide range of secondary materials, not just CCRs). EPA, other federal agencies, and academia have conducted research on specific uses, and have provided guidance and best management practices on using CCRs in an environmentally sound manner in a range of applications. For example, EPA, working with the Federal Highway Administration (FHWA), DOE, the American Coal Ash Association (ACAA), and USWAG issued guidance in April 2005 on the appropriate use of coal ash in highway construction. EPA understands that the composition of CCRs, the nature of different CCR uses, and the specific environment in which CCRs are used, can affect the effectiveness and the environmentally sound use of particular projects. In today's proposal, EPA is suggesting that an appropriate balance can be met by (1) determining that the placement of CCRs in sand and gravel pits, as well as the use of large volumes of CCRs in restructuring landscapes to constitute disposal, rather than the beneficial use of CCRs, and at the same time (2) leaving in place its determination that the beneficial uses of CCRs—*e.g.,* those identified in the May 2000 Regulatory Determination as clarified in this notice—should not be prohibited from continuing. As described later in this section of today's notice, EPA solicits comment on whether an alternative approach is appropriate, particularly for unencapsulated uses of CCRs on the land.

1. Why is EPA not proposing to change the determination that CCRs that are beneficially used do not warrant federal regulation?

As an initial matter, we would note that for some of the beneficial uses, CCRs are a raw material used as an ingredient in a manufacturing process that have never been "discarded,[70]" and thus, would not be solid wastes under the existing hazardous waste rules. For example, synthetic gypsum is a product of the FGD process at coal-fired power plants. In this case, the utility designs and operates its air pollution control devices to produce an optimal product, including the oxidation of the FGD to produce synthetic gypsum. In this example, after its production, the utility treats FGD as a valuable input into a production process, *i.e.,* as a product, rather than as something that is intended to be discarded. Wallboard plants are sited in close proximity to power plants for access to raw material, with a considerable investment involved. Thus, FGD gypsum used for wallboard manufacture is a product rather than a waste or discarded material. This use and similar uses of CCRs that meet product specifications would not be affected by today's proposed rule in any case, regardless of the option taken.

With that said, today's proposed action would leave in place EPA's May 2000 Regulatory Determination that beneficially used CCRs do not warrant federal regulation under subtitle C or D of RCRA. As EPA stated in the May 2000 Regulatory Determination, "In the [Report to Congress], we were not able to identify damage cases associated with these types of beneficial uses, nor do we now believe that these uses of coal combustion wastes present a significant risk to human health and the environment. While some commenters disagreed with our findings, no data or other support for the commenters' position was provided, nor was any information provided to show risk or damage associated with agricultural use. Therefore, we conclude that none of the beneficial uses of coal combustion wastes listed above pose risks of concern." (*See* 65 FR 32230.) Since that time, EPA is not aware of data or other information to indicate that existing

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[70] In order for EPA to regulate a material under RCRA, the material must be a solid waste, which the statute defines as materials that have been discarded. *See* Section 1004(27) of RCRA for definition of solid waste.

efforts of states, EPA and other federal agencies are not adequate to address environmental issues associated with the beneficial uses of CCRs, that were originally identified in the Regulatory Determination. Therefore, at this time, EPA is not proposing to reverse that determination. Specifically: (1) EPA believes today's proposal will ensure that inappropriate beneficial use situations, like the Gambrills, MD site, will be regulated as disposal; (2) many states are developing effective beneficial use programs which, in many cases, allow the use of CCRs as long as they are demonstrated to be non-hazardous materials, and (3) EPA does not wish to inhibit or eliminate the significant and measurable environmental and economic benefits derived from the use of this valuable material without a demonstration of an environmental or health threat.

EPA also wants to make clear that wastes that consist of or contain these Bevill-exempt beneficially used materials, including demolition debris from beneficially used CCRs in wallboard or concrete that were generated because the products have reached the end of their useful lives—would also not be listed as a special waste subject to subtitle C of RCRA, from the point of their generation to their ultimate disposal.

In summary, EPA continues to believe that the beneficial use of CCRs, when performed properly and in an environmentally sound manner, is the environmentally preferable outcome for CCRs and, therefore, is concerned about regulatory decisions that would limit beneficial uses, including research on beneficial uses. Thus, EPA is not proposing to modify the existing Bevill exemption for CCRs (sometimes referred to as CCPs when beneficially used), and instead is proposing to leave the current determination in place. However, EPA recognizes that there is a disparity in the quality of state programs dealing with beneficial uses, uncertainty relative to the future characteristics of CCRs and, therefore, uncertainty concerning the risks associated with some beneficial uses. At the same time, EPA recognizes the potential environmental benefits with regard to the uses of CCRs. For these reasons, EPA is requesting information and data on the appropriate means of characterizing beneficial uses that are both protective of human health and the environment and provide benefits. EPA is also requesting information and data demonstrating where the federal and state programs are or have been inadequate in being environmentally protective and, conversely, where states have, or are developing, increasingly effective beneficial use programs.

As previously discussed, and discussed in section VI, some stakeholders have commented that EPA should not regulate CCRs when disposed of in landfills or surface impoundments as a hazardous waste, because such an approach would stigmatize the beneficial use of CCRs, and these uses would disappear. Although it remains unclear whether any stigmatic effect from regulating CCRs destined for disposal as hazardous waste would decrease the beneficial use of CCRs, and irrespective of whether EPA ultimately concludes to promulgate regulations under RCRA subtitles C or D, EPA is convinced that regulating the beneficial use of CCRs under RCRA subtitle C as hazardous waste would be unnecessary, in light of the potential risks associated with these uses. For example, use of fly ash as a replacement for Portland cement is one of the most environmentally beneficial uses of CCRs (as discussed below), yet regulating this beneficial use under RCRA subtitle C requirements would substantially increase the cost and regulatory difficulties of using this material, without providing any corresponding risk reduction. Regulating the use of coal ash as a cement ingredient under RCRA subtitle C would subject the coal ash to full hazardous waste requirements up to the point that it is made into concrete, including requirements for generators, manifesting for transportation, and permits for storage. In addition, ready-mix operators would be subject to the land disposal restrictions and other requirements, as use of the concrete would constitute disposal if placed on the land. EPA instead is proposing an approach that would allow beneficial uses to continue, under state controls, EPA guidance, and current industrial standards and practices. Where specific problems are identified, EPA believes they can be safely addressed, but we do not believe that an approach that eliminates a wide range of uses that would add considerably to the costs of the rule, and that would disrupt and potentially close ongoing businesses legitimately using CCRs is justified, on the strength of the existing evidence.

EPA's May 2000 Regulatory Determination not to regulate various beneficial uses under the hazardous waste requirements, and today's proposal to leave that determination in place, does not conflict with EPA's view that certain beneficial uses, *e.g.*, use in road construction or agriculture, should be conducted with care, according to appropriate management practices, and with appropriate characterization of the material and the site where the materials would be placed. In this respect, CCRs are similar to other materials used in this manner—including raw materials derived from quarried aggregates, secondary materials from other industrial processes, and materials derived from natural ores. Rather, EPA concludes that, based on our knowledge of how CCRs are used, that potential risks of these uses do not warrant federal regulation, but can be addressed, if necessary, in other ways, as discussed previously, such as the State of Wisconsin has an extensive beneficial use program that supports the use of CCRs in a variety of circumstances, including in road base construction and agriculture uses, provided certain criteria are met. Similarly, EPA is working with the U.S. Department of Agriculture to develop guidance on the use of FGD gypsum in agriculture.

2. What constitutes beneficial use?

As discussed previously, EPA is not proposing to change the regulatory status of those CCRs that are beneficially used. However, because EPA is proposing to draw a distinction between CCRs that are destined for disposal and those that are beneficially used, we believe it is necessary and appropriate to distinguish between beneficial use and operations that would constitute disposal operations—such as large volumes of CCRs that are used in sand and gravel pits or for restructuring the landscape. EPA believes the following criteria can be used to define legitimate beneficial uses appropriately, and are consistent with EPA's approach in the May 2000 Regulatory Determination, although such criteria were not specifically identified at that time:

○ The material used must provide a functional benefit. For example, CCRs in concrete increase the durability of concrete—and are more effective in combating degradation from salt water; synthetic gypsum serves exactly the same function in wallboard as gypsum from ore, and meets all commercial specifications; CCRs as a soil amendment adjusts the pH of soil to promote plant growth.

○ The material substitutes for the use of a virgin material, conserving natural resources that would otherwise need to be obtained through practices, such as extraction. For example, the use of FGD gypsum in the manufacture of wallboard (drywall) decreases the need to mine natural gypsum, thereby conserving the natural resource and conserving energy that otherwise would be needed to mine natural gypsum; the use of fly ash in lieu of portland cement reduces the need for cement. CCRs used in road bed replace quarried aggregate or other industrial materials. These CCRs substitute for another ingredient in an industrial or commercial product.

○ Where relevant product specifications or regulatory standards are available, the materials meet those specifications, and where such specifications or standards have not been established, they are not being used in excess quantities. Typically, when CCRs are used as a commercial product, the amount of CCRs used is controlled by product specifications, or the demands of the user. Fly ash used as a stabilized base course in highway construction is part of many engineering considerations, such as the ASTM C 593 test for compaction, the ASTM D 560 freezing and thawing test, and a seven day compressive strength above 2760 (400 psi). If excessive volumes of CCRs are used—*i.e.,* greater than were necessary for a specific project,—that could be grounds for a determination that the use was subject to regulations for disposal.

○ In the case of agricultural uses, CCRs would be expected to meet appropriate standards, constituent levels, prescribed total loads, application rates, etc. EPA has developed specific standards governing agricultural application of biosolids. While the management scenarios differ between biosludge application and the use of CCRs as soil amendments, EPA would consider application of CCRs for agriculture uses not to be a legitimate beneficial use if they occurred at constituent levels or loading rates greater than EPA's biosolids regulations allow.[71] EPA also recognizes that the characteristics of CCRs are such that total concentrations of metals, as biosolids are assessed, may not be the most appropriate standard, as CCRs have been shown to leach metals with significant variability.

EPA is proposing that these criteria be included in the regulations as part of the definition of beneficial use. EPA requests comment on these criteria, as well as suggestions for other criteria that may need to be included to ensure that legitimate beneficial uses can be identified and enforcement action can be taken against inappropriate uses.

Each of the uses identified in the May 2000 Regulatory Determination, CCRs can and have been utilized in a manner that is beneficial. The discussion that follows provides a brief summary of how certain of the beneficial uses meet the various criteria. EPA solicits comment on the need to provide a formal listing of all beneficial uses. To this end, EPA solicits comment on whether additional uses of CCRs have been established since the May 2000 Regulatory Determination that have not been discussed elsewhere in today's preamble should be regarded as beneficial. Of particular concern in this regard are reports that CCRs are being used in producing counter tops, bowling balls, and in the production of makeup. The Agency solicits comment on whether use of CCRs in consumer products of this kind can be safely undertaken. The Agency further solicits comments for any new uses of CCR, as well as the information and data that supports that it is beneficially used in an environmentally sound manner. The concern with such an alternative is that new and innovative uses that are not on the list would be subject to disposal regulations, until EPA revised its rule.

In the uses where the CCR is encapsulated in the product, such as cement, concrete, brick and concrete products, wallboard, and roofing materials—the CCRs provide a functional benefit—that is, the CCRs provide a cementitious or structural function, the CCRs substitute for cement, gypsum, and aggregate and thus save resources that would otherwise need to be mined and processed, and the CCRs are subject to product specifications, such as ASTM standards. Some of the uses, such as CCRs in paints and plastics not only provide benefits, but EPA generally does not consider materials used in these ways to be waste—that is, they have not been discarded. Use of CCRs in highway projects is a significant practice covering road bed and embankments. CCRs used according to FHA/DOT standards provide an important function in road building, replacing material that would otherwise need to be obtained, such as aggregate or clay. In many cases, the CCRs can lead to better road performance. For snow and ice controls, the beneficial use is limited to boiler slag and bottom ash, which replaces fine aggregate that would otherwise need to be used to prevent skidding, and amounts used are in line with the materials they replace.[72]

3. Disposal of CCRs in Sand and Gravel Pits and Large Scale Fill Operations Is Not Considered a Beneficial Use

As indicated earlier, EPA has identified several proven damage cases associated with the placement of CCRs in sand and gravel pits. There has also been significant community concern with large-scale fill operations. Because of the damage cases and the concern that sand and gravel pits and large scale fill operations are essentially landfills under a different name, EPA is clarifying and, thus, proposing to define the placement of CCRs in sand and gravel pits and large scale fill projects as land disposal that would be subject to either the proposed RCRA subtitle C or D regulations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

However, EPA recognizes that we need to define or provide guidance on the meaning of "a large scale fill operation." EPA solicits comments on appropriate criteria to distinguish between legitimate beneficial uses and inappropriate operations, such as, for example, a comparison to features associated with relatively small landfills used by the utility industry, and whether characteristics of the materials would allow their safe use for a particular application in a particular setting (*i.e.,* characterize both the materials for the presence of leachable metals and the area where the materials will be placed).

4. Issues Associated With Unencapsulated Beneficial Uses

Since the May 2000 Regulatory Determination, the major issues associated with the placement of CCRs on the land for beneficial use has involved the Gambrills, MD site which involves a sand and gravel pit and the Battlefield golf course, which was a large scale fill operation. These are the types of operations that EPA is proposing would be subject to any disposal regulations proposed in today's rule. However, because the Gambrills and Battlefield sites involved the unencapsulated placement of CCRs on the land, it raises questions regarding the beneficial use of unencapsulated uses of CCRs; accordingly, in this section, the Agency presents information on the issues on which it is specifically soliciting comment.

First, we identify the array of environmental issues associated with unencapsulated uses. CCRs can leach toxic metals at levels of concern, so depending on the characteristics of the CCR, the amount of material placed, how it is placed, and the site conditions, there is a potential for environmental concern.

- The importance of characterizing CCRs prior to their utilization is that CCRs from certain facilities may be acceptable under particular beneficial

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[71] *See* 40 CFR part 503.

[72] According to the ACAA survey, 80% of boiler slag—a vitreous material often used as an abrasive—is reused, although industry has reported that the demand for boiler slag products is high, and virtually all of the slag is currently used.

use scenarios, while the same material type from a different facility or from the same facility, but generated under different operating conditions (*e.g.*, different air pollution controls or configurations) may not be acceptable for the same management scenario. Changes in air pollution controls will result in fly ash and other CCRs presenting new contaminant issues (*e.g.*, hexavalent chromium from post-NOx controls). Additionally, as described in section I. F. 2, there is significant variability in total metals content and leach characteristics.

- The amount of material placed can significantly impact whether placement of unencapsulated CCRs causes environmental risks. There are great differences between the amount of material disposed of in a landfill and in beneficial use settings. For example, a stabilized fly ash base course for roadway construction may be on the order of 6 to 12 inches thick under the road where it is used—these features differ considerably from the landfill and sand and gravel pit situations where hundreds of thousands to millions of tons of CCRs are disposed of and for which damage cases are documented.
- Unencapsulated fly ash used for structural fill is moistened and compacted in layers, and placed on a drainage layer. By moistening and compacting the fly ash in layers, the hydraulic conductivity can be greatly reduced, sometimes achieving levels similar to liner systems. This limits the transport of water through the ash and thus acts to protect groundwater. The drainage layer prevents capillary effects and thus also limits the amount of water that remains in contact with the fly ash. Although EPA is not aware of the use of organosilanes for beneficial use operations in the U.S., if mixed with fly ash, it is reported to be able to essentially render the fly ash impermeable to water, and thus there may be emerging placement techniques that can also greatly influence the environmental assessment.
- Site conditions are important factors. Hydraulic conductivity of the subsurface, the rainfall in the area, the depth to groundwater, and other factors (*e.g.*, changes in characteristics due to the addition of advanced air pollution controls) are important considerations in whether a specific beneficial use will remain protective of the environment.

Second, EPA notes the work and research being done by states, federal agencies, and academics to assess, provide guidance on, or regulate to address the environmental issues that may be associated with beneficial use. In addition to the recent EPA research on constituent leaching from CCRs described earlier in the preamble, a few highlights include:

- Many states have beneficial use programs. The ASTSWMO 2006 Beneficial Use Survey Report states: "A total of 34 of the 40 reporting States, or 85 percent, indicated they had either formal or informal decision-making processes or beneficial use programs relating to the use of solid wastes." [73] (*http://www.astswmo.org/files/publications/solidwaste/2007BUSurveyReport11–30–07.pdf*) For example, Wisconsin's Department of Natural Resources has developed a regulation (NR 538 Wis. Adm. Code), which includes a five-category system to allow for the beneficial use of industrial by-products, including coal ash. The state has approved CCRs in a full range of uses, including road construction and agricultural uses.
- EPA and USDA are conducting a multi-year study on the use of FGD gypsum in agriculture. The results of that study should be available in late 2012.
- EPA developed an easy to use risk model for assessing the use of recycled industrial materials in highways. This model is shared with states to facilitate assessments to determine if such beneficial use projects will be environmentally protective.[74]
- There is also considerable study and research by states and academic institutions, which EPA views as valuable in not only guiding the parties to appropriate uses, but also in informing EPA. A few examples are:
  - Li L, Benson CH, Edil TB, Hatipoglu B. Groundwater impacts from coal ash in highways. Waste and Management Resources 2006;159(WR4):151–63.
  - Friend M, Bloom P, Halbach T, Grosenheider K, Johnson M. Screening tool for using waste materials in paving projects (STUWMPP). Office of Research Services, Minnesota Dept. of Transportation, Minnesota; 2004. Report nr MN/RC–2005–03.
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Overall, federal agencies, states, and others are doing a great amount of work to promote environmentally sound beneficial use practices, to advance our understanding, and to consider emerging science and practices. Furthermore, the beneficial use of CCRs is a world wide activity, so there is also considerable work and effort from around the globe. In Europe, nearly all CCRs are beneficially used, and when used are considered to be products rather than wastes. Sweden, for example, actively supports the use of CCRs in road construction, and has conducted long-term tests of its use in this manner.

While recognizing the many beneficial use opportunities for CCRs, EPA believes it is imperative to gather a full range of views on the issue of unencapsulated uses in order to ensure the protection of human health and the environment. EPA is fully prepared to reconsider our proposed approach for these uses if comments provide information and data to demonstrate that it is inappropriate. For example, previous risk analyses do not address many of the use applications currently being implemented, and have not addressed the changes to CCR composition with more advanced air pollution control methods and improved leachate characterization. In addition, some scientific literature indicates that the uncontrolled (*i.e.*, excessive) application of CCRs can lead to the potentially toxic accumulation of metals (*e.g.*, in agricultural applications [75] and as fill material [76]). Thus, while EPA does not want to negatively impact the legitimate beneficial use of CCRs unnecessarily, we are also aware of the need to fully consider the risks, management practices, state controls, research, and any other pertinent information. Thus, to help EPA determine whether to revise

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[73] Part of EPA's efforts with the states is to support the development of a national database on state beneficial use determinations. Information on the beneficial use determination database can be found on the Northeast Waste Management Officials' Association (NEWMOA) Web site at *http://www.newmoa.org/solidwaste/bud.cfm*. This database helps states share information on beneficial use decisions providing for more consistent and informed decisions.

[74] *See* a Final Report titled, "Use of EPA's Industrial Waste Management Evaluation Model (IWEM) to Support Beneficial Use Determinations" at *http://www.epa.gov/partnerships/c2p2/pubs/iwem-report.pdf* and the Industrial Waste Management Evaluation Model (IWEM) at *http://www.epa.gov/osw/nonhaz/industrial/tools/iwem*.

[75] *See*, for example, "Effects of coal fly ash amended soils on trace element uptake in plant," S.S. Brake, R.R. Jensen, and J. M. Mattox, Environmental Geology, November 7, 2003 *available at http://www.springerlink.com/content/3c5gaq2qrkr5unvp/fulltext.pdf*.

[76] *See* information regarding the Town of Pines Groundwater Plume at *http://www.epa.gov/region5superfund/npl/sas_sites/INN000508071.htm. Also see* additional information for this site at *http://www.epa.gov/region5/sites/pines/#updates*.

its approach and regulate, for example, unencapsulated uses of CCRs on the land, we solicit comments on whether to regulate, and if so, the most appropriate regulatory approach to be taken. For example, EPA might consider a prohibition on these uses, except where, as part of a case-by-case, or material-by-material petition process where appropriate characterization of the material is used (including taking into account the pH to which the material will be exposed) and a risk assessment, approved by a regulatory Agency, shows that the risks were within acceptable ranges.[77] Moreover, if regulating these uses under the RCRA hazardous waste authority is deemed warranted, the risk assessment would have to be approved, through a notice-and-comment process, by EPA or an authorized state. EPA expects that the risk assessment would be based on actual leach data from the material. (*See* request for comment below on material characterization.)

In reaching its decision on whether to regulate unencapsulated uses, EPA would be interested in comments and data on the following:

- We would like comment on whether persons should be required to use a leaching assessment tool in combination with the Draft SW–846 leaching test methods described in Section I. F. 2 and other tools (*e.g.*, USEPA's *Industrial Waste Management Evaluation Model* (IWEM)) to aid prospective beneficial users in calculating potential release rates over a specified period of time for a range of management scenarios, including use in engineering and commercial applications using probabilistic assessment modeling.
- As discussed previously, EPA is working with USDA to study agricultural use of FGD gypsum to provide further knowledge in this area. The Agency is interested in comments relating to the focus of these assessments, the use of historical data, the impact of pH on leaching potential of metals, the scope of management scenarios, the variable and changing nature of CCRs, and variable site conditions. Commenters interested in the EPA/USDA effort should consider the characteristics of FGD gypsum (*see http://www.epa.gov/epawaste/partnerships/c2p2/pubs/fgdgyp.pdf*) and information on the current study (*see http://www.epa.gov/epawaste/partnerships/c2p2/pubs/fgd-fs.pdf*).
- If EPA determines that regulations are needed, should EPA consider removing the Bevill exemption for such unencapsulated uses and regulate these under RCRA subtitle C or should EPA develop regulations under RCRA subtitle D?
- If materials characterization is required, what type of characterization is most appropriate? If the CCRs exceed the toxicity characteristic at pH levels different from the TCLP, should they be excluded from beneficial use? When are total levels relevant? EPA solicits information and data on the extent to which states request and evaluate CCR characterization data prior to the use of unencapsulated CCRs (keeping in mind that EPA ORD studies generally show that measurement of total concentrations for metals do not correlate well with metal leachate concentrations).
- If regulations are developed, should they cover specific practices, for example, restricting fill operations to those that moisten and compact fly ash in layers to attain 95% of the standard Proctor maximum dry density value and provide a drainage layer? Are such construction practices largely followed now?
- Historically, EPA has proposed or imposed conditions on other types of hazardous wastes destined for land placement (*e.g.*, maximum application rates and risk-based concentration limits for cement kiln dust used as a liming agent in agricultural applications (*see* 64 FR 45639; August 20, 1999); maximum allowable total concentrations for non-nutritive and toxic metals in zinc fertilizers produced from recycled hazardous secondary materials (*see* 67 FR 48393; July 24, 2002). Comments are solicited as to whether EPA should establish standards or rely on implementing states to impose CCR-/site-specific limits based on front-end characterization that ensures individual beneficial uses remain protective.
- Whether to exclude from beneficial use unencapsulated uses in direct contact with water bodies (including the seasonal high groundwater table)?

E. Placement of CCRs in Minefilling Operations

In today's proposal, EPA is not addressing its Regulatory Determination on minefilling, and instead will work with the OSM to develop effective federal regulations to ensure that the placement of coal combustion residuals in minefill operations is adequately controlled. In doing so, EPA and OSM will consider the recommendations of the National Research Council (NRC), which, at the direction of Congress, studied the health, safety, and environmental risks associated with the placement of CCRs in active and abandoned coal mines in all major U.S. coal basins. The NRC published its findings on March 1, 2006, in a report entitled "Managing Coal Combustion Residues (CCRs) in Mines," which is available at *http://books.nap.edu/openbook.php?isbn=0309100496.*

The report concluded that the "placement of CCRs in mines as part of coal mine reclamation may be an appropriate option for the disposal of this material. In such situations, however, an integrated process of CCR characterization, site characterization, management and engineering design of placement activities, and design and implementation of monitoring is required to reduce the risk of contamination moving from the mine site to the ambient environment." The NRC report recommended that enforceable federal standards be established for the disposal of CCRs in minefills to ensure that states have specific authority and that states implement adequate safeguards. The NRC Committee on Mine Placement of Coal Combustion Wastes also stated that OSM and its SMCRA state partners should take the lead in developing new national standards for CCR use in mines because the framework is in place to deal with mine-related issues. Consistent with the recommendations of the National Academy of Sciences, EPA anticipates that the U.S. Department of the Interior (DOI) will take the lead in developing these regulations. EPA will work closely with DOI throughout that process. Therefore, the Agency is not addressing minefilling operations in this proposed rule.

F. EPA Is Not Proposing To Revise the Bevill Determination for CCRs Generated by Non-Utilities

In this notice, EPA is not proposing to revise the Bevill exclusion for CCRs generated at facilities that are not part of the electric power sector and which use coal as the fuel in non-utility boilers, such as manufacturing facilities, universities, and hospitals. The Agency lacks sufficient information at this time to determine an appropriate course of action for the wastes from these facilities.

Industries that primarily burn coal to generate power for their own purposes (*i.e.*, non-utilities), also known as combined heat and power (CHP) plants, are primarily engaged in business activities, such as agriculture, mining, manufacturing, transportation, and education. The electricity that they generate is mainly for their own use, but

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[77] As part of the petition application, the petitioner would also need to demonstrate that the CCRs are being beneficially used.

any excess may be sold in the wholesale market.[78] According to the Energy Information Administration (EIA), CHPs produced 2.7% of the total electricity generated from coal combustion in 2007[79] and burned 2.3% of the total coal consumed for electricity generation (24 million tons)[80] at 2,967 facilities.[81] EPA estimates that CHPs generate approximately 3 million tons of CCRs annually or an average of just over 1,000 tons per facility. This is in comparison to electric utilities, which generated 136 million tons of CCRs in 2008, or an average of approximately 275,000 tons per facility. In addition, these manufacturing facilities generate other types of waste, many of which are generated in much larger quantities than CCRs, and thus, they are likely to be mixed or co-managed together. As a result, the composition of any co-managed waste might be fundamentally different from the CCRs that are generated by electric utilities. Presently, EPA lacks critical data from these facilities sufficient to address key Bevill criteria such as current management practices, damage cases, risks, and waste characterization. Thus, EPA solicits information and data on CCRs that are generated by these other industries, such as volumes generated, characteristics of the CCRs, whether they are co-managed with other wastes generated by the industry, as well as other such information. In addition, EPA does not currently have enough information on non-utilities to determine whether a regulatory flexibility analysis would be required under the Regulatory Flexibility Act, nor to conduct one if it is necessary. Therefore, the Agency has decided not to assess these operations in today's proposal, and will instead focus on the nearly 98% of CCRs that are generated at electric utilities.

V. Co-Proposed Listing of CCRs as a Special Waste Under RCRA Subtitle C and Special Requirements for Disposal of CCRs Generated by Electric Utilities

One of the alternatives in today's co-proposal is to add a new category of wastes that would be subject to regulation under subtitle C of RCRA, by adding to 40 CFR part 261, Subpart F—Special Wastes Subject to Subtitle C Regulations for CCRs destined for disposal. Under this alternative, the Agency further proposes to list CCRs destined for disposal as a special waste and CCRs would then be subject to regulation under 40 CFR parts 260 through 268 and 270 to 279 and 124, and subject to the notification requirements of section 3010 of RCRA. This listing would apply to all CCRs destined for disposal. This section provides EPA's basis for regulating CCRs under subtitle C of RCRA when disposed. As described in this preamble, the proposed listing would not apply to CCRs that are beneficially used (*see* section IV), CCRs that are part of a state or federally required cleanup that commenced prior to the effective date of the final rule (*see* section VI), or CCRs generated by facilities outside the electric power sector (*see* section IV).

A. What is the basis for listing CCRs as a special waste?

Many of the underlying facts on which EPA would rely on to support its proposed special waste listing have been discussed in the previous sections, which lay out reasons why the Agency may decide to reverse the Bevill Regulatory Determination and exemption. Rather than repeat that discussion here, EPA simply references the discussion in the earlier sections. In addition, EPA would be relying on the various risk assessments conducted on CCRs to provide significant support for a listing determination. EPA's risk assessment work includes four analyses: (1) U.S. EPA 1998, "Draft Final Report: Non-groundwater Pathways, Human Health and Ecological Risk Analysis for Fossil Fuel Combustion Phase 2 (FFC2)" (June 5, 1998) referred to hereafter as the 1998 Non-groundwater risk assessment (available in docket # F–1999–FF2P–FFFFF in the RCRA Information Center, and on the EPA Web site at *http://www.epa.gov/osw/nonhaz/industrial/special/fossil/ngwrsk1.pdf*); (2) preliminary groundwater and ecological risk screening of selected constituents in U.S. EPA 2002, "Constituent Screening for Coal Combustion Wastes," (contractor deliverable dated October 2002, available in docket EPA–HQ–RCRA–2006–0796 as Document # EPA–HQ–RCRA–2006–0796–0470); referred to hereafter as the 2002 screening analysis; (3) U.S. EPA 2010a, "Human and Ecological Risk Assessment of Coal Combustion Wastes" (April 2010) available in the docket for this proposed rule, and referred to hereafter as the 2010 risk assessment; and (4) U.S. EPA 2010b, "Inhalation of Fugitive Dust: A Screening Assessment of the Risks Posed by Coal Combustion Waste Landfills—DRAFT" available in the docket for this proposed rule. As explained below, the 2010 risk assessment correlates closely with the listing criteria in EPA's regulations.

1. Criteria for Listing CCRs as a Special Waste and Background on 2010 Risk Assessment

In making listing determinations under subtitle C of RCRA, the Agency considers the listing criteria set out in 40 CFR 261.11. EPA considered these same criteria in making the proposed special waste listing decision.

The criteria provided in 40 CFR 261.11(a)(3) include eleven factors that EPA must consider in determining whether the waste poses a "substantial present or potential hazard to human health and the environment when improperly treated, stored, transported or disposed of or otherwise managed." Nine of these factors, as described generally below, are incorporated or are considered in EPA's risk assessment for the waste streams of concern:

○ Toxicity (Sec. 261.11(a)(3)(i)) is considered in developing the health benchmarks used in the risk assessment modeling.

○ Constituent concentrations (Sec. 261.11(a)(3)(ii)) and the quantities of waste generated (Sec. 261.11(a)(3)(viii)) are combined in the calculation of the levels of the CCR constituents that pose a hazard.

○ Potential of the hazardous constituents and any degradation products to migrate, persist, degrade, and bioaccumulate (sections 261(a)(3)(iii), 261.11(a)(3)(iv), 261.11(a)(3)(v), and 261.11(a)(3)(vi)) are all considered in the design of the fate and transport models used to determine the concentration of the contaminants to which individuals are exposed.

○ Two of the factors, plausible mismanagement and the regulatory actions taken by other governmental entities based on the damage caused by the constituents ((§§ 261.11(a)(3)(vii) and 261.11(a)(3)(x)), were used in establishing the waste management scenario(s) modeled in the risk assessment.

One of the remaining factors of the eleven listed in 261.11(a)(3) is consideration of damage cases (§ 261.11(a)(3)(ix)); these are discussed in section II. C. The final factor allows EPA to consider other factors as appropriate (§ 261.11(a)(3)(xi)).

As discussed earlier, EPA conducted analyses of the risks posed by CCRs and determined (subject to consideration of public comment) that it would meet the criteria for listing set forth in 40 CFR 261.11(a)(3). The criteria for listing determinations found at 40 CFR part

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[78] Energy Information Administration (*http://www.eia.doe.gov/cneaf/electricity/page/prim2/toc2.html#non*).

[79] *http://www.eia.doe.gov/cneaf/electricity/epa/epaxlfile1_1.pdf.*

[80] *http://www.eia.doe.gov/cneaf/electricity/epa/epaxlfile4_1.pdf.*

[81] *http://www.eia.doe.gov/cneaf/electricity/epa/epaxlfile2_3.pdf.*

261.11 require the Administrator to list a solid waste as a hazardous waste (and thus subject to subtitle C regulation) upon determining that the solid waste meets one of three criteria in 40 CFR 261.11(a)(1)-(3). As just noted, the criteria considered by EPA in determining that listing is warranted pursuant to 40 CFR 261.11(a)(3) are:

- Whether the waste contains any of the toxic constituents listed in Appendix VIII of 40 CFR part 261 (Hazardous Waste Constituents) and, after considering the following factors, the Administrator concludes that the waste is capable of posing a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed:

(i) The nature of the toxicity presented by the constituent.

(ii) The concentration of the constituent in the waste.

(iii) The potential of the constituent or any toxic degradation product of the constituent to migrate from the waste into the environment under the types of improper management considered in paragraph (vii).

(iv) The persistence of the constituent or any toxic degradation product of the constituent.

(v) The potential for the constituent or any toxic degradation product of the constituent to degrade into non-harmful constituents and the rate of degradation.

(vi) The degree to which the constituent or any degradation product of the constituent bioaccumulates in ecosystems.

(vii) The plausible types of improper management to which the waste could be subjected.

(viii) The quantities of the waste generated at individual generation sites or on a regional or national basis.

(ix) The nature and severity of the human health and environmental damage that has occurred as a result of the improper management of wastes containing the constituent.

(x) Action taken by other governmental agencies or regulatory programs based on the health or environmental hazard posed by the waste or waste constituent.

(xi) Such other factors as may be appropriate.

In 1994, EPA published a policy statement regarding how the Agency uses human health and environmental risk estimates in making listing decisions, given the uncertainty that can co-exist with risk estimates. Specifically:

> "* * * the Agency's listing determination policy utilizes a "weight of evidence" approach in which risk is a key factor * * * however, risk levels themselves do not necessarily represent the sole basis for a listing. There can be uncertainty in calculated risk values and so other factors are used in conjunction with risk in making a listing decision. * * *. EPA's current listing determination procedure * * * uses as an initial cancer risk "level of concern" a calculated risk level of 1×10^{5} (one in one hundred thousand) * * * (1) Waste streams for which the calculated high-end individual cancer-risk level is 1×10^{-5} or higher generally are considered candidates for a list decision * * * (2) Waste streams for which these risks are calculated to be 1×10^{-4} or higher * * * generally will be considered to pose a substantial present or potential hazard to human health and the environment and generally will be listed as hazardous waste. Such waste streams fall into a category presumptively assumed to present sufficient risk to require their listing as hazardous waste. However, even for these waste streams there can in some cases be factors which could mitigate the high hazard presumption. These additional factors * * * will also be considered by the Agency in making a final determination. (3) Waste streams for which the calculated high-end individual cancer-risk level is lower than 1×10^{-5} generally are considered initial candidates for a no-list decision. (4) Waste streams for which these risks are calculated to be 1×10^{-6} or lower, and lower than 1.0 HQs or EQs for any non-carcinogens, generally will be considered not to pose a substantial present or potential hazard to human health and the environment and generally will not be listed as hazardous waste. Such waste streams fall into a category presumptively assumed not to pose sufficient risk as to require their listing as hazardous waste. However, even for these waste streams, in some cases, there can be factors that could mitigate the low hazard presumption. These also will be considered by the Agency in making a final determination. (5) Waste streams where the calculated high-end individual cancer-risk level is between 1×10^{-4} and 1×10^{-6} fall in the category for which there is a presumption of candidacy for either listing (risk > 10^{-5}) or no listing (risk < 10^{-5}). However, this presumption is not as strong as when risks are outside this range. Therefore, listing determinations for waste streams would always involve assessment of the additional factors discussed below. * * * Additional factors. b. The following factors will be considered in making listing determinations, particularly for wastes falling into the risk range between 1×10^{-4} and 1×10^{-6}. (1) Certainty of waste characterization; (2) Certainty in risk assessment methodology; (3) Coverage by other regulatory programs; (4) Waste volume; (5) Evidence of co-occurrence; (6) Damage cases showing actual impact to human health or the environment; (7) Presence of toxicant(s) of unknown or unquantifiable risk." *See* 59 FR 66075–66077, December 22, 1994.

B. Background on EPA's 2010 Risk Assessment

1. Human Health Risks

Individuals can be exposed to the constituents of concern found in CCRs through a number of exposure routes. Potential contaminant releases from landfills and surface impoundments include: leaching to ground water; overland transport from erosion and runoff; and air emissions. The potential of human exposure from any one of these exposure pathways for a particular chemical is dependent on the physical and chemical characteristics of the chemical, the properties of the waste stream, and the environmental setting. EPA has conducted a peer-reviewed risk assessment of potential human health risks from CCR constituents leaching to groundwater that subsequently migrate either to a nearby drinking water well, or to nearby surface water, and is ingested as drinking water or through fish consumption (U.S. EPA 2010a). EPA has also performed preliminary analyses of human health effects from CCR constituents that have eroded or have run off from CCR waste management units (U.S. EPA 2002), and of human health effects from breathing windblown particulate matter from CCR landfill disposal operations (the 1998 risk assessment and U.S. EPA 2010b).

Longstanding EPA policy is for EPA risk assessments to include a characterization of the risks at two points on a distribution (*i.e.,* range) of risk estimates: a central tendency estimate that represents conditions likely to be encountered in a typical exposure situation, and a high end estimate that represents conditions likely to be encountered by individuals with higher exposures (U.S. EPA 1995).[82] Examples of factors that would influence a nearby resident's exposure are the residence's distance from a CCR waste management unit, and an individual's behavior or activity patterns. In the 2010 risk assessment, the high end risk estimates are the 90th percentile estimates from a probabilistic analysis.

The comparisons that EPA used in this rule to judge whether either a high end or central tendency estimated risk

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[82] *Guidance for Risk Characterization,* U.S. Environmental Protection Agency, 1995; accessible at *http://www.epa.gov/OSA/spc/pdfs/rcguide.pdf,* which states that "For the Agency's purposes, high end risk descriptors are plausible estimates of the individual risk for those persons at the upper end of the risk distribution," or conceptually, individuals with "exposure above about the 90th percentile of the population distribution". As suggested in the *Guidance,* we also provide 50th percentile results as the central tendency estimate of that risk distribution.

is of concern are the risk criteria discussed in the 1995 policy. As noted under that policy, for an individual's cancer risk, the risk criteria are in the range of 1×10^{-6}, or one in one million "excess" (above and beyond pre-existing risk) probability of developing cancer during a lifetime, to 1×10^{-4} (one in ten thousand),[83] with 1×10^{-5} (one in one hundred thousand) being the "point of departure" for listing a waste and subjecting it to regulation under subtitle C of RCRA.[84] For human non-cancer hazard, the risk criterion is an estimated exposure above the level at which no adverse health effects would be expected to occur (expressed as a ratio of the estimated exposure to the exposure at which it is likely that there would be no adverse health effects; this ratio is also called a hazard quotient (HQ), and a risk of concern equates to a HQ greater than one, or, in certain cases of drinking water exposure, water concentrations above the MCL established under the Safe Drinking Water Act.

The exposure pathways for humans that EPA has evaluated for CCR landfills and surface impoundments are nearby residents' groundwater ingestion and air inhalation, and fish consumption by recreational fishers.

2. Ecological Risks

For ecological non-cancer hazards that are modeled, the risk criterion is a hazard quotient that represents impacts on individual organisms, with a risk of concern being an estimated HQ greater than one. In some instances, EPA also considered documented evidence of ecological harm, such as field studies published in peer-reviewed scientific literature. Such evidence is often sufficient to determine adverse ecological effects in lieu of or in addition to modeling potential ecological risks.

Two types of exposures can occur for ecological receptors: exposures in which ecological receptors inhabit a waste management unit directly, and exposures in which CCRs or its chemical constituents migrate, or move, out of the waste management unit and contaminate nearby soil, surface water, or sediment.

C. Consideration of Individual Listing Criteria

CCRs contain the following Appendix VIII toxic constituents: antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, and thallium. These Appendix VIII constituents are frequently found in CCRs, as has been reported by the U.S. EPA (1988, 1999, 2002, 2006, 2008, and 2010).[85] These are discussed below with respect to the factors outlined in § 261.11(a)(3)(i)–(xi), and the Agency's findings. In the following discussion of the eleven listing factors, we combined factors iii (Migration), iv (Persistence), v (Degradation) and vi (Bioaccumulation); and factors vii (Plausible Types of Mismanagement), viii (Quantities of the Waste Generated), and ix (Nature and Severity of Effects from Mismanagement) for a more lucid presentation of our arguments.

1. Toxicity—Factor (i)

Toxicity is considered in developing the health benchmarks used in risk assessment modeling. The Agency for Toxic Substances and Disease Registry (ATSDR) ToxFAQs,[86] the EPA Integrated Risk Information System (IRIS),[87] and the Toxicology Data Network (TOXNET) of the National Institutes of Health [88] are all sources of toxicological data on the Appendix VIII hazardous constituents found in CCRs. (The information from these data sources on the toxicity of the metals identified is included in the docket to today's proposed rule.) Two types of ingestion benchmarks are developed. For carcinogens, a cancer slope factor (CSF) is developed. A CSF is the slope of the curve representing the relationship between dose and cancer risk. It is used to calculate the probability that the toxic nature of a constituent ingested at a specific daily dose will cause cancer. For non-carcinogens, a reference dose (RfD) is developed. The RfD (expressed in units of mg of substance/kg body weight-day) is defined as an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. The constituents of concern associated with CCRs include antimony, arsenic, barium, beryllium, cadmium, hexavalent chromium, lead, mercury, nickel, selenium, silver, and thallium. Based on the information in ASTDR's Tox FAQs, EPA's IRIS system and TOXNET, the Agency believes that the metals identified are sufficiently toxic that they are capable of posing a substantial present or potential hazard to human health and the environment when improperly treated, stored, transported disposed of, or otherwise managed. A brief summary of the toxic effects associated with these constituents is presented below, including for the four Appendix VIII hazardous constituents that were estimated in the draft groundwater risk assessment to pose high-end (90th percentile) risks at or above the risk criteria in one or more situations, and that were also found to present risk to human health in one or more damage cases (arsenic, cadmium, lead, and selenium):

Arsenic. Ingestion of arsenic has been shown to cause skin cancer and cancer in the liver, bladder and lungs.[89]

Antimony. Antimony is associated with altered glucose and cholesterol levels, myocardial effects, and spontaneous abortions. EPA has set a limit of 145 ppb in lakes and streams to protect human health from the harmful effects of antimony taken in through water and contaminated fish and shellfish.[90]

Barium. Barium has been found to potentially cause gastrointestinal disturbances and muscular weaknesses when people are exposed to it at levels above the EPA drinking water standards for relatively short periods of time.[91]

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[83] *See* 40 CFR 300.430.

[84] As noted previously, EPA's hazardous waste listing determination policy is described in the notice of proposed rulemaking for wastes from the dye and pigment industries at 59 FR 66075–66077.

[85] Full references: U.S. EPA (Environmental Protection Agency). 1988. *Wastes from the Combustion of Coal by Electric Utility Power Plants—Report to Congress.* EPA–530–SW–88–002. U.S. EPA Office of Solid Waste and Emergency Response. Washington, DC. November.

U.S. EPA (Environmental Protection Agency). 1999. *Report to Congress: Wastes from the Combustion of Fossil Fuels—Volume II,* EPA 530–S–99–010. Office of Solid Waste. March.

U.S. EPA (Environmental Protection Agency). 2002. *Constituent Screening for Coal Combustion Wastes.* Draft Report prepared by Research Triangle Institute for Office of Solid Waste, Washington, DC. September.

U.S. EPA (Environmental Protection Agency). 2006. *Characterization of Mercury-Enriched Coal Combustion Residuals from Electric Utilities Using Enhanced Sorbents for Mercury Control.* EPA 600/R–06/008. Office of Research and Development. Research Triangle Park, NC. January.

U.S. EPA (Environmental Protection Agency). 2008. *Characterization of Coal Combustion Residuals from Electric Utilities Using Wet Scrubbers for Multi-Pollutant Control.* EPA/600/R–08/077. Report to U.S. EPA Office of Research and Development, Air Pollution Control Division. Research Triangle Park, NC. July.

U.S. EPA (Environmental Protection Agency). 2010. *Human and Ecological Risk Assessment of Coal Combustion Wastes.* Office of Resource Conservation and Recovery, Washington, DC. April.

[86] *http://www.atsdr.cdc.gov/toxfaq.html.*

[87] *http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList&list type=alpha&view=B.*

[88] *http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.*

[89] ATSDR ToxFAQs. *Available at: http://www.atsdr.cdc.gov/toxfaq.html.*

[90] *Ibid.*

[91] *Ibid.*

Beryllium. Beryllium can be harmful if you breathe it. If beryllium air levels are high enough (greater than 1,000 ug/m³), an acute condition can result. This condition resembles pneumonia and is called acute beryllium disease.[92]

Cadmium and Lead. Cadmium and lead have the following effects: kidney disease, lung disease, fragile bone, decreased nervous system function, high blood pressure, and anemia.[93]

Hexavalent Chromium. Hexavalent chromium has been shown to cause lung cancer when inhaled.[94]

Mercury. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus.[95]

Nickel. The most common harmful health effect of nickel in humans is an allergic reaction. Approximately 10–20% of the population is sensitive to nickel. The most common reaction is a skin rash at the site of contact. Less frequently, some people who are sensitive to nickel have asthma attacks following exposure to nickel. Some sensitized people react when they consume food or water containing nickel or breathe dust containing it.[96]

Selenium. Selenium is associated with selenosis.[97]

Silver. Exposure to high levels of silver for a long period of time may result in a condition called arygria, a blue-gray discoloration of the skin and other body tissues.[98]

Thallium. Thallium exposure is associated with hair loss, as well as nervous and reproductive system damage.[99]

2. Concentration of Constituents in Waste—Factor (ii)

A CCR constituent database was developed for the Regulatory Determination in May 2000 and in followup work leading to today's co-proposal. This database contained data on the total CCR constituents listed above, as well as many others, with the Appendix VIII constituents found in varying concentrations (*see* Table 6).[100]

TABLE 6—TOTAL METALS CONCENTRATIONS FOUND IN CCRS

[ppm]

Constituent	Mean	Minimum	Maximum
Antimony	6.32	0.00125	3100
Arsenic	24.7	0.00394	773
Barium	246.75	0.002	7230
Beryllium	2.8	0.025	31
Cadmium	1.05	0.000115	760.25
Chromium	27.8	0.005	5970
Lead	25	0.0074	1453
Mercury	0.18	0.000035	384.2
Nickel	32	0.0025	54055
Selenium	2.4075	0.0002	673
Silver	0.6965	0	3800
Thallium	1.75	0.09	100

The data in Table 6 show that many of these metals are contained in CCRs at relatively high concentrations, such that if CCRs were improperly managed, they could leach out and pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of or otherwise managed. The risk assessment that was conducted confirms this finding, as do the many damage cases that have been documented and presented in today's co-proposal, including documents contained in the docket to today's proposed rule.

3. Migration, Persistence, Degradation, and Bioaccumulation—Factors (iii), (iv), (v), and (vi)

The potential of the hazardous constituents and any degradation products to migrate, persist, degrade and/or bioaccumulate in the environment are all factors that EPA considered and evaluated in the design of the fate and transport models that were used in assessing the concentrations of the toxic constituents to which humans and ecological receptors may be exposed. However, before discussing the hazardous constituents in the fate and transport models, the Agency would note that the toxic constituents for CCRs are all toxic metals—antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver and thallium, which do not decompose or degrade with the passage of time. Thus, these toxic metals will persist in the environment for very long periods of time, and if they escape from the disposal site, will continue to provide a potential source of long-term contamination.

The purpose of the risk assessment was to use the fate and transport models to assess likely migration of the CCR toxic constituents from different waste types through different exposure pathways, to receptors and to predict whether CCRs under different management scenarios may produce risks to human health and the environment. To estimate the risks posed by the management of CCRs in landfills and surface impoundments, the risk assessment estimated the release of the CCR toxic constituents from landfills and surface impoundments, the concentrations of these constituents in environmental media surrounding coal-fired utility power plants, and the risks that these concentrations pose to human and ecological receptors. The risk estimates were based on a groundwater fate and transport model in which constituents leached to groundwater consumed as drinking water, migrated to surface water and bioaccumulated in recreationally caught and consumed fish, and on direct ecological exposure. The specific 50th and 90th percentile risk assessment results for relevant Appendix VIII constituents are discussed below. While these results are based on a subset of CCR disposal units, they are likely representative of the risks posed by other similar disposal units. As discussed previously, the risk

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[92] *Ibid.*

[93] *Ibid.*

[94] *Ibid.*

[95] *Ibid.*

[96] *Ibid.*

[97] *Ibid.*

[98] *Ibid.*

[99] *Ibid.*

[100] Additional data on the waste characteristics of fly ash and FGD are presented in section I.F.2.

assessment demonstrates that if CCRs are improperly managed, they have the potential to present a hazard to human health and the environment above a 1×10^{-4} to 1×10^{-6} cancer range or an HQ of 1. A detailed discussion of the modeling and risks from this pathway can be found in U.S. EPA 2009a (available in the docket for this proposal). This report presents the methodology, results, and uncertainties of EPA's assessment of human health risks resulting from groundwater contamination from coal-fired electric utilities.

Ingestion of Groundwater: The risk assessment predicted that CCRs pose an estimated trivalent arsenic cancer risk of 4 in 10,000 for unlined landfills and 2 in 10,000 for clay-lined landfills at the 90th percentile. No cancer risks above 1 in 100,000 were found at the 50th percentile. The 90th percentile results also estimated that thallium is ingested at three times the reference dose and antimony at twice the reference dose for unlined landfills. For clay-lined landfills, only thallium is estimated to exceed the reference dose, with a 90th percentile ingestion of twice the reference dose.

CCRs co-managed with coal refuse in landfills are estimated to pose arsenic cancer risks of 5 in 10,000 for an unlined landfill and 2 in 10,000 for a clay-lined landfill at the 90th percentile. EPA estimates that arsenic poses a 2 in 100,000 risk of cancer at the 50th percentile for unlined landfills, but poses cancer risks of less than 1 in 100,000 for clay or composite-lined landfills. For CCRs co-managed with coal refule, thallium is estimated at two times the reference dose in unlined landfills at the 90th percentile, but did not exceed the reference dose at the 0th percentile for any liner type.

For unlined landfills managing FBC waste, arsenic is estimated to have a cancer risk of three in one hundred thousand at the 90th percentile. For clay-lined landfills managing FBC waste, arsenic is estimated to have a cancer risk of six in one hundred thousand at the 90th percentile, while thallium is estimated to have an HQ of 4, and antimony is estimated to have an HQ of 3.

The Appendix VIII constituents in CCRs managed in landfills are not all estimated to arrive at the drinking water well at the same time. For unlined landfills, the median number of years until peak well water concentrations are estimated to occur is approximately 2,800 to 9,700 years for arsenic, 2,600 to 10,000 years for selenium, and 2,300 years for thallium. For clay-lined landfills, the median estimated time until peak well concentrations is approximately 4,000 to 10,000 years for arsenic, 5,100 to more than 10,000 years for selenium, and 4,300 years for thallium. Of the contaminated groundwater plumes that are estimated to reach the receptor wells from composite-lined units, the median time to peak well concentration as not estimated to sour in the 10,000 year time period that was modeled.[101]

For surface impoundments, the risk estimates differ. CCRs managed alone, that is, without coal refuse in the same impoundment, are found to pose an arsenic cancer risk of 2 in 1,000 for unlined surface impoundments and 9 in 10,000 for clay-lined surface impoundments at the 90th percentile. For unlined surface impoundments at the 90th percentile, selenium's HQ is two and lead's is three. At the 50th percentile, none of the constituents assessed for non-cancer effects exceed their reference dose in any scenario, but arsenic did pose estimated cancer risks of 1 in 10,000 and 6 in 100,000 for unlined and clay-lined units, respectively. For the surface impoundments with composite liners, arsenic did not exceed cancer risks of 1 in 100,000, nor did selenium exceed its reference dose.

Co-disposed CCRs and coal refuse managed in surface impoundments resulted in the highest risks. For the 90th percentile, arsenic's estimated cancer risk is 2 in 100 and 7 in 1,000 for unlined and clay-lined surface impoundments, respectively.[102] At the 50th percentile, these units still resulted in estimated arsenic cancer risks of 6 in 10,000 for the unlined surface impoundment and 2 in 10,000 for the clay-lined surface impoundment. Cadmium and lead both are estimated to exceed the reference dose by nine times at the 90th percentile for unlined surface impoundments. In clay-lined surface impoundments, cadmium has an estimated cadmium HQ of 3. When managed in surface impoundments with composite liners, these constituents' estimated cancer risks did not exceed 1 in 100,000, nor are they estimated to exceed their reference doses.

As with landfills, the modeling shows differing arrival times of various constituents at the modeled well locations. Due to differences in behaviors when interacting in soil, some chemical constituents move more quickly than others through the subsurface environment. For unlined surface impoundments, the median number of years until peak well water concentrations would occur is estimated to be 74 years for hexavalent selenium and 78 years for arsenic. For clay-lined surface impoundments, the median number of years was estimated to be 90 years for hexavalent selenium and 110 years for trivalent arsenic. Of the plumes that did reach the receptor wells from composite-lined units,[103] the median number of years was estimated to be 4,600 years for hexavalent selenium and 8,600 years for trivalent arsenic.

While hexavalent chromium, and nickel were not modeled using the fate and transport models, they did show the potential for excess risk at the screening stage.[104] Risk attenuation factors were developed for each of these constituents at the 50th and 10th percentiles. Here, attenuation refers to the dilution of the concentration of a constituent. Thus, the 10th percentile (not the 90th percentile) was developed to represent the high-end risks. These risk attenuation factors were calculated by dividing the screening risk results by the full-scale risk results, across all unit types combined, for the constituents modeled in the full-scale assessment. Using the risk attenuation factors, none of the constituents were estimated to exceed an HQ of 1 at either the 50th or 10th percentile for landfills. For surface impoundments, hexavalent chromium was estimated to exceed an HQ of 1 at the 50th percentile, while hexavalent chromium was estimated to exceed an HQ of 1 at the 10th percentile. The HQ for nickel under the surface

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[101] The risk model used by EPA evaluates conditions over a 10,000 year period, and considers constituent concentrations during that period. In some cases, peak concentrations do not occur during the 10,000 year period.

[102] Including data with very high leach levels in surface impoundments where pyritic wastes were managed. As mentioned earlier, management of CCRs with coal refuse may have changed, and some pore water data from the coal refuse may not represent the management of these materials today. EPA has solicited comments on these issues.

[103] In other words, based on the results from this subset of the total number of Monte Carlo realizations.

[104] Previous risk assessment results for CCR (U.S. EPA, 1998) indicated concern for the groundwater pathway and limited concern for aboveground pathways for human and ecological receptors. The primary purpose of subsequent risk analyses was to update those results by incorporating new waste characterization data received since 1998 and by applying current data and methodologies to the risk analyses. The initial step in this process is screening and constituent selection for a more detailed analysis. The goal of screening is to identify CCR constituents, waste types, receptors, and exposure pathways with risks below the level of concern and eliminate those combinations from further analysis. The screening analysis (U.S. EPA, 2002) compared the 90th percentile leachate values directly to the human health benchmarks identified above. In other words, it was assumed that a human receptor was drinking leachate directly from a CCR landfill or surface impoundment with no attenuation or variation in exposure.

impoundment scenario was less than 1 using the 50th and 10th percentile values. However, the use of risk attenuation factors in place of probabilistic fate and transport modeling increases the uncertainty associated with these results. This analysis was conducted only for the drinking water exposure pathway.

Consumption of Recreationally Caught Fish: For the unlined, clay-lined, or composite-lined landfills, none of the modeled Appendix VIII hazardous constituents posed a cancer risk greater than 1 in 100,000, nor did they exceed their reference doses. However, for surface impoundments co-disposing of CCRs with coal refuse, trivalent arsenic's 90th percentile estimates are 3 in 100,000 and 2 in 100,000 excess cancer risk for unlined and clay-lined units, respectively. Pentavalent arsenic's 90th percentile estimate is 2 in 100,000 excess cancer risk for unlined impoundments. For all other liner and management unit scenarios at the 90th percentile, and all scenarios at the 50th percentile, there were no arsenic cancer risks above 1 in 100,000. Hexavalent selenium is estimated to result in exposures at three times the reference dose and twice the reference dose in the unlined and clay-lined surface impoundment scenarios, respectively, at the 90th percentile. However, selenium is not estimated to exceed the reference dose in the composite lined scenario at the 90th percentile, or any scenario at the 50th percentile.

Particulate Matter Inhalation: Air emissions from CCR disposal and storage sites can originate from waste unloading operations, spreading and compacting operations, the re-suspension of particulates from vehicular traffic, and from wind erosion. Air inhalation exposures may cause adverse human health effects, either due to inhalation of small-diameter (less than 10 microns) "respirable" particulate matter that causes adverse effects (PM_{10} and smaller particles which penetrate to and potentially deposit in the thoracic regions of the respiratory tract), which particles are associated with a host of cardio and pulmonary mortality and morbidity effects. *See e.g.* 71 FR at 61151–62 and 61178–85 (Oct. 6, 2006); *see* also 40 CFR 50.6 and 50.13 (National Ambient Air Quality Standards for thoracic coarse particles and fine particles).

To evaluate the potential exposure of residents to particulate matter that live near landfills that have disposed of CCRs, EPA has performed a screening-level analysis using the SCREEN3 model. This analysis, in *Inhalation of Fugitive Dust: A Screening Assessment of the Risks Posed by Coal Combustion Waste Landfills—DRAFT* (U.S. EPA 2010b, copy of which is in the docket for this proposed rule), indicates that, without fugitive dust controls, there could be exceedances of the National Ambient Air Quality Standards (NAAQS) for fine particulate matter in the air at residences near CCR landfills. EPA requests comment and data on the screening analysis, on the results of any ambient air monitoring for particulate matter that has been conducted, where air monitoring stations are located near CCR landfills, along with information on any techniques, such as wetting, compaction, or daily cover that may be employed to reduce such exposures.

A description of the modeling and risks from this pathway for disposal of CCRs in landfills and surface impoundments can be found in the Draft Final Report: Non-ground Water Pathways, Human Health and Ecological Risk Analysis for Fossil Fuel Combustion Phase 2 (FFC2); June 5, 1998.[105] This analysis did not address the issue of enrichment of toxic constituents present in the finer, inhalable fraction of the overall particulate matter size distribution,[106] but used the total constituent concentrations to represent the concentrations of constituents present on the inhaled particulate matter. Based on the analysis, at landfills, the highest estimated risk value was an individual excess lifetime risk of 4 in one million for the farmer, due to inhalation of chromium (all chromium present in the particulate matter was assumed to be in the more toxic, hexavalent form). For surface impoundments, the highest risk value was 2 in one million for the farmer (again assuming all chromium present was hexavalent). The Agency requests comment on the analysis, as presented in the draft final report, as well as any data, including air monitoring data that may be available regarding the potential for residents to be exposed to toxic constituents by this exposure pathway.

Ecological Exposure: Where species were directly exposed to surface impoundments, the risk assessment found ecological risks due to selenium, silver, nickel, chromium, arsenic, cadmium, barium, lead, and mercury. For scenarios where species were exposed to constituents that had migrated from the groundwater to surface water and sediment, ecological risk exceedances were found for lead, selenium, arsenic, barium, antimony, and cadmium at the 90th percentile, but not at the 50th percentile. EPA's risk assessment, confirmed by the existing damage cases and field studies published in the peer-reviewed scientific literature, show elevated selenium levels in migratory birds, and elevated contaminant levels in mammals as a result of environmental uptake, fish deformities, and inhibited fish reproductive capacity. Because of the large size of these management units, many being 100's of acres to one that is about 2,600 acres, receptors can often inhabit these waste management units. There are a number of recent references in the peer-reviewed scientific literature specific to CCRs managed in surface impoundments that confirm the 1998 risk assessment results and provide additional pertinent information of potential ecological damage. Hopkins, et al. (2006)[107] observed deformities and reproductive effects in amphibians living on or near CCR disposal sites in Georgia. Rowe, et al. (2002)[108] provided a thorough review of laboratory and field studies that relate to the impact of CCR surface impoundment management practices' on aquatic organisms and communities. Examples of studies cited in Rowe, et al. (2002) that illustrates the impact of CCRs on aquatic organisms in direct contact with surface impoundment waters and/or sediments include Benson and Birge (1985),[109] Coutant, et al. (1978)[110] and Rowe, et al. (2001),[111] while examples of studies cited in Rowe, et al. 2002 that illustrates the impact of CCRs on aquatic organisms in water bodies near CCR surface

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[105] *http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/ngwrsk1.pdf.*

[106] *See,* for example, Vouk, V. and Piver, W. "Metallic Elements in Fossil Fuel Combustion Products: Amounts and Form of Emissions and Evaluation of Carcinogenicity and Mutagenicity." Env Health Perspec 1983:47(201–225).

[107] Hopkins, W.A., S.E. DuRant, B.P. Staub, C.L. Rowe, and B.P. Jackson. 2006. Reproduction, embryonic development, and maternal transfer of contaminants in the amphibian Gastrophryne carolinensis. *Environmental Health Perspectives.* 114(5):661–666.

[108] Rowe, C., Hopkins, W., Congdon, G. "Ecotoxicological Implications of Aquatic Disposal of Coal Combustion Residuals in the United States: A Review." Env Monit Assess 2002: 80(270–276).

[109] Benson, W. and Birge, W. "Heavy metal tolerance and metallothionein induction in fathead minnows: results from field and laboratory investigations." Environ Toxicol Chem 1985:4(209–217).

[110] Coutant, C., Wasserman, C., Chung, M., Rubin, D., Manning, M. "Chemistry and biological hazard of a coal-ash seepage stream." J. Water Poll. Control Fed. 1978:50(757–743).

[111] Rowe C., Hopkins, W., and Coffman, V. "Failed recruitment of southern toads (Bufo terrestris) in a trace-element contaminated breeding habitat: direct and indirect effects that may lead to a local population sink." Arch. Environ. Contam. Toxicol. 2001:40(399–405).

impoundments include Lemly (1993),[112] Sorensen, et al. (1982)[113] and (1988).[114] This latter category may reflect CCR impacts attributable to three constituent migration mechanisms: (1) NPDES-permitted discharges from impoundments; (2) overtopping of impoundments; and (3) groundwater-to-surface-water discharges (modeled in US EPA 2010a), as well as other, non-CCR-related, sources of pollutants.

Although chromium, beryllium, and silver were not modeled, they were analyzed using dilution attenuation factors developed for the 50th and 10th percentiles in the same manner as described above. The only exceedance of the HQ of 1 was for silver at the 10th percentile under the landfill scenario. The only exceedances of the ecological criteria for surface impoundments of the 40 CFR part 261 Appendix VIII constituents was for chromium at the 10th percentile. Since full-scale modeling was not conducted, the results for these constituents are uncertain.

4. Plausible Types of Mismanagement, Quantities of the Waste Generated, Nature and Severity of Effects From Mismanagement—Factors (vii), (viii) and (ix)

As discussed earlier, approximately 46 million tons of CCRs were managed in calendar year 2008 in landfills (34%) and nearly 29.4 million tons were managed in surface impoundments (22%).[115] EPA has estimated that in 2004, 69% of the CCR landfills and 38% of the CCR surface impoundments had liners. As shown in the risk assessment and damage cases, the disposal of CCRs into unlined landfills and surface impoundments is likely to pose significant risks to human health and the environment. Additionally, documented damage cases have helped to confirm the actuality and magnitude of risks posed by these unlined disposal units.

The CCR waste stream is generated in very large volumes and is increasing. The ACAA estimates that the production of CCRs has increased steadily from approximately 30 million tons in the 1960s to over 120 million tons in the 2000s.[116] A recent ACAA survey estimates a total CCR production of just over 136 million tons in 2008.[117] This is a substantially large waste stream when compared to the 6.9 million tons of non-wastewater hazardous wastes disposed by all other sectors in 2007, and the 2 million tons of hazardous waste being reported as disposed of in landfills and surface impoundments in 2005.[118]

EPA currently has documented evidence of proven damages to groundwater and surface water from 27 disposal sites and potential damages at 40 sites which are discussed in detail above and in the Appendix to this proposal. The damage cases resulting from CCR constituents migrating into groundwater were generally the same with those predicted in the risk assessment with respect to constituents which migrated, the concentrations reaching receptors, and the consequent magnitude of risk to those receptors. Of the constituents in Appendix VIII of Part 261, four were found at levels of concern in both the risk assessment and the damage cases (arsenic, cadmium, lead, and selenium). Two additional Appendix VIII (Part 261) constituents (chromium and nickel) were found in damage cases, and showed the potential for risk in the risk assessment, but were not modeled through fate and transport modeling. Finally, there were two Appendix VIII (Part 261) constituents (antimony and thallium) that were projected to be capable of migrating and reaching receptors at levels of concern in the risk assessment, but have yet to be identified in any of our groundwater damage cases.[119]

The damages to surface water from Appendix VIII (Part 261) constituents do not reflect a ground water to surface water pathway, but rather reflect surface water discharges. Five damage cases resulted in selenium fish consumption advisories consistent with the risk assessment's prediction that selenium consumption from fish in water bodies affected by CCR disposal units would result in excess ecologic and human health risk. We are aware that at least three of the fish advisories were subsequently rescinded when the criteria was reassessed and revised. The risk assessment also predicts that arsenic would pose such risks. However, while no arsenic fish advisories have been linked to CCR disposal at this time, the risk assessment predicts that selenium will migrate faster than arsenic.

In addition to the impacts on human health from groundwater and surface water contaminated by CCR released from disposal units, the damage cases have also shown the following adverse effects to plants and wildlife: Elevated selenium levels in migratory birds, wetland vegetative damage, fish kills, amphibian deformities, snake metabolic effects, plant toxicity, mammal uptake, fish deformities, and inhibited fish reproductive capacity. Although these effects cannot easily be linked to the results of the risk assessment as was done for groundwater and surface water above, the risk assessment generally agreed with the damage cases because it sometimes showed very high risks to ecological receptors. For additional information on ecological damages, *see* the document titled "What Are the Environmental and Health Effects Associated with Disposing of CCRs in Landfills and Surface Impoundments?" in the docket to this proposal.

Furthermore, four of the 27 proven damage case disposal sites have been listed on the EPA's National Priorities List (NPL). The NPL is the list of national priority sites with known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The Hazard Ranking System (HRS), the scoring system EPA uses to assess the relative threat associated with a release from a site, is the primary method used to determine whether a site should be placed on the NPL.[120] The HRS takes into account the three elements of environmental and human health risk: (1) Probability of release; (2) exposure; and (3) toxicity. EPA generally will list sites with scores of 28.5 or above. The HRS is a proven tool for evaluating and prioritizing the releases that may pose threats to human health and the environment throughout the nation.

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[112] Lemly A., "Guidelines for evaluating selenium data from aquatic monitoring and assessment studies." Environ. Monit. Assess. 1993:28(83–100).

[113] Sorensen, E., Bauer, T., Bell, J., Harlan, C. "Selenium accumulation and cytotoxicity in teleosts following chronic, environmental exposure." Bull. Environ. Contam. Toxicol. 1982:29(688–696).

[114] Sorenson, E. "Selenium accumulation, reproductive status, and histopathological changes in environmentally exposed redear sunfish." Arch Toxicol 1988:61(324–329).

[115] Estimated from the 2009 ACAA survey and Energy Information Administration 2005 F767 Power Plant database.

[116] ACAA (American Coal Ash Association). 2008. Production & Use Chart (1966–2007). *http://www.acaa-usa.org/associations/8003/files/Revised 1966 2007 CCP Prod v Use Chart.pdf.*

[117] ACAA (American Coal Ash Association). 2009. *2008 Coal Combustion Product (CCP) Production & Use Survey Results. http://www.acaa-usa.org/associations/8003/files/2007_ACAA_CCP_Survey_Report_Form%2809-15-08%29.pdf.*

[118] The National Biennial RCRA Hazardous Waste Report (2007) available at *http://www.epa.gov/epawaste/inforesources/data/br07/national07.pdf.*

[119] While this could indicate a potential conservatism in the model with respect to these two constituents, it is more likely to result from a failure to sample for these constituents as frequently. This is consistent with the data reported in Table 4–29 of the revised risk assessment (only 11 samples taken for antimony and thallium in surface impoundments versus hundreds for various other constituents).

[120] U.S. EPA 2007. "Introduction to the Hazard Ranking System (HRS)." Accessed at: *http://www.epa.gov/superfund/programs/npl_hrs/hrsint.htm.*

Whereas each of those 4 NPL sites also contains waste other than CCRs, CCRs are one of the prevalent waste types in each case.[121]

In addition, the Kingston, Tennessee damage case (*see* the Appendix) helps to illustrate the additional threats to human health and the environment that can be caused by the failure of a CCR waste management unit. At TVA's Kingston facility, there were four failure conditions: The presence of an unusually weak fly ash ("Slimes") foundation; the fill geometry and setbacks; increased loads due to higher fill; and hydraulically placed loose wet ash. If owners or operators do not maintain due diligence regarding the structural integrity of surface impoundments, significant damage to human health and the environment could be a likely outcome. In summary, while the preponderance of documented damage cases were the result of releases from unlined landfills and surface impoundments, EPA believes that the above data identify situations (*e.g.*, adverse impacts on migratory birds) illustrative of potential problems occurring from the management of CCRs in any type of surface impoundment.

5. Action Taken by Other Governmental Agencies or Regulatory Programs Based on the Health or Environmental Hazard Posed by the Waste or Waste Constituent—Factor (x)

As a result of the mismanagement of CCRs, EPA and states have taken steps to compel cleanup in several situations. Specifically, in addition to EPA placing sites on the NPL due to the disposal or indiscriminant placement of CCRs, at least 12 states have issued administrative orders for corrective actions at CCR disposal sites. Corrective action measures at these CCR management units vary depending on the site specific circumstances and include formal closure of the unit, capping, re-grading of ash and the installation of liners over the ash, ground water treatment, groundwater monitoring, and combinations of these measures.

6. Other Factors—Factor (xi)

The damage cases and the risk assessment also found excess risks for human and ecological receptors that resulted from non-Appendix VIII (Part 261) constituents.[122] While not currently identified under RCRA as hazardous or toxic constituents, several of these constituents have the same toxic endpoints as the Appendix VIII (Part 261) constituents found in CCRs, while nitrate is associated with pregnancy complications and methemoglobinemia (blue baby syndrome).[123] Although these non-Appendix VIII (Part 261) constituents do not provide an independent basis for listing CCRs, EPA finds their presence in the damage cases and risk assessment results to be relevant to the listing decision because of the potential to cause additive or synergistic effects to the Appendix VIII constituents. For instance, exposure to high levels of cobalt (cobalt has an HQ of 500 when rounded to 1 significant digit) can result in lung and heart effects, the same endpoints as exposure to high levels of antimony. Thus, these two constituents could act additively or synergistically on both the heart and lungs. The risk assessment showed 90th percentile cobalt drinking water ingestion to be 500 times the reference dose. Thus, cobalt could exacerbate the heart and lung effects due to CCR antimony exposures.

Therefore, based on our examination of CCRs against the criteria for listing, a listing determination for CCRs destined for disposal can be based on such factors as (1) The continued evidence that CCRs in landfills and surface impoundments may not be properly managed—*e.g.*, the lack of groundwater monitoring for many existing units; (2) the continued gaps in some state regulations; (3) the damage cases we have documented to date, including the damage done by the recent catastrophic release of CCRs from the impoundment failure in Kingston, Tennessee; and (4) the results of the risk assessment, which indicates high-end risks associated with disposal of CCRs in unlined and clay-lined CCR landfills and surface impoundments far exceeding acceptable levels (*e.g.*, exceeding a cancer risk threshold of 1×10^{-5})[124] and the non-cancer risk threshold (HQ greater than 1).

VI. Summary of the Co-Proposed Subtitle C Regulations

Under the subtitle C alternative, EPA would list CCRs from electric utilities and independent power producers intended for disposal in landfills and surface impoundments as a special waste, which would make them subject to the existing subtitle C regulations at 40 CFR parts 260 through 268, as well as the permitting requirements in 40 CFR part 270, and the state authorization process in 40 CFR parts 271–272.[125] These regulations establish, among other things, location restrictions; standards for liners, leachate collection and removal systems, and groundwater monitoring for land disposal units; fugitive dust control; closure and post-closure care requirements; storage requirements; corrective action; financial assurance; waste characterization; and permitting requirements. These regulations also impose requirements on generators and transporters of CCRs destined for disposal, including manifesting (if the CCRs destined for disposal are sent off site). As discussed in detail in section IV. E of today's preamble, EPA is proposing to leave the Bevill determination in place for CCRs used beneficially. Thus, CCRs beneficially used would not be subject to regulation from the point of generation or from the point they are recovered from landfills or surface impoundments, to the point where they are used beneficially. In addition, when beneficially used (*e.g.*, in wallboard and concrete), the CCRs become part of a new product; these products do not carry the special waste listing. When these products reach the end of their useful life and are to be disposed of, this represents a new point of generation. This new waste would be subject to RCRA subtitle C if the waste exhibits a characteristic of hazardous waste (*i.e.*, ignitability, corrosivity, reactivity, or toxicity).

In the majority of cases, EPA is proposing that CCRs be subject to the existing subtitle C requirements without modification. Accordingly, for those regulatory requirements that we propose not to modify or for which EPA does not specifically solicit comment, EPA is not proposing to reopen any aspect of those requirements, and will not respond to any unsolicited comments submitted during this rulemaking. However, where EPA has determined that special

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[121] For specifics, please *see http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&d=EPA-HQ-RCRA-2006-0796-0015.*

[122] Aluminum, boron, chloride, cobalt, copper, fluoride, iron, lithium, manganese, molybdenum, nitrate/nitrite, strontium, sulfate, vanadium, and zinc.

[123] ATSDR CSEM. Available at: *http://www.atsdr.cdc.gov/csem/nitrate/no3physiologic_effects.html.*

[124] This risk level is consistent with those discussed in EPA's hazardous waste listing determination policy (see the discussion in a proposed listing for wastes from the dye and pigment industries, December 22, 1994; 59 FR 66072).

[125] As discussed in section VI. D of the preamble, as part of the proposal to list CCRs as a special waste, as is done routinely with listed wastes, EPA is also proposing to subject CCRs that are disposed of to the notification requirements under CERCLA at 40 CFR part 302.

characteristics of these wastes warrant changes; *e.g.,* where implementation of existing requirements would present practical difficulties, or where additional requirements are necessary due to the special characteristics of these wastes, EPA is proposing to revise the requirements to account for these considerations. For example, EPA is proposing tailored design criteria for new CCR disposal units, pursuant to its authority under section 3004(x) of RCRA.[126] Similarly, under the authority of section 3004(x) of RCRA, EPA is proposing to modify the CCR landfill and surface impoundment liner and leak detection system requirements and the effective dates for the land disposal restrictions, and the surface impoundment retrofit requirements. EPA is also proposing to establish new land disposal prohibitions and treatment standards for both wastewater and non-wastewater CCRs. In addition, to address dam safety and stability issues, EPA is proposing design and inspection requirements for surface impoundments, similar to those of the Mine Safety and Health Administration (MSHA) design requirements for slurry impoundments at 30 CFR part 77.216 for surface impoundments. Further, EPA is proposing that all existing surface impoundments that have not closed in accordance with the rule's requirements by the effective date of this rule would be subject to all of the requirements of this rule, including the need to obtain a permit, irrespective of whether the unit continues to receive CCRs or the facility otherwise engages in the active management of those units.

Finally, we would note that if the Agency concludes to reverse the Bevill determinations and list CCRs as a special waste, EPA would make in any final rule conforming changes to 40 CFR parts 260 through 268 and 270 through 272 so that it is clear that these requirements apply to all facilities regulated under the authority of RCRA subtitle C that generate, transport, treat, store, or dispose of special wastes as well as to those facilities that generate, treat, store, or dispose of special wastes.

The following paragraphs set out the details of this subtitle C proposal, with the modified or new requirement discussed in Section B. and the existing subtitle C requirements discussed in Section C.

A. Special Waste Listing

Under this regulatory option, EPA is proposing to list CCRs generated by electric utilities and independent power producers destined for disposal as a special waste subject to the requirements of RCRA subtitle C by amending 40 CFR part 261 and to add Subpart F—Special Wastes Subject to Subtitle C Regulations. The Agency believes this would be the appropriate manner for listing these wastes, and, as discussed in detail later in this section, the Agency believes that listing CCRs destined for disposal as a special waste, rather than a hazardous waste could, in large measure, address potential issues of stigma.

B. Proposed Special Requirements for CCRs

The following paragraphs discuss the special requirements the Agency is proposing for CCRs. These requirements modify or are in addition to the general subtitle C requirements found at 40 CFR parts 264–268 and 270–272.

1. Modification of Technical Standards Under 3004(x)

Section 3004(x) of RCRA authorizes the Administrator to modify the statutory requirements of sections 3004(c), (d), (e), (f), (g), (o), (u), and 3005(j) of RCRA in the case of landfills or surface impoundments receiving Bevill wastes, including CCRs that EPA determines to regulate under subtitle C, to take into account the special characteristics of the wastes, the practical difficulties associated with implementation of such requirements, and site-specific characteristics, including, but not limited to the climate, geology, hydrology and soil chemistry at the site, so long as such modified requirements assure protection of human health and the environment. The Agency is proposing to modify, through its authority under RCRA 3004(x), the CCR landfill and surface impoundment liner and leak detection system requirements, the effective dates for the land disposal restrictions, and the surface impoundment retrofit requirements.

i. Modification of CCR Landfills and Surface Impoundments From the Section 3004(o) Liner and Leak Detection Requirements

The minimum technological requirements set out in RCRA Section 3004(o)(1)(A)(i) requires that new hazardous waste landfills and surface impoundments, replacements of existing landfills and impoundments, and lateral expansions of existing landfills and impoundments,[127] to install two or more liners and a leachate collection and removal system above (in the case of a landfill) and between such liners. Section 3004(o)(4)(A) also requires these units to install a leak detection system. Landfills and surface impoundments covered under the regulations at 40 CFR part 264 are required to have a double liner system, and a leachate collection and removal system that can also serve as a leak detection system as described in 40 CFR sections 264.221 and 264.301. Under section 3005 (j)(1) (and, as explained below, effectively under section 3005 (j)(11) as well), existing surface impoundments are required to meet all of these requirements as well.

EPA is proposing to modify the double liner and leachate collection and removal system requirement by substituting a requirement to install a composite liner and leachate collection and removal system. As modeled in EPA's risk assessment, composite liners effectively reduce risks from all constituents to below the risk criteria for both landfills and surface impoundments. Therefore, the Agency believes a composite liner system would be adequately protective of human health and the environment and a double liner system would be unnecessarily burdensome. The modified standards specify a composite liner system that consists of two components: the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component. The leachate collection system must be designed and constructed to maintain less than a 30-cm depth of leachate over the liner.

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[126] Section 3004(x) of RCRA provides EPA the authority to modify certain statutory provision (i.e., 3004(c), (d), (e), (f), (g), (o), and (u) and 3005(j) taking into account the special characteristics of such wastes, the practical difficulties associated with implementation of such requirements, and site-specific characteristics, including, but not limited to, climate, geology, hydrology, and soil chemistry at the site, so long as such modified requirements are protective of human health and the environment.

[127] Replacement unit means a landfill, surface impoundment, or waste pile unit (1) from which all or substantially all of the waste is removed, and (2) that is subsequently reused to treat, store, or dispose of such waste. "Replacement unit" does not apply to a unit from which waste is removed during closure, if the subsequent reuse solely involves the disposal of waste from that unit and other closing units or corrective action areas at the facility, in accordance with an approved closure plan or EPA or State approved corrective action. Lateral expansion means a horizontal expansion of the waste boundaries of an existing landfill or surface impoundment.

EPA has concluded that these liner and leachate collection requirements will be protective of human health and the environment from the release of contaminants to groundwater from CCRs in landfills and surface impoundments. Specifically, the risk assessment indicates that risks from disposal units with composite liners will be less than the 1×10^{-5} for carcinogens and less than an HQ of one for other hazardous constituents—levels that EPA has considered protective for the management of hazardous wastes. (The results of EPA's risk analyses are discussed in section II.B, and in the full risk assessment document, which is in the docket for today's proposed rulemaking.) Further support is provided by the damage cases, as none of the proven damage cases involved lined landfills or surface impoundments (with the possible exception of one unit, which in any case did not have a composite liner). In addition, the proposed modified requirements are the design standards for composite liners specified for municipal solid waste landfills at 40 CFR part 258; based on EPA's experience, such liner design would be expected to be effective in mitigating the risks of leaching to groundwater for a waste, such as CCRs. For example, CCRs do not contain volatile organics, such as ethylbenzene, which has recently been shown to be problematic for synthetic liners.

Although EPA has not confirmed damage cases involving the failure of clay liners, it is not proposing to allow new disposal units to be built solely with clay liners. EPA's modeling in its risk assessment indicated that clay liners could be of concern; EPA also believes that composite liners reflect today's best practices for new units, and, as such, can therefore be feasibly implemented.[128] Nevertheless, EPA solicits comments on whether clay liners should also be allowed under EPA's regulations. To assist EPA in its review, we request that commenters provide data on the hydraulic conductivity of clay liners associated with coal ash disposal units, and information on the protectiveness of clay liner designs based on site-specific analyses.

Thus, we are proposing to amend the current requirements of 40 CFR 264.220, and 264.300 to require that CCR surface impoundments and landfills install a composite liner and leachate collection and removal system. EPA would codify these requirements, as well as other special requirements for CCR wastes in a new subpart FF of 40 CFR part 264.

EPA also notes that section 3004(o)(2) allows the Agency to approve alternate liner designs, based on site-specific demonstrations that the alternate design and operating practices, together with location characteristics, will prevent the migration of any hazardous constituents into ground or surface water at least as effectively as the double-liner system (42 U.S.C. 6924(o)(2)). EPA solicits comment on whether, in addition to the flexibility provided by section 3004(o)(2), EPA's regulations should also provide for alternative liner designs based on, for example, a specific performance standard, such as the subtitle D performance standard in 40 CFR 258.40(a)(1), or a site specific risk assessment, or a standard that the alternative liner, such as a clay liner, was at least as effective as the composite liner. Such an approach might be appropriate, for example, in situations where groundwater is particularly deep and/or infiltration rates are low, or where alternative liner systems provide an equivalent level of protection.

Subtitle C of RCRA requires only new hazardous waste landfills (or new portions of existing landfills) to meet the minimum technology requirements for liners and leachate collection and removal systems. RCRA section 3004 (o)(1)(A). The statute thus does not require existing landfills that are brought into the subtitle C system because they are receiving newly listed hazardous wastes, or the new category of listed special wastes proposed in this notice, to be retrofitted with a new minimum-technology liner/leachate collection and removal system (or to close). They can continue to receive hazardous or special waste, and continue to operate as compliant hazardous or special waste landfills. Following from these provisions, EPA has not typically required existing landfills to be retrofitted to meet the new requirements. Congress specifically established this approach under subtitle C, and EPA sees no reason or special argument to adopt more stringent requirements for CCR landfills, particularly given the volume of the material and the disruption that would be involved with any other approach. However, under the proposal, existing units would have to meet the groundwater monitoring, corrective action, and other requirements of the subtitle C regulations to assure that any groundwater releases from the unit were identified and promptly remediated. This is consistent with the manner in which EPA has historically implemented the hazardous waste requirements. EPA believes that maintaining this approach in this context will be protective, in part, because, unless facilities ship all of their wastes off-site (which EPA believes is highly unlikely), they will need a permit for on-site management of CCRs, which will provide regulatory oversight that could, as necessary, address the risks from the existing (unpermitted) landfills.

By contrast, Congress was significantly more concerned about the risks associated with unlined surface impoundments managing newly listed hazardous wastes (*see* 42 U.S.C. Section 6924, October 21, 1976). This is addressed in more detail in section (iv) below titled "Wet-Handling of CCRs, Closure, and Interim Status for Surface Impoundments."

ii. Fugitive Dust Controls

The proposed subtitle C approach would require that surface impoundments and landfills be managed in a manner that controls fugitive dust consistent with any applicable requirements developed under a State Implementation Plan (SIP) or issued by EPA under section 110 of the Clean Air Act (CAA). Specifically, EPA is proposing to adopt as a standard the 35 $\mu g/m^3$ level established as the level of the 24-hour NAAQS for fine particulate matter (PM–2.5). In addition, CCR facilities would be required to control fugitive dust by either covering or otherwise managing CCRs to control wind dispersal of dust, emplacement as wet conditioned CCRs to control wind dispersal, when stored in piles, or storage in tanks or buildings. For purposes of the proposal, wet conditioning means wetting CCRs with water to a moisture content that prevents wind dispersal, facilitates compaction, but does not result in free liquids. Trucks or other vehicles transporting CCRs are to be covered or otherwise managed to control wind dispersal of dust. EPA is proposing this requirement based on the results of a screening level analysis of the risks posed by fugitive dusts from CCR landfills, which showed that, without fugitive dust controls, levels at nearby locations could exceed the 35 $\mu g/m^3$ level established as the level of the 24-hour PM 2.5 NAAQS for fine particulate.

iii. Special Requirements for Stability of CCR Surface Impoundments

To detect and prevent potential catastrophic releases, EPA is proposing requirements for periodic inspections of surface impoundments. The Agency

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[128] EPA notes that the state of Maryland, in developing new standards for CCR disposal units under its subtitle D authorities, prescribes composite liners.

believes that such a requirement is critical to ensure that the owner and operator of the surface impoundment becomes aware of any problems that may arise with the structural stability of the unit before they occur and, thus, prevent the past types of catastrophic releases, such as at Martins Creek, Pennsylvania and TVA's Kingston, Tennessee facility. Therefore, EPA is proposing that inspections be conducted every seven days by a person qualified to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation. If a potentially hazardous condition develops, the owner or operator shall immediately take action to eliminate the potentially hazardous condition; notify the Regional Administrator or the authorized State Director; and notify and prepare to evacuate, if necessary, all personnel from the property which may be affected by the potentially hazardous condition(s). Additionally, the owner or operator must notify state and local emergency response personnel if conditions warrant so that people living in the area down gradient from the surface impoundment can be evacuated. Reports of inspections are to be maintained in the facility operating record.

To address surface impoundment (or impoundment) integrity (dam safety), EPA considered two options. One option, which is the option proposed in this notice, is to establish standards under RCRA for CCR surface impoundments similar to those promulgated for coal slurry impoundments regulated by the Mine Safety and Health Administration (MSHA) at 30 CFR 77.216. Facilities relying on CCR impoundments would need to (1) submit to EPA or the authorized state plans for the design, construction, and maintenance of existing impoundments, (2) submit to EPA or the authorized state plans for closure, (3) conduct periodic inspections by trained personnel who are knowledgeable in impoundment design and safety, and (4) provide an annual certification by an independent registered professional engineer that all construction, operation, and maintenance of impoundments is in accordance with the approved plan. When problematic stability and safety issues are identified, owners and operators would be required to address these issues in a timely manner.

In developing these proposed regulations for structural integrity of CCR impoundments, EPA sought advice from the federal agencies charged with managing the safety of dams in the United States. Many agencies in the federal government are charged with dam safety, including the U.S. Department of Agriculture (USDA), the Department of Defense (DOD), the Department of Energy (DOE), the Nuclear Regulatory Commission (NRC), the Department of Interior (DOI), and the Department of Labor (DOL), MSHA. EPA looked particularly to MSHA, whose charge and jurisdiction appeared to EPA to be the most similar to our task. MSHA's jurisdiction extends to all dams used as part of an active mining operation and their regulations cover "water, sediment or slurry impoundments" so they include dams for waste disposal, freshwater supply, water treatment, and sediment control. In fact, MSHA's current impoundment regulations were created as a result of the dam failure at Buffalo Creek, West Virginia on February 26, 1972. (This failure released 138 million gallons of stormwater run-off and fine coal refuse, and resulted in 125 persons being killed, another 1,000 were injured, over 500 homes were completely demolished, and nearly 1,000 others were damaged.)

MSHA has nearly 40 years of experience writing regulations and inspecting dams associated with coal mining, which is directly relevant to the issues presented by CCRs in this rule. In our review of the MSHA regulations, we found them to be comprehensive and directly applicable to the dams used in surface impoundments at coal-fired utilities to manage CCRs. We also believe that, based on the record compiled by MSHA for its rulemaking, and on MSHA's 40 years of experience implementing these regulations, these requirements will prevent the catastrophic release of CCRs from surface impoundments, as occurred at TVA's facility in Kingston, Tennessee, and will generally meet RCRA's mandate to ensure the protection of humans and the environment. Thus, we have modeled our proposal on the MSHA regulations in 30 CFR Part 77 and we have placed the text of the salient portions of the MSHA regulations in the docket for this rulemaking. The Agency requests comment on EPA's proposal to adopt the MSHA standards (with limited modifications to deal with issues specific to CCR impoundments) to address surface impoundment integrity under RCRA.

MSHA's regulations cover impoundments which can present a hazard and which impound water, sediment or slurry to an elevation of more than five (5) feet and have a storage volume of 20 acre-feet or more and those that impound water, sediment, or slurry to an elevation of 20 feet or more. EPA seeks comment on whether to cover all CCR impoundments for stability, regardless of height and storage volume, whether to use the cut-offs in the MSHA regulations, or whether other regulations, approaches, or size cut-offs should be used. If commenters believe that other regulations or size cut-offs should be adopted (and not the size-cut offs established in the MSHA regulations), we request that commenters provide the basis and technical support for their position.

The second option that EPA considered, but is not being proposed today, is to establish impoundment integrity requirements under the Clean Water Act's NPDES permit system. Existing regulations at 40 CFR 122.41(e) require that permittees properly operate and maintain all facilities of treatment and control used to achieve compliance with their permits. In addition, regulations at 40 CFR 122.44(k) allow the use of best management practices for the control and abatement of the discharge of toxic pollutants. Guidance could be developed to use best management practices to address impoundment construction, operation, and maintenance, consistent with the requirements of 40 CFR 122.41(e) and 122.44(k). Associated permit conditions could require that surface impoundments be designed and constructed in accordance with relevant state and federal regulations. The Agency requests comments regarding the alternate use of NPDES permits rather than the development of RCRA regulations to address dam safety and structural integrity.

iv. Wet-Handling of CCRs, Closure, and Interim Status for Surface Impoundments

Where a nonhazardous waste surface impoundment is storing a waste that becomes newly subject to the RCRA hazardous waste requirements, RCRA subtitle C and the implementing regulations require these surface impoundments either to be closed or upgraded to meet the minimum technology requirements within four years. RCRA section 3005 (j)(6), is implemented by 40 CFR 268.14.[129] In order to be eligible for this four year grace period, the impoundment must be in compliance with the applicable

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[129] 40 CFR 268.14 allows owners and operators of newly regulated surface impoundments to continue managing hazardous waste without complying with the minimum technology requirements for a period up to four years before upgrading or closing the unit.

groundwater monitoring provision under Part 40 CFR 265, Subpart F within 12 months of the promulgation of the new hazardous listing or characteristic.

RCRA section 3005 (j)(11) allows the placement of untreated hazardous waste (*i.e.* hazardous waste otherwise prohibited from land disposal which has not been treated to meet EPA-established treatment standards before land disposal) in surface impoundments under limited circumstances. Such hazardous wastes may be placed in impoundments for purposes of treatment provided the impoundments meet the minimum technology requirements and provided that any treatment residues which either do not meet the treatment standards or which remain classified as hazardous wastes are removed from the impoundment annually. *See* the implementing rules in 40 CFR section 268.4. EPA has interpreted this provision so as not to nullify the provisions of section 3005(j)(6), the upshot being that impoundments receiving newly identified or listed wastes would have four years to close or retrofit under all circumstances. *See* 56 FR 37194. If the surface impoundment continues to treat hazardous wastes after the four year period, it must then be in compliance with 40 CFR 268.4 (Treatment Surface Impoundment Exemption).

Section 3005(j) of RCRA generally requires that existing surface impoundments cannot obtain interim status and continue to receive or store newly regulated hazardous waste for more than four years after the promulgation of the listing—unless the facility owner retrofits the unit by installing a liner that meets the requirements of section 3004(o)(1)(A), or meets the conditions specified in section 3005(j)(2). Under section 3005(j)(2), a surface impoundment may obtain interim status and continue to receive or store hazardous waste after the four-year deadline if (1) The unit has at least one liner, and there is no evidence it is leaking, (2) is located more than one-quarter mile from an underground source of drinking water; and (3) complies with the groundwater monitoring requirements applicable to permitted facilities. In this case, under section 3005(j)(9), the facility owner, at the closure of the unit, would have to remove or decontaminate all waste residues, all contaminated liner material, and contaminated soil to the extent practicable.

As part of the requirement to assure that surface impoundments will be safely phased out, EPA also proposes to regulate surface impoundments that have not completed closure prior to the effective date of the rule. Under that scenario, these units would be subject to the interim status closure requirements of 40 CFR 265.111 and 265.228(a)(2). For surface impoundments that have not met the interim status requirements by the effective date of the rule, they would be subject to the full RCRA subtitle C closure requirements (*e.g.,* obtain a Part A permit and comply with the interim status regulations).

EPA recognizes that for regulatory purposes, it has historically not required disposal units that cease receiving new listed or characteristic wastes before the effective date of RCRA subtitle C to comply with the requirements. However, EPA believes that a revised approach is necessary to protect human health and the environment, in this particular case, given the size of the CCR surface impoundments in question; the enormous volumes of CCRs they typically contain (which typically represent overwhelming mass of the material in place); the fact that the CCRs are typically destined for permanent entombment when the unit is eventually closed (typically with limited removal); the presence of very large hydraulic head leading to continued release—even where the impoundment has been drained—that is, improperly closed CCR impoundments remain open to precipitation and infiltration; and the continuing threat to human health and the environment through catastrophic failure, if the impoundments are not properly closed.

EPA's authority under subtitle C of RCRA extends to wastes that are treated, stored, or disposed of; the statutory definition of disposal has been broadly interpreted to include passive leaking. But historically, EPA has construed the definition of disposal for regulatory purposes to be narrower than the statutory definition of disposal. Although in some situations, post-placement management has been considered disposal, triggering RCRA subtitle C regulatory requirements *e.g.,* multiple dredging of impoundments or management of leachate, EPA has generally interpreted the statute to require a permit only if a facility treats, stores, or disposes of the waste, after the effective date of its designation as a hazardous waste. *See, e.g.,* 43 FR 58984 (Dec. 18, 1978; 45 FR 33074 (May 1980).

The consequence of this interpretation is that, for example, no permit would be required if, after the rule's effective date, a facility neither continued to accept the listed wastes for disposal, nor continued to "manage the wastes" in the existing unit. In other words, under this interpretation, facility owners could abandon the unit before the effective date of the rule without incurring any regulatory obligations under RCRA subtitle C (presuming no other regulated unit is present on-site).

Given the particularly significant risk associated with CCR impoundments described above, as well as the fact that these risks are primarily driven by the existing disposal units, EPA believes a broader interpretation of disposal is appropriate in this case. This is reinforced by the fact that the continued release of constituents to surrounding soil and groundwater through the continued infiltration of precipitation through inappropriately closed CCR impoundments (or failure to remove the impoundment waters, which provides a hydraulic head) properly constitute regulatory disposal in this specific situation.

As a practical matter, EPA believes that owners of facilities where CCRs are managed in existing surface impoundments being brought under RCRA subtitle C by today's proposal would choose not to, or would not be able to, comply with either of these alternatives (*i.e.,* retrofit or clean closure), given the size of the units and the volume of CCRs involved. Therefore, EPA believes that the section 3005(j) requirements, for all practical purposes, will have the effect of requiring the closure of existing surface impoundments receiving CCRs within four years of the effective date of today's proposed rule (unless they already meet the liner requirements).[130]

Section 3004(x), however, gives EPA the authority to modify section 3005(j) requirements, if the specific criteria listed in that section are met. In today's notice, EPA is proposing to modify the time required for retrofitting surface impoundments under section 3005(j), because of the special characteristics (*i.e.,* extremely large volumes) of CCRs and the practical difficulties associated with requiring facilities to cease to store CCRs within four years of the effective date of today's rule.

Therefore, EPA is proposing to modify the section 3005(j) requirements by extending the time limit for unit closure. The modified standard in today's proposal would require facilities operating surface impoundments that do not meet minimum technology

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[130] The HSWA surface impoundment retrofit requirements, as they applied to impoundments in existence at the time RCRA was amended in 1984, went into effect in 1988. EPA is not aware of any facility owner/operator managing an existing surface impoundment at the time who chose to retrofit its impoundment, rather than to close it. EPA believes facilities managing surface impoundments today, will similarly choose to close the surface impoundment rather than retrofit.

requirements and are receiving CCRs to stop receiving those CCRs no later than five years after the effective date of the final regulation and to close the unit within two years after that date. In other words, the time required for closure would be up to seven years rather than four years.

EPA believes that the four-year deadline in RCRA section 3005(j) receiving CCRs will be extraordinarily difficult if not impossible for many facilities to meet, given the size of the units and limitations in available alternative subtitle C disposal capacity. Facility owners choosing to close surface impoundments may have to make significant engineering and process changes, *e.g.,* to convert from wet- to dry-handling of wastes, which cannot necessarily be accomplished within four years. For example, USWAG has raised concerns that there is limited manufacturing capacity for key conversion equipment, which could reasonably be expected to complicate the utilities' ability to collectively make the necessary engineering changes within a four-year timeframe. An additional consideration is that EPA expects that many facilities would need to obtain permits for new units or find alternative subtitle C capacity to receive the wastes diverted from surface impoundments. Also, facilities that use surface impoundments receiving CCRs to manage stormwater and nonhazardous wastewater will have to site and get permits for new stormwater management units before facility owners can cease utilizing existing units. The amount of time to achieve either of these alternatives relies, to some extent, on events beyond the facility's control; for example, the timeframes to obtain a permit for a new unit can vary substantially and, in large measure, are ultimately dictated by the permitting authority, rather than the applicant. This may be further complicated by the fact that location standards or on-site space limitations can restrict the opportunity for siting new units at the generating facility, requiring utilities to find off-site disposal facilities able to receive the special waste in the volumes in question.

In the 1984 amendments, Congress only allowed surface impoundments four years to cease receiving hazardous waste (or comply with minimum technological design requirements, etc.). Given the enormously greater volume of waste involved with CCR surface impoundments and the process changes that the facilities will need to implement to convert to dry handling, EPA believes it not practicable to require surface impoundments to cease receiving CCR waste or comply with the minimum technological requirements four years and that additional time is appropriate. (As noted below, facilities in most states will have significantly more time for planning, because the rules will not become effective in states authorized for the RCRA program before those states have amended their requirements consistent with today's rule; the state regulatory process will likely take several years.) On the other hand, as the risks predicted in the risk assessment are extraordinarily high (up to 2×10^{-2}), EPA believes that closure within the shortest practicable time is important.

Any modifications of section 3005(j) must meet the section 3004(x) stricture that the modification must still "assure protection of human health and the environment (42 U.S.C. 6924(x)." EPA believes that allowing three additional years for closure, under today's proposal, would be protective because surface impoundments subject to the closure requirements would be required (during this interim period) to have groundwater monitoring systems sufficient to detect releases of hazardous constituents into the groundwater, and take corrective action where releases were detected above drinking water levels.[131] Additionally, the median number of years until peak well water concentrations are reached for selenium and arsenic are estimated at 74 and 78 years, respectively, for unlined surface impoundments and 90 and 110 years, respectively, for clay-lined surface impoundments, reducing the likely risks posed over this five-year period.

In addition, although not directly relevant to leaching from these surface impoundments, we would also note (as described previously in this section) that the facility would be required to have an independent registered professional engineer certify that design of the impoundment is in accordance with recognized and generally accepted good engineering practices (RAGAGEP)[132] for the maximum volume of CCR slurry and wastewater that will be impounded therein, and that the design and management features ensure dam stability. Finally, the facilities will be required to conduct weekly inspections to ensure that any potentially hazardous condition or structural weakness will be quickly identified. Therefore, the additional timeframe that EPA is proposing to allow—needed to address practical realities—will "assure protection of human health and the environment. While groundwater monitoring, corrective action, and close oversight of these units is not, we believe, the most appropriate long-term solution, we do believe that these steps will protect public health and the environment in the short term while the permanent solutions are being implemented.

EPA recognizes that the costs of these requirements will be significant, especially for existing surface impoundments and similar units that handle wet CCRs. EPA also acknowledges that the date by which impoundments have to close is an important issue, affecting the costs of phase-out of wet handling and the ability of industry to comply. USWAG has argued strenuously against a closure requirement in the first place, and has asserted that, if such a requirement were imposed, industry would require ten years to comply.[133]

EPA is not persuaded by these comments. We appreciate the cost considerations but also believe it is important that these surface impoundments cease receiving wet-handled CCRs and proceed to closure as soon as practicable. The Agency believes that the time period proposed today is sufficient to provide industry the time necessary to convert from wet handling to dry handling of these wastes, close out existing units, and find or put in place new disposal capacity for these wastes. In addition, the Agency notes that TVA and other utilities have already decided, or are being required by states, to close existing impoundments, regardless of the requirements of today's proposed rule. As a result, EPA believes today's proposal would have less effect than industry commenters suggest because some facilities may be making these changes anyway and they reflect best management practices in today's environment. However, EPA solicits comments on whether seven years (5 years to cease receiving waste and 2 years to close) from the effective date to implement these provisions is an achievable time for facilities to comply.

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[131] The Agency is also modifying the requirement that surface impoundments be dredged annually, based on RCRA section 3004(x). This is discussed in detail in section v (Proposed Land Disposal Restrictions) below.

[132] Recognized and generally accepted good engineering practices (RAGAGEPs) are engineering, operation, or maintenance activities based on established codes, standards, published technical reports or recommended practices (RP) or a similar document. RAGAGEPs detail generally approved ways to perform specific engineering, inspection or mechanical integrity activities. *See http://www.osha.gov/OshDoc/Directive_pdf/CPL_03-00-010.pdf.*

[133] In developing cost estimates for closing its surface impoundments, TVA also assumed that the process would take place over ten years.

EPA is interested in comments on procedural, as well as technical, issues (*e.g.,* time to allow permit modifications for new capacity or EPA or state approval of closure plans). As stated earlier, EPA does note that, in the 1984 amendments to RCRA, Congress required existing hazardous waste surface impoundments without liners to retrofit within four years if they are to continue operating. Congress also required impoundments which place hazardous wastes into impoundments to either treat the wastes first, or to use minimum technology impoundments, including a requirement to dredge the impoundment annually. *See* discussion of section 3005(j)(11) and implementing regulations above. As a practical matter, this meant that all but a very few surface impoundments ceased receiving hazardous wastes within this time period. Thus, a requirement that surface impoundments cease receiving liquid wastes in five years and close in seven years is consistent with Congressional direction on appropriate time periods to phase out the management of CCRs in surface impoundments. Further, as noted previously, these specific requirements will not go into effect in most cases until a state is authorized for this aspect of the RCRA program, which normally takes from two to five years after the regulations become federally effective (with some estimates as long as eight years), giving facilities substantial advance notice. (*See* discussion on when the rules become effective in section VII of this preamble.) For commenters who suggest a longer time period is needed, EPA solicits comment on how a longer time period would meet the section 3004(x) risk standard.

Whatever time period EPA selects, the Agency solicits comment on whether it should include a provision that would allow the regulatory Agency to provide additional time on a case-by-case basis because of site-specific issues (*e.g.,* particular technical difficulties or equipment availability outside the utility's control, as well as permitting delays). This provision might be modeled after the provision of 40 CFR 264.112 and 265.112 (Amendment of Plans), allowing facilities to delay closure of hazardous waste management units.

Commenters have also stated that, while it may be appropriate to require closure of most existing impoundments, some may be clearly safe. For example, existing impoundments theoretically may already have a composite liner, and present minimal threat of release (*e.g.,* because they are below grade or not far above grade). EPA solicits comment on whether a variance process would be appropriate allowing some impoundments or similar units that manage wet-handled CCRs to remain in operation because they present minimal risk to groundwater (*e.g.,* because they have a composite liner) and minimal risk of a catastrophic release (*e.g.,* as indicated by a low potential hazard rating under the Federal Guidelines for Dam Safety established by the Federal Emergency Management Agency). It should be noted that the statute already provides such a mechanism in section 3005 (j)(4) and (5) (based on making a so-called 'no-migration' demonstration—evidently Congress' view of what level of control is considered protective for hazardous waste impoundments not utilizing minimum technology controls[134]) and commenters should address whether this existing case-by-case mechanism should be utilized here. In such cases, the wastes might also meet current LDR treatment standards.

v. Proposed Land Disposal Restrictions

Through RCRA sections 3004 (d), (e), (f), and (g), Congress has prohibited the land disposal of hazardous waste unless the waste meets treatment standards established by EPA before the waste is disposed of, or is disposed of in units from which there will be no migration of hazardous constituents for as long as the waste remains hazardous. The treatment standards may be either a treatment level or a specified treatment method, and the treatment must substantially diminish the toxicity of the waste or substantially reduce the likelihood of migration of hazardous constituents from the waste so that short-term and long-term threats to human health and the environment are minimized (RCRA section 3004(m)). If the hazardous waste has been treated to the level or by a method specified in the regulations (or if the waste as generated meets the treatment standard), the waste is not subject to any land disposal prohibition and may be disposed of in a land disposal unit which meets the requirements of 40 CFR parts 264 or 265 (the exception being for surface impoundments discussed in the preceding subsection and further below). For hazardous wastes identified or listed under RCRA section 3001 after the date of the 1984 amendments to RCRA subtitle C (the situation here), EPA is required to determine whether the waste shall be prohibited from one or more methods of land disposal within six months after the date of such identification or listing, and if EPA determines that one or more methods are prohibited, the Agency is also required to specify treatment levels or methods of treatment for the waste (RCRA section 3004(g)(4)).

In an effort to make treatment standards as uniform as possible, while adhering to the fundamental requirement that the standards must minimize threats to human health and the environment before hazardous wastes can be land disposed, EPA developed the Universal Treatment Standards (UTS) (codified at 40 CFR 268.48). Under the UTS, whenever technically and legally possible, the Agency adopts the same technology-based numerical limit for a hazardous constituent regardless of the type of hazardous waste in which the constituent is present. *See* 63 FR 28560 (May 26, 1998); 59 FR 47982 (September 19, 1994). The UTS, in turn, reflect the performance of Best Demonstrated Available Technologies (BDAT) of the constituents in question. These treatment standards can be met by any type of treatment, other than impermissible dilution, and wastes can satisfy the treatment standards as generated (*i.e.,* without being treated).

As explained above, section 3004(x) of RCRA authorizes the EPA Administrator to modify the requirements of sections (d), (e), (f), and (g) of section 3004 for Bevill wastes, including CCRs that EPA determines to regulate as hazardous, to take into account the special characteristics of the wastes, the practical difficulties associated with implementation of the requirements, and site-specific characteristics, so long as such modified requirements assure protection of human health and the environment.

In conjunction with a proposed listing, EPA is proposing to prohibit the land disposal of CCRs, unless they meet the applicable treatment standards. In addition, although CCRs could be disposed of without treatment in landfills and impoundments from which there will be no migration of hazardous constituents for as long as the waste remains hazardous, EPA doubts that such a unit exists, given the volumes of CCRs and their many (documented) release pathways discussed above. In any case, no-migration determinations are necessarily made on a case-by-case basis, and the burden is on petitioners to show that individual land disposal units satisfy the exacting standard. *See* 40 CFR section 268.6.

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[134] See RCRA section 3004 (d), (e), (f), and (g) all of which define a land disposal unit as protective of human health and the environment if "it has been demonstrated to a reasonable degree of certainty that there will be no migration of hazardous constituents from the disposal unit * * * for as long as the wastes remain hazardous".

2. Proposed Treatment Standards for Non-Wastewaters (Dry CCRs)

For non-wastewaters (*i.e.,* dry CCRs), EPA is proposing that CCRs be subject to the UTS. As EPA has found repeatedly, this standard reflects the performance of Best Demonstrated Available Technology and so satisfies the requirements of section 3004 (m) (*see Hazardous Waste Treatment Council* v. *EPA,* 886 F. 2d 355, 363 (D.C. Cir. 1989)), and also does not force treatment past the point at which threats to human health and the environment are minimized (*see* 55 FR 6640, 6641–42 (Feb. 26, 1990)). These standards should be achievable by application of various available technologies, although data[135] indicate that a great portion (if not virtually all) dry CCRs meet these standards as generated.

3. Proposed Treatment Standards for Wastewaters (Wet-Handled CCRs)

EPA is also proposing standards for wastewater CCRs. As an initial matter, EPA is proposing to adopt a specific and different definition of wastewater for CCRs. Under the existing RCRA subtitle C rules, a wastewater is defined as one that contains less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (*i.e.,* the current wastewater definition for purposes of LDRs; *see* 40 CFR part 268.2 (f)). Functionally, the current definition of wastewaters would not include slurried fly ash or slurried FGD from wet air pollution control systems. EPA believes it important to distinguish between nonwastewaters which involve dry coal ash and surface impoundment systems which are commonly viewed as involving wastewaters. EPA, therefore, is proposing to create the distinction between wastewater and nonwastewater CCRs by classifying CCRs as wastewaters if the moisture content of the waste exceeds 50%. Thus, if CCRs contain more water than solids, the CCR would be classified as a wastewater, and would be subject to the LDR treatment standard for wastewaters. By proposing the criteria at 50% moisture, EPA believes new methods for pumping and disposal of high solids material without free liquids are still viable. EPA is proposing this definition to appropriately address risks associated with CCRs surface impoundments, which contain free liquids. However, the Agency requests comment on this alternative definition of wastewaters for purposes of determining which treatment standards the CCRs would be subject to.

As part of the proposed treatment standard, EPA is proposing that these wastewaters undergo solids removal so that the wastewaters contain no greater than 100 mg/l total suspended solids (TSS) and meet the UTS for wastewaters. This proposed level is consistent with wastewater treatment requirements based on Best Practicable Control Technology Currently Available for the Electric Power Generating Point Source Category (40 CFR section 423.12).[136] Solids separation is a base level water pollution control technology, which assures that the vast majority of coal ash and associated contaminants are removed and managed in landfills.

EPA is proposing that wastewaters meet the UTS for wastewaters at 40 CFR section 268.48 as the treatment standard for the liquid fraction. (The CCR solids removed from the wastewater stream would be a non-wastewater and would be subject to the UTS for non-wastewaters.) EPA believes dry disposal of the CCR solids will protect human health and the environment. As previously discussed, this is borne out by the results of the Agency's risk assessment and damage case assessments, which show that wet disposal poses the greatest risks of contaminant releases.

The Agency believes the proposed treatment methods will diminish the toxicity of the waste or substantially reduce the likelihood of migration of toxic constituents from the waste so that short-term and long-term threats to human health and the environment are minimized. If finalized, EPA will add new treatment method codes to the table of Technology Codes and Description of Technology-Based Standards at 40 CFR 268.42. EPA seeks comments on the proposed treatment standards.

4. Effective Date of the LDR Prohibitions

Land disposal prohibitions are to be effective immediately unless EPA finds that there is insufficient alternative protective treatment, recovery or disposal capacity for the wastes. RCRA section 3004(h)(2). National capacity variances can be for up to two years from the date of the prohibition. During the duration of a national capacity variance, the wastes do not require treatment in order to be land disposed. If they are disposed of in a landfill or surface impoundment, however, that unit must meet the minimum technology requirements of RCRA section 3004(o). RCRA section 3004 (h) and 40 CFR section 268.5 (h).[137]

In this case, EPA is proposing that the prohibition and treatment standards for nonwastewaters take effect within 6 months from the date of promulgation of the listing of CCRs as a special waste. We are proposing 6 months to allow time for owners and operators to set up analytic capacity and record-keeping mechanisms for dry CCR wastes, as well as for federal and state agencies to assure that implementation mechanisms are in place. We are not allocating additional time for treatment because our expectation is that all or virtually all dry CCRs meet the proposed treatment standards as generated. However, EPA solicits comment on this issue. EPA also notes that the proposed LDR prohibition and treatment standards would not take effect until programs in authorized states are authorized and the state implementing rules take effect, so this proposal effectively is for the prohibition and treatment standard requirement to take effect 6 months following the conclusion of the authorization process and effective date of authorized state rules. This should be ample time to come into compliance.

For wastewaters, however, under the authority of section 3004 (x), we are proposing that the prohibition and treatment standards take effect within five years of the prohibition. In practice, these requirements will have the effect of prohibiting disposal of wet-handled CCRs in surface impoundments after that date. The proposed date for the wastewater treatment standards would thus be the same as the proposed date that impoundments would stop receiving CCRs, and is being proposed for many of the same reasons. Surface impoundments, of course, are the land disposal units in which wastewaters are managed, so the issues are necessarily connected. As discussed in section VI. B. above, the statute allows owners and operators up to four years to retrofit existing surface impoundments to meet

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[135] EPA's CCR constituent database which is available from the docket to this proposal.

[136] Although TSS is not a hazardous constituent, it is a reasonable surrogate of effective treatment performance here because TSS necessarily contain the metal hazardous constituents which are the object of treatment, and these metals will necessarily be removed as TSS are removed. See e.g.; *National Lime Ass'n* v. *EPA, 234 F. 3d 625, 639* (D.C. Cir. 2000) (even though particulate matter is not a hazardous air pollutant, it can be used as a permissible surrogate for treatment of hazardous air pollutant metals since those metals are removed by treatment as PM is removed).

[137] EPA is also authorized to grant up to a one-year extension, renewable for another year, of a prohibition effective date on a case-by-case basis. RCRA section 3004 (h)(3). Applicants must demonstrate that adequate alternative treatment, recovery, or disposal capacity for the petitioners waste cannot reasonably be made available by the effective date due to circumstances beyond the applicant's control, and that the petitioner has entered into a binding contractual commitment to construct or otherwise provide such capacity. 40 CFR 268.5.

the minimum technology requirements (or to close such surface impoundments), and EPA has interpreted this provision as applying to treatment surface impoundments receiving hazardous wastes otherwise prohibited from land disposal. *See* RCRA sections 3005 (j)(6) and 3005 (j)(11). As further explained above, EPA believes that an additional three years is needed for owners and operators to close surface impoundments—*i.e.* seven years in all—and is thus proposing a two year national capacity variance (as provided in RCRA section 3004(h)(2)) and a five year period for impoundment retrofitting yielding a seven year extension.

The legal basis for the proposal is 3004 (x) (which specifically authorizes modification of the section 3005 (j) requirements). Section 3005 (j) (11) allows untreated wastewaters to be managed in surface impoundments that do not meet the minimum technology requirements, but requires that residues in the impoundment be dredged at least annually for management elsewhere. Given the enormous volume of CCRs currently managed in surface impoundments, estimated at 29.4 million tons per year (within EPA's estimated range of 23.5 to 30.3 million tons for the total available U.S. hazardous waste disposal capacity), and the absence of alternative disposal capacity in the short-term, EPA believes annual dredging is impractical and would defeat the purpose of providing additional time to convert to the dry handling of CCRs. Moreover, in this short time, the utilities will be working to convert their processes to dry handling and it is not practicable or necessary to impose this additional requirement. Finally, as discussed previously, in the interim period before surface impoundments cease taking waste and are closed, numerous safeguards will be in place to protect public health and the environment, including ground water monitoring and the requirement to act on any releases quickly. Thus, while such measures are not a long-term solution, they will "assure protection of human health and the environment" in the short-term.

As this discussion clarifies, the issue of a national capacity extension for CCR wastewaters is really an issue of how long it will take to convert to dry handling and to find management capacity for solids dredged from impoundments, *i.e.* issues arising under section 3005 (j)(11) of the statute. EPA, therefore, believes it has the authority and that it is appropriate to use section 3004 (x) to extend the national capacity period in order to convert to dry handling.[138]

EPA is further proposing that during the national capacity variance (the initial two years of the proposed two years plus five year extension of otherwise-applicable requirements), CCR wastewaters could continue to be managed in impoundments that do not meet the minimum technology requirements. The reasons are identical to those allowing such impoundments to receive CCRs for the remainder of the proposed extension period.

EPA solicits comment on these proposals, including comment on whether further time extensions are actually needed in light of the already extended time which will be afforded by the state authorization process.

C. Applicability of Subtitle C Regulations

The discussion in this section describes the existing technical standards required in 40 CFR parts 264/265/267. However, persons who generate and transport CCRs, under the subtitle C alternative, would also be subject to the generator (40 CFR part 262) and transporter (40 CFR part 263) requirements. Although EPA presents this to provide the public with background information as noted previously, EPA is not proposing to modify these standards, nor to reopen the requirements.

1. General Facility Requirements, including Location Restrictions. Under the existing regulations, all of the following requirements would apply: the general facility standards of 40 CFR parts 264/265/267 (Subpart B), the preparedness and prevention standards of 40 CFR parts 264/265/267 (Subpart C), the contingency plan and emergency procedures of 40 CFR parts 264/265/267 (Subpart D), and the manifest system, recordkeeping, and reporting requirements of 40 CFR parts 264/265/267 (Subpart E). Consistent with section 264.18, the regulations would include location standards prohibiting the siting of new treatment, storage, or disposal units in a 100-year floodplain (unless the facility made a specific demonstration)[139] and seismic impact areas would be prohibited.[140]

2. Ground water monitoring/corrective action for regulated units. The subtitle C alternative to today's proposed rule would require the current ground water monitoring and corrective action requirements of 40 CFR parts 264/265 for regulated landfills and surface impoundments, without modification. Consistent with 40 CFR 265.90, existing CCR disposal units would be required to install groundwater monitoring systems within one year of the effective date of these regulations. The facility would operate under the self-implementing interim status requirements of 40 CFR part 265 until the regulatory authority imposed the specific requirements of 40 CFR part 264 through the RCRA permitting process. Generally, 40 CFR parts 264/265 require groundwater monitoring systems that consist of enough wells, installed at appropriate locations and depths, to yield ground water samples from the uppermost aquifer that represent the quality of background groundwater that has not been affected by leakage from the disposal unit. A detection monitoring program would be required to detect releases to groundwater of CCR constituents listed in the facility permit (these constituents, we believe, would be the metals typically identified as constituents of concern in CCRs). Monitoring frequency is determined by the EPA Regional Administrator or, more typically the authorized state, and required in the RCRA permit. If any of the constituents listed in the facility permit are detected at levels that constitute statistically significant evidence of contamination, the owner or operator must initiate a compliance monitoring program to determine whether the disposal units are in

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[138] EPA notes in addition that it is authorized under section 3004 (x) to modify the requirements of LDR prohibitions under section 3004 (g), and EPA views capacity variances related to such prohibitions as within the scope of that section 3004 (x) authorization.

[139] A 100-year flood means a flood that as a one-percent or greater chance of recurring in any given year or a flood of a magnitude equaled or exceeded once in 100 years on the average over a significantly long period.

[140] A seismic impact area means an area with a two percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10 g in 50 years. Note that in the pre-1997 editions of the NEHRP (National Earthquake Hazards Reduction Program) provisions, seismic hazards around the nation were defined at a uniform 10 percent probability of exceedance in 50 years. Since the 1997 NEHRP Provisions, however, the seismic design maps have been redefined such that for most regions of the nation, the maximum considered earthquake ground motion is defined with uniform probability of exceedance of 2 percent in 50 years. The change in the exceedance probability (from 10% to 2%) was responsive to comments that the use of 10 percent probability of exceedance in 50 years is not sufficiently conservative in the central and eastern United States where earthquakes are expected to occur infrequently.

compliance with the groundwater protection standards established by EPA or the state and specified in the permit. (*See* 40 CFR part 264, subpart F.)

Under 40 CFR part 264, subpart F, if the results of the compliance monitoring program indicate exceedances of any of the constituent levels listed in the permit for the groundwater protection standard, the owner or operator would have to initiate corrective action to achieve compliance with the groundwater protection standards.

3. Storage. EPA is not proposing to modify the existing 40 CFR parts 264/265/267 storage standards. These regulations establish design and operating requirements for containers, tanks, and buildings used to treat or store hazardous wastes. For containers, the regulations establish requirements for the storage of hazardous waste, including a requirement for secondary containment. However, if the wastes do not contain free liquids, they need not require a secondary containment system, provided the storage area is sloped or is otherwise designed and operated to drain and remove liquid resulting from precipitation or the containers are elevated or otherwise protected from contact with accumulated liquid.

For new tanks, owners or operators must submit to EPA or the authorized states an assessment certified by an independent registered professional engineer that the foundation, structural support, seams, connections, and pressure controls (if applicable) are adequately designed and that the tank system has sufficient structural strength, compatibility with the waste(s) to be stored or treated, and corrosion protection to ensure that the tank will not collapse, rupture, or fail. Tank systems are required to have secondary containment under section 264.193, unless they receive a specific variance; however, tanks that contain no free liquids and are in buildings with an impermeable floor do not require secondary containment. New tanks (that are required to have secondary containment) must have secondary containment when constructed; existing tanks (that are required to have secondary containment) must come into compliance within two years of the rule's effective date (or when the tank has reached fifteen years of age). Section 264.193 specifically describes the secondary containment required, and the variance process.

Containment buildings must be completely enclosed with a floor, walls, and a roof to prevent exposure to the elements (*e.g.,* precipitation, wind, run-on), and to assure containment of the managed wastes. Buildings must be designed so that they have sufficient structural strength to prevent collapse or other failure, and all surfaces to be in contact with hazardous wastes must be chemically compatible with those wastes.

Recently, representatives of the utility industry have stated their view that CCRs cannot be practically or cost effectively managed under the existing 40 CFR parts 264/265/267 storage standards, and that these standards impose significant costs without meaningful benefits when applied specifically to CCRs.[141] In particular, they cite the very large volume of wastes that must be handled on a daily basis, and the extensive storage and other infrastructure already in place that might have to be retrofitted if the existing 40 CFR parts 264/265/267 storage requirements applied. For example, they state that some CCRs are stored prior to disposal in silos which are not located within a building and may contain free liquids. As a result, under the subtitle C requirements, the owner or operator would be required to construct a building with an impermeable floor, or construct a secondary containment system around the silo (alternatively, they could go through a variance process with the regulatory Agency).

EPA believes that the variance process allowing alternatives to secondary containment would address the concerns raised by industry. The Agency, however, recognizes that the variance process imposes time and resource burdens not only on industry, but on the regulatory agencies. EPA notes that, in the case of larger volume, higher toxicity mineral processing materials being reclaimed, the Agency developed special storage standards under RCRA subtitle C, and it solicits comments on whether those or similar-type standards would be appropriate for CCRs.[142]

Namely, in 40 CFR 261.4(a)(17), EPA required that tanks, containers, and buildings handling this material must be free standing and not a surface impoundment (as defined in the definitions section of this proposal) and be manufactured of a material suitable for storage of its contents. (While not specifically mentioned in this section, we would also consider a requirement that such materials meet appropriate specifications, such as those established either by the American Society of Testing Materials (ASTM), the American Petroleum Institute (API), or Underwriters Laboratories, Inc. (UL) standards.) Buildings must be man-made structures and have floors constructed from non-earthen materials, have walls, and have a roof suitable for diverting rainwater away from the foundation. A building may also have doors or removable sections to enable trucks or machines access.

EPA solicits comments on the practicality of the proposed subtitle C storage requirements for CCRs, the workability of the existing variance process, and the alternative requirements based, for example, on the mining and mineral processing wastes storage requirements. EPA has not developed cost estimates for managing CCRs in compliance with the 40 CFR parts 264/265/267 storage standards. EPA solicits specific comments on these potential costs.

4. Closure and Post-Closure Care. Under the RCRA subtitle C alternative to this co-proposal, all of the requirements for closure and post-closure care of landfills and surface impoundments would apply to those landfills that continue to receive CCRs, or otherwise actively manage them, and to those surface impoundments that have not completed closure, when the requirements of a final rule become effective. The 40 CFR parts 264/265 landfill and surface impoundment requirements establish cover requirements (*e.g.,* the cover must have a permeability less than or equal to the permeability of any bottom liner system and must minimize the migration of liquids through the closed landfill). These requirements are generally applied through a closure-plan or permit approval process. Also, the regulations require 30 years of post-closure care, including maintenance of the cap and ground-water monitoring, unless an alternative post-closure period is established by EPA or the authorized state.

5. Corrective action. EPA is also not proposing to modify the existing corrective action requirements, including the facility-wide corrective action requirements of RCRA under section 3004(u), section 3008(h), and 40 CFR 264.101. Under these requirements, landfills that continue to receive CCRs or otherwise actively manage them, and surface impoundments that have not

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[141] While the utility industry did not specifically mention the 40 CFR part 267 storage standards, we presume that they would make the same technical arguments with respect to those standards.

[142] Land Disposal Restrictions Phase IV: Final Rule Promulgating Treatment Standards for Metal Wastes and Mineral Processing Wastes; Mineral Processing Secondary Materials and Bevill Exclusion Issues; Treatment Standards for Hazardous Soils, and Exclusion of Recycled Wood Preserving Wastewaters; Final Rule (*http://www.epa.gov/EPA-WASTE/1998/May/Day-26/f989.htm*).

completed closure on the date the final rule becomes effective, will be requires to characterize, and as necessary remediate, releases of CCRs or hazardous constituents. Section 3004(x) provides EPA the flexibility to modify corrective action requirements for facilities managing CCRs, including facility-wide corrective action (assuming EPA can reasonably determine that an alternative is protective of human health and the environment). The facility-wide corrective action requirement applies to all solid waste management units from which there have been releases of hazardous wastes or hazardous constituents; however, EPA does not *see* a compelling reason to change the corrective action requirements. Imposing corrective action requirements, including facility-wide corrective action, will assure that closed and inactive units at the facility are properly characterized and, if necessary, remediated, especially since many of these closed or inactive units are unlined. Nevertheless, EPA solicits comment on whether EPA should modify the corrective action requirements under section 3004(x) of RCRA. Commenters should specifically address the issue of how other alternatives could be protective without mandating corrective action as needed for all solid waste management units from which there have been releases of hazardous waste or hazardous constituents at the facility.

6. Financial assurance. EPA is also not proposing to modify the existing financial assurance requirements at 40 CFR parts 264/265/267, subpart H. Financial assurance must be adequate to cover the estimated costs of closure and post-closure care (including facility-wide corrective action, as needed), and specific levels of financial assurance are required to cover liability for bodily injury and property damage to third parties caused by sudden accidental occurrences arising from operations of the facility. Allowable financial assurance mechanisms are trust funds, surety bonds, letters of credit, insurance policies, corporate guarantees, and demonstrations and documentation that owners or operators of the facility have sufficient assets to cover closure, post-closure care, and liability. The regulations also require financial assurance for corrective action under section 264.101.

As we have estimated that 53 local governments own and operate coal-fired electric utilities, EPA seeks comment on whether a financial test similar to that in 40 CFR 258.74(f) in the Criteria for Municipal Solid Waste Landfills should be established for local governments that own and operate coal-fired power plants.

7. Permitting requirements. Under the RCRA subtitle C alternative, facilities that manage CCRs (in this case, facilities with landfills and surface impoundments, and other possible management units used to store or dispose of CCRs, or generating facilities that store CCRs destined for off-site disposal) must obtain a permit from EPA or from the authorized state. The effect of EPA's proposed listing would extend these permitting requirements to those facilities managing special wastes regulated under subtitle C of RCRA. Parts 124, 267 and 270 detail the specific procedures for the issuance and modification of permits, including public participation, and through the permit process regulatory agencies impose technical design and management standards of 40 CFR parts 264/267. Facilities with landfills that are in existence on the effective date of the regulation (which in this case would generally be the effective date of the state regulations establishing the federal CCR requirements)—which receive CCRs or actively manage CCRs—are eligible for "interim status" under federal regulations, providing they comply with the requirements of 40 CFR section 270.70. By contrast, facilities with surface impoundments that have not completed closure as outlined in this proposal would be subject to the existing permitting requirements, irrespective of whether they continue to receive CCRs into the unit or to actively manage CCRs. While facilities are in interim status, they are subject to the largely self-implementing requirements of 40 CFR part 265. As noted previously, in a final regulation, EPA would make conforming changes to these parts of the CFR to make it clear that the requirements apply to facilities that manage either hazardous wastes or special wastes regulated under subtitle C.

8. EPA is Not Proposing to Apply the Subtitle C Requirements to CCRs from Certain On-Going State or Federally Required Cleanups. Under the subtitle C alternative, the Agency is proposing to allow state or federally-required cleanups commenced prior to the effective date of the final rule to be completed in accordance with the requirements determined to be appropriate for the specific cleanup. EPA's rationale for this decision is two-fold. First, for state or federally required cleanups that already commenced and are continuing, the state or federal government has entered into an administrative agreement with the facility owner or operator which specifies remedies, clean-up goals, and timelines that were determined to be protective of human health and the environment, based on the conditions at the site. The overseeing Agency will also be able to ensure that the cleanup waste, if sent off-site (which may sometimes be necessary) will go to appropriately designed and permitted facilities. Second, altering the requirements for cleanups currently underway would be disruptive and could cause significant delays in achieving clean-up goals. Once the rule becomes final, EPA or the state will be able to avail themselves of regulations under RCRA designed specifically for cleanup. However, the Agency takes comment on this proposed provision.

D. CERCLA Designation and Reportable Quantities

Under current law and regulations, all hazardous wastes listed under RCRA and codified in 40 CFR 261.31 through 261.33, and special wastes under 261.50 if the proposed special waste listing is finalized, as well as any solid waste that is not excluded from regulation as a hazardous waste under 40 CFR 261.4(b) and that exhibits one or more of the characteristics of a RCRA hazardous waste (as defined in §§ 261.21 through 261.24), are hazardous substances under CERCLA, as amended (*see* CERCLA section 101(14)(C)). CERCLA hazardous substances are listed in Table 302.4 at 40 CFR 302.4 along with their reportable quantities (RQs). If a hazardous substance is released in an amount that equals or exceeds its RQ within a 24-hour period, the release must be reported immediately to the National Response Center (NRC) pursuant to CERCLA section 103.

Thus, under this subtitle C alternative, and as EPA does with any other listed waste, the Agency is proposing to also list CCRs as a CERCLA hazardous substance in Table 302.4 of 40 CFR 302.4. The key constituents of concern in CCRs are already listed as hazardous substances under CERCLA (*i.e.*, arsenic, cadmium, mercury, selenium), and therefore persons who spill or release CCRs already have reporting obligations, depending on the volume of the spill. Typically, under current CERCLA requirements, a person releasing CCRs, for example, would report depending on his estimate of the amount of arsenic or other constituents contained in the release.

Typically, when EPA lists a new waste subject to RCRA subtitle C, the statutory one-pound RQ is applied to the waste. However, EPA is proposing two alternative methods to adjust the one-pound statutory RQ. The first method, one traditionally utilized by the Agency, adjusts the RQ based on the lowest RQ of the most toxic substance present in the waste. The second method, as part of the Agency's effort to review and re-evaluate its methods for CERCLA designation and RQ adjustment, adjusts the one-pound statutory RQ based upon the Agency's characterization and physical properties of the complex mixtures which comprise the waste to be designated as S001. The Agency invites comment on both methods, and may, based upon these comments and further information, decide to go forward with either method or both methods.

1. Reporting Requirements

Under CERCLA section 103(a), the person in charge of a vessel or facility from which a CERCLA hazardous substance has been released in a quantity that is equal to or exceeds its RQ within a 24-hour period must immediately notify the NRC as soon as that person has knowledge of the release. The toll-free telephone number of the NRC is 1–800–424–8802; in the Washington, DC, metropolitan area, the number is (202) 267–2675. In addition to the reporting requirement under CERCLA, section 304 of the Emergency Planning and Community Right-to-Know Act (EPCRA) requires owners or operators of certain facilities to report releases of extremely hazardous substances and CERCLA hazardous substances to state and local authorities. The EPCRA section 304 notification must be given immediately after the release of an RQ (or more) within a 24-hour period to the community emergency coordinator of the local emergency planning committee (LEPC) for any area likely to be affected by the release and to the state emergency response commission (SERC) of any state likely to be affected by the release.

Under section 102(b) of CERCLA, all hazardous substances (as defined by CERCLA section 101(14)) have a statutory RQ of one pound, unless and until the RQ is adjusted by regulation. In this rule, EPA is proposing to list CCRs that are generated by electric utility and independent power producers that are intended for disposal (and not beneficially used), as special wastes subject to regulation under subtitle C of RCRA. In order to coordinate the RCRA and CERCLA rulemakings with respect to the new special waste listing, the Agency is also proposing adjustments to the one-pound statutory RQs for this special waste stream.

2. Basis for RQs and Adjustments

EPA's methodology for adjusting the RQs of individual hazardous substances begins with an evaluation of the intrinsic physical, chemical, and toxicological properties of each hazardous substance. The intrinsic properties examined, called "primary criteria," are aquatic toxicity, mammalian toxicity (oral, dermal, and inhalation), ignitability, reactivity, chronic toxicity, and potential carcinogenicity.

Generally, for each intrinsic property, EPA ranks the hazardous substance on a five-tier scale, associating a specific range of values on each scale with an RQ value of 1, 10, 100, 1,000, or 5,000 pounds. The data for each hazardous substance are evaluated using the various primary criteria; each hazardous substance may receive several tentative RQ values based on its particular intrinsic properties. The lowest of the tentative RQs becomes the "primary criteria RQ" for that substance.

After the primary criteria RQ are assigned, the substances are further evaluated for their susceptibility to certain degradative processes, which are used as secondary adjustment criteria. These natural degradative processes are biodegradation, hydrolysis, and photolysis (BHP). If a hazardous substance, when released into the environment, degrades relatively rapidly to a less hazardous form by one or more of the BHP processes, its RQ (as determined by the primary RQ adjustment criteria) is generally raised by one level. Conversely, if a hazardous substance degrades to a more hazardous product after its release, the original substance is assigned an RQ equal to the RQ for the more hazardous substance, which may be one or more levels lower than the RQ for the original substance. Table 7 presents the RQ for each of the constituents of concern in CCRs taken from Table 302.4—List of Hazardous Substances and Reportable Quantities at 40 CFR 302.4.

TABLE 7—REPORTABLE QUANTITIES OF CONSTITUENTS OF CONCERN

Hazardous waste No.	Constituent of concem	RQ Pounds (Kg)
S001	Antimony	5000 (2270)
	Arsenic	1 (0.454)
	Barium	No RQ
	Beryllium	10 (4.54)
	Cadmium	10 (4.54)
	Chromium	5000 (2270)
	Lead	10 (4.54)
	Mercury	1 (0.454)
	Nickel	100 (45.4)
	Selenium	100 (45.4)
	Silver	1000 (454)
	Thallium	1000 (454)

The standard methodology used to adjust the RQs for RCRA wastes is based on an analysis of the hazardous constituents of the waste streams. EPA determines an RQ for each hazardous constituent within the waste stream and establishes the lowest RQ value of these constituents as the adjusted RQ for the waste stream. EPA is proposing to use the same methodology to adjust RQs for listed special wastes. In this notice, EPA is proposing a one-pound RQ for listed CCRs based on the one pound RQs for arsenic and mercury (*i.e.*, the two constituents within CCRs with the lowest RQ). In this same rule, however, EPA is also proposing that an alternative method for adjusting the RQ of the CCR wastes also can be used in lieu of the one pound RQ.

3. Application of the CERCLA Mixture Rule to Listed CCR

Although EPA is proposing a one-pound RQ for CCRs listed as a special waste, we are also proposing to allow the owner or operator to use the maximum observed concentrations of the constituents within the listed CCR wastes in determining when to report releases of the waste.

For listed CCR wastes, where the actual concentrations of the hazardous constituents in the CCRs are not known and the waste meets the S001 listing description, EPA is proposing that persons managing CCR waste have the option of reporting on the basis of the maximum observed concentrations that have been identified by EPA (*see* Table 8 below). Thus, although actual knowledge of constituent concentrations may not be known, assumptions can be made of the concentrations based on the EPA identified maximum concentrations. These assumptions are based on actual sampling data, specifically the maximum observed concentrations of hazardous constituents in CCRs.[143] Table 7 identifies the hazardous constituents for CCRs, their maximum observed concentrations in parts per million (ppm), the constituents' RQs, and the number of pounds of CCRs needed to contain an RQ of each constituent for the CCR to be reported.

TABLE 8—POUNDS REQUIRED TO CONTAIN RQ FOR EACH CONSTITUENT OF LISTED CCR

Waste stream constituent	Maximum ppm	RQ (lbs)	Pounds required to contain RQ
CCR	....	1	
Antimony	3,100	5,000	1,612,903
Arsenic	773	1	1,294
Barium	7,230	No RQ	No RQ
Beryllium	31	10	322,581
Cadmium	760	10	13,158
Chromium	5,970	5,000	837,521
Lead	1,453	10	6,883
Mercury	384	1	2,604
Nickel	6,301	100	15,871
Selenium	673	100	148,588
Silver	338	1,000	2,958,580
Thallium	100	1,000	10,000,000

For example, if listed CCR wastes are released from a facility, and the actual concentrations of the waste's constituents are not known, it may be assumed that the concentrations will not exceed those listed above in Table 8. Thus, applying the mixture rule, the RQ threshold for arsenic in this waste is 1,294 pounds—that is, 1,294 pounds of listed CCR waste would need to be released to reach the RQ for arsenic. Reporting would be required only when an RQ or more of any hazardous constituent is released.

Where the concentration levels of all hazardous constituents are known, the traditional mixture rule would apply. Under this scenario, if the actual concentration of arsenic is 100 ppm, 10,000 pounds of the listed CCR waste would need to be released to reach the RQ for arsenic. As applied to listed CCR waste, EPA's proposed approach reduces the burden of notification requirements for the regulated community and adequately protects human health and the environment.

The modified interpretation of the mixture rule (40 CFR 302.6) as it applies to listed CCR wastes in this proposal is consistent with EPA's approach in a final rule listing four petroleum refining wastes (K169, K170, K171, and K172) as RCRA hazardous wastes and CERCLA hazardous substances (*see* 63 FR 42110, Aug. 6, 1998). In that rule, the Agency promulgated a change to the regulations and its interpretation of the mixture rule to allow facilities to consider the maximum observed concentrations for the constituents of the petroleum refining wastes in determining when to report releases of the four wastes. EPA codified this change to its mixture rule interpretation in 40 CFR 302.6(b)(1) as a new subparagraph (iii). In another rule, EPA also followed this approach in the final rule listing two chlorinated aliphatic production wastes (K174 and K175) as RCRA hazardous wastes and CERCLA hazardous substances (*see* 65 FR 67068, Nov. 8, 2000). If the proposed subtitle C alternative becomes final, EPA may modify 40 CFR section 302.6(b)(1) to extend the modified interpretation of the mixture rule to include listed CCR wastes.

4. Correction of Table of Maximum Observed Constituent Concentrations Identified by EPA

When the final rule that listed Chlorinated Aliphatics Production Wastes was published in the Code of Federal Regulations (CFR), the existing table that provided the maximum observed constituent concentrations for petroleum refining wastes (K169, K170, K171, and K172) was inadvertently replaced instead of amended to add the maximum observed constituent concentrations for the chlorinated aliphatic production wastes (K174 and K175). Therefore, the Agency is at this time proposing to correct that inadvertent removal of the petroleum refining wastes by publishing a complete table that includes, the petroleum refining wastes, the chlorinated aliphatic production wastes, and now the CCR wastes (*e.g.*, K169, K170, K171, K172, K174, K175, and S001).

E. Listing of CCR as Special Wastes To Address Perceived Stigma Issue

Commenters suggested that the listing of CCRs as a hazardous waste will impose a stigma on their beneficial use, and significantly curtail these uses. EPA questions this assertion, in fact, our experience suggests that the increased costs of disposal of CCRs as a result of regulation of CCRs under RCRA subtitle C would create a strong economic incentive for increased beneficial uses of CCRs. We also believe that the increased costs of disposal of CCRs, as a result of regulation of CCR disposal, but not beneficial uses, should achieve increased usage in non-regulated beneficial uses, simply as a result of the economics of supply and demand. The economic driver—availability of a low-cost, functionally equivalent or often

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[143] EPA's CCR constituent concentrations database is available in the docket to this notice.

superior substitute for other raw materials—will continue to make CCRs an increasingly desirable product. Furthermore, it has been EPA's experience in developing and implementing RCRA regulation and elsewhere that material inevitably flows to less regulated applications.

However, with that said, the electric utility industry, the states, and those companies that beneficially use CCRs have nevertheless commented that listing of CCRs as a RCRA subtitle C waste will impose a stigma on their beneficial use and significantly curtail these uses. In their view, even an action that regulates only CCRs destined for disposal as RCRA subtitle C waste, but retains the Bevill exemption for beneficial uses, would have this adverse effect. Finally, the states particularly have commented that, by operation of state law, the beneficial use of CCRs would be prohibited under many states' beneficial use programs, if EPA were to designate CCRs destined for disposal as a RCRA subtitle C waste. Unlike the incentive effect introduced by increased disposal costs in which firms rationally try to avoid higher costs or seek lower cost of raw materials, the idea that there will be a stigma effect rests on an assumption that stigma would alter consumer preferences thereby decreasing end-users' willingness to pay for products that include CCPs. This would have the practical effect of shifting the aggregate CCP demand curve downward.

Some of the other comments that have been made include: (1) Beneficially used CCRs are the same material as that which would be considered hazardous; this asymmetry increases confusion and the probability of lawsuits, however, unwarranted, (2) while the supply of CCRs to be beneficially used may increase given the additional incentives to avoid disposal costs, the consumer demand may decrease as negative perceptions are not always based on reason, (3) any negative impact on beneficial use will require more reliance on virgin materials with higher GHG and environmental footprints, (4) state support may be weakened or eliminated, even in states that are friendly to beneficial use, (5) competitors who use virgin or other materials are taking advantage of the hazardous waste designation by using scare tactics and threats of litigation to get customers to stop using products containing CCRs, (6) customers are already raising questions about the safety of products that contain CCRs, and (7) uncertainty is already hurting business as customers are switching to products where there is less regulatory risk and potential for environmental liabilities. For example, one commenter stated that they have received requests to stop selling boiler slag for ice control due to potential liability.

EPA is concerned about potential stigma and, as we have stated previously, we do not wish to discourage environmentally sound beneficial uses of CCRs. In looking to evaluate this issue, we believe it is first important to understand that the proposed rule (if the subtitle C alternative is finalized) would regulate CCRs under subtitle C of RCRA only if they are destined for disposal in landfills and surface impoundments, and would leave the Bevill determination in effect for the beneficial use of CCRs. That is, the legal status of CCRs that are beneficially used would remain entirely unchanged (*i.e.,* they would not be regulated under subtitle C of RCRA as a hazardous waste, nor subject to any federal non-hazardous waste requirements). EPA is proposing to regulate the disposal of CCRs under subtitle C of RCRA because of the specific nature of disposal practices and the specific risks these practices involve—that is, the disposal of CCRs in (often unlined) landfills or surface impoundments, with millions of tons placed in a concentrated location. The beneficial uses that EPA identifies as excluded under the Bevill amendment, for the most part, present a significantly different picture, and a significantly different risk profile. As a result, EPA is explicitly not proposing to change their Bevill status (although we do take comment on whether "unconsolidated uses" of CCRs need to be subject to federal regulation). (For further discussion of the beneficial use of CCRs, *see* section IV. D in this preamble.)

Furthermore, in today's preamble, we make it clear that certain uses of CCRs—*e.g.,* FGD gypsum in wallboard—do not involve "waste" management at all; rather, the material is a legitimate co-product that, under most configurations, has not been discarded in the first place and, therefore, would not be considered a "solid waste" under RCRA. Moreover, EPA's experience suggests that it is unlikely that a material that is not a waste in the first place would be stigmatized, particularly when used in a consolidated form and while continuing to meet long established product specifications.

In fact, EPA's experience with past waste regulation, and with how hazardous waste and other hazardous materials subject to regulation under subtitle C are used and recycled, suggests that a hazardous waste "label" does not impose a significant barrier to its beneficial use and that non-regulated uses will increase as the costs of disposal increase. There are a number of examples that illustrate these points, although admittedly many of these products are not used in residential settings:

- Electric arc furnace dust is a listed hazardous waste (K061), and yet it is a highly recycled material. Specifically, between 2001 and 2007, approximately 42% to 51% of K061 was recycled (according to Biennial Reporting System (BRS) data). Both currently and historically, it has been used as an ingredient in fertilizer and in making steel, and in the production of zinc products, including pharmaceutical materials. Slag from the smelting of K061 is in high demand for use in road construction.[144] In fact, there is little doubt that without its regulation as a hazardous waste, a significantly greater amount of electric arc further dust would be diverted from recycling to disposal in non-hazardous waste landfills.
- Electroplating wastewater sludge is a listed hazardous waste (F006) that is recycled for its copper, zinc, and nickel content for use in the commercial market. In 2007, approximately 35% of F006 material was recycled (according to BRS data). These materials do not appear to be stigmatized in the marketplace.
- Chat, a Superfund mining cleanup waste with lead, cadmium and zinc contamination, is used in road construction in Oklahoma and the surrounding states.[145] In this case, the very waste that has triggered an expensive Superfund cleanup is successfully offered in the marketplace as a raw material in road building. The alternative costs of disposal in this case are a significant driver in the beneficial use of this material, and the Superfund origin of the material has not served as a barrier to its use.
- Used oil is regulated under RCRA subtitle C standards. While used oil that is recycled is subject to a separate set of standards under subtitle C (and is not identified as a hazardous waste), "stigma" does not prevent home do-it-yourselfers from collecting used oil, or automotive shops from accepting it and sending it on for recovery. Collected used oil may be re-refined, reused, or used as fuel in boilers, often at the site

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[144] According to the most recently available data, in 2008 *Horsehead* produced about 300,000 tons per year of an Iron-Rich Material (IRM) as a by-product of its dust recycling process, and in 2009 *Inmetco* produced close to 20,000 tons per year. PADEP asserts that these plants cannot meet the demands for use of the slag by PennDOT.

[145] 40 CFR part 260, 39331–39353.

where it is collected. Safety Kleen reported that in 2008, the company recycled 200 million gallons of used oil. (This example is almost directly analogous to the situation with respect to CCRs, although for CCRs, we are not proposing to subject them to any management standards when used or recycled, but, as in the case of used oil, this alternative would avoid labeling CCR's as "hazardous waste," even while relying on subtitle C authority.)

- Spent etchants are directly used as ingredients in the production of a copper micronutrient for livestock; and
- Spent solvents that are generated from metals parts washing and are generally hazardous wastes before reclamation are directly used in the production of roofing shingles.

Furthermore, common products and product ingredients routinely used at home (*e.g.,* motor oil; gasoline; many common drain cleaners and household cleaners; and cathode ray tube monitors for TVs and computers) are hazardous wastes in other contexts. This includes fluorescent lamps (and CFLs) which are potentially hazardous because of mercury. Consumers are generally comfortable with these products, and their regulatory status does not discourage their use. Given this level of acceptance, EPA questions whether CCR-based materials that might be used in the home, like concrete or wallboard, would be likely to raise concerns where they are safely incorporated into a product.

Certain commenters have also expressed the concern that standards-setting organizations might prohibit the use of CCRs in specific products or materials in their voluntary standards. Recently, chairpersons of the American Standards and Testing Materials (ASTM) International Committee C09, and its subcommittee, C09.24, in a December 23, 2009 letter indicated that ASTM would remove fly ash from the project specifications in its concrete standard if EPA determined that CCRs were a hazardous waste when disposed. However, it remains unclear whether ASTM would ultimately adopt this position, in light of EPA's decision not to revise the regulatory status of CCRs destined for beneficial use. Further ASTM standards are developed through an open consensus process, and they currently apply to the use of numerous hazardous materials in construction and other activities. For example, ASTM provides specifications for the reuse of solvents and, thus, by implication, does not appear to take issue with the use of these recycled secondary materials, despite their classification as hazardous wastes.[146]

Others take a different view on how standard-setting organizations will react. Most notably, a U.S. Green Building Council representative was referenced in the New York Times as saying that LEED incentives for using fly ash in concrete would remain in place, even under an EPA hazardous waste determination.[147] If the Green Building Council (along with EPA) continues to recognize fly ash as an environmentally beneficial substitute for Portland cement, the use of this material is unlikely to decrease solely because of "stigma" concerns. Additionally, we believe it is unlikely that ASTM will prohibit the use of fly ash in concrete under its standards solely because of a determination that fly ash is regulated under subtitle C of RCRA when it is discarded, especially given that this use of fly ash is widely accepted throughout the world as a practice that improves the performance of concrete, it is one of the most cost-effective near-term strategies to reduce GHG emissions, and there is no evidence of meaningful risk, nor any reason to think there might be, involved with its use in cement or concrete.

Finally, many states commented that their statutes or regulations prohibit the use of hazardous wastes in their state beneficial use programs and, therefore, that if EPA lists CCRs as hazardous wastes (even if only when intended for disposal), their use would be precluded in those states. EPA reviewed the regulations of ten states with the highest consumption of fly ash and concluded that, while these states do not generally allow the use of hazardous waste in their beneficial use programs, this general prohibition would not necessarily prohibit the beneficial use of CCRs under the proposal that EPA outlines in this rule. Beneficially used CCRs would remain Bevill-exempt solid wastes, or in some cases, would not be considered wastes at all and thus, the legal status of such CCRs may not be affected by EPA's proposed RCRA subtitle C rule. As an example, the use of slag derived from electric furnace dust (K061) is regulated under Pennsylvania's beneficial use program, despite the fact that it is derived from a listed hazardous waste. However, we are also aware that, in the case of Florida, its state definition of hazardous waste would likely prohibit the beneficial use of CCRs were the co-proposed RCRA subtitle C regulation finalized and were there no change to Florida's definition of hazardous waste.

The primary concern raised by these commenters is the fact that CCRs would be labeled a "hazardous waste" (even if only when disposed) and will change the public perception of products made from CCRs. To address this concern, EPA is proposing, as one alternative, to codify the listing in a separate, unique section of the regulations. Currently, hazardous wastes are listed in 40 CFR 261, Subpart D, which identifies the currently regulated industrial wastes, and which is labeled, "Lists of Hazardous Wastes." EPA would create a new Subpart F and label the section as "List of Special Wastes Subject to Subtitle C," to distinguish it from the industrial hazardous wastes. The regulations would identify CCRs as a "Special Waste" rather than a K-listed hazardous waste, so that CCRs would not automatically be identified with all other hazardous wastes. *See* sections V through VII for the full description of our regulatory proposal.

EPA believes that this action could significantly reduce the likelihood that products made from or containing CCRs would automatically be perceived as universally "hazardous." When taken in combination with (1) the fact that beneficially used CCRs will remain exempt and (2) EPA's continued promotion of the beneficial use of CCRs, we believe this will go a long way to address any stigmatic impact that might otherwise result from the regulation of CCRs under subtitle C of RCRA. We are seeking comment on other suggestions on how EPA might promote the beneficial use of CCRs, as well as suggestions that would reduce any perceived impacts resulting from "stigma" due to the identification of CCRs as "special wastes regulated under subtitle C authority."

In summary, based on our experiences, we expect that it will be more likely that the increased costs of disposal of CCRs as a result of regulation of CCR disposal under subtitle C would increase their usage in non-regulated beneficial uses, simply as a result of the economics of supply and demand. The economic driver—availability of a low-cost, functionally equivalent or often superior substitute for other raw materials—would continue to make CCRs an increasingly desirable product.

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[146] *See,* for example, ASTM Volume 15.05, Engine Coolants, Halogenated Organic Solvents and Fire Extinguishing Agents; Industrial and Specialty Chemicals, at *http://www.normas.com/ASTM/BOS/volume1505.html. See also* ASTM D5396—04 Standard Specification for Reclaimed Perchloroethylene, at *http://www.astm.org/Standards/D5396.htm.*

[147] *See http://www.nytimes.com/gwire/2020/01/13/13greenwire-recycling-questions-complicate-epa-coal-ash-de-90614.html.*

VII. How would the proposed subtitle c requirements be implemented?

A. Effective Dates

If EPA were to finalize the subtitle C regulatory alternative proposed today, the rule, as is the case with all RCRA subtitle C rules, would become effective six months after promulgation by the appropriate regulatory authority—that is, six months after promulgation of the federal rule in States and other jurisdictions where EPA implements the hazardous waste program (Iowa, Alaska, Indian Country, and the territories, except Guam) and in authorized States, six months after the State promulgates its regulations that EPA has approved via the authorization process (unless State laws specify an alternative time). This means that facilities managing CCRs must be in compliance with the provisions of these regulations on their effective date, unless the compliance date is extended. For this proposed regulatory alternative, the compliance dates for several of the proposed requirements for existing units are being extended due to the need for additional time for facilities to modify their existing units. The precise dates that facilities will need to be in compliance with the various requirements will depend on whether they are in a jurisdiction where EPA administers the RCRA subtitle C program or whether they are in a State authorized to administer the RCRA subtitle C program.

To summarize, (1) In States and jurisdictions where EPA administers the RCRA program (Iowa, Alaska, the territories [except Guam], and Indian Country), most of the subtitle C requirements go into effect and are enforceable by EPA six months after promulgation of the final rule. This includes the generator requirements, transporter requirements, including the manifest requirements, permitting requirements for facilities managing CCRs, interim status standards, surface impoundment stability requirements, and the Land Disposal Restriction (LDR) treatment standards for non-wastewaters in 40 CFR part 268. However, we are proposing that existing CCR landfills and surface impoundments (as defined in this regulation) will be given additional time to comply with several of the proposed requirements as specified later in this section. Any new CCR landfills, including lateral expansions (as defined in the regulation), must be in compliance with all the requirements of any final regulation before CCRs can be placed in the unit.

(2) In States that are authorized to administer the RCRA program, the requirements that are part of the RCRA base program (*i.e.,* those promulgated under the authority of RCRA and not the HSWA amendments) will not be effective until the State develops and promulgates its regulations. Once those regulations are effective in the States, they are enforceable as a matter of State law and facilities must comply with those requirements under the schedule established by the State. These RCRA base requirements will become part of the RCRA authorized program and enforceable as a matter of federal law once the State submits and EPA approves a modification to the State's authorized program. (*See* the State Authorization section (section VIII) for a more detailed discussion.) The requirements that are more stringent or broader in scope than the existing regulations and are promulgated pursuant to HSWA authority will become effective and federally enforceable on the effective date of the approved state law designating CCRs as a special waste subject to subtitle C—that is, they are federally enforceable without waiting for authorization of the program revision applicable to the HSWA provisions. On the other hand, any requirements that are promulgated pursuant to HSWA authority, but are less stringent than the existing subtitle C requirements (*e.g.,* modifications promulgated pursuant to Section 3004(x)) will become effective only when the State promulgates those regulations (and federally enforceable when the State program revision is authorized), as the State has the discretion to not adopt those less stringent requirements.

B. What are the requirements with which facilities must comply?

It is EPA's intention that this proposed alternative, if finalized, will be implemented in the same manner as previous regulations under RCRA subtitle C have been. The following paragraphs describe generally how this proposal will be implemented. While this notice provides some details on specific requirements, it is EPA's intention that, unless otherwise noted, all current Subtitle C requirements become applicable to the facilities generating, transporting, or treating, storing or disposing of CCRs listed as special wastes. While in this notice EPA has described the major subtitle C requirements, EPA has not undertaken a comprehensive description of all of the subtitle C regulatory requirements which may be applicable; therefore, we encourage commenters to refer to the regulations at 40 CFR parts 260 to 268, 270 to 279, and 124 for details.

1. Generators and Transporters

i. Requirements

Under this proposed regulation, regulated CCRs destined for disposal become a newly listed special waste subject to the subtitle C requirements. Persons that generate this newly identified waste is required to notify EPA within 90 days after the wastes are identified or listed[148] (by EPA or the state) and obtain an EPA identification number if they do not already have one in accordance with 40 CFR 262.12. (If the person who generates regulated CCRs already has an EPA identification number, EPA is proposing not to require that they re-notify EPA; however, EPA is seeking comment on this issue.) Moreover, on the effective date of this rule in the relevant state, generators of CCRs must be in compliance with the generator requirements set forth in 40 CFR part 262. These requirements include standards for waste determination (40 CFR 262.11), compliance with the manifest (40 CFR 262.20 to 262.23), pre-transport procedures (40 CFR 262.30 to 262.34), generator accumulation (40 CFR 262.34), record keeping and reporting (40 CFR 262.40 to 262.44), and the import/export procedures (40 CFR 262.50 to 262.60). It should be noted that the current generator accumulation provisions of 40 CFR 262.34 allow generators to accumulate hazardous wastes without obtaining interim status or a permit only in units that are container accumulation units, tank systems or containment buildings; the regulations also place a limit on the maximum amount of time that wastes can be accumulated in these units. If these wastes are managed in landfills, surface impoundments or other units that are not tank systems, containers, or containment buildings, these units are subject to the permitting requirements of 40 CFR parts 264, 265, and 267 and the generator is required to obtain interim status and seek a permit (or modify interim status or a permit, as appropriate). These requirements would be applied to special wastes as well. Permit requirements are described in Section VII.D below.

Transporters of CCRs destined for disposal will be transporting a special waste subject to subtitle C on the effective date of this regulation. Persons who transport these newly identified wastes will be required to obtain an EPA identification number as described

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[148] *See* section 3010 of RCRA.

above and must comply with the transporter requirements set forth in 40 CFR part 263 on the effective date of the final rule. In addition, generators and transporters of CCRs destined for disposal should be aware that an EPA identified waste subject to the EPA waste manifest requirements under 40 CFR part 262 meets the definition for a hazardous material under the Department of Transportation's Hazardous Materials Regulations (HMR; 49 CFR parts 171–180) and must be offered and transported in accordance with all applicable HMR requirements, including materials classification, packaging, and hazard communication.[149]

ii. Effective Dates and Compliance Deadlines

Generators must notify EPA within 90 days after the date that CCRs are identified or listed as special wastes (by EPA or the state). The other requirements for generators and transporters (in 40 CFR parts 262 and 263) are effective and generators and transporters must be in compliance with these requirements on the effective date of the final rules. The effective date of these rules is six months after promulgation of the federal rule in non-authorized States and in authorized States generally six months after promulgation of the State regulations. (*See* previous section for a more detailed discussion of effective dates.)

2. Treatment, Storage, and Disposal Facilities (TSDs)

i. Requirements

Facilities treating, storing, or disposing of the newly listed CCRs are subject to the RCRA 3010 notification requirements, the permit requirements in 40 CFR part 270, and regulations in 40 CFR part 264 or 267 for permitted facilities or part 265 for interim status facilities, including the general facility requirements in subpart B, the preparedness and prevention requirements in subpart C, the contingency plan and emergency procedure requirement in subpart D, the manifest, recordkeeping and reporting requirements in subpart E, the closure and post-closure requirements in subpart G, the corrective action requirements, including facility-wide corrective action in subpart F, and the financial assurance requirements in subpart H.

C. RCRA Section 3010 Notification

Pursuant to RCRA section 3010 and 40 CFR 270.1(b), facilities managing these special wastes subject to subtitle C must notify EPA of their waste management activities within 90 days after the wastes are identified or listed as a special waste. (As noted above, for facilities in States where EPA administers the program, this will be 90 days from the date of promulgation of the final federal regulation; in authorized States, it will be 90 days from the date of promulgation of listing CCRs as a special waste by the state, unless the state provides an alternative timeframe.) This requirement may be applied even to those TSDs that have previously notified EPA with respect to the management of hazardous wastes. The Agency is proposing to waive this notification requirement for persons who handle CCRs and have already: (1) Notified EPA that they manage hazardous wastes, and (2) received an EPA identification number because requiring persons who have notified EPA and received an EPA identification number would be duplicative and unnecessary, although the Agency requests comment on whether it should require such persons to re-notify the Agency that they generate, transport, treat, store or dispose of CCRs. However, any person who treats, stores, or disposes of CCRs and has not previously received an EPA identification number for other waste must obtain an identification number pursuant to 40 CFR 262.12 to generate, transport, treat, store, or dispose of CCRs within 90 days after the wastes are identified or listed as special wastes subject to subtitle C, as described above.

D. Permit Requirements

As specified in 40 CFR 270.1(b), six months after promulgation of a new regulation, the treatment, storage or disposal of hazardous waste or special waste subject to subtitle C by any person who has not applied for and received a RCRA permit is prohibited from managing such wastes. Existing facilities, however, may satisfy the permit requirement by submitting Part A of the permit application. Timely submission of Part A and the notification qualifies a facility for interim status under section 3005 of RCRA and facilities with interim status are treated as having been issued a permit until a final decision is made on a permit application.

The following paragraphs provide addition details on how the permitting requirements would apply to various categories of facilities:

1. Facilities Newly Subject to RCRA Permit Requirements

Facilities that treat, store, or dispose of regulated CCRs at the time the rule becomes effective would generally be eligible for interim status pursuant to section 3005 of RCRA. (*See* section 3005(e)(1)(A)(ii) of RCRA).[150] EPA believes most, if not all utilities generating CCRs and most if not all off-site disposal sites will be in this situation. In order to obtain interim status based on treatment, storage, or disposal of such newly listed CCRs, eligible facilities are required to comply with 40 CFR 270.70(a) and 270.10(e) (or more likely with analogous state regulations) by providing notice under RCRA section 3010 (if they do not have an EPA identification number) and submitting a Part A permit application no later than six months after date of publication of the regulations which first require them to comply with the standards. (In most cases, these would be the state regulations implementing the federal program; however, in those States and jurisdictions where EPA implements the program, the deadline will be six months after promulgation of the final federal rule.) Such facilities are subject to regulation under 40 CFR part 265 until EPA or the state issues a RCRA permit. In addition, under section 3005(e)(3) and 40 CFR 270.73(d), not later than 12 months after the effective date of the regulations that render the facility subject to the requirement to have a RCRA permit and which is granted interim status, land disposal facilities newly qualifying for interim status under section 3005(e)(1)(A)(ii) also must submit a Part B permit application and certify that the facility is in compliance with all applicable ground water monitoring and financial responsibility requirements. If the facility fails to submit these certifications and the Part B permit application, interim status will terminate on that date.

2. Existing Interim Status Facilities

EPA is not aware of any utilities or CCR treatment or disposal sites in RCRA interim status currently, and therefore

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[149] *See* the definition for "hazardous waste" in 49 CFR 171.8.

[150] Section 3005(e) of RCRA states, in part, that "Any person who * * * is in existence on the effective date of statutory or regulatory changes under this Act that render the facility subject to the requirement to have a permit under this section * * * shall be treated as having been issued such permit until such time as final administrative disposition of such application is made, unless the Administrator or other plaintiff proves that final administrative disposition of such application has not been made because of the failure of the applicant to furnish information reasonably required or requested in order to process the application.

EPA does not believe the standard federal rules on changes in interim status will apply. However, in case such a situation exists, EPA describes below the relevant provisions. Again, EPA is describing the federal requirements, but because the proposed requirements that subject these facilities to permitting requirements are part of the RCRA base program, authorized state regulations will govern the process, and the date those regulations become effective in the relevant state will trigger the process.

Pursuant to 40 CFR 270.72(a)(1), all existing hazardous waste management facilities (as defined in 40 CFR 270.2) that treat, store, or dispose of newly identified hazardous wastes and are currently operating pursuant to interim status under section 3005(e) of RCRA, must file an amended Part A permit application with EPA no later than the effective date of the final rule in the State where the facility is located. By doing this, the facility may continue managing the newly listed wastes. If the facility fails to file an amended Part A application by such date, the facility will not receive interim status for management of the newly listed wastes (in this case CCRs) and may not manage those wastes until the facility receives either a permit or a change in interim status allowing such activity (40 CFR 270.10(g)). This requirement, if applicable to any electric utilities, will be applied to those facilities managing CCRs destined for disposal since these facilities will now be managing CCRs subject to the subtitle C requirements.

3. Permitted Facilities

EPA also believes that no electric utilities treating, storing, or disposing of CCRs currently has a RCRA permit for its CCR management unit(s), nor is EPA aware of any on-going disposal of CCRs at permitted hazardous waste TSDs, although the latter situation is a possibility. Federal procedures for how permitted hazardous waste facilities manage newly listed hazardous wastes are described below, but again in practice (with the exception of those jurisdictions in which EPA administers the hazardous waste program), the authorized state regulations will govern the process.

Under 40 CFR 270.42(g), facilities that already have RCRA permits must request permit modifications if they want to continue managing the newly listed wastes (*see* 40 CFR 270.42(g) for details). This provision states that a permittee may continue managing the newly listed wastes by following certain requirements, including submitting a Class 1 permit modification request on or before the date on which the waste or unit becomes subject to the new regulatory requirements (*i.e.,* the effective date of the final federal rule in those jurisdictions where EPA administers the program or the effective date of the State rule in authorized States), complying with the applicable standards of 40 CFR parts 265 and 266 and submitting a Class 2 or 3 permit modification request within 180 days of the effective date of the final rule. Again, these requirements, if applicable to any electric utilities, will be applied to those facilities managing CCRs destined for disposal since they are now subject to the subtitle C requirements.

E. Requirements in 40 CFR Parts 264 and 265

The requirements of 40 CFR part 264 and 267 for permitted facilities or part 265 for interim status facilities, including the general facility standards in subpart B, the preparedness and prevention requirements in subpart C, the contingency plan and emergency procedure requirements in subpart D, the manifest, recordkeeping and reporting requirements in subpart E, the corrective action requirements, including facility-wide corrective action in subpart F, and the financial assurance requirements in Subpart H, are applicable to TSDs and TSDs must be in compliance with those requirements on the effective date of the final (usually state) regulation, except as noted below. These requirements will apply to those facilities managing CCRs destined for disposal.

Moreover, all units in which newly identified hazardous wastes are treated, stored, or disposed of after the effective date of the final (usually state) rule that are not excluded from the requirements of 40 CFR parts 264, 265 and 267 will be subject to both the general closure and post-closure requirements of subpart G of 40 CFR parts 264 and 265 and the unit-specific closure requirements set forth in the applicable unit technical standards in subparts 40 CFR parts 264 or 265 (*e.g.,* subpart N for landfill units). In addition, EPA promulgated a final rule that allows, under limited circumstances, regulated landfills or surface impoundments, (or land treatment units which is not used for the management of CCR waste) to cease managing hazardous waste, but to delay subtitle C closure to allow the unit to continue to manage non-hazardous waste for a period of time prior to closure of the unit (*see* 54 FR 33376, August 14, 1989). Units for which closure is delayed continue to be subject to all applicable 40 CFR parts 264 and 265 requirements. Dates and procedures for submittal of necessary demonstrations, permit applications, and revised applications are detailed in 40 CFR 264.113(c) through (e) and 265.113(c) through (e). As stated earlier, these requirements will be applicable to those facilities managing CCRs destined for disposal, since they will be managing a newly listed waste subject to subtitle C requirements.

Except as noted below, existing facilities are required to be in compliance with the surface impoundment stability requirements, the LDR treatment standards for non-wastewaters, and the fugitive dust controls on the effective date of the final rule.

For certain of the other requirements, existing facilities will have:

(a) 60 days from the effective date of the final rule to install a permanent identification marker on each surface impoundment as required by 40 CFR 264.1304(d) and 40 CFR 265.1304(d).

(b) 1 year from the effective date of the final rule:

To submit plans for each surface impoundments as required by 264.1304(b) and 265.1304(b).

To adopt and submit to the Regional Administrator a plan for carrying out the inspection requirements for each surface impoundment in 40 CFR 264.1305 and 40 CFR 265.1305.

To comply with the groundwater monitoring requirements for each landfill and surface impoundment in 40 CFR 264, Subpart F and 265, Subpart F.

(c) 2 years from the effective date of the final rule:

To install, operate, and maintain run-on and run-off controls as required by 264.1304(g) and 265.1304(g) for surface impoundments and by 264.1307(d) and 265.1307(d) for landfills.

(d) 5 years from the effective date of the final rule:

To comply with the LDR wastewater treatment standard.

To stop receiving CCR waste in surface impoundments.

(e) 7 years from the effective date of the final rule to close surface impoundments handling CCRs.

Any new CCR landfills, including lateral expansions of existing landfills (as defined in the regulation), must be in compliance with all the requirements of the final regulation before CCRs can be placed in the unit.

The table below (Table 9) provides a summary of the effective dates for the various requirements:

TABLE 9—CCR RULE REQUIREMENTS

	Compliance date non authorized state	Compliance date authorized state
Remove Bevill Exclusion	6 months after promulgation of final rule	6 months after State adopts regulations (under State law); federally enforceable when state program revision is authorized.
Listing CCRs as a Special Waste Subject to subtitle C.	Same	Same.
Notification (generators and TSDs)	90 days after rule promulgation (that is, the date the CCRs are listed as a Special Waste subject to subtitle C.	90 days after State rule promulgation (that is, the date the CCRs are listed as a Special Waste subject to subtitle C.
Generator requirements (40 CFR part 262)	6 months after promulgation	On the effective date of the State regulations.
Transporter Requirements (40 CFR part 263)	6 months after promulgation	On the effective date of State regulations.
Permit Requirement/Interim Status	File Part A of the permit application within six months of effective date of final rule.	File Part A of the permit application within six months of effective date of State final rule.
Facility Standards in Part 264/265	On effective date unless specifically noted	On effective date of state regulation unless specifically noted.
Install a permanent identification marker on each surface impoundment as required by 40 CFR 264.1304(d) and 40 CFR 265.1304(d).	60 days from the effective date of the final rule.	60 days from the effective date of the State regulation.
Submit plans required by 264.1304(b) and 265.1304(b).	1 year from the effective date of the final rule	1 year from the effective date of the State regulation.
Adopt and submit to the Regional Administrator a plan for carrying out the inspection requirements in 40 CFR 264.1305 and 40 CFR 265.1305.	1 year from the effective date of the final rule	1 year from the effective date of the State regulation.
Comply with ground water monitoring requirements in 40 CFR 264 Subpart F and 40 CFR 265 Subpart F.	1 year from the effective date of the final rule	1 year from the effective date of the State regulation.
Install, operate, and maintain run-on and run-off controls as required by 264.1304 (g) and 265.1304 (g) for surface impoundments and by 264.1307 (d) and 265.1307 (d) for landfills.	2 years from the effective date of the final rule	2 years from the effective date of the State regulation.
Comply with the LDR wastewater treatment standard.	5 years from the effective date of the final rule	5 years from the effective date of the State regulation.
Close surface impoundments receiving CCR waste.	7 years from the effective date of the final rule	7 years from the effective date of the State regulation.

VIII. Impacts of a Subtitle C Rule on State Authorization

A. Applicability of the Rule in Authorized States

Under section 3006 of RCRA, EPA authorizes qualified states to administer their own hazardous waste programs in lieu of the federal program within the state. Following authorization, EPA retains enforcement authority under sections 3008, 3013, and 7003 of RCRA, although authorized states have primary enforcement responsibility. The standards and requirements for state authorization are found at 40 CFR part 271.

Prior to enactment of the Hazardous and Solid Waste Amendments of 1984 (HSWA), a state with final RCRA authorization administered its subtitle C hazardous waste program in lieu of EPA administering the federal program in that state. The federal requirements no longer apply in the authorized state, and EPA could not issue permits for any facilities in that state, since only the state was authorized to issue RCRA permits. When new, more stringent federal requirements are promulgated, the state was obligated to enact equivalent authorities within specified time frames (one to two years). The new more stringent federal requirements did not take effect in the authorized state until the state adopted the federal requirements as state law, and the state requirements are not federally enforceable until EPA authorized the state program. This remains true for all of the requirements issued pursuant to statutory provisions that existed prior to HSWA.

In contrast, under RCRA section 3006(g) (42 U.S.C. 6926(g)), which was added by HSWA, new requirements and prohibitions imposed under HSWA authority take effect in authorized states at the same time that they take effect in unauthorized states. EPA is directed by the statute to implement these requirements and prohibitions in authorized states, until the state is granted authorization to do so. While states must still adopt new more stringent HSWA related provisions as state law to retain final authorization, EPA implements the HSWA provisions in authorized states until the states do so.

Authorized states are required to modify their programs only when EPA enacts federal requirements that are more stringent or broader in scope than the existing federal requirements. RCRA section 3009 allows the states to impose standards more stringent than those in the federal program (*see* also 40 CFR 271.1). Therefore, authorized states may, but are not required to, adopt federal regulations, both HSWA and non-HSWA, that are considered less stringent than previous federal regulations.

This alternative of the co-proposal is considered more stringent and broader in scope than current federal regulations and therefore States would be required to adopt regulations and modify their programs if this alternative is finalized.

B. Effect on State Authorization

If finalized, a subtitle C rule for CCRs would affect state authorization in the same manner as any new RCRA subtitle C requirement; *i.e.,* (1) this alternative of the co-proposal would be considered broader in scope and more stringent than the current federal program, so authorized states must adopt regulations so that their program remains at least as stringent as the federal program; and (2) they must receive authorization from

EPA for these program modifications. The process and requirements for modification of state programs at 40 CFR 271, specifically 271.21, will be used.

However, this process is made more complex due to the nature of this particular rulemaking and the fact that some of the provisions of this alternative, if finalized, would be finalized pursuant to the RCRA base program authority and some pursuant to HSWA authority. For RCRA base program or non-HSWA requirements, the general rule, as explained previously, is that the new requirements do not become enforceable as a matter of federal law in authorized states until states adopt the regulations, modify their programs, and receive authorization from EPA. For HSWA requirements, the general rule is that HSWA requirements are enforceable on the effective date of the final federal rule. If an authorized State has not promulgated regulations, modified their programs, and received authorization from EPA, then EPA implements the requirements until the State receives program authorization.

In accord with 271.2(e)(2), authorized states must modify their programs by July 1 of each year to reflect changes to the federal program occurring during the "12 months preceding the previous July 1." Therefore, for example, if the federal rule is promulgated in December 2011, the states would have until July 1, 2013 to modify their programs. States may have an additional year to modify their programs if an amendment to a state statute is needed. *See* 40 CFR 271.21(e)(2)(v).

As noted above, this alternative to the co-proposal is proposed pursuant in part to HSWA authority and in part to non-HSWA or RCRA base program authority. The majority of this alternative is proposed pursuant to non-HSWA authority. This includes, for example, the listing of CCRs destined for disposal as a special waste subject to subtitle C and the impoundment stability requirements. These requirements will be applicable on the effective date of the final federal rule only in those states that do not have final authorization for the RCRA program. These requirements will be effective in authorized states once a state promulgates the regulations and they will become a part of the authorized RCRA program and thus federally enforceable, once the state has submitted a program modification and received authorization for this program modification.

The prohibition on land disposal unless CCRs meet the treatment standards and modification of the treatment standards in 40 CFR part 268 are proposed pursuant to HSWA authority and would normally be effective and federally enforceable in all States on the effective date of the final federal rule. However, because the land disposal restrictions apply to those CCRs that are regulated under subtitle C, until authorized states revise their programs and become authorized to regulate CCRs as a special waste subject to RCRA subtitle C, the land disposal restriction requirements would apply only in those States that currently do not exclude CCRs from subtitle C regulation (that is, CCRs are regulated under subtitle C if they exhibit one or more of the characteristics) and the CCRs in fact exhibit one or more of the RCRA subtitle C characteristics. However, once the state has the authority to regulate CCRs as a special waste, the LDR requirements become federally enforceable in all States.

In addition, the tailored management standards promulgated pursuant to section 3004(x) of RCRA are also proposed pursuant to HSWA authority. However, as these tailored standards are less stringent than the existing RCRA subtitle C requirements, States would not be required to promulgate regulations for these less stringent standards—should a State decide not to promulgate such regulations, the facilities in that state would be required to comply with the full subtitle C standards. Therefore, the tailored management standards will be effective in authorized States only when States promulgate such regulations.

Therefore, the Agency would add this rule to Table 1 in 40 CFR 271.1(j), if this alternative to the co-proposal is finalized, which identifies the federal program requirements that are promulgated pursuant to HSWA and take effect in all states, regardless of their authorization status. Table 2 in 40 CFR 271.1(j) would be modified to indicate that these requirements are self-implementing. Until the states receive authorization for the more stringent HSWA provisions, EPA would implement them, as described above. In implementing the HSWA requirements, EPA will work closely with the states to avoid duplication of effort. Once authorized, states adopt an equivalent rule and receive authorization for such rule from EPA, the authorized state rule will apply in that state as the RCRA subtitle C requirement in lieu of the equivalent federal requirement.

IX. Summary of the Co-Proposal Regulating CCRs Under Subtitle D Regulations

A. Overview and General Issues

EPA is co-proposing and is soliciting comment on an approach under which the May 2000 Regulatory Determination would remain in place, and EPA would issue regulations governing the disposal of CCRs under sections 1008(a), 2002, 4004 and 4005(a) of RCRA (*i.e.,* "Subtitle D" of RCRA). Under this approach, the CCRs would remain classified as a non-hazardous RCRA solid waste, and EPA would develop national minimum criteria governing facilities for their disposal. EPA's co-proposed subtitle D minimum criteria are discussed below.

Statutory standards for Subtitle D approach. Under RCRA 4005(a), upon promulgation of criteria under 1008(a)(3), any solid waste management practice or disposal of solid waste which constitutes the "open dumping" of solid waste is prohibited. The criteria under RCRA 1008(a)(3) are those that define the act of open dumping, and are prohibited under 4005(a), and the criteria under 4004(a) are those to be used by states in their planning processes to determine which facilities are "open dumps" and which are "sanitary landfills." EPA has in practice defined the two sets of criteria identically. *See, e.g.,* Criteria for Classification of Solid Waste Disposal Facilities and Practices, 44 FR 53438, 53438–39 (Sept. 13, 1979). EPA has designed today's co-proposed subtitle D criteria to integrate with the existing open dumping criteria in this respect, as reflected in the proposed changes to 257.1.

Section 4004(a) of RCRA provides that EPA shall promulgate regulations containing criteria distinguishing which facilities are to be classified as sanitary landfills and which are open dumps. This section provides a standard that varies from that under RCRA subtitle C. Specifically, subtitle C provides that management standards for hazardous waste treatment, storage, and disposal facilities are those "necessary to protect human health or the environment." *See, e.g.,* RCRA 3004(a). By contrast, Section 4004(a) provides that

> *[a]t a minimum,* the such criteria shall provide that a facility may be classified as a sanitary landfill and not an open dump only if there is *no reasonable probability of adverse effects on health or the environment* from disposal of solid waste at such facility. Such regulations may provide for the classification of the types of sanitary landfills.

Thus, under the RCRA subtitle D regulatory standard in 4004, EPA is to develop requirements based on the adverse effects on health or the environment from disposal of solid waste at a facility, and accordingly, EPA looked at such effects in developing today's co-proposed Subtitle D rule.

At the same time, EPA believes that the differing standards, in particular the reference to the criteria as those which are needed to assure that there is "no reasonable probability" of adverse effects, allows the Agency the ability to adopt standards different from those required under the subtitle C proposal where appropriate. EPA notes that the 4004(a) standard refers to the "probability" of adverse effect on health or the environment. In EPA's view, this provides it the discretion to establish requirements that are less certain to eliminate a risk to health or the environment than otherwise might be required under Subtitle C, and allows additional flexibility in how those criteria may be applied to facilities. At the same time, however, EPA notes that the requirements meeting the "no reasonable probability" standard are those "at a minimum"—thus, EPA is not constrained to limit itself to that standard should it determine that additional protections are appropriate.

Statements in the legislative history of 4004(a) are also consistent with EPA's interpretation of the statutory language. While it provides little in the way of guidance on the meaning of the "reasonable probability" standard, the legislative history does indicate that Congress was aware of effects from solid waste disposal facilities that included surface runoff, leachate contamination of surface- and groundwaters, and also identified concerns over the location and operations of landfills. *See* H. Rep. 94–1491, at 37–8. In addition, the legislative history confirms that the standard in 4004(a) was intended to set a minimum for the criteria. *See* H. Rep. 94–1491, at 40 ("This legislation requires that the Administrator define sanitary landfill as disposal site at which there is no reasonable chance of adverse effects on health and the environment from the disposal of discarded material at the site. *This is a minimum requirement of this legislation and does not preclude additional requirements.*" Emphasis added.)

1. Regulatory Approach

In developing the proposed RCRA subtitle D option for CCRs, EPA considered a number of existing requirements as relevant models for minimum national standards for the safe disposal of CCRs. The primary source was the existing requirements under 40 CFR part 258, applicable to municipal solid waste landfills, which provide a comprehensive framework for all aspects of disposal in land-based units, such as CCR landfills. Based on the Agency's substantial experience with these requirements, EPA believes that the part 258 criteria represent a reasonable balance between ensuring the protection of human health and the environment from the risks of these wastes and the practical realities of facilities' ability to implement the criteria. The engineered structures regulated under part 258 are very similar to those found at CCR disposal facilities, and the regulations applicable to such units would be expected to address the risks presented by the constituents in CCR wastes. Moreover, CCR wastes do not contain the constituents that are likely to require modification of the existing part 258 requirements, such as organics; for example, no adjustments would be needed to ensure that groundwater monitoring would be protective, as the CCR constituents are all readily distinguishable by standard analytical chemistry. As discussed throughout this preamble, each of the provisions adopted for today's subtitle D co-proposal relies, in large measure, on the record EPA developed to support the 40 CFR part 258 municipal solid waste landfill criteria, along with the other record evidence specific to CCRs, discussed throughout the co-proposed subtitle C alternative. EPA also relied on the Agency's Guide for Industrial Waste Management (EPA530–R–03–001, February 2003), to provide information on existing best management practices that facilities have likely adopted.

The Guide was developed by EPA and state and tribal representatives, as well as a focus group of industry and public interest stakeholders chartered under the Federal Advisory Committee Act, and reflects a consensus view of best practices for industrial waste management. It also contains recommendations based on more recent scientific developments, and state-of-the art disposal practices for solid wastes.

In addition, EPA considered that many of the technical requirements that EPA developed to specifically address the risks from the disposal of CCRs as part of the subtitle C alternative, would be equally justified under a RCRA subtitle D regime. Thus, for example, EPA is proposing the same MSHA-based standards for surface impoundments that are discussed as part of the subtitle C alternative. The factual record—*i.e.*, the risk analysis and the damage cases—supporting such requirements is the same, irrespective of the statutory authority under which the Agency is operating. Although the statutory standards under subsections C and D differ, EPA has historically interpreted both statutory provisions to establish a comparable level of protection, corresponding to an acceptable risk level ranging between 1 × 10–4 to 1 × 10–6. In addition, EPA does not interpret section 4004 to preclude the Agency from establishing more stringent requirements where EPA deems such more stringent requirements appropriate. Thus, several of the provisions EPA is proposing under RCRA subtitle D either correspond to the provisions EPA is proposing to establish for RCRA subtitle C, or are modeled after the existing subtitle C requirements. These provisions include the following regulatory provisions specific to CCRs that EPA is proposing to establish: Scope, and applicability (*i.e.*, who will be subject to the rule criteria/requirements), the Design Criteria and Operating Criteria (including provisions for surface impoundment integrity), and several of the provisions specifying appropriate pollution control technologies. Additional support for EPA's decision to specify appropriate monitoring, corrective action, closure, and post-closure care requirements (since the specific requirements correlate closely with the existing 40 CFR 258 requirements) is found in the risk analysis and damage case information. Finally, many of the definitions are the same in each section.

However, both the RCRA subtitle C proposals and the existing 40 CFR part 258 requirements were developed to be implemented in the context of a permitting program, where an overseeing authority evaluates the requirements, and can adjust them, as appropriate to account for site specific conditions. Because there is no corresponding guaranteed permit mechanism under the RCRA subtitle D regulations proposed today, EPA also considered the 40 CFR part 265 interim status requirements for hazardous waste facilities, which were designed to operate in the absence of a permit. The interim status requirements were particularly relevant in developing the proposed requirements for surface impoundments, since such units are not regulated under 40 CFR part 258. Beyond their self-implementing design, these requirements provided a useful model because, based on decades of experience in implementing these requirements, EPA has assurance that they provide national requirements that have proven to be protective for a variety of wastes, under a wide variety of site conditions. Past experience also demonstrates that facilities can feasibly implement these requirements.

Taking all of these considerations into account, EPA has generally designed the proposed RCRA subtitle D criteria to create self-implementing requirements. These self-implementing requirements typically consist of a technical design standard (*e.g.,* the composite liner requirement for new CCR landfills and surface impoundments). In addition, for many of these requirements, the Agency also has established performance criteria that the owner or operator can meet, in place of the technical design standard, which provides the facility with flexibility in complying with the minimum national criteria. EPA generally has chosen to propose an alternate performance standard for a number of reasons. In several cases, the alternative standard is intended to address the circumstances where the appropriate requirement is highly dependent on site-specific conditions (such as the spacing and location of ground-water wells); consequently, uniform, national standards that assure the requisite level of protection are extremely difficult to establish. EPA could establish a minimum national requirement, but to do so, EPA would need to establish the most restrictive criteria that would ensure protection of the most vulnerable site conditions. Because this would result in overregulation of less vulnerable sites, EPA questions whether such a restrictive approach would be consistent with the RCRA section 4004 standard of ensuring "no *reasonable* probability of adverse effects." (emphasis added). The existing 40 CFR part 258 requirements provide the flexibility to address this issue by establishing alternate performance standards and relying on the oversight resulting from state permitting processes, and supported by EPA approval of state plans. Indeed, EPA made clear in the final MSWLF rule that this was the reason that several of the individual performance standards in the existing 40 CFR part 258 requirements are available only in states with EPA approved programs. *See, e.g.,* 56 FR 51096 (authorizing alternative cover designs). However, EPA cannot rely on these oversight mechanisms to implement the RCRA 4004 subtitle D requirements. Under these provisions of RCRA, EPA lacks the authority to require state permits, approve state programs, and to enforce the criteria. Moreover as discussed in Section IV, the level of state oversight varies appreciably among states. Consequently, for these provisions EPA is also proposing to require the owner or operator of the facility to obtain certifications by independent registered professional engineers to provide verification that these provisions are properly applied. EPA has also proposed to require certifications by independent professional engineers more broadly as a mechanism to facilitate citizen oversight and enforcement. As discussed in greater detail below, EPA is proposing to require minimum qualifications for the professionals who are relied upon to make such certifications. In general, EPA expects that professionals in the field will have adequate incentive to provide an honest certification, given that the regulations require that the engineer not be an employee of the owner or operator, and that they operate under penalty of losing their license.

EPA believes that these provisions allow facilities the flexibility to account for site conditions, by allowing them to deviate from the specific technical criteria, provided the alternative meets a specified performance standard, yet also provide some degree of third-party verification of facility practices. The availability of meaningful independent verification is critical to EPA's ability to conclude that these performance standards will meet the RCRA section 4004 protectiveness standard. EPA recognizes that relying upon third party certifications is not the same as relying upon the state regulatory authority, and will likely not provide the same level of "independence." For example, although not an employee, the engineer will still have been hired by the utility. EPA therefore broadly solicits comment on whether this approach provides the right balance between establishing sufficient guarantee that the regulations will be protective, and offering facilities sufficient flexibility to be able to feasibly implement requirements that will be appropriate to the site conditions. In this regard, EPA would also be interested in receiving suggestions for other mechanisms to provide facility flexibility and/or verification.

There is a broad range of the extent to which states already have some of these requirements in place under their current RCRA subtitle D waste management programs established under state law, as explained previously in this preamble. EPA and certain commenters, however, have identified significant gaps in state programs and current practices. For example, EPA does not believe that many, if any, states currently have provisions that would likely cause the closure of existing surface impoundments, such as the provisions in today's proposed rule that surface impoundments must either retrofit to meet all requirements, such as installing a composite liner, or stop receiving CCRs within a maximum of five years of the effective date of the regulation. The RCRA subtitle D proposal outlined here is intended to fill such gaps and ensure national minimum standards. EPA intends to provide a complete set of requirements, designed to ensure there will be no reasonable probability of adverse effects on health or the environment caused by CCR landfills or surface impoundments. EPA's co-proposed RCRA subtitle D minimum criteria are discussed below.

2. Notifications

In response to EPA's lack of authority to require a state permit program or to oversee state programs, EPA has sought to enhance the protectiveness of the proposed RCRA subtitle D standards by providing for state and public notifications of the third party certifications, as well as other information that documents the decisions made or actions taken to comply with the performance criteria. As discussed in the section-by-section analysis below, documentation of how the various standards are met must be placed in the operating record and the state notified.

The owner or operator must also maintain a web site available to the public that contains the documentation that the standard is met. EPA is proposing that owners and operators provide notification to the public by posting notices and relevant information on an internet site with a link clearly identified as being a link to notifications, reports, and demonstrations required under the regulations. EPA believes the internet is currently the most convenient and widely accessible means for gathering information and disseminating it to the public. However, the Agency solicits comments regarding the methods for providing notifications to the public and the states. EPA also solicits comments on whether there could be homeland security implications with the requirement to post information on an internet site and whether posting certain information on the internet may duplicate information that is already available to the public through the state.

The co-proposed subtitle D regulation accordingly includes a number of public notice provisions. In particular, to ensure that persons residing near CCR surface impoundments are protected from potential catastrophic releases, we are proposing that when a potentially hazardous condition develops regarding the integrity of a surface impoundment, that the owner or operator immediately notify potentially affected persons and the state. The Agency is also proposing to require that owners or operators notify the state, and place the report and other supporting materials in the operating record and on the company's internet site of various demonstrations, documentation, and certifications. Accordingly, notice must be provided: (1) Of demonstrations that CCR landfills or surface impoundments will not adversely affect human health or the environment; (2) of demonstrations of alternative fugitive dust control measures; (3) annually throughout the active life and post-closure care period that the landfill or surface impoundment is in compliance with the groundwater monitoring and corrective action provisions; (4) when documentation related to the design, installation, development, and decommission of any monitoring wells, piezometers and other measurement, sampling, and analytical devices has been placed in the operating record; (5) when certification of the groundwater monitoring system by an independent registered professional engineer or hydrologist has been placed in the operating record; (6) when groundwater monitoring sampling and analysis program documentation has been placed in the operating record; (7) when the use of an alternative statistical method is to be used in evaluating groundwater monitoring data and a justification for the alternative statistical method has been placed in the operating record; (8) when the owner or operator finds that there is a statistically significant increase over background for one or more of the constituents listed in Appendix III of the proposed rule, at any groundwater monitoring well; (9) when a notice of the results of assessment monitoring that may be required under the groundwater monitoring program is placed in the operating record; (10) when a notice is placed in the operating record that constituent levels that triggered assessment monitoring have returned to or below background levels; (11) when a notice of the intent to close the unit has been placed in the operating record; and (12) when a certification, signed by an independent registered professional engineer verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record. Please consult the proposed subtitle D regulation provided with this notice for all the proposed notification and documentation requirements.

As explained earlier, the RCRA subtitle D approach relies on state and citizen enforcement. EPA believes that it cannot conclude that the RCRA subtitle D regulations will ensure there is no reasonable probability of adverse effects on health or the environment, unless there is a mechanism for states and citizens to monitor the situation, such as when groundwater monitoring shows exceedances, so that they can determine when intervention is appropriate. EPA also believes that notifications, such as those described above, will minimize the danger of owners or operators abusing the self-implementing system through increased transparency and by facilitating the citizen suit enforcement mechanism.

EPA is proposing that owners and operators provide notification to the public by posting notices and relevant information on an internet site with a link clearly identified as being a link to notifications, reports, and demonstrations required under the regulations. EPA believes the internet is currently the most convenient and widely accessible means for gathering information. However, the Agency solicits comments regarding the methods for providing notifications to the public and the states.

B. Section-by-Section Discussion of RCRA Subtitle D Criteria

1. Proposed Modifications to Part 257, Subpart A

EPA is proposing to modify the existing open dumping criteria found in 40 CFR 257.1, *Scope and Purpose,* to recognize the creation of a new subpart D, which consolidates all of the criteria adopted for determining which CCR Landfills and CCR Surface impoundments pose a reasonable probability of adverse effects on health or the environment under sections 1008(a)(3) and 4004(a) of the Act. Facilities and practices failing to satisfy these consolidated subpart D criteria violate RCRA's prohibition on open dumping. The proposed regulation also excludes CCR landfills and surface impoundments subject to proposed subpart D from subpart A, except as otherwise provided in subpart D.

In general, these provisions are intended to integrate the new requirements with the existing open dumping criteria, and have only been modified to clarify that the proposed RCRA subtitle D regulations define which CCR landfills and surface impoundments violate the federal standards, and therefore may be enforced by citizen suit under RCRA 4005(a) and 7002. EPA has also proposed language to make clear that those CCR landfills and surface impoundments that are subject to the new proposed Subpart D would not also be subject to Subpart A, with the exception of three of the existing Subpart A criteria (257.3–1, *Floodplains,* 257.3–2 *Endangered Species,* 257.3–3 *Surface water*) that would continue to apply to these facilities. The applicability of these three provisions to CCR disposal facilities is discussed later in this preamble.

Finally, EPA also notes that its intent in excluding CCR landfills and surface impoundments from 40 CFR 257 Subpart A in this manner is to consolidate the requirements applicable to those particular facilities in one set of RCRA subtitle D regulations. EPA does not intend to modify the coverage of 40 CFR 257 subpart A as to other disposal facilities and practices for CCRs, such as beneficial uses of CCRs when they are applied to the land used for food-chain crops. It is EPA's intent that such activities would continue to be subject to the existing criteria under Subpart A.

2. General Provisions

The proposed general provisions address the applicability of the new proposed RCRA Subpart D requirements, the continuing applicability of certain of the existing open dumping criteria, provide for an effective date of 180 days after promulgation, and define key terms for the proposed criteria.

Applicability. The applicability provisions identify those solid waste disposal facilities subject to the new proposed RCRA Subpart D (*i.e.,* CCR landfills and CCR surface impoundments as defined under proposed 257.40(b)). The applicability section also identifies three of the existing subpart A criteria that would continue to apply to these facilities: 257.3–1, *Floodplains,* 257.3–2 *Endangered Species,* 257.3–3 *Surface water.* The applicability of these provisions to CCR disposal facilities is discussed later in this preamble.

The applicability section also specifies an effective date of 180 days after publication of the final rule. EPA believes that, with the specific exceptions discussed below, this time frame strikes a reasonable balance between the time that owners and operators of CCR units would need in order to come into compliance with the rule's requirements, and the need to implement the proposed requirements in a timeframe that will maximize protection of health and the environment. We note that 180 days is the timeframe for persons to come into compliance with most of the requirements under RCRA subtitle C, and believe that if persons can meet the hazardous waste provisions within this time period under RCRA subtitle C, that it is reasonable to conclude that persons should be able to meet those same or similar requirements under RCRA subtitle D. EPA also notes that pending finalization of any regulations, facilities continue to be subject to the existing part 257 open dumping criteria as they may apply.

3. Definitions

This section of the proposed regulation discusses the definitions of some of the key terms used in the proposed RCRA subtitle D rule that are necessary for the proper interpretation of the proposed criteria. Because EPA is creating a separate section of the regulations specific to CCR units, EPA is also consolidating the existing definitions in this section. However, by simply incorporating these unmodified definitions into this new section of the regulations, EPA is not proposing to reopen, or soliciting comments on these requirements. Nor, for definitions where the only modification relates to an adjustment specific to CCRs, is EPA proposing to revise or reopen the existing part 257 or part 258 definitions as they apply to other categories of disposal facilities, as those will remain unaltered. Accordingly, EPA will not respond to any comments on these definitions.

Aquifer. EPA has defined aquifer for this proposal as a geologic formation, group of formations, or portion of a formation capable of yielding significant quantities of ground water to wells or springs. This is the same definition currently used in EPA's hazardous waste program and MSWLF criteria in 40 CFR 258.2 and differs from the original criteria definition (40 CFR 257.3–4(c)(1)) only in that it substitutes the term "significant" for "usable." The Agency is proposing to adopt the modified definition to make the subtitle C and subtitle D alternatives consistent.

Coal Combustion Residuals (CCRs) means fly ash, bottom ash, boiler slag, and flue gas desulfurization wastes. CCRs are also known as coal combustion wastes (CCWs) and fossil fuel combustion (FFC) wastes.

CCR Landfill. The co-proposed criteria includes a definition of "CCR landfill" to mean an area of land or an excavation, including a lateral expansion, in which CCRs are placed for permanent disposal, and that is not a land application unit, surface impoundment, or injection well. For purposes of this proposed rule, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. EPA modeled this definition after the definition of "Municipal solid waste landfill (MSWLF) unit" contained in the existing criteria for those facilities. Although this is somewhat different than the definition proposed under the subtitle C alternative (which is based on the existing part 260 definition), EPA intends for this proposed definition to capture those landfills and other large-scale disposal practices that are described in EPA's damage cases and risk assessments discussed in sections II, VI, and the RIA.

CCR Surface Impoundment. EPA has proposed to define this term to mean a facility or part of a facility, including a lateral expansion, that is a natural topographic depression, human-made excavation, or diked area formed primarily of earthen materials (although it may be lined with human-made materials), that is designed to hold an accumulation of liquid CCR wastes or CCR wastes containing free liquids and that is not an injection well. EPA has included as examples of surface impoundments settling and aeration pits, ponds, and lagoons. This is the same definition that EPA is proposing as part of the subtitle C alternative, and is generally consistent with the definition of "surface impoundment or impoundment" contained in the existing 257.2 criteria.

EPA further proposes in the definition a description of likely conditions at a CCR surface impoundment, stating that CCR surface impoundments often receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices. EPA intends for this proposed definition to capture those surface impoundments that are described in EPA's damage cases and risk assessments described in sections II, VI, and the RIA.

Existing CCR Landfill/Existing CCR Surface Impoundment. EPA has included a proposed definition of this term to mean a CCR landfill or surface impoundment, which was in operation on, or for which construction commenced prior to the effective date of the final rule. The proposed definition states that a CCR landfill or surface impoundment has commenced construction if: (1) The owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and (2) either (i) a continuous on-site, physical construction program has begun; or (ii) the owner or operator has entered into contractual obligations—which cannot be cancelled or modified without substantial loss—for physical construction of the CCR landfill or surface impoundment to be completed within a reasonable time. These definitions are identical to the co-proposed subtitle C definitions, described in section VI. EPA sees no reason to establish separate definitions of these units for purposes of RCRA subtitle D since the question of whether these units are existing should not differ between whether they are regulated under RCRA subtitles C or D.

Factor of Safety (Safety Factor). The proposed definition is the ratio of the forces tending to resist the failure of a structure to the forces tending to cause such failure as determined by accepted engineering practice. This definition is the same as the co-proposed subtitle C definitions, described in section VI. EPA sees no reason to establish a separate definition for this term for purposes of RCRA subtitle D since the question of "Factor of safety" should not differ between units that would be regulated under RCRA subtitles C or D.

Hazard potential classification. This term is proposed to be defined as the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a dam (or impoundment) or misoperation of the dam or appurtenances.

The proposed definition further delineates the classification into four categories:

—*High hazard potential surface impoundment* which is a surface impoundment where failure or misoperation will probably cause loss of human life;

—*Significant hazard potential surface impoundment* which is a surface impoundment where failure or misoperation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns; and

—*Low hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/ or environmental losses. Losses are principally limited to the surface impoundment owner's property.

—*Less than low hazard potential surface impoundment* means a surface impoundment not meeting the definitions for High, Significant, or Low Hazard Potential.

This definition, just like the proposed RCRA subtitle C definition, follows the

Hazard Potential Classification System for Dams, developed by the U.S. Army Corps of Engineers for the National Inventory of Dams. This system is a widely-used definitional scheme for classifying the hazard potential posed by dams, and EPA expects that the regulated community's familiarity with these requirements will make their application to CCR surface impoundments relatively straightforward.

Independent registered professional engineer or hydrologist. This term is defined as a scientist or engineer who is not an employee of the owner or operator of a CCR landfill or surface impoundment who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

Because the proposed RCRA subtitle D requirements cannot presuppose the existence of a permit or state regulatory oversight, the criteria in today's proposed rule are self-implementing. However, as discussed earlier, to try to minimize the potential for overregulation, and to provide some degree of flexibility, EPA is proposing to allow facilities to deviate from the criteria upon a demonstration that the alternative meets a specified performance standard. But to provide for a minimum level of verification and to reduce the opportunity for abuse, the Agency believes it is imperative to have an independent party review, and certify the facility's demonstrations. The Agency also believes that those professionals certifying the requirements of today's proposed rule should meet certain minimum qualifications. The Agency is proposing to define a "qualified ground-water scientist" to be a scientist or engineer who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in ground-water hydrology and related fields as may be demonstrated by State registration, professional certification, or completion of accredited university programs that enable that individual to make sound professional judgments regarding ground-water monitoring, contaminant fate and transport, and corrective action. This requirement is the same as the current requirement at § 258.50(f). The Agency believes that specialized coursework and training should include, at a minimum, physical geology, ground-water hydrology or hydrogeology, and environmental chemistry (*e.g.,* soil chemistry or low temperature geochemistry). Some national organizations, such as the American Institute of Hydrology and the National Water Well Association, currently certify or register ground-water professionals. States may of course establish more stringent requirements for these professionals, including mandatory licensing or certification. As discussed above, EPA seeks comment on the proposed reliance on independent professionals in implementing the proposed flexibility of performance standards.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill, or existing CCR surface impoundment made after the effective date of the final rule. This definition is identical to the co-proposed subtitle C definition, described in section VI. EPA sees no reason to establish a separate definition of this term for purposes of RCRA subtitle D since whether a lateral expansion has occurred at a CCR landfill or surface impoundment should not differ between those units regulated under RCRA subtitles C or D.

New CCR landfill means a CCR landfill from which there is placement of CCRs without the presence of free liquids, which began operation, or for which the construction commenced after the effective date of the rule. This definition is identical to the co-proposed subtitle C definition, described in section VI. EPA sees no reason to establish a separate definition for this term for purposes of RCRA subtitle D since whether a landfill is new should not differ between those landfills that are regulated under RCRA subtitles C or D.

New CCR surface impoundment means a CCR surface impoundment into which CCRs with the presence of free liquids have been placed, which began operation, or for which the construction commenced after the effective date of the rule. EPA sees no reason to establish a separate definition for this term for purposes of RCRA subtitle D since whether a surface impoundment is new should not differ between those surface impoundments that are regulated under RCRA subtitles C or D.

Recognized and generally accepted good engineering practices means engineering maintenance or operation activities based on established codes, standards, published technical reports, recommended practice, or similar document. Such practices detail generally approved ways to perform specific engineering, inspection, or mechanical integrity activities. In several provisions, EPA requires that the facility operate in accordance with "recognized and generally accepted good engineering practices," or requires an independent engineer to certify that a design or operating parameter meets this standard. The definition references but does not attempt to codify any particular set of engineering practices, but to allow the professional engineer latitude to adopt improved practices that reflect the state-of-the art practices, as they develop over time. This definition is the same as the definition EPA is proposing under the subtitle C alternative.

4. Location Restrictions

To provide for no reasonable probability of adverse effects on health or the environment from the disposal of CCRs at CCR landfills and surface impoundments, EPA believes that any RCRA subtitle D regulation would need to ensure that CCR disposal units were appropriately sited. The proposed location restrictions include requirements relating to placement of the CCRs above the water table, wetlands, fault areas, seismic impact zones, and unstable areas. In addition, as previously noted, the location standards in subpart A of 40 CFR part 257 for floodplains, endangered species, and surface waters would also continue to apply. Finally, the proposed regulations also address the closure of existing CCR landfills and surface impoundments.

The location standards in this proposal are primarily based on the location standards developed for municipal solid waste landfill units, and represent provisions to ensure that the structure of the disposal unit is not adversely impacted by conditions at the site, or that the location of a disposal unit at the site would not increase risks to human health or the environment. The criteria for municipal solid waste landfills provide restrictions on siting units in wetlands, fault areas, seismic impact zones, and unstable areas.[151]

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[151] The proposed definition of seismic impact zone was modified from the part 258 definition as explained in the "Discussion of Individual Location Requirements" section below. The part 258 criteria also include location restrictions relating to airport safety and floodplains, in 258.10 and 258.11, respectively. EPA has not proposed an analogue to 258.10 because the hazard addressed by that criterion, bird strikes to aircraft, is inapplicable in the context of CCR disposal units, which do not tend to attract birds to them. As discussed in the

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Each of those factors is generally recognized as having the potential to impact the structure of a disposal unit negatively or increase the risks to human health and the environment. As discussed below in more detail, each of these provisions adopted for today's RCRA subtitle D co-proposal relies in large measure, on the record EPA developed to support the 40 CFR part 258 municipal solid waste landfill criteria. EPA's Guide for Industrial Waste Management (EPA530–R–03–001, February 2003) also identifies these location restrictions as appropriate for industrial waste management. These proposed requirements are all discussed in turn below, after a general explanation of the Agency's proposed treatment of new CCR disposal units compared to existing CCR disposal units.

a. Differences in Location Restrictions for Existing and New CCR Landfills and Surface Impoundments, and Lateral Expansions. EPA is proposing different sets of location restrictions under the Subtitle D approach, depending on whether a unit is a CCR landfill or surface impoundment, and whether it is an existing or new unit. Lateral expansions fall within the definitions of new units, and are treated accordingly.

While new landfills would be required to comply with all of the location restrictions, EPA is proposing to subject existing landfills to only two of the location restrictions—floodplains, and unstable areas—in today's rule. Existing landfills are already subject to the floodplains location restriction because it is contained in the existing 40 CFR part 257, subpart A criteria, which have been in effect since 1979. Because owners and operators of existing landfills already should be in compliance with this criterion, applying this location restriction will have no impact to the existing disposal capacity, while continuing to provide protection of human health and the environment.

The Agency decided to apply today's final unstable area location restriction to existing CCR landfills, because the Agency believes that the impacts to human health and the environment that would result from the rapid and catastrophic destruction of these units outweighs any disposal capacity concerns resulting from the closure of existing CCR disposal units.

On the other hand EPA is not proposing to impose requirements on existing CCR landfills in wetlands, fault areas, or seismic impact areas. We base this decision on the possibility that a significant number of CCR landfills may be located in areas subject to this requirement. The Agency believes that such landfills pose less risks and are structurally less vulnerable than surface impoundments, and disposal capacity shortfalls, which could result if existing CCR landfills in these locations were required to close, raise greater environmental and public health concerns than the potential risks caused by existing units in these locations. For example, if existing CCR landfills located in wetlands were required to close, there would be a significant decrease in disposal capacity, particularly given the Agency's expectation that many existing surface impoundments will choose to close, in response to this proposed rule. In addition, wetlands are more prevalent in some parts of the country (*e.g.*, Florida and Louisiana). In these States, the closure of all existing CCR landfills located in wetlands could potentially significantly disrupt statewide solid waste management. Therefore, the Agency believes that it may be impracticable to require the closure of existing CCR landfills located in wetlands. However, EPA seeks comment and additional information regarding the number of existing CCR landfills that are located in such areas.

Concern about impacts on solid waste disposal capacity as well as the lower level of risks and the structural vulnerability of landfills, as compared to surface impoundments, were also the primary reasons the Agency is not proposing to subject existing CCR landfills to today's proposed fault area location restrictions. The closure of a significant number of existing CCR landfills located in fault areas could result in a serious reduction of CCR landfill capacity in certain regions of the U.S. where movement along Holocene faults is common, such as along the Gulf Coast and in much of California and the Pacific Northwest. The Agency, however, does not have specific data showing the number of units and the distance between these disposal units and the active faults, and therefore, is unable to precisely estimate the number of these existing CCR landfills that would not meet today's fault area restrictions. EPA therefore solicits comment and additional data and information regarding the extent to which existing CCR landfills are currently located in such locations. However, given the potential for impacts on solid waste capacity and the lower levels of risk associated with landfills compared to surface impoundments, EPA has concluded that it may not be appropriate to subject existing CCR landfills to the proposed fault area requirements.

Similarly, the Agency is not proposing to impose the seismic impact zone restrictions on existing CCR landfills located in these areas. As with the other location restrictions, the Agency anticipates that a significant number of existing CCR disposal units are located in these areas. EPA is concerned that such facilities would be unable to meet the requirements, because retrofitting would be prohibitively expensive and technically very difficult in most cases, and would therefore be forced to close.

EPA generally seeks comment and additional information regarding the extent to which CCR landfill capacity would be affected by applying these location restrictions to existing CCR landfills. Information on the prevalence of existing CCR landfills in such areas would be of particular interest to the Agency. EPA also notes that the proposed location requirements do not reflect a complete prohibition on siting facilities in such areas, but provide a performance standard that facilities must meet in order to site a unit in such a location. EPA therefore solicits comment on the extent to which facilities could comply with these performance standards, and the necessary costs that would be incurred to retrofit the unit to meet these standards.

As discussed earlier in this preamble, this proposed approach is generally consistent with the proposed approach to existing landfills under subtitle C of RCRA, and with Congressional distinctions between the risks presented by landfills and surface impoundments. Existing landfills that are brought into the hazardous waste system because they are receiving newly listed hazardous wastes are not generally required to be retrofitted with a new minimum-technology liner/leachate collection and removal system (or to close), and they would not be subject to such requirements under today's proposal. EPA sees no reason or special argument to adopt more stringent requirements under the co-proposed subtitle D criteria for CCR landfills, particularly given the volume of the material and the disruption that could be involved if these design requirements were applied to existing landfills.

By contrast, and consistent with its approach to existing surface impoundments under subtitle C, the proposed regulations would apply all of the location restrictions to existing surface impoundments. This means that facilities would need to either

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main text, EPA is proposing to maintain the existing criterion in 257, subpart A for floodplains.

demonstrate that the surface impoundment meets the performance standard that serves as the alternative to the prohibition, retrofit the unit so that it can meet the performance standard, or close. EPA is making this distinction because, as discussed in sections IV–VI, the record indicates that the risks associated with CCR surface impoundments are substantially higher than the risks posed by CCR landfills. The impacts to human health and the environment that would result from the rapid and catastrophic destruction of these units could result in injuries to human health and the environment, that are far more significant, as illustrated by the impacts of the recent TVA spill in Tennessee. The risks to human health and the environment of such a catastrophic collapse far outweigh the costs of requiring surface impoundments to retrofit or close. Moreover, there are significant economic costs associated with the failure of a surface impoundment; as noted earlier, the direct cost to clean up the TVA spill is currently estimated to exceed one billion dollars. Surface impoundments also are more vulnerable to structural problems if located in unstable areas, fault areas and seismic impact areas. Finally, as already noted, the distinction EPA is making between existing landfills and existing surface impoundments is also consistent with Congressional direction; as discussed in section VI, Congress specifically required existing surface impoundments receiving hazardous wastes to retrofit to meet the new statutory requirements or to close, in direct contrast to their treatment of existing landfills.

Although many surface impoundments may close as a result of these requirements, EPA believes that it is proposing to take a number of actions to alleviate concerns that this will present significant difficulties with regard to disposal capacity in the short-term: *e.g.*, "grandfathering" in existing CCR landfills, allowing CCR landfills to vertically expand without retrofitting, and delayed implementation dates. At the same time, as discussed in greater detail in section VI, with regard to the subtitle C co-proposal, EPA is soliciting comment on the appropriate amount of time necessary to meet these time frames as well as measures that could help to address the potential for inadequate disposal capacity. EPA notes, however, that unlike under the subtitle C co-proposal, EPA is not proposing to require facilities to cease wet handling. Thus EPA expects that both the impacts and the time frames needed for facilities to come into compliance would be lower.

While the proposed requirements relating to the placement above the water table, wetlands, fault areas, and seismic impact zones would not apply to existing CCR disposal units, all of these restrictions apply to lateral expansions of existing CCR disposal units, as well as new CCR disposal units. Therefore, under the proposal, owners and operators of existing CCR landfills could vertically expand their existing facilities in these locations, but must comply with the provisions governing new units if they wish to laterally expand. EPA expects that allowing such vertical expansion will allow for increased capacity, which will be particularly important, if, as EPA expects, many surface impoundments would close, should this regulation be adopted. At the same time, EPA believes that the risks to human health or the environment will be mitigated because facilities will be required to otherwise comply with the more stringent environmental restrictions, such as the corrective action and closure provisions proposed below.

b. Discussion of Individual Location Requirements

Placement above the water table. The co-proposed subtitle D regulations would prohibit new CCR landfills and all surface impoundments from being located within two feet of the upper limit of the natural water table. EPA is proposing to define the natural water table as the natural level at which water stands in a shallow well open along its length and penetrating the surficial deposits just deeply enough to encounter standing water at the bottom. This is the level of water that exists, when uninfluenced by groundwater pumping or other engineered activities.

Floodplains. CCR landfills and surface impoundments are currently subject to the open dumping criteria contained in 40 CFR 257, Subpart A. These minimum criteria include restrictions on floodplain impacts under 257.3–1. As facilities should already be complying with this requirement, EPA is not proposing to modify it as part of today's rule. Accordingly, EPA is not reopening this requirement.

Wetlands. The regulations require that the facility prepare and make available a written demonstration that such engineering measures have been incorporated into the unit's design to mitigate any potential adverse impact, and require certification by an independent registered professional engineer either that the new CCR disposal unit is not in a prohibited area, as defined by the regulation, or that the demonstration meets the regulatory standards.

Today's proposed wetland provisions would apply only to new CCR landfills, including lateral expansions of existing CCR disposal units, and all surface impoundments. New CCR landfills, which include lateral expansions, as well as all surface impoundments, are barred from wetlands unless the owner or operator of the disposal unit can make the following demonstrations certified by an independent registered professional engineer or hydrologist. First, the owner or operator must rebut the presumption that a practicable alternative to the proposed CCR disposal unit or lateral expansion is available that does not involve wetlands. Second, the owner or operator must show that the construction or operation of the unit will not cause or contribute to violations of any applicable State water quality standard, violate any applicable toxic effluent standard or prohibition, jeopardize the continued existence of endangered or threatened species or critical habitats, or violate any requirement for the protection of a marine sanctuary. Third, the owner or operator must demonstrate that the CCR disposal unit or lateral expansion will not cause or contribute to significant degradation of wetlands. To this end, the owner or operator must ensure the integrity of the CCR disposal unit, and its ability to protect ecological resources by addressing: erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the unit; erosion, stability, and migration potential of dredged and fill materials used to support the unit; the volume and chemical nature of the CCRs; impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCRs; the potential effects of catastrophic release of CCRs to the wetland and the resulting impacts on the environment; and any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected. Fourth, the owner or operator must demonstrate that steps have been taken to attempt to achieve no net loss of wetlands by first avoiding impacts to wetlands to the maximum extent practicable, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions. The owner or operator must place the demonstrations in the operating record and the company's Internet site, and notify the state that the demonstrations have been placed in the operating record.

For facilities that cannot make such a demonstration, this proposed provision effectively bans the siting of new CCR landfills or surface impoundments in wetlands, and would require existing surface impoundments to close.

EPA notes that this section of the proposal is consistent with regulatory provisions currently governing the CWA section 404 program, including the definition of wetlands contained in proposed 257.61. *See* 40 CFR 232.2(r). EPA believes that wetlands are very important, fragile ecosystems that must be protected, and has identified wetlands protection as a top priority. Nevertheless, EPA has proposed to continue to allow existing CCR landfills to be sited in wetlands to minimize the disruption to existing CCR disposal facilities, as it is EPA's understanding that many existing CCR landfills are located near surface water bodies, in areas that also may qualify as wetlands under the proposed criteria. Likewise, EPA is concerned that an outright ban of new CCR landfills in wetlands would severely restrict the available sites or expansion possibilities, given that EPA is proposing to impose other conditions on surface impoundments that may cause many to ultimately close. As noted in section VI, concerns have been raised regarding the potential for disposal capacity shortfalls, which could lead to other health and environmental impacts, such as the transportation of large volumes of CCRs over long distances to other sites. Accordingly to provide additional flexibility in the proposed RCRA Subtitle D rules, and to address concerns regarding the potential for disposal capacity shortfalls, EPA is not proposing an outright ban on siting of existing CCR disposal units in wetlands.

However, EPA continues to believe that siting new CCR disposal units in wetlands should only be done under very limited conditions. The Agency is therefore proposing a comprehensive set of demonstration requirements. In addition, the Agency believes that when such facilities are sited in a wetland, that the owner or operator should offset any impacts through appropriate and practicable compensatory mitigation actions (*e.g.,* restoration of existing degraded wetlands or creation of man-made wetlands). This approach is consistent with the Agency's goal of achieving no overall net loss of the nation's remaining wetland base, as defined by acreage and function. Specifically, § 257.61(a)(4) requires owners or operators of new CCR landfills and surface impoundments to demonstrate that steps have been taken to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands and then minimizing such impacts to the maximum extent feasible, and finally, offsetting any remaining wetland impacts through all appropriate and feasible compensatory mitigation actions (*e.g.,* restoration of existing degraded wetlands or creation of man-made wetlands).

The Agency has also included other requirements to ensure that the demonstrations required under the proposed rule are comprehensive and ensure no reasonable probability of adverse effects to human health and the environment. First, EPA has included language in § 257.61(a)(2) clarifying that the owner or operator must demonstrate that both the construction and operation of the unit will not result in violations of the standards specified in § 257.61(a)(2)(i)–(iv). Second, in § 257.61(a)(3) EPA proposes to identify the factors the owner or operator must address in demonstrating that the unit will not cause or contribute to significant degradation of wetlands. These factors, which were partially derived from the section 404(b)(1) guidelines, address the integrity of the CCR unit and its ability to protect the ecological resources of the wetland. In addition, EPA is proposing requirements for third-party certification and state/public notice, to provide some verification of facility practices, and to generally assist citizens' ability to effectively intervene and enforce the requirements, as necessary.

Fault Areas. The proposed rule would ban the location of new CCR landfills and any surface impoundment within 200 feet (60 meters) of faults that have experienced displacement during the Holocene Epoch. The Holocene is a unit of geologic time, extending from the end of the Pleistocene Epoch to the present and includes the past 11,000 years of the Earth's history. EPA is proposing to define a fault to include a zone or zones of rock fracturing in any geologic material along which there has been an observable amount of displacement of the sides relative to each other. Faulting does not always occur along a single plane of movement (a "fault"), but rather along a zone of movement (a "fault zone"). Therefore, "zone of fracturing," which means a fault zone in the context of the definition, is included as part of the definition of fault, and thus the 200-foot setback distance will apply to the outermost boundary of a fault or fault zone.

The 200-foot setback was first adopted by EPA in the criteria for municipal solid waste landfills (MSWLFs), codified at 40 CFR part 258. In the course of that proceeding, EPA documented that seismologists generally believed that the structural integrity of MSWLFs could not be unconditionally guaranteed when they are built within 200-feet of a fault along which movement is highly likely to occur. Moreover, EPA relied on a study that showed that damage to engineered structures from earthquakes is most severe when the structures were located within 200-feet of the fault along which displacement occurred. Because the engineered structures found at MSWLFs are similar to those found in CCR disposal units, EPA expects that the potential for damage to those structures would be similar in the event of an earthquake near a CCR landfill or surface impoundment. Therefore, EPA is proposing a similar setback requirement for new CCR landfills and all surface impoundments. In general, EPA believes that the 200-foot buffer zone is necessary to protect engineered structures from seismic damages. EPA also expects that the 200-foot buffer is appropriate for CCR surface impoundments, but seeks comment and data on whether the buffer zone should be greater for such units.

However, the Agency is also concerned that the 200-foot setback may be overly protective in some geologic formations, but it is unable to provide a clear definition of these geologic formations. Therefore, the Agency is proposing to allow the opportunity for an owner or operator of a new CCR disposal unit to demonstrate that an alternative setback distance of less than 200 feet will prevent damage to the structural integrity of facility and will be protective of human health and the environment. The demonstration must be certified by an independent registered professional engineer and the owner or operator of the CCR disposal unit must notify the state that the demonstration has been placed in the operating record and on the company's internet site. This approach is consistent with other sections of today's RCRA subtitle D co-proposal for alternatives to the specified self-implementing requirement.

Seismic Impact Zones. As noted, the proposed rule would also ban the location of new CCR landfills and any surface impoundments in seismic impact zones, unless owners or operators demonstrate that the unit is designed to resist the maximum horizontal acceleration in lithified earth material for the site. The design features to be protected include all containment structures (*i.e.,* liners, leachate collection systems, and surface water control systems). The demonstration must be certified by an independent registered professional engineer and the owner or operator must notify the state that the demonstration has been placed in the operating record and on the company's internet site. For purposes of this requirement, EPA is proposing to define seismic impact zones as areas having a 10 percent or greater probability that the maximum expected horizontal acceleration in hard rock, expressed as a percentage of the earth's gravitation pull (g), will exceed 0.10g in 250 years. This is based on the existing part 258.14 definition of seismic impact. The maps for the 250-year intervals are readily available for all of the U.S. in the U.S. Geological Survey Open-File Report 82–1033, entitled "Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States."

Another approach would be to adopt criteria of the National Earthquake Hazards Reduction Program (NEHRP) of the U.S. Geological Survey used to develop national seismic hazard maps. The NEHRP uses ground motion probabilities of 2, 5, and 10% in 50 years to provide a relative range of seismic hazard across the country. The larger probabilities indicate the level of ground motion likely to cause problems in the western U.S. The smaller probabilities show how unlikely damaging ground motions are in many places of the eastern U.S. The maps are available at *http://earthquake.usgs.gov/hazards/products/.* A 50 year time period is commonly used because it represents the typical lifespan of a building, and a 2% probability level is generally considered an acceptable hazard level for building codes. For areas along known active faults, deterministic and scenario ground motion maps could be used to describe the expected ground motions and effects of specific hypothetical large earthquakes (*see* http://earthquake.usgs.gov/hazards/products/scenario/). The Agency solicits comments on the proposed definition and whether there are variants like those used to develop the national seismic hazard maps that could lessen the burden on the industry and the geographic areas covered by the proposed definition. For additional information on the National Seismic Hazard Mapping Project, *see http://earthquake.usgs.gov/hazards/about/.*

Unstable Areas. EPA is proposing to require owners or operators of all CCR landfills, surface impoundments and lateral expansions located in unstable areas to demonstrate that the integrity of the structural components of the unit will not be disrupted. EPA's damage cases have provided indirect evidence of the kind of environmental and human health risks that would be associated with failure of the structural components of the surface impoundment from subsidence or other instability of the earth at a CCR disposal unit. Accordingly, EPA believes that, to provide a reasonable probability of preventing releases and consequent damage to health and the environment from CCRs released from landfills or surface impoundments, limits on the siting of such disposal units is appropriate.

The proposed Subtitle D rule provides that "unstable areas" are locations that are susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the CCR disposal unit's structural components responsible for preventing releases from such units. Unstable areas are characterized by localized or regional ground subsidence, settling (either slowly, or very rapidly and catastrophically) of overburden, or by slope failure. The owner or operator must consider the following factors when determining whether an area is unstable: (1) On-site or local soil conditions that may result in significant differential settling; (2) on-site or local geologic or geomorphologic features; and (3) on-site or local human-made features or events (on both the surface and subsurface). The structural components include liners, leachate collection systems, final cover systems, run-on and run-off control systems, and any other component used in the construction and operation of the CCR landfill, surface impoundment or lateral expansion that is necessary for protection of human health and the environment.

Unstable areas generally include:

(1) Poor foundation conditions—areas where features exist that may result in inadequate foundation support for the structural components of the CCR landfill, surface impoundment or lateral expansion (this includes weak and unstable soils);

(2) Areas susceptible to mass movement—areas where the downslope movement of soil and rock (either alone or mixed with water) occurs under the influence of gravity; and

(3) Karst terraces—areas that are underlain by soluble bedrock, generally limestone or dolomite, and may contain extensive subterranean drainage systems and relatively large subsurface voids whose presence can lead to the rapid development of sinkholes.

Karst areas are characterized by the presence of certain physiographic features such as sinkholes, sinkhole plains, blind valleys, solution valleys, losing streams, caves, and big springs, although not all these features are always present. EPA's intent in this proposed requirement is to include as an unstable area only those karst terraces in which rapid subsidence and sinkhole development have been a common occurrence in recent geologic time. Many of the karst areas are shown on the U.S. Geological Survey's National Atlas map entitled "Engineering Aspects of Karst," published in 1984.

Specific examples of such natural or human-induced phenomena include: Debris flows resulting from heavy rainfall in a small watershed; the rapid formation of a sinkhole as a result of excessive local or regional ground-water withdrawal; rockfalls along a cliff face caused by vibrations set up by the detonation of explosives, sonic booms, or other mechanisms; or the sudden liquefaction of a soil with the attendant loss of shear strength following an extended period of constant wetting and drying. Various naturally-occurring conditions can make an area unstable and these can be very unpredictable and destructive, especially if amplified by human-induced changes to the environment. Such conditions can include the presence of weak soils, over steepened slopes, large subsurface voids, or simply the presence of large quantities of unconsolidated material near a watercourse.

The Agency recognizes that rapid sinkhole formation that occurs in some karst terraces can pose a serious threat to human health and the environment by damaging the structural integrity of dams, liners, caps, run-on/run-off control systems, and other engineered structures. However, EPA is not proposing an outright ban of CCR landfills and surface impoundments in all karst terraces because of concerns regarding the impacts of such a ban in certain regions of the country. For example, several States (*i.e.,* Kentucky, Tennessee) are comprised mostly of karst terraces and banning all CCR disposal facilities in karst terraces would cause severe statewide disruptions in capacity available for CCR disposal. Moreover, the Agency believes that some karst terraces may provide sufficient structural support for CCR disposal units and has accordingly tried to provide flexibility for siting in these areas. Therefore, EPA is proposing to allow the construction of new CCR units, and the continued operation of existing CCR landfills and surface impoundments in karst terraces where the owner or operator can demonstrate that engineering measures have been incorporated into the landfill, surface impoundment, or lateral expansion design to ensure that the integrity of the structural components of the landfill or surface impoundment will not be disrupted. The demonstration must be certified by an independent registered professional engineer, and the owner or operator must notify the state that the demonstration has been placed in the operating record and on the company's internet site.

Closure of Existing CCR Landfills and Surface Impoundments. The proposed rule would require owners and operators of existing CCR landfills and surface impoundments that cannot make the demonstrations required under § 257.62(a) after the effective date of the rule, to close the landfill or surface impoundment within five years of the date of publication of the final rule. Closure and post-closure care must be done in accordance with § 257.100 and § 257.101. The proposed rule would also allow for a case-by-case extension for up to two more years if the facility can demonstrate that there is no alternative disposal capacity and there is no immediate threat to health or the environment. This demonstration must be certified by an independent registered professional engineer or hydrologist. The owner or operator must place the demonstration in the operating record and on the company's internet site and notify the state that this action was taken.

Thus, the proposed rule allows a maximum of 7 years from the effective date of the final rule if this alternative is finally promulgated for existing CCR landfills to comply with the unstable area restrictions, and existing CCR surface impoundments to comply with the location restrictions or to close. As discussed under the subtitle C option, EPA believes that five years will, in most cases, be adequate time to complete proper and effective facility closure and to arrange for alternative waste management. However, there may be cases where alternative waste management capacity may not be readily available or where the siting and construction of a new facility may take longer than five years. EPA believes the two-year extension should provide sufficient time to address these potential problems. EPA continues to believe that impacts on human health and the environment need to be carefully considered, and therefore, today's proposed rule requires the owner or operator to demonstrate that there is no available alternative disposal capacity and there is no potential threat to human health and the environment before adopting the two-year extension. These time frames are consistent with those EPA is proposing under its subtitle C co-proposal for surface impoundments. EPA is aware of no reason that the time frames would need to differ under subtitle D, but solicits comment on this issue.

5. Design Requirements

The CCR damage cases and EPA's quantitative groundwater risk assessment clearly show the need for effective liners—namely composite liners—to very significantly reduce the probability of adverse effects. The co-proposed subtitle D design standards would require that new landfills and all surface impoundments that have not completed closure prior to the effective date of the rule, can only continue to operate if composite liners and leachate collection and removal systems have been installed. Units must be retrofitted or closed within five years of the effective date of the final rule, which is the time frame EPA is proposing for surface impoundments to retrofit or close under the subtitle C alternative. EPA is proposing to require the same liner and leachate collection and removal systems as part of the subtitle D criteria that are being proposed under the RCRA subtitle C co-proposal. The technical justification for these requirements is equally applicable to the wastes and the units, irrespective of the statutory authority under which the requirement is proposed.

EPA is also proposing to adopt the same approach to new and existing units under RCRA subtitle D that it is proposing under RCRA subtitle C. EPA would only require new landfills (or new portions of existing landfills) to meet these minimum technology requirements for liners and leachate collection and removal systems. Existing landfills that continue to receive CCRs after the effective date of the final rule, would not be required to be retrofitted with a new minimum-technology liner/leachate collection and removal system (or to close). They can continue to receive CCRs, and continue to operate as compliant landfills, without violating the open dumping prohibition. However, existing landfills would have to meet groundwater monitoring, corrective action, and other requirements (except as noted) of the subtitle D criteria, to assure that any groundwater releases from the unit were identified and promptly remediated. EPA sees no reason or special argument to adopt any different approach under the co-proposed subtitle D regulations for CCR landfills, particularly given the volume of the material and the disruption that would be involved if these design requirements were applied to existing landfills.

By contrast, existing surface impoundments that have not completed closure by the effective date of the final rule would be required to retrofit to install a liner. This is consistent with, but not identical to, the approach proposed under the RCRA subtitle C alternative. Under the subtitle C alternative, EPA is not proposing to require existing surface impoundments to install the proposed liner systems because the impoundments would only continue to operate for a limited period of time. EPA's proposed treatment standards—dewatering the wastes—will effectively phase out wet handling of CCRs. During this interim period (seven years as proposed), EPA believes that it would be infeasible to require surface impoundments to retrofit, and that compliance with the groundwater monitoring and other subtitle C requirements would be sufficiently protective. EPA lacks the authority under RCRA subtitle D to establish a comparable requirement; EPA only has the authority under RCRA section 4004 to establish standards relating to "disposal," not treatment, of solid wastes. Although EPA expects that many surface impoundments will choose to close rather than install a liner, wet-handling of CCRs can continue, even in existing units, and EPA's risk assessment confirms that the long-term operation of such units would not be protective without the installation of the composite liner and leachate collection system described below.

The composite liner would consist of two components: An upper component consisting of a minimum 30-mil flexible membrane liner (FML), and a lower component consisting of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7}cm/sec. The FML component would be required to be installed in direct and uniform contact with the compacted soil component. (In other words, the new landfill or new surface impoundment would be required to have a liner and leachate collection and removal system meeting the same design standard now included in EPA's municipal solid waste landfill criteria.) EPA solicits comment, however, on whether any subtitle D option should allow facilities to use an alternative design for new disposal units, so long as the owner or operator of a unit could obtain certification from an independent registered professional engineer or hydrologist that the alternative design would ensure that the appropriate concentration values for a set of constituents typical of CCRs will not be exceeded in the uppermost aquifer at the relevant point of compliance—*i.e.*, 150 meters from the unit boundary down gradient from the unit, or the property boundary if the point of compliance (*i.e.*, the monitoring well) is beyond the property boundary. Although the existing part 258 requirements allow for such a demonstration, EPA is not proposing such a requirement in today's rule. EPA's risk assessment shows that only a composite liner would ensure that disposal of CCR will meet the RCRA section 4004 standard on a national level, even though site specific conditions could support the use of alternate liner designs in individual instances. In the absence of a strong state oversight mechanism, such as a permit, EPA is reluctant to allow facilities to modify this key protection. Nevertheless, EPA would be interested in receiving data and information that demonstrates whether under other site conditions, an alternative liner would be equally protective. In this regard, EPA would also be interested in information documenting the extent to which such conditions currently exist at CCR units. If EPA adopts such a performance standard, EPA anticipates adopting a requirement that is as consistent as possible with the existing part 258 requirements, and would require the same documentation and notification procedures as with the other self-implementing provisions in the co-proposed subtitle D option.

—*Stability requirements for surface impoundments.* In our recent assessment of surface impoundments managing CCRs, EPA has identified deficiencies in units currently receiving wet-handled CCRs.[152] The damage cases also demonstrate the need for requirements to address the stability of surface impoundments, to prevent the damages associated with a catastrophic failure, such as occurred at the TVA facility in 2008. EPA is therefore proposing to adopt as part of the subtitle D operating criteria for surface impoundments, the same stability requirements that are proposed as part of the subtitle C alternative. As explained in that section, these are based on the long-standing MSHA requirements, with only minor modifications necessary to tailor the requirements to CCR unit conditions.

For those surface impoundments which continue to operate, (*i.e.*, both new and existing) the proposed regulation would require that an independent registered professional engineer certify that the design of the impoundment is in accordance with recognized and generally accepted good engineering practices for the maximum volume of CCR slurry and wastewater that will be impounded therein, and that together design and management features ensure dam stability. The proposed regulation also requires the facility to conduct weekly inspections to ensure that any potentially hazardous condition or structural weakness will be quickly identified. As with the co-proposed RCRA subtitle C option, the proposed RCRA subtitle D regulation also requires that existing and new CCR surface impoundments be inspected annually by an independent registered professional engineer to assure that the design, operation, and maintenance of the surface impoundment is in accordance with current, prudent engineering practices for the maximum volume of CCR slurry and CCR waste water which can be impounded. EPA has concluded, subject to consideration of public comment, that these requirements are necessary to ensure that major releases do not occur that would cause adverse effects on health or the environment.

6. Operating Requirements

EPA is proposing to establish specific criteria to address the day-to-day operations of the CCR landfill or surface impoundment. The criteria were developed to prevent the health and environmental impacts from CCR landfills and surface impoundments identified in EPA's quantitative risk groundwater risk assessment and the damage cases. Included among these criteria are controls relating to runon and runoff from the surface of the facilities, discharges to surface waters, and pollution caused by windblown dust from landfills, and recordkeeping.

—*Existing criteria for Endangered Species and Surface Water.* CCR landfills and surface impoundments are currently subject to the open dumping criteria contained in 40 CFR 257, Subpart A. These minimum criteria include restrictions on impacts to endangered species under 257.3–2, and impacts to surface water under 257.3–3. As facilities should already be complying with these requirements, EPA is not proposing to modify these existing requirements in today's co-proposal. EPA notes that the surface water criterion is not enforceable by RCRA citizen suit. The extent to which this criterion may be enforced is governed by the remedies available under the CWA, which is the source of the requirement, rather than RCRA. *See, e.g., Arc Ecology* v. *U.S. Maritime Admin.*, No. 02:07–cv–2320 (E.D. Cal. Jan. 21, 2010); Guidelines for the Development and Implementation of State Solid Waste Management Plans and Criteria for Classification of Solid Waste Disposal Facilities and Practices, 46 Fed. Reg. 47048, 47050 (Sept. 23, 1981).

—*Run-on and run-off controls.* The purpose of the run-on standard is to minimize the amount of surface water entering the landfill and surface impoundment facility. Run-on controls prevent (1) Erosion, which may damage the physical structure of the landfill; (2) the surface discharge of wastes in solution or suspension; and (3) the downward percolation of run-on through wastes, creating leachate. The proposed regulation requires run-on control systems to prevent flow onto the active portion of the CCR landfill or surface impoundment during the peak discharge from a 24-hour, 25-year storm. This helps to ensure that run-off does not cause an overflow of the surface impoundment or scouring of material from a landfill or the materials used to build the surface impoundment.

Run-off is one of the major sources of hazardous constituent releases from mismanaged waste disposal facilities, including CCR landfills and surface impoundments. Additionally, run-off control systems from the active portion of CCR disposal units are required to collect and control at least the water volume resulting from a 24-hour, 25-year storm. This protects surface water that would otherwise flow untreated into a body of water. The facility is required to prepare a report, available to the public, documenting how relevant calculations were made, and how the control systems meet the standard. A registered professional engineer must certify that the design of the control systems meet the standard. Also, the owner or operator is required to prepare a report, certified by an independent registered professional engineer, and documenting how relevant calculations were made, and how the control systems meet the standard. The state must be notified that the report was placed in the operating record for the site, and the owner or operator must make it available to the public on the owner's or operator's internet site. Under the existing part 257 requirements, to which CCR units are currently subject, runoff must not cause

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[152] For the findings of the assessment, *see: http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/surveys/index.htm#surveyresults.*

a discharge of pollutants into waters of the United States that is in violation of the National Pollutant Discharge Elimination System (NPDES) under section 402 of the Clean Water Act. (40 CFR 257.3–3). EPA is not proposing to revise the existing requirement, but is merely incorporating it here for ease of the regulated community.

The Agency chose the 24-hour period because it is an average that includes storms of high intensity with short duration and storms of low intensity with long duration. EPA believes that this is a widely used standard, and is also the current standard used for hazardous waste landfills and municipal solid waste landfill units under 40 CFR Part 258. EPA has no information that warrants a more restrictive standard for CCR landfills and surface impoundments than for MSWLFs and hazardous waste landfills.

Fugitive dust requirements. EPA has included under the co-proposed RCRA subtitle D regulation requirements similar to those included under the Subtitle C co-proposal, based upon its risk assessment findings that fugitive dust control at 35 μg/m3 or less is protective of human health or the environment. This is discussed in section VI above. Due to the lack of a permitting oversight mechanism under the RCRA Subtitle D alternative, and to facilitate citizen-suit enforcement of the criteria, EPA has provided for certification by an independent registered professional engineer, notification to the state that the documentation has been placed in the operating record, and provisions making available to the public on the owner's or operator's internet site documentation of the measures taken to comply with the fugitive dust requirements.

Recordkeeping requirements. EPA believes that it is appropriate for interested states and citizens to be able to access all of the information required by the proposed rule in one place. Therefore, the co-proposed Subtitle D alternative requires the owner or operator of a CCR landfill or surface impoundment to record and retain near the facility in an operating record which contains all records, reports, studies or other documentation required to demonstrate compliance with §§ 257.60 through 257.83 (relating to the location restrictions, design criteria, and operating criteria) and 257.90 through 257.101 (relating to ground water monitoring and corrective action, and closure and post-closure care).

The proposed rule would also require owners and operators of CCR surface impoundments that have not been closed in accordance with the closure criteria to place in the operating record a report containing several items of information. The reports would be required beginning every twelfth months after existing CCR surface impoundments would be required to comply with the design requirements in section 257.71 (that is, no later than seven years after the effective date of the final rule) and every twelfth month following the date of the initial plan for the design, construction, and maintenance of new surface impoundments and lateral expansions required under § 257.72(b)) to address:

(1) Changes in the geometry of the impounding structure for the reporting period;

(2) Location and type of installed instruments and the maximum and minimum recorded readings of each instrument for the reporting period;

(3) The minimum, maximum, and present depth and elevation of the impounded water, sediment, or slurry for the reporting period;

(4) Storage capacity of the impounding structure;

(5) The volume of the impounded water, sediment, or slurry at the end of the reporting period;

(6) Any other change which may have affected the stability or operation of the impounding structure that has occurred during the reporting period; and

(7) A certification by an independent registered professional engineer that all construction, operation, and maintenance were in accordance with the plan. The owner or operator would be required to notify the state that the report has been placed in the operating record and on the owner's or operator's internet site.

These reporting requirements are similar to those required under MSHA regulations for coal slurry impoundments (30 CFR 77.216–4). As the Agency has stated previously, MSHA has nearly 40 years of experience writing regulations and inspecting dams associated with coal mining, which is directly relevant to the issues presented by CCRs in this proposal. In our review of the MSHA regulations, we found them to be comprehensive and directly applicable to and appropriate for the dams used in surface impoundments at coal-fired utilities to manage CCRs.

The proposed rule would also allow the owner or operator to submit a certification by an independent registered professional engineer that there have been no changes to the information in items (1)–(6) above to the surface impoundment instead of a full report, although a full report would be required at least every 5 years.

7. Groundwater Monitoring/Corrective Action

EPA's damage cases and risk assessments all indicate the potential for CCR landfills and surface impoundments to leach hazardous constituents into groundwater, impairing drinking water supplies and causing adverse impacts on human health and the environment. Indeed, groundwater contamination is one of the key environmental risks EPA has identified with CCR landfills and surface impoundments. Furthermore, as mentioned previously, the legislative history of RCRA section 4004 specifically evidences concerns over groundwater contamination from open dumps. To this end, groundwater monitoring is a key mechanism for facilities to verify that the existing containment structures, such as liners and leachate collection and removal systems, are functioning as intended. Thus, EPA believes that, in order for a CCR landfill or surface impoundment to show no reasonable probability of adverse effects on health or the environment, a system of routine groundwater monitoring to detect any such contamination from a disposal unit, and corrective action requirements to address identified contamination, is necessary.

Today's co-proposed subtitle D criteria require a system of monitoring wells be installed at new and existing CCR landfills and surface impoundments. The co-proposed criteria also provide procedures for sampling these wells and methods for statistical analysis of the analytical data derived from the well samples to detect the presence of hazardous constituents released from these facilities. The Agency is proposing a groundwater monitoring program consisting of detection monitoring, assessment monitoring, and a corrective action program. This phased approach to groundwater monitoring and corrective action programs provide for a graduated response over time to the problem of groundwater contamination as the evidence of such contamination increases. This allows for proper consideration of the transport characteristics of CCR constituents in ground water, while protecting human health and the environment, and minimizing unnecessary costs.

In EPA's view, the objectives of a groundwater monitoring and corrective action regime and analytical techniques for evaluating the quality of groundwater are similar regardless of the particular wastes in a disposal unit, and regardless of whether the unit is a landfill or surface impoundment. Therefore, EPA has largely modeled the proposed groundwater monitoring and corrective action requirements for CCR landfills and surface impoundments after those for MSWLFs in the 40 CFR part 258 criteria, and for disposal units that may receive conditionally-exempt small quantity generator (CESQG) hazardous waste under 40 CFR part 257, subpart B. EPA believes that the underlying rationale for those requirements is generally applicable to groundwater monitoring and corrective action for CCR landfills and surface impoundments. Accordingly, EPA does not discuss these requirements at length in today's preamble. Rather, EPA refers the reader to the detailed discussions of these requirements in the preambles to the final and proposed rules for the MSWLF criteria for more information.[153] *See* Solid Waste Disposal Facility Criteria, 56 Fed. Reg. 50978 (Oct. 9, 1991) (final rule); Solid Waste Disposal Facility Criteria, 53 Fed. Reg. 33314 (Aug. 30, 1988) (proposed rule).

However, for a number of the requirements, EPA is proposing to modify or revise these requirements. Below, EPA discusses the particular areas where the Agency is proposing to make modifications, and solicits comment on those specific differences. EPA, more generally, solicits comment on whether relying on the existing groundwater monitoring and corrective action requirements for MSWLFs and CESQG facilities, as modified in today's proposal, are appropriate for CCR landfills and surface impoundments.

Relying on the existing criteria in 40 CFR 258 and 257 Subpart B has several advantages. Specifically, like the co-proposed Subtitle D regulations for CCR disposal, these requirements are structured to be largely self-implementing. In addition, states and citizens should already be familiar with those processes, which have been in place since 1991, and EPA expects that this familiarity with the processes may facilitate the states' creation of regulatory programs for CCR disposal facilities under state law, to the extent they do not already exist, and thus providing oversight (which EPA believes is important in implementing these rules) that is already found through MSWLFs and CESQG landfill permitting programs. Furthermore, familiarity with the overall approach may facilitate the states' and citizens' oversight of CCR disposal activities through the citizen suit mechanism, which is available, regardless of whether a state has adopted a regulatory program under state law for CCR disposal facilities.

At the same time, however, EPA is mindful of the differences in the statutory authorities for establishing criteria for CCR landfills and surface impoundments versus MSWLFs and CESQG facilities, and in particular, the possibility that a state may lack a permit program for CCR disposal units. Accordingly, EPA has sought to tailor these proposed requirements in the CCR disposal context, in particular by including in several of the proposed requirements a certification by an independent registered professional engineer or, in some cases, hydrologist, in lieu of the state approval mechanisms that are used in the 40 CFR part 258/257, Subpart B criteria. Such certifications are found in proposed §§ 257.95(h) (establishment of an alternative groundwater protection standard for constituents for which MCLs have not been established); and 257.97(e) (determination that remediation of a release of an Appendix IV constituent from a CCR landfill or surface impoundment is not necessary). As discussed earlier in this preamble, EPA believes that this provides an important independent validation of the particular route chosen. EPA solicits comment in particular on the appropriateness of relying on such a mechanism under the proposed groundwater monitoring and corrective action criteria.

In other instances, however, EPA has decided not to propose to allow facilities to operate under an alternative standard, such as the existing provisions under 257.21(g) and 258.50(h) (establishing alternative schedules for groundwater monitoring and corrective action); and 258.54(a)(1) and (2), and 257.24(a)(1) and (2), which allow the Director of an approved State to delete monitoring parameters, and establish an alternative list of indicator parameters, under specified circumstances. EPA is proposing not to adopt these alternatives for CCR disposal facilities because groundwater monitoring is the single most critical set of protective measures on which EPA is relying to protect human health and the environment. EPA is not proposing to require existing landfills to retrofit to install a composite liner. Since these units will continue to operate in the absence of a composite liner, groundwater monitoring is the primary means to prevent groundwater contamination. Although EPA is proposing to require existing surface impoundments to retrofit with composite liners, these units are more susceptible to leaking, and thus the need for a rigorous groundwater monitoring program is correspondingly high. Moreover, EPA is concerned that provisions allowing such modification of these requirements are particularly susceptible to abuse, since such provisions would allow substantial cost avoidance. Therefore, in the absence of a state oversight mechanism in place to ensure such modifications are technically appropriate, such a provision may operate at the expense of protectiveness. In addition, given the extremely technical nature of these requirements, EPA is concerned that such provisions would render the requirements appreciably more difficult for citizens to effectively enforce. In some instances, including these alternative standards would not be workable. For example, establishing alternative schedules under the groundwater monitoring and corrective action provisions (as currently provided under 257.21(g) and 258.50(h)) the Agency believes would not be workable in the context of a self-implementing rule, because there is no regulatory entity to judge the reasonableness of the desired alternatives. The Agency thus solicits comments on these omissions from today's proposed rule, and also on whether a more prescriptive approach could or should be developed under subtitle D of RCRA. EPA also solicits comment on whether the requirement for certification by an independent professional engineer would be effective or appropriate in such a case.

Applicability. The co-proposed subtitle D criteria require facilities to install a groundwater monitoring system at existing landfills and surface impoundments within one year of the effective date of the regulation so that any releases from these units will be detected, thus providing an opportunity to detect and, if necessary, take corrective action to address any releases from the facilities. The proposed rule also provides that new CCR landfills and surface impoundments comply with the groundwater monitoring requirements in the rule before CCRs can be placed in the units. EPA expects that the one-year timeframe for existing units is a reasonable time for facilities to install the necessary systems. This is the same time frame provided to

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[153] The preambles to the CESQG rules have more limited discussions of these requirements. See Criteria for Classification of Solid Waste Disposal Facilities and Practices; Identification and Listing of Hazardous Waste; Requirements for Authorization of State Hazardous Waste Programs, 61 FR 34252, 34259–61 (July 1, 1996) (final rule); Criteria for Classification of Solid Waste Disposal Facilities and Practices; Identification and Listing of Hazardous Waste; Requirements for Authorization of State Hazardous Waste Programs, 60 FR 30964, 30975–77 (June 12, 1995) (proposed rule).

facilities under the existing part 265 interim status regulations, and past experience demonstrates this implementation schedule would generally be feasible. Although one year for the installation of groundwater monitoring is a shorter time frame than EPA provided to facilities as part of the original part 258 or part 257 subpart A requirements, there are good reasons to establish a shorter time frame here. As discussed in section IV, many of the existing units into which much of the CCR is currently disposed are unlined, and they are aging. Under these circumstances, EPA believes that installation of groundwater monitoring is critical to ensure that releases from these units are detected and addressed appropriately. Moreover, EPA offered a longer implementation period in 1991 based on a factual finding that a shortage of drilling contractors existed; in the 1995 rule establishing groundwater monitoring requirements for CESQG facilities, EPA determined that this shortage had ended. EPA is aware of no information to suggest that a similar shortage exists today, but specifically solicits comment on this issue.

EPA has not included provisions for suspension of ground water monitoring that is currently allowed under 257.21(b) and 258.50(b). This is one of those provisions discussed above, that EPA believes are potentially, particularly susceptible to abuse, and EPA is reluctant to adopt a comparable provision in the absence of an approved state permit program. In addition, since these proposed criteria are designed to be applied even in the absence of state action, EPA has not included provisions for state establishment of a compliance schedule under 257.21(d) and 258.50(d). EPA solicits comment on whether these types of provisions are appropriate for CCR landfills and surface impoundments.

Section 257.90 also requires that the owner or operator of the CCR landfill or surface impoundment must notify the state once each year throughout the active life and post-closure care period that such landfill or surface impoundment is in compliance with the groundwater monitoring and corrective action provisions of this subpart. This notification must also be placed on the owner or operator's internet site. EPA believes that annual notification will facilitate state oversight of the groundwater monitoring and corrective action provisions.

Groundwater monitoring systems. The co-proposed subtitle D criteria require facilities to install, at a minimum, one up gradient and three down gradient wells at all CCR units. EPA is proposing this requirement based on the subtitle C interim status self-implementing requirements.

The design of an appropriate groundwater monitoring system is particularly dependent on site conditions relating to groundwater flow, and the development of a system must have a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer that represents the quality of background groundwater that has not been affected by contaminants from CCR landfills or surface impoundments. EPA's existing requirements under parts 257, Subpart B, 258, and 264 all recognize this, and because they operate in a permitting context, these requirements do not generally establish inflexible minimum requirements. Because the same guarantee of permit oversight is not available under the criteria developed for this proposal, EPA believes that establishing a minimum requirement is necessary. Past experience demonstrates that these monitoring requirements will be protective of a wide variety of conditions and wastes, and that facilities can feasibly implement these requirements. Moreover, in many instances a more detailed groundwater monitoring system may need to be in place, and EPA is therefore requiring a certification by the independent registered professional engineer or hydrologist that the groundwater monitoring system is designed to detect all significant groundwater contamination.

Groundwater sampling and analysis requirements. Owners and operators need to ensure that consistent sampling and analysis procedures are in place to determine whether a statistically significant increase in the level of a hazardous constituent has occurred, indicating the possibility of groundwater contamination. The co-proposed subtitle D criteria would require the same provisions addressing groundwater sampling and analysis procedures with those already in use for CESQG and MSWLF facilities, since generally the same constituents and analysis procedures would be appropriate in both instances. However, EPA is requesting comment on one issue in particular. In the final MSWLF criteria, EPA noted that in order to ensure protection of human health and the environment at MSWLFs, it was important to make sure that the right test methodology from among those listed in this section was selected for the conditions present at a particular MSWLF. At the time, EPA indicated its expectation that as states gained program approval, they would take on the responsibility of approving alternate statistical tests proposed by the facilities. *See* 56 Fed. Reg. 51071. Because states may choose not to create a regulatory oversight mechanism under the co-proposed subtitle D rule for CCR landfills and surface impoundments, however, EPA is requesting comment on whether the lack of such an oversight mechanism will impair selection of appropriate test methodologies, and whether EPA should instead adopt a different approach to ensure the protection of human health and the environment at CCR disposal facilities. For example, one approach might be for EPA to tailor a list of methodologies to particular site conditions. EPA would welcome suggestions from commenters on alternative approaches to this issue.

Detection monitoring program. The parameters to be used as indicators of groundwater contamination are the following: boron, chloride, conductivity, fluoride, pH, sulphate, sulfide, and total dissolved solids (TDS). In selecting the parameters for detection monitoring, EPA selected constituents that are present in CCRs, and would rapidly move through the subsurface and thus provide an early detection as to whether contaminants were migrating from the disposal unit. EPA specifically solicits comment on the appropriateness of this list of parameters.

In this provision of the proposed RCRA subtitle D co-proposed rule, EPA has decided not to include provisions parallel to 258.54(a)(1) and (2), and 257.24(a)(1) and (2) which allow the Director of an approved State to delete monitoring parameters, and establish an alternative list of indicator parameters, under specified circumstances. EPA is not including these provisions because it believes that a set of specified parameters are necessary to ensure adequate protectiveness, since EPA's information on CCRs indicates that their composition would not be expected to vary such that the parameters are inappropriate. Under the proposed rule, monitoring would be required no less frequently than semi-annually. EPA has again decided not to include a provision that would allow an alternative sampling frequency, because of the lack of guaranteed state oversight and potential for this provision to diminish protection of human health and the environment, as mentioned in the introductory discussions above. EPA solicits comments on whether it should allow deletion of monitoring parameters and alternative sampling frequencies, based on compliance with a performance standard that has been documented by an independent registered professional engineer or hydrologist. Commenters interested in supporting such an option are encouraged to provide data to demonstrate the conditions under which such alternatives would be protective, as well as information to indicate the prevalence of such conditions at CCR facilities.

Assessment monitoring program. When a statistically significant increase over background levels is detected for any of the monitored constituents, the rule would require the facility to begin an assessment monitoring program to detect releases of CCR constituents of concern including aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chloride, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, pH, selenium, sulphate, sulfide, thallium, and total dissolved solids.

EPA specifically solicits comment on the appropriateness of this list of parameters. For the same reasons as discussed under the proposed requirements for detection monitoring, EPA has chosen not to include in the proposed requirements for assessment monitoring provisions for allowing a subset of wells to be sampled, the deletion of assessment monitoring parameters, or alternative sampling frequencies. EPA again solicits comment on whether these options are appropriate for CCR landfills and surface impoundments.

Assessment of corrective measures. The proposed rule also requires that whenever monitoring results indicate a statistically significant level of any appendix IV constituent exceeding the groundwater protection standard, the owner or operator must initiate an assessment of corrective action remedies. Unlike for the MSWLF and CESQG criteria, the proposed rule provides a discrete time frame for completion of the assessment, at 90 days, while the earlier criteria provided for its completion within a "reasonable period of time." EPA believes that without a state oversight mechanism, a finite time frame is appropriate. EPA selected 90 days as the period over which the assessment must be completed because it expects that this will be a sufficient length of time to complete the required activities. EPA solicits comment on the appropriateness of the 90-day timeframe.

Selection of Remedy. The proposed rule establishes a framework for remedy selection based upon the existing requirements for MSWLFs and CESQG facilities. These provisions have been modified to eliminate consideration of "practicable capabilities" where such considerations have been included in the MSWLF and CESQG criteria. EPA believes that it does not have the discretion to include this consideration under the RCRA subtitle D co-proposal, because this consideration is explicitly required under the terms of RCRA section 4010. That section by its terms applies to facilities that may receive household hazardous wastes and CESQG wastes, and so is inapplicable to today's co-proposed standards for CCR landfills and surface impoundments. *See* 42 U.S.C. 6949a(c)(1). EPA solicits comment on these modifications, specifically, on how this modification may affect the ability of the regulated community to comply with the proposed criteria, and on how this modification may affect the protectiveness of the proposed standards for human health and the environment.

In the provisions discussing factors to be considered in determining whether interim measures are necessary, EPA has modified proposed 257.98(a)(3)(vi), to eliminate consideration of risks of fire or explosion, since EPA does not expect that these risks would be relevant to the disposal of CCRs in CCR landfills and surface impoundments.

Implementation of the corrective action remedy. The co-proposed subtitle D criteria require that the owner or operator comply with several requirements to implement the corrective action program, again modeled after the existing requirements for MSWLFs and CESQG facilities. Similar to proposed section 257.97, these provisions have been made consistent with the underlying statutory authorities for this proposed rule. *See* discussions above.

In these provisions, EPA has decided not to include a provision that is included in the MSWLF criteria in 258.58(e)(2) and 257.28(e)(2), allowing an alternative length of time during which the owner or operator must demonstrate that concentrations of constituents have not exceeded the ground water protection standards, in support of a determination that the remedy is complete. *See* proposed 257.98(e)(2). Instead, the proposed rule would require a set period of three consecutive years. EPA solicits comment on whether to allow for a different period of time. EPA is particularly concerned with whether such a provision would provide protection to human health or the environment because of the lack of a guaranteed state oversight mechanism.

8. Closure and Post-Closure Care

Effective closure and post-closure care requirements, such as requirements to drain the surface impoundment, are essential to ensuring the long-term safety of disposal units. Closure requirements, such as placing the cover system on the disposal unit, ensure that rainfall is diverted from the landfill or surface impoundment, minimizing any leaching that might occur based on the hydraulic head placed on the material in the unit. EPA's Guide for Industrial Waste Management, prepared in consultation with industry experts, a Tribal representative, state officials, and environmental groups, documents the general consensus on the need for effective closure and post-closure requirements.[154] Post-closure care requirements are also particularly important for CCR units because the time to peak concentrations for selenium and arsenic, two of the more problematic constituents contained in CCR wastes, is particularly long, and therefore the peak concentrations in groundwater may not occur during the active life of the unit. Continued groundwater monitoring is therefore necessary during the post-closure care period to ensure the continued integrity of the unit and the safety of human health and the receiving environment. For these provisions, then, EPA has again modeled its proposed requirements for CCR landfills on those already in place for MSWLFs with modifications to reflect the lack of a mandatory permitting mechanism, and other changes that it believes are appropriate to ensure that there is no reasonable probability of adverse effects from the wastes that remain after a unit has closed. For surface impoundments, EPA has modeled its proposed requirements on the part 265 interim status closure requirements for surface impoundments, as well as the MSHA requirements. EPA solicits comment on whether these proposed requirements are appropriate for CCR landfills and surface impoundments.

Requirements specific to closure of CCR landfills and surface impoundments include proposed 257.100(a)–(c). These provisions provide that prior to closure of any CCR unit, the owner or operator must develop a plan describing the closure of the unit, and a schedule for implementation. The plan must describe the steps necessary to close the CCR landfill or surface impoundment at any point during the active life in

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[154] Guide for Industrial Waste Management, *available at http://www.epa.gov/epawaste/nonhaz/industrial/guide/index.htm.*

accordance with the requirements in paragraphs (c) and (d) or (e) of this section, as applicable, and based on recognized and generally accepted good engineering practices. EPA is proposing to define recognized and generally accepted good engineering practices in the same manner as it is proposing under the subtitle C alternative. The definition references but does not attempt to codify any particular set of engineering practices, but to allow the professional engineer latitude in adopting improved practices that reflect the state-of-the art practices, as they develop over time. The plan must be certified by an independent registered professional engineer. In addition, the owner or operator must notify the state that a plan has been placed in the operating record and on the owner's or operator's publically accessible Internet site.

These provisions are modeled after the closure plan requirements in 258.60(c). Of note here is that, while EPA rejected a certification requirement for MSWLF closure plans, EPA is proposing to require one here to increase the ability of citizens to effectively enforce the rules. In the MSWLF rule, EPA rejected a certification requirement because "it will be relatively easy to verify that the plan meets the requirements," due to the specific design criteria specified in the rule. However, this was in the context of a state program, where EPA could assure that states would play an active role in overseeing and enforcing the facility's implementation of the requirements.

EPA is also proposing that the closure plan provide, at a minimum, the information necessary to allow citizens and states to determine whether the facility's closure plan is reasonable. This includes an estimate of the largest area of the CCR unit ever requiring a final cover during the active life of the unit, and an estimate of the maximum inventory of CCRs ever on-site during the active life of the unit.

Proposed 257.100(b) of the rule allows closure of a CCR landfill or surface impoundment with CCRs in place or through CCR removal and decontamination of all areas affected by releases from the landfill or surface impoundment. Proposed paragraph (c) provides that CCR removal and decontamination are complete when constituent concentrations throughout the CCR landfill or surface impoundment and any areas affected by releases from the CCR landfill or surface impoundment do not exceed the numeric cleanup levels for those CCR constituents, to the extent that the state has established such clean up levels in which the CCR landfill or surface impoundment is located. These "clean-closure" provisions are modeled after EPA's "Guide for Industrial Waste Management," found at *http://www.epa.gov/epawaste/nonhaz/industrial/guide/chap11s.htm*. As previously noted, the Guide represents a consensus view of best practices for industrial waste management, based on involvement from EPA, and state and tribal representatives, as well as a focus group of industry and public interest stakeholders chartered under the Federal Advisory Committee Act. EPA has included this provision to allow some flexibility in the self-implementing scheme for facilities in their closure options, while providing protection for health and the environment under either option. Although EPA anticipates that facilities will mostly likely not clean close their units, given the expense and difficulty of such an operation, EPA believes that they are generally preferable from the standpoint of land re-use and redevelopment, and so wishes explicitly to allow for such action in the proposed subtitle D rule. EPA is also considering whether to adopt a further incentive for clean closure, under which the owner or operator of the CCR landfill or surface impoundment could remove the deed notation required under proposed 257.100(m), if all CCRs are removed from the facility, and notification is provided to the state. In the absence of state cleanup levels, metals should be removed to either statistically equivalent background levels, or to maximum contaminant levels (MCLs), or health-based numbers. One tool that can be used to help evaluate whether waste removal is appropriate at the site is the risk-based corrective action process (RBCA) using recognized and generally accepted good engineering practices such as the ASTM Ec0–RBCA process. EPA solicits comment on the appropriateness of this provision under a RCRA subtitle D rule, and information on the number of facilities that may take advantage of a clean-closure option.

For closure of surface impoundments with CCRs in place, EPA has developed substantive requirements modeled on a combination of the existing 40 CFR part 265 interim status requirements for surface impoundments, and the long-standing MSHA standards. At closure, the owner or operator of a surface impoundment would be required to either drain the unit, or solidify the remaining wastes. EPA is also proposing to require that the wastes be stabilized to a bearing capacity sufficient to support the final cover. The proposed criteria further require that, in addition to the technical cover design requirements applicable to landfills, any final cover on a surface impoundment would have to meet requirements designed to address the nature of the large volumes of remaining wastes. Specifically, EPA is proposing that the cover be designed to minimize, over the long-term, the migration of liquids through the closed impoundment; promote drainage; and accommodate settling and subsidence so that the cover's integrity is maintained. Finally, closure of the unit is also subject to the general performance standard that the probability of future impoundment of water, sediment, or slurry is precluded. This general performance standard is based on the MSHA regulations, and is designed to ensure the long-term safety of the surface impoundment.

The proposed RCRA subtitle D regulation requires that CCR landfills and surface impoundments have a final cover system designed and constructed to have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less; it also requires an infiltration layer that contains a minimum of 18 inches of earthen material. The regulation also requires an erosion layer that contains a minimum of 6 inches of earthen material that is capable of sustaining native plant growth as a way to minimize erosion of the final cover. These requirements are generally modeled after the performance standard and technical requirements contained in the existing RCRA subtitle D rules for MSWLFs, in 258.60. EPA is also proposing, however a fourth requirement not found in those criteria modeled after the interim status closure requirements of 265.228(a)(iii)(D) that accounts for the conditions found in surface impoundments. Specifically, EPA is proposing that the final cover be designed to minimize the disruption of the final cover through a design that accommodates settling and subsidence. EPA believes that these requirements strike a reasonable balance between the costs of a protective final cover, and avoiding risks to health and the environment from the remaining wastes at the CCR landfill or surface impoundment. The regulation requires certification by an independent registered professional engineer that these standards were met. The design of the final cover system, including the certification, must be placed in the operating record and on the owner's or operator's Internet site. Based on the MSHA standards, EPA is also proposing that unit closure must provide for major slope stability to prevent the sloughing of the landfill over the long term.

Alternatively, the rule allows the owner or operator of the CCR landfill or surface impoundment to select an alternative final cover design, provided the alternative cover design is certified by an independent registered professional engineer and notification is provided to the state that the alternative cover design has been placed in the operating record and on the owner's or operator's Internet site. The alternative final cover design must include a infiltration layer that achieves an equivalent reduction in infiltration, and an erosion layer that provides equivalent protection from wind and water erosion, as the infiltration and erosion layers specified in the technical standards in paragraph (d). Under this alternative, EPA expects that evapo-transpiration covers may be an effective alternative, which are not appropriately evaluated based on permeability alone. For example, an independent registered professional engineer might certify an alternative cover design that prevents the same level of infiltration as the system described above (*i.e.,* no greater than 1×10^{-5} cm/sec, etc), based on: (1) hydrologic modeling and lysimetry or instrumentation using a field scale test section, or (2) Hydrologic modeling and comparison of the soil and climatic conditions at the site with the soil and climatic conditions at an analogous site with substantially similar cover design. In this case, the owner or operator of the disposal unit must obtain certification from an independent registered professional engineer that the alternative cover would minimize infiltration at least as effectively as the "design" cover described above. As with the other final covers, the design of the evapo-transpiration cover must be placed on the owner's or operator's Internet site.

EPA has included this alternative cover requirement to increase the flexibility for the facility to account for site-specific conditions. However, EPA is specifically soliciting comment on whether this degree of flexibility is appropriate, given the lack of guaranteed state oversight. In the final MSWLF rule, EPA adopted a comparable provision, but concluded that this alternative would not be available in States without approved programs. *See,* 56 FR 51096. Given that EPA can neither approve state programs, nor rely on the existence of a state permit process, EPA questions whether this kind of requirement is appropriate. Commenters who believe this requirement would be appropriate are encouraged to include examples documenting the need for flexibility in developing cover requirements, as well as data and information to demonstrate that alternative cover designs would be protective. EPA would also welcome suggestions for other methods to allow owners and operators of CCR landfills and surface impoundment facilities to account for site-specific conditions that provide a lower degree of individual facility discretion, such as a list of approved cover designs.

The proposed rule includes the same 30- and 180-day deadlines for beginning and completing closure, respectively, that are contained in existing section 258.60(f) and (g) for MSWLFs. However, EPA has decided not to propose to include a provision under which the owner and operator could extend those deadlines under the MSWLF criteria. EPA believes that extending the closure deadlines in this context is inappropriate because, in the absence of an approved State program, the owner or operator could unilaterally decide to extend the time for closure of the unit, without any basis, or oversight by a regulatory authority.

The proposed closure requirements also include a provision addressing required deed notations. In this regard, EPA is considering whether to include a provision for removing the deed notation once all CCRs are removed from the facility, and notification is provided to the state of this action. In the MSWLF rule, we adopted such a provision, but determined that state oversight of such a provision was essential, given the potential for abuse. As we noted in the final MSWLF rule, "EPA strongly believes that a decision to remove the deed notation must be considered carefully and that in practice very few owners or operators will be able to take advantage of the provision." EPA solicits comment on the propriety of such a provision, and encourages commenters who are interested in supporting such an option, to suggest alternatives to state oversight to provide for facility accountability.

Following closure of the CCR management unit, the co-proposed subtitle D approach requires post-closure care modeled after the requirements in 258.60. The owner or operator of the disposal unit must conduct post-closure care for 30 years. EPA is proposing to allow facilities to conduct post-closure care for a decreased length of time if the owner or operator demonstrates that (1) the reduced period is sufficient to protect human health and the environment, as certified by an independent registered professional engineer; (2) notice is provided to the state that the demonstration has been placed in the operating record and on the owner's or operator's Internet site; and (3) the owner or operator notifies the state of the company's findings. The proposed rule also allows an increase in this period, again, with notification to the state, if the owner or operator of the CCR landfill or surface impoundment determines that it is necessary to protect human health and the environment. The 30-year period is consistent with the period required under the criteria for MSWLFs, as well as under the subtitle C interim status requirements. EPA has no information to indicate that a different period would be appropriate for post-closure care for CCR disposal units. EPA recognizes that state oversight can be critical to ensure that post-closure care is conducted for the length of time necessary to protect human health and the environment; however, EPA also recognizes that there is no set length of time for post-closure care that will be appropriate for all possible sites, and all possible conditions. EPA therefore solicits comment on alternative methods to account for different conditions, yet still provide methods of oversight to assure facility accountability.

During post-closure care, the owner or operator of the disposal unit is required to maintain the integrity and effectiveness of any final cover, maintain and operate the leachate collection and removal system in accordance with the leachate collection and removal system requirements described above, maintain the groundwater monitoring system and monitor the groundwater in accordance with the groundwater monitoring requirements described above, and place the maintenance plan in the operating record and on the company's Internet site.

EPA is also considering whether to adopt a number of provisions to increase the flexibility available under these requirements. For example, EPA is considering a self-certified stoppage of leachate management, such as provided for in 258.61(a)(2), and is soliciting public comment on the need for such a provision, as well as its propriety, in light of the absence of guaranteed state oversight. EPA is also considering whether to adopt a provision to allow any other disturbance, provided that the owner or operator of the CCR landfill or surface impoundment demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of CCRs, will not increase the potential threat to human health or the environment. The demonstration would need to be certified by an independent registered professional engineer, and notification provided to the state that the demonstration had been placed in the operating record and on the owner's or operator's Internet site. In the MSWLF rule, EPA limited this option to approved states, on the ground that, "under very limited circumstances it may be possible or desirable to allow certain post-closure uses of land, including some recreational uses, without posing a significant threat to human health and the environment, but such situations are likely to be very limited and need to be considered very carefully." Commenters interested in supporting such an option should address why such a provision would nevertheless be appropriate in this context. In this regard, EPA would also be interested in suggestions for other mechanisms providing facility flexibility and/or oversight.

9. Financial Assurance

EPA currently requires showings of financial assurance under multiple programs, including for RCRA subtitle C hazardous waste treatment, storage and disposal facilities; the RCRA subtitle I underground storage tank program; and under other statutory authorities. Financial assurance requirements generally help ensure that owners and operators adequately plan for future costs, and help ensure that adequate funds will be available when needed to cover these costs if the owner or operator is unable or unwilling to do so; otherwise, additional governmental expenditures may otherwise be necessary to ensure continued protection of human health and the environment. Financial assurance requirements also encourage the development and implementation of sound waste management practices both during and at the end of active facility operations, since the associated costs of any financial assurance mechanism should be less when activities occur in an environmentally protective manner.

Today's proposed RCRA subtitle D alternative does not include proposed financial responsibility requirements. Any such requirements would be proposed separately. Specifically, on January 6, 2010, EPA issued an advance notice of proposed rulemaking ("ANPRM"), identifying classes of facilities within the Electric Power Generation, Transmission, and Distribution industry, among others, as those for which it plans to develop, as necessary, financial responsibility requirements under CERCLA § 108(b). *See* Identification of Additional Classes of Facilities for Development of Financial Responsibility Requirements under CERCLA Section 108(b), 75 FR 816 (January 6, 2010). EPA solicits comments on whether financial responsibility requirements under CERCLA § 108(b) should be a key Agency focus should it regulate CCR disposal under a RCRA subtitle D approach. (By today's proposed rule, EPA is not reopening the comment period on the January 2010 ANPRM, which closed on April 6, 2010. *See* Identification of Additional Classes of Facilities for Development of Financial Responsibility Requirements under CERCLA Section 108(b), 75 FR 5715 (Feb. 4, 2010) (extending comment period to April 6, 2010).) However, EPA also solicits comment on existing state waste programs for financial assurance for CCR disposal facilities, and whether and how the co-proposed RCRA subtitle D regulatory approach might integrate with those programs.

10. Off-Site Disposal

Under a subtitle D regulation, regulated CCR wastes shipped off-site for disposal would have to be sent to facilities that meet the standards above.

11. Alternative RCRA Subtitle D Approaches

A potential modification to the subtitle D option that was evaluated in our Regulatory Impact Analysis (RIA) is what we have termed a subtitle "D prime" option. Under this modification, the regulations would not require the closure or installation of composite liners in existing surface impoundments; rather, these surface impoundments could continue to operate for the remainder of their useful life. New surface impoundments would be required to have composite liners. The other co-proposed subtitle D requirements would remain the same. This modification results in substantially lower costs, but also lower benefits as described in section XII, which presents costs and benefits of the RCRA subtitle C, D, and D prime options. EPA solicits comments on this approach.

Finally, another approach that has been suggested to EPA is a subtitle D regulation with the same requirements as spelled out in the co-proposal, for example, composite liners for new landfills and surface impoundments, groundwater monitoring, corrective action, closure, and post-closure care requirements as co-proposed in this notice; however, in lieu of the phase-out of surface impoundments, EPA would establish and fund a program for conducting annual (or other frequency) structural stability (assessments) of impoundments having a "High" or "Significant" hazard potential rating as defined by criteria developed by the U.S. Army Corps of Engineers for the National Inventory of Dams. EPA would conduct these assessments and, using appropriate enforcement authorities already available under RCRA, CERCLA, and/or the Clean Water Act, would require facilities to respond to issues identified with their surface impoundments. The theory behind this suggested approach is that annual inspections would be far more cost effective than the phase-out of surface impoundments—approximately $3.4 million annually for assessments versus $876 million annually for phase-out. EPA also solicits comments on this approach and its effectiveness in ensuring the structural integrity of CCR surface impoundments.

X. How would the proposed subtitle D regulations be implemented?

A. Effective Dates

The effective date of the proposed RCRA subtitle D alternative, if this alternative is ultimately promulgated, would be 180 days after promulgation of a final rule. Thus, except as noted below, owners and operators of CCR landfills and surface impoundments would need to meet the proposed minimum federal criteria 180 days after promulgation of the final rule. As noted elsewhere in today's preamble (*see* Section XI.), facilities would need to comply with the RCRA subtitle D criteria, irrespective of whether or not the states have adopted the standards. For the remaining requirements, the compliance dates would be as follows:

- For new CCR landfills and surface impoundments that are placed into service after the effective date of the final rule, the location restrictions and design criteria would apply the date that such CCR landfills and surface impoundments are placed into service.
- For existing CCR surface impoundments, the compliance date for the liner requirement is five years after the effective date of the final rule.
- For existing CCR landfills and surface impoundments, the compliance date for the groundwater monitoring requirements is one year after the effective date of the final rule.
- For new CCR landfills and surface impoundments, and lateral expansions of existing CCR landfills and surface impoundments, the groundwater monitoring requirement must be in place and in compliance with the

groundwater monitoring requirements before CCRs can be placed in the unit.

Note: As discussed in Section IX, if EPA determines that financial assurance requirements would be implemented pursuant to CERCLA 108(b) authority, the compliance date for this provision would be the date specified in those regulations.

B. Implementation and Enforcement of Subtitle D Requirements

As stated previously, EPA has no authority to implement and enforce the co-proposed RCRA subtitle D regulation. Therefore, the proposed RCRA subtitle D standards have been drafted so that they can be self implementing—that is, the facilities can comply without interaction with a regulatory agency. EPA can however take action under section 7003 of RCRA to abate conditions that "may present an imminent and substantial endangerment to health or the environment." EPA could also use the imminent and substantial endangerment authorities under CERCLA, or under other federal authorities, such as the Clean Water Act, to address those circumstances where a unit may pose a threat.

In addition, the federal RCRA subtitle D requirements would be enforceable by states and by citizens using the citizen suit provisions of RCRA 7002. Under this section, any person may commence a civil action on his own behalf against any person, who (1) is alleged to be in violation of any permit, standard, regulation * * * which has become effective pursuant to this chapter" Because a RCRA subtitle D proposal relies heavily on citizen enforcement, our proposal requires facilities to make any significant information related to their compliance with the proposed requirements publicly available.

XI. Impact of a Subtitle D Regulation on State Programs

Under today's co-proposal, EPA is proposing to establish minimum nationwide criteria under RCRA subtitle D as one alternative. If the Agency were to choose to promulgate such nationwide criteria, EPA would encourage the states to adopt such criteria; however, the Agency has no authority to require states to adopt such criteria, or to implement the criteria upon their finalization. Nor does EPA have authority in this instance to require federal approval procedures for state adoption of the minimum nationwide criteria. States would be free to develop their own regulations and/or permitting programs using their solid waste laws or other state authorities. While states are not required to adopt such minimum nationwide criteria, some states (about 25) incorporate federal regulations by reference or have specific state statutory requirements that their state program can be no more stringent than the federal regulations (about 12, with varying degrees of exceptions). In those cases, EPA would expect that if the minimum nationwide criteria were promulgated, these states would adopt them, consistent with their state laws and administrative procedures.

If the states do not adopt or adopt different standards for the management of CCRs, facilities would still have to comply with the co-proposed subtitle D criteria, if finalized, independently of those state regulations. Thus, even in the absence of a state program, CCR landfills and CCR surface impoundments would be required to meet the proposed federal minimum criteria as set out in 40 CFR part 257, subpart D. As a result and to make compliance with the requirements as straightforward as possible, we have drafted the proposed criteria so that facilities are able to implement the standards without interaction with regulatory officials—that is, the requirements are self-implementing. Also, even in the absence of a state regulatory program for CCRs, these federal minimum criteria are enforceable by citizens and by states using the citizen suit provision of RCRA (Section 7002). EPA is also able to take action under RCRA Section 7003 to abate conditions that may pose an imminent and substantial endangerment to human health or the environment or and can rely on other federal authorities. *See* the previous section for a full discussion of this issue.

XII. Impacts of the Proposed Regulatory Alternatives

A. What are the economic impacts of the proposed regulatory alternatives?

EPA prepared an analysis of the potential costs and benefits associated with this action contained in the "Regulatory Impact Analysis" (RIA). A copy of the RIA is available in the docket for this action and the analysis is briefly summarized here. For purposes of evaluating the potential economic impacts of the proposed rule, the RIA evaluated baseline (*i.e.*, current) management of CCRs consisting of two baseline components: (1) The average annual cost of baseline CCR disposal practices by the electric utility industry, and (2) the monetized value of existing CCR beneficial uses in industrial applications. Incremental to this baseline, the RIA estimated (1) future industry compliance costs for CCR disposal associated with the regulatory options described in today's action, and (2) although not completely quantified or monetized, three categories of potential future benefits from RCRA regulation of CCR disposal consisting of (a) Groundwater protection benefits at CCR disposal sites, (b) CCR impoundment structural failure prevention benefits, and (c) induced future annual increases in CCR beneficial use. The findings from each of these main sections of the RIA are summarized below. These quantified benefit results are based on EPA's initial analyses using existing information and analytical techniques.

1. Characterization of Baseline Affected Entities and CCR Management Practices

Today's action will potentially affect CCRs generated by coal-fired electric utility plants in the NAICS industry code 221112 (*i.e.*, the "Fossil Fuel Electric Power Generation" industry within the NAICS 22 "Utilities" sector code). Based on 2007 electricity generation data published by the Energy Information Administration (EIA), the RIA estimated a total of 495 operational coal-fired electric utility plants in this NAICS code could be affected by today's action. These plants are owned by 200 entities consisting of 121 companies, 18 cooperative organizations, 60 state or local governments, and one Federal Agency. A sub-total of 51 of the 200 owner entities (*i.e.*, 26%) may be classified as small businesses, small organizations, or small governments.

Based on the most recent (2005) EIA data on annual CCR tonnages generated and managed by electric utility plants greater than 100 megawatts nameplate capacity in size, supplemented with additional estimates made in the RIA for smaller sized electric utility plants between 1 and 100 megawatts capacity, these 495 plants generate about 140 million tons of CCRs annually, of which 311 plants dispose 57 million tons in company-owned landfills, 158 plants dispose 22 million tons in company-owned surface impoundments, and an estimated 149 plants may send upwards of 15 million tons of CCRs to offsite disposal units owned by other companies (*e.g.*, NAICS 562 commercial waste management service companies). Based on lack of data on the type of offsite CCR disposal units, and the fact that it costs much more to transport wet CCRs than dry CCRs (*i.e.*, CCRs which have been de-watered), the RIA assumes all offsite CCR disposal units are landfills. Because some plants use more than one CCR management method, these management plant counts exceed 495 total plants. Based on the estimates developed for the RIA, total CCR disposal is about 94 million tons annually which is two-thirds of annual CCR generation. (EPA notes that the alternative, lower CCR generation and disposal estimates of 131 million tons and 75 million tons cited elsewhere in today's notice were derived from different and less comprehensive ACAA and EIA survey data sources, respectively, that do not include tonnage estimates for plants between 1 and 100 megawatt capacity.) In addition, 272 of the 495 plants supply CCRs which are not disposed for beneficial uses in at least 14 industries, of which 28 of the 272 plants solely supply CCRs for beneficial uses. As of 2005, CCR beneficial uses (*i.e.*, industrial applications) involved about 47 million tons annually representing one-third of annual CCR generation, which the RIA estimates may grow to an annual quantity of 62 million tons by 2009. For 2008, the American Coal Ash Association estimates CCR beneficial use has grown to 60.6 million tons.[155]

2. Baseline CCR Disposal

For each of the 467 operating electric utility plants which dispose CCRs onsite or offsite (28 of the 495 total plants solely send their CCRs for beneficial use and not disposal), the RIA estimated baseline engineering controls at CCR disposal units and associated baseline disposal costs for two types of CCR disposal units: landfills and surface impoundments. Impoundments are sometimes named by electricity plant personnel as basins, berms, canals, cells, dams, embankments, lagoons, pits, ponds, reservoirs, or sumps. The baseline is defined as existing (current) conditions with respect to the presence or absence of 10 types of environmental engineering controls and eight ancillary regulatory elements, plus projection of future baseline conditions of CCR disposal units without regulation over the 50-year future period-of-analysis—2012 to 2061—applied in the RIA. A 50-year future period was applied in the RIA to account for impacts of the proposed regulatory options which are specific only to future new disposal units given average lifespans of over 40-years. Existing conditions were determined based on review of a sample of current state government regulations of CCR disposal in 34 states, as well as limited survey information on CCR disposal units from studies published in 1995, 1996, and 2006 about voluntary engineering controls installed for CCR disposal units at some electric utility plants. The 10 baseline engineering controls evaluated in the RIA are (1) Groundwater monitoring, (2) bottom liners, (3) leachate collection and removal systems, (4) dust controls, (5) rainwater run-on and run-off controls, (6) financial assurance for corrective action, disposal unit closure, and post-closure care, (7) disposal unit location restrictions, (8) closure capping of disposal units, (9) post-closure groundwater monitoring, and (10) CCR storage design and operating standards prior to disposal (**Note:** Although listed here, this 10th element was not estimated in the RIA because of EPA's lack of information on baseline CCR storage practices). This specific set of engineering controls represents the elements of the RCRA 3004(x) custom-tailored technical standards proposed in today's notice for the RCRA subtitle C option. The eight ancillary elements evaluated in the RIA are (11) offsite transport and disposal, (12) disposal unit structural integrity inspections, (13) electricity plant facility-wide environmental investigations, (14) facility-wide corrective action requirements, (15) waste disposal permits, (16) state government regulatory enforcement inspections, (17) environmental release remediation requirements, and (18) recordkeeping and reporting to regulatory agencies. Some states require many of these technical standards for future newly-constructed CCR disposal units, some states require them for existing units, and some states have few or no regulatory requirements specific to CCR disposal and thus were not estimated in the baseline cost. Furthermore, some of the ancillary elements are only relevant to the regulatory options based on subtitle C as co-proposed in today's notice. The percentage of CCR landfills with baseline controls ranged from 61% to 81%, and the percentage of CCR surface impoundments with baseline controls ranged from 20% to 49%, depending upon the type of control. Based on this estimation methodology, the RIA estimates the electric utility industry spends an average of S5.6 billion per year for meeting state-required and company voluntary environmental standards for CCR disposal. Depending upon state location for any given electricity plant (which determines baseline regulatory requirements), and whether any given plant disposes CCRs onsite or offsite, this baseline cost is equivalent to an average cost range of $2 to $80 per ton of CCRs disposed of.

3. Baseline CCR Beneficial Use

In addition to evaluating baseline CCR disposal practices, the RIA also estimated the baseline net benefits associated with the 47 million tons per year (2005) of industrial beneficial uses of CCRs. CCRs are beneficially used nationwide as material ingredients in at least 14 industrial applications according to the American Coal Ash Association: (1) Concrete, (2) cement, (3) flowable fill, (4) structural fill, (5) road base, (6) soil modification, (7) mineral filler in asphalt, (8) snow/ice control, (9) blasting grit, (10) roofing granules, (11) placement in mine filling operations,[156] (12) wallboard, (13) waste solidification, and (14) agriculture. The baseline annual sales revenues (as of 2005) received by the electric utility industry for sale of CCRs used in these industrial applications are estimated at $177 million per year. In comparison, substitute industrial ingredient materials (*e.g.*, portland cement, quarried stone aggregate, limestone, gypsum) would cost industries $2,477 million per year. Thus, the beneficial use of CCRs provides $2,300 million in annual cost savings to these industrial applications, labeled economic benefits in the RIA. Based on the lifecycle materials and energy flow economic framework presented in the RIA, although only based on limited data representing 47% of annual CCR beneficial use tonnage involving only three of the 14 industrial applications (*i.e.*, concrete, cement and wallboard), baseline lifecycle benefits of beneficially using CCRs compared to substitute industrial materials are (a) $4,888 million per year in energy savings, (b) $81 million per year in water consumption savings, (c) $365 million per year in greenhouse gas (*i.e.*, carbon dioxide and methane) emissions reductions, and (d) $17,772 million per year in other air pollution reductions. Altogether, industrial beneficial uses of CCRs provide over S23 billion in annual environmental benefits as of 2005. In addition, baseline CCR beneficial use provides $1,830 million per year in industrial raw materials costs savings to beneficial users, and $2,927 million per year in avoided CCR disposal cost to the electric utility industry as of 2005. The sum of environmental benefits,

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[155] Note that ACAA's definition of beneficial use does not align with that used by EPA in this rulemaking. For example, ACAA includes minefilling as a beneficial use, where EPA classifies it as a separate category of use.

[156] While today's proposed rule does not deal directly with the mine filling of CCRs, the RIA includes it as a baseline beneficial use because the RIA uses the categories identified by the American Coal Ash Association (*http://acaa.affiniscape.com/displaycommon.cfm?an=1&subarticlenbr=3*). However, as noted previously in today's notice, the Agency is working with OSM of the Department of Interior on the placement of CCRs in mine fill operations.

industrial raw materials costs savings, and CCR disposal cost savings, $27.9 billion per year, gives the baseline level of what the RIA has labeled social benefits from the beneficial use of CCRs.

4. Estimated Costs for RCRA Regulation of CCR Disposal

The RIA includes estimates of the costs associated with the options described in today's notice are summarized here: (1) RCRA subtitle C regulation of CCRs as a "special waste"; (2) RCRA subtitle D regulation as "non-hazardous waste"; and (3) the subtitle "D prime" options. Full descriptions of each option are presented in a prior section of today's notice. The RIA assumes that the engineering controls that would be established under the RCRA subtitle C option would be tailored on the basis of RCRA section 3004(x). The controls for the RCRA subtitle D option are identical to the subtitle C option. The controls under the subtitle "D prime" option would be identical as well, except that existing surface impoundments would not have to close or be dredged and have composite liners installed within five years of the effective date of the regulation. The RIA also assumes all three options retain the existing Bevill exemption for CCR beneficial uses.

The estimated costs for each option are incremental to the baseline, and are estimated in the RIA using both an average annualized and a present value equivalent basis over a 50-year period-of-analysis (2012 to 2061) using both a 7% and an alternative 3% discount rate. These two alternative discount rates are required by the Office of Management and Budget's September 2003 "Regulatory Analysis" Circular A–4. For the purpose of summary here, only the 7% discount rate results are presented for each option because the 7% rate represents the "base case" in the RIA for the reason that most of the regulatory compliance costs will be incurred by industry (*i.e.,* private capital). On an average annualized basis, the estimated regulatory compliance costs for the three options are $1,474 million (subtitle C special waste), $587 million (subtitle D), and $236 million (subtitle "D prime") per year. On a present value basis discounted at 7% over the 50-year future period-of-analysis applied in the RIA, estimated future regulatory compliance costs for the three options total $20,349 million, $8,095 million, and $3,259 million present value, respectively. EPA requests public comment on all data sources and analytical approaches.

5. Benefits for RCRA Regulation of CCR Disposal

The potential environmental and public health benefits of CCR regulation estimated and monetized in the RIA include three categories:

1. Groundwater protection benefits consisting of (a) human cancer prevention benefits and (b) avoided groundwater remediation costs at CCR disposal sites;
2. CCR impoundment structural failure prevention benefits (*i.e.,* cleanup costs avoided); and
3. Induced future increase in industrial beneficial uses of CCRs.

As was done with the cost estimates described above, the RIA estimated benefits both at the 7% and 3% discount rates using the same 50-year period-of-analysis. However, only the benefit estimates based on the 7% rate are summarized here. While the RIA focused on monetizing these three impact categories, there are also human non-cancer prevention benefits, ecological protection benefits, surface water protection benefits, and ambient air pollution prevention benefits, which are not monetized in the RIA, but qualitatively described below.

i. Groundwater Protection Benefits

The RIA estimated the benefits of reduced human cancer risks and avoided groundwater remediation costs associated with controlling arsenic leaching from CCR landfills and surface impoundments. These estimates are based on EPA's risk assessment (described elsewhere in today's notice), which predicts arsenic leaching rates using SPLP and TCLP data. Furthermore, recent research and damage cases indicate that these leaching tests under-predict risks from dry disposal.[157] Therefore, the groundwater protection benefits may be underestimated in the RIA. The RIA based estimation of future human cancer cases avoided on the individual "excess" lifetime cancer probabilities reported in the EPA risk assessment, although the RIA also used more recent (2001) science published by the National Research Council on arsenic carcinogenicity.

The RIA estimated groundwater protection benefits by categorizing electric utility plants according to their individual types of CCR disposal units (*i.e.,* landfill or impoundment) and presence/types of liners in those units. For each category, GIS data were used to determine the potentially affected populations of groundwater drinkers residing within 1-mile of the disposal units. Results from the risk assessment were applied to these populations by using a linear extrapolation, starting from a risk of zero to the peak future risk as demonstrated by the risk assessment. The count of people who might potentially get cancer was then adjusted upward to account for the more recent and more widely accepted arsenic carcinogenicity research by the National Research Council.[158] The RIA then segregated the future cancer counts into lung cancers and bladder cancers, as well as into those that were predicted to result in death versus those that were not. The RIA monetized each of these cancer sub-categories using EPA-published economic values for statistical life and cost of illness.

The RIA further adjusted these monetized future cancer counts, to take into account existing state requirements for groundwater monitoring at CCR disposal units, such that fewer cancer

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[157] Recent EPA research demonstrates that CCRs can leach significantly more aggressively under different pH conditions potentially present in disposal units. In the EPA Office of Research & Development report "Characterization of Coal Combustion Residues from Electric Utilities—Leaching and Characterization Data," EPA–600/R–09/151, Research Triangle Park, NC, December 2009, CCRs from 19 of the 34 facilities evaluated in the study exceeded at least one of the Toxicity Characteristic regulatory values for at least one type of CCR (*e.g.,* fly ash or FGD residue) at the self-generated pH of the material. This behavior likely explains the rapid migration of constituents from disposal sites like Chesapeake, VA and Gambrills, MD. *See also* the EPA Office of Research & Development reports (a) "Characterization of Mercury-Enriched Coal Combustion Residues from Electric Utilities Using Enhanced Sorbents for Mercury Control," EPA 600/R–06/008, January 2006; and (b) Characterization of Coal Combustion Residues from Electric Utilities Using Wet Scrubbers for Multi-Pollutant Control, EPA/600/R–08/077, July 2008.

[158] EPA's current Integrated Risk Information System (IRIS) has a cancer slope factor for arsenic developed in 1995. This slope factor is based on skin cancer incidence and was used in the 2010 EPA risk assessment. Skin cancer is a health endpoint associated with lower fatality risk than lung and bladder cancers induced by arsenic. Since the IRIS slope factors were developed, quantitative data on lung and bladder cancers have become available, and the skin cancer based slope factors no longer represent the current state of the science for health risk assessment for arsenic. The National Research Council (NRC) published the report, "Arsenic in Drinking Water: 2001 Update" (2001) which reviewed the available toxicological, epidemiological, and risk assessment literature on the health effects of inorganic arsenic, building upon the NRC's prior report, "Arsenic in Drinking Water" (NRC 1999). The 2001 report, developed by an eminent committee of scientists with expertise in arsenic toxicology and risk assessment provides a scientifically sound and transparent assessment of risks of bladder and lung cancers from inorganic arsenic. EPA's Science Advisory Board is currently reviewing EPA's new proposed IRIS cancer slope factors based on bladder and lung cancer. Because the more recent NRC scientific information is available, the RIA (2010) uses the NRC arsenic cancer data for the estimate of benefits associated with cancers avoided by the proposed regulation of CCR.

cases than initially projected would ultimately occur from early detection of groundwater contamination in those states. Therefore, a baseline was established for the operation of state regulatory and remedial programs which led to a reduction in expected cancer cases in states with existing groundwater protection requirements. However, once groundwater contamination was found in those states, remediation costs would be incurred. Thus, the RIA also accounted for these costs under each of the regulatory options as well, thus avoiding possible double-counting of cancer cases and remediation costs. On an average annualized basis, the human cancer prevention component of the groundwater protection benefit category for the three options are $37 million (RCRA subtitle C special waste), $15 million (RCRA subtitle D), and $8 million (subtitle "D prime") per year. On a present value basis, the human cancer prevention benefit totals $504 million, $207 million, and $104 million present value, respectively. On an average annualized basis, the estimated avoided groundwater remediation cost benefit component of the groundwater protection benefit category for the three options are $34 million (RCRA subtitle C special waste), $12 million (RCRA subtitle D), and $6 million (subtitle "D prime") per year. On a present value basis, the avoided remediation cost benefit totals to $466 million, $168 million, and $84 million present value, respectively. Added together on an average annualized basis, these two groundwater protection benefit components total to $71 million (RCRA subtitle C special waste), $27 million (RCRA subtitle D), and $14 million (subtitle "D prime") per year. On a present value basis, the groundwater protection benefit category totals to $970 million, $375 million, and $188 million present value, respectively.

ii. Impoundment Structural Failure Prevention Benefits

The December 2008 CCR surface impoundment collapse at the Tennessee Valley Authority's Kingston, Tennessee coal-fired electricity plant illustrated that structural failures of large CCR impoundments can lead to catastrophic environmental releases and large cleanup costs. The RIA estimated the benefit of avoiding future cleanup costs for impoundment failures, which the structural integrity inspection requirement of all regulatory options, and the future conversion or retrofitting of existing or new impoundments (under the subtitle C, subtitle D, and subtitle "D prime" options) would be expected to prevent.

The RIA based the estimate of future cleanup costs avoided on information contained in EPA's 2009 mail survey[159] of 584 CCR impoundments operated by the electric utility industry. In response to the survey request for information on known spills or non-permitted releases from CCR impoundments within the last 10 years, revealed 42 CCR impoundment releases spanning 1995 to 2009. Particularly, there were five significant releases between 4,950 cubic yards and 5.4 million cubic yards of CCRs, and one catastrophic release of 5.4 million cubic yards of CCRs during this time period at coal fired power plants. Given these historic releases, the RIA projected the probability of future impoundment releases using a Poisson distribution. In addition to this approach, the RIA formulated two alternative failure scenarios based on 96 high-risk CCR impoundments identified as at least 40 feet tall and at least 25 years old. The two alternative failure scenarios assumed impoundment failure rates involving these 96 impoundments of 10% and 20%, respectively. On an average annualized basis ranging across these three alternative failure probability estimation methods (scenarios), the avoided cleanup cost benefit category for the three options is estimated at $128 million to $1,212 million (subtitle C special waste), $58 million to $550 million (subtitle D), and $29 million to $275 million (subtitle "D prime") per year. On a present value basis, the avoided cleanup cost benefit category totals $1,762 million to $16,732 million (RCRA subtitle C special waste), $793 million to $7,590 million (RCRA subtitle D), and $405 million to $3,795 million present value (RCRA subtitle "D prime"), respectively.

iii. Benefit of Induced Future Increase in Industrial Beneficial Uses of CCRs

The third and final potential benefit category evaluated in the RIA includes the potential effects of RCRA regulation of CCR disposal on future annual tonnages of CCR beneficial use. As its base case, the RIA estimates an expected future increase in beneficial use induced by the increased costs of disposing CCR in RCRA-regulated disposal units. The RIA also evaluates the potential magnitude of a future decrease in beneficial use as a result of a potential "stigma" effect under the subtitle C option. Both scenarios are based on a baseline consisting of (a) projecting the future annual tonnage of CCR generation by the electric utility industry in relation to the Energy Information Administration's (EIA) future annual projection of coal consumption by the electric utility industry, and (b) projecting the future baseline growth in CCR beneficial use relative to the historical growth trendline (*i.e.,* absent today's proposed regulation).

For the induced increase "base case" scenario, the compliance costs for each regulatory option represent an "avoided cost incentive" to the electric utility industry to shift additional CCRs from disposal to beneficial use. Proportional to the estimated cost for each option, the RIA applied a beneficial use market elasticity factor to the projected baseline future growth in beneficial use to simulate the induced increase. On an average annualized basis, the monetized value—based on the same unitized (*i.e.,* per-ton) monetized social values assigned to the lifecycle benefits of baseline CCR beneficial uses—of the estimated potential induced increases in future annual CCR beneficial use tonnage for the three options are $6,122 million (RCRA subtitle C special waste), $2,450 million (RCRA subtitle D), and $980 million (subtitle "D prime") per year. On a present value basis, the potential induced increases in beneficial use totals to $84,489 million (RCRA subtitle C special waste), $33,796 million (RCRA subtitle D), and $13,518 million (subtitle "D prime") present value, respectively.

The RIA also monetized the alternative "stigma" scenario of future reduction in beneficial use induced by the RCRA subtitle C option. The RIA formulated assumptions about the percentage future annual tonnage reductions which might result to some of the 14 beneficial use markets. For example, federally purchased concrete was assumed to stay at baseline levels because of the positive influence of comprehensive procurement guidelines that are already in place to encourage such types of beneficial uses. Conversely, the levels of non-federally purchased concrete were assumed to decrease relative to the baseline. On an average annualized basis, the monetized value—based on the same unitized (*i.e.,* per-ton) monetized social values assigned to the lifecycle benefits of baseline CCR beneficial uses—of the potential "stigma" reduction in future annual CCR beneficial use for the RCRA subtitle C option is $16,923 million per year cost. On a present value basis, the potential "stigma" reduction in beneficial use totals to $233,549 million

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[159] Descriptive information and electric utility industry responses to EPA's 2009 mail survey is available at the survey webpage *http://www.epa.gov/waste/nonhaz/industrial/special/fossil/surveys/.*

present value cost. The RIA did not estimate a potential "stigma" reduction effect on the RCRA subtitle D or subtitle "D prime" regulatory options.

B. Benefits Not Quantified in the RIA

1. Non-Quantified Plant and Wildlife Protection Benefits

EPA's risk assessment estimated significant risks of adverse effects to plants and wildlife, which are confirmed by the existing CCR damage cases and field studies published in peer-reviewed scientific literature. Such reported adverse effects include: (a) Elevated selenium levels in migratory birds, (b) wetland vegetative damage, (c) fish kills, (d) amphibian deformities, (e) snake metabolic effects, (f) plant toxicity, (g) elevated contaminant levels in mammals as a result of environmental uptake, (h) fish deformities, and (i) inhibited fish reproductive capacity. Requirements in the proposed rule should prevent or reduce these impacts in the future by limiting the extent of environmental contamination and thereby reducing the levels directly available.

2. Non-Quantified Surface Water Protection Benefits

In EPA's risk assessment, recreational fishers could be exposed to chemical constituents in CCR via the groundwater-to-surface water exposure pathway. Furthermore, State Pollutant Discharge Elimination System (SPDES) and National Pollutant Discharge Elimination System (NPDES) discharges from CCR wet disposal (*i.e.*, impoundments) likely exceed the discharges from groundwater to surface water. Thus, exposure to arsenic via fish consumption could be significant. However, EPA expects that most electric utility plants will eventually switch to dry CCR disposal (or to beneficial use), a trend which is discussed in the RIA. Such future switchover will reduce potential future exposures to these constituents from affected fish.

3. Non-Quantified Ambient Air Protection Benefits

Another impact on public health not discussed in the RIA is the potential reduction of excess cancer cases associated with hexavalent chromium inhaled from the air. As estimated in the RIA, over six million people live within the Census population data "zip code tabulation areas" for the 495 electric utility plant locations. Thus, the potential population health benefits of RCRA regulation may be quite large. Inhalation of hexavalent chromium has been shown to cause lung cancer.[160] By requiring fugitive dust controls, the proposed rule would reduce inhalation exposure to hexavalent chromium near CCR disposal units that are not currently required to control fugitive dust.

Furthermore, several non-cancer health effects associated with CCRs are a result of particulate matter inhalation due to dry CCR disposal. Human health effects for which EPA is evaluating causality due to particulate matter exposure include (a) Cardiovascular morbidity, (b) respiratory morbidity, (c) mortality, (d) reproductive effects, (e) developmental effects, and (f) cancer.[161] The potential for and extent of adverse health effects due to fugitive dusts from dry CCR disposal was demonstrated in the 2009 EPA report "Inhalation of Fugitive Dust: A Screening Assessment of the Risks Posed by Coal Combustion Waste Landfills—DRAFT," which is available in the docket for today's co-proposed rules. The co-proposed rules' fugitive dust controls would serve to manage such potential risks by bringing them to acceptable levels.

CCR dust (and other types of particulate matter) can also be carried over long distances by wind and then settle on ground or water. The effects of this settling could include: (a) Changing the pH of lakes and streams; (b) changing the nutrient balance in coastal waters and large river basins; (c) depleting nutrients in soil; (d) damaging sensitive forests and farm crops; and (e) affecting the diversity of ecosystems.[162] Additionally, fine particulates are known to contribute to haze.[163] Thus, the fugitive dust controls contained in the proposed rule would improve visibility, and reduce the environmental impacts discussed above.

C. Comparison of Costs to Benefits for the Regulatory Alternatives

For purposes of comparing the estimated regulatory compliance costs to the monetized benefits for each regulatory option, the RIA computed two comparison indicators: Net benefits (*i.e.*, benefits minus costs), and benefit/cost ratio (*i.e.*, benefits divided by costs). The results of each indicator are displayed in the following tables (Table 10, Table 11 and Table 12) for three regulatory options, based on the 7% discount rate and the 50-year period-of-analysis applied in the RIA. There are three tables because three different scenarios were analyzed concerning potential impacts on beneficial use of CCRs impact under the regulatory options.

The three tables below represent three possible outcomes regarding impacts of the rule upon the beneficial use of CCR. In the first table, EPA presents the potential impact scenario that we view to be most likely. This first scenario assumes that the increased cost of disposal from regulation under subtitle C will encourage industry to seek out additional markets and greatly increase their beneficial use of CCRs. In the second table, EPA presents a negative effect on beneficial use, based on stigma, and the possibility of triggering use restrictions under state regulation and private sector standards due to subtitle C regulation. In the final table, EPA presents a scenario where beneficial use continues on its current path, without any changes as a result of the rule. On the basis of past experience, EPA believes that it is likely that recycling rates will increase as presented in the first scenario. Comments are requested on the impact of stigma on the beneficial use of CCRs.

TABLE 10—COMPARISON OF REGULATORY BENEFITS TO COSTS

[$Millions @ 2009$ prices and @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

	Subtitle C "Special Waste"	Subtitle D	Subtitle "D prime"
A. Present Values:			
1. Regulatory Costs (1A+1B+1C):	$20,349	$8,095	$3,259.
1A. Engineering Controls	$6,780	$3,254	$3,254.

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[160] ATSDR Texas. *Available at: http://www.atsdr.cdc.gov/toxfaq.html.*

[161] Source: EPA Office of Research & Development report "Integrated Science Assessment for Particulate Matter: First External Review Draft," EPA/600/R–08/139, 2008.

[162] Source: U.S. EPA Office of Air & Radiation, Particulate Matter "Health and Environment" Web site at *http://www.epa.gov/particles/health.html.*

[163] *Ibid;* and also *see http://www.intheairwebreathe.com/html/photo_gallery.html.*

TABLE 10—COMPARISON OF REGULATORY BENEFITS TO COSTS—Continued

[$Millions @ 2009$ prices and @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

	Subtitle C "Special Waste"	Subtitle D	Subtitle "D prime"
1B. Ancillary Regulatory Requirements.	$1,480	$5	$5.
1C. Conversion to Dry CCR Disposal.	$12,089	$4,836	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	$87,221 to $102,191	$34,964 to $41,761	$14,111 to $17,501.
2A. Monetized Value of Human Cancer Cases Avoided.	$504	$207	$104.
2B.Groundwater Remediation Costs Avoided.	$466	$168	$84.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$1,762 to $16,732	$793 to $7,590	$405 to $3,795.
2D. Included Future Increase in CCR Beneficial Use.	$84,489	$33,796	$13,518.
3. Net Benefits (2–1)	$66,872 to $81,842	$26,869 to $33,666	$10,852 to $14,242.
4. Benefit/Cost Ratio (2/1)	4.286 to 5.022	4.319 to 5.159	4.330 to 5.370.
B. Average Annualized Equivalent Values:*.			
1. Regulatory Costs (1A+1B+1C)	$1,474	$587	$236.
1A. Engineering Controls	$491	$236	$236.
1B. Ancillary Regulatory Requirements.	$107	<$1	<$1.
1C. Conversion to Dry CCR Disposal.	$876	$350	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	$6,320 to $7,405	$2,533 to $3,026	$1,023 to $1,268.
2A. Monetized Value of Human Cancer Cases Avoided.	$37	$15	$8.
2B. Groundwater Remediation Costs Avoided.	$34	$12	$6.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$128 to $1,212	$58 to $550	$29 to $275.
2D. Included Future Increase in CCR Beneficial Use.	$6,122	$2,450	$980.
3. Net Benefits (2–1)	$4,845 to $5,930	$1,947 to $2,439	$786 to $1,032.
4. Benefit/Cost Ratio (2/1)	4.286 to 5.022	4.319 to 5.159	4.330 to 5.370.

* **Note:** Average annualized equivalent values calculated by multiplying the 50-year present values by a 50-year 7% discount rate "capital recovery factor" of 0.07246.

TABLE 11—COMPARISON OF REGULATORY BENEFITS TO COSTS UNDER SCENARIO #2—INDUCED BENEFICIAL USE DECREASE

[$Millions @ 2009$ prices @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

	Subtitle C "Special Waste"	Subtitle D	Subtitle "D prime"
A. Present Values:			
1. Regulatory Costs (1A+1B+1C):	$20,349	$8,095	$3,259.
1A. Engineering Controls	$6,780	$3,254	$3,254.
1B. Ancillary Costs	$1,480	$5	$5.
1C. Conversion to Dry CCR Disposal.	$12,089	4,836	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	($230,817) to ($215,847)	$1,168 to $7,965	$593 to $3,983.
2A. Monetized Value of Human Cancer Risks Avoided.	$504	$207	$104.
2B. Groundwater Remediation Costs Avoided.	$466	$168	$84.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$1,762 to $16,732	$793 to $7,590	$405 to $3,795.
2D. Induced Impact on CCR Beneficial Use.	($233,549)	N/A	N/A.
3. Net Benefits (2–1)	($251,166) to ($236,196)	($6,927) to ($130)	($2,666) to $724.
4. Benefit/Cost Ratio (2/1)	(11.343) to (10.607)	0.144 to 0.984	0.182 to 1.222.
B. Average Annualized Equivalent Values*.			
1. Regulatory Costs (1A+1B+1C):	$1,474	$587	$236.
1A. Engineering Controls	$491	$236	$236.
1B. Ancillary Costs	$107	$0.36	$0.36.

TABLE 11—COMPARISON OF REGULATORY BENEFITS TO COSTS UNDER SCENARIO #2—INDUCED BENEFICIAL USE DECREASE—Continued

[$Millions @ 2009$ prices @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

	Subtitle C "Special Waste"	Subtitle D	Subtitle "D prime"
1C. Conversion to Dry CCR Disposal.	$876	$350	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	($16,725) to ($15,640)	$85 to $577	$43 to $289.
2A. Monetized Value of Human Cancer Risks Avoided.	$37	$15	$8.
2B. Groundwater Remediation Costs Avoided.	$34	$12	$6.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$128 to $1,212	$57 to $550	$29 to $275.
2D. Induced Impact on CCR Beneficial Use.	($16,923)	NA	NA.
3. Net Benefits (2–1)	($18,199) to ($17,115)	($502) to ($9)	($193) to $52.
4. Benefit/Cost Ratio (2/1)	(11.347) to (10.610)	0.145 to 0.983	0.182 to 1.225.

* **Note:** Average annualized equivalent values calculated by multiplying 50-year present values by a 50-year 7% discount rate "capital recovery factor" of 0.07246.

TABLE 12—COMPARISON OF REGULATORY BENEFITS TO COSTS UNDER SCENARIO #3—NO CHANGE TO BENEFICIAL USE

[$Millions @ 2009$ prices @ 7% discount rate over 50-year future period-of-analysis 2012 to 2061]

Costs	Subtitle C "Special Waste"	Subtitle D	Subtitle "D prime"
A. Present Values:			
1. Regulatory Costs (1A+1B+1C):	$20,349	$8,095	$3,259.
1A. Engineering Controls	$6,780	$3,254	$3,254.
1B. Ancillary Costs	$1,480	$5	$5.
1C. Dry Conversion	$12,089	4,836	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	$2,732 to $17,702	$1,168 to $7,965	$593 to $3,983.
2A. Monetized Value of Human Cancer Risks Avoided.	$504	$207	$104.
2B. Groundwater Remediation Costs Avoided.	$466	$168	$84.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$1,762 to $16,732	$793 to $7,590	$405 to $3,795.
2D. Induced Impact on CCR Beneficial Use.	$0	$0	$0.
3. Net Benefits (2–1)	($17,617) to ($2,647)	($6,927) to ($130)	($2,666) to $724.
4. Benefit/Cost Ratio (2/1)	0.134 to 0.870	0.144 to 0.984	0.182 to 1.222.
B. Average Annualized Equivalent Values.			
1. Regulatory Costs (1A+1B+1C):	$1,474	$587	$236.
1A. Engineering Controls	$491	$236	$236.
1B. Ancillary Costs	$107	$0.36	$0.36.
1C. Dry Conversion	$876	$350	$0.
2. Regulatory Benefits (2A+2B+2C+2D):	$198 to $1,283	$85 to $577	$43 to $289.
2A. Monetized Value of Human Cancer Risks Avoided.	$37	$15	$8.
2B. Groundwater Remediation Costs Avoided.	$34	$12	$6.
2C. CCR Impoundment Failure Cleanup Costs Avoided.	$128 to $1,212	$57 to $550	$29 to $275.
2D. Induced Impact on CCR Beneficial Use.	$0	$0	$0.
3. Net Benefits (2–1)	($1,277) to ($192)	($502) to ($9)	($193) to $52.
4. Benefit/Cost Ratio (2/1)	0.134 to 0.870	0.145 to 0.983	0.182 to 1.225.

* **Note:** Average annualized equivalent values calculated by multiplying 50-year present values by a 50-year 7% discount rate "capital recovery factor" of 0.07246.

EPA seeks comment on data and findings presented in the RIA, as well as on the cost and benefit estimation uncertainty factors identified in the RIA.

D. What are the potential environmental and public health impacts of the proposed regulatory alternatives?

The potential environmental and public health impacts of CCR regulation assessed within the RIA include the following three categories:

- Groundwater Benefits (human health benefits and cleanup costs avoided)
- Catastrophic Failure Benefits (catastrophic and significant releases avoided)
- Beneficial Use Benefits

The analyses of the groundwater impacts for the RIA were derived based on results from the risk assessment that was conducted for coal combustion residue landfills and surface impoundments. The second category of catastrophic impacts in the RIA was assessed, primarily based upon data on releases, as reported in EPA's 2009 Information Collection Request. And finally, the RIA assessment of beneficial use impacts was conducted using life-cycle analyses of current types and quantities of CCR beneficial use in the U.S. While the RIA focuses on monetizing these three impact categories, EPA notes that there are also likely noncancer health impacts, ecological impacts, other surface water impacts, and impacts on the ambient air, which are not monetized in this RIA.

1. Environmental and Public Health Impacts Estimated in the RIA

Groundwater Impacts

In the RIA, EPA estimated the benefits of reduced cancer risks and avoided groundwater remediation costs associated with controlling arsenic from landfills and surface impoundments that manage coal combustion residuals (CCRs). These estimates are based on EPA's risk assessment, which predicts leaching behavior using SPLP and TCLP data. Furthermore, recent research and damage cases indicate that these leaching tests may under-predict risks from dry disposal.[164] Therefore, the benefits estimated in this section are likely to underestimate the actual benefits provided by the proposed rule. EPA bases the cancer cases avoided on the individual "excess" lifetime cancer probabilities reported in the risk assessment, although for the present analysis, EPA uses more recent science on arsenic carcinogenicity, reflected in more recent NRC research.

The RIA began its groundwater impacts assessment by first segregating facilities by their individual type of liner and their respective Waste Management Unit (WMU) designations. For each class of facility, GIS data were used to determine the potentially affected populations of groundwater drinkers within 1-mile of the WMU. Results from the risk assessment were applied to these populations by using a linear extrapolation, starting from a risk of zero—to the peak future risk as demonstrated by the risk assessment. The number of people who might potentially get cancer was then adjusted to account for more recent research by the NRC.

Given the number of total potential cancers, EPA was able to use the same NRC data to split these cancers into lung cancers and bladder cancers, as well as into those that resulted in death versus those that did not. Once this subdivision was complete, EPA was then able to monetize these cancers using accepted economic values for a statistical life and cost of illness. In doing so, EPA was able to take account of both the potential lag in cancer cessation and the increase in value of a statistical life due to increases in income.

EPA also recognized that due to the relevant pre-existing state regulations in this area, fewer cancers than the number projected would ultimately occur. Therefore, a baseline was established for the operation of state regulatory and remedial programs. This led to the exclusion of some cancers where states would likely fill the gap in the absence of any EPA regulations. However, once contamination was found by states, cleanup costs would be incurred. Thus, EPA accounted for these costs under each of the regulatory options as well.

Once groundwater remediation costs and cancer costs under the baseline and each regulatory option were estimated, the aggregate benefits from each regulatory option were calculated (in comparison to the baseline). Net present value estimates were generated both at the 3% and 7% discount rate, as discussed in further detail within the RIA. To summarize, at a discount rate of 7%, the net present value of the groundwater benefits (including both the avoided cleanup costs and the value of cancer cases avoided) from the proposed rule totaled $970 million under the subtitle C option, and $375 million under the subtitle D option.

Catastrophic Failure Impacts

The 2008 surface impoundment failure at the TVA's Kingston, TN power plant illustrated that the improper handling of CCRs can lead to catastrophic releases. EPA's co-proposal for the management of CCRs includes requirements that would lead to all plants with surface impoundments converting to dry handling in landfills within 5-years of rule implementation. In the RIA, EPA estimated the avoided catastrophic failures and associated cleanup cost savings resulting from this provision of the rule.

First, EPA began by characterizing the releases reported in its 2009 Information Collection Request. In this data set, 42 releases were reported for the years 1995 through 2009. Particularly, there were 5 significant releases of between 1 million and 1 billion gallons, and one catastrophic release of over 1 billion gallons during this time period at coal fired power plants. Given these historic releases, EPA projected the occurrence of future releases using a Poisson distribution. EPA then estimated future avoided cleanup costs under the two proposed rules, and determined net present values of these benefits using both a 3% and 7% discount rate across the average and upper percentiles of risk demonstrated by the results of the Poisson distribution. The full details of these analyses are reported in the RIA. To summarize the results here at the 7% discount rate, the estimated net present value of avoided releases under the subtitle C requirements total $1,762 million on average (with the upper-bound estimates reaching from $3,140 to $4,177 million for the 90th and 99th percentiles). And under the subtitle D requirements and discount rate of 7%, the estimated net present value of avoided releases total $793 million on average (with the upper-bound estimates reaching from $1,413 to $1,880 million for the 90th and 99th percentiles).

In addition, a second Poisson distribution was developed as a sensitivity analysis, using an alternative historical rate of occurrence. This was done to see to what extent an increased release rate would pose in terms of greater risks. Given the age of many CCR surface impoundments, an increase in the release rate might be expected. The cleanup costs avoided under the two co-proposed rules were again calculated as described above and included in the

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[164] Recent EPA research demonstrates that CCRs can leach significantly more aggressively under different pH conditions potentially present in disposal units. In U.S. EPA (2009c), a recent ORD study of 34 facilities, CCRs from 19 facilities exceeded at least one of the Toxicity Characteristic regulatory values for at least one type of CCR (*e.g.*, fly ash or FGD residue) at the self-generated pH of the material. This behavior likely explains the rapid migration of constituents from disposal sites like Chesapeake, VA and Gambrills, MD. *See also* U.S. EPA (2006, 2008b).

RIA, given this alternative higher occurrence rate. To summarize the results of this sensitivity analysis, at a 7% discount rate the estimated net present value of avoided releases under the subtitle C requirements total $5,154 million on average (with the upper-bound estimates reaching from $7,356 to $9,423 million for the 90th and 99th percentiles). And under the subtitle D requirements and same discount rate of 7%, the estimated net present value of avoided releases total $2,319 million on average (with the upper-bound estimates reaching from $3,310 to $4,240 million for the 90th and 99th percentiles).

Finally, a further sensitivity analysis was also performed to determine the extent to which these benefits would change if the catastrophic failures occurred sooner than projected by the Poisson distribution. Here, 96 impoundments were identified that were at least 40 feet tall and at least 25 years old. For the purposes of the assessment, benefit estimates were calculated based on assumed impoundment failure rates of both 10% and 20%. The RIA includes net present value estimates of the avoided cleanup costs under the two co-proposed rules for these two assumed failure rates, which are calculated using both 3% and 7% discount rates. Given the potential earlier releases, the analyses in the RIA find that at a 7% discount rate and a 10% failure rate, the net present value of avoided catastrophic failure costs is $8,366 under subtitle C, versus $3,795 million under subtitle D. Furthermore, when assuming a failure rate of 20% rather than 10%, the estimated net present value of avoided catastrophic failure costs increases to $16,732 million under Subtitle C, versus $7,590 million under subtitle D.

Beneficial Use Impacts

The last category of such impacts assessed within the RIA includes the potential effects that the different regulatory options for disposal of coal combustion residuals (CCRs) may have upon the quantities of CCRs that are being beneficially used. In the RIA, EPA estimates the expected increase in beneficial use associated with the increased costs of disposing CCRs, and also evaluates potential future changes in the beneficial uses of CCRs as a result of a potential "stigma" effect.

To begin, EPA projected the quantity of CCRs that will be produced in the future, based upon Energy Information Administration's (EIA) estimates of future coal supply and demand. At the same time, EPA also projected the growth in the percent of beneficial use that would take place absent any EPA rule. Combining these, EPA was able to project the total quantities of beneficially used CCRs under the baseline of no federal rule.

However, it is anticipated that the increased CCR disposal costs associated with a federal RCRA subtitle C rule, and the continued application of the Bevill exclusion to CCRs that are beneficially used, would provide significant incentive to electric utilities avoid higher disposal costs by increasing the quantity of CCRs going to beneficial use. Using the cost projections from the RIA for CCR disposal, EPA assumed that there would initially be unit elasticity with respect to cost, but that the elasticity would decrease with increasing market saturation. Based upon these assumptions, EPA projected the increased growth in beneficial use under a subtitle C rule. EPA then took the monetized benefits of current beneficial use, and applied them to our projected increases in beneficial use under the rule.

When monetized, the values of these increases are extremely large, summing to a net present value of $5,560 million in economic benefits at a 7% discount rate. Furthermore, when considering total social benefits (*e.g.*, decreased GHG emissions) the numbers are even greater, resulting in $84,489 million at a 7% discount rate. (Please note that because the total social benefits overlap with the economic benefits, these numbers should not be added together.) This number represents EPA's lower-bound estimate of the potential increase that it anticipates will occur.

On the basis of past experience, EPA believes it is realistic to expect that there is a possibility that recycling rates will increase under a subtitle C rule, increasing the beneficial use of CCRs. However, stakeholders have raised the potential issue of "stigma." Thus, the RIA also assesses this potential stigma effect and develops estimates of its potential impacts. Here, assumptions were made about what losses or reductions might result among the various sectors involved in the beneficial use of CCRs. For example, federally purchased concrete was assumed to stay at baseline levels because of the positive influence of comprehensive procurement guidelines that are already in place to encourage such types of beneficial uses. Conversely, for the purposes of assessing potential stigma effects, the levels of non-federally purchased concrete were assumed to decrease relative to the baseline.

When monetized, the values of these decreases are also large, summing to a net present value of $18,744 million in economic costs at a 7% discount rate. Furthermore, when considering total social benefits (*e.g.*, GHG emissions) the numbers are even greater, resulting in $233,549 million in economic costs at a 7% discount rate. This number represents EPA's estimate of the potential worst-case decrease that could occur in the event of potential stigma effect.

Since the potential increases in beneficial use as discussed above are driven largely by increases in disposal costs under the subtitle C option, EPA further estimated the effects that would result under a subtitle D rule by applying a ratio of the rule's respective costs under both the C and D options. Using the ratio of the subtitle D costs to the subtitle C costs (a ratio of 0.40:1); the net present value of social benefits associated with increased beneficial use under subtitle D would be approximately $33,796 million (at an assumed discount rate of 7%). It is important to note further that under the subtitle D option for the proposed rule, no such stigma effect would exist and is, therefore, not accounted for in our analyses. However, to the extent that a stigma effect is real, it could just as easily decrease beneficial use under a subtitle D option.

2. Environmental and Public Health Impacts Not Estimated in the RIA

Impacts on Plants and Wildlife

The risk assessment estimated significant risk of adverse effects to plants and wildlife, which is confirmed by the many impacts seen in the existing damage cases and field studies published in the peer-reviewed scientific literature. These include: elevated selenium levels in migratory birds, wetland vegetative damage, fish kills, amphibian deformities, snake metabolic effects, plant toxicity, elevated contaminant levels in mammals as a result of environmental uptake, fish deformities, and inhibited fish reproductive capacity. Requirements in the proposed rule should prevent or reduce these impacts in the future by limiting the extent of environmental contamination and thereby reducing the levels directly available.

Impacts on Surface Water Not Captured in the RIA

In EPA's risk assessment, recreational fishers could be exposed to constituents via the groundwater to surface water pathway. Furthermore, State Pollutant Discharge Elimination System (SPDES) and National Pollutant Discharge

Elimination System (NPDES) discharges from wet handling likely exceed the discharges from groundwater to surface water. Thus, exposure to arsenic via fish consumption could be significant. However, EPA expects that most facilities will eventually switch to dry handling of CCRs, a trend which is discussed in the RIA. This will reduce potential exposures to these constituents from affected fish.

Impacts on Ambient Air

Another impact on public health not discussed in the RIA is the potential reduction of excess cancer cases associated with hexavalent chromium inhaled from the air. Since over six million individuals are estimated to live within the Census population data "zip code tabulation areas" for the plant location zip codes of coal-fired power plants affected by this proposed rule,[165] the potential population health effects may be quite large. Inhalation of hexavalent chromium has been shown to cause lung cancer.[166] By requiring fugitive dust controls, the proposed rule would reduce inhalation exposure to hexavalent chromium near waste management units that are not currently required to control fugitive dust.

Non-Cancer Health Effects Associated With CCR Particulate Matter

There are several non-cancer health effects associated with CCRs are a result of particulate matter inhalation due to dry handling. Human health effects for which EPA is evaluating causality due to particulate matter exposure include cardiovascular morbidity, respiratory morbidity, and mortality, reproductive and developmental effects, and cancer.[167] The potential for and extent of adverse health effects due to fugitive dusts from dry handling of CCRs was demonstrated in U.S. EPA 2010b, "Inhalation of Fugitive Dust: A Screening Assessment of the Risks Posed by Coal Combustion Waste Landfills—DRAFT." The proposed rule's fugitive dust controls would serve to manage such potential risks by bringing them to acceptable levels.

Particles can also be carried over long distances by wind and then settle on ground or water. The effects of this settling include: changing the pH of lakes and streams; changing the nutrient balance in coastal waters and large river basins; depleting nutrients in soil; damaging sensitive forests and farm crops; and affecting the diversity of ecosystems.[168] Additionally, fine particulates are known to contribute to haze.[169] Thus, the fugitive dust controls contained in the proposed rule would improve visibility, and reduce the environmental impacts discussed above.

XIII. Other Alternatives EPA Considered

In determining the level of regulation appropriate for the management of CCRs, taking into account both the need for regulations to protect human health and the environment and the practical difficulties associated with implementation of such regulations, the Agency considered a number of approaches in addition to regulating CCRs under subtitle C or subtitle D of RCRA. Specifically, the Agency also considered several combination approaches, such as regulating surface impoundments under subtitle C of RCRA, while regulating landfills under subtitle D of RCRA.

Under all of the approaches EPA considered, CCRs that were beneficially used would retain the Bevill exemption. In addition, under all the approaches, requirements for liners and ground water monitoring would be established, as well as annual inspections of all CCR surface impoundments by an independent registered professional engineer to ensure that the design, operation, and maintenance of surface impoundments are in accordance with recognized and generally accepted good engineering standards. However, the degree and extent of EPA's authority to promulgate certain requirements, such as permitting, financial assurance, facility-wide corrective action, varies under RCRA subtitle C versus subtitle D. In addition, the degree and extent of federal oversight, including enforcement, varies based on whether a regulation is promulgated under RCRA subtitle C or subtitle D authority. (*See* Section IV. for a more detailed discussion on the differences in EPA's authorities under RCRA subtitle C and subtitle D.)

Under one such approach, wet-handled CCRs—that is, those CCRs managed in surface impoundments or similar management units—would be regulated as a hazardous or special waste under RCRA subtitle C, while dry handled CCRs—that is, those CCRs managed in landfills—would be regulated under RCRA subtitle D. Wet-handled CCR wastes would be regulated under the co-proposed subtitle C alternative described earlier in the preamble (*see* section VI), while dry-handled CCRs would be regulated under the co-proposed RCRA subtitle D alternative described earlier in the preamble (*see* section IX). In addition, EPA would retain the existing Bevill exemption for CCRs that are beneficially used. Under this approach, EPA would establish modified requirements for wet-handled CCRs, pursuant to RCRA 3004(x), as laid out in the co-proposed subtitle C alternative.

This approach would have many of the benefits of both of today's co-proposed regulations. For example, this approach provides a high degree of federal oversight, including permit requirements and federally enforceable requirements, for surface impoundments and similar units that manage wet CCRs. Based on the results of our ground water risk assessment, it would also provide a higher level of protection for those wastes whose method of management presents the greatest risks (*i.e.,* surface impoundments). On the other hand, dry CCRs managed in landfills, while still presenting a risk if the CCRs are not properly managed, clearly present a lower risk, according to the risk assessment and, therefore, a subtitle D approach might be more appropriate. Also, landfills that manage CCRs are unlikely to present a risk of catastrophic failure, such as that posed by surface impoundments that contain large volumes of wet-handled CCRs. EPA also believes this approach could address the concerns of many commenters who expressed their views that subtitle C regulations would overwhelm off-site disposal capacity and would place a stigma on beneficial uses of CCRs.

Of course, this approach also shares the disadvantages of the subtitle C approach, as it applies to surface impoundments, and of the subtitle D approach, as it applies to landfills. For example, portions of the rules applicable to surface impoundments would not become enforceable until authorized states adopt the subtitle C regulations and become authorized; and rules applicable to landfills would not be directly federally enforceable. For a full discussion of the advantages and disadvantages of the subtitle C and subtitle D options *see* sections VI and IX.

Under another approach considered by EPA, the Agency would issue the proposed subtitle C regulations, but they would not go into effect for some time

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[165] U.S. EPA. Regulatory Impact Analysis for EPA's Proposed Regulation of Coal Combustion Wastes Generated by the Electric Utility Industry, 2009. Office of Resource Conservation and Recovery.

[166] ATSDR Texas. *Available at: http://www.atsdr.cdc.gov/toxfaq.html.*

[167] Integrated Science Assessment for Particulate Matter: First External Review Draft. EPA/600/R–08/139. Research Triangle Park, NC: U.S. Environmental Protection Agency, Office of Research and Development. 2008.

[168] *http://www.epa.gov/particles/health.html.*

[169] *Ibid.*

period, such as three years, as an example, after promulgation. The rule would include a condition that would exclude CCRs from regulation under subtitle C of RCRA in states that: (l) Had developed final enforceable subtitle D regulations that are protective of human health and the environment,[170] (2) had submitted those regulations to EPA for review within two years after the promulgation date of EPA's subtitle C rule, and (3) EPA had approved within one year, through a process allowing for notice and comment, possibly comparable to the current MSW subtitle D approval process. If a state failed to develop such a program within the two year timeframe for state adoption of the regulations or if EPA did not approve a state program within the one-year timeframe for state approval, the hazardous waste or special waste listing would become effective. Under this alternative, each state would be evaluated individually, which could lead to a situation where CCRs were managed as hazardous or special wastes in certain states, while in other states, they would be managed as non-hazardous wastes. Such an approach could present some implementation issues, particularly if CCRs were transported across state lines. In addition, EPA has serious questions as to whether RCRA, as currently drafted, would allow EPA to promulgate such a regulation. However, EPA solicits comments on this option, both generally and with respect to the specific time frames.

Commenters also have suggested an approach similar to that proposed for cement kiln dust (CKD) in an August 20, 1999 proposed rule (*see* 64 FR 45632 *available at http://www.epa.gov/fedrgstr/EPA–WASTE/1999/August/Day-20/f20546.htm*). Under the CKD approach, the Agency would establish detailed management standards under subtitle D of RCRA. CCRs managed in accordance with the standards would not be a hazardous or special waste. However, CCRs that were in egregious violation of these requirements, such as disposal in land-based disposal units that were not monitored for groundwater releases or in new units built without liners, would be considered listed hazardous or special waste and subject to the tailored subtitle C requirements. (EPA is soliciting comment on this approach because commenters have suggested it; interested commenters may wish to consult the CKD proposal for more detail on how it would work. *See* 64 FR 45632 *available at http://www.epa.gov/epawaste/nonhaz/industrial/special/ckd/ckd/ckd-fr.pdf*). Like the previous approach, EPA is evaluating (and in fact is re-evaluating) this approach, and whether RCRA provides EPA the authority to promulgate such a rule.

Other commenters suggested yet another approach whereby EPA would regulate CCRs going for disposal under RCRA subtitle C, but they assert that EPA would not have to specifically list CCR as a hazardous waste using the criteria established in 40 CFR 261.11. These commenters believe that RCRA § 3001(b)(3)(A) (the so-called Bevill Amendment) authorizes the Agency to regulate CCRs under subtitle C as long as the Agency determines that subtitle C regulation is warranted based on the consideration of the eight factors identified in RCRA § 8002(n). The commenters analysis of their approach is set forth in a memorandum submitted to the Agency and is in the docket for today's notice. EPA has not adopted the commenters suggested reading of the statute, but solicits comments on it. (*See* "EPA Has Clear Authority to Regulate CCW under RCRA's Subtitle C without Making a Formal Listing Determination," White Paper from Eric Schaeffer, Environmental Integrity Project which is available in the docket for this proposal.)

Finally, some commenters have suggested that EPA not promulgate any standards, whether it be RCRA subtitle C or D, but continue to rely on the states to regulate CCRs under their existing or new state authority, and that EPA could rely on RCRA section 7003 (imminent and substantial endangerment) authority, to the extent the Agency had information that a problem existed that it needed to address. The Agency does not believe that such an approach is at all acceptable, and that national regulations whether it be under RCRA subtitle C or D needs to be promulgated. First, RCRA was designed as a preventative statute and not one where EPA would get involved only after a problem has been discovered. Thus, such an approach would not be consistent with the purpose and objectives of RCRA. In addition, this approach would basically implement the status quo—that is, the control of CCRs over the last decade, which the Agency believes has not shown to be at all acceptable. Furthermore, imminent and substantial endangerment authority is facility-specific and resource intensive. That is, such authority can only be used when EPA has sufficient information to determine that disposal of CCRs are contributing to an imminent and substantial endangerment. Thus, relying on this authority, without national regulations, is poorly suited to address the many problems that have occurred, and are likely to occur in the future. Nevertheless, the Agency solicits comment on such an approach.

EPA solicits comments on all of the approaches discussed above. The Agency is still considering all of these approaches, as well as our legal authorities to promulgate them, and will continue to do so as we move toward finalizing the regulations applicable to the disposal of CCRs.

XIV. Is the EPA soliciting comments on specific issues?

Throughout today's preamble, the Agency has identified many issues for which it is soliciting comment along with supporting information and data. In order to assist readers in providing EPA comments and supporting information, in this section EPA is identifying many of the major issues on which comments with supporting information and data are requested.

Management of CCRs

- Whether regulatory approaches should be established individually for the four Bevill CCR wastes (fly ash, bottom ash, boiler slag, and FGD sludges) when destined for disposal.
- The extent to which the information currently available to EPA reflects current industry practices at both older and new units.
- The regulatory approaches proposed in the notice and the alternative approaches EPA is considering as discussed in Section XIII of the preamble.
- The Agency has documented, through proven damage cases and risk analyses, that the wet handling of CCRs in surface impoundments poses higher risks to human health and the environment than the dry handling of CCRs in landfills. EPA seeks comments on the standards proposed in this notice to protect human health and the environment from the wet handling of CCRs. For example, in light of the TVA Kingston, Tennessee, and the Martins Creek, Pennsylvania CCR impoundment failures, should the Agency require that owners or operators of existing and new CCR surface impoundments submit emergency response plans to the regulatory authority if wet handling of CCRs is practiced?
- The degree to which coal refuse management practices have changed and the impacts of those changes or, for

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[170] Under this approach, EPA also would establish minimum national standards that ensure that CCRs that are managed under the "D" regulations would be protective of human health and the environment.

example, groundwater monitoring and the use of liners.

- Information and data on CCRs that are generated by non-utility industries, such as volumes generated, characteristics of the CCRs, and whether they are co-managed with other wastes generated by the non-utility industry.

Risk Assessment

- Are there any additional data that are representative of CCR constituents in surface impoundment or landfill leachate (from literature, state files, industry or other sources) that EPA has not identified and should be used in evaluating the risks presented by the land disposal of CCRs?
- The screening analysis conducted to estimate risks from fugitive CCR dust; data from any ambient air monitoring for particulate matter that has been conducted; where air monitoring stations are located near CCR landfills or surface impoundments; and information on any techniques, such as wetting, compaction, or daily cover that are or can be employed to reduce such exposures.
- Whether site-averaged porewater data used in model runs in EPA's risk analyses are representative of leachate from surface impoundments.
- Information and data regarding the existence of drinking water wells that are down-gradient of CCR disposal units, any monitoring data that exists on those monitoring wells and the potential of these wells to be intercepted by surface water bodies.

Liners

- Whether, in addition to the flexibility provided by section 3004(o)(2), regulations should also provide for alternative liner designs based on, for example, a specific performance standard, such as the performance standard in 40 CFR 258.40(a)(1), or a site specific risk assessment, or a standard that the alternative liner, such as a clay liner, was at least as effective as the composite liner.
- Whether clay liners designed to meet a 1×10^{-7} cm/sec hydraulic conductivity might perform differently in practice than modeled in the risk assessment, including specific data on the hydraulic conductivity of clay liners associated with CCR disposal units.
- The effectiveness of such additives as organosilanes, including any analyses that would reflect long-term performance of the additives, as well as the appropriateness of a performance standard that would allow the use of these additives in lieu of composite liners.

Beneficial Use

- The growth and maturation of state beneficial use programs and the growing recognition that the beneficial use of CCRs is a critical component in strategies to reduce GHG emissions taking into account the potentially changing composition of CCRs as a result of improved air pollution controls and the new science on metals leaching.
- Information and data on the extent to which states request and evaluate CCR characterization data prior to the beneficial use of unencapsulated CCRs.
- The appropriate means of characterizing beneficial uses that are both protective of human health and the environment and provide benefits. EPA is also requesting information and data demonstrating where the federal and state programs could improve on being environmentally protective and, where states have, or are developing, increasingly effective beneficial use programs.
- Whether certain uses of CCRs (*e.g.*, uses involving unencapsulated uses of CCRs) warrant tighter control and why such tighter control is necessary.
- If EPA determines that regulations are needed for the beneficial use of CCRs, should EPA consider removing the Bevill exemption for such uses and regulate these uses under RCRA subtitle C, develop regulations under RCRA subtitle D or some other statutory authority, such as under the Toxic Substances Control Act?
- Whether it is necessary to define beneficial use better or develop detailed guidance on the beneficial use of CCRs to ensure protection of human health and the environment, including whether certain unencapsulated beneficial uses should be prohibited.
- Whether the Agency should promulgate standards allowing uses on the land, on a site-specific basis, based on site specific risk assessments, taking into consideration the composition of CCRs, their leaching potential under the range of conditions under which the CCRs would be managed, and the context in which CCRs would be applied, such as location, volume, rate of application, and proximity to water.
- If materials characterization is required, what type of characterization is most appropriate? If the CCRs exceed the toxicity characteristic at pH levels different from the TCLP, should they be excluded from beneficial use? When are totals levels relevant?
- Whether EPA should fully develop a leaching assessment tool in combination with the Draft SW–846 leaching test methods described in Section I. F. 2 and other tools (*e.g.*, USEPA's *Industrial Waste Management Evaluation Model* (IWEM)) to aid prospective beneficial users in calculating potential release rates over a specified period of time for a range of management scenarios.
- Information and data relating to the agricultural use of FGD gypsum, including the submission of historical data, taking into account the impact of pH on leaching potential of metals, the variable and changing nature of CCRs, and variable site conditions.
- Historically, EPA has proposed or imposed conditions on other types of hazardous wastes used in a manner constituting disposal (*e.g.*, maximum application rates and risk-based concentration limits for cement kiln dust used as a liming agent in agricultural applications (*see* 64 FR 45639; August 20, 1999); maximum allowable total concentrations for non-nutritive and toxic metals in zinc fertilizers produced from recycled hazardous secondary materials (*see* 67 FR 48393; July 24, 2002). Should EPA establish standards, such as maximum/minimum thresholds, or rely on implementing states to impose CCR site-specific limits based on front-end characterization that ensures individual beneficial uses remain protective?
- Whether additional beneficial uses of CCRs have been established, since the May 2000 Regulatory Determination, that have not been discussed elsewhere in today's preamble. The Agency solicits comment on any new uses of CCR, as well as the information and data which support that CCRs are beneficially used in an environmentally sound manner.
- Whether there are incentives that could be provided that would increase the amount of CCRs that are beneficially used and comment on specific incentives that EPA could adopt that would further encourage the beneficial use of CCRs.
- Information and data on the best means for estimating current and future quantities and changes in the beneficial use of CCRs, as well as on the price elasticity of CCR applications in the beneficial use market.

Stigma

- If EPA were to regulate CCRs as a "special waste" under subtitle C of RCRA, and stigma turns out to be an issue, suggestions on methods by which the Agency could reduce any stigmatic impact that might indirectly arise. We are seeking information on actual instances where "stigma" has adversely affected the beneficial use of CCRs and the causes of these adverse effects.
- The issue of "stigma" and its impact on beneficial uses of CCRs, including

more specifics on the potential for procedural difficulties for state programs, and measures that EPA might adopt to try to mitigate these effects.

- For those commenters who argue that regulating CCRs under subtitle C of RCRA would raise liability issues, EPA requests that commenters describe the types of liability and the basis/data/information on which these claims are based.
- EPA furthermore welcomes ideas on how to best estimate these effects for purposes of conducting regulatory impact analysis, and requests any data or methods that would assist in this effort.

Today's Co-Proposed Regulations

General

- Some commenters have suggested that EPA not promulgate any standards, whether they be RCRA subtitle C or D, but continue to rely on the states to regulate CCRs under their existing or new state authorities. The Agency solicits comment on such an approach, including how such an approach would be protective of human health and the environment.

RCRA Subtitle C Regulations

- Whether EPA should modify the corrective action requirements for facility-wide corrective action under the subtitle C co-proposal under the authority of section 3004(x) of RCRA. If so, how such modification would be protective of human health and the environment.
- Pursuant to RCRA section 3010 and 40 CFR 270.1(b), facilities managing these special wastes subject to RCRA subtitle C must notify EPA of their waste management activities within 90 days after the wastes are identified or listed as a special waste. The Agency is proposing to waive this notification requirement for persons who handle CCRs and have already: (1) notified EPA that they manage hazardous wastes, and (2) received an EPA identification number. Should such persons be required to re-notify the Agency that they generate, transport, treat, store or dispose of CCRs?
- Representatives of the utility industry have stated their view that CCRs cannot be practically or cost effectively managed under the existing RCRA subtitle C storage standards, and that these standards impose significant costs without meaningful benefits when applied specifically to CCRs. Comments are solicited on the practicality of the proposed subtitle C storage requirements for CCRs, the workability of the existing variance process allowing alternatives to secondary containment, and the alternative requirements based, for example, on the mining and mineral processing waste storage requirements.

RCRA Subtitle D Regulations

- EPA broadly solicits comment on the approach of relying on certifications by independent registered professional hydrologists or engineers of the adequacy of actions taken at coal-fired utilities to design and operate safe waste management systems.
- The Agency does not have specific data showing the number of CCR landfills located in fault areas where movement along Holocene faults is common, and the distance between these units and the active faults and, thus, is unable to precisely estimate the number of these existing CCR landfills that would not meet today's proposed fault area restrictions. Additional information regarding the extent to which existing landfills are currently located in such locations is solicited.
- In general, EPA believes that a 200-foot buffer zone is necessary to protect engineered structures from seismic damages and also expects that the 200-foot buffer is appropriate for CCR surface impoundments. The Agency seeks comment and data on whether the buffer zone should be greater for surface impoundments.
- Additional information regarding the extent to which landfill capacity would be affected by applying the proposed subtitle D location restrictions to existing CCR landfills.
- The proposed location requirements do not reflect a complete prohibition on siting facilities in areas of concern, but provide a performance standard that facilities must meet in order to site a unit in such a location. Information on the extent to which facilities could comply with the proposed performance standards, and the necessary costs that would be incurred to retrofit CCR disposal units to meet these standards is solicited.
- The proposed definition of seismic impact zones and whether there are variants that could lessen the burden on the industry and the geographic areas covered by the proposed definition.
- Whether the subtitle D option, if promulgated, should allow facilities to use alternative designs for new disposal units, so long as the owner or operator of a unit could obtain certification from an independent registered professional engineer or hydrologist that the alternative design would ensure that the appropriate concentration values for a set of constituents typical of CCRs will not be exceeded in the uppermost aquifer at the relevant point of compliance (*i.e.,* 150 meters from the unit boundary down gradient from the unit, or the property boundary if the point of compliance is beyond the property boundary).
- Whether there could be homeland security implications with the requirement to post information on an internet site and whether posting certain information on the internet may duplicate information that is already available to the public through the State.
- Whether the subtitle "D prime" option is protective of human health and the environment.
- EPA is proposing that existing CCR landfills and surface impoundments that cannot make a showing that a CCR landfill or surface impoundment can be operated safely in a floodplain or unstable area must close within five years after the effective date of the rule. EPA solicits comment on the appropriate amount of time necessary to meet this requirement, as well as measures that could help to address the potential for inadequate disposal capacity.
- The effectiveness of annual surface impoundment assessments in ensuring the structural integrity of CCR surface impoundments over the long term.

Surface Impoundment Closeout

- Whether the Agency should provide for a variance process allowing some surface impoundments that manage wet-handled CCRs to remain in operation because they present minimal risk to groundwater (*e.g.,* because they have a composite liner) and minimal risk of a catastrophic release (*e.g.,* as indicated by a low or less than low potential hazard rating under the Federal Guidelines for Dam Safety established by the Federal Emergency Management Agency).

Surface Impoundment Stability

- The adequacy of EPA's proposals to address surface impoundment integrity under RCRA.
- Whether to address all CCR impoundments for stability, regardless of height and storage volume; whether to use the cut-offs in the MSHA regulations; or whether other regulations, approaches, or size cut-offs should be used. If commenters believe that other regulations or different size cut-offs should be adopted, we request that commenters provide the basis and technical support for their position.
- Whether surface impoundment integrity should be addressed under EPA's NPDES permit program, rather than the development of regulations under RCRA, whether it be RCRA subtitles C or D.

Financial Assurance

- EPA broadly solicits comments on whether financial assurance should be a key program element under a subtitle D approach, if the decision is made to promulgate regulations under RCRA subtitle D.
- Whether financial responsibility requirements under CERCLA § 108(b) should be a key Agency focus for ensuring that funds are available for addressing the mismanagement of CCRs.
- How the financial assurance requirements might apply to surface impoundments that cease receiving CCRs before the effective date of the rule.
- Whether a financial test similar to that in 40 CFR 258.74(f) in the Criteria for Municipal Solid Waste Landfills should be established for local governments that own and operate coal-fired power plants.

State Programs

- Detailed information on current and past individual state regulatory and non-regulatory approaches taken to ensure the safe management of CCRs, not only under State waste authorities, but under other authorities as well, including the implementation of those approaches.
- The potential of federal regulations to cause disruption to States' implementation of CCR regulatory programs under their own authorities, including more specifics on the potential for procedural difficulties for State programs, and measures that EPA might adopt to try to mitigate these effects.

Damage Cases

- EPRI's report and additional data regarding the proven damage cases identified by EPA, especially the degree to which there was off-site contamination.
- The report of additional damage cases submitted to EPA on February 24, 2010 by the Environmental Integrity Project and EarthJustice.

Regulatory Impact Analysis

- Data and findings presented in the RIA, as well as on the cost and benefit estimation uncertainty factors identified in the RIA.
- Data on the costs of converting coal fired power plants from wet handling to dry handling with respect to the various air pollution controls, transportation systems, disposal units, and other heterogeneous factors.
- Relevant RCRA corrective actions and related costs that would be useful in characterizing the potential costs for future actions.
- Information on other significant and catastrophic surface impoundment releases of CCRs or other similar materials and cleanup costs associated with these releases?
- Data on the costs of storage of CCRs in tanks or tank systems, on pads, or in buildings.
- EPA has also quantified and monetized the benefits of this rule to the extent possible based on available data and modeling tools, but welcomes additional data that may be available that would assist the Agency in expanding and refining our existing benefit estimates.

XV. Executive Orders and Laws Addressed in This Action

A. Executive Order 12866: Regulatory Planning and Review

Under section 3(f)(1) of Executive Order (EO) 12866 (58 FR 51735, October 4, 1993), this action is an "economically significant regulatory action" because it is likely to have an annual effect on the economy of $100 million or more (section 3(f)(1)). This determination is based on the regulatory cost estimates provided in EPA's "Regulatory Impact Analysis" (RIA) which is available in the docket for this proposal. The RIA estimated regulatory implementation and compliance costs, benefits and net benefits for a number of regulatory options, including a subtitle C "special waste" option, a subtitle D option and, a subtitle "D prime" option. The subtitle D prime option was briefly described in the Preamble and is more fully discussed in the RIA to the co-proposal. On an average annualized basis, the estimated regulatory compliance costs for the three options in today's proposed action are $1,474 million (subtitle C special waste), $587 million (subtitle D), and $236 million (subtitle "D prime") per year. On an average annualized basis, the estimated regulatory benefits for the three options in today's proposed action are $6,320 to $7,405 million (subtitle C special waste), $2,533 to $3,026 million (subtitle D), and $1,023 to $1,268 million (subtitle "D prime") per year. On an average annualized basis, the estimated regulatory net benefits for the three options in today's proposed action are $4,845 to $5,930 million (subtitle C special waste), $1,947 to $2,439 million (subtitle D), and $786 to $1,032 million (subtitle "D prime") per year. All options exceed $100 million in expected future annual effect. Accordingly, EPA submitted this action to the Office of Management and Budget (OMB) for review under EO 12866, and changes made in response to OMB recommendations are documented in the docket for this proposal.

B. Paperwork Reduction Act

The information collection requirements contained in this proposed rule has been submitted for approval to the Office of Management and Budget (OMB) under the *Paperwork Reduction Act,* 44 U.S.C. 3501 *et seq.* The Information Collection Request (ICR) document prepared by EPA has been assigned EPA ICR number 1189.22.

Today's action co-proposes two regulatory alternatives that would regulate the disposal of CCRs under RCRA. The regulatory options described in today's notice contain mandatory information collection requirements. One of the regulatory options (subtitle C special waste option) would also trigger mandatory emergency notification requirements for releases of hazardous substances to the environment under CERCLA and EPCRA. The labor hour burden and associated cost for these requirements are estimated in the ICR "Supporting Statement" for today's proposed action. The Supporting Statement identifies and estimates the burden for the following nine categories of information collection: (the proposed options also contain other regulatory requirements not listed here because they do not involve information collection).

1. Groundwater monitoring
2. Post-closure groundwater monitoring
3. RCRA manifest cost (for subtitle C only)
4. Added cost of RCRA subtitle C permits for all offsite CCR landfills
5. Structural integrity inspections
6. RCRA facility-wide investigation (for subtitle C only)
7. RCRA TSDF hazardous waste disposal permit (for subtitle C only)
8. RCRA enforcement inspection (for subtitle C only)
9. Recordkeeping requirements

Based on the same data and cost calculations applied in the "Regulatory Impact Analysis" (RIA) for today's action, but using the burden estimation methods for ICRs, the ICR "Supporting Statement" estimates an average annual labor hour burden of 2.88 million hours for the subtitle C "special waste" option and 1.38 million hours for both the subtitle D and "D prime" options at an average annual cost of $192.93 million for the subtitle C "special waste" option and $92.6 million for both the subtitle D options. One-time capital and hourly costs are included in these estimates based on a three-year annualization period. The estimated number of likely respondents (under the options) ranges from 90 to 495, depending on the information category enumerated above. Burden is defined at 5 CFR 1320.3(b). An Agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid OMB control number. The OMB control numbers for EPA's regulations in 40 CFR are listed in 40 CFR part 9.

To comment on the Agency's need for this information, the accuracy of the provided burden estimates, and any suggested methods for minimizing respondent burden, EPA has established a public docket for this rule, which includes this ICR, under Docket ID number EPA–HQ–RCRA–2009–0640. Submit any comments related to the ICR to EPA and OMB. *See* **ADDRESSES** section at the beginning of this notice for where to submit comments to EPA. Send comments to OMB at the Office of Information and Regulatory Affairs, Office of Management and Budget, 725 17th Street, NW., Washington, DC 20503, Attention: Desk Office for EPA. Since OMB is required to make a decision concerning the ICR between 30 and 60 days after June 21, 2010, a comment to OMB is best assured of having its full effect if OMB receives it by July 21, 2010. The final rule will respond to any OMB or public comments on the information collection requirements contained in this proposal.

C. Regulatory Flexibility Act

The Regulatory Flexibility Act (RFA) generally requires an Agency to prepare a regulatory flexibility analysis of any rule subject to notice and comment rulemaking requirements under the Administrative Procedure Act or any other statute unless the Agency certifies that the rule will not have a significant economic impact on a substantial number of small entities. Small entities include small businesses, small organizations, and small governmental jurisdictions.

For purposes of assessing the impacts of today's rule on small entities in the electric utility industry, small entity is defined as: (1) A small fossil fuel electric utility plant as defined by NAICS code 221112 with a threshold of less than four million megawatt-hours of electricity output generated per year (based on Small Business Administration size standards); (2) a small governmental jurisdiction that is a government based on municipalities with a population of less than 50,000; and (3) a small organization that is any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.

EPA certifies that this action will not have a significant economic impact on a substantial number of small entities (*i.e.,* no SISNOSE). EPA nonetheless continues to be interested in the potential impacts of the proposed rule on small entities and welcomes comments on issues related to such impacts, including our estimated count of small entities that own the 495 electric utility plants covered by this rule. This certification is based on the small business analysis contained in the RIA for today's proposal, which contains the following findings and estimates.

- The RIA identifies 495 electric utility plants likely affected by the proposed rule, based on 2007 data. The RIA estimates these 495 plants are owned by 200 entities consisting of 121 companies, 18 cooperative organizations, 60 state or local governmental jurisdictions, and one Federal government Agency. The RIA estimates that 51 of these 200 owner entities (*i.e.,* 26%) may be classified as small entities, consisting of 33 small municipal governments, 11 small companies, 6 small cooperatives, plus 1 small county government.
- The RIA includes a set of higher cost estimates for the regulatory options and the RFA evaluation is based on these estimates and therefore overestimates potential impacts of our proposed regulations. The RIA estimated that (a) None of the 51 small entities may experience average annualized regulatory compliance costs of greater than three percent of annual revenues, (b) one to five of the 51 small entities (*i.e.,* 2% to 10%) may experience regulatory costs greater than one percent of annual revenues, and (c) 46 to 50 of the small entities (*i.e.,* 90% to 98%) may experience regulatory costs less than one percent of annual revenues. These percentages constitute the basis for today's no-SISNOSE certification.

As analyzed in the RIA, there are two electricity market factors which may be expected to reduce or eliminate these potential revenue impacts on small entities, as well as for the other owner entities for the 495 plants:

- Electric utility plants have a mechanism to cover operating cost increases via rate hike petitions to public utility commissions in states which regulate public utilities, and via market price increases in the 18 states (as of 2008) which have de-regulated electric utilities, and
- The residential, commercial, industrial, and transportation sector economic demand for (*i.e.,* consumption of) electricity is relatively price inelastic, which suggests that electric utility plants may succeed in passing through most or all regulatory costs to their electricity customers.

However, because the Agency is sensitive to any potential impacts its regulations may have on small entities, the Agency requests comment on its analysis, and its finding that this action is not expected to have a significant economic impact on a substantial number of small entities.

D. Unfunded Mandates Reform Act

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA), 2 U.S.C. 1531–1538, requires Federal agencies, unless otherwise prohibited by law, to assess the effects of their regulatory actions on State, local, and tribal governments and the private sector. This co-proposal contains a Federal mandate that may result in expenditures of $100 million or more for State, local, and tribal governments, in the aggregate, or for the private sector, in any one year.

The RIA includes a set of higher cost estimates for the regulatory options and the UMRA evaluation is based on these estimates and therefore overestimates the potential impacts of this co-proposal. Accordingly, EPA has prepared under section 202 of the UMRA a "Written Statement" (an appendix to the RIA) which is summarized below. Today's co-proposal will likely affect 495 electric utility plants owned by an estimated 200 entities, of which 139 private sector electric utility companies and cooperatives may incur between $415 million to $1,999 million in future annual direct costs across the high-end options in the RIA, which exceed the $100 million UMRA direct cost threshold under each of the regulatory options. In addition, 60 entities are state or local governments which may incur between $56 million to $97 million in future annual direct costs across the regulatory options, the upper-end of which is slightly under the $100 million UMRA direct cost threshold. The remainder single entity is a Federal government Agency (*i.e.,* Tennessee Valley Authority).

Although the estimated annual direct cost on state or local governments is less than the $100 million UMRA threshold, (a) because the highest-cost regulatory option is only 3% less than the $100 million annual direct cost threshold, and (b) because there are a number of uncertainty factors (as identified in the RIA) which could result in regulatory costs being lower or higher than estimated, EPA consulted with small governments according to EPA's UMRA interim small government consultation plan developed pursuant to section 203 of the UMRA. EPA's interim plan provides for two types of possible small government input: technical input and administrative input. According to this plan, and consistent with section 204 of the UMRA, early in the process for developing today's co-proposal, the Agency implemented a small government consultation process consisting of two consultation components.

- A series of meetings in calendar year 2009 were held with the purpose of acquiring small government technical input, including: (1) A February 27 meeting with ASTSWMO's Coal Ash Workgroup (Washington, DC); (2) a March 22–24 meeting with ECOS at their Spring Meeting (Alexandria VA); (3) a April 15–16 meeting with ASTSWMO at their Mid-Year Meeting (Columbus OH), (4) a May 12–13 meeting at the EPA Region IV State Directors Meeting (Atlanta, GA), (5) a June 17–18 meeting at the ASTSWMO Solid Waste Managers Conference (New Orleans, LA), (6) a July 21–23 meeting at ASTSWMO's Board of Directors Meeting (Seattle, WA), and (7) an August 12 meeting at ASTSWMO's Hazardous Waste Subcommittee Meeting (Washington, DC). ASTSWMO is an organization with a mission to work closely with EPA to ensure that its state government members are aware of the most current developments related to their state waste management programs. ECOS is a national non-profit, non-partisan association of state and territorial environmental Agency leaders. As a result of these meetings, EPA received letters in mid-2009 from 22 state governments, as well as a letter from ASTSWMO expressing their stance on CCR disposal regulatory options.

Letters were mailed on August 24, 2009 to the following 10 organizations representing state and local elected officials, to inform them and seek their input for today's proposed rulemaking, as well as to invite them to a meeting held on September 16, 2009 in Washington, DC: (1) National Governors Association; (2) National Conference of State Legislatures, (3) Council of State Governments, (4) National League of Cities, (5) U.S. Conference of Mayors, (6) County Executives of America, (7) National Association of Counties, (8) International City/County Management Association, (9) National Association of Towns and Townships, and (10) ECOS. These 10 organizations of elected state and local officials are identified in EPA's November 2008 Federalism guidance as the "Big 10" organizations appropriate to contact for purpose of consultation with elected officials. EPA has received written comments from a number of these organizations and a copy of their comments has been placed in the docket for this rulemaking. The commenters express significant concerns with classifying CCRs as a hazardous waste. Their major concerns are that federal regulation could undercut or be duplicative of State regulations; that any federal regulation will have a great impact on already limited State resources; and that such a rule would have a negative effect on beneficial use. A number of commenters also raise the issue of the cost to their facilities of a subtitle C rule, particularly increased disposal costs and the potential shortage of hazardous waste disposal capacity.

Consistent with section 205 of UMRA, EPA identified and considered a reasonable number of regulatory alternatives. Today's proposed rule identifies a number of regulatory options, and EPA's RIA estimates that the average annual direct cost to industry across the three originally considered options (*e.g.* as reflected in the RIA in Exhibit 7L) may range between $415 million to $1,999 million. Section 205 of the UMRA requires Federal agencies to select the least costly or most cost-effective regulatory alternative unless the Agency publishes with the final rule an explanation of why such alternative was not adopted. We are co-proposing two regulatory options in today's notice involving RCRA subtitle C "special waste" and subtitle D. The justification for co-proposing the higher-cost options is that this provides for greater benefits and protection of public health and the environment by phasing out surface impoundments, compared to the lower cost subtitle D prime option.

E. Executive Order 13132: Federalism

Executive Order 13132, entitled "Federalism" (64 FR 43255, August 10, 1999), requires EPA to develop an accountable process to ensure "meaningful and timely input by State and local officials in the development of regulatory policies that have federalism implications." "Policies that have federalism implications" are defined in the Executive Order to include regulations that have "substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government."

Under Executive Order 13132, EPA may not issue a regulation that has federalism implications, that imposes substantial direct compliance costs, and that is not required by statute, unless the Federal government provides the funds necessary to pay the direct compliance costs incurred by State and local governments, or EPA consults with State and local officials early in the process of developing the proposed regulation.

EPA has concluded that this proposed rule may have federalism implications, because it may impose substantial direct compliance costs on State or local governments, and the Federal government may not provide the funds necessary to pay those costs. Accordingly, EPA provides the following federalism summary impact statement as required by section 6(b) of Executive Order 13132.

The RIA includes a set of higher cost estimates for the regulatory options and the Federalism evaluation is based on these estimates and, therefore, overestimates the potential impacts of our proposal.

Based on the estimates in EPA's RIA for today's action, the proposed regulatory options, if promulgated, may have federalism implications because the options may impose between $56 million to $97 million in annual direct compliance costs on 60 state or local governments. These 60 state and local governments consist of 33 small municipal government jurisdictions, 19 non-small municipal government jurisdictions, 7 state government jurisdictions, and one county government jurisdiction. In addition, the 48 state governments with RCRA-authorized programs for the proposed regulatory options may incur between $0.05 million to over $5.4 million in added annual administrative costs involving the 495 electric utility plants for reviewing and enforcing the various requirements. Based on these estimates, the expected annual cost to state and local governments for at least one of the regulatory options described in today's notice exceeds the $25 million per year "substantial compliance cost" threshold defined in section 1.2(A)(1) of EPA's November 2008 "Guidance on Executive Order 13132: Federalism." In developing the regulatory options described in today's notice, EPA consulted with 10 national organizations representing state and local elected officials to ensure meaningful and timely input by state/local governments, consisting of two consultation components, which is described under the UMRA Executive Order discussion.

In the spirit of Executive Order 13132, and consistent with EPA policy to promote communications between EPA and State and local governments, EPA specifically solicits comment on this co-proposal from elected State and local government officials.

F. Executive Order 13175: Consultation and Coordination With Indian Tribal Governments

Executive Order 13175 (65 FR 67249–67252, November 9, 2000) requires Federal agencies to provide funds to tribes, consult with tribes, and to conduct a tribal summary impact statement, for regulations and other actions which are expected to impose substantial direct compliance costs on one or more Indian tribal governments. Today's co-proposal, whether under subtitle C or subtitle D authority, is likely to impose direct compliance costs on an estimated 495 coal-fired electric utility plants. This estimated plant count is based on operating plants according to the most recent (2007) data available as of mid-2009 from the DOE's Energy Information Administration "Existing Generating Units in the United States by State, Company and Plant 2007." Based on information published by the Center for Media and Democracy,[171] three of the 495 plants are located on tribal lands, but are not owned by tribal governments: (1) Navajo Generating Station in Coconino County, Arizona owned by the Salt River Project; (2) Bonanza Power Plant in Uintah County, Utah owned by the Deseret Generation and Transmission Cooperative; and (3) Four Corners Power Plant in San Juan County, New Mexico owned by the Arizona Public Service Company. The Navajo Generating Station and the Four Corners Power Plant are on lands belonging to the Navajo Nation, while the Bonanza Power Plant is located on the Uintah and Ouray Reservation of the Ute Indian Tribe. According to this same information source, there is one additional coal-fired electric utility plant planned for construction on Navajo Nation tribal land near Farmington, New Mexico, but to be owned by a non-tribal entity (the Desert Rock Energy Facility to be owned by the Desert Rock Energy Company, a Sithe Global Power subsidiary). Because none of the 495 plants are owned by tribal governments, this action does not have tribal implications as specified in Executive Order 13175. Thus, Executive Order 13175 does not apply to this action. EPA solicits comment on the accuracy of the information used for this determination. EPA met with a Tribal President, whose Tribe owns a cement plant, and who was concerned about the adverse impact of designating coal combustion residuals as a hazardous waste and the effect that a hazardous waste designation would have on the plant's business. We assured the Tribal President that we are aware of the "stigma" concerns related to a hazardous waste listing and will be analyzing that issue throughout the rulemaking process.

G. Executive Order 13045: Protection of Children From Environmental Health & Safety Risks

Executive Order (EO) 13045 (62 FR 19885, April 23, 1997) establishes federal executive policy on children's health and safety risks. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children in the United States. EPA has conducted a risk assessment which includes evaluation of child exposure scenarios, as well as has evaluated Census child population data surrounding the 495 plants affected by today's co-proposal, because today's action meets both of the two criteria for "covered regulatory actions" defined by Section 2–202 of EO 13045: (a) today's co-proposal is expected to be an "economically significant" regulatory action as defined by EO 12866, and (b) based on the risk analysis discussed elsewhere in today's notice, the environmental and safety hazards addressed by this action may have a disproportionate effect on children.

For each covered regulatory action, such as today's action, Section 5 of EO 13045 requires federal agencies (a) to evaluate the environmental health or safety effects of the planned regulation on children, and (b) to explain why the planned regulation is preferable to other potentially effective and reasonably feasible alternatives considered by the Agency. The remainder of this section below addresses both of these requirements, as well as presents a summary of the human health risk assessment findings with respect to child exposure scenarios, and the results of the child demographic data evaluation.

G1. Evaluation of Environmental Health and Safety Effects on Children

EPA conducted a risk evaluation consisting of two steps, focusing on environmental and health effects to adults and to children that may occur due to groundwater contamination. The first step, conducted in 2002, was a screening effort targeting selected hazardous chemical constituents that appeared to be the most likely to pose risks. The second step, conducted between 2003 and 2009, consisted of more detailed "probabilistic" modeling for those constituents identified in the screening as needing further evaluation. Constituents that may cause either cancer or non-cancer effects in humans (*i.e.,* both adults and children) were evaluated under modeling scenarios where they migrate from a CCR landfill or surface impoundment toward a drinking water well or nearby surface water body, and where humans ingest the constituents either by drinking the contaminated groundwater or by eating fish caught in surface water bodies affected by the contaminated groundwater.

As described elsewhere in today's notice, EPA found that for the non-cancer health effects in the groundwater-to-drinking-water pathway and in the fish consumption pathways evaluated in the probabilistic modeling, children rather than adults had the higher exposures. This result stems from the fact that while at a given exposure point (*e.g.,* a drinking water well located a certain distance and direction down-gradient from the landfill or surface impoundment), the modeled groundwater concentration is the same regardless of whether the receptor is an adult or a child. Thus the other variables in the exposure equations (that relate drinking water intakes or fish consumption rates and body weight to a daily "dose" of the constituent) mean that, on a per-kilogram-body-weight basis, children are exposed to higher levels of constituents than adults.

G2. Evaluation of Children's Population Census Data Surrounding Affected Electric Utility Plants

The RIA for today's co-proposal contains an evaluation of whether children may disproportionately live near the 495 electric utility plants potentially affected by this rulemaking. This demographic data analysis is supplemental to and separate from the risk assessment summarized above. To make this determination, the RIA compares Census demographic data on child populations residing near each of the 495 affected plants, to statewide children population data. The results of that evaluation are summarized here.

- Of the 495 electric utility plants, 383 of the plants (77%) operate CCR disposal units on-site (*i.e.,* onsite landfills or onsite surface

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[171] The Center for Media and Democracy (CMD) was founded in 1993 as an independent, non-profit, non-partisan, public interest organization. Information about electric utility plants located on tribal lands is from CMD's SourceWatch Encyclopedia at: *http://www.sourcewatch.org/index.php?title=Coal_and_Native_American_tribal_lands.*

impoundments), 84 electric utility plants solely transport CCRs to offsite disposal units operated by other companies (*e.g.*, commercial waste management companies), and 28 other electric utility plants generate CCRs that are solely beneficially used rather than disposed. Child demographic data is evaluated in the RIA for all 495 plants because some regulatory options could affect the future CCR management method (*i.e.*, disposal versus beneficial use) for some plants.

- The RIA provides three complementary approaches to comparison of child populations surrounding the 495 plants to statewide child population data: (a) Plant-by-plant comparison basis, (b) state-by-state aggregation comparison basis, and (c) nationwide total comparison basis. There are year 2000 Census data for 464 (94%) of the 495 electric utility plants which the RIA used for these comparisons and extrapolated to all 495 plants. Statewide children population benchmark percentages range from 21.5% (Maine) to 30.9% (Utah), with a nationwide average of 24.7%.
- For purpose of determining the relative degree by which children may exceed these statewide percentages, the percentages are not only compared in absolute terms, but also compared as a numerical ratio whereby a ratio of 1.00 indicates that the child population percentage living near an electric utility plant is equal to the statewide average, a ratio greater than 1.00 indicates the child population percentage near the electric utility plant is higher than the statewide population, and a ratio less than 1.00 indicates the child population is less than the respective statewide average.
- Using the plant-by-plant basis, 310 electric utility plants (63%) have surrounding child populations which exceed their statewide children benchmark percentages, whereas 185 of the electric utility plants (37%) have children populations below their statewide benchmarks, which represents a ratio of 1.68 (*i.e.*, 310/185). Since this ratio is much greater than 1.00, this finding indicates that a disproportionate number of electric utility plants have surrounding child population percentages which exceed their statewide benchmark. Using the state-by-state aggregation basis, 27 of the 47 states (57%) where the 495 electric utility plants are located have disproportionate percentages of children residing near the plants compared to the statewide averages, which also indicates a disproportionate surrounding child population. Using the nationwide aggregation basis across all 495 electric utility plants in all 47 states where the plants are located, 6.08 million people reside near these electric utility plants, including 1.54 million children (25.4%). Comparison of this percentage to the national aggregate benchmark across all states of 24.7% children yields a ratio of 1.03 (*i.e.*, 25.4%/24.7%). This ratio indicates a slightly higher disproportionate child population surrounding the 495 electric utility plants.

These three alternative comparisons indicate that the current (baseline) environmental and human health hazards and risks from electric utility CCR disposal units, and the expected future benefits of the regulatory options being considered in today's co-proposal may have a disproportionately higher effect on child populations.

The public is invited to submit comments or identify peer-reviewed studies and data that assess effects of early life exposure to CCRs managed in landfills and surface impoundments.

H. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This co-proposal, if either of the options being considered is promulgated, is not expected to be a "significant energy action" as defined in Executive Order 13211 (66 FR 28355, May 22, 2001), because the regulatory options described in today's co-proposal are not expected to have a significant adverse effect on the supply, distribution, or use of energy. This determination is based on the energy price analysis presented in EPA's Regulatory Impact Analysis (RIA) for this proposed rule. The following is the basis for this conclusion.

The Office of Management and Budget's (OMB) July 13, 2001 Memorandum M–01–27 guidance for implementing this Executive Order identifies nine numerical indicators (thresholds) of potential adverse energy effects, three of which are relevant for evaluating potential energy effects of this proposed rule: (a) Increases in the cost of energy production in excess of 1%; (b) increases in the cost of energy distribution in excess of 1%; or (c) other similarly adverse outcomes.

Because EPA does not have data on energy production costs or energy distribution costs for the 495 electric utility plants likely affected by this rulemaking, EPA in its RIA for today's action evaluated the potential impact on electricity prices (for the regulatory options) as measured relative to the 1% numerical threshold of these two Executive Order indicators to represent an "other similarly adverse outcome."

The RIA calculated the potential increase in electricity prices of affected plants that the industry might induce under each regulatory option. Because the price analysis in the RIA is based only on the 495 coal-fired electric utility plants that would likely be affected by the co-proposal (with 333,500 megawatts nameplate capacity), rather than on all electric utility and independent electricity producer plants in each state using other fuels, such as natural gas, nuclear, hydroelectric, etc. (with 678,200 megawatts nameplate capacity), the price effects estimated in the RIA are higher than would be if the regulatory costs were averaged over the entire electric utility and independent electricity producer supply (totaling 1,011,700 megawatts, not counting an additional 76,100 megawatts of combined heat and electricity producers).

The price effect calculation in the RIA involved estimating plant-by-plant annual revenues, plant-by-plant average annualized regulatory compliance costs for each regulatory option, and comparison with statewide average electricity prices for the 495 electric utility plants. In its analysis, the Agency used the May 2009 statewide average retail prices for electricity published by DOE's, Energy Information Administration; these costs ranged from $0.0620 (Idaho & Wyoming) to $0.1892 (Hawaii) per kilowatt-hour, and the nationwide average for the 495 plants was $0.0884. Based on a 100% regulatory cost pass-thru scenario representing an upper-bound potential electricity price increase for each plant, the RIA estimated the potential target electricity sales revenue needed to cover these costs for each plant. The RIA then compared the higher target revenue to recent annual revenue estimates per plant, to calculate the potential price effect of this cost pass-thru scenario on electricity prices for each of the 495 electric utility plants, as well as on a state-by-state sub-total basis and on a nationwide basis across all 495 electric utility plants.

The RIA includes a set of higher cost estimates for the regulatory options and this Executive Order 13211 evaluation is based on the higher estimates and, therefore, overestimates the potential impacts of our proposal.

The RIA indicates that on a nationwide basis for all 495 electric utility plants, compared to the estimated average electricity price of $0.0884 per kilowatt-hour, the 100% regulatory cost pass-thru scenario may increase prices for the 495 electric utility plants by 0.172% to 0.795% across the original regulatory options; the high-end is the estimate associated with a regulatory cost pass-thru scenario increase for the 495 electric utility plants for the subtitle C "special waste" option. Based on this analysis, the Agency does not expect that either of the options being co-proposed today would have a significant adverse effect on the supply, distribution, or use of energy. However, the Agency solicits comments on our analysis and findings.

I. National Technology Transfer and Advancement Act

Section 12(d) of the National Technology Transfer and Advancement Act of 1995 ("NTTAA"), Public Law No. 104–113, 12(d) (15 U.S.C. 272 note) directs EPA to use voluntary consensus standards in its regulatory activities unless to do so would be inconsistent with applicable law or otherwise impractical. Voluntary consensus standards are technical standards (*e.g.*, materials specifications, test methods, sampling procedures, and business practices) that are developed or adopted by voluntary consensus standards bodies. NTTAA directs EPA to provide Congress, through OMB, explanations when the Agency decides not to use available and applicable voluntary consensus standards.

This proposed rulemaking does not involve technical standards. Therefore, EPA is not considering the use of any voluntary consensus standards.

J. Executive Order 12898: Federal Actions To Address Environmental Justice in Minority Populations and Low-Income Populations

Executive Order (EO) 12898 (59 FR 7629, February 16, 1994) establishes federal executive policy on environmental justice. Its main provision directs federal agencies, to the greatest extent practicable and permitted by law, to make environmental justice part of their mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of their programs, policies, and activities on minority populations and low-income (*i.e.*, below poverty line) populations in the United States.

Furthermore, Section 3–302(b) of EO 12898 states that Federal agencies, whenever practicable and appropriate, shall collect, maintain and analyze information on minority and low-income populations for areas surrounding facilities or sites expected to have substantial environmental, human health, or economic effects on the surrounding populations, when such facilities or sites become the subject of a substantial Federal environmental administrative or judicial action. While EO 12898 does not establish quantitative thresholds for this "substantial effect" criterion, EPA has collected and analyzed population data for today's co-proposal because of the substantial hazards and adverse risks to the environment and human health described elsewhere in today's notice.

The RIA for today's action presents comparisons of minority and low-income population Census data for each of the 495 electric utility plant locations, to respective statewide population data, in order to identify whether these two demographic groups may disproportionately reside near electric utility plants. The result of these comparisons indicate (a) whether existing hazards associated with CCR disposal at electric utility plants to community safety, human health, and the environment may disproportionately affect minority and low-income populations surrounding the plants, and (b) whether the expected effects (*i.e.*, benefits and costs) of the regulatory action described in today's co-proposal rule may disproportionately affect minority and low-income populations.

Of the 495 electric utility plants, 383 of the plants (77%) operate CCR disposal units onsite (*i.e.*, onsite landfills or onsite surface impoundments), 84 electric utility plants solely transport CCRs to offsite disposal units operated by other companies (*e.g.*, commercial waste management companies), and 28 of the electric utility plants generate CCRs that are solely beneficially used rather than disposed. The minority and low-income Census data evaluation is conducted for all 495 plants because some regulatory options could affect the future CCR management method (*i.e.*, disposal versus beneficial use) for some plants.

In addition to this Census data evaluation, the RIA identifies three other possible affects of the co-proposal on (a) populations surrounding offsite CCR landfills, (b) populations surrounding the potential siting of new CCR landfills and (c) populations within the customer service areas of the 495 electric utility plants who may incur electricity price increases resulting from regulatory cost pass-thru. These three Census data evaluations are also summarized below.

J.1. Findings of Environmental Justice Analysis for Electric Utility Plants

For the first comparison, the RIA provides three complementary approaches to evaluating the Census data on minority and low-income populations: (a) Itemized plant-by-plant comparisons to statewide percentages, (b) state-by-state aggregation comparisons, and (c) nationwide aggregate comparisons. There are year 2000 Census data for 464 (94%) of the 495 electric utility plants which the RIA used for these comparisons and extrapolated to all 495 plants. Statewide minority population benchmark percentages range from 3.1% (Maine) to 75.7% (Hawaii), with a nationwide average of 24.9%, and statewide low-income population percentages range from 7.3% (Maryland) to 19.3% (New Mexico), with a nationwide average of 11.9%.

For purpose of determining the relative degree by which either group may exceed these statewide percentages, in addition to a comparison of absolute percentages, the percentages are compared as a numerical ratio whereby a ratio of 1.00 indicates that the group population percentage living near an electric utility plant is equal to the statewide average, a ratio greater than 1.00 indicates the group population percentage near the electric utility plant is higher than the statewide population, and a ratio less than 1.00 indicates the group population is less than the respective statewide average.

Using the plant-by-plant comparison, 138 electric utility plants (28%) have surrounding minority populations which exceed their statewide minority benchmark percentages, whereas 357 of the electric utility plants (72%) have minority populations below their statewide benchmarks, which represents a ratio of 0.39 (*i.e.*, 138/357). Because this ratio is less than 1.00, this finding indicates a relatively small number of the electric utility plants have surrounding minority population percentages which disproportionately exceed their statewide benchmarks. On a plant zip code tabulation area basis, 256 electric utility plants (52%) have surrounding low-income populations which exceed their respective statewide benchmarks, whereas 239 plants (48%) have surrounding low-income populations below their statewide benchmarks, which represents a ratio of 1.07 (*i.e.*, 256/239). Because this ratio is above 1.00, it indicates that a slightly disproportionate higher number of electric utility plants have surrounding low-income population percentages which exceed their statewide benchmarks.

Using the state-by-state aggregation comparison, the percentages of minority and low-income populations surrounding the plants were compared to their respective statewide population benchmarks. From this analysis, state ratios revealed that 24 of the 47 states

(51%) have higher minority percentages, and 29 of the 47 states (62%) have higher low-income percentages surrounding the 495 electric utility plants, suggesting a slightly disproportionate higher minority surrounding population and a higher disproportionate, higher low-income surrounding population. However, in comparison to the other two numerical comparisons—the plant-by-plant basis and the nationwide aggregation basis, this approach does not include numerically weighting of state plant counts or state surrounding populations, which explains why this comparison method yields a different numerical result.

Using the nationwide aggregation comparison across all 495 electric utility plants in all 47 states where the plants are located, 6.08 million people reside near these plants, including 1.32 million (21.7%) minority and 0.8 million (12.9%) low-income persons. A comparison of these percentages to the national benchmark of 24.9% minority and 11.9% low-income, represents a minority ratio of 0.87 (*i.e.,* 21.7%/24.9%) and a low-income ratio of 1.08 (*i.e.,* 12.9%/11.9%). These nationwide aggregate ratios indicate a disproportionately lower minority population surrounding the 495 electric utility plants, and a disproportionately higher low-income population surrounding these plants.

These demographic data comparisons indicate that the current (baseline) environmental and human health hazards and risks from electric utility CCR disposal units, and the expected future effects (*i.e.,* benefits and costs) of the regulatory options described in today's co-proposal may have a disproportionately lower effect on minority populations and may have a disproportionately higher effect on low-income populations.

J.2. Environmental Justice Analysis for Offsite Landfills, Siting of New Landfills, and Electricity Service Area Customers

There are three other potential differential effects of the regulatory options on three other population groups: (a) Populations surrounding offsite landfills, (b) populations surrounding the potential siting of new landfills and (c) populations within the customer service areas of the 495 electric utility plants. The RIA for today's notice does not quantify these potential effects so only a qualitative discussion appears below.

The potential effect on offsite landfills as evaluated in the RIA only involves the RCRA subtitle C "special waste" based regulatory option described in today's co-proposal, whereby electric utility plants may switch the management of CCRs, in whole or in part, from current onsite disposal to offsite commercial RCRA-permitted landfills. In addition, some or all of the CCRs which are currently disposed in offsite landfills that do not have RCRA operating permits may also switch to RCRA-permitted commercial landfills. Another fraction of annual CCR generation which could also switch to offsite commercial RCRA-permitted landfills are CCRs which are currently supplied for industrial beneficial use applications if such use is curtailed.

The future addition of any or all of these three fractions of CCR generation to offsite commercial hazardous waste landfills could exceed their capacity considering that a much smaller quantity of about 2 million tons per year of existing RCRA-regulated hazardous waste is currently disposed of in RCRA subtitle C permitted landfills in the U.S. As of 2009, there are 19 commercial landfills with RCRA hazardous waste permits to receive and dispose of RCRA-regulated hazardous wastes located in 15 states (AL, CA, CO, ID, IL, IN, LA, MI, NV, NY, OH, OK, OR, TX, UT). This potential shift could have a disproportionate effect on populations surrounding these locations, and in particular, minority and low-income populations surrounding commercial hazardous waste facilities, for the reason that a recent (2007) study determined that minority and low-income populations disproportionately live near commercial hazardous waste facilities. However, the study included other types of commercial hazardous waste treatment and disposal facilities in addition to commercial hazardous waste landfills.

The siting of new landfills is another potential effect due to possible changes in the management of CCRs, especially if the switch to offsite commercial hazardous waste landfills causes a capacity shortage (as described above) under subtitle C option. However, since it is unknown where these new landfills might possibly be sited, two possibilities were examined: (a) An expansion of existing commercial subtitle C landfills offsite from electric utility plants, and (b) an expansion of existing electric utility plant onsite landfills. If an expansion of existing commercial subtitle C landfills were to occur, this potential shift could have a disproportionate effect on populations surrounding these locations, as described previously.

The other possibility is the expansion of electric utility plant onsite landfills. That is, these landfills become permitted under RCRA subtitle C and expand existing onsite landfills or build new ones onsite. If this were to occur, the environmental justice impacts could be similar to the demographic comparison findings previously discussed, which indicates that the current environmental and human health hazards and risks from electric utility CCR disposal units, and the expected future effects (*i.e.,* benefits and costs) of the regulatory options, may have a disproportionately lower effect on minority populations, but may have a disproportionately higher effect on low-income populations.

A third potential effect of the regulatory options described in today's notice is the increase in price of electricity supplied by some or all of the affected 495 electric utility plants to cover the cost of regulatory compliance (as evaluated in a previous section of today's notice). Thus, customers in electric utility service areas could experience price increases, as described above in the Federalism sub-section of today's notice. The RIA for today's action did not evaluate the demographics of the customer service area populations for the 495 electric utility plants.

Appendix to the Preamble: Documented Damages From CCR Management Practices

EPA has gathered or received through comments on the 1999 Report to Congress and the May 2000 Regulatory Determination, and through allegations, 135 possible damage cases. Six cases involved minefills and, therefore, are outside the scope of today's proposed rule. Sixty-two cases have not been further assessed because there was little or no supporting information to assess the allegations.

Of the remaining 67 cases, EPA determined that 24 were proven damage cases. Sixteen were determined to be proven damage cases to ground water and eight were determined to be proven damages cases to surface water, as a result of elevated levels of contaminants from CCRs.[172] Four of the proven ground water damage cases were from unlined landfills, five were from unlined surface impoundments, one

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[172] Of the 16 proven cases of damages to ground water, the Agency has been able to confirm that corrective action has been completed in seven cases and are ongoing in the remaining nine cases. Corrective action measures at these CCR management units vary depending on site specific circumstances and include formal closure of the unit, capping, re-grading of ash and the installation of liners over the ash, ground water treatment, groundwater monitoring, and combinations of these measures.

involved a surface impoundment for which it is not clear whether the unit was lined, and the remaining six were from unlined sand and gravel pits. Another 43 alleged cases were determined to be potential damage cases to ground water or surface water. However, four of these potential damage cases were attributable to oil combustion wastes, which are outside the scope of this notice. Therefore, we have determined that there were a total of 40 potential damage cases attributable to CCRs. (The concern with wastes from the combustion of oil involved unlined surface impoundments. Prior to the May 2000 Regulatory Determination, the unlined oil ash impoundments were closed, and thus EPA decided regulatory action to address oil ash was unnecessary.) These cases are discussed in more detail in the document "Coal Combustion Wastes Damage Case Assessments" available in the docket to the 2007 NODA at *http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&d=EPA-HQ-RCRA-2006-0796-0015*. Three proven damage cases are sites that have been listed on EPA's National Priorities List (NPL). The sites, and links to additional information are: (1) Chisman Creek, Virginia (*http://www.epa.gov/reg3hwmd/npl/VAD980712913.htm*), (2) Salem Acres, Massachusetts (*http://yosemite.epa.gov/r1/npl_pad.nsf/f52fa5c31fa8f5c885256adc0050b631/C8A4A5BEC0121F048525691F0063F6F3?OpenDocument*), and (3) U.S. Department of Energy Oak Ridge Reservation, Tennessee (*http://www.epa.gov/region4/waste/npl/npltn/oakridtn.htm*). One potential damage case has also been listed on the NPL: Lemberger Landfill, Wisconsin (*http://www.epa.gov/region5/superfund/npl/wisconsin/WID980901243.htm*). Another site has undergone remediation under EPA enforcement action: Town of Pines (*http://cfpub.epa.gov/supercpad/cursites/cactinfo.cfm?id=0508071*).

In response to the 2007 NODA (*see* section II. A.), EPA received information on 21 alleged damage cases. Of these, 18 pertain to alleged violations of state solid waste permits, and 3 to alleged violations of NPDES permits. Upon review of this information, we conclude that 13 of the alleged RCRA violations are new, and one of the alleged NPDES violations is new; the other damage cases have previously been submitted to EPA and evaluated. In addition, five new alleged damage cases have been brought to EPA's attention since February 2005 (the closure date of damage cases assessed by the NODA's companion documents). For the most part, these cases involve activities that are different from the prior damage cases and the focus of the regulatory determination on groundwater contamination from landfills and surface impoundments. Specifically:

○ Two of the new alleged cases involve the structural failure of surface impoundments; *i.e.*, dam safety and structural integrity issues, which were not a consideration at the time of the May 2000 Regulatory Determination. In both cases, there were Clean Water Act violations.

○ One other alleged case involves the failure of an old discharge pipe, and is clearly a regulated NPDES permit issue.

○ Two other alleged cases involve the use of coal ash in large scale structural fill operations, one of which involves an unlined sand and gravel pit. The Agency is considering whether to regulate this method of disposal as a landfill or whether to address the issue separately as part of its rulemaking to address minefilling. EPA is soliciting comments on those alternatives.

The Agency has classified three of the five new cases as proven damage cases (BBBS Sand and Gravel Quarries, Martins Creek Power Plant, TVA Kingston Power Plant), one as a potential damage case (Battlefield Golf Course), and the other as not being a damage case under RCRA (TVA Widows Creek). Several of the recently submitted damage cases are discussed briefly below. The following descriptions further illustrate that there are additional risk concerns (dam safety, and fill operations) which EPA did not evaluate when it completed its the May 2000 Regulatory Determination, in which EPA primarily was concerned with groundwater contamination associated with landfills and surface impoundments and the beneficial use of CCRs. Additional information on these damage cases is included in the docket.

Recent Cases

BBBS Sand and Gravel Quarries—Gambrills, Maryland

On October 1, 2007, the Maryland Department of the Environment (MDE) filed a consent order in Anne Arundel County, Maryland Circuit Court to settle an environmental enforcement action that was taken against the owner of a sand and gravel quarry and the owner of coal fired power plants (defendants) for contamination of public drinking water wells in the vicinity of the sand and gravel quarry.

Specifically, beginning in 1995, the defendants used fly ash and bottom ash from two Maryland power plants to fill excavated portions of two sand and gravel quarries. Ground water samples collected in 2006 and 2007 from residential drinking water wells near the site indicated that, in certain locations, contaminants, including heavy metals and sulfates were present at or above ground water quality standards. The Anne Arundel County, Maryland Department of Health tested private wells in 83 homes and businesses in areas around the disposal site. MCLs were exceeded in 34 wells [arsenic (1), beryllium (1), cadmium (6), lead (20),[173] and thallium (6)]. The actual number of wells affected by fly ash and bottom ash is undetermined since some of the sample results may reflect natural minerals in the area. SMCLs were exceeded in 63 wells [aluminum (44), manganese (14), and sulfate (5)]. MDE concluded that leachate from the placement of CCRs at the site resulted in the discharge of pollutants to waters of the state. Based on these findings, as well as an MDE consent order, EPA has concluded that the Gambrills site is a proven case of damage to ground water resulting from the placement of CCRs in unlined sand and gravel quarries.

Under the terms of the consent order, the defendants are required to pay a fine, remediate the ground water in the area and provide replacement water supplies for 40 properties. A retail development is now planned for the site with a cap over the fill designed to reduce infiltration and subsequent leaching from the site. An MDE fact sheet on this site is available at *http://www.mde.state.md.us/assets/document/AA_Fly_Ash_QA.pdf*.

Battlefield Golf Course—Chesapeake, Virginia

On July 16, 2008, the City of Chesapeake, Virginia sent a letter to the EPA Region III Regional Administrator requesting assistance to perform an assessment of the Battlefield Golf Course. The 216 acre site was contoured with 1.5 million cubic yards of fly ash, amended with 1.7% to 2.3% cement kiln dust to develop the golf course. Virginia's Administrative Code allowed the use of fly ash as fill material (considered a beneficial use under Virginia's Administrative Code) without a liner as long as the fly ash was placed at least two feet above groundwater and covered by an 18-inch soil cap.

Because of ground water contamination discovered at another site where fly ash was used, the City of

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[173] It is uncertain whether lead exceedances were due to CCRs or lead in plumbing and water holding tanks.

Chesapeake initiated a drinking water well sampling assessment at residences surrounding the golf course. Additionally, 13 monitoring points were installed around the site. No monitoring points were installed through the fly ash area to avoid creating an additional path of contaminant migration. EPA conducted a site investigation by reviewing analytical data from fly ash, soil, surface water, sediment, and groundwater sampling events completed in 2001, 2008 and 2009. The sampling results of the City of Chesapeake ground water and surface water sampling[174] indicated that the highest detections of metals occurred in monitoring wells located on the golf course property. The concentrations of arsenic, boron, chromium, copper, lead and vanadium detected in groundwater collected from on-site monitoring wells were considered to be significantly above background concentrations. Of these compounds, only boron has been detected in approximately 25 drinking water wells.

Although not a primary contaminant of concern, boron is suspected to be the leading indicator of fly ash migration. The highest level of boron reported in a residential well was 596 µg/L which was significantly below the health-based regional screening level for boron in tap water of 7,300 µg/L. Additionally, the secondary drinking water standard for manganese (0.05 mg/L) was exceeded in nine residential wells; however, the natural levels of both manganese and iron in the area's shallow aquifer are very high and, thus, it could not be ruled out that the elevated levels of manganese and iron are a result of the natural background levels of these two contaminants.

Metal contaminants were below MCLs and Safe Drinking Water Act (SDWA) action levels in all residential wells that EPA tested, except for lead. Lead has been detected during EPA sampling events above the action level of 15 µg/L in six residential wells. The lead in these wells, however, does not appear to come from the fly ash. Lead concentrations are lower in groundwater collected from monitoring wells on the golf course (1.1 to 1.6 µg/L) than in these residential wells; and lead concentrations in the fly ash are not higher than background concentrations of lead in soil.

The recently issued EPA Final Site Inspection Report[175] concluded that (i) Metal contaminants were below MCLs and Safe Drinking Water Act (SDWA) action levels in all residential wells that EPA tested; (2) the residential well data indicate that metals are not migrating from the fly ash to residential wells; and (iii) there are no adverse health effects expected from human exposure to surface water or sediments on the Battlefield Golf Course site as the metal concentrations were below the ATSDR standards for drinking water and soil. Additionally, the sediment samples in the ponds were below EPA Biological Technical Assistance Group screening levels and are not expected to pose a threat to ecological receptors. Based on these findings, EPA has categorized the Battlefield Golf Club site as a potential damage case, as there is a possibility that leaching could cause levels of toxic constituents to increase over time and that groundwater could become contaminated at off-site locations if due diligence is not practiced.

Martins Creek Power Plant—Martins Creek, Pennsylvania

In August 2005, a dam confining a 40 acre CCR surface impoundment in eastern Pennsylvania failed. The dam failure, a violation of the State's solid waste disposal permit, resulted in the discharge of 0.5 million cubic yards of coal-ash and contaminated water into the Oughoughton Creek and the Delaware River.

Ground-water monitoring results from approximately 20 on-site monitoring wells found selenium concentrations exceeding Pennsylvania's Statewide Health Standards and Federal primary drinking water standards. There was also one exceedance of the primary MCL for chromium and two exceedances of the secondary MCL for iron.

Surface water samples were also taken from a number of locations along the Delaware River upstream and downstream of the spill. Sampling began soon after the spill in August 2005 and continued through November 2005. Several samples exceeded the Federal Water Quality Criteria (WQC) for aluminum, copper, iron, manganese, and silver (*see http://www.epa.gov/waterscience/criteria/wqctable/index.html*). Four samples also exceeded the WQC for arsenic—three of which were taken near the outfall to the river. Lead, nickel and zinc were also detected above the WQC in samples taken near the outfall to the river. Sampling results are available from the Pennsylvania Department of Environmental Protection (PADEP) at *http://www.depweb.state.pa.us/northeastro/cwp/view.asp?a=1226&q=478264&northeastroNav=|*.

As a result of the exceedances of primary and secondary MCLs in on-site ground water, and exceedances of federal water quality criteria in off-site surface water, in addition to a PADEP consent order for clean up, the Agency considers this site to be a proven damage case.

TVA Kingston—Harriman, Tennessee

On December 22, 2008, a failure of the northeastern dike used to contain fly ash occurred at the dewatering area of the Tennessee Valley Authority's (TVA's) Kingston Fossil Plant in Harriman, Tennessee. Subsequently, approximately 5.4 million cubic yards of fly ash sludge was released over an approximately 300 acre area and into a branch of the Emory River. The ash slide disrupted power, ruptured a gas line, knocked one home off its foundation and damaged others. The state-issued NPDES permit requires that TVA properly operate and maintain all facilities and systems for collection and treatment, and expressly prohibits overflows of wastes to land or water from any portion of the collection, transmission, or treatment system other than through permitted outfalls. Therefore, the release was a violation of the NPDES permit. A root-cause analysis report developed for TVA, accessible at *http://www.tva.gov/kingston/rca/index.htm,* established that the dike failed because it was expanded by successive vertical additions, to a point where a thin, weak layer of fly ash ('slime') on which it had been founded, failed by sliding. Additional information on the TVA Kingston incident is available at *http://www.epa.gov/region4/kingston/index.html* and *http://www.tva.gov/kingston/*.

EPA joined TVA, the Tennessee Department of Environment and Conservation (TDEC), and other state and local agencies in a coordinated response. EPA provided oversight and technical advice to TVA, and conducted independent water sampling and air monitoring to evaluate public health and environmental threats.

Following the incident, EPA sampled the coal ash and residential soil to determine if the release posed an immediate threat to human health. Sampling results for the contaminated residential soil showed arsenic, cobalt, iron, and thallium levels above the residential Superfund soil screening levels.[176] Sampling results also showed

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[174] *Available at http://cityofchesapeake.net/services/citizen_info/battlefieldgolfclub/index.shtml.*

[175] *http://www.epa.gov/reg3hwmd/CurrentIssues/finalr-battlefield_golf_club_site/redacted_DTN_0978_Final_Battlefield_SI_Report.pdf.*

[176] Soil screening levels (SSLs) for contaminants in soil are used to identify sites needing further

average arsenic levels above the EPA Region 4 Residential Removal Action Level (RAL)[177] of 39 mg/L, but below EPA Region 4's Industrial RAL of 177 mg/L. All residential soil results were below the Residential RAL.

Shortly after the release, samples were also collected of untreated river water, which showed elevated levels of suspended ash and heavy metals known to be associated with coal ash. Nearly 800 surface water samples were taken by TVA and TDEC, ranging from two miles upstream of the release on the Emory River to approximately eight miles downstream on the Clinch River. Sampling results of untreated river water showed elevated levels of arsenic, cadmium, chromium, and lead just after the incident. This was also observed again after a heavy rainfall. In early January 2009, the Tennessee Wildlife Resources Agency (TWRA) issued a fish advisory stating that until further notice, fishing should be avoided in the lower section of the Emory River. TWRA plans to resample fish tissue on a semiannual basis and expects that the assessment of the impact of this release on wildlife resources and habitat will require repeated sampling and evaluation over the next three to five years.

Constituent concentrations measured in drinking water on December 23, 2008, near the intake of the Kingston Water Treatment Plant, located downstream of the release, were below federal MCLs for drinking water, with the exception of elevated thallium levels. Subsequent EPA testing on December 30, 2008, of samples at the same intake found that concentration levels for thallium had fallen below the MCL. Subsequent testing of treated drinking water from the Kingston Water Treatment Plant showed that the drinking water from the treatment plant met all federal drinking water standards.

Additionally, EPA and TDEC identified and sampled potentially impacted private wells that are used as a source for drinking water. More than 100 wells have been tested to date and all have met drinking water standards.

To address potential risks from windblown ash, TVA, under EPA oversight, began air monitoring for coarse and fine particles. EPA also conducted independent monitoring to validate TVA's findings. To date, all of the more than 25,000 air samples from this area have measured levels below the NAAQS for particulates.

On January 12, 2009, TDEC issued an order to TVA to, among other things, continue to implement measures to prevent the movement of contaminated materials into waters of the state and, where feasible, minimize further downstream migration of contaminated sediments.

Than on May 11, 2009, TVA agreed to clean up more than 5 million tons of coal ash spilled from its Kingston Fossil Fuel Plant under an administrative order and agreement on consent. TVA and EPA entered into the agreement under CERCLA. The order requires TVA to perform a thorough cleanup of coal ash from the Emory River and surrounding areas and EPA will oversee the removal. Based on the consent order, EPA has identified this site as a proven damage case.

TVA Widows Creek—Stevenson, Alabama

On Friday, January 9, 2009, a cap in an unused discharge pipe became dislodged, resulting in a discharge from an FGD pond at a Tennessee Valley Authority (TVA) coal-burning power plant in Stevenson, Alabama. FGD is a residual of a process that reduces sulfur dioxide emissions from coal-fired boilers Some 5,000 cubic yards of FGD material containing water and a mixture of predominantly gypsum and some fly ash, was released from the pond into Widows Creek which flows into the Tennessee River.[178] Information on the TVA Widows Creek incident is available at *http://www.epa.gov/region4/stevenson/index.html.*

EPA joined TVA and the Alabama Department of Environmental Management (ADEM) in a coordinated response. EPA is supporting the response by coordinating environmental sampling and monitoring response operations by TVA. EPA has also collected surface water samples from both Widows Creek and the Tennessee River to determine if there have been any environmental impacts. Samples have also been taken from the FGD pond to characterize the material that was released into the creek fully. The drinking water intake for Scottsboro, Alabama, about 20 miles downstream, has also been sampled.

EPA Region 4 has received final results of its independent environmental sampling activities for the TVA Widows Creek Fossil Plant FGD pond release. Specifically, the concentrations of metals, solids and nutrients detected in samples drawn from the drinking water intake for Scottsboro, Alabama, along with samples collected from two locations in Widows Creek and three other locations in the Tennessee River, are all below national primary drinking water standards and/or other health-based levels. The pH of all these samples also fell within the standard range and no oil or grease was detected in any of the samples.

Four waste samples and one water sample collected from the bank along the ditch connecting TVA's permitted discharge outfall and the Tennessee River, and from TVA's permitted discharge outfall showed elevated pH and elevated concentrations of metals, nutrients, and suspended and dissolved solids. However, because samples drawn downstream at the drinking water intake and from locations where individuals would likely come into contact with the water were below the primary drinking water standards, EPA does not expect the release to pose a threat to the public. On July 7, 2009, TVA issued a finding of no significant impact and final environmental assessment for the Gypsum Removal Project from Widows Creek.[179] Therefore, EPA has not classified the TVA Widows Creek fly ash release as a damage case.

Summary

In summary, as discussed above, the Agency has documented evidence of proven damages to ground water or surface water in 27 cases[180]—17 cases of damage to ground water, and ten cases of damage to surface water, including ecological damages in seven of the ten. Sixteen of the 17 proven damages to ground water involved disposal in unlined units (for the remaining unit, it is unclear whether a liner was present). We have also identified 40 cases of potential damage to ground water or surface water.[181] Another two cases were determined to be potential ecological damage cases. Finally, the more recently documented damage cases also provide evidence that current management practices can pose additional risks that EPA had not

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investigation. SSLs alone do not trigger the need for a response action or define "unacceptable" levels of contaminants in soil. Generally, at sites where contaminant concentrations fall below the SSLs, no further action or study is warranted under CERCLA. However, where contaminant concentrations equal or exceed the SSLs, further study or investigation, but not necessarily cleanup, is warranted.

[177] RALs are used to trigger time-critical removal actions.

[178] *http://www.tva.gov/emergency/wc_1-29-09.htm.*

[179] *http://www.tva.gov/environment/reports/widows_creek/wcf_gypsum_removal_fonsi.pdf.*

[180] The 24 cases identified in the Damage Cases Assessment report, plus Martin Creek, PA; Gambrills, MD; and Kingston/TVA, TN.

[181] The 39 cases of potential damages from CCR identified in the Damage Cases Assessment report (excludes the 4 damage cases from oil combustion wastes), plus the Battlefield Golf Course, Chesapeake, Virginia.

previously studied—that is, from catastrophic releases due to the structural failure of CCR surface impoundments.

TABLE OF EPA'S PROVEN DAMAGE CASES

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
Alliant Nelson Dewey Ash Landfill, WI.	Groundwater	Arsenic, Selenium, Sulfate, Boron, Flourine.	The LF [182] was originally constructed in the early 1960's as a series of settling basins for sluiced ash and permitted by the State in 1979.	*Scientific*—Although the boron standard was not health-based at the time of the exceedances, the boron levels reported for the facility would have exceeded the State's recently promulgated health-based ES for boron, and *Administrative*—The State required a groundwater investigation, and the facility took action to remediate groundwater contamination and prevent further contamination.
Dairyland Power E.J. Stoneman, WI.	Groundwater	Cadmium, Chromium, Sulfate, Manganese, Iron, Zinc.	Unlined SI [183], on permeable substrate, that managed ash, demineralizer regenerant, and sand filter backwash between the 1950'and 1987.	*Scientific*—Cadmium and chromium exceeded (health-based) primary MCLs, and contamination migrated to nearby, private drinking water wells, and *Administrative*—The State required closure of the facility.
WEPCO Cedar Sauk Ash Landfill/WEPCO, WI.	Groundwater	Selenium, Boron, Sulfate.	An abandoned sand and gravel pit that received CCW from the WEPCO Port Washington Power Plant from 1969 to 1979.	*Scientific*—Selenium in groundwater exceeded the (health-based) primary MCL, and there was clear evidence of vegetative damage, and *Administrative*—The State required remedial action.
WEPCO Highway 59 Landfill/We Energies 59, WI.	Groundwater	Arsenic, Boron, Chlorides, Iron, Manganese, Sulfate.	Located in an old sand and gravel pit that received fly ash and bottom ash between 1969 and 1978.	*Scientific*—Although the boron standard was not health-based at the time of the exceedances, the boron levels reported for the facility would have exceeded the State's recently promulgated health-based ES for boron; and contamination from the facility appears to have migrated to off-site private wells, and *Administrative*—As a result of the various PAL [184] and ES [185] exceedances, the State required a groundwater investigation.
WEPCO Port Washington Facility/ Druecker Quarry Fly Ash Site, WI.	Groundwater	Boron, Selenium	The power company placed 40–60 feet deep column of fly ash in a sand & gravel pit from 1948–1971. A well located ~250′ south of the old quarry was impacted.	*Scientific*—The off-site exceedance of a health-based standard for selenium.
SC Electric & Gas Canadys Plant, SC.	Groundwater	Arsenic, Nickel	Ash from the Canadys power plant was mixed with water and managed in a SI. The facility operated an unlined, 80-acre SI from 1974 to 1989.	*Scientific*—There are exceedances of the health-based standard for arsenic at this site. While there are no known human exposure points nearby, some recent exceedances have been detected outside an established regulatory boundary.
PEPCO Morgantown Generating Station Faulkner Off-site Disposal Facility, MD.	Groundwater	Iron, pH	LFs at this shallow groundwater site manage fly ash, bottom ash, and pyrites from the Morgantown Generating Station starting in 1970. Unlined settling ponds also are used at the site to manage stormwater runoff and leachate from the ash disposal area.	*Scientific*—Ground water contamination migrated off-site, and *Administrative*—The State required remedial action.

TABLE OF EPA'S PROVEN DAMAGE CASES—Continued

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
Don Frame Trucking, Inc., Fly Ash Landfill, NY.	Groundwater	Lead, Manganese	This LF has been used for disposal of fly ash, bottom ash, and other material including yard sweepings generated by the Niagara Mohawk Power Corporation's Dunkirk Steam Station. The age of the facility is unknown.	*Scientific*—The lead levels found in down-gradient wells exceed the primary MCL Action Level. *Administrative*—The State has required remedial action as a result of the contamination, and the owner was directed, by the Supreme Court of the State of New York County of Chautauqua (July 22, 1988), to cease receiving the aforementioned wastes at the facility no later than October 15, 1988.
Salem Acres, MA	Groundwater	Antimony, Arsenic, Manganese.	Fly ash disposal occurred at this site—a LF and SI, from at least 1952 to 1969.	*Scientific*—Arsenic and chromium exceeded (health-based) primary MCLs, and *Administrative*—The site was placed on the NPL list, and EPA signed a Consent Order with the owner to clean up the lagoons.
Vitale Fly Ash Pit, MA	Groundwater	Aluminum, Arsenic, Iron, Manganese, Selenium.	An abandoned gravel and sand pit that was used as an unpermitted LF between the 1950s and the mid-1970s. The Vitale Brothers, the site owners until 1980, accepted and disposed saltwater-quenched fly ash from New England Power Company along with other wastes.	This case was not counted as a proven damage case in the 1999 RTC[186] because it was a case of illegal disposal not representative of historical or current disposal practices. However, it otherwise meets the criteria for a proven damage case for the following reasons: *Scientific*—(i) Selenium and arsenic exceeded (health-based) primary MCLs, and (ii) there is evidence of contamination of nearby wetlands and surface waters, and *Administrative*—the facility was the subject of several citations and the State has enforced remedial actions.
Town of Pines, IN	Groundwater	Boron, Molybdenum	NIPSCO's Bailly and Michigan City power plants have deposited ~1 million tons of fly ash in the Town of Pines since 1983. Fly ash was buried in the LF and used as construction fill in the town. The ash is pervasive on site, visible in roads and driveways.	*Scientific*—Evidence for boron, molybdenum, arsenic and lead exceeding health-based standards in water wells away from the Pines Yard 520 Landfill site, and *Administrative*—Orders of consent signed between the EPA and IDEM with responsible parties for continued work at the site.
North Lansing Landfill, MI.	Groundwater	Lithium, Selenium	The North Lansing Landfill (NLL), an unlined, former gravel quarry pit with an elevated groundwater table, was licensed in 1974 for disposal of inert fill materials including soil, concrete, and brick. From 1980 to 1997, the NLL was used for disposal of coal ash from the Lansing Board of Water and Light electric and steam generating plants.	*Scientific*—Observation of off-site exceedances of the State's health-based standard for lithium.
Basin Electric, W.J. Neal Plant, ND.	Groundwater	Aluminum, Arsenic, Barium, Copper, Manganese, Zinc.	An unlined, 44-acre SI that received fly ash and scrubber sludge from a coal-fired power plant, along with other wastes (including ash from the combustion of sunflower seed hulls), between the 1950s and the late 1980s.	*Scientific*—Several constituents have exceeded their (health-based) primary MCLs in down-gradient groundwater, and the site inspection found documentation of releases to ground water and surface water from the site, and *Administrative*—The State required closure of the facility.

TABLE OF EPA'S PROVEN DAMAGE CASES—Continued

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
Great River Energy (GRE)—(formerly Co-operative Power Association/United Power) Coal Creek Station, ND.	Groundwater	Arsenic, Selenium	This site includes a number of evaporation ponds and SIs that were constructed in 1978 and 1979. Both the SIs and the evaporation ponds leaked significantly upon plant start-up. A ND DOH regulator was uncertain as to whether a liner was initially installed, although the plant may have thought they were placing some sort of liner. The surficial soils were mostly sandy materials with a high water table.	*Scientific*—Arsenic and selenium exceeded (health-based) primary MCLs, and *Administrative*—The State required remedial action.
VEPCO Chisman Creek, VA.	Groundwater	Selenium, Sulfate, Vanadium.	Between 1957 and 1974, abandoned sand and gravel pits at the site received fly ash from the combustion of coal and petroleum coke at the Yorktown Power Station. Disposal at the site ended in 1974 when Virginia Power began burning oil at the Yorktown plant. In 1980, nearby shallow residential wells became contaminated with vanadium and selenium.	Designated as a proven damage case in the 1999 RTC. *Scientific*—(i) Drinking water wells contained selenium above the (health-based) primary MCL and (ii) There is evidence of surface water and sediment contamination, and *Administrative*—The site was remediated under CERCLA.
VEPCO Possum Point, VA.	Groundwater	Cadmium, Nickel	At this site, oil ash, pyrites, boiler chemical cleaning wastes, coal fly ash, and coal bottom ash were co-managed in an unlined SI, with solids dredged to a second pond.	Damage case described in the 1999 RTC. *Administrative*—Action pursued by the State based on evidence on exceedances of cadmium and nickel, by requiring the removal of the waste.
BBBS Sand and Gravel Quarries, Gambrills, MD.	Groundwater	Aluminum, Arsenic, Beryllium, Cadmium, Lead, Manganese, Sulfate, Thallium.	As of 1995, the defendants used fly ash and bottom ash from two Maryland power plants to fill excavated portions of two unlined sand and gravel quarries. GW samples collected in 2006/07 from residential drinking water wells near the site indicated contaminants at or above GW quality standards. Testing of private wells in 83 homes and businesses in areas around the disposal site revealed MCL exceedances in 34 wells, and SMCLs exceedances in 63 wells.	*Scientific*—Documented exceedances of MCLs in numerous off-site drinking water wells. *Administrative*—On October 1, 2007, the Maryland Department of the Environment (MDE) filed a consent order in Anne Arundel County, Maryland Circuit Court to settle an environmental enforcement action against the owner of a sand and gravel quarry and the owner of coal fired power plants for contamination of public drinking water wells in the vicinity of the sand and gravel quarry.

TABLE OF EPA'S PROVEN DAMAGE CASES—Continued

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
Hyco Lake, Roxboro, NC.	Surface Water ...	Selenium	Hyco Lake was constructed in 1964 as a cooling water source for the Electric Plant. The lake received discharges from the plant's ash-settling ponds containing high levels of selenium. The selenium accumulated in the fish in the lake, affecting reproduction and causing declines in fish populations in the late 1970s and 1980s.	*Scientific*—Declines in fish populations were observed (1970s & 1980s). *Administrative*—The State concluded that the impacts were attributable to the ash ponds, and issued a fish consumption advisory as a result of the contamination.
Georgia Power Company, Plant Bowen, Cartersville, GA.	Surface Water ...	Ash Slurry	This unlined SI was put in service in 1968. On July 28, 2002, a sinkhole developed in the SI that ultimately reached four acres in area. An estimated 2.25 million gallons of ash/water mixture was released to a tributary of the Euharlee Creek, containing 281 tons of ash.	*Scientific*—Unpermitted discharge of water containing ash slurry into the Euharlee Creek resulting in a temporary degradation of public waters. *Administrative*—Georgia Department of Natural Resources issued a consent order requiring, among others, a fine and corrective action.
Department of Energy—Oak Ridge Y–12 Plant Chestnut Ridge Operable Unit 2, DOE Oak Ridge Reservation, Oak Ridge, TN.	Surface Water ...	Aluminum, Arsenic, Iron, Manganese.	The Filled Coal Ash Pond (FCAP) is an ash retention SI used to dispose of coal ash slurry from the Y–12 steam plant. It was constructed in 1955 by building an earthen dam across a northern tributary of Upper McCoy Branch. After the SI was filled to capacity, the slurry was released directly into Upper McCoy Branch. Erosion of both the spillway and the ash itself resulted in releases of ash into Upper McCoy Branch.	*Scientific*—Exceedances of primary and secondary MCLs were detected in on-site monitoring locations. *Administrative*—Federal RCRA and the Tennessee Department of Environmental Conservation (TDEC) requirements, including placement of the entire Oak Ridge Reservation on the NPL.
Belews Lake, NC	Surface Water ...	Selenium	This Lake was impounded in the early 1970s to serve as a cooling reservoir for a large coal-fired power plant. Fly ash was disposed in a settling basin, which released selenium-laden effluent in return flows to the Lake. Sixteen of the 20 fish species originally present in the reservoir were entirely eliminated.	*Scientific*—Evidence of extensive impacts on fish populations due to direct discharge to a surface water body. *Administrative*—The State required changes in operating practices to mitigate the contamination.

TABLE OF EPA'S PROVEN DAMAGE CASES—Continued

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
U.S. Department of Energy Savannah River Project, SC.	Surface Water ...	Not cited	A coal-fired power plant sluices fly ash to a series of open settling basins. A continuous flow of sluice water exits the basins, overflows, and enters a swamp that in turn discharges to Beaver Dam Creek. Bullfrog tadpoles inhabiting the site have oral deformities and impaired swimming and predator avoidance abilities, and there also is evidence of metabolic impacts on water snakes inhabiting the site.	*Scientific*—Evidence of impacts on several species in a nearby wetland caused by releases from the ash settling ponds.
Brandy Branch Reservoir, TX.	Surface Water ...	Selenium	A power plant cooling reservoir built in 1983 for Southwestern Electric Power Company's Pirkey Power Plant. The cooling reservoir received discharges from SIs containing elevated levels of selenium.	*Scientific*—Observations of impacts on fish populations were confirmed by scientific study, based on which the State concluded that the impacts were attributable to the ash ponds. *Administrative*—The State issued a fish consumption advisory as a result of the contamination.
Southwestern Electric Power Company Welsh Reservoir, TX.	Surface Water ...	Selenium	This Lake was constructed in 1976 to serve as a cooling reservoir for a power plant and receives discharges from an open SI. The Texas Parks and Wildlife Department's monitoring documents elevated levels of selenium and other metals in fish.	*Scientific*—Selenium accumulation in fish may be attributable to the ash settling ponds. *Administrative*—The State has issued a fish consumption advisory as a result of the contamination.
Texas Utilities Electric Martin Lake Reservoir, TX.	Surface Water ...	Selenium	This Lake was constructed in 1974 to serve as a cooling reservoir for a power plant and was the site of a series of major fish kills in 1978 and 1979. Investigations determined that unpermitted discharges from ash settling ponds resulted in elevated levels of selenium in the water and fish.	*Scientific*—Evidence of adverse effects on wildlife—impacts on fish populations were observed, and the State concluded that the impacts were attributable to the ash setting ponds. *Administrative*—The State has issued a fish consumption advisory as a result of the contamination.
Martins Creek Power Plant, Martins Creek, PA.	Groundwater and Surface Water.	Aluminum, Arsenic, Chromium, Copper, Iron, Lead, Manganese, Nickel, Selenium, Silver, Zinc.	In August 2005, a dam confining a 40 acre CCR SI failed. The dam failure, a violation of the State's solid waste disposal permit, resulted in the discharge of 100 million gallons of coal-ash and contaminated water into the Oughoughton Creek and the Delaware River. Ground-water monitoring found Se and Cr concentrations exceeding Pennsylvania's Statewide Health Standards and Federal primary drinking water standards, and there were also exceedances of the secondary MCL for iron.	*Scientific*—Exceedances of primary and secondary MCLs in on-site ground water, and exceedances of federal water quality criteria in off-site surface water, and *Administrative*—PA DEP issued a consent order for cleanup.

TABLE OF EPA'S PROVEN DAMAGE CASES—Continued

Damage case, State	Affected media	Constituents of concern	Brief description	Basis for consideration as a proven damage case
TVA Kingston, Harriman, TN.	Surface Water ...	Arsenic, Cobalt, Iron, Thallium.	On December 22, 2008, the northeastern dike of a SI failed. About 5.4 million cubic yards of fly ash sludge was released over about a 300 acre area and into a branch of the Emory River, disrupting power, rupturing a gas line, and destroying or damaging scores of homes. Sampling results for the contaminated residential soil showed arsenic, cobalt, iron, and thallium levels above the residential Superfund soil screening levels.	*Administrative*—On May 11, 2009, TVA agreed to clean up more than 5 million tons of spilled coal ash under an administrative order and agreement on consent under CERCLA issued by the USEPA, and In early January 2009, the Tennessee Wildlife Resources Agency (TWRA) issued a fish advisory stating that until further notice, fishing should be avoided in the lower section of the Emory River.

Abbreviations key:
1 LF—Landfill
2 SI—Surface Impoundment
3 PAL—Prevention Action Level
4 ES—Enforcement Standard
5 RTC—Report to Congress

List of Subjects

40 CFR Part 257

Environmental Protection, coal combustion products, coal combustion residuals, coal combustion waste, beneficial use, disposal, hazardous waste, landfill, surface impoundment.

40 CFR Part 261

Hazardous waste, Recycling, Reporting and recordkeeping requirements.

40 CFR Part 264

Air pollution control, Hazardous waste, Insurance, Packaging and containers, Reporting and recordkeeping requirements, Security measures, Surety bonds.

40 CFR Part 268

Hazardous waste, Reporting and recordkeeping requirements.

40 CFR Part 271

Administrative practice and procedure, Confidential business information, Hazardous materials transportation, Hazardous waste, Indians-lands, Intergovernmental relations, Penalties, Reporting and recordkeeping requirements, Water pollution control, Water supply.

40 CFR Part 302

Air pollution control, Chemicals, Hazardous substances, Hazardous waste, Intergovernmental relations, Natural resources, Reporting and recordkeeping requirements, Superfund, Water pollution control, Water supply.

Dated: May 4, 2010.

Lisa P. Jackson,

Administrator.

For the reasons set out in the preamble, title 40, chapter I of the Code of Federal Regulations is proposed to be amended as follows:

Alternative 1: Co-Proposal Under Authority of Subtitle D

PART 257—CRITERIA FOR CLASSIFICATION OF SOLID WASTE DISPOSAL FACILITIES AND PRACTICES

1. The authority citation for part 257 continues to read as follows:

Authority: 42 U.S.C., 6907(a)(3), 6912(a)(1), 6944(a), and 6949a(c); 33 U.S.C. 1345(d) and (e).

2. Section 257.1 is amended by revising the last sentence of paragraph (a) introductory text, revising paragraphs (a)(1) and (a)(2), and adding new paragraph (c)(12) to read as follows:

§ 257.1 Scope and purpose.

(a) * * * Unless otherwise provided, the criteria §§ 257.51 through 257.101 are adopted for determining which CCR Landfills and CCR Surface impoundments pose a reasonable probability of adverse effects on health or the environment under sections 1008(a)(3) and 4004(a) of the Act.

(1) Facilities failing to satisfy either the criteria in §§ 257.1 through 257.4 or §§ 257.5 through 257.30 or §§ 257.51 through 257.101 are considered open dumps, which are prohibited under section 4005 of the Act.

(2) Practices failing to satisfy either the criteria in §§ 257.1 through 257.4 or §§ 257.5 through 257.30 or §§ 257.51 through 257.101 constitute open dumping, which is prohibited under section 4005 of the Act.

* * * * *

(c) * * *

(12) Except as otherwise provided in subpart C, the criteria in subpart A of this part do not apply to CCR landfills and CCR surface impoundments subject to subpart C of this part.

3. Section 257.2 is amended by adding definitions of "CCR landfill " and "CCR surface impoundment or impoundment" to read as follows:

§ 257.2 Definitions.

* * * * *

CCR landfill means a disposal facility or part of a facility where CCRs are placed in or on land and which is not a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit. For purposes of this part, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

CCR surface impoundment or *impoundment* means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of CCRs containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons. CCR surface impoundments are used to receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

* * * * *

Subpart C—[Added and Reserved]

4. Part 257 is amended by adding and reserving Subpart C.

5. Part 257 is amended by adding Subpart D to part 257 to read as follows:

Subpart D—Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments

Subpart D—Standards for the Receipt of Coal Combustion Residuals in Landfills and Surface Impoundments

General Provisions

§ 257.40 Disposal standards for owners/operators of CCR landfills and CCR surface impoundments.

(a) *Applicability.* (1) The requirements of this subpart apply to owners or operators of CCR landfills and CCR surface impoundments. Any CCR landfill and surface impoundment continues to be subject to the requirements in §§ 257.3–1, 257.3–2, and 257.3–3.

(2) Except as otherwise specified in this Subpart, all of the requirements in this Subpart are applicable [date 180 days after the effective date of the final rule].

(b) *Definitions.* As used in this subpart:

Acre-foot means the volume of one acre of surface area to a depth of one foot.

Active life means the period of operation beginning with the initial placement of CCRs in the landfill or surface impoundment and ending at completion of closure activities in accordance with § 257.110.

Aquifer means a geological formation, group of formations, or portion of a formation capable of yielding significant quantities of groundwater to wells.

Area-capacity curves means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations.

Coal Combustion Residuals (CCRs) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials. CCRs are also known as coal combustion wastes (CCWs) and fossil fuel combustion (FFC) wastes.

CCR landfill means a disposal facility or part of a facility where CCRs are placed in or on land and which is not a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit. For purposes of this subpart, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

CCR surface impoundment or *impoundment* means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of CCRs containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons. CCR surface impoundments are used to receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

Existing CCR landfill means a CCR landfill which was in operation on, or for which construction commenced prior to [the effective date of the final rule]. A CCR landfill has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either:

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which cannot be cancelled or modified without substantial loss—for physical construction of the CCR landfill to be completed within a reasonable time.

Existing CCR surface impoundment means a surface impoundment which was in operation on, or for which construction commenced prior to [the effective date of the final rule]. A CCR surface impoundment has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which can not be cancelled or modified without substantial loss—for physical construction of the CCR surface impoundment to be completed within a reasonable time.

Facility means all contiguous land and structures, other appurtenances, and improvements on the land used for the disposal of CCRs.

Factor of safety (Safety factor) means the ratio of the forces tending to resist the failure of a structure to the forces tending to cause such failure as determined by accepted engineering practice.

Freeboard means the vertical distance between the slurry or liquid elevation in an impoundment and the lowest point on the crest of the impoundment embankment.

Groundwater means water below the land surface in a zone of saturation.

Hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a dam (or impoundment) or mis-operation of the dam or appurtenances. (Note: The Hazard Potential Classification System for Dams was developed by the U.S. Army Corps of Engineers for the National Inventory of Dams.)

(1) *High hazard potential surface impoundment* means a surface impoundment where failure or mis-operation will probably cause loss of human life.

(2) *Significant hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

(3) *Low hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

Independent registered professional engineer or hydrologist means a scientist or engineer who is not an employee of the owner or operator of a CCR landfill or surface impoundment who has received a baccalaureate or post-graduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields as may be demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding the technical information for which a certification under this subpart is necessary.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill, or existing CCR surface impoundment made after [the effective date of the final rule].

New CCR landfill means a CCR landfill in which there is placement of CCRs without the presence of free liquids, which began operation, or for which the construction commenced after [the effective date of the final rule].

New CCR surface impoundment means a CCR surface impoundment from which there is placement of CCRs with the presence of free liquids, which began operation, or for which the construction commenced after [the effective date of the final rule].

Operator means the person(s) responsible for the overall operation of a facility.

Owner means the person(s) who owns a facility or part of a facility.

Probable maximum precipitation means the value for a particular area which represents an envelopment of depth-duration-area rainfall relations for all storm types affecting that area adjusted meteorologically to maximum conditions.

Recognized and generally accepted good engineering practices means engineering maintenance or operation activities based on established codes, standards, published technical reports, recommended practice, or similar document. Such practices detail generally approved ways to perform specific engineering, inspection, or mechanical integrity activities.

Representative sample means a sample of a universe or whole (*e.g.,* waste pile, lagoon, groundwater) which can be expected to exhibit the average properties of the universe or whole.

Run-off means any rainwater, leachate, or other liquid that drains over land from any part of a CCR landfill or surface impoundment.

Run-on means any rainwater, leachate, or other liquid that drains over land onto any part of a CCR landfill or surface impoundment.

Sand and gravel pit or quarry means an excavation for the commercial extraction of aggregate for use in construction projects.

State means any of the several States, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, American Samoa, and the Commonwealth of the Northern Mariana Islands.

Surface water means all water naturally open to the atmosphere (rivers, lakes, reservoirs, ponds, streams, impoundments, seas, estuaries, etc.).

Uppermost aquifer means the geologic formation nearest the natural ground surface that is an aquifer, as well as lower aquifers that are hydraulically interconnected with this aquifer within the facility's property boundary.

Waste boundary means a vertical surface located at the hydraulically downgradient limit of the CCR landfill or CCR surface impoundment, or lateral expansion. The vertical surface extends down into the uppermost aquifer.

§§ 257.42–257.49 [Reserved]

General Requirements

§ 257.50 Applicability of other regulations.

(a) The owner or operator of a CCR landfill or CCR surface impoundment must comply with any other applicable federal, state, tribal, or local laws or other requirements.

§§ 257.51–257.59 [Reserved]

Location Restrictions

§ 257.60 Placement above the natural water table.

(a) New CCR landfills and new CCR surface impoundments and lateral expansions must be constructed with a base that is located a minimum of two feet above the upper limit of the natural water table.

(b) For purposes of this section, natural water table means the natural level at which water stands in a shallow well open along its length and penetrating the surficial deposits just deeply enough to encounter standing water at the bottom. This level is uninfluenced by groundwater pumping or other engineered activities.

§ 257.61 Wetlands.

(a) New CCR landfills, new CCR surface impoundments, and lateral expansions shall not be located in wetlands, unless the owner or operator can make the following demonstrations, certified by an independent registered professional engineer or hydrologist. The owner or operator must place the demonstrations in the operating record and the owner's or operator's publicly accessible internet site, and notify the state of this action.

(1) Where applicable under section 404 of the Clean Water Act or applicable state wetlands laws, the presumption that a practicable alternative to the proposed landfill, surface impoundment, or lateral expansion is available which does not involve wetlands is clearly rebutted; and

(2) The construction and operation of the new CCR landfill, new CCR surface impoundment, or lateral expansion will not:

(i) Cause or contribute to violations of any applicable state water quality standard,

(ii) Violate any applicable toxic effluent standard or prohibition under Section 307 of the Clean Water Act;

(iii) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and

(iv) Violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary; and

(3) The new CCR landfill, new CCR surface impoundment, or lateral expansion will not cause or contribute to significant degradation of wetlands. The owner or operator must demonstrate the integrity of the new CCR landfill, new CCR surface impoundment, or lateral expansion and its ability to protect ecological resources by addressing the following factors:

(i) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the new CCR landfill, new CCR surface impoundment, or lateral expansion;

(ii) Erosion, stability, and migration potential of dredged and fill materials used to support the landfill or surface impoundment.

(iii) The volume and chemical nature of the CCRs.

(iv) Impacts on fish, wildlife, and other aquatic resources and their habitat from release of CCRs.

(v) The potential effects of catastrophic release of CCRs to the wetland and the resulting impacts on the environment; and

(vi) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected; and

(4) To the extent required under section 404 of the Clean Water Act or applicable state wetlands laws, steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by paragraph (a)(1) of this section, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (*e.g.*, restoration of existing degraded wetlands or creation of man-made wetlands); and

(5) Sufficient information is available to make a reasonable determination with respect to these demonstrations.

(b) For purposes of this section, *wetlands* means those areas defined in 40 CFR 232.2.

§ 257.62 Fault areas.

(a) New CCR landfills, new CCR surface impoundments and lateral expansions shall not be located within 200 feet (60 meters) of a fault that has had displacement in Holocene time unless the owner or operator demonstrates that an alternative setback distance of less than 200 feet (60 meters) will prevent damage to the structural integrity of the new CCR landfill, new CCR surface impoundment and lateral expansion and will be protective of human health and the environment. The demonstration must be certified by an independent registered professional engineer and the owner or operator must notify the state that the demonstration has been placed in the operating record and on the owner's or operator's publicly accessible Internet site.

(b) For the purposes of this section:

(1) *Fault* means a fracture or a zone of fractures in any material along which strata on one side have been displaced with respect to that on the other side.

(2) *Displacement* means the relative movement of any two sides of a fault measured in any direction.

(3) *Holocene* means the most recent epoch of the Quaternary period, extending from the end of the Pleistocene Epoch to the present.

§ 257.63 Seismic impact zones.

(a) New CCR landfills, new CCR surface impoundments and lateral expansions shall not be located in seismic impact zones, unless the owner or operator demonstrates that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site. The demonstration must be certified by an independent registered professional engineer and the owner or operator must notify the state that the demonstration has been placed in the operating record and on the owner's or operator' publicly accessible internet site.

(b) For the purposes of this section:

(1) *Seismic impact zone* means an area with a ten percent or greater probability that the maximum horizontal acceleration in lithified earth material, expressed as a percentage of the earth's gravitational pull (g), will exceed 0.10g in 250 years.

(2) *Maximum horizontal acceleration in lithified earth material* means the maximum expected horizontal acceleration depicted on a seismic hazard map, with a 98 percent or greater probability that the acceleration will not be exceeded in 50 years, or the maximum expected horizontal acceleration based on a site-specific seismic risk assessment.

(3) *Lithified earth material* means all rock, including all naturally occurring and naturally formed aggregates or masses of minerals or small particles of older rock that formed by crystallization of magma or by induration of loose sediments. This term does not include man-made materials, such as fill, concrete, and asphalt, or unconsolidated earth materials, soil, or regolith lying at or near the earth surface.

§ 257.64 Unstable areas.

(a) Owners or operators of new or existing CCR landfills, new or existing CCR surface impoundments and lateral expansions located in an unstable area must demonstrate that engineering measures have been incorporated into the landfill, surface impoundment, or lateral expansion design to ensure that the integrity of the structural components of the landfill or surface impoundment will not be disrupted. The demonstration must be certified by an independent registered professional engineer. The owner or operator must notify the state that the demonstration has been placed in the operating record and on the owner's or operator's publicly accessible internet site. The owner or operator must consider the following factors, at a minimum, when determining whether an area is unstable:

(1) On-site or local soil conditions that may result in significant differential settling;

(2) On-site or local geologic or geomorphologic features; and

(3) On-site or local human-made features or events (both surface and subsurface).

(b) For purposes of this section:

(1) *Unstable area* means a location that is susceptible to natural or human-induced events or forces capable of impairing the integrity of some or all of the CCR landfill or CCR surface impoundment or lateral expansion structural components responsible for preventing releases from a landfill or surface impoundment. Unstable areas can include poor foundation conditions, areas susceptible to mass movements, and Karst terrains.

(2) *Structural components* means liners, leachate collection systems, final covers, run-on/run-off systems, and any other component used in the construction and operation of the CCR landfill or CCR surface impoundment or lateral expansion that is necessary for protection of human health and the environment.

(3) *Poor foundation conditions* means those areas where features exist which indicate that a natural or man-induced event may result in inadequate foundation support for the structural components of a CCR landfill, CCR surface impoundment, or lateral expansion.

(4) *Areas susceptible to mass movement* means those areas of

influence (*i.e.,* areas characterized as having an active or substantial possibility of mass movement) where the movement of earth material at, beneath, or adjacent to the CCR landfill, CCR surface impoundment, or lateral expansion, because of natural or man-induced events, results in the downslope transport of soil and rock material by means of gravitational influence. Areas of mass movement include, but are not limited to, landslides, avalanches, debris slides and flows, soil fluction, block sliding, and rock fall.

(5) *Karst terranes* means areas where karst topography, with its characteristic surface and subterranean features, has developed as a result of dissolution of limestone, dolomite, or other soluble rock. Characteristic physiographic features present in karst terranes include, but are not limited to, sinkholes, sinking streams, caves, large springs, and blind valleys.

§ 257.65 Closure of existing CCR landfills and surface impoundments.

(a) Existing CCR landfills and surface impoundments that cannot make the demonstration specified in § 257.64 (a) pertaining to unstable areas, must close by [date five years after the effective date of the final rule], in accordance with § 257.100 and conduct post-closure activities in accordance with § 257.101.

(b) The deadline for closure required by paragraph (a) of this section may be extended up to two years if the owner or operator can demonstrate that:

(1) There is no available alternative disposal capacity;

(2) There is no immediate threat to human health and the environment.

(c) The demonstration in paragraph (b) of this section must be certified by an independent registered professional engineer or hydrologist.

(d) The owner or operator must place the demonstration in paragraph (b) of this section in the operating record and on the owner's or operator's publicly accessible internet site and notify the state that this action was taken.

§§ 257.66–257.69 [Reserved]

Design Criteria

§ 257.70 Design criteria for new CCR landfills and lateral expansions.

(a) New CCR landfills and lateral expansions of CCR landfills shall be constructed:

(1) With a composite liner, as defined in paragraph (a)(2) of this section and a leachate collection system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner. The design of the composite liner and leachate collection system must be prepared by, or under the direction of, and certified by an independent registered, professional engineer.

(2) For purposes of this section, *composite liner* means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

(3) For purpose of this section, *hydraulic conductivity* means the rate at which water can move through a permeable medium. (*i.e.,* the coefficient of permeability).

(b) [Reserved]

§ 257.71 Design criteria for existing CCR surface impoundments.

(a) No later than [five years after effective date of final rule] existing CCR surface impoundments shall be constructed:

(1) With a composite liner, as defined in paragraph (a)(2) of this section and a leachate collection system between the upper and lower components of the composite liner. The design shall be in accordance with a design prepared by, or under the direction of, and certified by an independent registered professional engineer.

(2) For purposes of this section, *composite liner* means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane line (FML), and the lower component must consist of at least two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

(3) For purposes of this section, *hydraulic conductivity* means the rate at which water can move through a permeable medium (*i.e.,* the coefficient of permeability).

(b) The owner or operator of an existing CCR surface impoundment shall place in the operating record and on the owner's or operator's publicly accessible internet site, and provide to the state a history of construction, and any record or knowledge of structural instability if the existing surface impoundment can:

(1) Impound CCRs to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or

(2) Impound CCRs to an elevation of 20 feet or more above the upstream toe of the structure.

(c) For purposes of this subpart, *upstream toe* means, for an embankment dam, the junction of the upstream slope of the dam with the ground surface. (Federal Guidelines for Dam Safety, Glossary of Terms, Federal Emergency Management Agency, April 2004.)

(d) The history of construction specified in paragraph (b) of this section shall contain, at a minimum, the following information as may be available:

(1) The name and address of the persons owning or operating the CCR surface impoundment; the name associated with the CCR surface impoundment; and the identification number of the CCR surface impoundment if one has been assigned by the state.

(2) The location of the CCR surface impoundment indicated on the most recent USGS 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(3) A statement of the purpose for which the CCR surface impoundment is being used.

(4) The name and size in acres of the watershed affecting the CCR surface impoundment.

(5) A description of the physical and engineering properties of the foundation materials on which the CCR surface impoundment is constructed.

(6) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment; the method of site preparation and construction of each zone of the CCR surface impoundment; and the approximate dates of construction, and each successive stage of construction of the CCR surface impoundment.

(7) At a scale not to exceed 1 inch = 100 feet, detailed dimensional drawings of the CCR surface impoundment, including a plan view and cross sections of the length and width of the CCR surface impoundment, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the measurement of the minimum vertical distance between the crest of the CCR surface impoundment

and the reservoir surface at present and under design storm conditions, CCR slurry level and CCR waste water level, and any identifiable natural or manmade features which could affect operation of the CCR surface impoundment.

(8) A description of the type and purpose of existing or proposed instrumentation.

(9) Graphs showing area-capacity curves.

(10) The hazard potential classification for which the facility is designed and a detailed explanation of the basis for this classification.

(11) A description of the spillway and diversion design features and capacities and calculations used in their determination.

(12) The computed minimum factor of safety for slope stability of the CCR retaining structure(s) and the analyses used in their determinations.

(13) A certification by an independent registered professional engineer that the design of the CCR surface impoundment is in accordance with current, prudent engineering practices for the maximum volume of CCR slurry and CCR waste water which can be impounded therein and for the passage of runoff from the design storm which exceeds the capacity of the CCR surface impoundment; or, in lieu of the certification, a report indicating what additional investigations, analyses, or improvement work are necessary before such a certification can be made by an independent registered professional engineer, including what provisions have been made to carry out such work in addition to a schedule for completion of such work. Upon completion of such work, the owner or operator shall place the certification in the operating record and on the owner's or operator's publicly accessible internet site and provide to the state notice of such certification.

(14) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.

(15) General provisions for closure.

(e) A permanent identification marker, at least six feet high and showing the identification number of the existing CCR surface impoundment, if one has been assigned by the state, the name associated with the CCR surface impoundment and the name of the person owning or operating the structure, shall be located on or immediately adjacent to each existing CCR surface impoundment. This requirement becomes effective [date 60 days after the effective date of the final rule].

(f) For existing CCR surface impoundments classified as having a high or significant hazard potential, as certified by an independent registered professional engineer, the owner or operator shall develop and maintain in the operating record, and on the owner's or operator' publicly accessible internet site, an Emergency Action Plan which: defines responsible persons and the actions to be taken in the event of a dam-safety emergency; provides contact information for emergency responders; includes a map which delineates the downstream area which would be affected in the event of a dam failure; and includes provisions for an annual face-to-face meeting or exercise between representatives of the facility owner and the local emergency responders.

(g) CCR surface impoundments shall be dredged of CCRs and lined with a composite liner system, as defined in paragraph (d)(2) of this section, by [date five years after the effective date of the final rule] or closed in accordance with § 257.100.

§ 257.72 Design criteria for new CCR surface impoundments and lateral expansions.

(a) New CCR surface impoundments and lateral expansions of CCR landfills or surface impoundments shall be constructed:

(1) With a composite liner, as defined in paragraph (a)(2) of this section and a leachate collection system between the upper and lower components of the composite liner. The design of the composite liner and leachate collection system must be prepared by, or under the direction of, and certified by an independent registered, professional engineer.

(2) For purposes of this section, *composite liner* means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

(3) For purpose of this section, *hydraulic conductivity* means the rate at which water can move through a permeable medium (*i.e.,* the coefficient of permeability).

(b) Plans for the design, construction, and maintenance of new CCR surface impoundments and lateral expansions shall be placed in the operating record and be submitted to the state upon certification by an independent registered professional engineer, and a notice shall be placed on the owner's or operator's publicly accessible internet site that such plans have been placed in the operating record and submitted to the state, if such proposed surface impoundment or lateral expansion can:

(1) Impound CCRs to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or

(2) Impound CCRs to an elevation of 20 feet or more above the upstream toe of the structure.

(c) A permanent identification marker, at least six feet high and showing the identification number of the CCR surface impoundment, if one has been assigned by the state, the name associated with the CCR surface impoundment and the name of the person owning or operating the structure, shall be located on or immediately adjacent to each CCR surface impoundment. This requirement becomes effective [date 60 days after the effective date of the final rule].

(d) The plan specified in paragraph (b) of this section, shall contain at a minimum the following information:

(1) The name and address of the persons owning or operating the CCR surface impoundment; the name associated with the CCR surface impoundment; and the identification number of the CCR surface impoundment if one has been assigned by the state.

(2) The location of the CCR surface impoundment indicated on the most recent USGS 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(3) A statement of the purpose for which the CCR surface impoundment is being used.

(4) The name and size in acres of the watershed affecting the CCR surface impoundment.

(5) A description of the physical and engineering properties of the foundation materials on which the CCR surface impoundment is constructed.

(6) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment; the method of site preparation and construction of each zone of the CCR surface impoundment; and the approximate dates of construction, and each successive stage of construction of the CCR surface impoundment.

(7) At a scale not to exceed 1 inch = 100 feet, detailed dimensional drawings

of the CCR surface impoundment, including a plan view and cross sections of the length and width of the CCR surface impoundment, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the measurement of the minimum vertical distance between the crest of the CCR surface impoundment and the reservoir surface at present and under design storm conditions, CCR slurry level and CCR waste water level, and any identifiable natural or manmade features which could affect operation of the CCR surface impoundment.

(8) A description of the type and purpose of existing or proposed instrumentation.

(9) Graphs showing area-capacity curves.

(10) The hazard potential classification for which the facility is designed and a detailed explanation of the basis for this classification.

(11) A description of the spillway and diversion design features and capacities and calculations used in their determination.

(12) The computed minimum factor of safety for slope stability of the CCR retaining structure(s) and the analyses used in their determinations.

(13) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.

(14) General provisions for closure.

(15) A certification by an independent registered professional engineer that the design of the CCR surface impoundment is in accordance with generally accepted engineering standards for the maximum volume of CCR slurry and CCR waste water which can be impounded therein and for the passage of runoff from the design storm which exceeds the capacity of the CCR surface impoundment. The owner or operator shall place the certification in the operating record and on the owner's or operator's publicly accessible internet site and notify the state that these actions have been taken.

(e) Any changes or modifications to the plans for CCR surface impoundments shall be certified by an independent registered professional engineer and provided to the state prior to the initiation of such changes or modifications. The certification required in this paragraph shall be placed on the owner's or operator's publicly accessible internet site.

(f) For CCR surface impoundments classified by as having a high or significant hazard potential, as certified by an independent registered professional engineer, the owner or operator shall develop and maintain in the operating record and on the owner's or operator's publicly accessible internet site, an Emergency Action Plan which: Defines responsible persons and the actions to be taken in the event of a dam-safety emergency; provides contact information for emergency responders; includes a map which delineates the downstream area which would be affected in the event of a dam failure; and includes provisions for an annual face-to-face meeting or exercise between representatives of the facility owner and the local emergency responders.

§§ 257.73–257.79 [Reserved]

Operating Criteria

§ 257.80 Air criteria.

(a) CCR surface impoundments and CCR landfills must be managed in a manner that fugitive dusts do not exceed 35 $\mu g/m^3$, unless some alternative standard has been established pursuant to applicable requirements developed under a State Implementation Plan (SIP) approved or promulgated by the Administrator pursuant to section 110 of the Clean Air Act, as amended.

(b) CCR surface impoundments must be managed to control wind dispersal of dusts, consistent with the standard in paragraph (a) of this section.

(c) CCR landfills must be managed to control wind dispersal of dusts, consistent with the standard in paragraph (a). CCRs must be emplaced as conditioned CCRs as defied in paragraph (d) of this section.

(d) For purposes of this section, conditioning means wetting CCRs with water to a moisture content that will prevent wind dispersal, but will not result in free liquids.

(e) Documentation of the measures taken to comply with the requirements of this section must be certified by an independent registered professional engineer and notification provided to the state that the documentation has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

§ 257.81 Run-on and run-off controls.

(a) Owners or operators of all CCR landfills and surface impoundments must design, construct, and maintain:

(1) A run-on control system to prevent flow onto the active portion of the CCR landfill or surface impoundment during the peak discharge from a 24-hour, 25-year storm;

(2) A run-off control system from the active portion of the CCR landfill or surface impoundment to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

(b) The design required in paragraph (a) of this section must be certified by an independent registered professional engineer that the design meets the requirements of this section. The owner or operator must notify the state that the design has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(c) The owner or operator must prepare a report, certified by an independent registered professional engineer, that documents how relevant calculations were made, and how the control systems meet the requirements of this subpart and notify the state that the report has been placed in the operating record and made available to the public on the owner's or operator's publicly accessible internet site.

(d) Run-off from the active portion of the CCR landfill or surface impoundment must be handled in accordance with § 257.3–3.

§ 257.82 Surface water requirements.

(a) CCR landfills and surface impoundments shall not:

(1) Cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to section 402 of the Clean Water Act.

(2) Cause the discharge of a nonpoint source of pollution to waters of the United States, including wetlands, that violates any requirement of an area-wide or State-wide water quality management plan that has been approved under section 208 or 319 of the Clean Water Act, as amended.

(b) [Reserved]

§ 257.83 Surface impoundment inspection requirements.

(a) All existing CCR surface impoundments shall be examined as follows:

(1) At intervals not exceeding 7 days for appearances of structural weakness and other hazardous conditions.

(2) At intervals not exceeding 7 days all instruments shall be monitored.

(3) All inspections required by paragraphs (a)(1) and (2) of this section shall be performed by a qualified person, as defined in paragraph (e) of this section, designated by the person owning or operating the CCR surface impoundment.

(4) All existing CCR surface impoundments shall be inspected

annually by an independent registered professional engineer to assure that the design, operation, and maintenance of the surface impoundment is in accordance with generally accepted engineering standards. The owner or operator must notify the state that a certification by the independent registered professional engineer that the design, operation, and maintenance of the surface impoundment is in accordance with generally accepted engineering standards has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(b) When a potentially hazardous condition develops, the person owning or operating the CCR surface impoundment shall immediately:

(1) Take action to eliminate the potentially hazardous condition;

(2) Notify potentially affected persons and state and local first responders;

(3) Notify and prepare to evacuate, if necessary, all personnel from the owner or operator's property which may be affected by the potentially hazardous conditions; and

(4) Direct a qualified person to monitor all instruments and examine the structure at least once every eight hours, or more often as required by an authorized representative of the state.

(c) After each inspection and instrumentation monitoring referred to in paragraphs (a) and (b) of this section, each qualified person who conducted all or any part of the inspection or instrumentation monitoring shall promptly record the results of such inspection or instrumentation monitoring in a book which shall be available in the operating record and such qualified person shall also promptly report the results of the inspection or monitoring to the state. A report of each inspection and instrumentation monitoring shall also be placed on the owner's or operator's publicly accessible internet site.

(d) All inspection and instrumentation monitoring reports recorded in accordance with paragraph (c) of this section shall include a report of the action taken to abate hazardous conditions and shall be promptly signed by the person designated by the owner or operator as responsible for health and safety at the owner or operator's facility.

(e) The qualified person or persons referred to in this section shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation.

§ 257.84 Recordkeeping requirements.

(a) The owner or operator of a CCR landfill or surface impoundment must record and retain near the facility in an operating record and on the owner's or operator's publicly accessible internet site, all records, reports, studies or other documentation required to demonstrate compliance with §§ 257.60 through 257.83 and 257.90 through 257.101.

(b) Except as provided in paragraph (c) of this section, every twelfth month following [the effective date of the final rule] for CCR surface impoundments addressed under § 257.71, and every twelfth month following the date of the initial plan for the design (including lateral expansions), construction, and maintenance of the surface impoundments addressed under § 257.72(b), the owner or operator of such CCR surface impoundments that have not been closed in accordance with § 257.100 shall place in the operating record and on the owner's or operator's publicly accessible internet site, a report containing the following information. The owner or operator shall notify the state that the report has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(1) Changes in the geometry of the impounding structure for the reporting period.

(2) Location and type of installed instruments and the maximum and minimum recorded readings of each instrument for the reporting period.

(3) The minimum, maximum, and present depth and elevation of the impounded water, sediment, or slurry for the reporting period.

(4) Storage capacity of the impounding structure.

(5) The volume of the impounded water, sediment, or slurry at the end of the reporting period.

(6) Any other change which may have affected the stability or operation of the impounding structure that has occurred during the reporting period.

(7) A certification by an independent registered professional engineer that all construction, operation, and maintenance were in accordance with the approved plan.

(c) A report is not required under this section when the owner or operator provides the state with a certification by an independent registered professional engineer that there have been no changes under paragraphs (b)(1) through (b)(6) of this section to the surface impoundment. However, a report containing the information set out in paragraph (b) of this section shall be placed in the operating record and on the owner's or operator's publicly accessible internet site and notification submitted to the state at least every 5 years.

§§ 257.85–257.89 [Reserved]

Groundwater Monitoring and Corrective Action

§ 257.90 Applicability.

(a) Owners and operators of all CCR landfills, surface impoundments subject to this subpart must comply with the groundwater monitoring requirements according to the following schedule:

(1) Existing CCR landfills and surface impoundments must comply with the groundwater monitoring requirements specified in §§ 257.91 through 257.95 within [one year after the effective date of the final rule];

(2) New CCR landfills and surface impoundments must comply with the groundwater monitoring requirements specified in §§ 257.91 through 257.95 before CCR can be disposed of in the CCR landfill or surface impoundment.

(b) The owner or operator must notify the state once each year throughout the active life and post-closure care period that the CCR landfill or surface impoundment is in compliance with the groundwater monitoring and corrective action provisions of this subpart.

(c) Once established at a CCR landfill or surface impoundment, groundwater monitoring shall be conducted throughout the active life and post-closure care period of that CCR landfill or surface impoundment as specified in § 257.101.

§ 257.91 Groundwater monitoring systems.

(a) A groundwater monitoring system must be installed that consists of a sufficient number of wells, installed at appropriate locations and depths, to yield groundwater samples from the uppermost aquifer (as defined in § 257.41) that:

(1) Represent the quality of background groundwater that has not been affected by leakage from a CCR landfill or surface impoundment. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the CCR management area where:

(i) Hydrogeologic conditions do not allow the owner or operator to determine what wells are hydraulically upgradient; or

(ii) Sampling at other wells will provide an indication of background groundwater quality that is as representative or more representative than that provided by the upgradient wells; and

(2) Represent the quality of groundwater passing the waste

boundary. The downgradient monitoring system must be installed at the waste boundary that ensures detection of groundwater contamination in the uppermost aquifer.

(b) The groundwater monitoring system must include at a minimum one up gradient and three downgradient wells.

(c) A multiunit groundwater monitoring system may be installed instead of separate groundwater monitoring systems for each CCR landfill or surface impoundment when the facility has several units, provided the multi-unit groundwater monitoring system meets the requirement of § 257.91(a) and will be as protective of human health and the environment as individual monitoring systems for each CCR landfill or surface impoundment, based on the following factors:

(1) Number, spacing, and orientation of the CCR landfill or surface impoundment;

(2) Hydrogeologic setting;

(3) Site history;

(4) Engineering design of the CCR landfill or surface impoundment; and

(d) Monitoring wells must be cased in a manner that maintains the integrity of the monitoring well bore hole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (*i.e.,* the space between the bore hole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater.

(1) The owner or operator of the CCR landfill or surface impoundment must notify the state that the design, installation, development, and decommission of any monitoring wells, piezometers and other measurement, sampling, and analytical devices documentation has been placed in the operating record and on the owner's or operator's publicly accessible internet site; and

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to design specifications throughout the life of the monitoring program.

(e) The number, spacing, and depths of monitoring systems shall be:

(1) Determined based upon site-specific technical information that must include thorough characterization of:

(i) Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and

(ii) Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer; including, but not limited to: thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities.

(2) Certified by an independent registered professional engineer or hydrologist. Within 14 days of this certification, the owner or operator must notify the state that the certification has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

§ 257.92 [Reserved]

§ 257.93 Groundwater sampling and analysis requirements.

(a) The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with § 257.91. The owner or operator of the CCR landfill or surface impoundment must notify the State that the sampling and analysis program documentation has been placed in the operating record and on the owner's or operator's publicly accessible internet site and the program must include procedures and techniques for:

(1) Sample collection;

(2) Sample preservation and shipment;

(3) Analytical procedures;

(4) Chain of custody control; and

(5) Quality assurance and quality control.

(b) The groundwater monitoring program must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. Groundwater samples shall not be field-filtered prior to laboratory analysis.

(c) The sampling procedures and frequency must be protective of human health and the environment.

(d) Groundwater elevations must be measured in each well immediately prior to purging, each time groundwater is sampled. The owner or operator of the CCR landfill or surface impoundment must determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same CCR management area must be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.

(e) The owner or operator of the CCR landfill or surface impoundment must establish background groundwater quality in a hydraulically upgradient or background well(s) for each of the monitoring parameters or constituents required in the particular groundwater monitoring program that applies to the CCR landfill or surface impoundment, as determined under § 257.94(a) or § 257.95(a). Background groundwater quality may be established at wells that are not located hydraulically upgradient from the CCR landfill or surface impoundment if it meets the requirements of § 257.91(a)(1).

(f) The number of samples collected to establish groundwater quality data must be consistent with the appropriate statistical procedures determined pursuant to paragraph (g) of this section. The sampling procedures shall be those specified under § 257.94(b) for detection monitoring, § 257.95(b) and (c) for assessment monitoring, and § 257.96(b) for corrective action.

(g) The owner or operator of the CCR landfill or surface impoundment must specify in the operating record and on the owner's or operator's publicly accessible Internet site, one of the following statistical methods to be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well.

(1) A parametric analysis of variance (ANOVA) followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance (ANOVA) based on ranks followed by multiple comparison procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of paragraph (h) of this section. The owner or operator of the CCR landfill or surface impoundment must place a justification for this alternative in the operating record and on the owner's or operator's publicly accessible internet site and notify the state of the use of this alternative test. The justification must demonstrate that the alternative method meets the performance standards of paragraph (h) of this section.

(h) Any statistical method chosen under paragraph (g) of this section shall comply with the following performance standards, as appropriate:

(1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or hazardous constituents. If the distribution of the chemical parameters or hazardous constituents is shown by the owner or operator of the CCR landfill or surface impoundment to be inappropriate for a normal theory test, then the data should be transformed or a distribution-free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.

(2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparison procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons must be maintained. This performance standard does not apply to tolerance intervals, prediction intervals, or control charts.

(3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

(5) The statistical method shall account for data below the limit of detection with one or more statistical procedures that are protective of human health and the environment. Any practical quantitation limit (pql) that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

(6) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

(i) The owner or operator of the CCR landfill or surface impoundment must determine whether or not there is a statistically significant increase over background values for each parameter or constituent required in the particular groundwater monitoring program that applies to the CCR landfill or surface impoundment, as determined under §§ 257.94(a) or 257.95(a).

(1) In determining whether a statistically significant increase has occurred, the owner or operator must compare the groundwater quality of each parameter or constituent at each monitoring well designated pursuant to § 257.91(a)(2) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs (g) and (h) of this section.

(2) Within a reasonable period of time after completing sampling and analysis, the owner or operator of the CCR landfill or surface impoundment must determine whether there has been a statistically significant increase over background at each monitoring well.

§ 257.94 Detection monitoring program.

(a) Detection monitoring is required at CCR landfills and surface impoundments at all groundwater monitoring wells. At a minimum, a detection monitoring program must include monitoring for the parameters listed in Appendix III to this part.

(b) The monitoring frequency for all parameters listed in Appendix III to this part shall be at least semiannual during the active life of the CCR landfill or surface impoundment (including closure) and the post-closure period. A minimum of four independent samples from each background and downgradient well must be collected and analyzed for the Appendix III parameters during the first semiannual sampling event.

(c) At least one sample from each background and downgradient well must be collected and analyzed during subsequent semiannual sampling events.

(d) If the owner or operator of the CCR landfill or surface impoundment determines, pursuant to § 257.93(g) that there is a statistically significant increase over background for one or more of the parameters listed in Appendix III to this part at any monitoring well at the waste boundary specified under § 257.91(a)(2), the owner or operator:

(1) Must, within 14 days of this finding, place a notice in the operating record and on the owner's or operator's publicly accessible internet site indicating which parameters have shown statistically significant changes from background levels, and notify the state that this notice was placed in the operating record and on the owner's or operator's publicly accessible internet site; and

(2) Must establish an assessment monitoring program meeting the requirements of § 257.95 of this part within 90 days except as provided for in paragraph (c)(3) of this section.

(3) The owner/operator may demonstrate that a source other than the CCR landfill or surface impoundment caused the statistically significant increase or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by an independent registered professional engineer or hydrologist and be placed in the operating record and on the owner's or operator's publicly accessible internet site and the state notified of this finding. If a successful demonstration is made and documented, the owner or operator of the CCR landfill or surface impoundment may continue detection monitoring as specified in this section. If, after 90 days, a successful demonstration is not made, the owner or operator of the CCR landfill or surface impoundment must initiate an assessment monitoring program as required in § 257.95.

§ 257.95 Assessment monitoring program.

(a) Assessment monitoring is required whenever a statistically significant increase over background has been detected for one or more of the constituents listed in the Appendix III to this part.

(b) Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator of the CCR landfill or surface impoundment must sample and analyze the groundwater for all constituents identified in Appendix IV to this part. A minimum of one sample from each downgradient well must be collected and analyzed during each sampling event. For any constituent detected in the downgradient wells as a result of the complete Appendix IV analysis, a minimum of four independent samples from each well (background and downgradient) must be collected and analyzed to establish background for the constituents.

(c) After obtaining the results from the initial or subsequent sampling events required in paragraph (b) of this section, the owner or operator of the CCR landfill or surface impoundment must:

(1) Within 14 days, place a notice in the operating record and on the owner's or operator's publicly accessible internet site identifying the Appendix IV constituents that have been detected and notify the state that this notice has been placed in the operating record and on the owner's or operator's publicly accessible internet site;

(2) Within 90 days, and on at least a semiannual basis thereafter, resample all wells specified by § 257.91(a), conduct analyses for all parameters in Appendix III to this part and for those constituents in Appendix IV to this part that are detected in response to paragraph (b) of this section, and record their concentrations in the facility operating record and place the results on the owner's or operator's publicly accessible internet site. At least one sample from each well (background and downgradient) must be collected and analyzed during these sampling events.

(3) Establish background concentrations for any constituents detected pursuant to paragraph (b) or (c)(2) of this section; and

(4) Establish groundwater protection standards for all constituents detected pursuant to paragraph (b) or (c) of this section. The groundwater protection standards shall be established in accordance with paragraphs (g) or (h) of this section.

(d) If the concentrations of all Appendix IV constituents are shown to be at or below background values, using the statistical procedures in § 257.93(g), for two consecutive sampling events, the owner or operator of the CCR landfill or surface impoundment must place that information in the operating record and on the owner's or operator's publicly accessible internet site and notify the state of this finding and may return to detection monitoring.

(e) If the concentrations of any Appendix IV constituents are above background values, but all concentrations are below the groundwater protection standard established under paragraphs (g) or (h) of this section, using the statistical procedures in § 257.93(g), the owner or operator must continue assessment monitoring in accordance with this section.

(f) If one or more Appendix IV constituents are detected at statistically significant levels above the groundwater protection standard established under paragraphs (g) or (h) of this section in any sampling event, the owner or operator must, within 14 days of this finding, place a notice in the operating record and on the owner's or operator's publicly accessible internet site identifying the Appendix IV constituents that have exceeded the groundwater protection standard and notify the state and all appropriate local government officials that the notice has been placed in the operating record and on the owner's or operator's publicly accessible internet site. The owner or operator of the CCR landfill or surface impoundment also must:

(1)(i) Characterize the nature and extent of the release by installing additional monitoring wells as necessary;

(ii) Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (c)(2) of this section;

(iii) Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site if indicated by sampling of wells in accordance with paragraph (f)(1) of this section; and

(iv) Initiate an assessment of corrective measures as required by § 257.96 of this part within 90 days; or

(2) May demonstrate that a source other than the CCR landfill or surface impoundment caused the contamination, or that the statistically significant increase resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by an independent registered professional engineer or hydrologist and placed in the operating record and on the owner's or operator's publicly accessible internet site, and the state notified of this action. If a successful demonstration is made the owner or operator of the CCR landfill or surface impoundment must continue monitoring in accordance with the assessment monitoring program pursuant to this section, and may return to detection monitoring if the Appendix IV constituents are at or below background as specified in paragraph (d) of this section. Until a successful demonstration is made, the owner or operator of the CCR landfill or surface impoundment must comply with paragraph (f) of this section including initiating an assessment of corrective measures.

(g) The owner or operator of the CCR landfill or surface impoundment must establish a groundwater protection standard for each Appendix IV constituent detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been promulgated under section 1412 of the Safe Drinking Water Act (codified) under 40 CFR part 141, the MCL for that constituent;

(2) For constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells in accordance with § 257.91(a)(1); or

(3) For constituents for which the background level is higher than the MCL identified under paragraph (g)(1) of this section or health based levels identified under paragraph (h)(1) of this section, the background concentration.

(h) The owner or operator may establish an alternative groundwater protection standard for constituents for which MCLs have not been established provided that the alternative groundwater protection standard has been certified by an independent registered professional engineer and the state has been notified that the alternative groundwater protection standard has been placed in the operating record and on the owner's or operator's publicly accessible internet site. These groundwater protection standards shall be appropriate health based levels that satisfy the following criteria:

(1) The level is derived in a manner consistent with Agency guidelines for assessing the health risks of environmental pollutants;

(2) The level is based on scientifically valid studies conducted in accordance with the Toxic Substances Control Act Good Laboratory Practice Standards (40 CFR part 792) or equivalent;

(3) For carcinogens, the level represents a concentration associated with an excess lifetime cancer risk level

(due to continuous lifetime exposure) within the 1×10^{-4} to 1×10^{-6} range; and

(4) For systemic toxicants, the level represents a concentration to which the human population (including sensitive subgroups) could be exposed to on a daily basis that is likely to be without appreciable risk of deleterious effects during a lifetime. For purposes of this subpart, *systemic toxicants* include toxic chemicals that cause effects other than cancer or mutation.

(i) In establishing groundwater protection standards under paragraph (h) of this section, the owner or operator of the CCR landfill or surface impoundment may consider the following:

(1) Multiple contaminants in the groundwater;

(2) Exposure threats to sensitive environmental receptors; and

(3) Other site-specific exposure or potential exposure to groundwater.

§ 257.96 Assessment of corrective measures.

(a) Within 90 days of finding that any of the constituents listed in Appendix IV to this part have been detected at a statistically significant level exceeding the groundwater protection standards defined under § 257.95 (g) or (h) of this part, the owner or operator of the CCR landfill or surface impoundment must initiate an assessment of corrective measures. Such an assessment must be completed within 90 days.

(b) The owner or operator of the CCR landfill or surface impoundment must continue to monitor in accordance with the assessment monitoring program as specified in § 257.95.

(c) The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under § 257.97, addressing at least the following:

(1) The performance, reliability, ease of implementation, and potential impacts of appropriate potential remedies, including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

(2) The time required to begin and complete the remedy;

(3) The costs of remedy implementation; and

(4) The institutional requirements such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(s).

(d) The owner or operator of the CCR landfill or surface impoundment must provide notification of the corrective measures assessment to the state and the public.

(e) The owner or operator must discuss the results of the corrective measures assessment, prior to the selection of remedy, in a public meeting with interested and affected parties.

§ 257.97 Selection of remedy.

(a) Based on the results of the corrective measures assessment conducted under § 257.96, the owner or operator of the CCR landfill or surface impoundment must select a remedy that, at a minimum, meets the standards listed in paragraph (b) of this section. The owner or operator of the CCR landfill or surface impoundment must notify the state and the public within 14 days of selecting a remedy, that a report certified by an independent registered professional engineer or hydrologist describing the selected remedy, has been placed in the operating record and on the owner's or operator's publicly accessible internet site, and how it meets the standards in paragraph (b) of this section.

(b) Remedies must:

(1) Be protective of human health and the environment;

(2) Attain the groundwater protection standard as specified pursuant to §§ 257.95 (g) or (h);

(3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of Appendix IV of this part constituents into the environment that may pose a threat to human health or the environment; and

(4) Comply with standards for management of wastes as specified in § 257.98(d).

(c) In selecting a remedy that meets the standards of paragraph (b) of this section, the owner or operator of the CCR landfill or surface impoundment shall consider the following evaluation factors:

(1) The long- and short-term effectiveness and protectiveness of the potential remedy(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(i) Magnitude of reduction of existing risks;

(ii) Magnitude of residual risks in terms of likelihood of further releases due to CCRs remaining following implementation of a remedy;

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance;

(iv) Short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, and redisposal of containment;

(v) Time until full protection is achieved;

(vi) Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;

(vii) Long-term reliability of the engineering and institutional controls; and

(viii) Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

(i) The extent to which containment practices will reduce further releases;

(ii) The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(s) based on consideration of the following types of factors:

(i) Degree of difficulty associated with constructing the technology;

(ii) Expected operational reliability of the technologies;

(iii) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(iv) Availability of necessary equipment and specialists; and

(v) Available capacity and location of needed treatment, storage, and disposal services.

(4) The degree to which community concerns are addressed by a potential remedy(s).

(d) The owner or operator of the CCR landfill or surface impoundment shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a schedule must require the initiation of remedial activities within a reasonable period of time taking into consideration the factors set forth in paragraphs (d) (1) through (8) of this section. The owner or operator of the CCR landfill or surface impoundment must consider the following factors in determining the schedule of remedial activities:

(1) Extent and nature of contamination;

(2) Reasonable probabilities of remedial technologies in achieving compliance with the groundwater protection standards established under § 257.95 (f) or (g) and other objectives of the remedy;

(3) Availability of treatment or disposal capacity for CCRs managed during implementation of the remedy;

(4) Desirability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

(5) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;

(6) Resource value of the aquifer including:

(i) Current and future uses;

(ii) Proximity and withdrawal rate of users;

(iii) Groundwater quantity and quality;

(iv) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to CCR constituents;

(v) The hydrogeologic characteristic of the facility and surrounding land;

(vi) Groundwater removal and treatment costs; and

(vii) The cost and availability of alternative water supplies.

(7) Other relevant factors.

(e) The owner or operator of the CCR landfill or surface impoundment may determine that remediation of a release of an Appendix IV constituent from a CCR landfill or surface impoundment is not necessary if the owner or operator of the CCR landfill or surface impoundment demonstrates the following, and notifies the state that the demonstration, certified by an independent registered professional engineer or hydrologist, has been placed in the operating record and on the owner's or operator's publicly accessible internet site:

(1) The groundwater is additionally contaminated by substances that have originated from a source other than a CCR landfill or surface impoundment and those substances are present in concentrations such that cleanup of the release from the CCR landfill or surface impoundment would provide no significant reduction in risk to actual or potential receptors; or

(2) The constituent(s) is present in groundwater that:

(i) Is not currently or reasonably expected to be a source of drinking water; and

(ii) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in a concentration(s) that would exceed the ground-water protection standards established under § 257.95 (g) or (h); or

(3) Remediation of the release(s) is technically impracticable; or

(4) Remediation results in unacceptable cross-media impacts.

(f) A determination by the owner or operator pursuant to paragraph (e) of this section shall not affect the obligation of the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are reasonable and significantly reduce threats to human health or the environment.

§ 257.98 Implementation of the corrective action program.

(a) Based on the schedule established under § 257.97(d) for initiation and completion of remedial activities the owner or operator must:

(1) Establish and implement a corrective action groundwater monitoring program that:

(i) At a minimum, meets the requirements of an assessment monitoring program under § 257.95;

(ii) Indicates the effectiveness of the corrective action remedy; and

(iii) Demonstrates compliance with ground-water protection standard pursuant to paragraph (e) of this section.

(2) Implement the corrective action remedy selected under § 257.97; and

(3) Take any interim measures necessary to ensure the protection of human health and the environment. Interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to § 257.97. The following factors must be considered by an owner or operator in determining whether interim measures are necessary:

(i) Time required to develop and implement a final remedy;

(ii) Actual or potential exposure of nearby populations or environmental receptors to any of the Appendix IV constituents;

(iii) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(iv) Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;

(v) Weather conditions that may cause any of the Appendix IV of this part constituents to migrate or be released;

(vi) Potential for exposure to any of the Appendix IV of this part constituents as a result of an accident or failure of a container or handling system; and

(vii) Other situations that may pose threats to human health and the environment.

(b) An owner or operator of the CCR landfill or surface impoundment may determine, based on information developed after implementation of the remedy has begun or other information, that compliance with requirements of § 257.97(b) are not being achieved through the remedy selected. In such cases, the owner or operator of the CCR landfill or surface impoundment must implement other methods or techniques that could reasonably achieve compliance with the requirements, unless the owner or operator makes the determination under paragraph (c) of this section.

(c) If the owner or operator determines that compliance with requirements under § 257.97(b) cannot be reasonably achieved with any currently available methods, the owner or operator of the CCR landfill or surface impoundment must:

(1) Obtain certification of an independent registered professional engineer or hydrologist that compliance with requirements under § 257.97(b) cannot be reasonably achieved with any currently available methods;

(2) Implement alternate measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment; and

(3) Implement alternate measures for control of the sources of contamination or for removal or decontamination of equipment, units, devices, or structures that are consistent with the overall objective of the remedy.

(4) Notify the state within 14 days that a report, including the certification required in paragraph (c)(1) of this section, justifying the alternative measures prior to implementing the alternative measures has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(d) All CCRs that are managed pursuant to a remedy required under § 257.97, or an interim measure required under paragraph (a)(3) of this section, shall be managed in a manner:

(1) That is protective of human health and the environment; and

(2) That complies with applicable RCRA requirements.

(e) Remedies selected pursuant to § 257.97 shall be considered complete when:

(1) The owner or operator of the CCR landfill or surface impoundment complies with the groundwater protection standards established under §§ 257.95 (h) or (i) at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under § 257.91(a).

(2) Compliance with the groundwater protection standards established under §§ 257.95 (h) or (h) has been achieved by demonstrating that concentrations of Appendix IV constituents have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in § 257.93 (g) and (h).

(3) All actions required to complete the remedy have been satisfied.

(f) Upon completion of the remedy, the owner or operator of the CCR landfill or surface impoundment must notify the state within 14 days that a certification that the remedy has been completed in compliance with the requirements of paragraph (e) of this section has been placed in the operating record and on the owner's or operator's publicly accessible internet site. The certification must be signed by the owner or operator and by an independent registered professional engineer or hydrologist.

§ 257.99 [Reserved]

Closure and Post-Closure Care

§ 257.100 Closure criteria.

(a) Prior to closure of any CCR landfill or surface impoundment covered by this subpart, the owner or operator shall submit to the state, a plan for closure of the unit based on recognized and generally accepted good engineering practices and certified by an independent registered professional engineer. The closure plan shall be consistent with paragraph (g) of this section and provide for major slope stability, include a schedule for the plan's implementation and contain provisions to preclude the probability of future impoundment of water, sediment, or slurry. The closure plan shall be placed in the operating record and on the owner's or operator's publicly accessible internet site.

(b) Closure of a CCR landfill or surface impoundment may be accomplished with CCRs in place or through CCR removal and decontamination of all areas affected by releases from the CCR landfill or surface impoundment. CCR removal and decontamination are complete when constituent concentrations throughout the CCR landfill or surface impoundment and any areas affected by releases from the CCR landfill or surface impoundment do not exceed numeric cleanup levels for those constituents found in the CCRs established by the state in which the CCR landfill or surface impoundment is located.

(c) At closure, the owner or operator of a surface impoundment must:

(1) Eliminate free liquids by removing liquid wastes or solidifying the remaining wastes and waste residues;

(2) Stabilize remaining wastes to a bearing capacity sufficient to support the final cover; and

(3) Cover the surface impoundment with a final cover designed and constructed to:

(i) Provide long-term minimization of the migration of liquids through the closed impoundment;

(ii) Function with minimum maintenance; and

(iii) Promote drainage and minimize erosion or abrasion of the cover;

(iv) Accommodate settling and subsidence so that the cover's integrity is maintained; and

(v) Have a final cover system that meets the requirements of subsection (d).

(d) For closure with CCRs in place, a final cover system must be installed at all CCR landfills and surface impoundments that is designed to minimize infiltration and erosion. The final cover system must be designed and constructed to:

(1) Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present, or a permeability no greater than 1×10^{-5} cm/sec, whichever is less, and

(2) Minimize infiltration through the closed CCR landfill or surface impoundment by the use of an infiltration layer that contains a minimum 18-inches of earthen material, and

(3) Minimize erosion of the final cover by the use of an erosion layer that contains a minimum 6-inches of earthen material that is capable of sustaining native plant growth, and

(4) Minimize the disruption of the final cover through a design that accommodates settling and subsidence.

(e) The owner or operator of the CCR landfill or surface impoundment may select an alternative final cover design, provided the alternative cover design is certified by an independent registered professional engineer and notification is provided to the state and the EPA Regional Administrator that the alternative cover design has been placed in the operating record and on the owner's or operator's publicly accessible internet site. The alternative final cover design must include:

(1) An infiltration layer that achieves an equivalent reduction in infiltration as the infiltration layer specified in paragraphs (d)(1) and (d)(2) of this section, and

(2) An erosion layer that provides equivalent protection from wind and water erosion as the erosion layer specified in paragraph (d)(3) of this section.

(f) The design of the final cover system shall be placed on the owner's or operator's publicly accessible internet site.

(g) The owner or operator of the CCR landfill or surface impoundment must prepare a written closure plan that describes the steps necessary to close the CCR landfill or surface impoundment at any point during the active life in accordance with the cover design requirements in paragraph (d) or (e) of this section, as applicable. The closure plan, at a minimum, must include the following information:

(1) A description of the final cover, designed in accordance with paragraph (d) or (e) of this section and the methods and procedures to be used to install the cover;

(2) An estimate of the largest area of the CCR landfill or surface impoundment ever requiring a final cover as required under paragraph (d) or (e) of this section at any time during the active life;

(3) An estimate of the maximum inventory of CCRs ever on-site over the active life of the CCR landfill or surface impoundment; and

(4) A schedule for completing all activities necessary to satisfy the closure criteria in this section.

(h) The owner or operator of the CCR landfill or surface impoundment must notify the state that a closure plan, certified by an independent registered professional engineer, has been prepared and placed in the operating record and on the owner's or operator's publicly accessible internet site no later than the effective date of this part, or by the initial receipt of CCRs, whichever is later.

(i) Prior to beginning closure of each CCR landfill or surface impoundment as specified in paragraph (j) of this section, an owner or operator of a CCR landfill or surface impoundment must notify the state that a notice of the intent to close the unit has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(j) The owner or operator of the CCR landfill or surface impoundment must begin closure activities no later than 30 days after the date on which the CCR landfill or surface impoundment receives the known final receipt of CCR or, if the CCR landfill or surface impoundment has remaining capacity and there is a reasonable likelihood that the CCR landfill or surface impoundment will receive additional CCRs, no later than one year after the most recent receipt of CCRs.

(k) The owner or operator of the CCR landfill or surface impoundment must complete closure activities in accordance with the closure plan within 180 days following the beginning of closure as specified in paragraph (j) of this section.

(l) Following closure of each CCR landfill or surface impoundment, the owner or operator of the CCR landfill or surface impoundment must notify the state that a certification, signed by an independent registered professional engineer, verifying that closure has been completed in accordance with the closure plan and the requirements of this subpart that has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(m)(1) Following closure of all CCR landfills or surface impoundments, the owner or operator of the CCR landfill or surface impoundment must record a notation on the deed to the property, or some other instrument that is normally examined during title search, and notify the state that the notation has been recorded and a copy has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(2) The notation on the deed must in perpetuity notify any potential purchaser of the property that:

(i) The land has been used as a CCR landfill or surface impoundment; and

(ii) Its use is restricted under § 257.101(c)(3).

§ 257.101 Post-closure care requirements.

(a) Following closure of each CCR landfill or surface impoundment, the owner or operator must conduct post-closure care. Post-closure care must be conducted for 30 years, except as provided under paragraph (b) of this section, and consist of at least the following:

(1) Maintaining the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

(2) Maintaining the integrity and effectiveness of the leachate collection and removal system and operating the leachate collection and removal system in accordance with the requirements of §§ 257.70, 257.71, and 257.72.

(3) Maintaining the groundwater monitoring system and monitoring the groundwater in accordance with the requirements of §§ 257.91 through 257.98 of this part.

(b) The length of the post-closure care period may be:

(1) Decreased if the owner or operator of the CCR landfill or surface impoundment demonstrates that the reduced period is sufficient to protect human health and the environment and this demonstration is certified by an independent registered professional engineer and notice is provided to the state that the demonstration has been placed in the operating record and on the owner's or operator's publicly accessible Internet site; or

(2) Increased if the owner or operator of the CCR landfill or surface impoundment determines that a lengthened period is necessary to protect human health and the environment.

(c) The owner or operator of the CCR landfill or surface impoundment must prepare a written post-closure plan, certified by an independent registered professional engineer that includes, at a minimum, the following information:

(1) A description of the monitoring and maintenance activities required in paragraph (a) of this section for each CCR landfill or surface impoundment, and the frequency at which these activities will be performed;

(2) Name, address, and telephone number of the person or office to contact about the facility during the post-closure period; and

(3) A description of the planned uses of the property during the post-closure period. Post-closure use of the property shall not disturb the integrity of the final cover, liner(s), or any other components of the containment system, or the function of the monitoring systems unless necessary to comply with the requirements in this subpart. Any other disturbance is allowed if the owner or operator of the CCR landfill or surface impoundment demonstrates that disturbance of the final cover, liner or other component of the containment system, including any removal of CCRs, will not increase the potential threat to human health or the environment. The demonstration must be certified by an independent registered professional engineer, and notification shall be provided to the state that the demonstration has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

(d) The owner or operator of the CCR landfill or surface impoundment must notify the state that a post-closure plan has been prepared and placed in the operating record and on the owner's or operator's publicly accessible internet site no later than the effective date of this rule, or by the initial receipt of CCRs, whichever is later.

(e) Following completion of the post-closure care period for the CCR landfill or surface impoundment, the owner or operator of the CCR landfill or surface impoundment must notify the state that a certification, signed by an independent registered professional engineer, verifying that post-closure care has been completed in accordance with the post-closure plan has been placed in the operating record and on the owner's or operator's publicly accessible internet site.

§§ 257.102–257.109 [Reserved]

6. Add Appendixes III and IV to Part 257 to read as follows:

Appendix III to Part 257—Constituents for Detection Monitoring

Common Name [1]
Boron
Chloride
Conductivity
Fluoride
pH
Sulphate
Sulfide
Total Dissolved Solids

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Appendix IV to Part 257—Constituents for Assessment Monitoring

Common Name [1]
Aluminum
Antimony
Arsenic
Barium
Beryllium
Boron
Cadmium
Chloride
Chromium (total)
Copper
Fluoride
Iron
Lead
Manganese
Mercury
Molybdenum
pH
Selenium
Sulphate
Sulfide
Thallium
Total Dissolved Solids

[1] Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Alternative 2: Co-Proposal Under Authority of Subtitle C

PART 261—IDENTIFICATION AND LISTING OF HAZARDOUS WASTE

6a. The authority citation for part 261 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, 6922, 6924(y), and 6938.

7. Section 261.4 is amended by revising paragraph (b)(4) to read as follows.

§ 261.4 Exclusions.

* * * * *

(b) * * *

(4)(i) Fly ash, bottom ash, boiler slag, and flue gas emission control wastes, generated primarily from the combustion of coal for the purpose of generating electricity by the electric power sector if the fly ash, bottom ash, boiler slag, and flue gas emission control wastes are beneficially used or placed in minefilling operations. Beneficial Use of Coal Combustion Products (CCPs) means the use of CCPs that provides a functional benefit; replaces the use of an alternative material, conserving natural resources that would otherwise need to be obtained through practices such as extraction; and meets relevant product specifications and regulatory standards (where these are available). CCPs that are used in excess quantities, placed as fill in sand and gravel pits, or used in large scale fill projects, such as for restructuring the landscape, are not considered beneficial uses.

(ii) Fly ash, bottom ash, boiler slag, and flue gas emission control wastes generated primarily from the combustion of coal for the purpose of generating electricity by facilities outside of the electric power sector (*i.e.*, not included in NAICS code 221112).

(iii) Fly ash, bottom ash, boiler slag, and flue gas emission control wastes, generated primarily from the combustion of fossil fuels other than coal, for the purpose of generating electricity, except as provided by § 266.112 of this chapter for facilities that burn or process hazardous waste.

* * * * *

8. Part 261 is amended by adding Subpart F to read as follows.

Subpart F—Special Wastes Subject to Subtitle C Regulations

§ 261.50 General.

(a) The following solid wastes are special wastes subject to regulation under parts 262 through 268, and parts 270, 271, and 124 of this chapter, and to the notification requirements of section 3010 of RCRA,

Industry and EPA special waste No.	Special waste	Hazard code
Coal Combustion Residuals:		
S001	Coal combustion residuals generated by the electric power sector (Electric Utilities and Independent Power Producers).	(T)

(b) For the purposes of the S001 listing, the electric power sector is defined as electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public; *i.e.*, NAICS code 221112 plants. Coal combustion residuals are defined to include fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated by the electric utility industry. This listing does not apply to coal combustion residuals that are:

(1) Uniquely associated wastes as defined in paragraph (c) of this section;

(2) Beneficially used as defined in paragraph (d) of this section;

(3) Placed in minefilling operations;

(4) Generated by facilities outside the electric power sector (*i.e.*, not included in NAICS code 22112); or

(5) Generated from clean-up activities that are conducted as part of a state or federally required clean-up that commenced prior to the effective date of this rule.

(c) Uniquely associated wastes are low-volume wastes other than those defined as coal combustion residuals in paragraph (a) of this section that are related to the coal combustion process. Examples of uniquely associated wastes are precipitation runoff from coal storage piles at the facility, waste coal or coal mill rejects that are not of sufficient quality to burn as fuel, and wastes from cleaning the boilers used to generate steam.

(d) Beneficial Use of Coal Combustion Products (CCPs) means the use of CCPs that provides a functional benefit; replaces the use of an alternative material, conserving natural resources that would otherwise need to be obtained through practices such as extraction; and meets relevant product specifications and regulatory standards (where these are available). CCPs that are used in excess quantities, placed as fill in sand and gravel pits, or used in large scale fill projects, such as for restructuring the landscape, are not considered beneficial uses.

9. Part 261 is amended by adding Appendix X to read as follows.

Appendix X to Part 261—Basis for Listing Special Wastes

EPA special waste No.	Hazardous constituents for which listed
S001	Antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium.

PART 264—STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

10. The authority citation for part 264 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6924, and 6925.

11. Section 264.1 is amended by adding paragraph (k) to read as follows:

§ 264.1 Purpose, scope and applicability.

* * * * *

(k) Owners or operators who treat, store or dispose of EPA Special Waste Number S001, also referred to as coal combustion residuals are subject to the requirements of this part, except as specifically provided otherwise in this part. In addition, subpart FF of this part includes additional requirements for the treatment, storage or disposal of EPA Special Waste Number S001.

12. Section 264.140 is amended by revising paragraph (a) to read as follows:

§ 264.140 Applicability.

(a) The requirements of §§ 264.142, 264.143, and 264.147 through 264.151 apply to owners and operators of all hazardous waste facilities and facilities that treat, store or dispose of special wastes, except as provided otherwise in this section, or in § 264.1.

* * * * *

13. Part 264 is amended by adding subpart FF to read as follows:

Subpart FF—Special Requirements for Coal Combustion Residual (S001) Wastes

Sec.
264.1300 Applicability.
264.1301 Definitions.
264.1302 Reporting.
264.1303 Surface impoundments.
264.1304 Inspection requirements for surface impoundments.
264.1305 Requirements for surface impoundment closure.
264.1306 Landfills.
264.1307 Surface water requirements.
264.1308 Air requirements.

Subpart FF—Special Requirements for Coal Combustion Residual (S001) Wastes

§ 264.1300 Applicability.

(a) The regulations in this subpart apply to owners or operators of facilities that treat, store or dispose of EPA Special Waste Number S001.

(b) Owners or operators of surface impoundments that cease receiving EPA Special Waste Number S001, must comply with the closure requirements in 40 CFR 265.111 and 40 CFR 265.228. Facilities that have not met these closure requirements by the effective date of this regulation would be subject to the requirements in Parts 260 through 268, and 270 through 272, of this chapter.

§ 264.1301 Definitions.

This section contains definitions for terms that appear throughout this subpart; additional definitions appear in 40 CFR 260.10 or the specific sections to which they apply.

Area-capacity curves means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations.

CCR landfill means a disposal facility or part of a facility where CCRs are placed in or on land and which is not a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit. For purposes of this subpart, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

CCR surface impoundment or *impoundment* means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of CCRs containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons. CCR surface impoundments are used to receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

Coal Combustion Residuals (CCRs) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials, destined for disposal. CCRs are also known as coal combustion wastes (CCWs) and fossil fuel combustion (FFC) wastes, when destined for disposal.

Existing CCR landfill means a landfill which was in operation or for which construction commenced prior to the effective date of the final rule. A CCR landfill has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which cannot be cancelled or modified without substantial loss—for physical construction of the CCR landfill to be completed within a reasonable time.

Existing CCR surface impoundment means a surface impoundment which was in operation or for which construction commenced prior to the effective date of the final rule. A CCR surface impoundment has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which can not be cancelled or modified without substantial loss—for physical construction of the CCR surface impoundment to be completed within a reasonable time.

Factor of safety (Safety factor) means the ratio of the forces tending to resist the failure of a structure to the forces tending to cause such failure as determined by recognized and generally accepted good engineering practices.

Hazard potential means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a dam (or impoundment) or mis-operation of the dam or appurtenances.

(1) *High hazard potential surface impoundment* means a surface impoundment where failure or mis-operation will probably cause loss of human life.

(2) *Significant hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns.

(3) *Low hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

(4) *Less than low hazard potential surface impoundment* means a surface impoundment not meeting the definitions for High, Significant, or Low Hazard Potential.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill, or CCR surface impoundment made after the effective date of the final rule.

New CCR landfill means a landfill, including lateral expansions, or installation from which there is or may be placement of CCRs without the presence of free liquids, which began operation, or for which the construction commenced after the effective date of the final rule.

New CCR surface impoundment means a surface impoundment, including lateral expansions, or installation from which there is or may be placement of CCRs with the presence of free liquids, which began operation, or for which the construction commenced after the effective date of the final rule.

Probable maximum precipitation means the value for a particular area which represents an envelopment of depth-duration-area rainfall relations for all storm types affecting that area adjusted meteorologically to maximum conditions.

Recognized and generally accepted good engineering practices (RAGAGEPs) means engineering, operation, or maintenance activities based on established codes, standards, published technical reports or recommended practices (RP) or a similar document. RAGAGEPs detail generally approved ways to perform specific engineering, inspection or mechanical integrity activities.

§ 264.1302 Reporting.

(a) Except as provided in paragraph (b) of this section, every twelfth month following the date of the initial plan approval required in § 264.1303, the person owning or operating a CCR surface impoundment that has not been properly closed in accordance with an approved plan shall submit to the Regional Administrator a report containing the following information:

(1) Changes in the geometry of the CCR surface impoundment for the reporting period.

(2) Location and type of installed instruments and the maximum and minimum recorded readings of each instrument for the reporting period.

(3) The minimum, maximum, and present depth and elevation of the CCR slurry and CCR wastewater in the CCR surface impoundment for the reporting period.

(4) The storage capacity of the CCR surface impoundment.

(5) The volume of the CCR slurry and CCR wastewater in the CCR surface impoundment at the end of the reporting period.

(6) Any other change which may have affected the stability or operation of the CCR surface impoundment that has occurred during the reporting period.

(7) A certification by an independent registered professional engineer that all construction, operation, and maintenance are in accordance with the approved plan prepared in accordance with § 264.1303.

(b) A report is not required under this section when the person owning or operating the CCR surface impoundment provides the Regional Administrator with a certification by an independent registered professional engineer that there have been no changes in the operation of the CCR surface impoundment or to any of the parameters previously reported under paragraphs (a)(1) through (a)(6) of this section. However, a report containing the information set out in paragraph (a) of this section shall be submitted to the Regional Administrator at least every 5 years.

§ 264.1303 Surface impoundments.

(a) In addition to the requirements in subpart K of this part, EPA Special Waste No. S001 is subject to the requirements in this section.

(b) Plans for the design, construction, and maintenance of existing CCR surface impoundments shall be required if such a unit can:

(1) Impound CCRs to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or

(2) Impound CCRs to an elevation of 20 feet or more above the upstream toe of the structure.

(c) Plans required under paragraph (b) of this section shall be submitted in triplicate to the Regional Administrator on or before [date one year after the effective date of the final rule].

(d) A permanent identification marker, at least six feet high and showing the identification number of the CCR surface impoundment as assigned by the Regional Administrator, the name associated with the CCR surface impoundment and the name of the person owning or operating the structure, shall be located on or immediately adjacent to each CCR surface impoundment by [date 60 days after the effective date of the final rule].

(e) The plan specified in paragraph (b) of this section, shall contain at a minimum the following information:

(1) The name and address of the persons owning or operating the CCR surface impoundment; the name associated with the CCR surface impoundment; and the identification number of the CCR surface impoundment as assigned by the Regional Administrator.

(2) The location of the CCR surface impoundment indicated on the most recent USGS 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(3) A statement of the purpose for which the CCR surface impoundment is being used.

(4) The name and size in acres of the watershed affecting the CCR surface impoundment.

(5) A description of the physical and engineering properties of the foundation materials on which the CCR surface impoundment is constructed.

(6) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment; the method of site preparation and construction of each zone of the CCR surface impoundment; the approximate dates of construction, and each successive stage of construction of the CCR surface impoundment; and for existing CCR surface impoundments, such history of construction as may be available, and any record or knowledge of structural instability.

(7) At a scale not to exceed 1 inch = 100 feet, detailed dimensional drawings of the CCR surface impoundment, including a plan view and cross sections of the length and width of the CCR surface impoundment, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the measurement of the minimum vertical distance between the crest of the CCR surface impoundment and the reservoir surface at present and under design storm conditions, CCR slurry level and CCR wastewater level, and other information pertinent to the CCR surface impoundment itself, including any identifiable natural or manmade features which could affect operation of the CCR surface impoundment.

(8) A description of the type and purpose of existing or proposed instrumentation.

(9) Graphs showing area-capacity curves.

(10) The hazard potential classification for which the facility is designed and a detailed explanation of the basis for this classification.

(11) A statement of the runoff attributable to the storm for which the CCR surface impoundment is designed and the calculations used in determining such runoff and the minimum freeboard during the design storm.

(12) A description of the spillway and diversion design features and capacities and calculations used in their determination.

(13) The computed minimum factor of safety for slope stability of the CCR retaining structure(s) and the analyses used in their determinations.

(14) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.

(15) General provisions for closure.

(16) Such other information pertaining to the CCR surface impoundment which may be requested by the Regional Administrator.

(17) A certification by an independent registered professional engineer that the design of the CCR surface impoundment is in accordance with recognized and generally accepted good engineering practices for the maximum volume of CCR slurry and CCR wastewater which can be impounded therein and for the passage of runoff from the design storm which exceeds the capacity of the CCR surface impoundment; or, in lieu of the

certification, a report indicating what additional investigations, analyses, or improvement work are necessary before such a certification can be made by an independent registered professional engineer, including what provisions have been made to carry out such work in addition to a schedule for completion of such work.

(f) Any changes or modifications to the plans for CCR surface impoundments shall be approved by the Regional Administrator prior to the initiation of such changes or modifications.

(g) Effective [date two years after the effective date of the final rule], all existing CCR surface impoundments that receive CCRs shall be operated and maintained with:

(1) A run-on control system to prevent flow onto the active portion of the CCR surface impoundment during the peak discharge from a 24-hour, 25-year storm;

(2) A run-off control system from the active portion of the CCR surface impoundment to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR surface impoundment must be handled in accordance with § 264.1307.

(h) For CCR surface impoundments classified as having high or significant hazard potential, the owner or operator shall develop and maintain in the operating record an Emergency Action Plan which: defines responsible persons and the actions to be taken in the event of a dam-safety emergency; provides contact information for emergency responders; includes a map which delineates the downstream area which would be affected in the event of a dam failure; and includes provisions for an annual face-to-face meeting or exercise between representatives of the facility owner and the local emergency responders.

§ 264.1304 Inspection requirements for surface impoundments.

(a) In addition to the inspection requirements in § 264.226 of this part, all CCR surface impoundments that meet the requirements of § 264.1303(b) of this subpart shall be inspected by the owner or operator as follows:

(1) At intervals not exceeding 7 days, or as otherwise approved by the Regional Administrator, for appearances of structural weakness and other hazardous conditions.

(2) At intervals not exceeding 7 days, or as otherwise approved by the Regional Administrator, all instruments shall be monitored.

(3) Longer inspection or monitoring intervals approved under this paragraph shall be justified by the owner or operator of the CCR surface impoundment based on the hazard potential and performance of the CCR surface impoundment, and shall include a requirement for inspection immediately after a specified event approved by the Regional Administrator.

(4) All inspections required by paragraphs (a)(1) and (2) shall be performed by a qualified person, as defined in paragraph (e) of this section, designated by the person owning or operating the CCR surface impoundment.

(5) All CCR surface impoundments that meet the requirements of § 264.1303(b) of this subpart shall be inspected annually by an independent registered professional engineer to assure that the design, operation, and maintenance of the surface impoundment is in accordance with recognized and generally accepted good engineering standards. The owner or operator must notify the state and the EPA Regional Administrator that a certification by the registered professional engineer that the design, operation, and maintenance of the surface impoundment is in accordance with recognized and generally accepted good engineering standards has been placed in the operating record.

(b) When a potentially hazardous condition develops, the person owning or operating the CCR surface impoundment shall immediately:

(1) Take action to eliminate the potentially hazardous condition;

(2) Notify the Regional Administrator and State and local first responders;

(3) Notify and prepare to evacuate, if necessary, all personnel from the owner or operator's property which may be affected by the potentially hazardous conditions; and

(4) Direct a qualified person to monitor all instruments and examine the structure at least once every eight hours, or more often as required by an authorized representative of the Regional Administrator.

(c) After each inspection and instrumentation monitoring referred to in paragraphs (a) and (b) of this section, each qualified person who conducted all or any part of the inspection or instrumentation monitoring shall promptly record the results of such inspection or instrumentation monitoring in a book which shall be available in the operating record for inspection by an authorized representative of the Regional Administrator and such qualified person shall also promptly report the results of the inspection or monitoring to one of the persons specified in paragraph (d) of this section.

(d) All inspection and instrumentation monitoring reports recorded in accordance with paragraph (c) of this section shall include a report of the action taken to abate hazardous conditions and shall be promptly signed or countersigned by the person designated by the owner or operator as responsible for health and safety at the owner or operator's facility.

(e) The qualified person or persons referred to in this section shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation.

§ 264.1305 Requirements for surface impoundment closure.

Prior to the closure of any CCR surface impoundment which meets the requirements of § 264.1303(b) of this subpart, the person owning or operating such CCR surface impoundment shall submit to and obtain approval from the Regional Administrator, a plan for closure in accordance with the requirements of § 264.228 and subpart G of this part. This plan shall provide for major slope stability, include a schedule for the plan's implementation and, contain provisions to preclude the probability of future impoundment of water.

§ 264.1306 Landfills.

(a) Owners or operators of new CCR landfills and lateral expansions of existing landfills are exempt from the double liner and leachate collection system requirements of § 264.301(c), and the requirements of § 264.302, provided the owner or operator is in compliance with the requirements of paragraph (b) of this section. Owners or operators of existing landfills are also exempt from the liner requirements of paragraph (b)(1) of this section, provided they comply with the requirements of paragraph (c) of this section and the requirements at 40 CFR part 264 subparts F, G, H, and N.

(b) Prior to placement of CCRs in new landfills and lateral expansions of new and existing landfills, new landfills and lateral expansions shall be constructed:

(1) With a composite liner, as defined in paragraph (b)(2) of this section, and a leachate collection and removal system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner.

(2) For purposes of this subpart, composite liner means a system consisting of two components; the upper component must consist of a

minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

(3) For purpose of this subpart, hydraulic conductivity means the rate at which water can move through a permeable medium (*i.e.*, the coefficient of permeability).

(c) Effective [date two years after the effective date of the final rule], all existing landfills that receive CCRs shall be operated and maintained with:

(1) A run-on control system to prevent flow onto the active portion of the CCR landfill during the peak discharge from a 24-hour, 25-year storm;

(2) A run-off control system from the active portion of the CCR landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR landfill must be handled in accordance with § 264.1307 of this subpart.

§ 264.1307 Surface water requirements.

(a) Permits for CCR surface impoundments and CCR landfills shall include conditions to ensure that:

(1) The operation of the unit will not cause any violation of any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to section 402 of the Clean Water Act.

(2) The operation of the unit will not cause any violation of any requirement of an area-wide or state-wide water quality management plan that has been approved under section 208 or 319 of the Clean Water Act, as amended.

(b) [Reserved]

§ 264.1308 Air requirements.

(a) CCR surface impoundments and CCR landfills must be managed in a manner that fugitive dusts do not exceed 35 $\mu g/m^3$, unless an alternative standard has been established by the Regional Administrator.

(b) CCR surface impoundments must be managed to control wind dispersal of dusts consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator.

(c) CCR landfills must be managed to control wind dispersal of dusts consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator. CCRs placed in landfills as wet conditioned CCRs shall not result in the formation of free liquids.

(d) Tanks, containers, buildings and pads used for the storage must be managed to control the dispersal of dust. Pads must have wind protection that will ensure comparable levels of control.

(e) CCRs transported in trucks or other vehicles must be covered or otherwise managed to control the wind dispersal of dust consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator.

PART 265—INTERIM STATUS STANDARDS FOR OWNERS AND OPERATORS OF HAZARDOUS WASTE TREATMENT, STORAGE, AND DISPOSAL FACILITIES

14. The authority citation for part 265 continues to read as follows:

Authority: 42 U.S.C. 6905, 6906, 6912, 6922, 6923, 6924, 6925, 6935, 6936, and 6937.

15. Section 265.1 is amended by adding paragraph (g) to read as follows:

§ 265.1 Purpose, scope, and applicability.

* * * * *

(g) Owners or operators who treat, store or dispose of EPA Special Waste Number S001, also referred to as coal combustion residuals (CCRs) are subject to the requirements of this part, except as specifically provided otherwise in this part. In addition, subpart FF of this part includes additional requirements for the treatment storage or disposal of EPA Special Waste No. S001.

* * * * *

16. Section 265.140 is amended by revising paragraph (a) to read as follows:

§ 265.140 Applicability.

(a) The requirements of §§ 265.142, 265.143 and 265.147 through 265.150 apply to owners or operators of all hazardous and special waste facilities, except as provided otherwise in this section, or in § 265.1.

* * * * *

17. Part 265 is amended by adding Subpart FF to read as follows:

Subpart FF—Special Requirements for S001 Wastes

Subpart FF—Special Requirements for S001 Wastes

§ 265.1300 Applicability.

(a) The regulations in this subpart apply to owners or operators of hazardous waste facilities that treat, store or dispose of EPA Hazardous Waste Number S001.

(b) Owners or operators of surface impoundments that cease receiving EPA Special Waste Number S001,must comply with the closure requirements in 40 CFR Part 265.111 and 40 CFR 265.228. Facilities that have not met these closure requirements by the effective date of this regulation would be subject to the requirements in Parts 260 through 268, and 270 through 272, of this chapter.

§ 265.1301 Definitions.

This section contains definitions for terms that appear throughout this subpart; additional definitions appear in 40 CFR 260.10 or the specific sections to which they apply.

Area-capacity curves means graphic curves which readily show the reservoir water surface area, in acres, at different elevations from the bottom of the reservoir to the maximum water surface, and the capacity or volume, in acre-feet, of the water contained in the reservoir at various elevations.

Coal Combustion Residuals (CCRs) means fly ash, bottom ash, boiler slag, and flue gas desulfurization materials, destined for disposal. CCRs are also known as coal combustion wastes (CCWs) and fossil fuel combustion (FFC) wastes, when destined for disposal, and as coal combustion products (CCPs) when beneficially used.

CCR landfill means a disposal facility or part of a facility where CCRs are placed in or on land and which is not a land treatment facility, a surface impoundment, an underground injection well, a salt dome formation, a salt bed formation, an underground mine, a cave, or a corrective action management unit. For purposes of this subpart, landfills also include piles, sand and gravel pits, quarries, and/or large scale fill operations. Sites that are excavated so that more coal ash can be used as fill are also considered CCR landfills.

CCR surface impoundment or *impoundment* means a facility or part of a facility which is a natural topographic depression, man-made excavation, or diked area formed primarily of earthen materials (although it may be lined with man-made materials), which is designed to hold an accumulation of CCRs containing free liquids, and which is not an injection well. Examples of CCR surface impoundments are holding, storage, settling, and aeration pits, ponds, and lagoons. CCR surface impoundments are used to receive CCRs that have been sluiced (flushed or mixed with water to facilitate movement), or wastes from wet air pollution control devices, often in addition to other solid wastes.

Existing CCR landfill means a landfill which was in operation or for which construction commenced prior to the effective date of the final rule A CCR landfill has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which cannot be cancelled or modified without substantial loss—for physical construction of the CCR landfill to be completed within a reasonable time.

Existing CCR surface impoundment means a surface impoundment which was in operation or for which construction commenced prior to the effective date of the final rule. A CCR surface impoundment has commenced construction if the owner or operator has obtained the Federal, State and local approvals or permits necessary to begin physical construction; and either

(1) A continuous on-site, physical construction program has begun; or

(2) The owner or operator has entered into contractual obligations—which can not be cancelled or modified without substantial loss—for physical construction of the CCR surface impoundment to be completed within a reasonable time.

Factor of safety (Safety factor) means the ratio of the forces tending to resist the failure of a structure to the forces tending to cause such failure as determined by recognized and accepted good engineering practices.

Hazard potential means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of a dam (or impoundment) or mis-operation of the dam or appurtenances.

(1) *High hazard potential surface impoundment* means a surface impoundment where failure or mis-operation will probably cause loss of human life.

(2) *Significant hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environment damage, disruption of lifeline facilities, or impact other concerns.

(3) *Low hazard potential surface impoundment* means a surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

(4) *Less than low hazard potential surface impoundment* means a surface impoundment not meeting the definitions for High, Significant, or Low Hazard Potential.

Lateral expansion means a horizontal expansion of the waste boundaries of an existing CCR landfill, or CCR surface impoundment made after the effective date of the final rule.

New CCR landfill means a landfill, including lateral expansions, or installation from which there is or may be placement of CCRs without the presence of free liquids, which began operation, or for which the construction commenced after the effective date of the final rule.

New CCR surface impoundment means a surface impoundment, including lateral expansion, or installation from which there is or may be placement of CCRs with the presence of free liquids, which began operation, or for which the construction commenced after the effective date of the final rule.

Probable maximum precipitation means the value for a particular area which represents an envelopment of depth-duration-area rainfall relations for all storm types affecting that area adjusted meteorologically to maximum conditions.

Recognized and generally accepted good engineering practices (RAGAGEPs) means engineering, operation, or maintenance activities based on established codes, standards, published technical reports or recommended practices (RP) or a similar document. RAGAGEPs detail generally approved ways to perform specific engineering, inspection or mechanical integrity activities.

§ 265.1302 Reporting.

(a) Except as provided in paragraph (b) of this section, every twelfth month following the date of the initial plan approval required in § 265.1303 of this subpart, the person owning or operating a CCR surface impoundment that has not been properly closed in accordance with an approved plan shall submit to the Regional Administrator a report containing the following information:

(1) Changes in the geometry of the CCR surface impoundment for the reporting period.

(2) Location and type of installed instruments and the maximum and minimum recorded readings of each instrument for the reporting period.

(3) The minimum, maximum, and present depth and elevation of the CCR slurry and CCR waste water in the CCR surface impoundment for the reporting period.

(4) The storage capacity of the CCR surface impoundment.

(5) The volume of the CCR slurry and CCR waste water in the CCR surface impoundment at the end of the reporting period.

(6) Any other change which may have affected the stability or operation of the CCR surface impoundment that has occurred during the reporting period.

(7) A certification by an independent registered professional engineer that all construction, operation, and maintenance are in accordance with the approved plan prepared in accordance with § 265.1303.

(b) A report is not required under this section when the person owning or operating the CCR surface impoundment provides the Regional Administrator with a certification by an independent registered professional engineer that there have been no changes in the operation of the CCR surface impoundment or to any of the parameters previously reported under paragraphs (a)(1) through (a)(6) of this section. However, a report containing the information set out in paragraph (a) of this section shall be submitted to the Regional Administrator at least every 5 years.

§ 265.1303 Surface impoundments.

(a) In addition to the requirements in subpart K of this part, EPA Special Waste No. S001 is subject to the requirements in this section.

(b) Plans for the design, construction, and maintenance of existing CCR surface impoundments shall be required if such a unit can:

(1) Impound CCRs to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or

(2) Impound CCRs to an elevation of 20 feet or more above the upstream toe of the structure.

(c) Plans required under paragraph (b) of this section shall be submitted in triplicate to the Regional Administrator on or before [date one year after the effective date of the final rule].

(d) A marker, at least six feet high and showing the identification number of the CCR surface impoundment as assigned by the Regional Administrator, the name associated with the CCR surface impoundment and the name of the person owning or operating the structure, shall be located on or immediately adjacent to each CCR surface impoundment permanent identification by [date 60 days after the effective date of the final rule].

(e) The plan specified in paragraph (b) of this section, shall contain at a minimum the following information:

(1) The name and address of the persons owning or operating the CCR surface impoundment; the name associated with the CCR surface impoundment; and the identification number of the CCR surface impoundment as assigned by the Regional Administrator.

(2) The location of the CCR surface impoundment indicated on the most recent USGS 7½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.

(3) A statement of the purpose for which the CCR surface impoundment is being used.

(4) The name and size in acres of the watershed affecting the CCR surface impoundment.

(5) A description of the physical and engineering properties of the foundation materials on which the CCR surface impoundment is constructed.

(6) A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR surface impoundment; the method of site preparation and construction of each zone of the CCR surface impoundment; the approximate dates of construction, and each successive stage of construction of the CCR surface impoundment; and for existing CCR surface impoundments, such history of construction as may be available, and any record or knowledge of structural instability.

(7) At a scale not to exceed 1 inch = 100 feet, detailed dimensional drawings of the CCR surface impoundment, including a plan view and cross sections of the length and width of the CCR surface impoundment, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection, in addition to the measurement of the minimum vertical distance between the crest of the CCR surface impoundment and the reservoir surface at present and under design storm conditions, CCR slurry level or CCR waste water level, and other information pertinent to the CCR surface impoundment itself, including any identifiable natural or manmade features which could affect operation of the CCR surface impoundment.

(8) A description of the type and purpose of existing or proposed instrumentation.

(9) Graphs showing area-capacity curves.

(10) The hazard potential classification for which the facility is designed and a detailed explanation of the basis for this classification.

(11) A statement of the runoff attributable to the storm for which the CCR surface impoundment is designed and the calculations used in determining such runoff and the minimum freeboard during the design storm.

(12) A description of the spillway and diversion design features and capacities and calculations used in their determination.

(13) The computed minimum factor of safety for slope stability of the CCR retaining structure(s) and the analyses used in their determinations.

(14) The construction specifications and provisions for surveillance, maintenance, and repair of the CCR surface impoundment.

(15) General provisions for closure.

(16) Such other information pertaining to the stability of the CCR surface impoundment which may be requested by the Regional Administrator.

(17) A certification by an independent registered professional engineer that the design of the CCR surface impoundment is in accordance with recognized and generally accepted good engineering practices for the maximum volume of CCR slurry and CCR waste water which can be impounded therein and for the passage of runoff from the design storm which exceeds the capacity of the CCR surface impoundment; or, in lieu of the certification, a report indicating what additional investigations, analyses, or improvement work are necessary before such a certification can be made by an independent registered professional engineer, including what provisions have been made to carry out such work in addition to a schedule for completion of such work.

(f) Any changes or modifications to the plans for CCR surface impoundments shall be approved by the Regional Administrator prior to the initiation of such changes or modifications.

(g) Effective [date two years after the effective date of the final rule], all existing surface impoundments that receive CCRs shall be operated and maintained with:

(1) A run-on control system to prevent flow onto the active portion of the CCR surface impoundment during the peak discharge from a 24-hour, 25-year storm;

(2) A run-off control system from the active portion of the CCR surface impoundment to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR surface impoundment must be handled in accordance with § 265.1307 of this subpart.

(h) For CCR surface impoundments classified as having high or significant hazard potential, the owner or operator shall develop and maintain in the operating record an Emergency Action Plan which: defines responsible persons and the actions to be taken in the event of a dam-safety emergency; provides contact information for emergency responders; includes a map which delineates the downstream area which would be affected in the event of a dam failure; and includes provisions for an annual face-to-face meeting or exercise between representatives of the facility owner and the local emergency responders.

§ 265.1304 Inspection requirements for surface impoundments.

(a) In addition to the inspection requirements in § 265.226, all CCR surface impoundments that meet the requirements of § 265.1303(b) of this subpart shall be inspected by the owner or operator as follows:

(1) At intervals not exceeding 7 days, or as otherwise approved by the Regional Administrator, for appearances of structural weakness and other hazardous conditions.

(2) At intervals not exceeding 7 days, or as otherwise approved by the Regional Administrator, all instruments shall be monitored.

(3) Longer inspection or monitoring intervals approved under this paragraph shall be justified by the owner or operator of the CCR surface impoundment based on the hazard potential and performance of the CCR surface impoundment, and shall include a requirement for inspection immediately after a specified event approved by the Regional Administrator.

(4) All inspections required by paragraphs (a)(1) and (2) of this section shall be performed by a qualified person, as defined in paragraph (e) of this section, designated by the person owning or operating the CCR surface impoundment.

(5) All CCR surface impoundments that meet the requirements of § 265.1303(b) of this subpart shall be inspected annually by an independent registered professional engineer to assure that the design, operation, and maintenance of the surface impoundment is in accordance with recognized and generally accepted good engineering practices. The owner or operator must notify the state and the EPA Regional Administrator that a certification by the independent registered professional engineer that the design, operation, and maintenance of the surface impoundment is in accordance with recognized and generally accepted good engineering practices has been placed in the operating record.

(b) When a potentially hazardous condition develops, the person owning or operating the CCR surface impoundment shall immediately:

(1) Take action to eliminate the potentially hazardous condition;

(2) Notify the Regional Administrator and State and local first responders;

(3) Notify and prepare to evacuate, if necessary, all personnel from the owner or operator's property which may be affected by the potentially hazardous conditions; and

(4) Direct a qualified person to monitor all instruments and examine the structure at least once every eight hours, or more often as required by an authorized representative of the Regional Administrator.

(c) After each inspection and instrumentation monitoring referred to in paragraphs (a) and (b) of this section, each qualified person who conducted all or any part of the inspection or instrumentation monitoring shall promptly record the results of such inspection or instrumentation monitoring in a book which shall be available in the operating record for inspection by an authorized representative of the Regional Administrator and such qualified person shall also promptly report the results of the inspection or monitoring to one of the persons specified in paragraph (d) of this section.

(d) All inspection and instrumentation monitoring reports recorded in accordance with paragraph (c) of this section shall include a report of the action taken to abate hazardous conditions and shall be promptly signed or countersigned by the person designated by the owner or operator as responsible for health and safety at the owner or operator's facility.

(e) The qualified person or persons referred to in this section shall be trained to recognize specific signs of structural instability and other hazardous conditions by visual observation and, if applicable, to monitor instrumentation.

§ 265.1305 Requirements for surface impoundment closure.

Prior to the closure of any CCR surface impoundment which meets the requirements of § 264.1303(b) of this subpart, the person owning or operating such CCR surface impoundment shall submit to and obtain approval from the Regional Administrator, a plan for closure in accordance with the requirements of § 265.228 and part 265 subpart G. This plan shall provide for major slope stability, include a schedule for the plan's implementation, and contain provisions to preclude the probability of future impoundment of water.

§ 265.1306 Landfills.

(a) Owners or operators of new CCR landfills and lateral expansions of existing landfills are exempt from the double liner and leachate collection system requirements of § 265.301(c), and the requirements of § 265.302, provided the owner or operator is in compliance with the requirements of paragraph (b) of this section. Owners or operators of existing landfills are also exempt from the liner requirements of paragraph (b)(1) of this section, provided they comply with the requirements of paragraph (c) of this section and the requirements at 40 CFR part 265 subparts F, G, H, and N.

(b) Prior to placement of CCRs in new landfills and lateral expansions, new landfills and lateral expansions shall be constructed:

(1) With a composite liner, as defined in paragraph (b)(2) of this section, and a leachate collection and removal system that is designed and constructed to maintain less than a 30-cm depth of leachate over the liner.

(2) For purposes of this subpart, composite liner means a system consisting of two components; the upper component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two-foot layer of compacted soil with a hydraulic conductivity of no more than 1×10^{-7} cm/sec. FML components consisting of high density polyethylene (HDPE) shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

(3) For purposes of this subpart, hydraulic conductivity means the rate at which water can move through a permeable medium. (*i.e.,* the coefficient of permeability.)

(c) Effective [date two years after the effective date of the final rule], all existing landfills that receive CCRs shall be operated and maintained with:

(1) A run-on control system to prevent flow onto the active portion of the CCR landfill during the peak discharge from a 24-hour, 25-year storm;

(2) A run-off control system from the active portion of the CCR landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm. Run-off from the active portion of the CCR landfill must be handled in accordance with § 265.1307 of this subpart.

§ 265.1307 Surface water requirements.

(a) Permits for CCR surface impoundments and CCR landfills shall include conditions to ensure that:

(1) The operation of the unit will not cause any violation of any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to section 402 of the Clean Water Act.

(2) The operation of the unit will not cause any violation of any requirement of an area-wide or state-wide water quality management plan that has been approved under section 208 or 319 of the Clean Water Act, as amended.

(b) [Reserved]

§ 265.1308 Air requirements.

(a) CCR surface impoundments and CCR landfills must be managed in a manner that fugitive dusts do not exceed 35 $\mu g/m^3$, unless an alternative standard has been established by the Regional Administrator.

(b) CCR surface impoundments must be managed to control wind dispersal of dusts consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator.

(c) CCR landfills must be managed to control wind dispersal of dusts consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator. CCRs placed in landfills as wet conditioned CCRs shall not result in the formation of free liquids.

(d) Tanks, containers, buildings and pads used for the storage must be managed to control the dispersal of dust. Pads must have wind protection that will ensure comparable levels of control.

(e) CCRs transported in trucks or other vehicles must be covered or otherwise managed to control the wind dispersal of dust consistent with the standard in paragraph (a) of this section unless an alternative standard has been established by the Regional Administrator.

PART 268—LAND DISPOSAL RESTRICTIONS

18. The authority citation for part 268 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), 6921, and 6924.

19. Section 268.2 is amended by revising paragraph (f) to read as follows:

§ 268.2 Definitions applicable in this part.

* * * * *

(f) Wastewaters are wastes that contain less than 1% by weight total organic carbon (TOC) and less than 1% by weight total suspended solids (TSS), except for coal combustion residuals, [waste code S001], which are wastewaters if the moisture content exceeds 50%.

* * * * *

20. Section 268.14 is amended by adding paragraph (d) to read as follows:

§ 268.14 Surface impoundment exemptions.

* * * * *

(d) The waste specified in 40 CFR Part 261 as EPA Special Waste Number S001 may continue to be placed in an existing CCR surface impoundment of this subpart for 60 months after the promulgation date of listing the waste provided the existing CCR surface impoundment is in compliance with the requirements of subpart F of part 265 of this chapter within 12 months after the promulgation of the new listing. Closure in accordance with subpart G of part 264 must be completed within two years after placement of waste in the existing CCR surface impoundment ceases.

21. Section 268.21 is added to Subpart C to read as follows:

§ 268.21 Waste specific prohibitions—Coal combustion residuals.

(a) Effective [date six months after the effective date of the final rule], nonwastewaters specified in 40 CFR part 261 as EPA Special Waste Number S001 are prohibited from land disposal.

(b) Effective [date 60 months after the effective date of the final rule], wastewaters specified in 40 CFR part 261 as EPA Special Waste Number S001 are prohibited from land disposal.

(c) The requirements of paragraphs (a) and (b) of this section do not apply if:

(1) The wastes meet the applicable treatment standards specified in subpart D of this Part;

(2) Persons have been granted an exemption from a prohibition pursuant to a petition under § 268.6, with respect to those wastes and units covered by the petition;

(3) The wastes meet the applicable treatment standards established pursuant to a petition granted under § 268.44;

(4) Persons have been granted an extension to the effective date of a prohibition pursuant to § 268.5, with respect to these wastes covered by the extension.

22. In § 268.40, the table "Treatment Standards for Hazardous Wastes" is amended by adding in alphanumeric order the new entry for S001 to read as follows:

§ 268.40 Applicability of treatment standards.

* * * * *

TREATMENT STANDARDS FOR HAZARDOUS WASTES

[Note: NA means not applicable]

Waste code	Waste description and treatment/ regulatory subcategory [1]	Regulated hazardous constituent		Wastewaters	Nonwastewaters
		Common name	CAS [2] No.	Concentration in mg/L [3], or technology code [4]	Concentration in mg/kg [5] unless noted as "mg/L TCLP", or technology code
*	*	*	*	*	*
S001	Coal combustion wastes generated by the electric power sector. For purposes of this listing, the electric power sector is defined as electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public; *i.e.,* NAICS code 221112 plants. For the purposes of this listing, coal combustion wastes are defined as fly ash, bottom ash, boiler slag, and flue gas desulfurization materials generated by the electric power sector. This listing does not apply to coal combustion residuals that are: (1) Uniquely associated wastes with wastes from the burning of coal; (2) beneficially used; (3) placed in minefilling operations; (4) generated by facilities that are outside the electric power sector; or (5) generated from clean-up activities that are conducted as part of a state or federally required clean-up that commenced prior to the effective date of this rule..	Antimony	7440–36–0	TSS of 100mg/l and meet § 268.48.	Meet § 268.48.
		Arsenic	7440–38–2		
		Barium	7440–39–3		
		Beryllium	7440–41–7		
		Cadmium	7440–43–9		
		Chromium	7440–47–3		
		Lead	7439–92–1		
		Mercury	7439–97–6		
		Nickel	7440–02–0		
		Selenium	7782–49–2		
		Silver	7440–22–4		
		Thallium	7440–28–0		
*	*	*	*	*	*

Footnotes to Treatment Standard Table 268.40

[1] The waste descriptions provided in this table do not replace waste descriptions in 40 CFR 261. Descriptions of Treatment/Regulatory Subcategories are provided, as needed, to distinguish between applicability of different standards.

[2] CAS means Chemical Abstract Services. When the waste code and/or regulated constituents are described as a combination of a chemical with its salts and/or esters, the CAS number is given for the parent compound only.

[3] Concentration standards for wastewaters are expressed in mg/L and are based on analysis of composite samples.

[4] All treatment standards expressed as a Technology Code or combination of Technology Codes are explained in detail in 40 CFR 268.42 Table 1—Technology Codes and Descriptions of Technology-Based Standards.

[5] Except for Metals (EP or TCLP) and Cyanides (Total and Amenable) the nonwastewater treatment standards expressed as a concentration were established, in part, based upon incineration in units operated in accordance with the technical requirements of 40 CFR Part 264 Subpart O or Part 265 Subpart O, or based upon combustion in fuel substitution units operating in accordance with applicable technical requirements. A facility may comply with these treatment standards according to provisions in 40 CFR 268.40(d). All concentration standards for nonwastewaters are based on analysis of grab samples.

* * * * *

23. In § 268.42, Table 1 is amended by adding an entry for "RSLDS" to read as follows:

§ 268.42 Treatment standards expressed as specified technologies.

* * * * *

TABLE 1—TECHNOLOGY CODES AND DESCRIPTION OF TECHNOLOGY-BASED STANDARDS

Technology code	Description of technology-based standards
* * *	* *
RSLDS	Removal of solids and meet § 268.48 treatment levels.
* * *	* *

* * * * *

PART 271—REQUIREMENTS FOR AUTHORIZATION OF STATE HAZARDOUS WASTE PROGRAMS

24. The authority citation for part 271 continues to read as follows:

Authority: 42 U.S.C. 6905, 6912(a), and 6926.

25. Section 271.1(j) is amended by adding the following entries to Table 1 and Table 2 in chronological order by date of publication to read as follows.

§ 271.1 Purpose and scope.

* * * * *

(j) * * *

TABLE 1—REGULATIONS IMPLEMENTING THE HAZARDOUS AND SOLID WASTE AMENDMENTS OF 1984

Promulgation date	Title of regulation	Federal Register reference	Effective date
* *	*	* *	* *
[date of signature of final rule]	Listing of Special Waste S001	[Federal Register page numbers for final rule].	[effective date of final rule].

TABLE 2—SELF-IMPLEMENTING PROVISIONS OF THE SOLID WASTE AMENDMENTS OF 1984

Effective date	Self-implementing provision	RCRA citation	Federal Register reference
*	* * *	*	* *
[effective date of final rule].	Prohibition on land disposal of S001 waste with free liquids and prohibition on the disposal of S001 waste below the natural water table. For purposes of this provision, free liquids means liquids which readily separate from the solid portion of a waste under ambient temperature and pressure.	3001(b)(3)(A) and 3004(g)(4)(C).	[date of publication date of final rule Federal Register page numbers] [FR page numbers].

PART 302—DESIGNATION, REPORTABLE QUANTITIES, AND NOTIFICATION

26. The authority citation for part 302 continues to read as follows:

Authority: 42 U.S.C. 9602, 9603, and 9604; 33 U.S.C. 1321 and 1361.

27. In § 302.4, Table 302.4 is amended by adding the following new entry in alphanumeric order to the table to read as follows:

§ 302.4 Designation of hazardous substances.

* * * * *

TABLE 302.4—LIST OF HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES

[Note: All comments/notes are located at the end of this table]

Hazardous substance	CASRN	Statutory code†	RCRA waste No.	Final RQ pounds (Kg)
* *	* * *	*		*
S001[f] Coal combustion residuals generated by the electric power sector (Electric Utilities and Independent Power Producers)	....	4	S001	1 (0. 4536)

TABLE 302.4—LIST OF HAZARDOUS SUBSTANCES AND REPORTABLE QUANTITIES—Continued

[Note: All comments/notes are located at the end of this table]

Hazardous substance	CASRN	Statutory code†	RCRA waste No.	Final RQ pounds (Kg)
*	*	*	*	*

† Indicates the statutory source defined by 1, 2, 3, and 4, as described in the note preceding Table 302.4.

* * * * *

[f] *See* 40 CFR 302.6(b)(1) for application of the mixture rule to this hazardous waste.

* * * * *

28. Section 302.6 is amended by amending paragraph (b)(1)(iii), including the Table, to read as follows:

§ 302.6 Notification requirements.

* * * * *

(b) * * *

(1) * * *

(iii) For waste streams K169, K170, K171, K172, K174, K175, and S001, knowledge of the quantity of all of the hazardous constituent(s) may be assumed, based on the following maximum observed constituent concentrations identified by EPA:

Waste	Constituent	Max ppm
K169	Benzene	220.0
K170	Benzene	1.2
	Benzo (a) pyrene	230.0
	Dibenz (a,h) anthracene	49.0
	Benzo (a) anthracene	390.0
	Benzo (b) fluoranthene	110.0
	Benzo (k) fluoranthene	110.0
	3–Methylcholanthrene	27.0
	7,12–Dimethylbenz (a) anthracene	1,200.0
K171	Benzene	500.0
	Arsenic	1,600.0
K172	Benzene	100.0
	Arsenic	730.0
K174	2,3,7,8TCDD	0.000039
	1,2,3,7,8–PeCDD	0.0000108
	1,2,3,4,7,8–HxCDD	0.0000241
	1,2,3,6,7,8–HxCDD	0.000083
	1,2,3,7,8,9–HxCDD	0.000062
	1,2,3,4,6,7,8–HpCDD	0.00123
	OCDD	0.0129
	2,3,7,8–TCDF	0.000145
	1,2,3,7,8–PeCDF	0.0000777
	2,3,4,7,8–PeCDF	0.000127
	1,2,3,4,7,8–HxCDF	0.001425
	1,2,3,6,7,8–HxCDF	0.000281
	1,2,3,7,8,9–HxCDF	0.00014
	2,3,4,6,7,8–HxCDF	0.000648
	1,2,3,4,6,7,8–HpCDF	0.0207
	1,2,3,4,7,8,9–HpCDF	0.0135
	OCDF	0.212
K175	Mercury	9,200
S001	Antimony	3,100
	Arsenic	773
	Barium	7,230
	Beryllium	31
	Cadmium	760
	Chromium	5,970
	Lead	1,453
	Mercury	384
	Nickel	6,301
	Selenium	673
	Silver	338
	Thallium	100

* * * * *

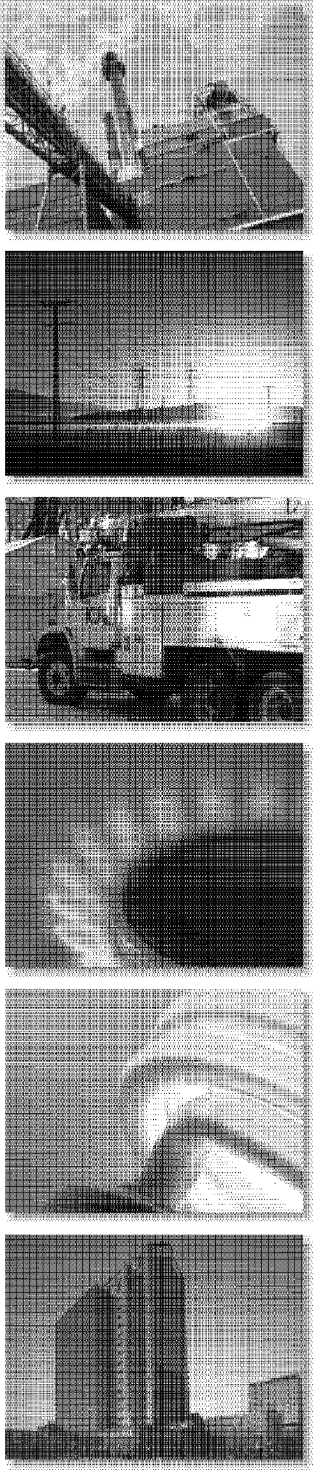
[FR Doc. 2010–12286 Filed 6–18–10; 8:45 am]

BILLING CODE 6560–50–P

PPL companies

New and Proposed Federal EPA Regulations Will Increase the Cost of Coal-fired Electricity

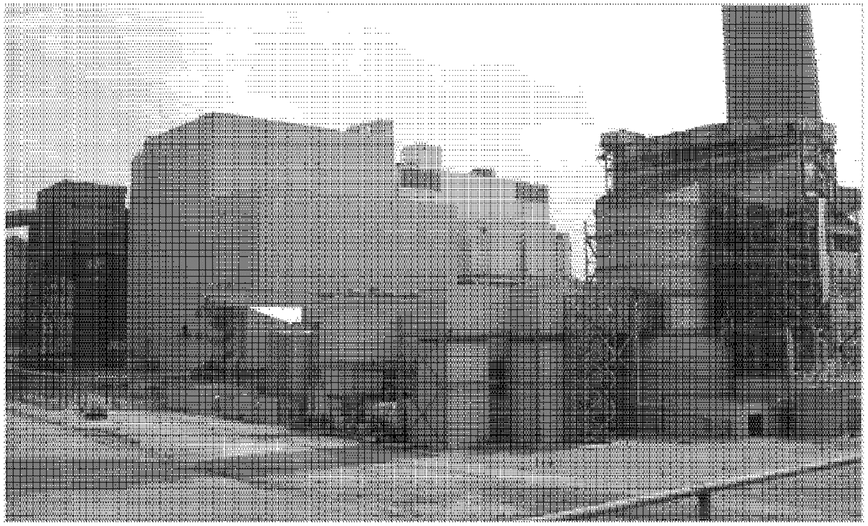
October 14, 2010

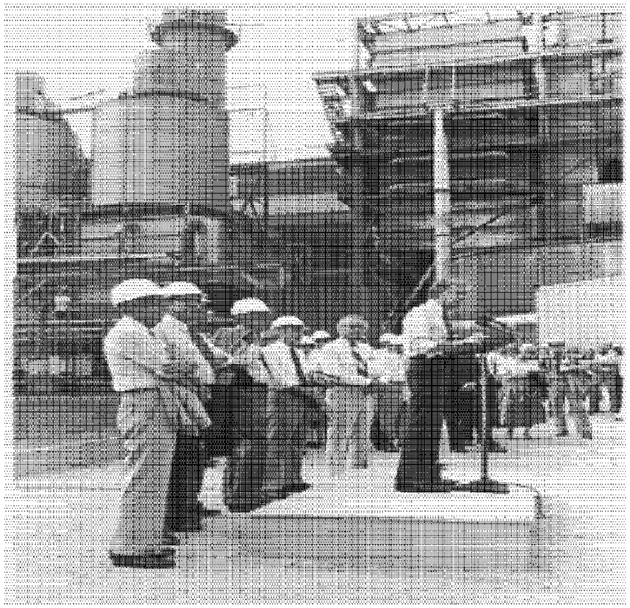


Environmental compliance is a high priority for LG&E and KU

- In the 1970's, LG&E pioneered flue gas desulfurization (FGD) or "scrubber" technology used to control SO_2.

- LG&E and KU and their customers have spent $2.6 billion on emission controls since the 1970's.



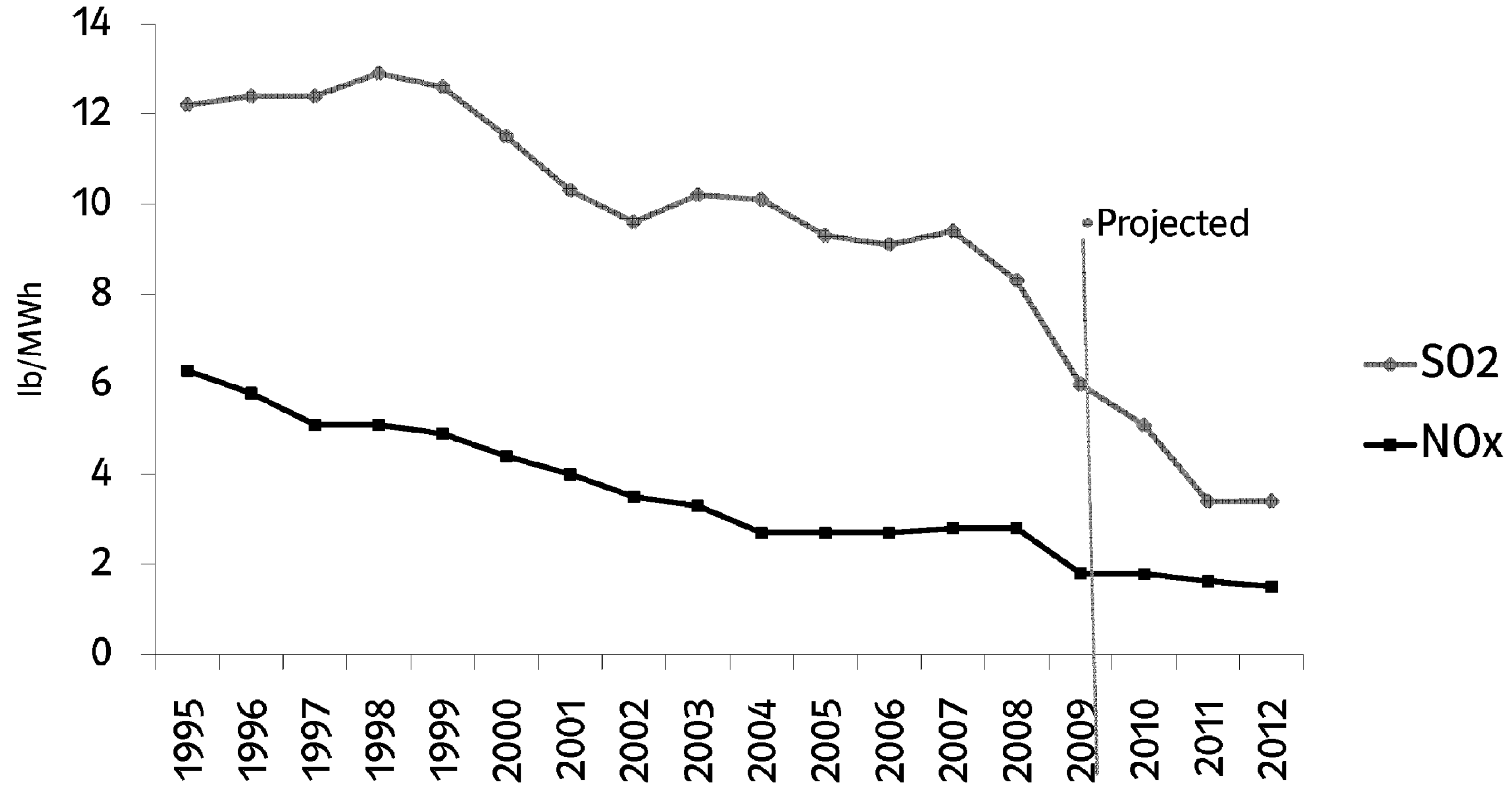


Our new TC2 generating unit will be among the cleanest coal-fired power plants in the U.S. including:

- Selective Catalytic Reduction (SCR); Dry Electrostatic Precipitator (ESP); Powdered Activated Carbon Injection; Fabric Filter Baghouse; Wet Flue Gas Desulfurization (WFGD); Wet Electrostatic Precipitator (WESP)

LG&E KU
PPL companies

Since 1995, LG&E and KU have reduced coal SO_2 emission rates by 50%; NO_x emission rates by 70%. Further reductions are expected when TC2 and the Brown FGD come online.



PPL companies

Unprecedented number of proposed regulations

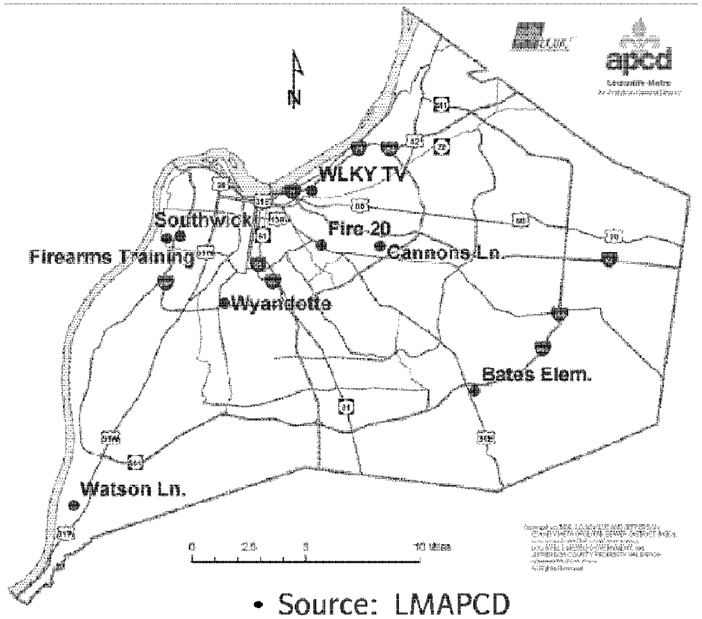
EPA is proposing an unprecedented number of regulations that will have a major impact on coal-fired utilities and their customers. The significant risks are as follows –

- Absence of a comprehensive and coordinated federal strategy compels implementation on a piecemeal basis.
- Reversal of prior regulatory determinations will generate large economic impacts.
- Inconsistent deadlines will cause unnecessary compliance costs.
- Short deadlines are compromising state and utility efforts to prepare proper implementation plans.
- Practical implication: we will be proposing construction projects without benefit of final regulations in order to meet federal deadlines for compliance because of long lead time in fabrication and construction.

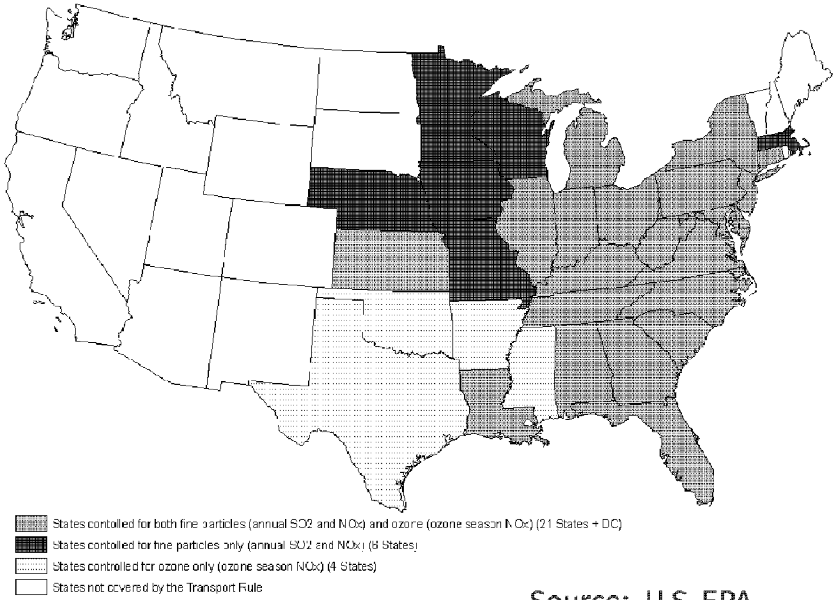
PPL companies

New air regulations

- *National Ambient Air Quality Standards* ***(NAAQS)*** *– revised hourly SO_2, NO_x, ozone, and particulate matter* ***(PM)*** *standards will make Louisville a "nonattainment" area subject to federal sanctions.*



- Source: LMAPCD



Source: U.S. EPA

Clean Air Transport Rule **(CATR)** – aimed at reducing air quality problems (SO_2, NO_x, ozone and particulate matter) in the eastern U.S.

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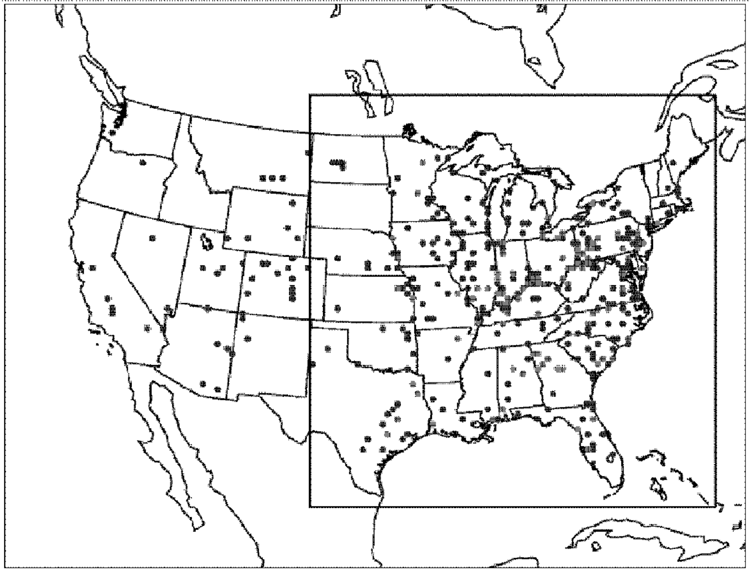
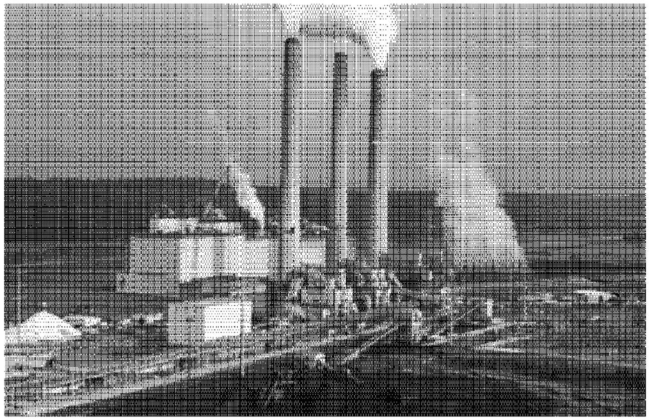
New air regulations (continued)

- *Maximum Achievable Control Technology **(MACT)** for Hazardous Air Pollutants **(HAP)** – new federal focus on plant-by-plant controls (as opposed to a system basis) will dramatically increase the cost of reducing mercury and other emissions.*

- *CO_2 Best Available Control Technology **(BACT)** – EPA will require implementation of BACT despite the consensus that no commercial scale control technology is currently available.*



- Source: U.S. EPA



LG&E KU
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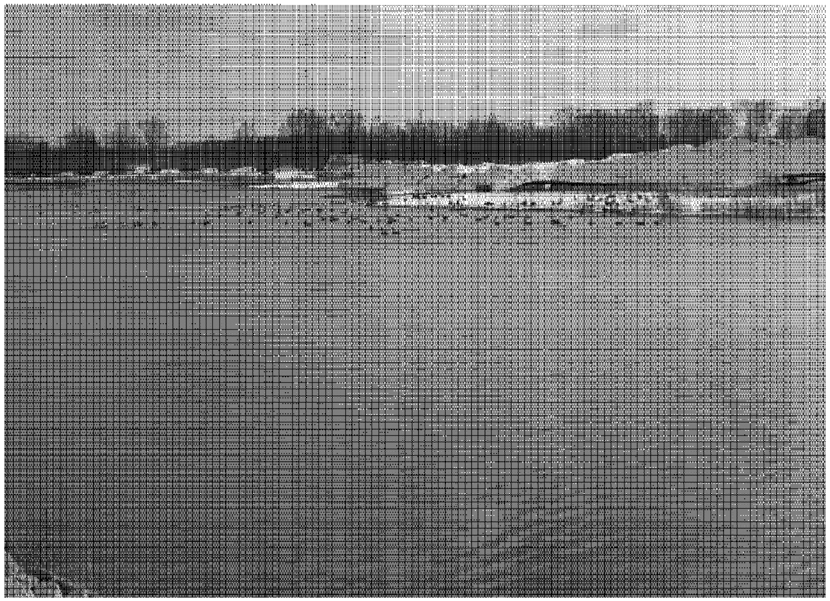
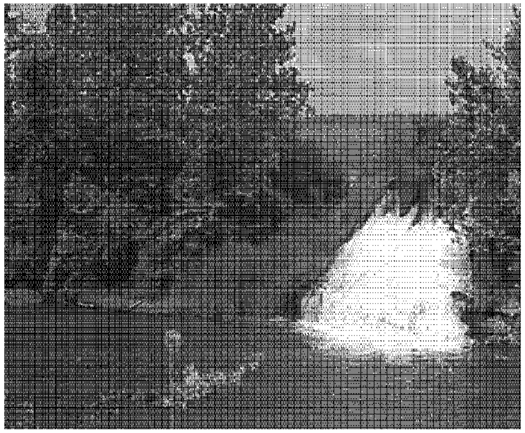
New coal combustion residuals and water regulations

- *Coal Combustion Residuals **(CCR)** – Despite past EPA determinations that CCRs do not pose any significant human health or environmental risks, EPA is considering designation of CCRs as a "hazardous waste," subject to extensive requirements or modifying current "non-hazardous" rules with more stringent requirements. Both approaches will increase costs.*

- *Water quality – EPA is revising cooling water withdrawal and water discharge guidelines and standards.*





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The new EPA regulations will significantly impact Kentucky's electric customers

- *The new regulations are focused on coal-fired power plants.*
- *95% of Kentucky's electricity is provided by coal.*
- *LG&E and KU will comply with any new EPA regulations in the most cost effective manner possible, but the cost increase will be significant.*

PPL companies

Short compliance timelines likely once final rules are issued

- National Ambient Air Quality Standards **(NAAQS)** for NO_2 and SO_2 – Issued: February - June 2010; Compliance: 2016, 2017 respectively
- Clean Air Transport Rule **(CATR)** – Projected Final Rule: June 2011; Compliance: January 2012 & January 2014
- Maximum Achievable Control Technology **(MACT)** for Hazardous Air Pollutants (HAP) – Projected Final Rule: November 2011; Compliance: January 2015
- Carbon Dioxide **(CO_2)** Best Available Control Technology **(BACT)** – Issued: May 2010; Compliance: January 2011
- Coal Combustion Residuals **(CCR)** – Alternatives Proposed: May 2010; Projected Final Rule: uncertain; Compliance: within five years of final rule
- Water quality – Water withdrawal Projected Issue date: December 2010; Water Discharge Projected Issue date: 2012; Compliance: uncertain

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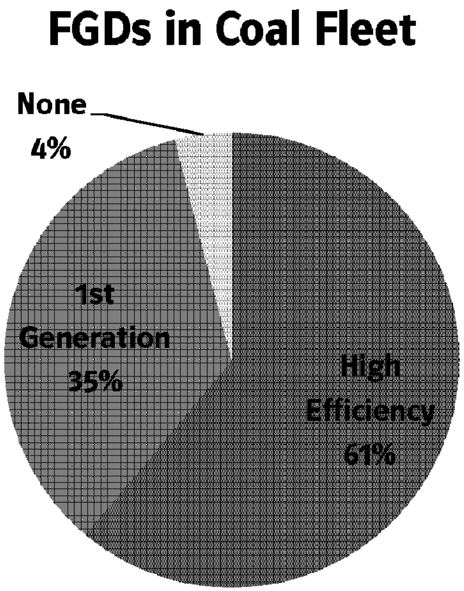
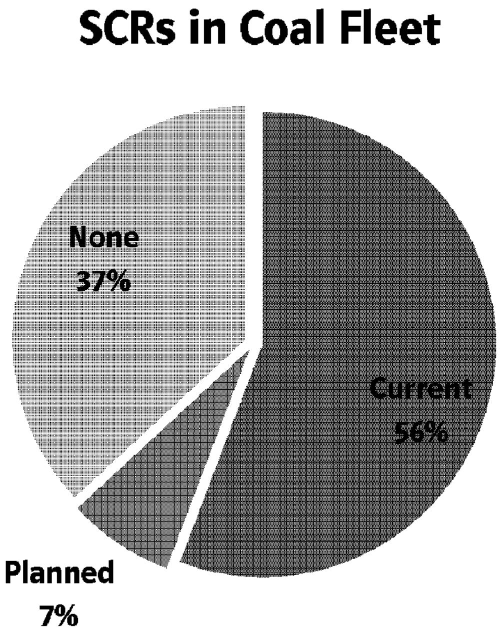
LG&E and KU's coal fleet already has a high level of SO_2 and NO_X control technologies, but some additions or enhancements will be required





Percents are based on capacity including TC2

LG&E KU
PPL companies

Technology options for addressing air emissions are known – except for CO_2

Technology	*Targeted Pollutant*	*Regulation Addressed*	*Removal Rate*	*LG&E/KU Estimated Cost ($/kW)*	*LG&E/KU Estimated Cost ($/quantity captured)*
Flue Gas Desulfurization (FGD)	SO_2	CATR, NAAQS	98%	$450 – 900	$5,000 – 11,000 /ton
Selective Catalytic Reduction (SCR)	NO_x	CATR, NAAQS	90%	$300 – 500	$4,000 – 8,000 /ton
FGD + SCR (Hg Co-Benefit)	Hg	MACT for HAP	60-70%	Co-benefit	Co-benefit
Fabric Filter & PAC* Injection (with FGD and SCR)	Hg	MACT for HAP	25-35%	$200 – 500	$150,000 – 450,000 /lb
Sorbent Injection	SO_3, Hg	MACT for HAP	TBD	$15 – 30	TBD
Replace Coal Plant with Gas Plant					
Combined Cycle Combustion Turbine	All	All	NA	$950 – 1,250	NA

*Powdered Activated Carbon

PPL companies

Despite low emission levels at most stations, sizable investments will be required to meet new air regulations

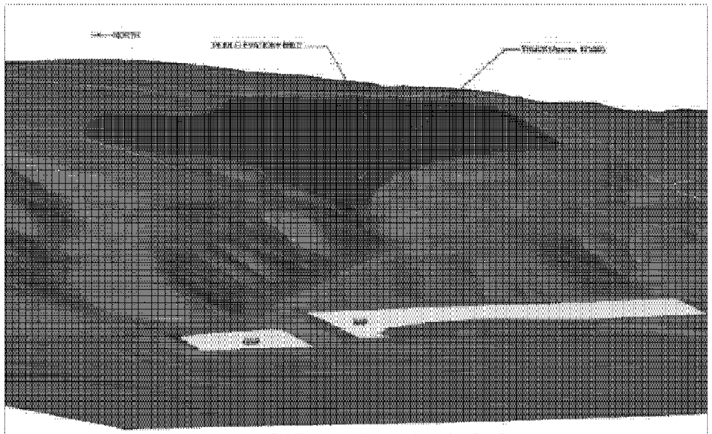
Station	Capacity (Net MW)	Options to Address Regulations	Cost ($M)
Brown	684	SCR, Fabric Filter Baghouse, PAC Injection, Lime Injection	$350 - 450
Ghent	1,918	SCR, Fabric Filter Baghouse, PAC Injection	$950 - 1,150
Green River	163	SCR, Fabric Filter Baghouse, PAC Injection	$150 - 250
Cane Run	563	FGD, SCR, Fabric Filter Baghouse, PAC Injection, Lime Injection	$850 - 950
Mill Creek	1,472	FGD, SCR, Fabric Filter Baghouse, Electrostatic Precipitator (ESP), PAC Injection, Lime Injection, Ammonia	$1,250 - 1,900
Trimble County	932	Fabric Filter Baghouse, PAC Injection	$150 - 200
Replace Coal Plant with Gas Plant			
Potential CCCT Replacement	640	640 MW 2x1 Combined Cycle Combustion Turbine	$600 - 800

Note: Does not include any investment to control for CO_2

LG&E KU
PPL companies

Proposed EPA CCR regulations would require dry storage and closing of existing ash ponds

- Retrofit or close 21 ponds, including 10 ash ponds and 11 process/runoff ponds across the fleet (8 stations).
- Build landfills for future storage (Brown, Cane Run, Ghent, Mill Creek, Trimble County).
- Construct new process water ponds for each operating site.
- Decommissioning ponds for moving to dry storage will cost an estimated $700 million over the next ten years under the proposed CCR rules for non-hazardous waste. Additional closure costs will be incurred upon plant retirements.



1L-CH Proposed Mound (Looking East)

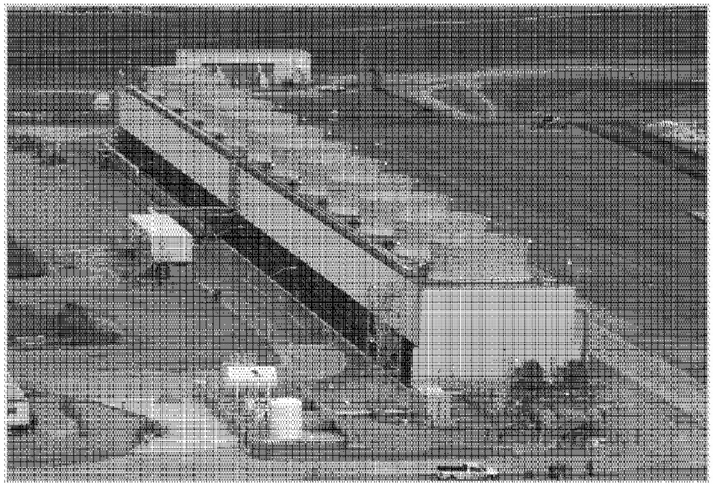
September 10, 2010

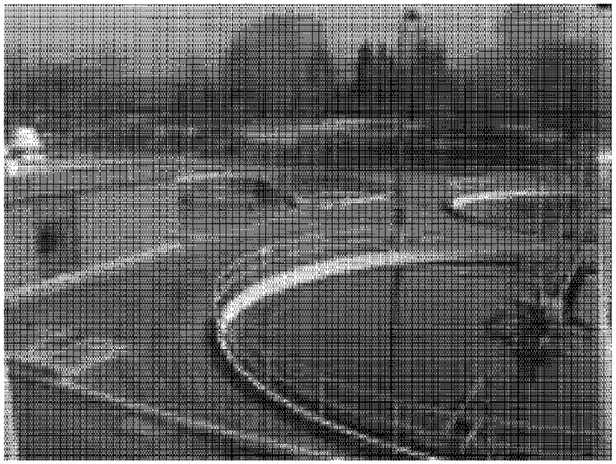
PPL companies

Increased water withdrawal and discharge requirements

- *Potential federal EPA water regulations would impose more stringent requirements on water withdrawal and discharges.*

- *Potential addition of cooling towers or discharge water treatment systems:*
    - *Stations without cooling towers: Cane Run, Green River, Mill Creek 1, Tyrone*





New treatment technologies are being developed for water discharges, but are not widely deployed in utility operations:

Physical-chemical treatment and/or biological treatment systems may be required

Cost of $40 - $300 million for each site pending final regulations, specific standards and treatment volumes

PPL companies

Estimate at least $4 billion in capital costs needed over next ten years

Regulation	Capital ($M)	Annual Operating Expense ($M)
Air	$3,300 – 5,000	$150 – 300
CCR	$700	*To be determined*
Water	*To be determined*	

LG&E KU
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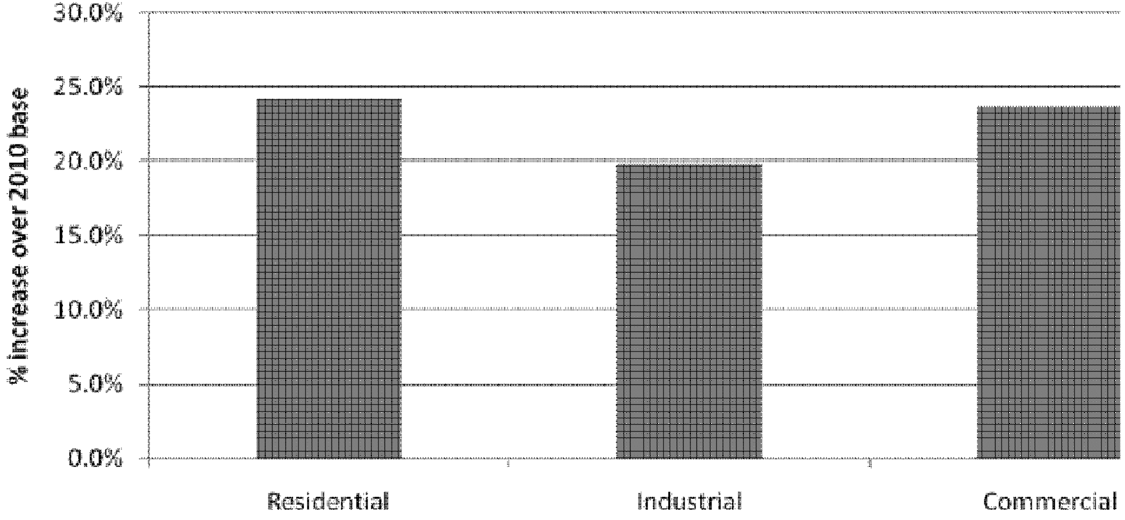
Cumulative impact of proposed EPA regulations will significantly increase electricity rates

Due to these regulations, by 2019 rates could increase by more than 20% and almost $550 million annually

Rate Impact of proposed EPA regulations



Note: This calculation does not include potential compliance costs for water regulations, Renewal Portfolio Standards (RPS) or carbon dioxide (CO_2) reductions

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Challenges and risks related to proposed regulations

- ***Short time horizon** – some air regulations would require compliance as early as 2012 with the most costly regulations beginning in 2014 and 2015. This allows insufficient time to design facilities, obtain necessary federal and state regulatory approvals, contract with vendors and install equipment.*

- ***Potential impacts on system reliability and transmission system** – one consequence of the proposed regulations will be the retirement of significant amounts of coal-fired generation across the region.*

- ***Rapid cost escalation** – industry rush to achieve compliance will drive up labor and material costs (repeat of 2008) and make it difficult to obtain labor and equipment at any price.*

- ***CO_2 policy could change** – uncertainty associated with future CO_2 legislation could result in less than optimal long-term investment decisions.*

LG&E KU
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What should you expect?

- *Requests for Kentucky Public Service Commission approval of environmental compliance projects perhaps before the federal regulations are finalized.*
- *Compressed construction timelines due to compliance timing.*
- *Additional compliance costs to meet implementation dates of federal rules.*
- *More frequent requests for rate increases due to substantial upward cost pressures caused by compliance with the federal regulations.*

LG&E KU
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What are LG&E and KU doing?

- Evaluating multiple compliance alternatives.
- Participating in industry efforts to advocate more reasonable regulations and timelines.
- Communicating our concerns directly with EPA on proposed regulations.
- Educating elected officials, regulators and customers on the effect of the federal regulations will have on their electric bill.

LG&E KU
PPL companies

From:	Wilson, Stuart
To:	Sinclair, David; Voyles, John; Straight, Scott; Schram, Chuck; Bowling, Ralph
CC:	Karavayev, Louanne
Sent:	12/3/2010 12:46:07 PM
Subject:	Follow-up Items from Environmental Compliance Meetings
Attachments:	20101124_AnalysisExplanations_0022_FIN.docx

On Monday (11/22), we presented an analysis of various alternatives for complying with the CATR and NAAQS. Several follow-up items were taken from that meeting. The attached document provides responses to those items.

Overall, our recommendation not to build the GH2 and MC1-2 SCRs is unchanged. However, based on the analysis we did in responding to these follow-up items, it may make sense to delay the construction of the MC3-4 FGDs by one year. I've scheduled a meeting for next week to discuss this decision.

Stuart

Generation Planning & Analysis – 12/3/2010

Follow-up to Meeting on 11/22 Regarding Environmental Compliance

The following is a summary of open questions (and responses to those questions) from our meeting on 11/22/2010 regarding Generation Planning's analysis of CATR/NAAQS compliance alternatives.

Question #1: On slide 9 of the presentation (and in Table 1 below), alternative #5 ('Don't build GH2 or MC1-2 SCRs') is identified as the least cost alternative. In our discussion, we stated that – since the GH2 and MC1-2 SCRs are not needed to comply with the CATR – the NPVRR deltas for alternatives #1 ($300 million) and #3 ($343 million) are driven almost entirely by the capital and O&M costs associated with the SCR projects (that is, the GH2 SCR in alternative #1 and the MC1-2 SCR in alternative #3). John Voyles recalled the costs of the GH2 and MC1-2 SCR projects to be $150 and $300 million, respectively. Given these amounts, the group was surprised that (a) the NPVRR delta for alternative #1 was so large and (b) the deltas for alternatives #1 and #3 were so similar.

Table 1

	Normal Load	
	NPVRR Delta to Best Alt ($M)	Rank
Reference Case	638	6
Alternative 1	300	2
Alternative 2	337	3
Alternative 3	343	4
Alternative 4	395	5
Alternative 5	0	1

Response: Based on the information from Project Engineering (and Black and Veatch) used in this analysis, the costs of the GH2 and MC1-2 SCR projects (in 2010$) are $227 million and $243 million, respectively (see Table 2 below). So, the difference in capital cost assumptions is less than we thought. In fact, because the MC1-2 SCRs are installed 1-2 years after the GH2 SCR (and therefore discounted an additional 1-2 years), the capital component of NPVRR for the GH2 and MC1-2 SCR projects are almost the same (4% capital escalation rate is less the 6.96% discount rate). Ultimately, the difference in NPVRR deltas ($43 million) is driven primarily by the difference in SCR O&M costs.

Table 2

	Capital ($M)	Incr. O&M ($/MWh)	Capital NPVRR ($M)
GH2 SCR	227	0.15	304
MC1-2 SCRs	243	1.24	307
MC4 SCR Upgrade	16		21
MC1-2 FGD Upgrades	30		39
MC3 FGD Upgrade	89		118
MC4 FGD	236		319

Question #2: Related to the previous question… What's the NPVRR for a $1 million capital investment (excluding related O&M costs)?

Answer: If we assume a 30-year book life and a 20-year tax life, the NPVRR for a $1 million capital investment is $1.3 million. Table 3 summarizes the components of revenue requirements. These components are discounted at the after-tax weighted average cost of capital (WACC) of 6.96%.

Table 3 ($000s)

	Book Dep.	Deferred Tax	Prop. Tax/Ins.	Current Tax	Interest Exp.	Total
2010	0	0	0	0	0	0
2011	0	-10	0	30	43	64
2012	33	2	2	35	79	150
2013	33	16	2	19	76	146
2014	33	14	2	20	72	141
2015	33	12	2	20	68	135
2016	33	10	2	20	65	130
2017	33	8	2	20	61	125
2018	33	7	2	21	58	120
2019	33	5	2	21	55	116
2020	33	5	2	19	52	112
2021	33	5	2	18	49	107
2022	33	5	2	17	46	103
2023	33	5	2	15	43	99
2024	33	5	2	14	40	94
2025	33	5	2	13	37	90
2026	33	5	2	11	34	85
2027	33	5	2	10	31	81
2028	33	5	2	8	28	77
2029	33	5	2	7	25	72
2030	33	5	2	6	22	68
2031	33	5	2	4	19	64
2032	33	-4	2	12	17	59
2033	33	-13	2	20	14	56
2034	33	-13	2	19	13	54
2035	33	-13	2	18	11	51
2036	33	-13	2	17	10	49
2037	33	-13	2	17	8	47
2038	33	-13	2	16	6	44
2039	33	-13	2	15	5	42
2040	33	-13	2	14	3	40
2041	33	-13	2	14	2	38
Total NPV	**388**	**43**	**22**	**237**	**603**	**1,293**

Question #3: As an additional sensitivity, we assumed TC2 would be out for three months during the summer period – to evaluate the impact of that event on NOx emissions. We found that NOx emissions increased by about 400 tons but were still less than the CATR allocations. However, in the meeting, it was proposed that an extended outage in the shoulder months could have a greater impact on NOx emissions.

Response: We assumed TC2 would be out for three months during the fall months and found that NOx emissions increased by about 500 tons (a greater impact, as suspected) but, again, were still less than the CATR allocations.

Question #4: In alternatives #1 and #2, an SCR is installed at GH2 in 2013. In alternatives #3 and #4, SCRs are installed at MC1-2 in 2015/16. In alternative #2 (compared to alternative #1), we delay the construction of the MC3-4 FGDs by 2 years (from 2013/14 to 2015/16)[1]. Aside from this difference, the alternatives are the same. In alternative #4 (compared to alternative #3), we make the same change. The differences between these alternatives (i.e., the differences between (a) alternatives #1 and #2 and (b) alternatives #3 and #4) should be very similar, but they are not. Why?

Answer: Because NOx (and the decision to build additional SCRs) was the primary focus of this analysis, we optimized the dispatch of our generating units based on NOx emissions (only). Ultimately, this approach correctly evaluated the need for additional SCRs, but it did not optimize the dispatch of our FGD units in the decision to delay (or not) the installation of the MC3-4 FGDs (even though all of our SCR units have FGDs). In alternative #2 (compared to alternative #4), we have more SCR capacity in 2014-15. This difference in SCR capacity – when dispatch is optimized based on NOx emissions – resulted in the differences at issue here.

Based on our findings in responding to this question, we modified our approach to optimize the dispatch of our units based on NOx AND SO2 emissions. While this change in approach doesn't affect our recommendation – based on what we know today – not to build the GH2 and MC1-2 SCRs, it does suggest we may want to consider delaying the construction of the MC3-4 FGDs by one year. A meeting has been scheduled for next week to discuss this decision.

---

[1] Note: In the MTP/LTP, we assume the MC3-4 FGDs will be constructed in 2014/15.

From:	Straight, Scott
To:	Saunders, Eileen; Hudson, Rusty; Ritchey, Stacy; Garrett, Chris
CC:	Joyce, Jeff; Kirkland, Mike; Bowling, Ralph; Voyles, John
Sent:	1/5/2011 9:30:08 AM
Subject:	FW: Air Totals With No SCRs and with Only Ghent 2 SCR
Attachments:	Environmental Summary Breakdown 1-3-11 R1.xlsx

All,

A small note to clarify the parenthetical in Rusty's note. The $7M for each SCR unit that Rusty referenced is for a modification to allow SCR operation at reduced loads beyond what these units can do now. The hot water recirc process is just one method to achieve this capability. I would title the $7M for each unit something like "SCR Turndown" instead of hot water recirc to pick up the other ways to achieve the results we want.

"cc" Joyce and Kirkland to keep them in the info loop.

Scott

From: Hudson, Rusty
Sent: Monday, January 03, 2011 5:20 PM
To: Garrett, Chris
Cc: Ritchey, Stacy; Straight, Scott
Subject: Air Totals With No SCRs and with Only Ghent 2 SCR

Chris, at Paul's 4:00 meeting it was determined that we should provide a range between none of the SCR's being built, and just the Ghent 2 SCR being built. Given that new EPA allocations will be issued in March of 2011 and that we are right on the margin until the Cane Run combined cycle unit comes on line, that should give us room in case the allocations go against us. Also included in the numbers is $7m per unit for turn-down capabilities on the existing units of Ghent 1,3, and 4, and MC 3 and 4 (adding hot water recirc similar to what is being done on Brown 3). The range therefore is a reduction of $379m if Ghent 2 is still built, to $641m if none of the SCR's are built. Rusty

	A	D	E	F	G	H	I	J	K	L	M	N
1	**2.) Environmental Air - CATR by January 2015, NAAQS by January 2016, HAPs by January 2017**											
2	**Capital Cost - Investment Accrual Basis (Includes Removal/ARO), Excluding all SCR except Ghent 2**											
3	$ in thousands											
4		Total	2010	2011	2012	2013	2014	2015	2016	2017		
5	**Cash Flow By Year**											
6	**Brown**											
7	Brown 1 - Baghouse	$39,218		$1,830	$13,322	$15,834	$8,233					
8	Brown 1 - PAC Injection	$1,899		$0	$0	$931	$968					
9	Brown 1 - SAM Mitigation	$4,632		$215	$1,343	$1,863	$1,211					
10	Total Brown 1	**$45,750**	**$0**	**$2,045**	**$14,665**	**$18,627**	**$10,412**	**$0**	**$0**	**$0**		
11												
12	Brown 2 - Baghouse	$41,179		$0	$1,522	$11,875	$13,174	$13,272	$1,336	$0		
13	Brown 2 - PAC Injection	$3,058		$0	$0	$0	$1,499	$1,559	$0	$0		
14	Brown 2 - SAM Mitigation	$4,568		$215	$1,791	$2,561	$0	$0	$0			
15	Total Brown 2	**$48,805**	**$0**	**$215**	**$3,314**	**$14,437**	**$14,673**	**$14,831**	**$1,336**	**$0**		
16												
17	**Brown 1 & 2 - SAM Mitigation**											
18												
19	Brown 3 - Baghouse	$76,066		$0	$0	$2,131	$25,851	$36,102	$11,983	$0		
20	Brown 3 - PAC Injection	$6,835		$0	$0	$0	$1,211	$4,314	$1,310	$0		
21	Total Brown 3	**$82,901**	**$0**	**$0**	**$0**	**$2,131**	**$27,061**	**$40,416**	**$13,292**	**$0**		
22												
23	**Total Brown**	**$177,455**	**$0**	**$2,260**	**$17,978**	**$35,194**	**$52,146**	**$55,248**	**$14,628**	**$0**		
24												
25	**Ghent**											
26	Ghent 1 - Baghouse	$163,356				$4,575	$55,515	$77,531	$25,734			
27	Ghent 1 - PAC Injection	$8,036		$0	$0	$0	$1,211	$5,515	$1,310	$0		
28	Ghent 1 - SAM Mitigation	$7,750	$375	$7,375								
29	Total Ghent 1	**$179,142**	**$375**	**$7,375**	**$0**	**$4,575**	**$56,726**	**$83,047**	**$27,043**	**$0**		
30												
31	Ghent 2 - SCR	$262,878		$12,217	$76,235	$105,712	$68,713	$0	$0	$0		
32	Ghent 2 - Baghouse	$149,464		$0	$0	$5,588	$50,854	$71,021	$22,001			
33	Ghent 2 - PAC Injection	$7,695		$0	$0	$0	$1,211	$5,174	$1,310			
34	Ghent 2 - SAM Mitigation	$7,750	$375	$7,375								
35	Total Ghent 2	**$427,787**	**$375**	**$19,592**	**$76,235**	**$111,301**	**$120,778**	**$76,195**	**$23,311**	**$0**		
36												
37	Ghent 3 - Baghouse	$170,210		$0	$0	$19,280	$58,482	$83,412	$9,036	$0		
38	Ghent 3 - PAC Injection	$7,624		$0	$0	$0	$3,737	$3,887	$0	$0		
39	Ghent 3 - SAM Mitigation	$8,570	$250	$650	$7,670							
40	Total Ghent 3	**$186,403**	**$250**	**$650**	**$7,670**	**$19,280**	**$62,219**	**$87,298**	**$9,036**	**$0**		
41												
42	Ghent 4 - Baghouse	$144,530		$0	$0	$13,622	$49,582	$73,665	$7,661	$0		
43	Ghent 4 - PAC Injection	$7,669		$0	$0	$0	$3,760	$3,910	$0	$0		
44	Ghent 4 - SAM Mitigation	$8,570	$250	$650	$7,670							
45	Total Ghent 4	**$160,770**	**$250**	**$650**	**$7,670**	**$13,622**	**$53,342**	**$77,575**	**$7,661**	**$0**		
47	**Total Ghent**	**$954,101**	**$1,250**	**$28,267**	**$91,575**	**$148,777**	**$293,065**	**$324,115**	**$67,052**	**$0**		
48												
49	**Mill Creek**											
50	Mill Creek 1 - FGD Upgrade	$49,565		$0	$0	$12,006	$34,962	$2,597	$0	$0		

	A	D	E	F	G	H	I	J	K	L	M	N
51	Mill Creek 1 - Baghouse	$96,033		$0	$9,051	$32,945	$48,947	$5,090	$0	$0		
52	Mill Creek 1 - PAC Injection	$5,085		$0	$480	$1,748	$2,857	$0	$0	$0		
53	Mill Creek 1 - SAM Mitigation	$10,137		$0	$0	$461	$959	$2,992	$5,186	$539		
54	Total Mill Creek 1	**$160,821**	**$0**	**$0**	**$9,531**	**$47,160**	**$87,725**	**$10,680**	**$5,186**	**$539**		
55												
56	Mill Creek 2 - FGD Upgrade	$47,659		$0	$11,544	$33,617	$2,497	$0	$0	$0		
57	Mill Creek 2 - Baghouse	$92,339		$8,703	$31,678	$47,064	$4,895	$0	$0	$0		
58	Mill Creek 2 - Electrostatic Precipitator	$37,690		$3,552	$12,930	$19,210	$1,998	$0	$0	$0		
59	Mill Creek 2 - PAC Injection	$4,890		$462	$1,681	$2,747	$0	$0	$0	$0		
60	Mill Creek 2 - SAM Mitigation	$9,747		$0	$443	$922	$2,877	$4,987	$519	$0		
61	Total Mill Creek 2	**$192,325**	**$0**	**$12,717**	**$58,276**	**$103,560**	**$12,267**	**$4,987**	**$519**	**$0**		
62												
63	Mill Creek 3 - FGD (U4 update and tie in)	$84,262		$0	$0	$0	$59,235	$25,027	$0	$0		
64	Mill Creek 3 - FGD (Unit 3 Removal)	$25,500		$0	$0	$0	$6,375	$19,125	$0	$0		
65	Mill Creek 3 - Baghouse	$125,943		$0	$2,331	$36,368	$47,908	$39,335	$0	$0		
66	Mill Creek 3 - PAC Injection	$6,683		$0	$124	$1,930	$2,542	$2,087	$0	$0		
67	Total Mill Creek 3	**$242,388**	**$0**	**$0**	**$2,455**	**$38,297**	**$116,061**	**$85,575**	**$0**	**$0**		
68												
69	Mill Creek 4 - FGD	$271,994		$20,344	$89,920	$104,519	$57,210	$0	$0	$0		
70	Mill Creek 4 - SCR Upgrade	$5,696		$4,521	$1,175	$0	$0	$0	$0	$0		
71	Mill Creek 4 - Baghouse	$151,571		$5,651	$51,425	$61,122	$33,373	$0	$0			
72	Mill Creek 4 - PAC Injection	$7,882		$294	$2,674	$3,178	$1,735	$0	$0			
73	Mill Creek 4 - Ammonia	$11,528		$5,651	$5,877	$0	$0	$0	$0			
74	Total Mill Creek 4	**$448,671**	**$0**	**$36,461**	**$151,072**	**$168,820**	**$92,319**	**$0**	**$0**	**$0**		
75												
76	**Total Mill Creek**	**$1,044,205**	**$0**	**$49,177**	**$221,334**	**$357,838**	**$308,371**	**$101,241**	**$5,705**	**$539**		
77												
78	**Trimble**											
79	Trimble 1 - Baghouse	$158,119	$0	$0	$0	$14,902	$54,244	$80,591	$8,381	$0		
80	Trimble 1 - PAC Injection	$7,967	$0	$0	$0	$0	$3,905	$4,062	$0	$0		
81	Total Trimble 1	**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**		
82												
83	**Total Trimble**	**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**		
84												
85	**Environmental Air Studies**											
86	Environmental Air Studies	$2,000	$1,250	$750	$0	$0	$0	$0	$0	$0		
87	Total Environmental Air Studies	**$2,000**	**$1,250**	**$750**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**		
88												
89												
90	**Total Environmental Compliance - Air**	**$2,343,848**	**$2,500**	**$80,455**	**$330,887**	**$556,712**	**$711,731**	**$565,256**	**$95,766**	**$539**		
91												
92	Variance to MTP (Only SCR Ghent 2)	($378,754)	$0	($13,078)	($44,194)	($95,869)	($91,563)	($81,855)	($49,553)	($2,643)		
93	LGE Variance to MTP (Only SCR Ghent 2)	($226,458)	$0	$0	$3,742	($28,016)	($68,134)	($81,855)	($49,553)	($2,643)		
94	KU Variance to MTP (Only SCR Ghent 2)	($152,296)	$0	($13,078)	($47,936)	($67,853)	($23,429)	$0	$0	$0		
95												
96	$7m for each of five SCR's (three KU and two LG&E) has been added back in (above) for turn-down capabilities (1/2 in 2012 and 1/2 in 2013).											
97	LG&E (two Mill Creek units)				7000	7000						
98	KU (three Ghent units)				10500	10500						

	A	D	E	F	G	H	I	J	K	L	M	N
1	**2.) Environmental Air - CATR by January 2015, NAAQS by January 2016, HAPs by January 2017**											
2	**Capital Cost - Investment Accrual Basis (Includes Removal/ARO), No SCR**											
3	$ in thousands											
4		Total	2010	2011	2012	2013	2014	2015	2016	2017		
5	**Cash Flow By Year**											
6	**Brown**											
7	Brown 1 - Baghouse	$39,218		$1,830	$13,322	$15,834	$8,233					
8	Brown 1 - PAC Injection	$1,899		$0	$0	$931	$968					
9	Brown 1 - SAM Mitigation	$4,632		$215	$1,343	$1,863	$1,211					
10	Total Brown 1	**$45,750**	**$0**	**$2,045**	**$14,665**	**$18,627**	**$10,412**	**$0**	**$0**	**$0**		
11												
12	Brown 2 - Baghouse	$41,179		$0	$1,522	$11,875	$13,174	$13,272	$1,336	$0		
13	Brown 2 - PAC Injection	$3,058		$0	$0	$0	$1,499	$1,559	$0	$0		
14	Brown 2 - SAM Mitigation	$4,568		$215	$1,791	$2,561	$0	$0	$0			
15	Total Brown 2	**$48,805**	**$0**	**$215**	**$3,314**	**$14,437**	**$14,673**	**$14,831**	**$1,336**	**$0**		
16												
17	**Brown 1 & 2 - SAM Mitigation**											
18												
19	Brown 3 - Baghouse	$76,066		$0	$0	$2,131	$25,851	$36,102	$11,983	$0		
20	Brown 3 - PAC Injection	$6,835		$0	$0	$0	$1,211	$4,314	$1,310	$0		
21	Total Brown 3	**$82,901**	**$0**	**$0**	**$0**	**$2,131**	**$27,061**	**$40,416**	**$13,292**	**$0**		
22												
23	**Total Brown**	**$177,455**	**$0**	**$2,260**	**$17,978**	**$35,194**	**$52,146**	**$55,248**	**$14,628**	**$0**		
24												
25	**Ghent**											
26	Ghent 1 - Baghouse	$163,356				$4,575	$55,515	$77,531	$25,734			
27	Ghent 1 - PAC Injection	$8,036		$0	$0	$0	$1,211	$5,515	$1,310	$0		
28	Ghent 1 - SAM Mitigation	$7,750	$375	$7,375								
29	Total Ghent 1	**$179,142**	**$375**	**$7,375**	**$0**	**$4,575**	**$56,726**	**$83,047**	**$27,043**	**$0**		
30												
31	Ghent 2 - Baghouse	$149,464		$0	$0	$5,588	$50,854	$71,021	$22,001			
32	Ghent 2 - PAC Injection	$7,695		$0	$0	$0	$1,211	$5,174	$1,310			
33	Ghent 2 - SAM Mitigation	$7,750	$375	$7,375								
34	Total Ghent 2	**$164,909**	**$375**	**$7,375**	**$0**	**$5,588**	**$52,065**	**$76,195**	**$23,311**	**$0**		
35												
36	Ghent 3 - Baghouse	$170,210		$0	$0	$19,280	$58,482	$83,412	$9,036	$0		
37	Ghent 3 - PAC Injection	$7,624		$0	$0	$0	$3,737	$3,887	$0	$0		
38	Ghent 3 - SAM Mitigation	$8,570	$250	$650	$7,670							
39	Total Ghent 3	**$186,403**	**$250**	**$650**	**$7,670**	**$19,280**	**$62,219**	**$87,298**	**$9,036**	**$0**		
40												
41	Ghent 4 - Baghouse	$144,530		$0	$0	$13,622	$49,582	$73,665	$7,661	$0		
42	Ghent 4 - PAC Injection	$7,669		$0	$0	$0	$3,760	$3,910	$0	$0		
43	Ghent 4 - SAM Mitigation	$8,570	$250	$650	$7,670							
44	Total Ghent 4	**$160,770**	**$250**	**$650**	**$7,670**	**$13,622**	**$53,342**	**$77,575**	**$7,661**	**$0**		
46	**Total Ghent**	**$691,224**	**$1,250**	**$16,050**	**$15,340**	**$43,065**	**$224,352**	**$324,115**	**$67,052**	**$0**		
47												
48	**Mill Creek**											
49	Mill Creek 1 - FGD Upgrade	$49,565		$0	$0	$12,006	$34,962	$2,597	$0	$0		
50	Mill Creek 1 - Baghouse	$96,033		$0	$9,051	$32,945	$48,947	$5,090	$0	$0		

	A	D	E	F	G	H	I	J	K	L	M	N
51	Mill Creek 1 - PAC Injection	$5,085		$0	$480	$1,748	$2,857	$0	$0	$0		
52	Mill Creek 1 - SAM Mitigation	$10,137		$0	$0	$461	$959	$2,992	$5,186	$539		
53	Total Mill Creek 1	**$160,821**	**$0**	**$0**	**$9,531**	**$47,160**	**$87,725**	**$10,680**	**$5,186**	**$539**		
54												
55	Mill Creek 2 - FGD Upgrade	$47,659		$0	$11,544	$33,617	$2,497	$0	$0	$0		
56	Mill Creek 2 - Baghouse	$92,339		$8,703	$31,678	$47,064	$4,895	$0	$0	$0		
57	Mill Creek 2 - Electrostatic Precipitator	$37,690		$3,552	$12,930	$19,210	$1,998	$0	$0	$0		
58	Mill Creek 2 - PAC Injection	$4,890		$462	$1,681	$2,747	$0	$0	$0	$0		
59	Mill Creek 2 - SAM Mitigation	$9,747		$0	$443	$922	$2,877	$4,987	$519	$0		
60	Total Mill Creek 2	**$192,325**	**$0**	**$12,717**	**$58,276**	**$103,560**	**$12,267**	**$4,987**	**$519**	**$0**		
61												
62	Mill Creek 3 - FGD (U4 update and tie in)	$84,262		$0	$0	$0	$59,235	$25,027	$0	$0		
63	Mill Creek 3 - FGD (Unit 3 Removal)	$25,500		$0	$0	$0	$6,375	$19,125	$0	$0		
64	Mill Creek 3 - Baghouse	$125,943		$0	$2,331	$36,368	$47,908	$39,335	$0	$0		
65	Mill Creek 3 - PAC Injection	$6,683		$0	$124	$1,930	$2,542	$2,087	$0	$0		
66	Total Mill Creek 3	**$242,388**	**$0**	**$0**	**$2,455**	**$38,297**	**$116,061**	**$85,575**	**$0**	**$0**		
67												
68	Mill Creek 4 - FGD	$271,994		$20,344	$89,920	$104,519	$57,210	$0	$0	$0		
69	Mill Creek 4 - SCR Upgrade	$5,696		$4,521	$1,175	$0	$0	$0	$0	$0		
70	Mill Creek 4 - Baghouse	$151,571		$5,651	$51,425	$61,122	$33,373	$0	$0			
71	Mill Creek 4 - PAC Injection	$7,882		$294	$2,674	$3,178	$1,735	$0	$0			
72	Mill Creek 4 - Ammonia	$11,528		$5,651	$5,877	$0	$0	$0	$0			
73	Total Mill Creek 4	**$448,671**	**$0**	**$36,461**	**$151,072**	**$168,820**	**$92,319**	**$0**	**$0**	**$0**		
74												
75	**Total Mill Creek**	**$1,044,205**	**$0**	**$49,177**	**$221,334**	**$357,838**	**$308,371**	**$101,241**	**$5,705**	**$539**		
76												
77	**Trimble**											
78	Trimble 1 - Baghouse	$158,119	$0	$0	$0	$14,902	$54,244	$80,591	$8,381	$0		
79	Trimble 1 - PAC Injection	$7,967	$0	$0	$0	$0	$3,905	$4,062	$0	$0		
80	Total Trimble 1	**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**		
81												
82	**Total Trimble**	**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**		
83												
84	**Environmental Air Studies**											
85	Environmental Air Studies	$2,000	$1,250	$750	$0	$0	$0	$0	$0	$0		
86	Total Environmental Air Studies	**$2,000**	**$1,250**	**$750**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**		
87												
88												
89	**Total Environmental Compliance - Air**	**$2,080,970**	**$2,500**	**$68,238**	**$254,653**	**$450,999**	**$643,018**	**$565,256**	**$95,766**	**$539**		
90												
91	Variance to MTP (No SCR Amounts)	($641,631)	$0	($25,295)	($120,429)	($201,581)	($160,276)	($81,855)	($49,553)	($2,643)		
92	LGE Variance to MTP (No SCR Amounts)	($226,458)	$0	$0	$3,742	($28,016)	($68,134)	($81,855)	($49,553)	($2,643)		
93	KU Variance to MTP (No SCR Amounts)	($415,174)	$0	($25,295)	($124,171)	($173,565)	($92,142)	$0	$0	$0		
94												
95	$7m for each of five SCR's (three KU and two LG&E) has been added back in (above) for turn-down capabilities (1/2 in 2012 and 1/2 in 2013).											
96	LG&E (two Mill Creek units)				7000	7000						
97	KU (three Ghent units)				10500	10500						

From:	Jackson, Fred
To:	Thompson, Paul
CC:	Voyles, John
Sent:	1/26/2011 12:59:24 PM
Subject:	Draft Energy Services Major Projects Report November-December 2010
Attachments:	Energy Services Major Projects Monthly Report November - December 2010 Draft.docx; PE's Bi-Weekly Update of 11-22-10.docx; PE's Bi-Weekly Update of 12-19-10.docx

Paul,

Sorry for the delay in sending this report. Attached is a draft of the November-December 2010 ES Major Projects Monthly Report. All updates are shown as tracked changes against the October report you sent to Vic. I have ***not*** mentioned the potential Cane Run CCGT impact on Cane Run CCP project other than a that a smaller landfill design is being developed as an alternative based on pending environmental regulations..

I also attached the November 22 and December 19 Project Engineering Bi-Weekly Update as reference. Please let me know if questions.

Thanks,
Fred

Energy Services Major Projects Monthly Report
November - December 2010

I. KU SOx Program

A. Safety

Contractor on Ghent Project, Flour, received Governor's Safety Award for 4.5 million safe work hours without a lost time injury.

B. Schedule

Ghent: Unit 4 ID fans installed and in service.

Brown: FGD tie-in to Units 1, 2, and 3 successfully completed

Note: Flour demobilized from both Ghent and Brown.

C. Budget

Brown: Currently forecasting a positive variance to budget of greater than $80M.

D. Issues/Risks

Siding on Ghent Unit 1 SCR and FGD complete.

II. Trimble County 2

A. Safety

No Issues to report.

B. Schedule

Maximum achievable load to date is ~827 MW gross. Estimated COD is late January. Doosan/Bechtel placed a restriction on the coals allowed to be combusted and grouped in three categories. Negotiating a "conditional CO" with Bechtel allowing commercial operation on limited coals thus suspending LD's until the modifications, if any, to allow the total coal box to be used are implemented. Performance Testing completed with the unit passing heat rate, generation, and all environmental air emission permit conditions.

C. Budget

Forecasted to slightly overrun sanction pending final closeout of EPC. Liquidated damages for Bechtel expected to total $25.65M.

D. Issues/Risks

Demand Letter for LDs sent to Bechtel on 12/10/10 for the full LDs ($38.1m).

Design of the DBEL burners/combustion system for our coal specification

III. Brown Ash Pond

A. Safety

No issues to Report

B. Schedule

Work on Phase I of the Main Pond was suspended. Detail engineering to convert the Main Pond to a landfill proceeding to plan for a 2011 ECR filing.

C. Budget

No Material Change

D. Issues/Risks

Potential impact of proposed coal combustion products regulations as noted above.

IV. KU NOx Program (Brown 3)

A. Safety

No issues to Report

B. Schedule

On plan for spring 2012 in-service.

C. Budget

No material change.

D. Issues/Risks

Permits received.

V. Trimble County Coal Combustion Products

A. Safety

No issues to Report

B. Schedule

See Issues/Risks below. Submitted 401/404 permit applications on 12/21/10. Detail engineering for landfill awarded to GAI.

C. Budget

No Material Change

D. Issues/Risks

Meeting long term on site disposal needs is a schedule concern based upon engineering/construction and permitting. CCN issued December 23, 2009.

Holcim contract for beneficial reuse executed.

VI. Ghent Coal Combustion Products

A. Safety

No Issues to Report

B. Schedule

All permit applications submitted. Detail engineering of CCP Transport System awarded to B&V with final conceptual design expected in February 2011.

C. Budget

Current projected cost for CCP Transport System considerable higher than original estimate. Verifying scope and cost estimate.

D. Issues/Risks

Meeting on site disposal needs is a schedule concern based on timeline associated land acquisition, permitting, and engineering/construction. CCN issued December 23, 2009.

Final offer sent to last landowner. Verbal agreement reached with two landowners. One remaining landowner decision expected in early January.

VII. Cane Run Coal Combustion Products

A. Safety

No issues to Report

B. Schedule

404 and Special Waste Landfill permit applications submitted to KY Division of Water and KY Division of Waste Management, respectively. Received 401 permit on August 4, 2010.

C. Budget

No Material Change

D. Issues/Risks

Meeting on site disposal needs is a schedule concern based on timeline associated with permitting and engineering/construction. No land acquisition expected under current construction plan.

Developing a smaller landfill alternative based on pending environmental regulations.

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
November 22, 2010

- **KU SOx**
  - Safety – Fluor experienced a recordable at Brown, this was not a lost-time accident. At Ghent, Fluor was awarded the Governor's Safety Award for working 4.5 million safe work hours without a lost time injury.
  - Schedule/Execution:
    - Ghent Unit 4 ID Fans – Fluor revised their projected completion date to 11/22/10. Balancing of the fans has been completed and start-up on Unit 4 is in progress. A faulty coupling was replaced.
    - Ghent Elevators – in progress.
    - Ghent Miscellaneous: Valves on all units associated with the previously identified valve drift problem have been replaced.
    - Brown Unit 1 – **ductwork tie-in outage completed per plan**. Fluor will complete new I.D. fan commissioning and tuning during unit startup.
    - Brown Unit 2 – preparing for I.D. fan and damper control implementation during the outage.
    - Brown Coal Pile Modification
      - Contract awarded to Charah who has begun clearing/grubbing of expansion footprint and installed silt fence.
      - Discussions held with Mercer Co. Health Dept. in preparation for septic field modification permit filing.
      - Targeting to have the work complete in time to utilize the expansion for FGD testing fuel early next year.
    - UGS is nearing completion of the design work for the elevators, they have mobilized to the site to begin excavations and the structural steel is in fabrication. Still targeting completion February 2011.

- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – 3 of 6 pulverizer gearboxes are schedule to be on site by 11/21/10. The remaining 3 gearboxes are expected by the end of November. This delay is being incorporated into a revised schedule by Bechtel which tentatively reflects re-fire around 11/26/10 and Substantial Completion around mid-December. Bechtel is revising their schedule for PE and Station review relative to coal burn and is expected to reissue a schedule by 11/24/10. Bechtel missed the 11/14/10 requirement to have the CEMS RATA certified. A letter will be issued to Bechtel notifying them of this in writing and stating the need to prioritize this on next re-fire. Bechtel is not disputing the CEMS issue.
  - Contract Disputes/Resolution:
    - Bechtel
      - Bechtel has submitted their understanding of how the multiple "donut holes" work in conjunction with the extended COD. It is currently under review within PE, Legal and outside counsel.
      - PE is reviewing Bechtel's LD Reduction events and durations. Preliminary findings agree with Bechtel's information submitted to date.

        - Differences currently focus on Bechtel's settlement with Doosan and how it impacts our "donut hole" provision in the EPC.
    - Issues/Risk:
        - Design of the DBEL burners for our coal specification, remaining commissioning beyond the 75% load achieved to date.
- **Brown 3 SCR**
    - Safety – NTR
    - Permitting – Permit to construct SCR received in draft form through the revised Title V. Comments submitted to State no draft Title V permit.
    - Engineering – proceeding as planned to support the spring 2012 in-service.
    - Schedule/Execution – SCR ductwork deliveries have begun.
    - Issues/Risk – NTR

- **Ohio Falls Rehabilitation**
    - Safety – NTR
    - Engineering
        - Voith proceeding with engineering as planned to support fabrication/manufacturing.

- **Mill Creek Limestone Project**
    - Safety - NTR
    - Schedule/Execution
        - East and Westbrook continue their work on the building expansion.
    - Contracting – Bids for the Detailed Engineering continue to be reviewed.

- **Cane Run CCP Project**
    - Permitting
        - 404 and Landfill Permit applications remain under review by the agencies. To date permitting process has gone well. The 401 permit was received on 8/4/10.
    - Engineering
        - The review of constructing the smaller landfill versus modifying the existing landfill and trucking balance to Mill Creek is nearing completion. Preliminary results indicate no financial benefit to NOT build the landfill with significant potentials for trucking to Mill Creek (ie. Safety, emissions off of trucks, bad weather handling, etc.). PE and Station management plan to review with Ralph and John after Thanksgiving.
        - Finalization of construction drawings are on hold until the KYDWM permit review is completed and any necessary changes can be incorporated.
        - Working on finalizing design of the smaller landfill to support the proposed 2016 CCGT.

- **Trimble Co. Barge Loading/Holcim**
    - Finalized order with UCC to purchase pneumatic Fly Ash handling system.
    - Updated the 404 Permit drawings per USACE request. Permit has been published on the USACE's website.
    - The Station has now signed the contract with Holcim.

- **TC CCP Project – BAP/GSP**
    - Safety – NTR
    - Schedule/Execution:
        - GSP's liner system installation completed.
        - Nearing completion on fill placement and mechanically stabilized earth wall on BAP.

    - Work continues on erection of the new Pipe Rack, electrical duct banks to GSP Electrical Building and to Ash Pond Raft.

  - Contract Disputes/Resolution
    - Resolution of Weather Delays and requested change to Liquidated Damages by contractor under review.
    - Working on resolution of Engineering Delays
  - Issues/Risk
    - Weather remains the biggest risk; however, the weather over the last 4 months has been exceptional for this project.

- **TC CCP Project – Landfill**
  - Engineering - Detailed Engineering to be awarded to GAI.
  - Permitting:
    - Work continues on the development of the 401/404 Permits for Fall 2010 submittal.

- **Ghent CCP Projects - Landfill**
  - Safety – NTR
  - Engineering:
    - Detailed Engineering of gypsum fines continues with B&V.
    - Detailed Engineering of the CCR Transport System awarded to B&V. The first focus of B&V is to finalize the conceptual scope of the transport and handling systems by the end of 2010. B&V will then focus on the three major equipment RFQs and then the EPC RFQ specification.
    - Drawings and Specifications for the Detailed Engineering for the Landfill have been submitted for review within EON-US.
  - Permitting:
    - All permit applications have been made.
    - Relocation of the impacted cemetery continues and was delayed due to finding three additional corpses that did not have gravestones. No issues overall with this relocation.
  - Issues/Risk:
    - Land Acquisition – A meeting was held in Carrolton with the remaining land owner's counsel (Mr. Crawford). Purchase agreement reached verbally with Owens and McDole. Final verbal offer given to Deaton with the understanding that this last offer would determine whether or not we would seek condemnation. Deaton's asked for two weeks to review offer with accountants relative to taxation scenarios.

- **E.W. Brown Ash Pond Project**
  - Safety – NTR
  - Engineering – Detailed Engineering of the landfill awarded to MACTEC.
  - Schedule/Execution:
    - All work in the field is currently related to the Aux. Pond Scope of Work.
    - Continued to place Type I shot rock and filter fabric in the drainage layer of the South side embankment.
    - Continued to place Type IIa-24 shot rock from the Starter Dike into the East embankment.
    - Removed clay layer from Starter Dike and placed atop ash to serve as dust control.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
  - Safety – NTR

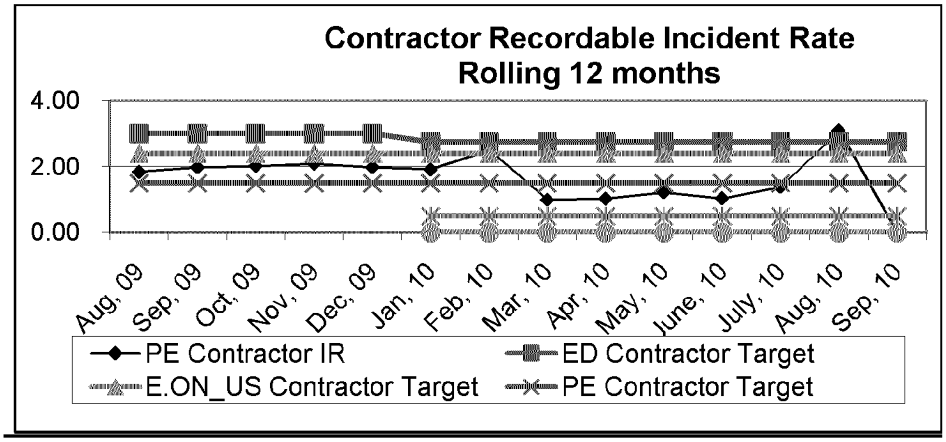
  - Schedule/Execution – all projects essentially on hold until resolution of Ghent with EPA and Air Compliance planning with B&V study nears finalization in 1Q of 2011.

- **Cane Run CCGT**
  - Gas Pipe Line Routing – Bids under review from EMS, Photo Science and URS.
  - Owner's Engineer – Bids reviewed and finalized between HDR and B&McD. Meetings were held the week of 11/15/10 with HDR and B&McD in their offices to review their bids, rates and execution plan in detail. Expect to award this work in early December.
  - Sound Survey – NTR
  - Set-back Survey of Neighbors at Cane Run – Work in progress.
  - Paddy's Run Siting Evaluation – Determination made that Paddy's site is not large enough to support a 2x1 CCGT.
  - Two 1x1 Single Shaft Cost Estimate – Completed and forwarded to Generation Planning
  - Turndown Assessment of 2x1 – Completed and forwarded to Generation Planning
  - Start Up Emissions – Concerns for CO & VOC PSD netting out based on start up estimates; refining analysis week of Nov. 1.
  - Black Start at Cane Run – Black start of the NGCC is not required. CR 4-6 all use natural gas as start up fuel; the NGCC plant would have the same fuel delivery issue as the coal units.
  - Auxiliary Boiler – emissions profile submitted to EA

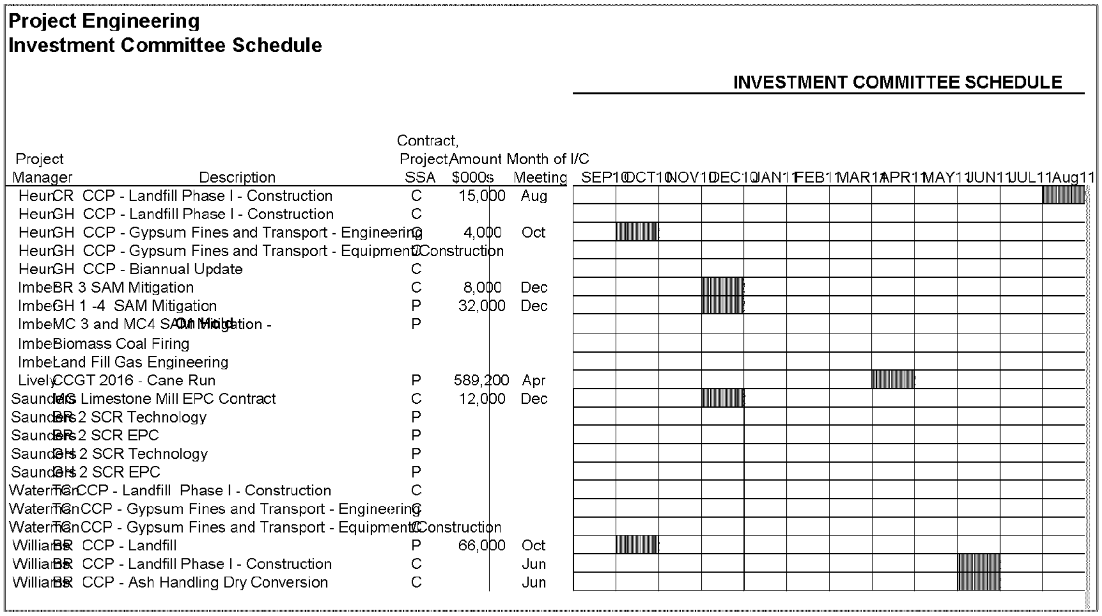
- **Other Generation Development**
  - LFG - NTR.
  - Biomass - NTR
  - CCS 100 MW Project –
    - EPRI work is ongoing.
    - KGS is released to begin work.
    - KBR GSA in final review..
  - FutureGen – NTR.

- **General**
  - Environmental Scenario Planning:
    - All stations (MC, Ghent and Brown) are under review.
    - Various meetings held with Gen Planning to continue honing the plan and various compliance scenarios.
    - SCRs not in plan for Hg co-benefit. This will lead towards several (if not all but Ghent 2) SCRs not being needed, pending final allowance allocation by EPA.
  - A trip to East Kentucky Power is planned to review the Alstom NID system. PE and Mill Creek Management will be attending the tour.
  - 2011 MTP ECR/CCN Filings – working closely with Rates on PSC submittals and presentations/updates. **A filing is needed in the March/April 2011 timeframe to execute the 2011 MTP Plan. This has been communicated to Legal, Rates, Gen Planning and management.**
  - Continue to work with Legal and EA on Ghent SAM compliance.
  - Continue to work with Legal on asbestos litigation regarding construction of TC1.

Metrics



Upcoming PWT Needs:



Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Contract, Project, SSA	Amount $000s	Month of I/C Meeting	SEP10	OCT10	NOV10	DEC10	JAN11	FEB11	MAR11	APR11	MAY11	JUN11	JUL11	Aug11
Heun	CR CCP - Landfill Phase I - Construction	C	15,000	Aug												▨
Heun	GH CCP - Landfill Phase I - Construction	C														
Heun	GH CCP - Gypsum Fines and Transport - Engineering	C	4,000	Oct		▨										
Heun	GH CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Heun	GH CCP - Biannual Update	C														
Imbe	BR 3 SAM Mitigation	C	8,000	Dec				▨								
Imbe	GH 1 -4 SAM Mitigation	P	32,000	Dec				▨								
Imbe	MC 3 and MC4 SAM Mitigation - On Hold	P														
Imbe	Biomass Coal Firing															
Imbe	Land Fill Gas Engineering															
Lively	CCGT 2016 - Cane Run	P	589,200	Apr								▨				
Saunders	MC Limestone Mill EPC Contract	C	12,000	Dec				▨								
Saunders	BR 2 SCR Technology	P														
Saunders	BR 2 SCR EPC	P														
Saunders	GH 2 SCR Technology	P														
Saunders	GH 2 SCR EPC	P														
Waterman	TC CCP - Landfill Phase I - Construction	C														
Waterman	TC CCP - Gypsum Fines and Transport - Engineering	C														
Waterman	TC CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Williams	BR CCP - Landfill	P	66,000	Oct		▨										
Williams	BR CCP - Landfill Phase I - Construction	C		Jun										▨		
Williams	BR CCP - Ash Handling Dry Conversion	C		Jun										▨		

Staffing

- Significant staffing increases in PE will be required to manage the current slate of projects in PE's draft 2011 MTP. Headcount planning in process now that the MTP has been approved by LG&E and KU Energy.
- New position being created to manage project approval documentation and schedules.

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
December 19, 2010

- **KU SOx**
  - Safety – NTR
  - Schedule/Execution:
    - Ghent Elevators – in progress.
    - Ghent Misc. - Fluor plans to be demobilized by December 22, 2010.
    - Brown Unit 1 - Performance testing has been performed on the new I.D. fan and the fan continues to be functioning satisfactorily.
    - Brown Unit 2 - ID fan and damper control implementation planned during the last week of the outage.
    - Brown Gypsum De-watering
      - Continue to dewater gypsum as available.
      - The first period of extreme cold weather has brought out a few freezing issues that are being addressed.
      - Brown Coal Pile Modification
      - Placed foundation material for pile and retention pond expansion footprints.
- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – Doosan/Bechtel has placed a restriction on the coals allowed to be combusted. In turn, we are negotiating a "conditional CO" with Bechtel to allow them to test on the limited coals and suspend LD's until the modifications necessary to allow the total coal box to be used is implemented. CEMS RATAs passed conditionally until KDAQ approves testing. Performance Testing is planned for 12/19/10 on the Unit with KDAQ present to witness the test.
  - Contract Disputes/Resolution:
    - Demand Letter for LDs sent to Bechtel on 12/10/10 for the full LDs ($38.1m). We expect Bechtel to submit a LD Reduction Claim for the "donut hole" provisions.
  - Issues/Risk:
    - Design of the DBEL burners/combustion system for our coal specification
    - Long-term life of the coal mill gearbox bearings.

- **Brown 3 SCR**
  - Safety – NTR
  - Permitting – NTR
  - Engineering – proceeding as planned to support the spring 2012 in-service.
  - Schedule/Execution – SCR ductwork deliveries continue. Monthly progress meeting held in San Antonio.
  - Issues/Risk – NTR

- **Ohio Falls Rehabilitation**
  - Safety – NTR
  - Engineering
    - Voith Hydro proceeding with equipment orders and pre-mobilization issues for a restart of rehabilitation on Unit 5 in June, 2011.

    - Black and Veatch is engineering the underwater repair scope that will go out for bid in January and for gate modifications and pumping improvements.
    - Received Aquarius Marine draft of underwater inspection report for entire plant as required by FERC.
    - PE continues SOW for possible 240/480 VAC station auxiliary system upgrade.
    - PE continues working with Voith (VHMS) generator group on refinement of data for the application for grid interconnection.
    - PE assembling SOW documents for Historic Maintenance Plan including upstream stairway down to head-works and façade repairs.
  - Issues/Risks
    - NTR

- **Mill Creek Limestone Project**
  - Safety - NTR
  - Schedule/Execution
    - East and Westbrook continue their work on the building expansion.
    - Detailed Engineering - an award recommendation is planned by December 31, 2010.

- **Cane Run CCP Project**
  - Permitting
    - 404 and Landfill Permit applications remain under review by the agencies. To date permitting process has gone well. The 401 permit was received on 8/4/10. The Flood Plain permit was received 11/22/10.
  - Engineering
    - The review of constructing the smaller landfill versus modifying the existing landfill and trucking balance to Mill Creek is nearing completion. Preliminary results indicate no financial benefit to NOT building the landfill; however, while cons exist for long-term trucking to Mill Creek (i.e. Safety, emissions off of trucks, bad weather handling, etc.) there are pros as well with regards to local issues. Initial review held with Bowling with a final with Bowling and Voyles planned after 1/1/11.
    - Finalization of construction drawings are on hold until the KYDWM permit review is completed and any necessary changes can be incorporated.
    - Working on finalizing design of the smaller landfill to support the proposed 2016 CCGT. A revised estimate for the smaller landfill has been completed by STANTEC and is under review with PE. The revised estimate is lower than the 2011 MTP amount that was a prorate from the original landfill scope.

- **Trimble Co. Barge Loading/Holcim**
  - Finalized order with UCC to purchase pneumatic Fly Ash handling system.
  - The permit has been published on the USACE's website.
  - The Station has received the signed contract from Holcim.

- **TC CCP Project – BAP/GSP**
  - Safety – NTR
  - Schedule/Execution:
    - GSP's liner system installation completed. Placement of ballasting water continues.
    - All fill and mechanically stabilized earth wall work on the BAP is completed except for a small section of the South Dike. Work continues on erection of the new Pipe Rack, electrical duct banks to GSP Electrical Building and to Ash Pond Raft.

    - Actions being taken to prevent deer from entering the GSP.
  - Contract Disputes/Resolution
    - Minor issues to resolve with Riverside.
    - IC approved $4.2m increase in Riverside contract authorization.
  - Issues/Risk
    - Weather remains the biggest risk; however, the weather over the last 4 months has been exceptional for this project.

- **TC CCP Project – Landfill**
  - Engineering
    - Detailed Engineering in progress with GAI.
    - Drill crews beginning geotechnical exploration.
  - Permitting:
    - Work continues on the development of the 401/404 Permits for Fall 2010 submittal. The final review with MACTEC and Environmental Affairs occurred 12/9/10 along with meetings with Legal and Right of Way on potential acquisition of small land parcels for right of ways and stream mitigation.

- **Ghent CCP Projects - Landfill**
  - Safety – NTR
  - Engineering:
    - Detailed Engineering of gypsum fines continues with B&V.
    - Detailed Engineering of the CCR Transport System awarded to B&V. <u>The first focus of B&V is to finalize the conceptual scope of the transport and handling systems by the end of 2010 to allow KU approval in January/February 2011</u>**.** B&V will then focus on the three major equipment RFQs and then the EPC RFQ specification.
    - Drawings and Specifications for the Detailed Engineering for the Landfill have been submitted for review within EON-US.
  - Permitting:
    - **All permit applications have been made.**
  - Miscellaneous
  - Issues/Risk:
    - Land Acquisition – A meeting was held in LG&E Building on 12/17/10 with the remaining land owner's counsel (Mr. Crawford) and the Deatons. A final final offer will be submitted to Deatons counsel the first week in January that positions them to accept the offer or we move to condemnation.

- **E.W. Brown Ash Pond Project**
  - Safety – NTR
  - Issues/Risk:
    - Continue to work with Summit on contract settlement payout/resolution. The first meeting between Summit and the Director of PE scheduled for 12/21/10.
  - Engineering – Detailed Engineering in progress by MACTEC.
  - Schedule/Execution:
    - All work in the field is currently related to the Aux. Pond Scope of Work.
    - Placement of Gypsum on hold for favorable weather conditions. Gypsum will be stockpiled instead of sluicing to Aux Pond.

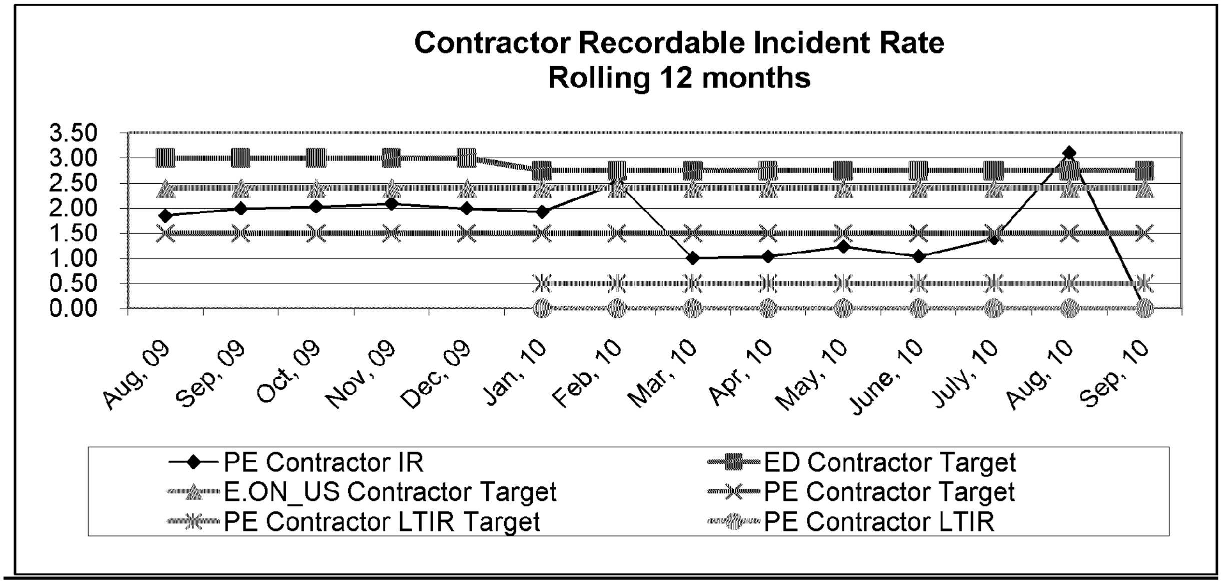
- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
    - Safety – NTR
    - Schedule/Execution – all projects essentially on hold until resolution of Ghent with EPA and Air Compliance planning with B&V study nears finalization in 1Q of 2011.

- **Cane Run CCGT**
    - Gas Pipe Line Routing – EMS has completed initial routing concepts, completed "windshield survey" of routes, performance of evaluation and weighting is on schedule. Expected completion of routing assessment January 2011.
    - Owner's Engineer – Circulating a $2.5M award recommendation for firm and non-firm OE scopes for the project through commercialization. HDR is the recommended OE.
    - Sound Survey – Survey report is under review.
    - Set-back Survey of Neighbors at Cane Run – Survey at the site is complete. Drawing submitted. 1000' setback is clear from site boundary. 2000' setback from residential property is close – when OE contract is let the plant layout and the survey data will be overlaid on the same drawing.
    - Start Up Emissions – NTR

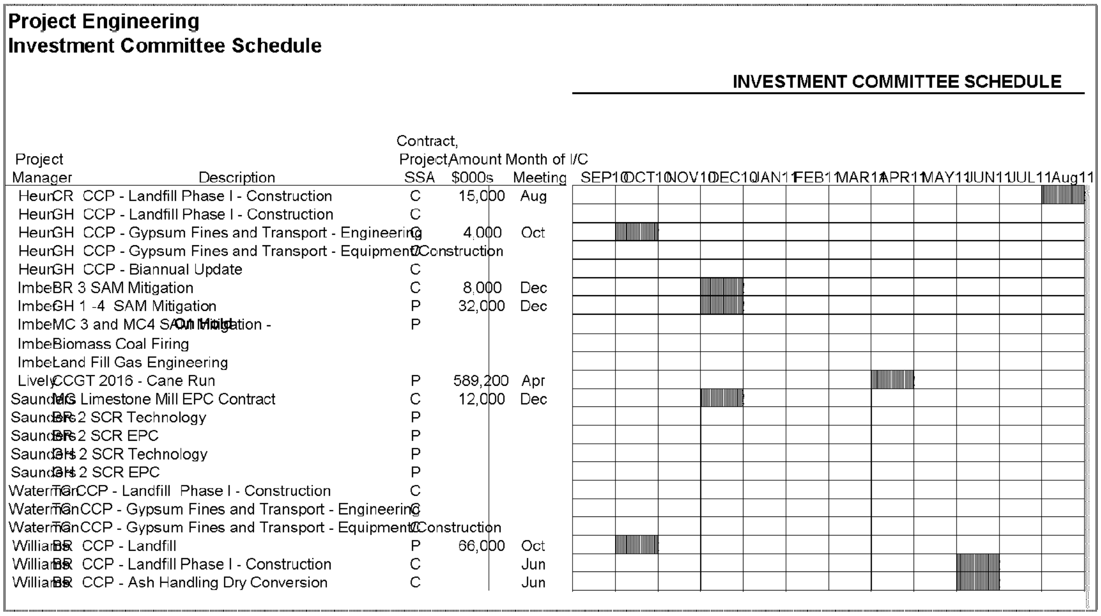
- **Other Generation Development**
    - LFG - NTR.
    - Biomass - NTR
    - CCS 100 MW Project –
        - EPRI work is ongoing.
        - KGS is released to begin work.
        - KBR Technical and Commercial discussions ongoing.
    - FutureGen – Member of the surface evaluation team – data collection and proposal evaluations progressing to meet the December 8 requirement.

- **General**
    - Environmental Scenario Planning:
        - All stations (MC, Ghent and Brown) are under review.
        - Various meetings being held with Gen Planning, Rates & Regulatory to continue honing the plan and various compliance scenarios.
        - SCRs not in plan for Hg co-benefit. This will lead towards several (if not all but Ghent 2) SCRs not being needed, pending final allowance allocation by EPA.
    - 2011 MTP ECR/CCN Filings – working closely with Rates on PSC submittals and presentations/updates. **A filing date has been preliminarily set with Rates for April 1 2011.**
    - Continue to work with Legal and EA on Ghent SAM compliance.
    - Continue to work with Legal on asbestos litigation regarding construction of TC1.

<u>Metrics</u>



Upcoming PWT Needs:



Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Contract, Project, SSA	Amount $000s	Month of I/C Meeting	SEP10	OCT10	NOV10	DEC10	JAN11	FEB11	MAR11	APR11	MAY11	JUN11	JUL11	Aug11
Heur	CR CCP - Landfill Phase I - Construction	C	15,000	Aug												▨
Heur	GH CCP - Landfill Phase I - Construction	C														
Heur	GH CCP - Gypsum Fines and Transport - Engineering	C	4,000	Oct		▨										
Heur	GH CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Heur	GH CCP - Biannual Update	C														
Imbe	BR 3 SAM Mitigation	C	8,000	Dec				▨								
Imbe	GH 1 -4 SAM Mitigation	P	32,000	Dec				▨								
Imbe	MC 3 and MC4 SAM Mitigation - On Hold	P														
Imbe	Biomass Coal Firing															
Imbe	Land Fill Gas Engineering															
Lively	CCGT 2016 - Cane Run	P	589,200	Apr								▨				
Saunders	MC Limestone Mill EPC Contract	C	12,000	Dec				▨								
Saunders	BR 2 SCR Technology	P														
Saunders	BR 2 SCR EPC	P														
Saunders	GH 2 SCR Technology	P														
Saunders	GH 2 SCR EPC	P														
Waterman	TC CCP - Landfill Phase I - Construction	C														
Waterman	TC CCP - Gypsum Fines and Transport - Engineering	C														
Waterman	TC CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Williams	BR CCP - Landfill	P	66,000	Oct		▨										
Williams	BR CCP - Landfill Phase I - Construction	C		Jun										▨		
Williams	BR CCP - Ash Handling Dry Conversion	C		Jun										▨		

Staffing

- Significant staffing increases in PE expected to manage the current slate of projects in PE's 2011 MTP and to account for retirements. Headcount planning is in process now that the MTP has been approved by LG&E and KU Energy. The revised PE headcount plan is expected to be in final draft in January 2011.
- The new position to manage project approval documentation and schedules is expected to be posted within two weeks. The position description is under final review with HR.

From:	Schram, Chuck
To:	Thompson, Paul
CC:	Sinclair, David; Voyles, John
Sent:	4/13/2011 12:11:42 PM
Subject:	Project Calendar
Attachments:	Prj Calendar 20110413.pdf

Paul,
Attached is a calendar with the key dates for ECR, RFP, and CCCT (2016 and 2018) development thru 2014. This is sorted by project instead of the prior calendar's combined view. We can extend this calendar's timeframe and include additional project detail if needed.

Chuck

Key Dates

April 13, 2011

	2011									2012	2013	2014
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
ECR												
Complete analysis	15-Apr											
Draft testimony for review	18-Apr											
Finalize bill impacts	22-Apr											
File KPSC notice		2-May										
Submit newspaper notices		11-May										
Final draft ECR appl and testimony		16-May										
File ECR/CCN applications			1-Jun									
Final CATR issued			27-Jun									
EPA releases proposed GHG regs				26-Jul								
ECR order due from KPSC								28-Nov				
Receive final MACT/HAPS rule								30-Nov				
Complete review of MACT/HAPS control plan based on final rule									30-Dec			
RFP												
Bidders deadline for best offer	11-Apr											
Decision on selection of final RFP offer(s)			3-Jun									
Finalize agreement(s) with RFP finalist(s)				29-Jul								
File KPSC notice/CCN						1-Sep						
CCCT (2016 unit)												
Inv Comm/internal approvals		31-May										
Public ROW mtgs for gas pipeline			1-Jun									
Air permit application				1-Jul								
Draft CCN filing				15-Jul								
File CCN						1-Sep						
Prepare Transmission CCN							1-Oct		16-Dec			
Receive CCN and air permit										Q3		
Award eqpt and EPC contract										Q4		
EPC full notice to proceed											Q1	
Eminent domain filings for ROW (if needed)											Q2	
CCCT (2018 unit)												
Identify site acquisition needs										Q4		
Complete plant concept											Q1	
File CCN application												Q3

From:	Sturgeon, Allyson </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=N093308>
Sent:	4/19/2011 2:53:47 PM
To:	Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Schroeder, Andrea; Schram, Chuck; Conroy, Robert; Kendrick Riggs; Bellar, Lonnie; Charnas, Shannon; Revlett, Gary; Voyles, John; Straight, Scott; Saunders, Eileen; Wilson, Stuart; Winkler, Michael; Ehrler, Bob
Subject:	Copy: General Comments/Discussion on First Draft of ECR Applications and Testimony
Location:	LGEC12 North 2 (Cap 15)
Start:	Tue 4/26/2011 9:00:00 AM
End:	Tue 4/26/2011 10:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Sturgeon, Allyson; Schroeder, Andrea; Schram, Chuck; Conroy, Robert; Kendrick Riggs; Bellar, Lonnie; Charnas, Shannon; Revlett, Gary; Voyles, John; Straight, Scott; Saunders, Eileen; Wilson, Stuart; Winkler, Michael; Ehrler, Bob

I realize that not everyone is available, but if you can make it, please try to do so. Thanks.

From: Walters, Kim </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=E010358>
Sent: 4/20/2011 7:52:02 AM
To: Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Voyles, John; LGEC12 West 1201 (Cap 20); Straight, Scott; Saunders, Eileen
Subject: Copy: ECR Testimony Review-Voyles
Location: LGEC 1201
Start: Tue 5/10/2011 1:30:00 PM
End: Tue 5/10/2011 3:00:00 PM
Recurrence: (none)
Meeting Status: Not yet responded

Required Attendees: Sturgeon, Allyson; 'Riggs, Kendrick R.'; Conroy, Robert; Schroeder, Andrea; Bellar, Lonnie; Voyles, John; LGEC12 West 1201 (Cap 20); Straight, Scott; Saunders, Eileen

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From:	Schroeder, Andrea </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=E026206>
Sent:	4/27/2011 11:35:54 AM
To:	Schroeder, Andrea <Andrea.Schroeder@lge-ku.com>; Conroy, Robert; Bellar, Lonnie; Straight, Scott; Saunders, Eileen; Voyles, John; Sturgeon, Allyson; Kendrick Riggs; 'Crosby, W. Duncan'
Subject:	Copy: Discuss supporting documents for Voyles ECR Testimony
Location:	LGEC12 North 1 (Cap 15)
Start:	Tue 5/3/2011 8:30:00 AM
End:	Tue 5/3/2011 10:00:00 AM
Recurrence:	(none)
Meeting Status:	Not yet responded
Required Attendees:	Schroeder, Andrea; Conroy, Robert; Bellar, Lonnie; Straight, Scott; Saunders, Eileen; Voyles, John; Sturgeon, Allyson; Kendrick Riggs; 'Crosby, W. Duncan'

The purpose of the meeting is to finalize the documents to be provided as support to John Voyles's testimony in the 2011 ECR Plan filings.

From:	Voyles, John
To:	Rives, Brad
Sent:	5/11/2011 8:32:06 AM
Subject:	RE: Bag Houses

Brad,

Here's the information:

Pending final engineering assessments, we currently plan to construct 11 baghouses (currently the plan is to have 1 baghouse for Brown 1 & 2 combined).

The costs which we have in the plan and our ECR filing includes supporting subsystems required for retrofit applications as well (these subsystems include lime and carbon injection systems, any needed ductwork, new fans and associated electrical system upgrades).

Assuming regulatory approvals, the installations will begin in 2012 and conclude in late 2015.

The costs range from approximately $300 to $470 per kw installed.

Rough costs per unit:

Brown 1&2 = $95M
Brown 3 = $ 80M
Ghent 1 = $155M
Ghent 2 = $165M
Ghent 3 = $190M
Ghent 4 = $175M
Trimble 1 = $165M
Mill Creek 1 = $155M
Mill Creek 2 = $150M
Mill Creek 3 = $140M
Mill Creek 4 = $150M

JV

From: Rives, Brad
Sent: Wednesday, May 11, 2011 7:06 AM
To: Voyles, John
Subject: Fwd: Bag Houses

Can you provide a quick response please? Thx

Sent from my iPhone

Begin forwarded message:

From: "Farr, Paul" <PFarr@pplweb.com>
Date: May 11, 2011 6:26:13 AM EDT
To: "Rives, Stephen B" <brad.rives@lge-ku.com>
Subject: Bag Houses

How many will we be installing, at what rough cost per installation and over what time frame?

Sent from my BlackBerry Wireless Handheld

From: Walters, Kim </O=LGE/OU=LOUISVILLE/CN=RECIPIENTS/CN=E010358>
Sent: 5/18/2011 7:58:47 AM
To: Sturgeon, Allyson <Allyson.Sturgeon@lge-ku.com>; Voyles, John; Schram, Chuck; Charnas, Shannon; Bellar, Lonnie; Conroy, Robert; Revlett, Gary; Straight, Scott; Wilson, Stuart; Saunders, Eileen; Schroeder, Andrea; 'Riggs, Kendrick R.'; 'Crosby, W. Duncan'; LGEC12 West 1202 (Cap 35)
Subject: Copy: Final ECR Application and Testimony Review (Updated with new location)
Location: LGEC 1202
Start: Wed 5/18/2011 1:00:00 PM
End: Wed 5/18/2011 3:00:00 PM
Recurrence: (none)
Meeting Status: Not yet responded

Required Attendees: Sturgeon, Allyson; Voyles, John; Schram, Chuck; Charnas, Shannon; Bellar, Lonnie; Conroy, Robert; Revlett, Gary; Straight, Scott; Wilson, Stuart; Saunders, Eileen; Schroeder, Andrea; 'Riggs, Kendrick R.'; 'Crosby, W. Duncan'; LGEC12 West 1202 (Cap 35)

From:	Hillman, Timothy M.
To:	Saunders, Eileen
CC:	168908 E.ON-AQC; Jackson, Audrey; Smith, Dave; Crabtree, Jonathan D.; Wehrly, M. R.; Lucas, Kyle J.
Sent:	10/21/2010 5:19:42 PM
Subject:	168908.22.1000 101021 - Ghent Project Design Memorandum (PDM)
Attachments:	EON Ghent Project Design Memo.doc

Eileen,

As defined in our scope of work under Task 5, attached please find a copy of the Project Design Memorandum (PDM) for the Ghent Plant. As you are already aware from Mill Creek, the purpose of the PDM is to summarize and define the technical and functional requirements on which the Ghent Phase II AQC study will be based. The PDM is a dynamic document subject to change as new project information is made available, but B&V will control this document and will be responsible for updates and revisions.

This PDM document includes Ghent project specific information and was built upon the initial design basis prepared for the Phase I project; however, Phase II requires additional information. Thus, there are several tables that require specific input from E.ON. These tables were included with the Ghent Information Request, sent on 10/18/10. Please review the document and use the "track changes" feature of the Word software to include your comments. We would request comments from E.ON no later than Thursday 10/28/10.

Please let us know if you have any questions.
Regards,

Tim Hillman | Project Manager
Power Generation - Environmental Services
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-7928**
Email: **hillmantm@bv.com**

E.ON – Ghent Station

Phase II Air Quality Control Study

Project Design Memorandum

October 21, 2010
Revision B – Issued For Client Review

B&V File Number 22.1000

BLACK & VEATCH
Building a world of difference.

Black & Veatch Corporation ▪ 11401 Lamar ▪ Overland Park, KS 66211
Tel: (913) 458-2000
www.bv.com

Table of Contents

Appendices

Tables

Figures

1.0 Project Description

1.1 Introduction

1.1.1 Purpose

This site-specific Project Design Memorandum document defines the technical and functional requirements on which the Ghent Phase II Air Quality Control Study will be based. The stated functional and technical requirements include E.ON US (E.ON) requirements and are applicable to the Ghent portion of the overall project. Separate PDMs will be developed for other stations included in the overall project.

1.1.2 Organization of the Document

This Project Design Memorandum document is organized into various sections covering scope of work, environmental, and engineering criteria and requirements. Additional sections may be added during other phases of the project.

1.1.3 Revisions

The Project Design Memorandum document is dynamic in nature. Black & Veatch (B&V) controls this document and is thus responsible for updates and revisions. It is anticipated that this document will be periodically updated and potentially expanded during the life of the project as additional data and specific design criteria become available.

1.2 Overview

The purpose of this Phase II air quality control study is to build upon the previous fleet-wide, high-level air quality technology review and cost assessment conducted for six E.ON facilities (Phase I) in order to develop a facility-specific project definition consisting of a conceptual design and a budgetary cost estimate for selected air quality control technologies (Phase II) for three different facilities, including Ghent. Similar studies will be performed for the Mill Creek and E.W. Brown facilities. Each facility will have a specific project design memorandum.

The Ghent Station is located in Carroll County, approximately 9 miles northeast of Carrolton, Kentucky, on an approximately 1,670 acre site. Ghent Station includes four pulverized coal fired electric generating units with a gross total generating capacity of 2,107 MW. Ghent Station began commercial operations in 1973.

All four steam generators (boilers) fire high sulfur bituminous coal. Two of the boilers are manufactured by Combustion Engineering and two by Foster Wheeler. The Combustion Engineering boilers are tangential-fired, balanced draft forced circulation boilers, and Foster Wheeler boilers are balanced draft natural circulation boilers. Unit 1 has a gross capacity of 541 MW and is equipped with Low NO_x Burners (LNBs) and Selective Catalytic Reduction (SCR) for nitrogen oxide ($NO_{x)}$ control; cold-side dry Electrostatic Precipitator (ESP) for particulate matter (PM) control; Wet Flue Gas Desulfurization (WFGD) for sulfur dioxide (SO_2) control, and lime injection system for sulfuric acid (H_2SO_4) and/or sulfur trioxide (SO_3) control. Unit 2 has a gross capacity of 517 MW and is equipped with LNBs and Overfire Air (OFA) for NO_x control; hot-side dry ESP for PM control; and WFGD system for SO_2 control. Units 3 and 4 have a gross capacity of 523 MW and 526 MW, respectively, and are equipped with LNBs, OFA, and low-dust SCR for NO_x control; hot-side dry ESP for PM control; wet FGD system for SO_2 control, and trona injection system for H_2SO_4 (SO_3) control.

Gypsum, a scrubber by-product, produced at Ghent is either stored in the on-site landfill or sold for use in manufacture of wall board for the home construction industry. Fly ash and bottom ash is sluiced to on-site storage ponds. Black & Veatch is also involved in a separate study for the transportation of coal combustion products. Layouts developed for the alternative transport systems will be taken into account during the Phase II Air Quality Control Study. All four units are cooled using mechanical draft cooling towers.

The following is a summary of basic project information.

• Project Name:	Phase II Air Quality Control Study – Ghent
• Client/Owner:	E.ON US (E.ON)
• Operator:	Kentucky Utilities (KU)
• Engineer & Regulatory Consultant	Black & Veatch Corporation (B&V)
• Project Site Location:	Ghent, Kentucky (refer to Figure 1-1 and Figure 1-2)
• Project Type/Size:	Retrofit of Environmental/Air Quality Control equipment for existing units.
• On-Site Work:	Start Construction – [LATER]
• Target In Service Date:	2013 to 2017
• Fuel	High Sulfur Western Kentucky Bituminous Coal from Illinois Basin, Fuel Oil for startup
• Water Source:	Well Water, City Water, Ohio River Water

North

South

Figure 1-1
Ghent Power Plant Site

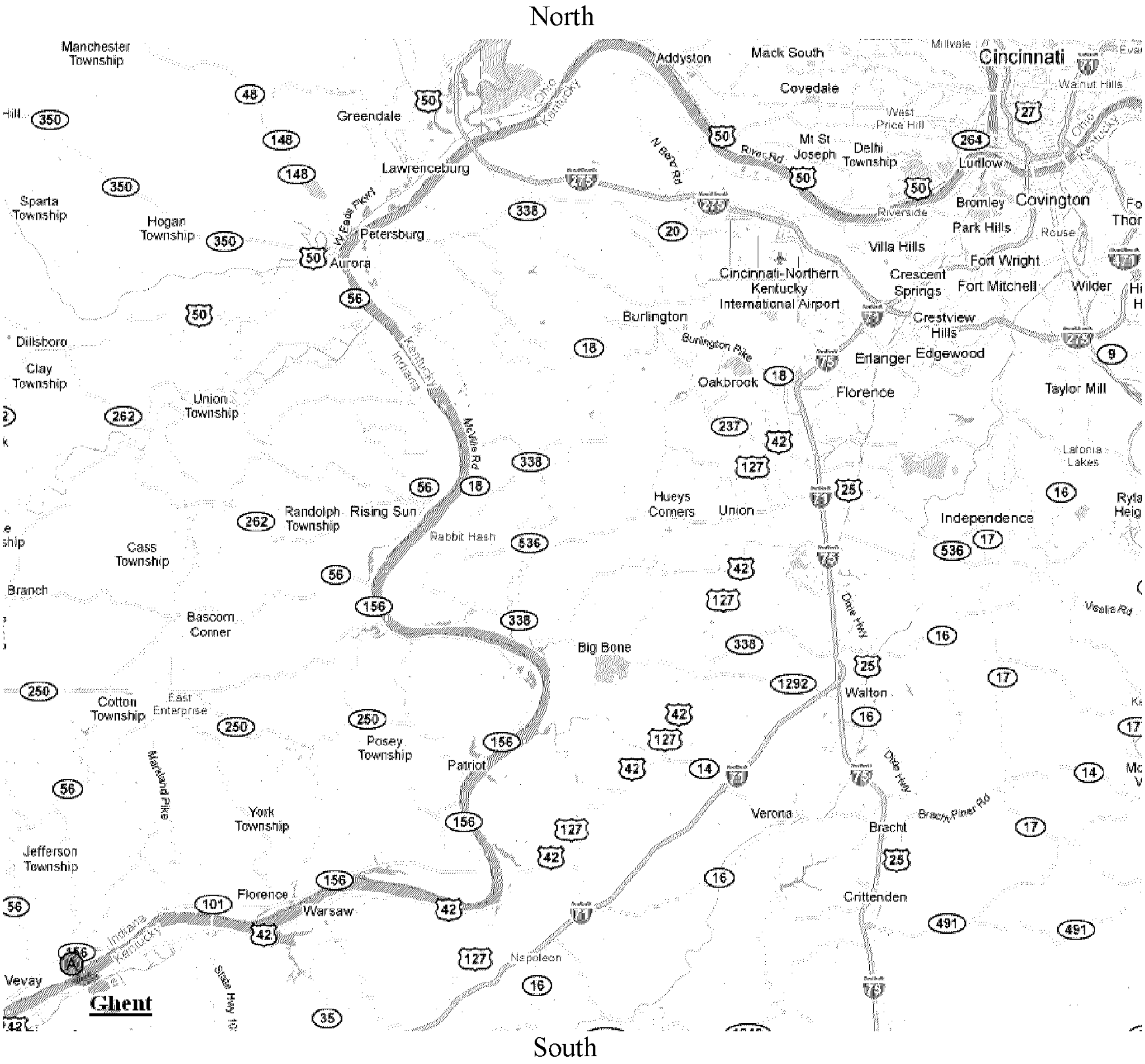


Figure 1-2
Ghent and Surrounding Area Map

Existing Facilities:

• Existing On Site Generation Units:	• Unit 1 - 541 gross MW (in-service date 1973) • Unit 2 - 517 gross MW (in-service date 1977) • Unit 3 - 523 gross MW (in-service date 1981) • Unit 4 - 526 gross MW (in-service date 1984)
• Existing Air Quality Control Equipment:	• Unit 1 - Low NO_x Burners (LNBs), Selective Catalytic Reduction (SCR), Cold-side Dry Electrostatic Precipitator (ESP), Wet Flue Gas Desulfurization (WFGD), Lime Injection System • Unit 2 - LNBs, Overfire Air System (OFA), Hot-side Dry ESP, WFGD • Unit 3 - LNBs, OFA, Low -dust SCR, Hot-side Dry ESP, WFGD, Trona Injection System • Unit 4 - LNBs, OFA, Low -dust SCR, Hot-side Dry ESP, WFGD, Trona Injection System
• Site Access:	Site is located in Carroll County, Ghent, Kentucky, on the southeast side of the Ohio River, approximately 9 miles northeast of Carrolton, KY and 35 miles southwest of Cincinnati, OH with access off of Hwy 42.

1.3 Scope of Work

A summary of the current scope of work is provided below. Refer to Appendix A for the complete scope of work. Project scope items provided by others, but requiring technical interface, are also listed below.

- Project Kick-off Meeting & Site Visit
- Environmental Regulatory Considerations
- Develop Project Instruction Memorandum
- Project Management
- Develop Project Design Memorandum

- AQC Technology Validation and Selection
- Develop Preliminary Conceptual Design
- Project Cost Estimate
- Implementation Schedule
- Constructability Plan
- Evaluation Report

Project Elements being provided by others:

- Permitting – E.ON Environmental Affairs Department
- Coal Combustion Products Transport Project study – Black & Veatch under separate assignment

1.4 Governing Building Code

The governing local building code is the Kentucky Building Code, Ninth Edition (2006 International Building Code (IBC), as specifically amended).

1.5 Design and Performance

This section summarizes major plant and scope of work interfaces. When fuel or utilities are considered, the following defined properties shall be used as the design basis.

1.5.1 Unit Performance

Plant design is based on the criteria listed in Table 1-1.

Table 1-1
Performance Design Basis

Parameter	**Basis Value**
Ambient Temperature	77 °F Dry Bulb
Ambient Pressure	29.49 in Hg
Ambient Humidity	60.0 % Relative Humidity
Fuel Analysis	Refer to Subsection 1.5.2

1.5.2 *Fuel Specifications*

All four Ghent units burn high sulfur, western Kentucky, bituminous coal from the Illinois Basin. Refer to Appendix B, Design Basis, for main fuel specifications.

Startup fuel is fuel oil.

1.5.3 *Water*

1.5.3.1 Quality Requirements. Water quality characteristics for water to be used as the source for the AQC systems are listed in Table 1-2.

Table 1-2
Design Basis Water Analysis
[INCLUDED IN INFO REQUEST TO E.ON]

Constituent	**Well Water**	**City Water**	**Ohio River Water**
	mg/L as such	mg/L as such	mg/L as such
Calcium			
Magnesium			
Sodium			
Potassium			
Total Cations, mg/L as $CaCO_3$			
M-alkalinity, mg/L as $CaCO_3$			
Sulfate			
Chloride			
Nitrate			
Silica			
Total Anions, mg/L as $CaCO_3$			
pH (range)			
Specific Conductance, µS/cm			
Temperature (range), °F			
Total Suspended Solids			
Total Dissolved Solids			
Turbidity, NTU			

Table 1-2 (continued)
Design Basis Water Analysis

Constituent	**Well Water**	**City Water**	**Ohio River Water**
	mg/L as such	mg/L as such	mg/L as such
Color, PCU			
Total Phosphate, mg/l as PO_4			
Aluminum			
Barium			
Boron			
Cadmium			
Chromium			
Copper			
Iron			
Manganese			
Nickel			
Strontium			
Zinc			

References:
-

1.5.4 Emissions

Plant design is based on the primary target emissions criteria defined in Table 1-3.

Table 1-3
Primary Design Emission Targets

Pollutant	Unit 1	Unit 2	Unit 3	Unit 4
NO_x	N/A(b)	0.041 lb/MBtu	N/A(b)	N/A(b)
SO_2	N/A(b)	N/A(b)	N/A(b)	N/A(b)
Sulfuric Acid Mist (SAM)	2-10 ppm(a) TBD	2-10 ppm(a) TBD	2-10 ppm(a) TBD	2-10 ppm(a) TBD
Mercury (Hg)	90% control or 0.012 lb/GWh	90% control or 0.012 lb/GWh	90% control or 0.012 lb/GWh	90% control or 0.012 lb/GWh
HCl	0.002 lb/MBtu	0.002 lb/MBtu	0.002 lb/MBtu	0.002 lb/MBtu
Particulate Matter(d),(e)	0.03(c) lb/MBtu	0.03(c) lb/MBtu	0.03(c) lb/MBtu	0.03(c) lb/MBtu
Arsenic (As)(f)	0.5 x 10^{-5} lb/MBtu	0.5 x 10^{-5} lb/MBtu	0.5 x 10^{-5} lb/MBtu	0.5 x 10^{-5} lb/MBtu
CO	0.10 lb/MBtu	0.10 lb/MBtu	0.10 lb/MBtu	0.10 lb/MBtu
Dioxin/Furan	15 x 10^{-18} lb/MBtu	15 x 10^{-18} lb/MBtu	15 x 10^{-18} lb/MBtu	15 x 10^{-18} lb/MBtu

Data from E.ON Ghent Station kickoff meeting October 6, 2010 (Gary Revlett handouts and meeting notes) unless noted otherwise.

(a) Units provided in ppmvd @ 3% O_2 as indicated in the draft H_2SO_4 BACT analysis dated September 30, 2010.

(b) Not applicable for this Phase II study.

(c) Emission rate target is higher than what can typically be achieved with chosen technology; a lower emission target may be possible.

(d) Particulate matter control limits for $PM_{2.5}$ or $PM_{condensable}$ have not been determined for this project.

(e) Particulate matter assumed to be the surrogate for emissions of certain non-mercury metallic HAP (i.e., antimony (Sb), beryllium (Be), cadmium (Cd), cobalt (Co), lead (Pb), manganese (Mn), and nickel (Ni)).

(f) Arsenic assumed to be the surrogate for non-mercury metallic HAP (i.e., arsenic (As), chromium (Cr), and selenium (Se)).

1.5.5 Bulk Material

The following bulk materials may be associated with this project:

- Limestone is currently being used as a reagent in the WFGD systems.
- Lime and trona are already used on site to support SO_3 control and there use or that of another reagent would be continued.
- Powder Activated Carbon (PAC) will be used for Hg control
- Fly ash will be collected dry from the precipitator and fabric filter.

1.5.5.1 Pebble Lime Handling and Storage. Refer to Table 1-4 for the pebble lime properties.

Table 1-4
Pebble Lime Properties

Proximate Analysis, Dry Basis, Percent (%) by Weight	Nominal	Range
Available Calcium Oxide (CaO) Content	90.00	90% minimum
Magnesium Oxide (MgO) Content	0.00	0 – 5%
Inert	10.00	5 – 10%
Total	100.00	--
Bulk Density Design Basis		
Volumentric Sizing	55	pcf
Structural Loading	110	pcf
Angle of Repose	30	degree
Surcharge Angle	25	degree
Maximum lump size	3/4	inch

1.5.5.2 Powdered Lime Handling and Storage. Refer to Table 1-5 for the powdered lime properties.

Table 1-5
Powdered Lime Properties

Bulk Density Design Basis		
Volumentric Sizing	60	pcf
Structural Loading	85	pcf

1.5.5.3 Powdered Activated Carbon (PAC) Handling and Storage. Refer to Table 1-6 for the powdered activated carbon properties.

Table 1-6
Powdered Activated Carbon Properties

Bulk Density Design Basis		
Volumentric Sizing	15	pcf
Structural Loading	35	pcf

1.5.5.4 Fly Ash from Precipitator/Fabric Filter Handling and Storage.

Refer to Table 1-7 for the fly ash properties.

Table 1-7
Fly Ash Properties

Bulk Density Design Basis		
Volumentric Sizing	65	pcf
Structural Loading	90	pcf

1.5.6 Classification of Hazardous Areas

Electrical equipment, materials, raceway and wiring will be selected, designed, and installed in accordance with NFPA-70 [NEC].

1.5.7 Future Expansion Considerations

The arrangement of the facility will be based on the configuration of the existing units. No additional units or future expansion is planned. Equipment layouts of the air quality control options must leave room for the modification or addition of gypsum fines and dry ash conversion equipment as identified in the recently completed Black & Veatch Conceptual Engineering for Coal Combustion Products Transport Project dated April 23, 2010.

1.6 Permits and Licenses

1.6.1 Permits

The Environmental Affairs Department of E.ON US is responsible for identifying and obtaining the necessary Federal, State and Local permits required to construct and operate the facility and associated equipment. B&V is contracted to coordinate with the environmental counterpart at E.ON US, and provide guidance relevant to regulatory scenario planning to ensure project conceptual design is compliant with applicable federal, state, and local statutes and regulations.

1.7 Site Investigations

1.7.1 Surveys and Topography

The general area of the Ghent site under consideration for siting the AQC equipment has been developed as part of the existing plant installation and additional improvements. General site arrangement drawings covering the existing site were developed previously and are available for use in this study. However, several subsequent improvements have been completed in the area and the data on some of the older drawings may not be up to date. The existing drawings are sufficient for purposes of this study with regard to available space and topography, but a full survey of the as-built conditions is recommended before start of detailed design to ensure the latest information is used.

1.7.1.1 Underground Utilities. Relatively extensive existing underground utilities are located in the general area under consideration for the AQC improvements. The expected locations of underground utilities are documented on existing drawings, but again the degree of completeness and accuracy may be suspect. The existing drawings are adequate for purposes of the AQC study, but a survey of existing underground utilities should be completed prior to detailed design.

1.7.2 Geology and Seismology

Significant large modifications have previously been completed at the site since original construction, resulting in several detailed geotechnical investigations at various locations on the site. Specifically, the following four investigations were completed and reviewed for applicability to the study.

- Report of Geotechnical Exploration, Unit 1 SCR Addition, KU Ghent Generating Station; MACTEC, Inc.; August 9, 2002
- Report of Geotechnical Exploration, Unit 1 Stack and FGD Additions, KU Ghent Generating Station; MACTEC, Inc.; January 18, 2007
- Report of Geotechnical Exploration, Unit 3 FGD Absorber Addition, Ghent Generating Station; MACTEC, Inc.; September 14, 2005
- Report of Geotechnical Exploration, Unit 4 FGD and Exhaust Stack Additions, KU Ghent Generating Station; MACTEC, Inc.; March 27, 2006

The areas investigated in the above three explorations include the general areas under consideration in the study. Moreover, the general geotechnical data and results of the investigation as documented in the three documents are relatively consistent, leading to the assumption that the information is applicable to all new construction across the four units to be considered as part of this study.

In general, the existing documentation noted indicated the following subsurface conditions.

- During original construction portions of the area received significant amount of fill material varying from soft silty clay to sand and gravely sand. Fill depth varied from 0 to 12 feet in depth.
- Below the fill, a natural firm to very dense noncohesive (sand and gravely sand) stratum exists to an approximate depth of 40 to 60 feet.
- Below the first stratum of natural material, the natural soil consists of very firm to very dense noncohesive materials (sands, gravely sand, and gravels) to the depth investigated (approximately 100 feet).
- Groundwater elevation was relatively constant as documented in each investigation at approximately 55 to 60 feet below grade.

The investigations noted that the existence of significant underground foundations and utilities made soil-supported shallow foundations difficult to install without impacting existing facilities. For that reason, and due to small areas of softer fill near the surface, all investigations recommended auger-cast pile deep foundations for new structures carrying significant load. For purposes of the study, foundations for structures with significant concentrated loads, tensile loads, and significant overturning and lateral loads will be assumed as founded on reinforced-throughout concrete augered cast-in-place (ACIP) friction piles. High capacity piles will be assumed as 18 inches in diameter by 50 feet long with a 150 ton capacity in compression. Lower capacity piles, such as those required for piperacks and other more lightly loaded structures, will be assumed as 18 inch by 40 feet ACIP piles with a 100 ton capacity. Due to the expected significant congestion, both overhead and below grade, the ACIP piles assumed will be of the low overhead installation type.

Light structures not subject to significant overturning can be assumed to be supported on shallow footing or raft foundations extending below the frost line where conditions allow their installation. Shallow foundations extending to at least 3 feet below the surface will be designed based on an allowable bearing pressure of 4.0 thousand pounds per square foot (ksf). Excavations are not expected to be either large or deep enough to warrant special consideration to prevent groundwater intrusion during construction, noting the low groundwater level expected.

The above assumptions will form the basis of the conceptual design of foundations for the AQC structures in the study. However, prior to start of detailed design, additional geotechnical investigation should be completed to more exactly determine the geotechnical design parameters in the immediate area of the proposed improvements.

1.7.3 Hydrology

The site in the area of the AQC improvements is fully developed. Hydrology and storm event design have previously been established and will not be modified unless required. The addition of runoff volume due to any increase in impermeable surfaces resulting form the AQC modifications, although expected to be minimal, will be evaluated and the impact to existing stormwater systems estimated as a part of the study. Modifications to existing stormwater systems, if any, deemed necessary by the improvements proposed by the study will be recommended. Due to the congestion above and below grade in the areas where new foundations are expected, some rerouting of existing storm sewers piping is likely, but the overall function of the existing systems is expected to remain for the most part unchanged.

1.7.4 Noise

The project's conceptual engineering for noise control will be based on compliance with OSHA requirements and local noise restrictions, as applicable.

1.8 Environmental Design Criteria

1.8.1 Meteorology

Table 1-8 summarizes the meteorological data applicable to plant design. Wind data for the indicated location have been analyzed to develop the wind roses which are included in Appendix C.

Table 1-8
Meteorological (Ambient and Extreme) Data

Design Parameter	Design Value	Units
Rainfall – 24 Hour, 10 Year Event (Design rainfall parameter may vary depending on local codes or agencies.)	4.13(A)	inches
Rainfall – 24 Hour, 25 Year Event (Design rainfall parameter may vary depending on local codes or agencies.)	4.81(A)	inches
Rainfall – Average Annual Total	42.60(B)	inches
Design Rain Rate (100 year recurrence)	3.0(C)	inches per hour
Evaporation Rate – Annual Average NWS Penman Equation	49.34*(D)	inches
Design Wind Speed (Chapter 6)	90**(C)	mph
Structural Occupancy Category for Wind (Table 1-1)	III(E)	
Wind Importance Factor, I_w (Table 6-1)	1.15(E)	
Wind Design Exposure (Chapter 6)	Category C(E)	N/A
Average Wind Speed	8.3***(F)	mph
Prevailing Wind Direction (from)	South-southwest*** (G)	
Frost Depth (50 Year Recurrence)	38(C)	Inches
Snow Load – Ground, p_g	20(I)	lb/ft^2
Snow Importance Factor, I_s (Table 7-4) Refer to Table 1-1	1.1(E)	
Open Structure Icing Design Conditions	0.75 inches ice thickness with 30 mph concurrent wind speed(I)	
Freeze Protection Design Conditions	-29.6°F (H) DB with 8.3*** (F) mph coincident wind	
Annual Barometric Pressure, adjusted to site elevation	29.09(C)	in. Hg
Design Ambient Temp (Extreme High)	104.0 DB(H)	°F
Design Ambient Temp (Extreme Low)	-29.6 DB(H)	°F
Design Annual Average Ambient Temp	54.2(B)	°F
Winter Design (Dec-Feb) Ave Temp	32.8(B)	°F
Summer Design (Jun-Aug) Ave Temp	74.3(B)	°F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 1.0%)	88.9 DB(H) 73.8 MCWB(H)	°F °F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 2.0%)	86.5 DB(H) 72.5 MCWB(H)	°F °F
Space Conditioning Ambient Design Temps (ASHRAE Fundamentals, 99.0%)	10.2 DB(H) 9.0 MCWB(C)	°F °F

Notes:
Design conditions based on ASHRAE 2009 data for: Cincinnati, OH
Approximate Location (Google Earth): Latitude: 39.04N Longitude: 84.67W Elevation: 867 ft MSL
* Dayton Weather Service Office Substituted for Cincinnati.
**3-second gust at 33 ft. above ground
***Wind data is for Louisville, KY.

References:
(A)National Weather Service - Hydrometeorological Design Studies Center.
(B)National Climatic Data Center (NCDC) Climate 20-Climate Normals; Cincinnati, OH.
(C)Engineering Weather CD, "Summary for Cincinnati, OH 1973-1996," Engineering Weather Data, 2000 Interactive Edition, 2001, Version 1.0, [CD].
(D)Technical Memorandum No. 34 from NWS, 1982. Dayton, OH Weather Service Office Substituted for Cincinnati.
(E)ASCE 7-05.
(F)NCDC United States Average Wind Speeds for US cities; Louisville, KY. Based upon 55 years of data, through 2002.
(G)Wind roses from Integrated Surface Hourly Data (ISH) 1995-2008 data for Louisville, KY.
(H)National Climatic Data Center (NCDC), "2009 ASHRAE Handbook Annual Summary with Comparative Data for Cincinnati, OH."
(I)Kentucky Building Code, Ninth Edition

1.8.2 Site Seismicity

Table 1-9 summarizes Seismicity parameters applicable to plant design. Table references are to ASCE 7 as referenced by the Kentucky Building Code.

Table 1-9
Seismicity Data

Design Parameter	**Value**
Building Code	Kentucky Building Code (IBC 2006 as specifically amended)
Building Use/Occupancy Category (main plant structures)	III
Seismic Importance Factors	1.25
Site Class (based on the existing geotechnical investigations listed in Section 1.7.2)	D
Spectral Response Accelerations: 0.2 second response (S_s) 1.0 second response (S_1)	 Ss = 0.204 S1 = 0.089
Adjusted maximum considered earthquake response acceleration parameters: F_a (site coefficient from Table 11.4-1) F_V (site coefficient from Table 11.4-2)	 Fa = 1.6 Fv = 2.4
Maximum considered spectral response accelerations: S_{MS} (short periods; Fa * Ss) S_{M1} (1-second period; Fv * S_1)	 SMS = 0.326 SM1 = 0.214
Design spectral response acceleration parameters: S_{DS} = 2/3 (SMS) S_{D1} = 2/3 (SM1)	 SDS = 0.218 SD1 = 0.142
Seismic Design Category (SDC) (from Table 11.6-2)	C

1.8.3 Site Elevation

Site Elevation: Existing at-grade floor of plant is 489 feet above Mean Sea Level (MSL).

1.8.4 Soil Resistivity

Minimal existing electrical soil resistivity information was available from the various geotechnical investigations previously noted (none was documented in the geotechnical investigations listed in Section 1.7.2). Resistivity data in the Unit 4 area was documented in another source at approximately 5,200 ohm-cm with probes at 5 foot spacing and 7,600 ohm-cm for a 10 foot spacing. For purposes of this study, these values will be assumed as representative and will be utilized to estimate material requirements The electrical soil resistivity profile used for future grounding design will need to be determined from additional geotechnical investigations to be completed prior to detailed design.

The previous geotechnical investigations did address thermal resistivity in the soils at the site. The investigations recommended using a thermal resistivity value ranging from 70 to 80 °C-cm/watt throughout the area under consideration.

1.9 Electrical Data

The electrical power system conceptual configuration shall be based on the project's one-line diagram which will be provided separately. Table 1-10 includes electrical parameters to be considered in the plant configuration.

Table 1-11 lists prevailing voltages and frequencies to be considered in the plant configuration.

Table 1-10
Electrical Design Data
[INCLUDED IN INFO REQUEST TO E.ON]

Design Parameter	Min	Max	Units
Available system fault current at electrical system interface point.			
• 345 KV System	???	???	amps
• 25 KV System	???	???	amps
• 22 KV System	???	???	amps
• 13.8 KV System	???	???	amps
• 4.16 KV System	???	???	amps
• 480 V System	???	???	amps

Table 1-11
Electrical Equipment and System Voltages
[INCLUDED IN INFO REQUEST TO E.ON]

	Continuous Voltage (Volts)	**Momentary Voltage Dip**	**Frequency (Hz)**		**System Neutral Grounding**	**Transfer to Alternate Source**	**Max Sym Short-Circuit at Max Voltage (Amps)**
Power Supply Code	Nom	% of Nominal	Nominal	Configuration	Type	Method	3-Phase Phase –Ground
25 kv Buses A & B	25,000	???	60	3-phase, 3-wire, Wye	???	???	(Later)
GEN-1 Generator (Existing)	22,000	???	60	3-phase, 3-wire, Wye	High Resistance	N/A	(Later)
MV-1 Medium Voltage (Existing)	4,160	???	60	3-phase, 3-wire, Wye	Low Resistance	???	(Later)
MV-2 Medium Voltage (Existing)	13,800	???	60	3-phase, 3-wire, Wye	???	???	(Later)
LV-1 Low Voltage (Power)	480	80	60	3-phase, 3-wire, Delta - Delta	High Resistance	???	(Later)
LV-2 Low Voltage (Lighting)	480Y/277	80	60	3-phase, 4-wire, Wye	Solidly Grounded	N/A	(Later)
LV-3 Low Voltage (Power)	208Y/120	80	60	3-phase, 4-wire, Wye	Solidly Grounded	N/A	(Later)
UPS-1 UPS Power	120	80	60	Single phase, 2-wire	Solidly Grounded	Static ½ Cycle	(Later)
DC-1 DC Power	125	70	0	Two-Pole	Ungrounded	N/A	(Later)
CP-1 Control Power (AC)	120	80	60	Single-Phase, 2-Wire	Solidly Grounded	N/A	(Later)

1.10 Temporary Facilities

Construction support services will be required by all onsite contractors, subcontractors, and their personnel. These support services and facilities, depending on contract requirements, may be provided by E.ON, KU, the Contractor(s), and/or their subcontractors. The following list summarizes construction facilities that will be estimated in this phase of the project:

- Field Office(s): B&V will estimate size and location of field offices and construction trailers.
- Material Lay-Down Area(s): B&V will estimate size of area needed for material lay-down during construction.
- Project Parking Requirements: B&V will estimate size and location of temporary parking facilities needed during construction.

1.11 Fire Protection Design Data

Fire protection systems design will be based on NFPA requirements. Details of planned fire protection design will be provided later.

1.12 Economic Evaluation Criteria

1.12.1 Economic Evaluation Factors

Table 1-12 lists economic criteria to be considered in the project cost estimate.

Table 1-12
Economic Criteria

Economic Parameters[(a)]	**2010 Costs**			
Unit Identification	**1**	**2**	**3**	**4**
Remaining Plant Life (years)	30			
Capacity Factor (percent)	81.00	71.00	78.00	77.00
Auxiliary Power Cost ($/MWh)	24.87	24.59	25.44	24.90
Limestone Cost ($/ton)	8.22			
Lime Cost ($/ton)	131.78			
Ash Disposal Cost ($/ton)	15[(b)]			
SCR Catalyst Replacement Cost ($/$m^3$)	6,500[(b)]			
Ammonia Cost for SCR ($/ton)	517.55			
Trona Cost ($/ton)	200.42			
Halogenated PAC Cost ($/lb)	1.10[(b)]			
Water Cost ($/1,000 gal)	2[(b)]			
Fully-Loaded Labor Rate ($/year)	121,000			
Fully-Loaded Labor Rate ($/hr)	58.17[(c)]			
Capital Escalation Rate (%)	2.5			
O&M Escalation Rate (%)	2			
Levelized Fixed Charge Rate or Capital Recovery Factor (%)	12.17			
Interest During Construction (%)	4.5			

Data from "Table 3-3 Economic Evaluation Parameters" of the Phase I Air Quality Control Technology Cost Assessment report.

(a) Utilities costs are as delivered costs.

(b) Economic variable was not provided by E.ON and are assumed data based on similar economic data for other E.ON plants.

(c) Based on Fully-Loaded Labor Rate ($/year) value and 2080 hours per year.

1.12.2 Load Model

The average annual unit load model used for economic evaluations is based on unit operation as follows:

Table 1-13
Load Model
[INCLUDED IN INFO REQUEST TO E.ON]

Unit #	Unit Load, Percent (%) MCR	Unit Gross Output/MW	Unit Net Output/MW	Operating Hours- Hours/year	Net MW Hours/year
Unit 1	100				
	90				
	80				
	75				
	Offline				
	Total				
Unit 2	100				
	90				
	80				
	75				
	Offline				
	Total				
Unit 3	100				
	90				
	80				
	75				
	Offline				
	Total				
Unit 4	100				
	90				
	80				
	75				
	Offline				
	Total				

2.0 Design Codes and Standards

2.1 Project Specifications

B&V's scope includes development of technical specifications for the purchase and erection of Fabric Filters for the various units requiring Fabric Filters as part of the AQC Study. Specifications will include technical specifications developed by B&V along with Front End Documents and General Conditions as developed by E.ON. Technical specifications are expected to be letter form in B&V standard format.

2.2 Codes and Standards

The design and specification of work shall be in accordance with applicable state and federal laws and regulations and local codes and ordinances. The codes and industry standards which will be the basis for design, fabrication, and construction are listed below and will be the editions in effect, including all addenda, as stated in equipment and construction purchase or contract documents. Other recognized standards may also be used as design, fabrication, and construction guidelines when not in conflict with the listed standards. Applicable codes will be as established based on consideration of applicable laws and regulations:

- American Association of State Highway and Transportation Officials (AASHTO)
- American Concrete Institute (ACI).
- American Institute of Steel Construction (AISC).
- American Iron and Steel Institute (AISI).
- American National Standards Institute (ANSI).
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).
- American Society of Civil Engineers (ASCE)
- American Society of Mechanical Engineers (ASME).
- American Society for Testing and Materials (ASTM).
- American Water Works Association (AWWA).
- American Welding Society (AWS).
- Compressed Gas Association (CGA).
- Concrete Reinforcing Steel Institute (CRSI).

- Conveyor Equipment Manufacturers Association (CEMA)
- U.S. Department of Transportation (DOT).
- Factory Mutual (FM).
- Illuminating Engineering Society (IES).
- Institute of Electrical and Electronics Engineers (IEEE).
- Instrument Society of America (ISA).
- Insulated Cable Engineers Association (ICEA).
- International Building Code (IBC).
- Kentucky Building Code
- National Electrical Manufacturer's Association (NEMA).
- National Electrical Safety Code (NESC) and National Electric Code (NEC) as applicable.
- National Fire Protection Association (NFPA).
- Occupational Safety and Health Administration (OSHA).
- Underwriters Laboratory (UL) Standards.

2.3 Engineering Drawings and Data Content

B&V standards will be used to establish tagging schemes, drawing content, drawing borders, drawing software and formats, symbols, data report content and formats, virtual modeling format and protocols, and interfaces to contractor and subcontractor drawings and data. Interfaces with and references to non-B&V drawings will be provided in sufficient detail to describe the complete design, but generally will not be a duplication of non-B&V data on B&V drawings. Major equipment interfaces will be represented as needed to support construction.

In instances where the new design impacts existing E.ON/KU drawings, such drawings will be modified by B&V as required to reference new drawings or reflect the new design, depending on which results in the most practical, functional, and cost-effective set of deliverables.

Appendix A

EON AQC Budgetary Cost Estimate Proposal

(Rev 1 - Pages 1-8)

PROPOSAL FOR
AIR QUALITY CONTROL BUDGETARY COST ESTIMATE

The purpose of this scope of work is to build upon the previous fleet-wide, high-level air quality technology review and cost assessment conducted for six E.ON facilities (Phase I) in order to develop a facility-specific project definition consisting of a conceptual design and a budgetary cost estimate for selected air quality control technologies (Phase II). The Phase II scope of work is proposed for the Mill Creek, Ghent, and Brown facilities, and will be composed of the following tasks and deliverables to ensure that the study is properly defined, documented, and completed on time. It should be noted that there are some scope differences between the three facilities because of variations in the complexity of the future AQC equipment scenarios for each. These differences in study scope are noted below in the appropriate tasks and reflected in the cost estimate. For the purpose of this proposal, E.ON's Mill Creek facility is assumed to be the first facility to begin the Phase II services, with the Ghent and Brown facilities to have a staggered kick-off delay of approximately 1 month each.

SCOPE OF WORK

Task 1 – Project Kick-off Meeting & Site Visit

The Black & Veatch project team members will attend project kickoff meetings at Mill Creek, Ghent, and Brown as depicted in the schedule. It is anticipated that Mill Creek's kick-off meeting will consist of an initial meeting with Project Engineering in Louisville, followed by a technical meeting and site walk down at the facility. The kick-off meetings for Ghent and Brown will be held on site. An agenda will be prepared prior to each kick-off meeting.

The following are the main objectives for the kick-off meeting and initial site visit:

- Discuss project objectives, expectations, and constraints.
- Discuss project communication procedures and identify project team contacts for both E.ON and Black & Veatch for utilization in the *Project Instructions Memorandum*.
- Obtain or identify key site specific drawings, plant performance data, and existing equipment information not previously collected.
- Continue discussions of potential equipment locations with plant engineers.
- Develop understanding of draft system capabilities for supporting new emissions control equipment.
- Develop understanding of the general condition of the balance-of-plant and major equipment to estimate existing equipment upgrade costs for various plans.
- Assess potential arrangement interferences for support of cost estimate.
- Obtain copies of existing reports and studies that will be used during the preparation of the study.
- Establish and agree upon the study schedule and deliverables.

To expedite onsite communications and information collection, Black & Veatch understands that utilization of a single point of contact (SPOC) throughout the project is desirable to ensure proper communications and tracking of data exchanges.

Task 2 – Environmental Regulatory Considerations

During the technology evaluation part of the analysis (Task 6), Black & Veatch's experienced staff of regulatory specialists, air quality scientists, biologists, and other environmental professionals will participate in an advisory capacity to the Black & Veatch engineering staff assigned to the project. We will assign an Environmental Permitting Manager who will be responsible for coordinating with the environmental counterpart at E.ON, providing guidance to E.ON and Black & Veatch engineers relevant to regulatory scenario planning to ensure project conceptual design compliance with applicable federal, state, and local statutes and regulations.

Task 3 – Develop Project Instruction Memorandum

To ensure proper communications, interchange of data and information, and development of a sound project definition and cost estimate, the project itself must have a set of processes and procedures. Black & Veatch will develop a Project Instructions Memorandum (PIM) for the project that will include all Owner specific procedures and additional procedures established by Black & Veatch for use during the execution of the project. The memorandum will establish guidelines, methods, procedures, and lines of communication to administer, control, and coordinate the work between Black & Veatch, other project participants, and E.ON as determined during the kick-off meeting. A full PIM will be completed for Mill Creek and amended for the Ghent and Brown facilities.

Task 4 – Project Management

The following Project Management tasks will be provided to ensure the success of the study.

Schedule & Planning

A project milestone schedule will be developed and issued to E.ON for review within 30 days of Kick-off meeting. After discussion and receipt of comments, a base line schedule will be prepared and issued.

Communications & Coordination

To facilitate communications for the project, we would hold weekly teleconferences between the E.ON team and the Black & Veatch project team. These meetings would include review of project status, schedule review, and review of the Action Item list. In addition to the weekly teleconferences, we would plan to attend periodic Progress Meetings at the plant site or E.ON offices to discuss present project status and address any questions or concerns. A monthly Project Progress Report will be prepared and issued to E.ON. In addition to normal email and telephone communication, Black & Veatch will establish a web based system for rapidly transmitting and exchanging information between E.ON, Black & Veatch and Third parties. Information and instructions for utilizing this system will be included in the PIM.

Management Documentation

In addition to the project schedule and the Monthly Progress Reports, Black & Veatch will prepare minutes of the weekly teleconference and prepare an Action Item List which will address pending actions and note responsible parties and commitments dates. The Action Item list will be updated weekly and discussed during the weekly teleconference and the Progress Meetings.

Project Documentation

As defined in the PIM, Black & Veatch will prepare meeting minutes of all meeting attended with E.ON and third parties for the project. The meeting minutes will be prepared and submitted for review and approval and subsequently issued as final. Project E-mail traffic will be captured and filed within the project filing system and key telephone conversations will be documented using confirming email to all parties. Black & Veatch will transmit, file, and track all reports, studies, drawings and other documentation in accordance with the PIM to ensure that the information is stored and retrievable.

Task 5 – Develop Project Design Memorandum.

Black & Veatch will build upon the initial design basis prepared for the fleet-wide, high-level cost assessment and develop a Project Design Memorandum (PDM) for each facility, which will incorporate the controlling requirements for the conceptual engineering design of the project. The purpose of this document will be to describe the design requirements of the project and to provide the basis for conceptual design and cost estimating. The PDM will include information already submitted by E.ON, as well as addition information that may be necessary.

Information contained in the PDM includes the following

- Project description and purpose.

- Scope of Work.
- Governing Building Codes and Standards.
- The site information in the form of data summaries resulting from initial investigations or monitoring of ambient environment, hydrology, meteorology, geology, topography, background noise, and the load bearing capability and resistive characteristics of soils.
- Air emission rate targets as identified by E.ON and reviewed by Black & Veatch.
- Unit capacity factors
- Capacities
- Flue gas temperature
- ID fan / FD fan capacities
- Other operating parameters
- Fuel data
- Water data
- Reagent/sorbent data
- Economic evaluation criteria
- Engineering design criteria, standards and codes for the engineering disciplines: mechanical, civil, structural, electrical, control, and chemical engineering, including site specific criteria.
- Flue gas flow rates and conditions.
- Ash production rates.

The project team will develop the PDM early in the project, but it will be a living document that will undergo updates during the course of the project to include new data and, results of decisions. The document will incorporate any modifications required by E.ON so that the project going forward will be utilizing the most up to date data and information. The chief purpose of the PDM is to encapsulate the preferences of E.ON under which the various control alternatives and conceptual design will be developed.

Task 6 – AQC Technology Validation and Selection

As E.ON is aware, during the course of the high-level, fleet wide analysis conducted in the previous study, preliminary air quality control (AQC) technologies were initially recommended and approved for the purpose of generating order-of-magnitude cost estimates. However, the very nature of the previous work may have resulted in overly conservative AQC technology assumptions and selections in order to meet the project schedule and bracket the cost estimate. Accordingly, Black & Veatch understands that E.ON may have plant-specific AQC preferences, configurations, and alternative control technology scenarios that may also be feasible and capable of meeting the stated environmental goals, particularly in light of fleet-wide averaging opportunities or other constraints.

To address the potential AQC technology scenarios, Black & Veatch will conduct a more refined available technology selection analysis to evaluate and validate the preliminary retrofit technologies, as well as improvement to existing site control equipment, that can achieve the required future emissions target levels. The evaluation includes estimating emissions reduction, addressing technical feasibility and capability, applying known site constraints, providing technical descriptions of each technology, addressing commercial availability and guarantees, and describing the pros and cons of each technology. The technology analysis will validate which retrofit technologies, or improvement to existing control technologies, are technically feasible and capable of meeting the established emission target levels. The analysis will also document and explain, based on physical, chemical, or engineering principles, why technical difficulties may preclude the successful use of a certain control or technology option. The analysis will consider various unit arrangements, including single unit as well as various combinations of multiple units. This task will ensure that the initial technology selection scenarios are feasible and suitable to the facility based on established selection criteria.

Based on the initial results of the Phase I work, as well as an AQC screening workshop conducted for Mill Creek, the following preliminary AQC technologies scenarios (and embedded options) have been identified for each facility.

- Mill Creek:
  - NIDs/DFGD or FF on Units 1-4
  - SCRs on Units 1 and/or 2
  - Refurbishing or replacing WFGDs on Units 1, 2 and 4, including using Unit 4's refurbished WFGD for Unit 3
  - New WFGD on Unit 4
  - PAC and/or trona/lime injection/SBS injection
  - Feasibility of neural network (NN) on Units 1-4
  - Feasibility of ESPs for pre-filtering
- Ghent
  - FFs on Units 1-4
  - PAC and trona/lime injection/SBS injection
  - SCR on Unit 2
  - Feasibility of neural network (NN) on Units 1-4
- Brown
  - FFs on Units 1-3
  - Separate or combined FF on Units 1 and 2
  - LNB/OFA or SCR on Unit 1
  - SCR on Unit 2
  - PAC and trona/lime injection/SBS injection
  - Feasibility of neural network (NN) on Units 1-3

In order to verify, properly vet, and ultimately select an AQC technology suite for each facility for final evaluation, Black & Veatch proposes to perform the following high level studies and comparative analyses.

- Overview analysis of existing water/wastewater systems (Mill Creek only)
- Water mass balance (Mill Creek only)
- Flue gas conditions
- Fan analysis
- Furnace design pressure analysis
- Simplified AQC mass balance
- Auxiliary electric system analysis/comparison
- Chimney analysis (Mill Creek only)
- High level differential cost analysis comparison for scenarios with multiple options (capital and O&M)
- Reagent cost analysis/comparison (Mill Creek only)
- WFGD mass balance and byproduct disposal analysis/comparison (Mill Creek only)
- Existing WFGD upgrade analysis with support from vendors for modeling (Mill Creek only)
- Truck and rail traffic analysis (Mill Creek only)
- Fly ash analysis/comparison
- High level site arrangement drawings for each AQC suite

Upon completion of the aforementioned studies and analyses, Black & Veatch will prepare a draft technology validation and selection report for E.ON's review and comment. Following incorporation of comments, Black & Veatch will meet with E.ON to discuss the results. During the meeting, the team will review the options suggested by the selection study to ensure they are consistent with the requirements and specific goals of the facility. Following the presentation of results, the E.ON/Black & Veatch team will formally select the AQC technology suite for final evaluation.

Task 7 – Develop Preliminary Conceptual Design

The following list defines the predominant conceptual design engineering services to be performed by Black & Veatch to define the basis for the cost estimate, as well as specific deliverables for E.ON. The conceptual design evaluation will address each item for the selected AQC technology scenario, as appropriate.

- Preliminary description of scope of work.
- Equipment performance and emissions review. Current emissions review of plant historical data provided by E.ON.
- Assessment of potential modifications to existing equipment, including upgrading existing WFGDs at Mill Creek.
- Determine the associated balance-of-plant requirements and plant modifications necessary.
- Develop key process flow diagrams (conceptual)
- An overall site plan drawing (conceptual) of the project major equipment, including air quality control equipment, chimney, fuel handling systems, reagent (limestone or lime) handling system, ash handling system, chemical storage, sorbent or PAC injection systems, etc, as applicable. The location of other existing key buildings such as boiler, administration/services building(s) and other buildings and structures, electrical transmission lines/corridors, and access roads will also be identified.
- Building and Plant Arrangements
- Equipment Logistics/Transportation Requirements (see Task 10)
- Permitting/Environmental Impacts (see Task 2)
- Specification and System List
- Lighting Requirements
- Grounding Requirements
- Fire Protection Requirements
- Communication Requirements
- Layout of Critical System and Underground Piping
- Terminal Point List
- Water Mass Balance Diagram (Mill Creek only)
- Equipment Lists
- One-Line Drawing
- Construction Equipment Requirements
- System Descriptions
- Demolition/Relocation Requirements
- Civil/Structural Discipline Drawings
- Mechanical Discipline Drawings
- Electrical Discipline Drawings
- Instrumentation/Control System Discipline Drawings

In addition to the conceptual design services listed above, this task will address the following topics and issues in the manner described for each.

- **Construction Materials**. Black & Veatch will select the materials of construction based on engineering judgment, past experience, and general site technology specifics.
- **Sparing and Capacity**. Since the final selection of AQC technologies may allow a single system to influence the direct operations of more than one unit, impacts to outage scheduling, unit operations and unit reliability are important considerations. Black & Veatch will use E.ON's planned usage pattern for the affected units to identify draft sparing and capacity guidelines and their implications for the units. Provision of these draft guidelines will allow E.ON to evaluate potential tradeoffs and conflicts with the various goals of the project to allow adjustment of the guidelines to achieve the overall project goals in the best approach possible.
- **Draft System**. Depending on the existing ID fan capacity and the incremental draft load to be imposed by the new emissions control equipment, draft system modifications may be required. Additionally, draft

system modifications may require ductwork and/or boiler stiffening to withstand the new operating conditions or for compliance with NFPA-85. Black & Veatch will evaluate the existing draft system capacity and design, operating ranges, and anticipated additional draft losses and recommend modifications, including fan capacity (flow and head) and margins, motor speed(s), draft control alternatives, and structural reinforcing. This will be a high level evaluation based upon the conceptual design developed and is intended to provide sufficient information to allow E.ON to evaluate the various options in the study. Additional future detailed study work would be required for any selected scenario implementation.

- **Chimney Alternatives.** As part of the overall study, Black & Veatch will evaluate the necessity for modifications or replacement of existing chimneys. This evaluation will only consider the physical characteristics of the stack(s) and its availability to operate under any new conditions imposed by the technology scenarios. This analysis is limited to the Mill Creek facility only.
- **Auxiliary Electric System.** Auxiliary electric power supply alternatives for multi-unit emissions control equipment retrofits typically involve a combination of unit-specific power supply and at a minimum, common load and/or startup power supply from the plant switchyards. Considerations in selecting the optimum site-specific configuration include unit startup, redundancy, bus capacity, load flow, generation metering, and capital cost issues. Black & Veatch will evaluate the emissions control equipment affects on the existing auxiliary electric system and a recommend solution for a reliable redundant power supply to the new AQC equipment. This will be a conceptual evaluation in order to provide sufficient information to evaluate the various AQC options of the study.
- **FGD and Landfill Waste Disposal.** As part of the study, Black & Veatch will define the physical and chemical characteristics of the by-products and determine the production rates. E.ON may utilize this information in addressing the transport and final disposition of the byproducts. This analysis is limited to the Mill Creek facility only.
- **FGD System Water Supply.** The water supply to the FGD systems and auxiliaries will be determined by evaluating the potential water and wastewater streams that could be required or produced for the different scenarios. Preliminary water mass balances will be developed for the new or added systems. An overall plant water mass balance has not been included but can be added to the work at E.ON's direction. This analysis is limited to the Mill Creek facility only.
- **Fly Ash Handling.** Black & Veatch will address modifications or replacement of the fly ash handling system only as necessary to accommodate the technology scenarios.

Task 8 – Project Cost Estimate

Black & Veatch will prepare a budgetary cost estimate for the AQC scenario selected by E.ON for continuation. The cost estimate will include monthly cash flows based on the determined contracting strategy (see Contracting Strategy Analysis task). Black & Veatch will solicit major equipment letter quotations to support the cost estimate. As a provider for AQC solutions, Black & Veatch has developed estimating tools that will be utilized for this project, as well as leveraging the information available from the many large AQC projects and coal projects recently completed and ongoing. The capital costs estimates will be generated from proprietary in-house data for similar sized coal fueled units. The cost estimate will go through our internal review processes and procedures that we use when developing our own project pricing structure. When available, this data can also be supplemented with actual pricing and labor rates. Construction contracts will be adjusted for craft wage rates and productivity at the project site. Owner's costs (project development, permitting, financing, etc.) will be estimated as a percentage of the total capital cost unless identified as an amount from E.ON.

In addition to the capital costs, annual O&M costs, both fixed and variable components, will be estimated. Black & Veatch will formulate the overall cost and cash flow estimate (month and year) for the agreed upon scenario. Black & Veatch will prepare capital and operating and maintenance (O&M) cost estimates using current (2010) dollars and include the estimated engineering cost for this project. The cost estimate will include analysis of the contingency use, analysis of any escalation used and a risk analysis for those elements of the cost estimate most at risk from market and pricing concerns.

Task 9 – Implementation Schedule

Black & Veatch will prepare a detailed Level 1 project implementation schedule from inception to commissioning using Primavera. The implementation schedule will begin with the conceptual design and specification development followed by the development period that will include licensing and permitting activities, bid negotiations, and finalization of procurement and construction contracts. Elements in the schedule will include engineering, procurement, construction, startup, and testing.

The implementation schedule will consider time required for each of the activities and their co-relationships, including contingency plans to offset permitting delays and the potential impact of licensing of patented technologies. The facility plant outage planning schedule will be included in the project scheduling process. The procurement and construction duration will also consider regional procurement strategies particularly related to major long lead items, and availability and productivity of local and regional labor.

In addition, as part of this task, Black & Veatch will develop project cash flows based on the implementation schedule and budget estimate.

Task 10 – Constructability Plan

Construction is a key consideration in the success of any major capital plan. The success or failure of a project is realized often only when construction begins. Black & Veatch strongly believes construction professionals must be involved early in the process to ensure the lessons learned from the past are not repeated and that adequate consideration is given to how the plant will be constructed. Simple changes early in the process can save millions only if fully considered at the appropriate time.

A constructability analysis will be developed and included as part of the project implementation schedule. Constructability will be a prime consideration as part of the selection process of virtually all the systems along with the considerations of overall costs, operability, and maintainability. As major systems are defined, the arrangement of the systems on the site will be reviewed with constructability and maintainability in mind. The ability to sequence construction, maintains crane and equipment access, levelize the construction labor force and provide for material deliveries, and lay-down space will be considered. The optimum approach for any one construction phase has to be balanced against available outages, interfacing work, cash flow considerations, fabrication and equipment delivery capabilities, engineering support, etc. In addition to the schedule input from the constructability plan, a construction facilities drawing will be developed as part of this task.

Task 11 – Evaluation Report

The end result of this study will be a document inclusive of the analyses conducted in the above tasks outlining the consideration undergone by E.ON and Black & Veatch to arrive at the selected AQC conclusions. Black & Veatch will prepare and submit five (5) hardcopies and electronic copies of the draft project report of the work performed under this contract to E.ON for review. Black & Veatch will forward some sections as drafts during earlier tasks and then amended to fit within the purpose of the final report. The draft report will include all conceptual engineering, drawings, costs and schedules developed for this project.

Following submittal of the draft report, Black & Veatch will meet with E.ON to discuss the report and obtain any comments or modifications required. Within four (4) weeks of receiving E.ON comments, Black & Veatch will incorporate these comments and issue five (5) hardcopies and electronic copies of the final report. If requested by E.ON, Black & Veatch will prepare and deliver a formal presentation of the report to E.ON noting conclusions, recommendations and decisions required by the project team and management.

Fabric Filter Letter Specification and Vendor Workshop

Black & Veatch will prepare letter specifications for new FFs at Mill Creek, Ghent, and Brown facilities. The letter specification will be approximately 2 to 3 pages in length, describing the design basis, scope of work, and technical requirements for budgetary purposes only. Following E.ON's review and incorporation of final comments, Black & Veatch will assist E.ON in contacting and scheduling vendor presentations to coincide with a FF workshop to be held at E.ON's engineering offices. A two-day workshop is proposed, with the first half-day consisting of a FF primer and presentation by Black & Veatch personnel, in preparation for 2-3 back-to-back half-day vendor presentations to follow. The actual schedule date of the workshop will be determined once the vendors are contacted. Black & Veatch will prepare meeting minutes summarizing discussions from the workshop.

SCHEDULE

As previously discussed with E.ON, this Phase II scope of work is proposed for the Mill Creek, Ghent, and Brown facilities. The Mill Creek facility is assumed to be the first facility to begin the Phase II services, with the Ghent and Brown facilities to have a staggered kick-off delay of approximately 1 month each. The following table identifies the major milestone schedule proposed herein.

Major Milestone Schedule

Activity	Mill Creek	Ghent	Brown
Notice to Proceed	Aug 26, 2010	Aug 26, 2010	Aug 26, 2010
Project Kickoff and Site Visit Meeting (Task 1)	Sep 14, 2010	Oct 4, 2010	Nov 8, 2010
Begin AQC Validation (Task 6)	Sep 7, 2010	Oct 11, 2010	Nov 15, 2010
Select AQC Technologies - Meeting (Task 6)	Nov 8, 2010	Dec 6, 2010	Jan 10, 2011
Begin Conceptual Design (Task 7)	Nov 15, 2010	Dec 13, 2010	Jan 17, 2011
Begin Cost Estimate (Task 8)	Dec 13, 2010	Jan 10, 2011	Feb 7, 2011
Issue Draft Report (Task 11)	Feb 7, 2011	Mar 14, 2011	Apr 11, 2011
Final Report – Presentation Meeting (Task 11)	Mar 7, 2011	Apr 11, 2011	May 7, 2011

Appendix B

Design Basis

(Excerpt From Phase I Report Appendix C - Ghent Only)

EON
Design Basis
10/19/2010

Unit Designation	**Ghent**				**Reference**
	1	**2**	**3**	**4**	
Ultimate Coal analysis, wet basis					
Carbon, %	61.20	61.20	61.20	61.20	Data from E-ON
Hydrogen, %	4.28	4.28	4.28	4.28	Data from E-ON
Sulfur, %	3.36	3.36	3.36	3.36	Data from E-ON
Nitrogen, %	1.27	1.27	1.27	1.27	Data from E-ON
Chlorine, %	0.16	0.16	0.16	0.16	Data from E-ON
Oxygen, %	6.89	6.89	6.89	6.89	Data from E-ON
Ash, %	12.00	12.00	12.00	12.00	Data from E-ON
Moisture, %	11.00	11.00	11.00	11.00	Data from E-ON
Higher Heating Value, Btu/lb	11,200	11,200	11,200	11,200	Data from E-ON
Trace Metal Analysis, ppm					
Antimony (Sb)	1.05	1.05	1.05	1.05	Data from E-ON
Arsenic (As)	13.00	13.00	13.00	13.00	Data from E-ON
Barium (Ba)	74.00	74.00	74.00	74.00	Data from E-ON
Cadmium (Cd)	0.65	0.65	0.65	0.65	Data from E-ON
Chlorine (Cl)	1600.00	1600.00	1600.00	1600.00	Data from E-ON
Chromium (Cr)	23.00	23.00	23.00	23.00	Data from E-ON
Fluorine (F)	98.00	98.00	98.00	98.00	Data from E-ON
Lead (Pb)	11.00	11.00	11.00	11.00	Data from E-ON
Magnesium (Mg)	684.00	684.00	684.00	684.00	Data from E-ON
Mercury (Hg)	0.12	0.12	0.12	0.12	Data from E-ON
Nickel (Ni)	20.00	20.00	20.00	20.00	Data from E-ON
Selenium (Se)	2.94	2.94	2.94	2.94	Data from E-ON
Strontium (Sr)	56.00	56.00	56.00	56.00	Data from E-ON
Vanadium (V)	40.00	40.00	40.00	40.00	Data from E-ON
Zinc (Zn)	48.00	48.00	48.00	48.00	Data from E-ON
Ash Analysis, % by mass					
Alumina (Al2O3)	21.69	21.69	21.69	21.69	Data from E-ON
Barium Oxide (BaO)	0.07	0.07	0.07	0.07	Data from E-ON
Lime (CaO)	2.74	2.74	2.74	2.74	Data from E-ON
Iron Oxide (Fe2O3)	21.80	21.80	21.80	21.80	Data from E-ON
Magnesia (MgO)	0.91	0.91	0.91	0.91	Data from E-ON
Manganese Oxide (MnO)	0.04	0.04	0.04	0.04	Data from E-ON
Phosphorous Pentoxide (P2O5)	0.26	0.26	0.26	0.26	Data from E-ON
Potassium Oxide (K2O)	2.33	2.33	2.33	2.33	Data from E-ON
Silica (SiO2)	45.88	45.88	45.88	45.88	Data from E-ON
Sodium Oxide (Na2O)	0.48	0.48	0.48	0.48	Data from E-ON
Strontium Oxide (SrO)	0.05	0.05	0.05	0.05	Data from E-ON
Sulfur Trioxide (SO3)	2.58	2.58	2.58	2.58	Data from E-ON
Titania (TiO2)	1.04	1.04	1.04	1.04	Data from E-ON
Undetermined	0.12	0.12	0.12	0.12	Data from E-ON
Unit Characteristics					
Gross Turbine Generator Load, MW	541	517	523	526	Data from E-ON
Boiler Efficiency, % (HHV)	85.74	86.83	86.31	86.77	Data from E-ON
Boiler Heat Input, MBtu/hr (HHV)	5,369	4,327	5,496	5,473	Data from E-ON
Coal Flow Rate, lb/hr	479,375	386,339	490,714	488,661	Data from E-ON
Capacity Factor, %	81.00	71.00	78.00	77.00	Data from E-ON
Fly Ash Portion of Total Ash, %	80.0	80.0	80.0	80.0	Data from E-ON
Air Heater Leakage, %	10.0	10.0	10.0	10.0	Data from E-ON
Excess Air, %	18.258	21.926	21.926	20.433	Data from E-ON
Economizer Outlet Conditions					
Flue Gas Temperature, F	729	610	731	791	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	-3.2	-5.1	-5.1	-4.5	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	5,206,933	4,316,060	5,482,104	5,397,559	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	2,563,081	1,922,533	2,718,161	2,805,958	B&V Combustion Calculations
Uncontrolled Sulfur Dioxide Concentration, lb/MBtu	6.00	6.00	6.00	6.00	= % Sulfur in Coal x 20,000 / HHV
Uncontrolled Sulfur Dioxide Mass Flow Rate, lb/hr	32,181	25,936	32,942	32,805	B&V Combustion Calculations
Uncontrolled PM Concentration, lb/MBtu	8.746	8.746	8.746	8.746	B&V Combustion Calculations
Uncontrolled PM Mass Flow Rate, lb/hr	46,957	37,844	48,068	47,867	= Uncontrolled PM (lb/MBtu) x Heat Input (MBtu/hr)
Uncontrolled Mercury Concentration, lb/TBtu	10.71	10.71	10.71	10.71	= Hg in Coal (ppm) x Coal Flow Rate (lb/hr) / Heat Input (MBtu/hr)
Uncontrolled HCl Mass Flow Rate, lb/hr	789	636	807	804	= HCl in Coal (ppm) / 1,000,000 x Coal Flow Rate (lb/hr) x MW of HCl / MW of Cl
Uncontrolled HCl Concentration, lb/MBtu	0.15	0.15	0.15	0.15	= HCl Flowrate (lb/hr) / Heat Input (MBtu/hr)
Hot-Side ESP Outlet Conditions	**No Hot-side ESP. Unit has a Cold-side ESP**				
Flue Gas Temperature, F		605	708	770	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.		-10.80	-10.90	-10.8	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr		4,531,863	5,756,209	5,667,437	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm		2,041,027	2,843,960	2,947,083	B&V Combustion Calculations
Controlled PM Concentration, lb/MBtu		0.0565	0.0451	0.0248	B&V Combustion Calculations
Controlled PM Mass Flow Rate, lb/hr		244	248	135.73	= Controlled PM (lb/MBtu) x Heat Input (MBtu/hr)
Particulate Removal Efficiency, %		99.35	99.48	99.72	= { 1- Controlled PM (lb/MBtu) / Uncontrolled PM (lb/MBtu) } x 100
SCR Outlet Conditions		**No SCR**			
Flue Gas Temperature, F	729		708	770	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	-13.2		-20.90	-20.8	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	5,311,071		5,871,333	5,780,786	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	2,682,371		2,977,658	3,085,629	B&V Combustion Calculations
Controlled NOx Concentration, lb/MBtu	0.0639		0.0479	0.0627	Data from E-ON
Controlled NOx Mass Flow Rate, lb/hr	343		263	343	= Controlled NOx (lb/MBtu) x Heat Input (MBtu/hr)
Air Heater Outlet Conditions					
Flue Gas Temperature, F	361	309	322	309	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	-22.4	-18.60	-36.10	-29.4	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	5,842,179	4,985,049	6,458,467	6,358,865	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	2,091,568	1,657,754	2,288,309	2,175,592	B&V Combustion Calculations
Cold-Side ESP Outlet Conditions		**No Cold-side ESP. Unit has a Hot-side ESP**	**No Cold-side ESP. Unit has a Hot-side ESP**	**No Cold-side ESP. Unit has a Hot-side ESP**	
Flue Gas Temperature, F	358				B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	-25.7				B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	6,134,288				B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	2,209,920				B&V Combustion Calculations
Controlled PM Concentration, lb/MBtu	0.023				Data from E-ON
Controlled PM Mass Flow Rate, lb/hr	123				= Controlled PM (lb/MBtu) x Heat Input (MBtu/hr)
Particulate Removal Efficiency, %	99.74				= { 1- Controlled PM (lb/MBtu) / Uncontrolled PM (lb/MBtu) } x 100
Fabric Filter Outlet Conditions	**No Fabric Filter**	**No Fabric Filter**	**No Fabric Filter**	**No Fabric Filter**	
Flue Gas Temperature, F					B&V Combustion Calculations
Flue Gas Pressure, in. w.g.					B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr					B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm					B&V Combustion Calculations
Controlled PM Concentration, lb/MBtu					Data from E-ON
Controlled PM Mass Flow Rate, lb/hr					= Controlled PM from fabric Filter (lb/MBtu) x Heat Input (MBtu/hr)
Particulate Removal Efficiency, %					= { 1- FF Controlled PM (lb/MBtu) / ESP Controlled PM (lb/MBtu) } x 100
ID Fan Outlet Conditions					
Flue Gas Temperature, F	376.94	325.52	346.34	333.60	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	6.10	11.40	5.90	14.60	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	6,134,288	4,985,049	6,458,467	6,358,865	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	2,086,965	1,571,913	2,119,437	2,010,799	B&V Combustion Calculations

EON
Design Basis
10/19/2010

Unit Designation	**Ghent**				
	1	**2**	**3**	**4**	**Reference**
Scrubber Outlet Conditions					
Flue Gas Temperature, F	131.74	128.04	129.28	128.50	B&V Combustion Calculations
Flue Gas Pressure, in. w.g.	1.70	1.50	2.00	1.60	B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr	6,534,149	5,252,980	6,834,132	6,711,801	B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm	1,643,977	1,306,064	1,705,743	1,671,656	B&V Combustion Calculations
Controlled Sulfur Dioxide Mass Flow Rate, lb/hr	805	865	824	821	B&V Combustion Calculations
Controlled Sulfur Dioxide Concentration, lb/MBtu	0.150	0.200	0.150	0.150	= Controlled SO_2 (lb/hr) / Heat Input (MBtu/hr)
Sulfur Dioxide Removal Efficiency, %	97.50	96.67	97.50	97.50	= { 1- Controlled SO_2 (lb/MBtu) / Uncontrolled SO_2 (lb/MBtu) } x 100
Wet ESP Outlet Conditions	**No WESP**	**No WESP**	**No WESP**	**No WESP**	
Flue Gas Temperature, F					B&V Combustion Calculations
Flue Gas Pressure, in. w.g.					B&V Combustion Calculations
Flue Gas Mass Flow Rate, lb/hr					B&V Combustion Calculations
Volumetric Flue Gas Flow Rate, acfm					B&V Combustion Calculations
Stack Outlet Emissions[1]					
Sulfur Dioxide Emission Concentration, lb/MBtu	0.15	0.20	0.15	0.15	Data from E-ON
Sulfur Dioxide Emission Rate, lb/hr	805	865	824	821	= SO_2 Emission (lb/MBtu) x Heat Input (MBtu/hr)
PM Emission Concentration, lb/MBtu	0.023	0.0565	0.0451	0.0248	Data from E-ON
PM Emission Rate, lb/hr	123	244	248	136	= PM Emission (lb/MBtu) x Heat Input (MBtu/hr)
NOx Emission Concentration, lb/MBtu	0.0639	0.276	0.0479	0.0627	Data from E-ON
NOx Emission Rate, lb/hr	343	1,194	263	343	= NOx Emission (lb/MBtu) x Heat Input (MBtu/hr)
Hg Emission Concentration, lb/TBtu	2.0	3.5	2.0	2.0	Data from E-ON
Hg Emission Rate, lb/hr	1.07E-02	1.51E-02	1.10E-02	1.09E-02	= Hg Emission (lb/TBtu) x Heat Input (MBtu/hr) / 1,000,000
HCl Emission Concentration, lb/MBtu	0.0015	0.0017	0.0015	0.0015	Data from E-ON
HCl Emission Rate, lb/hr	8	7	8	8	= HCl Emission (lb/MBtu) x Heat Input (MBtu/hr)
CO Emission Concentration, lb/MBtu	–	--	--	–	CO Emissions are not known
CO Emission Rate, lb/hr	–	--	--	–	CO Emissions are not known
Dioxin/Furan Emission Concentration, lb/MBtu	–	--	--	–	Dioxin/Furan Emissions are not known
Dioxin/Furan Emission Rate, lb/hr	–	--	--	–	Dioxin/Furan Emissions are not known

Notes:

1. Current Outlet Emissions as noted in E-ON Matrix

Revision History:

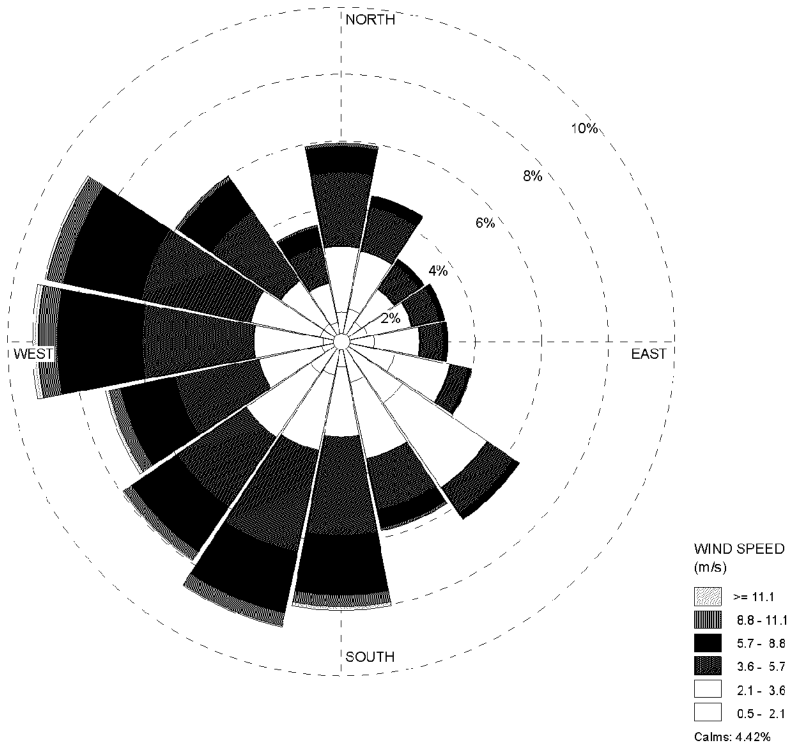
Rev	Date	Description
0	5/21/2010	Initial Issue
1	6/1/2010	Final Issue
2	10/19/2010	Corrected Chlorine Percentage for Phase II

Appendix C

Wind Roses

WIND ROSE PLOT:
Louisville, KY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:
Winter Wind Rose
Louisville, KY

DATA PERIOD:
1995-1999 2000 2001 2002
2003 2004 2005 2006 2007
2008
Check Date Range Report
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
4.42%

TOTAL COUNT:
28648 hrs.

AVG. WIND SPEED:
4.14 m/s

DATE:
9/21/2010

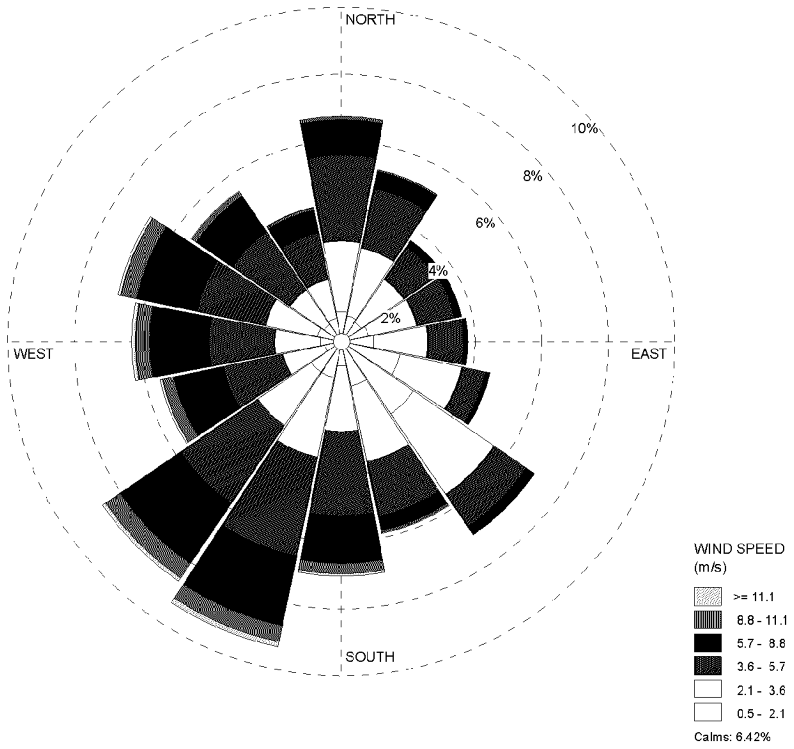
PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Winter Wind Rose 1995-2008
Louisville, KY

WIND ROSE PLOT:
Louisville, KY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:
Spring Wind Rose
Louisville, KY

DATA PERIOD:
1995-1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Mar 1 - May 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
6.42%

TOTAL COUNT:
29133 hrs.

AVG. WIND SPEED:
4.05 m/s

DATE:
9/21/2010

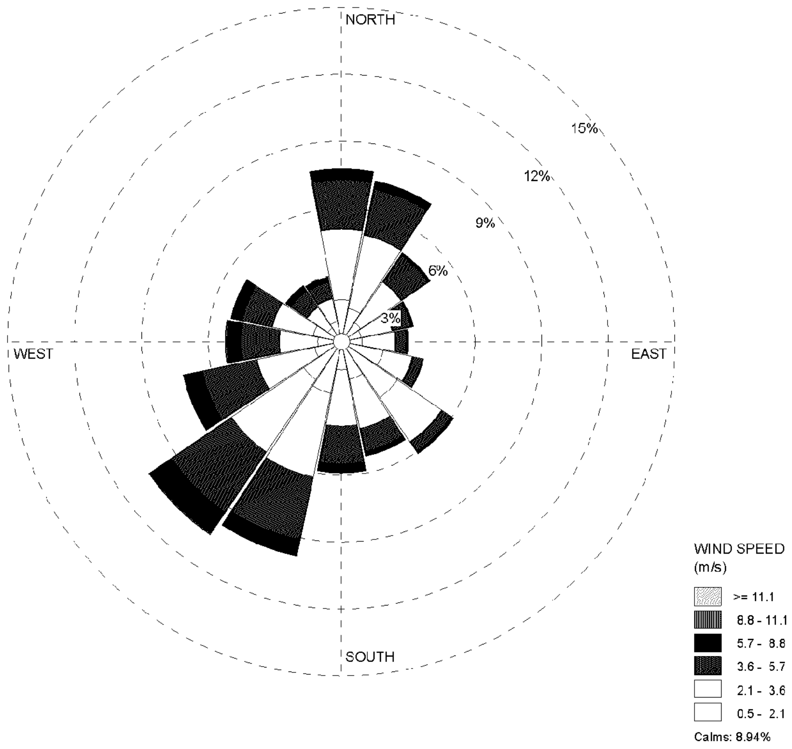
PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Spring Wind Rose 1995-2008
Louisville, KY

WIND ROSE PLOT:
Louisville, KY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:
Summer Wind Rose
Louisville, KY

DATA PERIOD:
1995-1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Jun 1 - Aug 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
8.94%

TOTAL COUNT:
28224 hrs.

AVG. WIND SPEED:
3.15 m/s

DATE:
9/21/2010

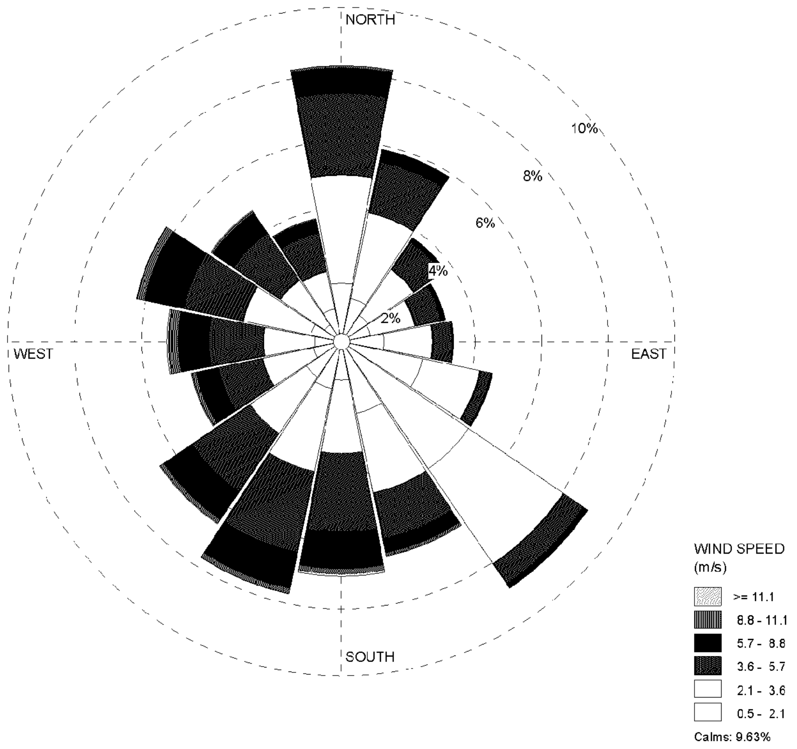
PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Summer Wind Rose 1995-2008
Louisville, KY

WIND ROSE PLOT:
Louisville, KY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:
Fall Wind Rose
Louisville, KY

DATA PERIOD:
1995-1999 2000 2001 2002
2003 2004 2005 2006 2007
2008
Sep 1 - Nov 30
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
9.63%

TOTAL COUNT:
27869 hrs.

AVG. WIND SPEED:
3.33 m/s

DATE:
9/21/2010

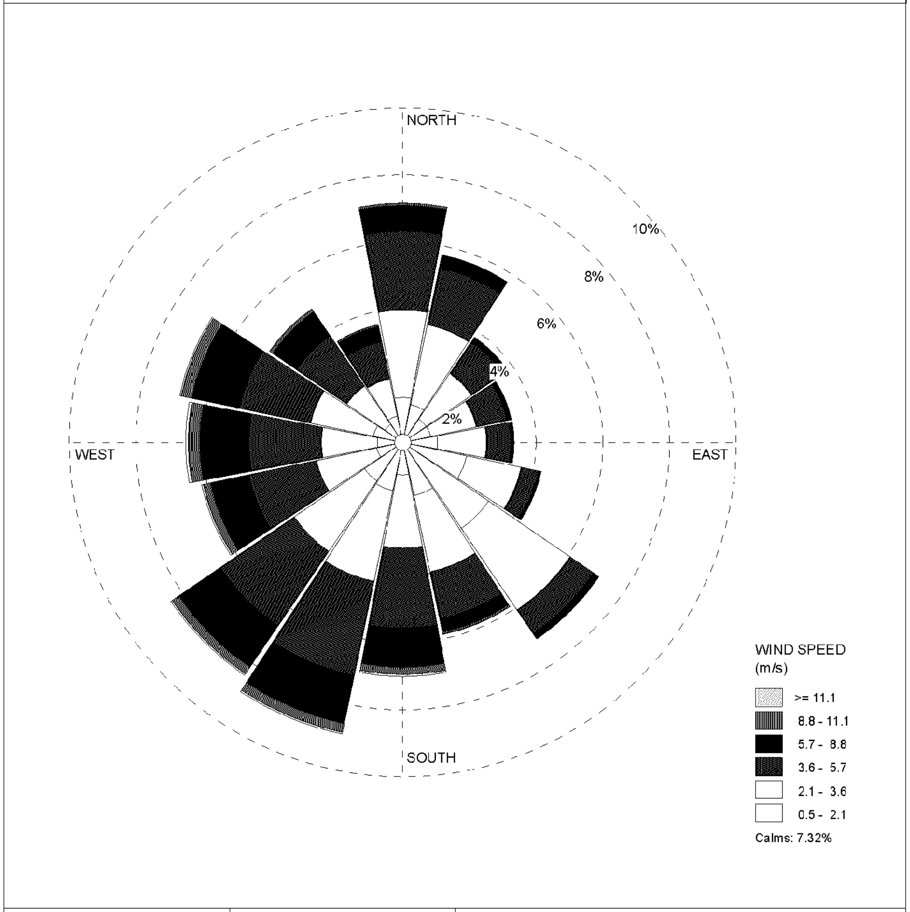
PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Fall Wind Rose 1995-2008
Louisville, KY

WIND ROSE PLOT:
Louisville, KY

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:
Annual Wind Rose
Louisville, KY

DATA PERIOD:
1995-1999 2000 2001 2002 2003 2004 2005 2006 2007 2008
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:
7.32%

TOTAL COUNT:
113967 hrs.

AVG. WIND SPEED:
3.67 m/s

DATE:
9/21/2010

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Annual Wind Rose 1995-2008
Louisville, KY

From: Straight, Scott
To: Thompson, Paul; Voyles, John; Bowling, Ralph; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
CC: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Cooper, David (Legal); Jones, Greg; Keeling, Chip; Hendricks, Claudia; Ray, Barry; O'brien, Dorothy (Dot); Bellar, Lonnie; Blake, Kent; Sturgeon, Allyson; Conroy, Robert; Cornett, Greg
Sent: 11/1/2010 9:14:15 AM
Subject: Project Engineering's ES Bi-Weekly Report - October 31, 2010
Attachments: PE's Bi-Weekly Update of 10-31-10.docx

Scott Straight, P.E.
Director, Project Engineering
E.ON U.S.
O (502) 627-2701
F (502) 217-2040
scott.straight@eon-us.com

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
October 31, 2010

- **KU SOx**
  - Safety – Nothing to report (NTR)
  - Schedule/Execution:
    - Ghent Unit 4 ID Fans – Fluor revised their projected completion date to 11/27/10. All ductwork has been installed and weld out is in progress. The large crane is being demobilized to make room for pile work that will occur in support of installing the maintenance bridge crane for the Unit 4 fans.
    - Ghent Elevators - MAC Construction has mobilized to the site to install the elevators.
    - Ghent Miscellaneous: The FGD Quarterly meeting was held at Ghent Station on 10/27/10 with PE and Fluor Management.
    - Brown Unit 1 – ductwork tie-in outage continuing per plan.
    - Brown Unit 2 – continuing to prepare for I.D. fan and damper control implementation during the outage.
    - Brown Coal Pile Modification
      - Award Recommendation out for signatures.
      - KU continued the overhead line relocation. These lines supply power to coal pile lighting and retention pond pumps.
    - The Plant has decided to route the pump controls around the coal pile expansion footprint rather than burying the cable in conduit. UGS continues design work for the elevators, targeting completion February 2011.

- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – Work was completed on the excitation transformer and the unit was synchronized on 10/20/10 to resume commissioning activities with modified burners in the A-row. The maximum achieved load to date has been ~817 MW gross and the unit ran at full load for 2+ days. Attempts to complete CEMS RATAs over the weekend at full load were halted after experiencing a feed-water leak that required bringing the unit down. Bechtel is now in the 2-week outage to modify all burners with the slopes like A Row. Dodge Hill was combusted in the A Row on Sunday for a short period of time. The Dodge Hill test run in the A Row will recommence when the unit is brought back up after the burner modifications. The unit will be ready for performance testing following this outage and, if all goes well, the revised COD of 11/25 is still achievable.
  - Contract Disputes/Resolution:
    - Bechtel
      - Meeting held with Legal and outside counsel to review Mechanical Completion, Substantial Completion, burner/transformer LDs, and Minimal Stable Load.
      - Mechanical Completion Certificate was issued to Bechtel.
      - Bechtel has submitted their understanding of how the multiple "donut holes" work in conjunction with the extended COD. It is currently under review within PE, Legal and outside counsel.
  - Issues/Risk:

        - Design of the DBEL burners for our coal specification, excitation transformer recovery, remaining commissioning beyond the 75% load achieved to date.
- **Brown 3 SCR**
    - Safety – NTR
    - Permitting – Permit to construct SCR issued in draft form by KYDAQ.
    - Engineering – proceeding as planned to support the spring 2012 in-service.
    - Issues/Risk – Permit timeframe against starting construction.

- **Ohio Falls Rehabilitation**
    - Safety – NTR
    - Engineering
        - Voith proceeding with engineering as planned to support fabrication/manufacturing.
        - B&V awarded second phase of engineering on the de-watering scope.

- **Mill Creek Limestone Project**
    - Safety - NTR
    - Schedule/Execution
        - East and Westbrook continue their work on the building expansion.
    - Contracting - The EPC contract and RFQ was issued and a Pre-Bid held at Mill Creek on 10/26/10. The bids are due back on 11/12/10.

- **Cane Run CCP Project**
    - Permitting
        - 404 and Landfill Permit applications remain under review by the agencies. To date permitting process has gone well. The 401 permit was received on 8/4/10.
    - Engineering
        - Finalization of construction drawings are on hold until the KYDWM permit review is completed and any necessary changes can be incorporated.
        - Working on finalizing design of the smaller landfill to support the proposed 2016 CCGT.
        - Transmission working towards relocation of the 69kV line.

- **Trimble Co. Barge Loading/Holcim**
    - Finalized order with UCC to purchase pneumatic Fly Ash handling system.
    - Updated the 404 Permit drawings per USACE request. Permit has been published on the USACE's website.

- **TC CCP Project – BAP/GSP**
    - Safety – NTR
    - Schedule/Execution:
        - GSP's liner system installation proceeding well.
        - Nearing completion on fill placement and mechanically stabilized earth wall on BAP.
        - Work continues on erection of the new Pipe Rack, electrical duct banks to GSP Electrical Building and to Ash Pond Raft.
    - Contract Disputes/Resolution
        - Resolution of Weather Delays and requested change to Liquidated Damages by contractor under review.
        - Working on resolution of Engineering Delays
    - Issues/Risk

- Weather remains the biggest risk; however, the weather over the last 4 months has been exceptional for this project.

- **TC CCP Project – Landfill**
    - Engineering - The Detailed Engineering RFPs are being reviewed.
    - Permitting:
        - Work continues on the development of the 401/404 Permits for Fall 2010 submittal.
        - Stream Mitigation estimates revised to incorporate all information know to date. Estimate has increased from $12m to approximately $13.5m.

- **Ghent CCP Projects - Landfill**
    - Safety – NTR
    - Engineering:
        - Detailed Engineering of gypsum fines continues with B&V.
        - Installation of Unit 4 FGD gypsum underflow nozzle underway.
        - Detailed Engineering of the CCR Transport System likely to be awarded to B&V.
        - Procurement activities for the gypsum fines project are in progress.
        - Drawings and Specifications for the Detailed Engineering for the Landfill have been submitted for review within EON-US.
    - Permitting:
        - All permit applications have been made.
        - Relocation of the impacted cemetery continues through October. Three additional corpses have been discovered that did not have gravestones. No issues overall with this relocation.
    - Issues/Risk:
        - Land Acquisition – A final letter was sent to the Deaton family. PE working with Legal to arrange a meeting with Mr. Crawford (legal counsel for Owens, McDole and now Deaton).
- **E.W. Brown Ash Pond Project**
    - Safety – NTR
    - Schedule/Execution:
        - Summit operated the water truck as dust control through 10/21. This effort will now be under Charah's responsibility.
        - Starter Dike contract work remains under suspension.
        - Completed proof-roll on South portion of Aux Pond expansion footprint.
        - Began placement of shot rock from the Starter Dike in the Aux Pond embankment.
        - Change order for Aux Pond project acceleration to be finalized week of 10/25.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
    - Safety – NTR
    - Testing:
        - E.ON Engineering outstanding
        - Breen test reports received.

- **SO3 Mitigation (Ghent)**
    - A&D to install injection ports on Ghent 4 pre-ID fan week of Nov. 1
    - Preparing design for new piping at Ghent 4 ESP inlet such that new Solvay lances can be tested

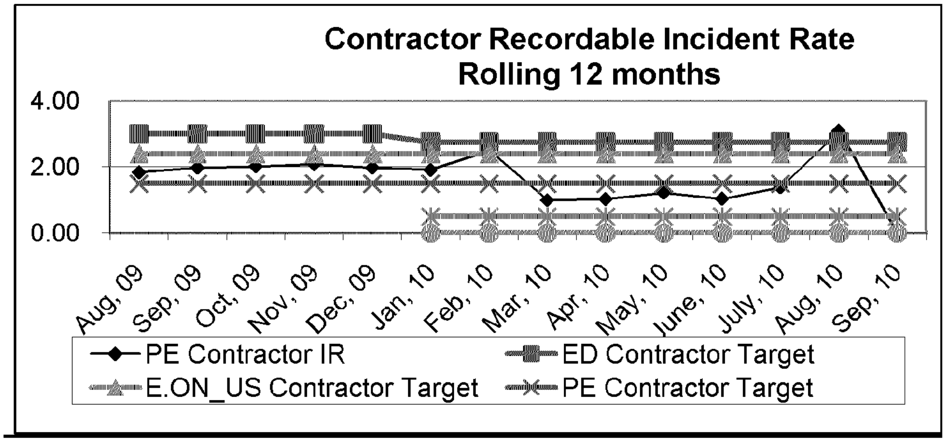
- **Cane Run CCGT**
    - Gas Pipe Line Routing – RFP released for routing analysis. Bids received from EMS, Photo Science and URS. Evaluation of bids and purchase order release planned for week of Nov 1.
    - Owner's Engineer – Scope of work prepared, RFP in development with plans to release the week of Nov 1. Bid list to include HDR, B&V, B&McD and possibly RW Beck. Bidding concept is to bid

known scopes firm and annual budgetary estimates and rates for continued OE work scopes through the project.
  - Sound Survey – RFP prepared and released to bidders October 27.
  - Set-back Survey of Neighbors at Cane Run – PO released October 28 with on site work to commence week of Nov. 1.
  - Paddy's Run Siting Evaluation – Work with HDR|CB ongoing.
  - Two 1x1 Single Shaft Cost Estimate – Completed and forwarded to Generation Planning
  - Turndown Assessment of 2x1 – Completed and forwarded to Generation Planning
  - Start Up Emissions – Concerns for CO & VOC PSD netting out based on start up estimates; refining analysis week of Nov. 1.
  - Black Start at Cane Run – Black start of the NGCC is not required. CR 4-6 all use natural gas as start up fuel; the NGCC plant would have the same fuel delivery issue as the coal units.
  - Auxiliary Boiler – emissions profile submitted to EA

- **Other Generation Development**
  - LFG - NTR.
  - Biomass - NTR
  - CCS 100 MW Project –
    - EPRI work is ongoing.
    - KGS is released to begin work.
    - KBR GSA in final review..
  - FutureGen – NTR.

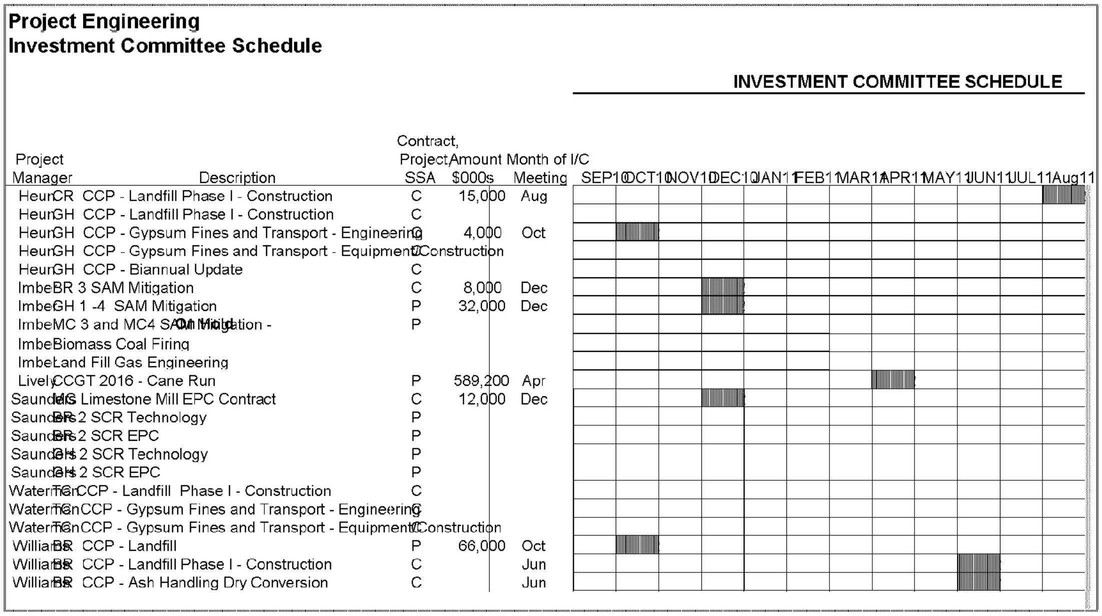
- **General**
  - Environmental Scenario Planning:
    - The kickoff for the Brown Program is scheduled for 11/10-11/11. A meeting with Project Engineering, Mill Creek Management and B&V is scheduled for 11/9/10 to review progress to date. Ghent data collection is in progress.
    - Hitachi and BPEI representatives were on site the week of October 25, 2010 to gather data for proposals to upgrade Mill Creek Unit 1, 2 and 4 FGDs.
    - Continue working with Gen Planning on the Revised Air Compliance analyses.
    - Provided Rates with major commitment dates on all air environmental projects needing ECR/CCN.
  - 2011 MTP ECR/CCN Filings – working closely with Rates on PSC submittals and presentations/updates.
  - Continue to work with Legal and EA on Ghent SAM compliance.
  - Continue to work with Legal on asbestos litigation regarding construction of TC1.

Metrics



Safety General – PE's YTD dropped significantly in September when it was discovered a significant number of hours at TC by PetroChem were being entered into the Stations history instead of PE's. The reversal of hours has brought PE in-line with our 2010 goals on IR.

Upcoming PWT Needs:



Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Contract, Project, SSA	Amount $000s	Month of I/C Meeting	SEP10	OCT10	NOV10	DEC10	JAN11	FEB11	MAR11	APR11	MAY11	JUN11	JUL11	Aug11
Heur	CR CCP - Landfill Phase I - Construction	C	15,000	Aug												▨
Heur	GH CCP - Landfill Phase I - Construction	C														
Heur	GH CCP - Gypsum Fines and Transport - Engineering	C	4,000	Oct		▨										
Heur	GH CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Heur	GH CCP - Biannual Update	C														
Imbe	BR 3 SAM Mitigation	C	8,000	Dec				▨								
Imbe	GH 1 -4 SAM Mitigation	P	32,000	Dec				▨								
Imbe	MC 3 and MC4 SAM Mitigation - On Hold	P														
Imbe	Biomass Coal Firing															
Imbe	Land Fill Gas Engineering															
Lively	CCGT 2016 - Cane Run	P	589,200	Apr								▨				
Saunders	MC Limestone Mill EPC Contract	C	12,000	Dec				▨								
Saunders	BR 2 SCR Technology	P														
Saunders	BR 2 SCR EPC	P														
Saunders	GH 2 SCR Technology	P														
Saunders	GH 2 SCR EPC	P														
Waterman	TC CCP - Landfill Phase I - Construction	C														
Waterman	TC CCP - Gypsum Fines and Transport - Engineering	C														
Waterman	TC CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Williams	BR CCP - Landfill	P	66,000	Oct		▨										
Williams	BR CCP - Landfill Phase I - Construction	C		Jun										▨		
Williams	BR CCP - Ash Handling Dry Conversion	C		Jun										▨		

Staffing

- Significant staffing increases in PE will be required to manage the current slate of projects in PE's draft 2011 MTP. Headcount planning to begin once MTP becomes approved from E.ON US and PPL.
- Lana Linkenhoker to return on November 1, 2010.
- New position being created to manage project approval documentation and schedules.

From: Ritchey, Stacy
To: Saunders, Eileen
Sent: 9/30/2010 6:16:23 PM
Subject: Updated Air Study
Attachments: Environmental Summary Breakdown 10-1-10.xlsx

Eileen,

Attached is the revised draft with the changes Chris suggested. I have a couple of concerns. When I cash flowed MC 1 & 2 SAM for the MTP, I used the SCR timeline. The SCR for MC1 doesn't go in service until 11/16 and 11/15 for MC2. Consequently the SAM's are also cash flowed for the same in-service, but I was thinking BART required it sooner. Also, everything except the Ghent SAM's are based on outage. Philip just estimated 12/31/11 for 1&2 and 12/31/12 for 3&4. There doesn't appear to be an outage to support that timeframe.

We can talk about all this on Monday. Do you want me to send Chris the updated version or wait until we can discuss on Monday? Thanks.

Stacy Ritchey
Sr Budget Analyst
E.ON US - Project Engineering
820 West Broadway
Louisville, KY 40232
BOC Phone: (502) 627-4388
EW Brown Phone (859) 748-4455
Fax: (502) 217-4980
Stacy.Ritchey@eon-us.com

	A	B	C	D	E	F	G	H	I	J	K
1	**Environmental Air - CATR by January 2015, NAAQS by January 2016, HAPs by January 2017**										
2	**Capital Cost - Investment Accrual Basis (Includes Removal/ARO)**										
3	$ in thousands										
4											
5											
6	**Brown**	**Regulation**	**d In-Servic**	**Total**		**B&V Study (2)**	**ON US Estima**	**Overhead/ Escalatio**		**2010**	**2011-2015**
7	Brown 1 - SCR	NAAQS, CATR	5/31/2014	$68,325		$59,000	$0	$9,325		$0	$68,325
8	Brown 1 - Baghouse	EGU MACT	5/31/2014	$39,218		$34,000	$0	$5,218		$0	$39,218
9	Brown 1 - PAC Injection	EGU MACT, PM 2.5	5/31/2014	$1,899		$1,599	$0	$300		$0	$1,899
10	Brown 1 - SAM Mitigation	NSR	5/31/2014	$4,632		$0	$4,000	$632		$0	$4,632
11	Total Brown 1			**$114,075**		**$94,599**	**$4,000**	**$15,476**		**$0**	**$114,075**
12											
13	Brown 2 - SCR	NAAQS, CATR	11/30/2013	$104,971		$92,000	$0	$12,971		$0	$104,971
14	Brown 2 - Baghouse	EGU MACT	11/30/2015	$41,179		$34,000	$0	$7,179		$0	$39,844
15	Brown 2 - PAC Injection	EGU MACT	11/30/2015	$3,058		$2,476	$0	$582		$0	$3,058
16	Brown 2 - SAM Mitigation	NSR	11/30/2013	$4,568		$0	$4,000	$568		$0	$4,568
17	Total Brown 2			**$153,776**		**$128,476**	**$4,000**	**$21,300**		**$0**	**$152,440**
18											
19	Brown 3 - Baghouse	EGU MACT, PM 2.5	5/31/2016	$76,066		$61,000	$0	$15,066		$0	$64,083
20	Brown 3 - PAC Injection	EGU MACT, PM 2.5	5/31/2016	$6,835		$5,426	$0	$1,409		$0	$5,525
21	Total Brown 3			**$82,901**		**$66,426**	**$0**	**$16,475**		**$0**	**$69,608**
22											
23	**Total Brown**			**$350,751**		**$289,501**	**$8,000**	**$53,250**		**$0**	**$336,123**
24											
25	**Ghent**										
26	Ghent 1 - Baghouse	EGU MACT, PM 2.5	5/31/2016	$163,356		$131,000	$0	$32,356		$0	$137,622
27	Ghent 1 - PAC Injection	EGU MACT, PM 2.5	5/31/2016	$8,036		$6,380	$0	$1,656		$0	$6,726
28	Ghent 1 - SAM Mitigation	NSR	12/31/2011	$7,750		$0	$7,750	$0		$375	$7,375
29	Total Ghent 1			**$179,142**		**$137,380**	**$7,750**	**$34,012**		**$375**	**$151,723**
30											
31	Ghent 2 - SCR	NAAQS, CATR	4/30/2014	$262,878		$227,000	$0	$35,878		$0	$262,878
32	Ghent 2 - Baghouse	EGU MACT, PM 2.5	4/30/2016	$149,464		$120,000	$0	$29,464		$0	$127,463
33	Ghent 2 - PAC Injection	EGU MACT, PM 2.5	4/30/2016	$7,695		$6,109	$0	$1,586		$0	$6,385
34	Ghent 2 - SAM Mitigation	NSR	12/31/2011	$7,750		$0	$7,750	$0		$375	$7,375
35	Total Ghent 2			**$427,787**		**$353,109**	**$7,750**	**$66,928**		**$375**	**$404,101**
36											
37	Ghent 3 - Baghouse	EGU MACT, PM 2.5	10/31/2015	$170,210		$138,000	$0	$32,210		$0	$161,173
38	Ghent 3 - PAC Injection	EGU MACT, PM 2.5	10/31/2015	$7,624		$6,173	$0	$1,451		$0	$7,624
39	Ghent 3 - SAM Mitigation	NSR	12/31/2012	$8,570		$0	$8,250	$320		$250	$8,320
40	Total Ghent 3			**$186,403**		**$144,173**	**$8,250**	**$33,980**		**$250**	**$177,117**
41											
42	Ghent 4 - Baghouse	EGU MACT, PM 2.5	12/31/2015	$144,530		$117,000	$0	$27,530		$0	$136,869
43	Ghent 4 - PAC Injection	EGU MACT, PM 2.5	12/31/2015	$7,669		$6,210	$0	$1,459		$0	$7,669
44	Ghent 4 - SAM Mitigation	NSR	12/31/2012	$8,570		$0	$8,250	$320		$250	$8,320
45	Total Ghent 4			**$160,770**		**$123,210**	**$8,250**	**$29,310**		**$250**	**$152,859**
46											
47	**Total Ghent**			**$954,101**		**$757,872**	**$32,000**	**$164,229**		**$1,250**	**$885,800**
48											
49	**Mill Creek**										
50	Mill Creek 1 - FGD Upgrade	NAAQS, CATR	11/30/2014	$49,565		$41,250	$0	$8,315		$0	$49,565
51	Mill Creek 1 - SCR	NAAQS, CATR, JEFF. CO., NON ATTAINMENT	11/30/2016	$122,586		$97,020	$0	$25,566		$0	$72,932
52	Mill Creek 1 - Baghouse	EGU MACT, PM 2.5	11/30/2014	$96,033		$80,850	$0	$15,183		$0	$96,033

	L
1	
2	
3	
4	
5	
6	**Post 2015**
7	$0
8	$0
9	$0
10	$0
11	**$0**
12	
13	$0
14	$1,336
15	$0
16	$0
17	**$1,336**
18	
19	$11,983
20	$1,310
21	**$13,292**
22	
23	**$14,628**
24	
25	
26	$25,734
27	$1,310
28	$0
29	**$27,043**
30	
31	$0
32	$22,001
33	$1,310
34	$0
35	**$23,311**
36	
37	$9,036
38	$0
39	$0
40	**$9,036**
41	
42	$7,661
43	$0
44	$0
45	**$7,661**
46	
47	**$67,052**
48	
49	
50	$0
51	$49,654
52	$0

	A	B	C	D	E	F	G	H	I	J	K
53	Mill Creek 1 - PAC Injection	EGU MACT, PM 2.5	11/30/2014	$5,085		$4,290	$0	$795		$0	$5,085
54	Mill Creek 1 - SAM Mitigation	BART	11/30/2016	$10,137		$7,920	$0	$2,217		$0	$4,412
55	Total Mill Creek 1			**$283,407**		**$231,330**	**$0**	**$52,077**		**$0**	**$228,028**
56											
57	Mill Creek 2 - FGD Upgrade	NAAQS, CATR	11/30/2013	$47,659		$41,250	$0	$6,409		$0	$47,659
58	Mill Creek 2 - SCR	NAAQS, CATR, JEFF. COUNTY, NON ATTAINMENT	11/30/2015	$117,872		$97,020	$0	$20,852		$0	$115,330
59	Mill Creek 2 - Baghouse	EGU MACT, PM 2.5	11/30/2013	$92,339		$80,850	$0	$11,489		$0	$92,339
60	Mill Creek 2 - Electrostatic Precipitator	NAAQS, CATR, JEFF. COUNTY, NON ATTAINMENT	11/30/2013	$37,690		$33,000	$0	$4,690		$0	$37,690
61	Mill Creek 2 - PAC Injection	EGU MACT, PM 2.5	11/30/2013	$4,890		$4,290	$0	$600		$0	$4,890
62	Mill Creek 2 - SAM Mitigation	BART	11/30/2015	$9,747		$7,920	$0	$1,827		$0	$9,229
63	Total Mill Creek 2			**$310,196**		**$264,330**	**$0**	**$45,866**		**$0**	**$307,137**
64											
65	Mill Creek 3 - FGD (U4 update and tie in)	NAAQS, CATR	4/30/2015	$90,564		$63,750	$0	$26,814		$0	$90,564
66	Mill Creek 3 - FGD (Unit 3 Removal)	NAAQS, CATR		$19,198		$25,500	$0	($6,302)		$0	$19,198
67	Mill Creek 3 - Baghouse	EGU MACT, PM 2.5	4/30/2015	$125,943		$104,125	$0	$21,818		$0	$125,943
68	Mill Creek 3 - PAC Injection	EGU MACT, PM 2.5	4/30/2015	$6,683		$5,525	$0	$1,158		$0	$6,683
69	Total Mill Creek 3			**$242,388**		**$198,900**	**$0**	**$43,488**		**$0**	**$242,388**
70											
71	Mill Creek 4 - FGD	NAAQS, CATR	5/31/2014	$271,994		$236,250	$0	$35,744		$0	$271,994
72	Mill Creek 4 - SCR Upgrade	NAAQS, CATR, JEFF. COUNTY, NON ATTAINMENT	5/31/2012	$5,696		$5,250	$0	$446		$0	$5,696
73	Mill Creek 4 - Baghouse	EGU MACT, PM 2.5	5/31/2014	$151,571		$131,250	$0	$20,321		$0	$151,571
74	Mill Creek 4 - PAC Injection	EGU MACT, PM 2.5	5/31/2014	$7,882		$6,825	$0	$1,057		$0	$7,882
75	Mill Creek 4 - Ammonia	NAAQS, CATR, JEFF. COUNTY, NON ATTAINMENT	5/31/2012	$11,528		$10,500	$0	$1,028		$0	$11,528
76	Total Mill Creek 4			**$448,671**		**$390,075**	**$0**	**$58,596**		**$0**	**$448,671**
77											
78	**Total Mill Creek**			**$1,284,663**		**$1,084,635**	**$0**	**$200,028**		**$0**	**$1,226,223**
79											
80	**Trimble**										
81	Trimble 1 - Baghouse	EGU MACT, PM 2.5	10/31/2015	$158,119		$128,000	$0	$30,119		$0	$149,737
82	Trimble 1 - PAC Injection	EGU MACT, PM 2.5	10/31/2015	$7,967		$6,451	$0	$1,516		$0	$7,967
83	Total Trimble 1			**$166,086**		**$134,451**	**$0**	**$31,635**		**$0**	**$157,704**
84											
85	**Total Trimble**			**$166,086**		**$134,451**	**$0**	**$31,635**		**$0**	**$157,704**
86											
87	**Environmental Air Studies**										
88	Environmental Air Studies			$2,000		$2,000	$0	$0		$1,250	$750
89	Total Environmental Air Studies			**$2,000**		**$2,000**	**$0**	**$0**		**$1,250**	**$750**
90											
91											
92	**Total Environmental Compliance - Air**			**$2,757,601**		**$2,268,459**	**$40,000**	**$449,142**		**$2,500**	**$2,606,600**
93											
94	Notes										
95	(1) - In-Service Dates are estimated based on current outage schedule.										
96	(2) - Black & Veatch study does not meet level 1 engineering criteria.										
97	(3) - 3.5% overhead and 4% escalation applies to all projects except Ghent 1 & 2 SAM Mitigation, MC3 FGD Removal and Environmental Air Studies.										

	L
53	$0
54	$5,725
55	**$55,380**
56	
57	$0
58	$2,541
59	$0
60	$0
61	$0
62	$519
63	**$3,060**
64	
65	$0
66	$0
67	$0
68	$0
69	**$0**
70	
71	$0
72	$0
73	$0
74	$0
75	$0
76	**$0**
77	
78	**$58,439**
79	
80	
81	$8,381
82	$0
83	**$8,381**
84	
85	**$8,381**
86	
87	
88	$0
89	**$0**
90	
91	
92	**$148,501**
93	
94	
95	
96	
97	

	A	B	C	D	E	F	G	H	I	K	L	M
1	**Environmental Compliance - CCR Ruling**											
2	**Capital Cost - Investment Accrual Basis (Includes Removal/ARO)**											
3	$ in thousands											
4												
5												
6		**Total**		**GAI Study**	**E.ON US**		**2011-2015**	**2016-2020**	**Post 2020**			
7	**Brown CCR Ruling**	$159,921		$46,665	$113,256		$2,109	$339	$157,473			
8	**Ghent CCR Ruling**	$724,084		$284,731	$439,353		$172,505	$136,516	$415,063			
9	**Green River CCR Ruling**	$96,425		$62,254	$34,171		$15,474	$76,294	$4,657			
10	**Pineville CCR Ruling**	$2,896		$2,639	$256		$2,896	$0	$0			
11	**Tyrone CCR Ruling**	$24,562		$16,426	$8,136		$4,673	$19,889	$0			
12	**Cane Run CCR Ruling**	$124,817		$62,802	$62,015		$2,792	$73,469	$48,556			
13	**Mill Creek CCR Ruling**	$201,692		$88,137	$113,555		$62,325	$38,632	$100,735			
14	**Trimble Co CCR Ruling**	$268,365		$73,093	$195,272		$42,198	$37,556	$188,611			
15												
16	**Total Environmental Compliance - CCR Ruling**	$594,874		$224,032	$370,842		$107,315	$149,657	$337,902			
17												
18	Note 1 - E.ON US includes 3.5% overheads and 6% escalation.											
19	Note 2 - GAI study does not meet level 1 engineering criteria.											
20												
21												
22												
23												

	A	C	D	E	F	G	H	I	J	K	L
1	**2.) Environmental Air - CATR by January 2015, NAAQS by January 2016, HAPs by January 2017**										
2	$ in thousands										
3	**Estimated**	**In-Servi**	Total	2010	2011	2012	2013	2014	2015	2016	2017
4	**Cash Flow By Year**										
5	**Brown**										
6	Brown 1 - SCR	5/31/2014	$68,325		$3,175	$19,814	$27,476	$17,859			
7	Brown 1 - Baghouse	5/31/2014	$39,218		$1,830	$13,322	$15,834	$8,233			
8	Brown 1 - PAC Injection	5/31/2014	$1,899		$0	$0	$931	$968			
9	Brown 1 - SAM Mitigation	5/31/2014	$4,632		$215	$1,343	$1,863	$1,211			
10	Total Brown 1		**$114,075**	**$0**	**$5,221**	**$34,479**	**$46,103**	**$28,272**	**$0**	**$0**	**$0**
11											
12	Brown 2 - SCR	11/30/2013	$104,971		$9,903	$38,621	$50,877	$5,570	$0	$0	$0
13	Brown 2 - Baghouse	11/30/2015	$41,179		$0	$1,522	$11,875	$13,174	$13,272	$1,336	$0
14	Brown 2 - PAC Injection	11/30/2015	$3,058		$0	$0	$0	$1,499	$1,559	$0	$0
15	Brown 2 - SAM Mitigation	11/30/2013	$4,568		$215	$1,791	$2,561	$0	$0	$0	
16	Total Brown 2		**$153,776**	**$0**	**$10,118**	**$41,935**	**$65,314**	**$20,242**	**$14,831**	**$1,336**	**$0**
17											
18	**Brown 1 & 2 - SAM Mitigation**										
19											
20	Brown 3 - Baghouse	5/31/2016	$76,066		$0	$0	$2,131	$25,851	$36,102	$11,983	$0
21	Brown 3 - PAC Injection	5/31/2016	$6,835		$0	$0	$0	$1,211	$4,314	$1,310	$0
22	Total Brown 3		**$82,901**	**$0**	**$0**	**$0**	**$2,131**	**$27,061**	**$40,416**	**$13,292**	**$0**
23											
24	**Total Brown**		**$350,751**	**$0**	**$15,339**	**$76,414**	**$113,547**	**$75,575**	**$55,248**	**$14,628**	**$0**
25											
26	**Ghent**										
27	Ghent 1 - Baghouse	5/31/2016	$163,356				$4,575	$55,515	$77,531	$25,734	
28	Ghent 1 - PAC Injection	5/31/2016	$8,036		$0	$0	$0	$1,211	$5,515	$1,310	$0
29	Ghent 1 - SAM Mitigation	12/31/2011	$7,750	$375	$7,375						
30	Total Ghent 1		**$179,142**	**$375**	**$7,375**	**$0**	**$4,575**	**$56,726**	**$83,047**	**$27,043**	**$0**
31											
32	Ghent 2 - SCR	4/30/2014	$262,878		$12,217	$76,235	$105,712	$68,713	$0	$0	$0
33	Ghent 2 - Baghouse	4/30/2016	$149,464		$0	$0	$5,588	$50,854	$71,021	$22,001	
34	Ghent 2 - PAC Injection	4/30/2016	$7,695		$0	$0	$0	$1,211	$5,174	$1,310	
35	Ghent 2 - SAM Mitigation	12/31/2011	$7,750	$375	$7,375						
36	Total Ghent 2		**$427,787**	**$375**	**$19,592**	**$76,235**	**$111,301**	**$120,778**	**$76,195**	**$23,311**	**$0**
37											
38	Ghent 3 - Baghouse	10/31/2015	$170,210		$0	$0	$19,280	$58,482	$83,412	$9,036	$0
39	Ghent 3 - PAC Injection	10/31/2015	$7,624		$0	$0	$0	$3,737	$3,887	$0	$0
40	Ghent 3 - SAM Mitigation	12/31/2012	$8,570	$250	$650	$7,670					
41	Total Ghent 3		**$186,403**	**$250**	**$650**	**$7,670**	**$19,280**	**$62,219**	**$87,298**	**$9,036**	**$0**
42											
43	Ghent 4 - Baghouse	12/31/2015	$144,530		$0	$0	$13,622	$49,582	$73,665	$7,661	$0
44	Ghent 4 - PAC Injection	12/31/2015	$7,669		$0	$0	$0	$3,760	$3,910	$0	$0
45	Ghent 4 - SAM Mitigation	12/31/2012	$8,570	$250	$650	$7,670					
46	Total Ghent 4		**$160,770**	**$250**	**$650**	**$7,670**	**$13,622**	**$53,342**	**$77,575**	**$7,661**	**$0**
48	**Total Ghent**		**$954,101**	**$1,250**	**$28,267**	**$91,575**	**$148,777**	**$293,065**	**$324,115**	**$67,052**	**$0**
49											
50	**Mill Creek**										

	A	C	D	E	F	G	H	I	J	K	L
51	Mill Creek 1 - FGD Upgrade	11/30/2014	$49,565		$0	$0	$12,006	$34,962	$2,597	$0	$0
52	Mill Creek 1 - SCR	11/30/2016	$122,586		$0	$0	$3,389	$32,892	$36,651	$47,011	$2,643
53	Mill Creek 1 - Baghouse	11/30/2014	$96,033		$0	$9,051	$32,945	$48,947	$5,090	$0	$0
54	Mill Creek 1 - PAC Injection	11/30/2014	$5,085		$0	$480	$1,748	$2,857	$0	$0	$0
55	Mill Creek 1 - SAM Mitigation	11/30/2016	$10,137		$0	$0	$461	$959	$2,992	$5,186	$539
56	Total Mill Creek 1		**$283,407**	**$0**	**$0**	**$9,531**	**$50,549**	**$120,617**	**$47,331**	**$52,197**	**$3,182**
57											
58	Mill Creek 2 - FGD Upgrade	11/30/2013	$47,659		$0	$11,544	$33,617	$2,497	$0	$0	$0
59	Mill Creek 2 - SCR	11/30/2015	$117,872		$0	$3,258	$31,627	$35,242	$45,203	$2,541	$0
60	Mill Creek 2 - Baghouse	11/30/2013	$92,339		$8,703	$31,678	$47,064	$4,895	$0	$0	$0
61	Mill Creek 2 - Electrostatic Precipitator	11/30/2013	$37,690		$3,552	$12,930	$19,210	$1,998	$0	$0	$0
62	Mill Creek 2 - PAC Injection	11/30/2013	$4,890		$462	$1,681	$2,747	$0	$0	$0	$0
63	Mill Creek 2 - SAM Mitigation	11/30/2015	$9,747		$0	$443	$922	$2,877	$4,987	$519	$0
64	Total Mill Creek 2		**$310,196**	**$0**	**$12,717**	**$61,534**	**$135,188**	**$47,508**	**$50,190**	**$3,060**	**$0**
65											
66	Mill Creek 3 - FGD (U4 update and tie in)	4/30/2015	$84,262		$0	$0	$0	$59,235	$25,027	$0	$0
67	Mill Creek 3 - FGD (Unit 3 Removal)		$25,500		$0	$0	$0	$6,375	$19,125	$0	$0
68	Mill Creek 3 - Baghouse	4/30/2015	$125,943		$0	$2,331	$36,368	$47,908	$39,335	$0	$0
69	Mill Creek 3 - PAC Injection	4/30/2015	$6,683		$0	$124	$1,930	$2,542	$2,087	$0	$0
70	Total Mill Creek 3		**$242,388**	**$0**	**$0**	**$2,455**	**$38,297**	**$116,061**	**$85,575**	**$0**	**$0**
71											
72	Mill Creek 4 - FGD	5/31/2014	$271,994		$20,344	$89,920	$104,519	$57,210	$0	$0	$0
73	Mill Creek 4 - SCR Upgrade	5/31/2012	$5,696		$4,521	$1,175	$0	$0	$0	$0	$0
74	Mill Creek 4 - Baghouse	5/31/2014	$151,571		$5,651	$51,425	$61,122	$33,373	$0	$0	
75	Mill Creek 4 - PAC Injection	5/31/2014	$7,882		$294	$2,674	$3,178	$1,735	$0	$0	
76	Mill Creek 4 - Ammonia	5/31/2012	$11,528		$5,651	$5,877	$0	$0	$0	$0	
77	Total Mill Creek 4		**$448,671**	**$0**	**$36,461**	**$151,072**	**$168,820**	**$92,319**	**$0**	**$0**	**$0**
78											
79	**Total Mill Creek**		**$1,284,663**	**$0**	**$49,177**	**$224,592**	**$392,854**	**$376,505**	**$183,095**	**$55,257**	**$3,182**
80											
81	**Trimble**										
82	Trimble 1 - Baghouse	10/31/2015	$158,119	$0	$0	$0	$14,902	$54,244	$80,591	$8,381	$0
83	Trimble 1 - PAC Injection	10/31/2015	$7,967	$0	$0	$0	$0	$3,905	$4,062	$0	$0
84	Total Trimble 1		**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**
85											
86	**Total Trimble**		**$166,086**	**$0**	**$0**	**$0**	**$14,902**	**$58,149**	**$84,653**	**$8,381**	**$0**
87											
88	**Environmental Air Studies**										
89	Environmental Air Studies		$2,000	$1,250	$750	$0	$0	$0	$0	$0	$0
90	Total Environmental Air Studies		**$2,000**	**$1,250**	**$750**	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
91											
92											
93	**Total Environmental Compliance Air - Alternate Plan**		**$2,757,601**	**$2,500**	**$93,533**	**$392,581**	**$670,080**	**$803,294**	**$647,111**	**$145,319**	**$3,182**

From:	Sinclair, David
To:	Brunner, Bob; Pfeiffer, Caryl; Schram, Chuck; Wilson, Stuart
Sent:	11/1/2010 2:07:29 PM
Subject:	FW: Project Engineering's ES Bi-Weekly Report - October 31, 2010
Attachments:	PE's Bi-Weekly Update of 10-31-10.docx

Bob, fyi - you will note under the Cane Run CCGT project that RW Beck is one of the firms that may be asked to respond to the owner's engineer RFP. I spoke to Doug about this and made him aware of the fact that Beck does work for the munis so should they be selected, we'd want to ensure the appropriate Chinese walls are put in place to prevent info flowing to the munis. He said that he will monitor this. We should also keep our eye on this topic as it develops. Obviously it will be easier if they are not selected.

Thanks

From: Straight, Scott
Sent: Monday, November 01, 2010 9:14 AM
To: Thompson, Paul; Voyles, John; Bowling, Ralph; Hudson, Rusty; Hincker, Loren; Sinclair, David; Schetzel, Doug; Yussman, Eric; Jackson, Fred
Cc: Waterman, Bob; Imber, Philip; Lively, Noel; Saunders, Eileen; Gregory, Ronald; Heun, Jeff; Hance, Chuck; Clements, Joe; Cooper, David (Legal); Jones, Greg; Keeling, Chip; Hendricks, Claudia; Ray, Barry; O'brien, Dorothy (Dot); Bellar, Lonnie; Blake, Kent; Sturgeon, Allyson; Conroy, Robert; Cornett, Greg
Subject: Project Engineering's ES Bi-Weekly Report - October 31, 2010

Scott Straight, P.E.
Director, Project Engineering
E.ON U.S.
O (502) 627-2701
F (502) 217-2040
scott.straight@eon-us.com

Energy Services - Bi-Weekly Update
PROJECT ENGINEERING
October 31, 2010

- **KU SOx**
  - Safety – Nothing to report (NTR)
  - Schedule/Execution:
    - Ghent Unit 4 ID Fans – Fluor revised their projected completion date to 11/27/10. All ductwork has been installed and weld out is in progress. The large crane is being demobilized to make room for pile work that will occur in support of installing the maintenance bridge crane for the Unit 4 fans.
    - Ghent Elevators - MAC Construction has mobilized to the site to install the elevators.
    - Ghent Miscellaneous: The FGD Quarterly meeting was held at Ghent Station on 10/27/10 with PE and Fluor Management.
    - Brown Unit 1 – ductwork tie-in outage continuing per plan.
    - Brown Unit 2 – continuing to prepare for I.D. fan and damper control implementation during the outage.
    - Brown Coal Pile Modification
      - Award Recommendation out for signatures.
      - KU continued the overhead line relocation. These lines supply power to coal pile lighting and retention pond pumps.
    - The Plant has decided to route the pump controls around the coal pile expansion footprint rather than burying the cable in conduit. UGS continues design work for the elevators, targeting completion February 2011.

- **TC2**
  - Safety – NTR
  - Schedule/Execution:
    - Bechtel EPC – Work was completed on the excitation transformer and the unit was synchronized on 10/20/10 to resume commissioning activities with modified burners in the A-row. The maximum achieved load to date has been ~817 MW gross and the unit ran at full load for 2+ days. Attempts to complete CEMS RATAs over the weekend at full load were halted after experiencing a feed-water leak that required bringing the unit down. Bechtel is now in the 2-week outage to modify all burners with the slopes like A Row. Dodge Hill was combusted in the A Row on Sunday for a short period of time. The Dodge Hill test run in the A Row will recommence when the unit is brought back up after the burner modifications. The unit will be ready for performance testing following this outage and, if all goes well, the revised COD of 11/25 is still achievable.
  - Contract Disputes/Resolution:
    - Bechtel
      - Meeting held with Legal and outside counsel to review Mechanical Completion, Substantial Completion, burner/transformer LDs, and Minimal Stable Load.
      - Mechanical Completion Certificate was issued to Bechtel.
      - Bechtel has submitted their understanding of how the multiple "donut holes" work in conjunction with the extended COD. It is currently under review within PE, Legal and outside counsel.
  - Issues/Risk:

        - Design of the DBEL burners for our coal specification, excitation transformer recovery, remaining commissioning beyond the 75% load achieved to date.
- **Brown 3 SCR**
    - Safety – NTR
    - Permitting – Permit to construct SCR issued in draft form by KYDAQ.
    - Engineering – proceeding as planned to support the spring 2012 in-service.
    - Issues/Risk – Permit timeframe against starting construction.

- **Ohio Falls Rehabilitation**
    - Safety – NTR
    - Engineering
        - Voith proceeding with engineering as planned to support fabrication/manufacturing.
        - B&V awarded second phase of engineering on the de-watering scope.

- **Mill Creek Limestone Project**
    - Safety - NTR
    - Schedule/Execution
        - East and Westbrook continue their work on the building expansion.
    - Contracting - The EPC contract and RFQ was issued and a Pre-Bid held at Mill Creek on 10/26/10. The bids are due back on 11/12/10.

- **Cane Run CCP Project**
    - Permitting
        - 404 and Landfill Permit applications remain under review by the agencies. To date permitting process has gone well. The 401 permit was received on 8/4/10.
    - Engineering
        - Finalization of construction drawings are on hold until the KYDWM permit review is completed and any necessary changes can be incorporated.
        - Working on finalizing design of the smaller landfill to support the proposed 2016 CCGT.
        - Transmission working towards relocation of the 69kV line.

- **Trimble Co. Barge Loading/Holcim**
    - Finalized order with UCC to purchase pneumatic Fly Ash handling system.
    - Updated the 404 Permit drawings per USACE request. Permit has been published on the USACE's website.

- **TC CCP Project – BAP/GSP**
    - Safety – NTR
    - Schedule/Execution:
        - GSP's liner system installation proceeding well.
        - Nearing completion on fill placement and mechanically stabilized earth wall on BAP.
        - Work continues on erection of the new Pipe Rack, electrical duct banks to GSP Electrical Building and to Ash Pond Raft.
    - Contract Disputes/Resolution
        - Resolution of Weather Delays and requested change to Liquidated Damages by contractor under review.
        - Working on resolution of Engineering Delays
    - Issues/Risk

- Weather remains the biggest risk; however, the weather over the last 4 months has been exceptional for this project.

- **TC CCP Project – Landfill**
    - Engineering - The Detailed Engineering RFPs are being reviewed.
    - Permitting:
        - Work continues on the development of the 401/404 Permits for Fall 2010 submittal.
        - Stream Mitigation estimates revised to incorporate all information know to date. Estimate has increased from $12m to approximately $13.5m.

- **Ghent CCP Projects - Landfill**
    - Safety – NTR
    - Engineering:
        - Detailed Engineering of gypsum fines continues with B&V.
        - Installation of Unit 4 FGD gypsum underflow nozzle underway.
        - Detailed Engineering of the CCR Transport System likely to be awarded to B&V.
        - Procurement activities for the gypsum fines project are in progress.
        - Drawings and Specifications for the Detailed Engineering for the Landfill have been submitted for review within EON-US.
    - Permitting:
        - All permit applications have been made.
        - Relocation of the impacted cemetery continues through October. Three additional corpses have been discovered that did not have gravestones. No issues overall with this relocation.
    - Issues/Risk:
        - Land Acquisition – A final letter was sent to the Deaton family. PE working with Legal to arrange a meeting with Mr. Crawford (legal counsel for Owens, McDole and now Deaton).
- **E.W. Brown Ash Pond Project**
    - Safety – NTR
    - Schedule/Execution:
        - Summit operated the water truck as dust control through 10/21. This effort will now be under Charah's responsibility.
        - Starter Dike contract work remains under suspension.
        - Completed proof-roll on South portion of Aux Pond expansion footprint.
        - Began placement of shot rock from the Starter Dike in the Aux Pond embankment.
        - Change order for Aux Pond project acceleration to be finalized week of 10/25.

- **SO3 Mitigation (Mill Creek 3, Mill Creek 4, Brown 3, Ghent)**
    - Safety – NTR
    - Testing:
        - E.ON Engineering outstanding
        - Breen test reports received.

- **SO3 Mitigation (Ghent)**
    - A&D to install injection ports on Ghent 4 pre-ID fan week of Nov. 1
    - Preparing design for new piping at Ghent 4 ESP inlet such that new Solvay lances can be tested

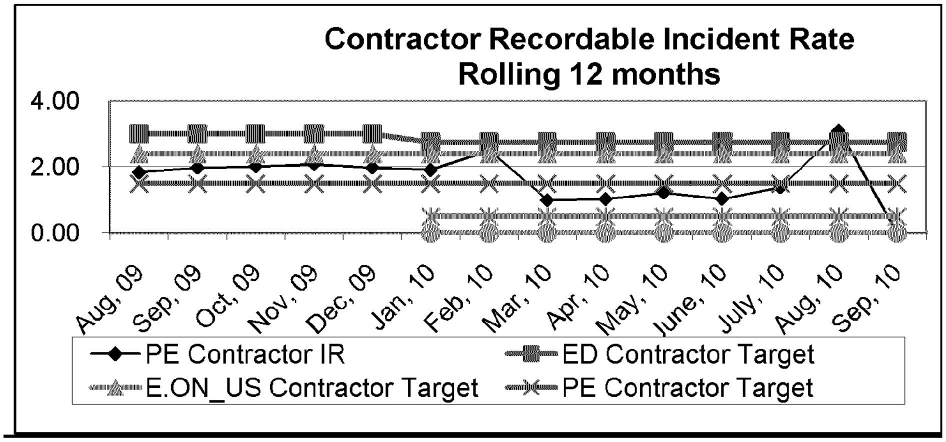
- **Cane Run CCGT**
    - Gas Pipe Line Routing – RFP released for routing analysis. Bids received from EMS, Photo Science and URS. Evaluation of bids and purchase order release planned for week of Nov 1.
    - Owner's Engineer – Scope of work prepared, RFP in development with plans to release the week of Nov 1. Bid list to include HDR, B&V, B&McD and possibly RW Beck. Bidding concept is to bid

  known scopes firm and annual budgetary estimates and rates for continued OE work scopes through the project.
  - Sound Survey – RFP prepared and released to bidders October 27.
  - Set-back Survey of Neighbors at Cane Run – PO released October 28 with on site work to commence week of Nov. 1.
  - Paddy's Run Siting Evaluation – Work with HDR|CB ongoing.
  - Two 1x1 Single Shaft Cost Estimate – Completed and forwarded to Generation Planning
  - Turndown Assessment of 2x1 – Completed and forwarded to Generation Planning
  - Start Up Emissions – Concerns for CO & VOC PSD netting out based on start up estimates; refining analysis week of Nov. 1.
  - Black Start at Cane Run – Black start of the NGCC is not required. CR 4-6 all use natural gas as start up fuel; the NGCC plant would have the same fuel delivery issue as the coal units.
  - Auxiliary Boiler – emissions profile submitted to EA

- **Other Generation Development**
  - LFG - NTR.
  - Biomass - NTR
  - CCS 100 MW Project –
    - EPRI work is ongoing.
    - KGS is released to begin work.
    - KBR GSA in final review..
  - FutureGen – NTR.

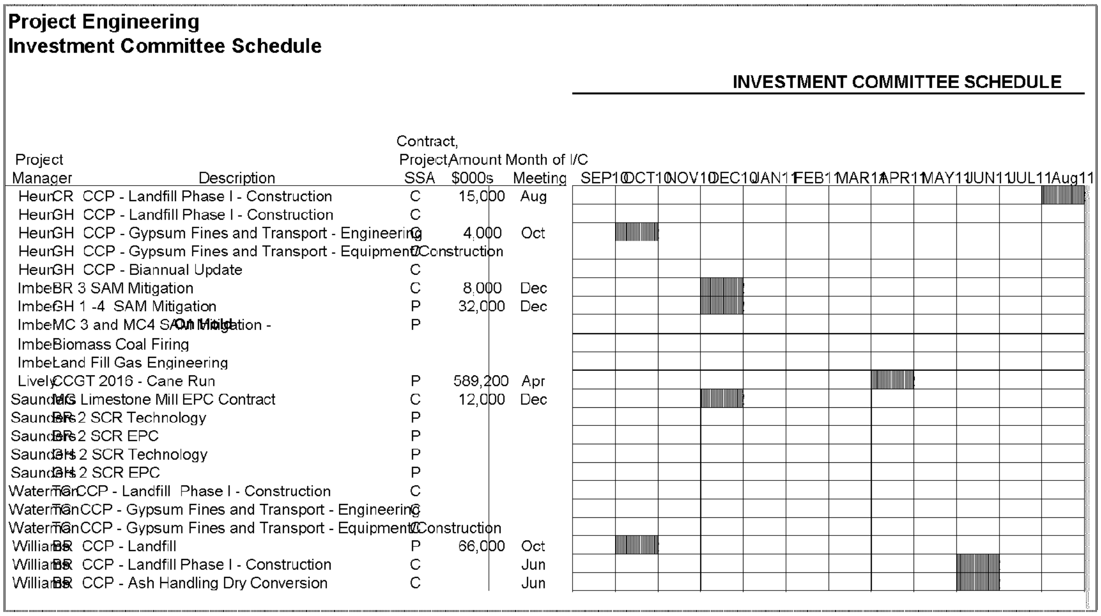
- **General**
  - Environmental Scenario Planning:
    - The kickoff for the Brown Program is scheduled for 11/10-11/11. A meeting with Project Engineering, Mill Creek Management and B&V is scheduled for 11/9/10 to review progress to date. Ghent data collection is in progress.
    - Hitachi and BPEI representatives were on site the week of October 25, 2010 to gather data for proposals to upgrade Mill Creek Unit 1, 2 and 4 FGDs.
    - Continue working with Gen Planning on the Revised Air Compliance analyses.
    - Provided Rates with major commitment dates on all air environmental projects needing ECR/CCN.
  - 2011 MTP ECR/CCN Filings – working closely with Rates on PSC submittals and presentations/updates.
  - Continue to work with Legal and EA on Ghent SAM compliance.
  - Continue to work with Legal on asbestos litigation regarding construction of TC1.

Metrics



Safety General – PE's YTD dropped significantly in September when it was discovered a significant number of hours at TC by PetroChem were being entered into the Stations history instead of PE's. The reversal of hours has brought PE in-line with our 2010 goals on IR.

Upcoming PWT Needs:



Project Engineering
Investment Committee Schedule

INVESTMENT COMMITTEE SCHEDULE

Project Manager	Description	Contract, Project, SSA	Amount $000s	Month of I/C Meeting	SEP10	OCT10	NOV10	DEC10	JAN11	FEB11	MAR11	APR11	MAY11	JUN11	JUL11	Aug11
Heun	CR CCP - Landfill Phase I - Construction	C	15,000	Aug												▨
Heun	GH CCP - Landfill Phase I - Construction	C														
Heun	GH CCP - Gypsum Fines and Transport - Engineering	C	4,000	Oct		▨										
Heun	GH CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Heun	GH CCP - Biannual Update	C														
Imbe	BR 3 SAM Mitigation	C	8,000	Dec				▨								
Imbe	GH 1 -4 SAM Mitigation	P	32,000	Dec				▨								
Imbe	MC 3 and MC4 SAM Mitigation - On Hold	P														
Imbe	Biomass Coal Firing															
Imbe	Land Fill Gas Engineering															
Lively	CCGT 2016 - Cane Run	P	589,200	Apr								▨				
Saunders	MC Limestone Mill EPC Contract	C	12,000	Dec				▨								
Saunders	BR 2 SCR Technology	P														
Saunders	BR 2 SCR EPC	P														
Saunders	GH 2 SCR Technology	P														
Saunders	GH 2 SCR EPC	P														
Waterman	TC CCP - Landfill Phase I - Construction	C														
Waterman	TC CCP - Gypsum Fines and Transport - Engineering	C														
Waterman	TC CCP - Gypsum Fines and Transport - Equipment/Construction	C														
Williams	BR CCP - Landfill	P	66,000	Oct		▨										
Williams	BR CCP - Landfill Phase I - Construction	C		Jun										▨		
Williams	BR CCP - Ash Handling Dry Conversion	C		Jun										▨		

Staffing

- Significant staffing increases in PE will be required to manage the current slate of projects in PE's draft 2011 MTP. Headcount planning to begin once MTP becomes approved from E.ON US and PPL.
- Lana Linkenhoker to return on November 1, 2010.
- New position being created to manage project approval documentation and schedules.

From:	Hillman, Timothy M.
To:	Saunders, Eileen
CC:	168908 E.ON-AQC; Jackson, Audrey; Lucas, Kyle J.; Goodlet, Roger F.; Lausman, Rick L.; Mahabaleshwarkar, Anand; Hintz, Monty E.; Wehrly, M. R.; Crabtree, Jonathan D.
Sent:	10/1/2010 8:47:36 AM
Subject:	168908.14.1000 101001 Ghent - Kickoff Meeting Agenda
Attachments:	EON Ghent Kickoff Meeting Agenda.doc

Eileen,

Please find attached a final copy of the agenda for the Ghent Kickoff. We plan to bring copies of the agenda and our presentation to the meeting.

If they are any other final details related to the kickoff meeting, lets plan on discussing them during our regularly scheduled Monday conference at 2 pm EST.

Finally, we are working on a priority-based schedule for the Mill Creek action item list, which we plan to send to you before the Monday call along with the updated action item list.

Best regards,

Tim Hillman | Project Manager
Power Generation - Environmental Services
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-7928**
Email: **hillmantm@bv.com**

From: Saunders, Eileen [mailto:Eileen.Saunders@eon-us.com]
Sent: Thursday, September 30, 2010 5:44 PM
To: Hillman, Timothy M.
Subject: Re: 168908.14.1000 100928 Ghent - Draft Kickoff Meeting Agenda

Tim,

After I do the introduction and purpose, Gary Revlett will do his Air Compliance overview. Once Gary is finished, B&V can do the presentation as reflected in the agenda.

Thanks,

Eileen

From: Hillman, Timothy M. <HillmanTM@bv.com>
To: Saunders, Eileen
Cc: Jackson, Audrey; 168908 E.ON-AQC <168908EONAQC@bv.com>; Wehrly, M. R. <WehrlyMR@bv.com>; Hintz, Monty E. <HintzME@bv.com>; Mahabaleshwarkar, Anand <MahabaleshwarkarA@bv.com>; Goodlet, Roger F. <GoodletRF@bv.com>; Lausman, Rick L. <LausmanRL@bv.com>; Lucas, Kyle J. <LucasKJ@bv.com>; Crabtree, Jonathan D. <CrabtreeJD@bv.com>; King, Michael L. (Mike) <kingml@bv.com>
Sent: Tue Sep 28 08:49:29 2010
Subject: 168908.14.1000 100928 Ghent - Draft Kickoff Meeting Agenda

Eileen,

Please find attached a draft meeting agenda for the Ghent kickoff meeting next week. Once again, I have assumed there will be lunch onsite. You will also note that agenda items III and IV on the first day include the presentations we discussed yesterday

during our conference call.
B&V attendees will include:

Anand Mahabaleshwarkar (Oct 6th only)
Rick Lausman
M.R. Wehrly
Monty Hintz
Roger Goodlet
Tim Hillman

Once I have your comments, I will finalize for distribution.

Best regards,

Tim Hillman | Project Manager
Power Generation - Environmental Services
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-7928**
Email: **hillmantm@bv.com**

AGENDA

Phase II Air Quality Control Study – Kickoff Meeting and Site Visit
E.ON - Ghent
October 6 - 7, 2010
Location: Ghent Generating Station

Day 1, October 6th, B&V Arrives 8 am

I. Introductions (Starts at 9 am)
II. Project/Scope Description (E.ON – Eileen S)
III. Environmental Drivers Presentation (E.ON – Gary R)
IV. Phase I Study Results/PJFF Overview Presentation (B&V – Rick L and Anand M)
V. Lunch (on site)
VI. Begin Escorted Site Walk Down and Data Collection

Day 2, October 7th, B&V Arrives 8 am

I. Continue Escorted Site Walk Down and Data Collection
II. Lunch (on site)
III. Site Debriefing Meeting
IV. Additional Walk Down Time if Required
V. Depart (no later than 4 pm)

From: Hillman, Timothy M.
To: Saunders, Eileen
CC: 168908 E.ON-AQC; Jackson, Audrey; Crabtree, Jonathan D.; Mahabaleshwarkar, Anand; Wehrly, M. R.; Lausman, Rick L.; Hintz, Monty E.; Goodlet, Roger F.; Betz, Alex
Sent: 10/1/2010 10:24:53 AM
Subject: 168908.28.3000 101001 - Action Item List
Attachments: 168908 EON ACTION ITEM LIST.xls

Eileen

Attached is the updated action item list for our weekly Monday conference call.

Regards,

Tim Hillman | Project Manager
Power Generation - Environmental Services
Black & Veatch - Building a World of Difference™
11401 Lamar Avenue
Overland Park, KS 66211
Phone: **(913) 458-7928**
Email: **hillmantm@bv.com**

	A	B	C	D	E	F	G	H	J	K	L	M	N
1	ITEM #	SOURCE		DESCRIPTION	FILE NO.	FACILITY	RESPONSIBILITY		ATE ADDE	IG DUE DA	RR DUE D	OMPL DAT	STATUS
2		DOC/MTNG	DATE				CO.	INITIAL					
3		**GENERAL**				n--	A						
4	11	KO & MC Site Vi	9/20/10	Evaluate pros and cons of NID system for November te	14.1000	n--	B&V	AM/RL	09/21/10	Nov. 2010			In Progress
5	13	KO & MC Site Vi	9/20/10	Provide structural steel study assessments	14.1000	n--	E.ON	ES	09/21/10	09/24/10	09/30/10		In Progress
6	14	KO & MC Site Vi	9/20/10	Provide minimum access dimension box	14.1000	n--	E.ON	ES	09/21/10	09/24/10	09/30/10		In Progress
7	18	Email 41.0100 1	9/29/10	Choose the coal fuel design basis for Mill Creek, Ghent,	41.0100	n--	E.ON	ES	09/30/10	10/06/10			Open
8	4	KO & MC Site Vi	9/20/10	Use B&V file system to set up E.ON document storage	14.1000	n--	E.ON	ES	09/21/10	TBD			Open
9	7	KO & MC Site Vi	9/20/10	Determine personnel assignments for document review	14.1000	n--	E.ON	ES	09/21/10	TBD			Open
10	12	KO & MC Site Vi	9/20/10	Schedule vendors for evaluation of existing scrubbers	14.1000	n--	E.ON	ES	09/21/10	TBD			Open
11		**MILL CREEK**				Mill Creek	A						
12	15	KO & MC Site Vi	9/20/10	Review B&V electrical study conducted in the 1990s	14.1000	Mill Creek	B&V	JB	09/21/10	09/24/10	TBD		Open
13	19	Re: Email 41.01	9/30/10	B&V to provide schedule/deadlines for Mill Creek inform	41.0100	Mill Creek	B&V	TH	09/30/10	10/06/10			In Progress
14	1	KO & MC Site Vi	9/20/10	Determine location for Mill Creek Task 6 Technology Se	14.1000	Mill Creek	E.ON	ES	09/21/10	10/15/10			In Progress
15	16	KO & MC Site Vi	9/20/10	Evaluate the possibility of accelerating the installation of	14.1000	Mill Creek	E.ON & B	ES &TH	09/21/10	TBD			Open
16		**GHENT**				Ghent	A						
17		**E.W. BROWN**				Brown	A						
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1	NOTES									
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4	Started - B&V met with Alstom Rep week of 9/13.									
5	CD received 9/27. Units 1, 2, and 4 on CD. Unit 3 still needed. Email request sent on 9/28.									
6	CD received 9/27. Access Dimension not included. Email request sent 9/28.									
7										
8	Planning to start set up of file system on 9/28.									
9	MC - Alex Betz and a couple others at plant.									
10										
11										
12	B&V could not locate study. Added to Data Request. Will review when E.ON provides study.									
13										
14	Potentially to be held in KC (9/27).									
15	B&V email addressed the acceleration of the SCR install for MC 1 & 2 (9/17). E.ON replied no change in direction at this time (9/27).									
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