VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, Joseph G. Potts, Principal Engineer, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing supplemental data requests and they are true and correct to the best of his knowledge, information, and belief.

Joseph G. Potts, Affiant

Subscribed and sworn to before me by Joseph G. Potts on this 22ND day of MAY, 2017.

ADELE M. FRISCH
Notary Public, State of Ohio
My Commission Expires 01-05-2019

NOTARY PUBLIC

My Commission Expires: 1/5/2019

VERIFICATION

STATE OF OHIO)
) **SS:**
COUNTY OF HAMILTON)

The undersigned, Subhashini Chandrasekar, Senior Engineer, being duly sworn, deposes and says that he has personal knowledge of the matters set forth in the foregoing supplemental data requests and they are true and correct to the best of his knowledge, information, and belief.

Subhashini C.

Subhashini Chandrasekar, Affiant

Subscribed and sworn to before me by Subhashini Chandrasekar on this 22ND day of MAY, 2017.

Adele M. Frisch

NOTARY PUBLIC

ADELE M. FRISCH
Notary Public, State of Ohio
My Commission Expires 01-05-2019

My Commission Expires: 1/5/2019

DEK Case No. 2016-00398
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Duke Energy Kentucky
Case No. 2016-00398
Staff First Set Data Requests
Date Received: January 17, 2017

STAFF-DR-01-003
SUPPLEMENTAL

REQUEST:

Refer to the Application, Exhibit 7, page 11 of 157. Section 2.4.1 states, "A screening process was completed to evaluate potential combinations of technologies that were considered feasible to provide the performance required and that also were in operation at other facilities with sufficient experience to confirm their viability for long term successful operation." Provide a copy of this analysis.

SUPPLEMENTAL RESPONSE:

The alternative technologies evaluated considered closure in place of the existing ash pond, which also necessitated construction of a separate new lined retention basin, new outfall, and water-redirection to the new pond for the remaining station waste water and storm water streams. The feasibility of constructing a new basin was speculative due to a lack of suitable land (flood plain, artifacts, and cemetery) on and surrounding the East Bend station that was sufficient for a new basin. Notwithstanding the issue of feasibility, the Company did perform a high-level evaluation of the costs of construction of a new separate basin and performed a comparison of these potential combinations of technologies. Please See Supplemental Staff DR-01-003 Attachment (a) and (b). When the cost of construction of a new basin was added to the evaluation, the selected strategy (Option 1A) of closure by removal and repurposing the existing pond as a lined basin was the least cost for Ash Basin Closure and Retention basin Construction Projects.

For ease of reference the Table 1 Planning Level Costs - below summarizes the data contained in Supplemental Staff DR-01-003-a. Strategies that included closure of the existing ash basin in place would require construction of a separate new lined basin for the other wastewater streams created at the station (coal pile run-off, leachate, sanitary, etc.). The Company's decision to pursue the Option 1A strategy was based upon comparison of planning level estimates (not fully engineered) that were performed as part of the initial evaluation. These planning level estimates assumed a new lined basin construction cost of approximately $50 million. When the cost of the new basin was added to the comparison versus the cost of pond repurposing, the Option 1A (closure by removal and pond repurposing) selected was more favorable by more than $20 million. Repurposing of the existing pond allows closure by removal and avoided the land availability challenges with having to construct an entirely new basin, and also relocates the ash to the new lined landfill

Table 2 Construction Level Costs - below compares fully engineered Option 1A costs as contained in the Company's CPCN application to estimated construction level costs of the closure in place strategies (Option 3A or 4) with construction of a separate new pond. The water redirection costs are assumed to be identical as with either strategy process modifications, storm water, and wastewater streams will need to be diverted. The projected construction level costs for the closure in place strategies were calculated using an escalation factor of 1.3 based upon the difference between planning level estimates of Option 1A to a fully engineered construction estimate. The construction level estimate factored in construction materials and activities that were not considered during the initial planning level estimates. The Company is confident that if a fully engineered closure in

place with separate new basin construction strategy were pursued, notwithstanding the issue of finding a suitable location for a new basin on or near the East Bend station, the total costs would far exceed the closure by removal and pond repurposing strategy ultimately selected as evident in the cost projections shown on Table 2.

TABLE 1: PLANNING LEVEL COSTS

	Option 1A (CLOSURE BY REMOVAL)	**Option 3A or 4 (CLOSURE IN PLACE)**
Basin closure planning level cost BD-1 (pg. 21)	$22,00,000	$14,500,000
Planning level estimated basin cost for re-purposing existing basin (Supplemental Staff DR-01-003-a)	$21,250,000 [1]	N/A
Planning level estimated basin cost for standalone new basin construction	N/A	$50,000,000 [2]
PLANNING LEVEL COMPARISON OF CLOSURE + RE-PURPOSING PROJECTS (Supplemental Staff DR-01-003- a)	**$43,750,000**	**$64,500,000**

[1] Refer to values at the bottom of the spreadsheet attachment "DR01-003-a" $21,250,000 = $11,250,000 + $5,000,000 + $5,000,000 (Liner + Temp berm & water handling + Dewatering basins)

[2] Refer to values at the bottom of the spreadsheet attachment "DR01-003-a" $50,000,000 = $20,000,000 + $15,000,000 + $11,250,000 + $5,000,000 (New outfall + new pumps & electrical for re-routing flows + Liner + Dewatering basins) Note: this estimate is partial and does not include excavation and soils for a new basin. Note: $50,000,000 is a rounded value from $51,250,000)

TABLE 2: CONSTRUCTION LEVEL COSTS

	Option 1A **(CLOSURE BY REMOVAL)** **FULLY LOADED CONSTRUCTION COST AS REFLECTED IN CPCN APPPLICATION**	**Option 3A or 4** **(CLOSURE IN PLACE)** **PROJECTED CONSTRUCTION COST USING ESTIMATED FACTOR OF 1.3**
Fully loaded basin closure construction cost (Attachment BD-02)	$29,000,000 [3]	$18,850,000 ($14,500,000 [4]*1.3)
Fully loaded pond re-purposing project construction cost (BD-04)	$36,100,000 [5]	
Projected fully loaded estimated basin cost for standalone new basin construction		$65,000,000 ($50,000,000 [6]*1.3)
Fully loaded water re-direction project cost (BD-03)	$28,100,000 [7]	$28,100,000 (assumes no difference in water re-direction costs)
TOTAL	**$93,200,000**	**$112,000,000**

PERSON RESPONSIBLE: Joseph Potts / Subhashini Chandrasekar

[3] CPCN attachment BD-2 & Testimony BD-1 pg. 14

[4] CPCN attachment BD-1 pg. 22

[5] CPCN attachment BD-4 & Testimony BD-1 pg. 14

[6] CPCN Supplement DR01-003-a and Table-1, footnote 2

[7] CPCN attachment BD-3 & Testimony BD-1 pg. 14

Criteria for Evaluation of Closure Options
Closure Options Evaluation Worksheet
Ash Basin Closure - Master Programmatic Document
Duke Energy

Threshold Criteria: All closure options must comply with the following threshold criteria based on Duke Energy Guiding Principals for Ash Basin Closure
1. Provide continued geotechnical stability under applicable loading conditions and safety factors
2. Provide flow capacity and erosion resistance during design storm and flooding conditions
3. Effectively mitigate groundwater impacts
4. Comply with applicable state and federal regulations (e.g. North Carolina Coal Ash Management Act)

Category	Criterion	Guidance
Environmental Protection and Impacts	Time to achieve compliance with groundwater standards at compliance boundary	Input time to achieve compliance as calculated by groundwater model.
	Residual groundwater-related risk	Based on source removed, source remains above groundwater, source remains below groundwater, conduits remain below ash pond.
	Proximity to riverbank, shoreline, or floodplain - choose reference feature appropriate for the site	Refer to Scoring System and Required Input columns on scoring sheet.
	Proximity to public drinking water intakes	Refer to Scoring System and Required Input columns on scoring sheet.
	Proximity to nearest downgradient potable water well	Refer to Scoring System and Required Input columns on scoring sheet.
	Proximity to flora, fauna and human receptors	Refer to Scoring System and Required Input columns on scoring sheet.
	Restoration of habitat, streams or wetlands	Refer to Scoring System and Required Input columns on scoring sheet.
	Air emissions off-site	Based on truck miles driven for hauling CCR and soil.
	Air emissions on-site from closure implementation	Based on total cubic yards of cut and fill on site as a surrogate for gallons of fuel consumed
	Avoidance of greenfield disturbance	Refer to Scoring System and Required Input columns on scoring sheet.
Cost	Capital Cost	From rough order-of-magnitude cost estimate or detailed cost estimate.
	Operation, Maintenance and Monitoring Cost	
Schedule	Initiation Time	From preliminary schedule for designing, permitting, bidding and constructing the option.
	Construction Duration	
Regional Factors	Plan or potential for beneficial reuse of site	Refer to Scoring System and Required Input columns on scoring sheet.
	Imported soil needs	Refer to Scoring System and Required Input columns on scoring sheet.
	Beneficial reuse of CCR	Refer to Scoring System and Required Input columns on scoring sheet.
	Transportation impact	Based on truck miles driven for hauling CCR and soil.
	Noise impact due to on-site activity	Based on proximity of neighbors to specific on-site work areas.
	View impact	Based on final height of storage facility and land uses within viewshed.
Constructability	Consider stormwater management, geotechnical, and dewatering	Subjective and relative comparison to other options

Scoring for Evaluation of Closure Options
Closure Options Evaluation Worksheet
Ash Basin Closure - Master Programmatic Document
Duke Energy

Site Name: East Bend Station

= Option-Specific User Input
= Calculated Value

Criterion	Value that Scores 10	Value that Scores 0	Option 1	Option 1A	Option 2	Option 2A	Option 3	Option 3A	Option 4	Criterion Weight	Contribution to Total Score
Time to achieve compliance with groundwater standards at compliance boundary	2	6	10	10	0	0	5	3	3	15%	4.5%
Result of groundwater model [illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	20%	6.0%
Proximity to [illegible]	3600	250	10	10	0	0	0	0	0	10%	3.0%
Proximity to public drinking water intakes	92	83.5	10	10	10	10	10	10	10	5%	1.5%
Proximity to nearest downgradient potable water well	3	2.25	10	10	10	10	10	10	10	5%	1.5%
Proximity to flora, fauna and human receptors			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	5%	1.5%
Disturbance of habitat, streams or wetlands	80	5	10	0	1	2	5	5	0	10%	3.0%
Air emissions off-site	0	400000	10	10	0	10	5	10	5	5%	1.5%
Air emissions on-site	283640	1630421	0	5	10	7	7	6	3	5%	1.5%
Avoidance of greenfield disturbance	30	20	0	0	0	0	5	5	10	20%	6.0%
Closure Cost*	$43,750,000	$77,500,000	8.8	10.0	2.9	2.7	3.9	3.8	3.9	80%	[illegible]
Operation, Maintenance and Monitoring Cost	$0	$4,100,000	10.0	10.0	0.0	0.0	2.9	2.5	5.8	20%	[illegible]

This Area Not Used For Subjective Scoring

Not Used For Subjective Scoring

*Note that the costs for three options include a ~$50M capital costs for construction of a separate lined retention basin for site water management as shown below:

Reuse ash basin for water re-direct (Option 1A)	
Ash removal base cost for 1A	$22,500,000
Liner cost for re-purposed pond @ $250k/ac	$11,250,000
Temporary berm & temp water handling	$5,000,000
Dewatering basins	$5,000,000
TOTAL	$43,750,000
Construct stand-alone new pond for water re-direct	
Ash basin base closure cost for Option 4	$14,500,000 Least cost closure option but not feasible to maintain outfall while lathing the pond
New outfall construction cost	$20,000,000
New pumps and electrical cost for re-routing flows	$15,000,000
New liner cost @ $250k/ac	$11,250,000
Dewatering basins	$5,000,000
TOTAL	$65,750,000

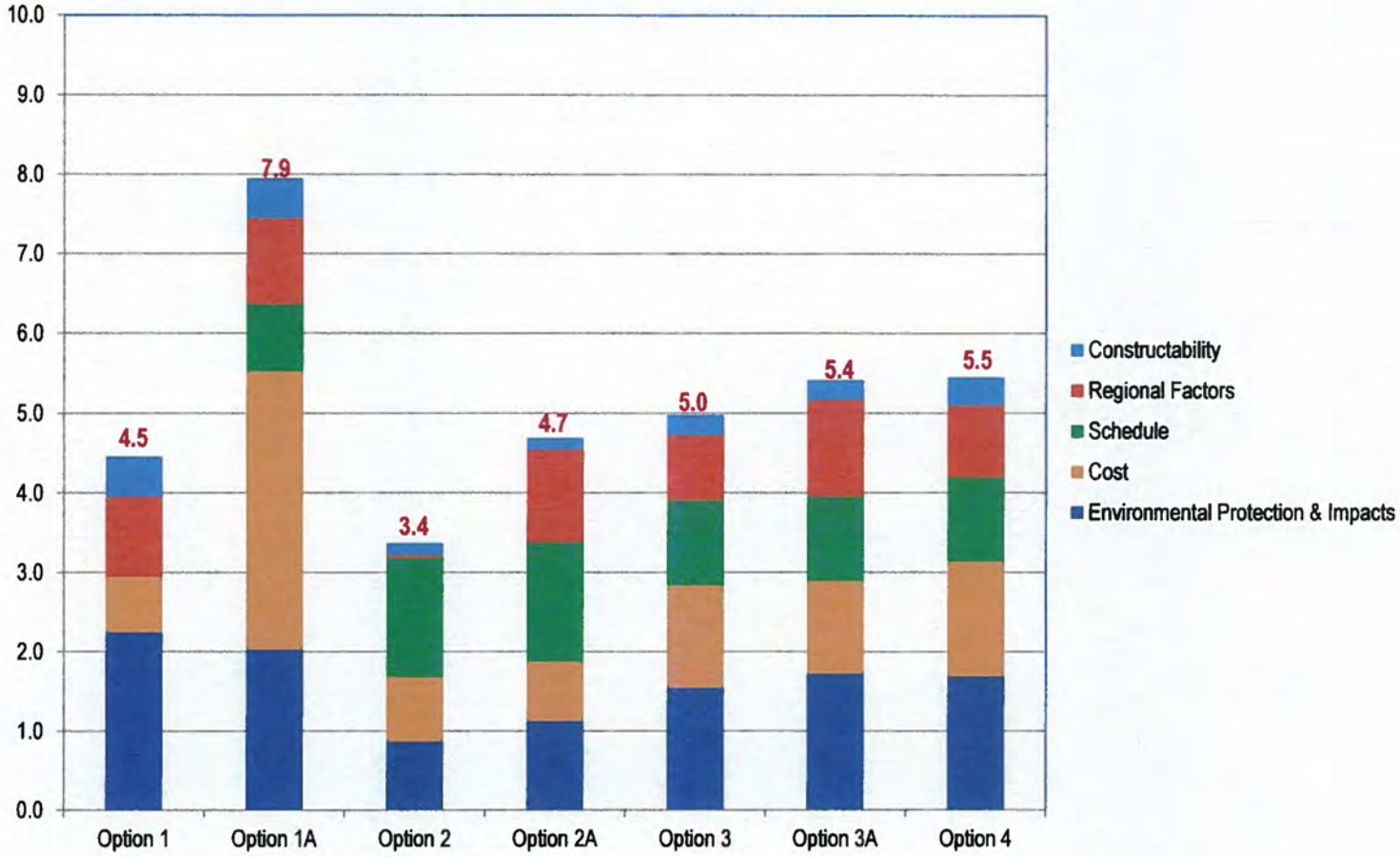
Approximate total adder cost for stand-alone basin construction is ~$50M
Overall project costs are lesser for Option 1A

Draft East Bend Ash Basin Closure Strategy

Summary of Closure Options

Option	Description
1	Ash Removal to the onsite West Special Waste landfill and fill and grade to drain
1A	Ash Removal to the onsite West Special Waste landfill and fill and grade to drain and use the ash basin for site water management
2	Close in place using compacted clay from offsite in final cover system
2A	Close in place with geosynthetics and onsite soil
3	Hybrid 1- Consolidate into smaller footprint to the west and close with compacted clay from offsite
3A	Hybrid 1-Consolidate into smaller footprint to the west and close with geosynthetics and onsite soil
4	Hybrid 2-Consolidate into smaller footprint to the west and close in place, use eastside for site water management

Closure Options Scoring Summary



Closure Options Cost Summary

Closure Option	Estimated Construction Cost*
Option 1	$77,500,000**
Option 1A	$43,750,000
Option 2	$67,600,000**
Option 2A	$68,500,000**
Option 3	$64,200,000**
Option 3A	$64,700,000**
Option 4	$64,500,000**

**These costs are conceptual level planning costs derived for comparison purposes only*

*** Note that the costs for these options include $50M capital costs for construction of a separate lined retention basin for site water management*

Removal Option vs Hybrid Closure Option

	Pros	Cons
Option 1A - Ash Removal to the onsite West Special Waste landfill and fill and grade to drain and use the ash basin for site management	• Complete removal of ash in the basin and place in lined landfill • Shorter timeframe to reduce groundwater impacts • No long term environmental monitoring or maintenance • Less miles driven and potentially less air quality impacts	• Cost highest for removal and transfer to on-site landfill • Longer timeframe for closure • Additional soil needed from on-site borrow for grading to drain • Consumes on-site landfill airspace

Removal Option vs Hybrid Closure Option (Cont'd)

	Pros	Cons
Option 4 - Consolidate into smaller footprint to the west and close in place, use eastside for site water management	• Lower costs than removal • Shorter time frame for closure than removal • Minimizes ash contact and disturbance and long-term monitoring and maintenance • Minimizes ash footprint and potential exposure to groundwater	• Longer to reduce groundwater impacts and potential for groundwater fluctuations into the ash • Proximity to riverbank or shoreline • Long-term monitoring and maintenance

Summary

- Duke evaluated a wide range of closure options for East Bend
- Critically examined top 2 scoring options:
  - Option 1A Ash Removal to the onsite landfills and line and re-purpose the ash basin for site water management
  - Option 4 Hybrid 2-Consolidate into smaller footprint to the west and close in place, use eastside for site water management
- Recommendation is to proceed with Option 1A-CBR and re-purpose the ash basin because it provides significant environmental as well as cost benefits, compared to the other options