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June 6, 2012

VIA HAND-DELIVERY

Mr. Jeff DeRouen
Executive Director
Kentucky Public Service Commission
211 Sower Boulevard
P.O. Box 615
Frankfort, KY 40602-0615

Re: Application of Louisville Gas and Electric Company for an Order Authorizing the Issuance of Securities and the Assumption of Obligations

Dear Mr. DeRouen:

Enclosed for filing, please find the original and ten (10) copies of the Application of Louisville Gas and Electric Company for an Order Authorizing the Issuance of Securities and the Assumption of Obligations. Also enclosed are an original and ten (10) copies of Applicant's Petition for Confidential Protection and Motion for Deviation from Commission Rules. The confidential material which is the subject of the Petition and Motion is being filed under seal. An extra copy of both the Application and the Petition and Motion are enclosed to be filed stamped and returned to the undersigned.

Please do not hesitate to contact me should you have any questions or require additional information.

Very truly yours,

J. Wade Hendricks

JWH/dvg
Enclosures

cc: Dennis G. Howard, II

400001.143117/830137.1

COMMONWEALTH OF KENTUCKY

BEFORE THE PUBLIC SERVICE COMMISSION

In The Matter Of:

THE APPLICATION OF LOUISVILLE GAS AND ELECTRIC COMPANY FOR AN ORDER AUTHORIZING THE ISSUANCE OF SECURITIES AND THE ASSUMPTION OF OBLIGATIONS	)))))	**CASE NO. 2012-**

APPLICATION

Louisville Gas and Electric Company ("LG&E" or the "Company") hereby requests, pursuant to KRS 278.300, that the Commission authorize LG&E to incur debt in the form of First Mortgage Bonds in a principal amount not to exceed $350,000,000. LG&E further requests authority to increase the amount of its multi-year revolving line of credit by up to an additional $100,000,000. In support of its Application, LG&E states as follows:

1. The Company's full name is Louisville Gas and Electric Company. The post office address of the Company is 220 West Main Street, Louisville, Kentucky 40202. LG&E is a Kentucky corporation, a utility as defined by KRS 278.010(3)(a) and (b), and, as of March 31, 2012, provides retail electric service to approximately 393,000 customers in nine counties in Kentucky, and retail gas service to approximately 319,000 customers in sixteen counties in Kentucky. A description of LG&E's properties is set out in Exhibit 1 to this Application. A certified copy of the Company's Articles of Incorporation was filed with the Commission in Case No. 2010-00204 and is incorporated by reference herein pursuant to 807 KAR 5:001, Section 8(3).

2. LG&E obtains financing through numerous sources of capital, including the forms of debt that are the subject of this Application. LG&E does not assign specific financing

to any particular project or use, and does not project-finance capital projects. All components of LG&E's capital structure are used to fund capital expenditures. Thus, the uses cited below are general reasons for LG&E's need for debt financing, rather than projects to which specific financing will be assigned.

FIRST MORTGAGE BOND DEBT

3. LG&E requests, pursuant to KRS 278.300, that the Commission authorize it to incur additional long-term debt in the form of First Mortgage Bonds in a principal amount not to exceed $350,000,000.

4. During 2012 and 2013, LG&E anticipates incurring up to approximately $1.3 billion in construction costs. In Case No. 2011-00375[1] by Order dated May 3, 2012, the Commission granted LG&E a Certificate of Public Convenience and Necessity and a Site Compatibility Certificate to construct a new 640 MW combined cycle combustion turbine unit at the Cane Run Generating Station in Jefferson County, and to purchase three turbines in LaGrange, Kentucky. By Order dated December 15, 2011, in Case No. 2011-00162,[2] the Commission approved LG&E's 2011 Environmental Compliance Plan and granted LG&E Certificates of Public Convenience and Necessity to upgrade existing equipment or to construct new pollution control equipment at the Mill Creek generating station in Jefferson County. The facilities which were the subjects of Case Nos. 2011-00375 and 2011-00162 are described in greater detail in Exhibit 4 and in the records of those cases. The costs of these projects are reflected in LG&E's capital budget which is attached as Exhibit 2.

---

[1] *Joint Application of Louisville Gas and Electric Company and Kentucky Utilities Company for a Certificate of Public Convenience and Necessity and Site Compatibility Certificate for the Construction of a Combined Cycle Combustion Turbine at the Cane Run Generating Station and the Purchase of Existing Simple Cycle Combustion Turbine Facilities from Bluegrass Generation Company, LLC in LaGrange, Kentucky.*

[2] *Application of Louisville Gas and Electric Company for Certificate of Public Convenience and Necessity and Approval of Its 2011 Compliance Plan for Recovery by Environmental Surcharge.*

5. The Company's Mortgage Indenture (the "Indenture") authorizes it to issue, from time to time, bonds ("First Mortgage Bonds") of one or more series, with each series having such date, maturity date(s), interest rate(s), and other terms as may be established by a supplemental indenture executed by the Company in connection with such series. All bonds issued under the Indenture would be equally and ratably secured by a first mortgage lien on substantially all of the Company's permanently fixed properties in Kentucky. A copy of the form of the Indenture has been previously filed with the Commission in Case No. 2010-00205.[3]

6. The First Mortgage Bonds may be sold at various times through the remainder of 2012 and 2013 in one or more underwritten public offerings, negotiated sales, or private placement transactions utilizing the proper documentation.

7. The First Mortgage Bonds of each series would be issued and secured by the Indenture as to be further supplemented and amended by a supplemental indenture creating the bonds of such series. Such supplemental indenture would set forth the terms and provisions of such series, including without limitation, the maturity date(s), interest rate(s), redemption provisions and other applicable terms. The First Mortgage Bonds of each series may be sold in one or more underwritten public offerings, negotiated sales, or private placement transactions utilizing the proper documentation. The price, maturity date(s), interest rate(s), and the redemption provisions, and other terms and provisions of each series of First Mortgage Bonds (including, in the event all or a portion of the First Mortgage Bonds bear a variable rate of interest, the method for determining the interest rates), would be determined on the basis of negotiations among LG&E and the underwriters or other purchasers of such First Mortgage Bonds. The amount of compensation to be paid to underwriters or purchasers for their services would not exceed one percent (1%) of the principal amount of the First Mortgage Bonds of the

[3] *Application of Louisville Gas and Electric Company for An Order Authorizing the Restructure and Refinancing of Unsecured Debt and the Assumption of Obligations and For Amendment of Existing Authority.*

series to be sold. Based upon past experience with similar financings, LG&E estimates that issuance costs, excluding underwriting fees, would be approximately $650,000.

8. Because of the historical spread between long-term fixed interest rates and short-term rates, all or a portion of the bonds could be issued with an interest rate that fluctuates on a quarterly or semi-annual basis .

9. In connection with the issuance of First Mortgage Bonds, LG&E may enter into one or more interest rate hedging agreements (including an interest rate cap, swap, collar, or similar agreement, collectively, the "Hedging Facility") with a PPL affiliate company, or a bank or financial institution (the "Counterparty"). The Hedging Facility would be an interest rate agreement designed to allow LG&E to actively manage and limit its exposure to variable interest rates or to lower its overall borrowing costs on any fixed rate First Mortgage Bond. The estimated cost of the financing does not include the costs of any Hedging Facility which would be determined at the time of the hedge. However, based on current market conditions, the cost of a three-year hedge would be approximately 17 basis points (.17%). The Hedging Facility could also be used to lock in interest rates in advance of a debt issuance. Once again based on current market conditions, the Company could lock in current rates for six months for a cost of approximately 15 basis points (.15%).

10. The terms of each Hedging Facility will be negotiated by LG&E with the respective Counterparty and would be the most favorable terms that can be negotiated by the Company.

INCREASE IN AMOUNT OF MULTI-YEAR REVOLVING LINE OF CREDIT

11. LG&E requests authority to increase the amount of its multi-year revolving line of credit by up to an additional $100,000,000 or, in the alternative, to enter into similar additional facilities not to exceed that amount.

12. By Order dated September 30, 2010, in Case No. 2010-00205, the Commission authorized LG&E to enter into one or more multi-year revolving credit facilities (the "Revolving Line of Credit") with one or more financial institutions in an aggregate amount not to exceed $400,000,000. The Revolving Line of Credit replaced similar revolving credit facilities, originally authorized in Case No. 2007-00232, which by Order dated August 2, 2007, the Commission had found would, by allowing LG&E the ongoing ability to incur short-term debt from time to time, alleviate the time and cost of annually negotiating and renewing short-term debt arrangements.

13. LG&E subsequently entered into its Revolving Line of Credit with a termination date of December 31, 2014. Subsequently, in Case No. 2011-00308 LG&E requested, and by Order dated October 10, 2011, the Commission authorized, LG&E to extend the term of its revolving credit facilities through December 31, 2016. By doing so, LG&E was able to pay lower on-going commitment fees immediately and incur a lower upfront fee to extend the existing facility than if it waited until the term expired in 2014. The facility was amended in October 2011, and now matures on October 19, 2016. Amending the existing facility also significantly reduced the credit spread the Company pays when it borrows under the line of credit, and the commitment fee paid under the facility for undrawn amounts.

14. The Revolving Line of Credit provides LG&E with the opportunity to request that the maximum debt allowed under the credit facility be increased by $100,000,000 to $500,000,000. While the lenders are not obligated to increase the limit under the Revolving Line of Credit, LG&E believes that it is likely that the lenders will agree to do so. However, in the event that the current lenders are unable or unwilling to increase the credit limit, LG&E proposes to obtain an additional revolving credit facility in the amount of $100,000,000. LG&E anticipates that any new, additional revolving credit facility would be on similar terms as its current Revolving Line of Credit, including a term not to exceed five (5) years. Exhibit 3, shows

the anticipated additional cost of increasing the credit limit under the existing credit facility, and alternatively, of entering into an additional revolving credit facility with a credit limit of $100,000,000.

15. The additional credit under the revolving credit facility would be available for the same purposes for which existing credit is currently available. Loan proceeds could be used to provide short-term financing for LG&E's general funding needs, for example, general costs of operation, costs of LG&E's various construction programs, or other general business purposes, until permanent or long-term financing can be arranged. In addition, the additional funds could be used to provide new or expanded liquidity or credit support for LG&E's other debt. For example, credit could be used to ensure that LG&E has readily available funds with which to repay commercial paper borrowings at their maturity.

16. No contracts have been made for the disposition of any of the securities which LG&E proposes to issue.

17. A redacted copy of a contract with respect to the projects noted in Paragraph 4 is attached as Exhibit 4. Filed concurrently with this Application is LG&E's Motion for Confidential Protection and for Deviation from Commission Rules.

18. LG&E shall, as soon as reasonably practicable after the issuance of each series of First Mortgage Bonds referred to herein, file with the Commission a statement setting forth the date or dates of issuance of the First Mortgage Bonds, the proceeds of such series of Bonds, the interest rates, costs or gains with any Hedging Facility and all fees and expenses associated with such issuance.

19. As soon as reasonably practicable after amendment of LG&E's Revolving Line of Credit to increase the debt allowed under such instrument, or, alternatively, entrance into a new and additional line of credit, LG&E shall file with the Commission a statement setting forth the date or dates of such action, as well as all fees and expenses.

20. Exhibit 5 to this Application contains the financial exhibit required by 807 KAR 5:001, Section 11(2)(a) and described by 807 KAR 5:001, Section 6. It also contains information required by 807 KAR 5:001, Section 11(2)(b).

21. Exhibit 6 to this Application is a certified copy of LG&E's Board of Directors' Resolution authorizing the issuance of the First Mortgage Bonds, the increase in the debt limit under the revolving credit facility, and the transactions related thereto as discussed in this Application.

22. Other requirements of the Commission's regulations concerning this Application, 807 KAR 5:001, Section 11, including (1)(b) regarding the amount and kind of bonds, etc., and 1(c) regarding the use to be made of the proceeds, have been supplied in the discussion above in Paragraphs 2 through 17 of this Application.

THEREFORE, Louisville Gas and Electric Company respectfully requests that the Commission enter its Order authorizing LG&E to issue securities in the form of First Mortgage Bonds in a total amount not to exceed $350,000,000 and to increase the credit limit under its existing revolving line of credit by up to an additional $100,000,000, or in the alternative, to enter into one or more new revolving credit facilities in addition to its existing credit facility, provided that the total revolving credit limit increase, whether under the existing line of credit, under the new revolving credit facility or facilities or in combination of both, shall not exceed an additional $100,000,000, all as set forth in this Application. LG&E further requests that the Order of the Commission specifically include provisions stating:

1. LG&E is authorized to issue long-term debt in the form of First Mortgage Bonds in one or more series at one or more times during the remainder of 2012 through 2013, in an aggregate principal amount not to exceed $350,000,000 in the manner set forth in its Application.

2. LG&E is authorized to execute an amendment to its existing revolving line of credit increasing the total principal amount of debt under said line or in the alternative, to enter into one or more new additional revolving credit facilities with a term not to exceed five (5) years, such increases in the existing line of credit and/or new facilities to not exceed, in total, a combined additional aggregate principal amount of $100,000,000.

3. LG&E is authorized to execute, deliver and perform the obligations of LG&E under all such agreements and documents as set out in its Application, and to perform the transactions contemplated by such agreements.

Dated: June 6, 2012.

Respectfully submitted,

Kendrick R. Riggs
John Wade Hendricks
Barry L. Dunn
Stoll Keenon Ogden PLLC
2000 PNC Plaza
500 West Jefferson Street
Louisville, Kentucky 40202
(502) 333-6000

Allyson K. Sturgeon
Senior Corporate Attorney
LG&E and KU Energy LLC
220 West Main Street
Louisville, KY 40202
(502) 627-2088

Counsel for Louisville Gas and Electric Company

VERIFICATION

COMMONWEALTH OF KENTUCKY

COUNTY OF JEFFERSON

Daniel K. Arbough, being first duly sworn, deposes and says that he is Treasurer for Louisville Gas and Electric Company, that he has read the foregoing Application and knows the contents thereof, and that the same is true of his own knowledge, except as to matters which are therein stated on information or belief, and that as to these matters, he believes them to be true.

DANIEL K. ARBOUGH

Subscribed and sworn before me this 4th day of June, 2012.

My Commission Expires: August 31, 2015

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LOUISVILLE GAS AND ELECTRIC COMPANY
(807 KAR 5:001, Section 11, Item 1 (a))

A DESCRIPTION OF APPLICANT'S PROPERTY, INCLUDING A STATEMENT OF THE NET ORIGINAL COST OF THE PROPERTY AND THE COST THEREOF TO APPLICANT

March 31, 2012

The applicant's generating, transmission and distribution systems described herein are calculated annually. As of December 31, 2011, the applicant owned 11 and operated 9 coal fired steam electric generating units having a total capacity of 2,656 Mw; 14 combustion turbine generating units having a total capacity of 644 Mw; and 1 hydroelectric generating station, the operation of which is affected by the water level and flow of the Ohio River, having a total capacity of 52 Mw.

The applicant's owned electric transmission system included 45 substations (32 of which are shared with the distribution system) with a total capacity of 7 million kVA and 916 circuit miles of lines. The distribution system included 97 substations (32 of which are shared with the transmission system) with a total capacity of 5 million kVA, 3,887 miles of overhead lines and 2,371 miles of underground wires.

The applicant's natural gas transmission system includes 4,290 miles of gas distribution mains and 386 miles of gas transmission mains, consisting of 254 miles of gas transmission pipeline, 123 miles of gas transmission storage lines, 6 miles of gas combustion turbine lines, and 3 miles of gas transmission pipeline in regulator facilities. Five underground natural gas storage fields, with a total working natural gas capacity of approximately 15 Bcf, are used in providing natural gas service to ultimate consumers.

Other properties include an office building, service centers, warehouses, garages and other structures and equipment, the use of which is common to both the electric and gas departments.

The net original cost of the property and cost thereof to the applicant at March 31, 2012, was:

	Electric	Gas	Common	Total	
Original Cost	$ 3,910,346,477	$ 784,887,882	$ 238,471,430	$ 4,933,705,789	
Less Reserve for Depreciation	1,578,149,869	181,608,155	100,933,414	1,860,691,438	*
Net Original Cost	2,332,196,608	603,279,727	137,538,016	3,073,014,351	
Allocation of Common To Electric and Gas	108,668,786	28,869,230	(137,538,016)	-	
Total	$ 2,440,865,394	$ 632,148,957	$ -	$ 3,073,014,351	

* Excludes $285,361,226 related to cost of removal reserves that is not included in the reserve in the Financial Statements and Additional Information, but instead is included as a regulatory liability.

LG&E

	($ millions) Projected				
	2012	2013	2014	2015	2016
Construction expenditures					
Generating facilities (a)	$ 146	$ 102	$ 128	$ 123	$ 52
Distribution facilities	134	162	151	180	170
Transmission facilities (b)	27	57	34	30	25
Environmental	233	421	441	449	41
Other	14	22	20	27	25
Total Construction Expenditures	$ 554	$ 764	$ 774	$ 809	$ 313

(a) Includes approximately $200 million of currently estimable costs related to replacement generation units due to EPA regulations not recoverable through the ECR mechanism. LG&E expects to recover over a period equivalent to the related depreciable lives of the assets through future rate proceedings.

(b) Includes approximately $70 million of currently estimable transmission costs related to replacement generation units. LG&E expects to recover these costs over a period equivalent to the related depreciable lives of the assets through future rate proceedings.

Estimated Cost of Increasing Current Credit Facility by $100 Million

Costs:

Upfront fees:		
	Assumes Lenders are paid 5bp upfront fee to commit	$ 50,000
Annual Utilization Fee:	$100 million x 0.125%	$ 125,000

Estimated Tax Rate	40.363%
Estimated Discount Rate	0.82%

NPV	Undrawn Cost of Borrowing	Undrawn Amortization	Upfront Cost	Taxes	Total Cash Outlay (Aftertax)	Present Value	
Year 0			$ 50,000		$ 50,000	$ 50,000	0
Year 1	$ 125,000	$ 16,667		$ (57,180)	$ 67,820	$ 67,268	1
Year 2	$ 125,000	$ 16,667		$ (57,180)	$ 67,820	$ 66,721	2
Year 3	$ 125,000	$ 16,667		$ (57,180)	$ 67,820	$ 66,178	3
						$ 250,168	

Income Statement View	Undrawn
Interest Expense	$ (125,000)
Amortization	$ (16,667)
Income Before Taxes	$ (141,667)
Taxes	$ 57,180
Net Income	$ (84,486)

Exhibit 3
Page 1 of 2

Estimated Cost of Additional New $100 Million Credit Facility

Costs:

Upfront fees:	Assumes one time upfront fee of 25bps.	$ 250,000
	Estimated Legal fees	50,000
	Total estimated upfront fees	$ 300,000
Annual Utilization Fee:	$100 million x 0.125%	$ 125,000

Estimated Tax Rate	40.363%
Estimated Discount Rate	0.82%

NPV	Undrawn Cost of Borrowing	Undrawn Amortization	Upfront Cost	Taxes	Total Cash Outlay (Aftertax)	Present Value	
Year 0			$ 300,000		$ 300,000	$ 300,000	0
Year 1	$ 125,000	$ 100,000		$ (90,816)	$ 34,184	$ 33,906	1
Year 2	$ 125,000	$ 100,000		$ (90,816)	$ 34,184	$ 33,631	2
Year 3	$ 125,000	$ 100,000		$ (90,816)	$ 34,184	$ 33,357	3
						$ 400,894	

Income Statement View	Undrawn
Interest Expense	$ (125,000)
Amortization	$ (100,000)
Income Before Taxes	$ (225,000)
Taxes	$ 90,816
Net Income	$ (134,184)

EQUIPMENT PURCHASE AGREEMENT

FOR

WFGD

between

Babcock Power Environmental Inc.

as WFGD Supplier

and

Louisville Gas and Electric Company

as Buyer

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EQUIPMENT PURCHASE AGREEMENT

This Equipment Purchase Agreement (the "**Agreement**") is entered into as of the 19th day of April, 2012 ("**Effective Date**") by and between Louisville Gas and Electric Company, a Kentucky corporation ("**Buyer**") and Babcock Power Environmental Inc., a Delaware corporation ("**WFGD Supplier**").

WHEREAS, Buyer desires to enter into an agreement with a qualified equipment supplier to purchase the Equipment and Materials (as hereinafter defined) with related technical services as set forth in this Agreement;

WHEREAS, WFGD Supplier represents that it is qualified to supply the Equipment and Materials and desires to perform all Work and other obligations in connection therewith in accordance with the terms and conditions of this Agreement; and

WHEREAS, WFGD Supplier agrees to supply the WFGD and perform the Work and other obligations in accordance with the terms and conditions of this Agreement.

NOW, THEREFORE, in consideration of the foregoing and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereto, intending to be legally bound, do hereby agree as follows.

ARTICLE I

AGREEMENT

1.1 Definitions

Where the following terms appear in this Agreement with initial capitalization, they shall have the meaning set forth below.

"**Acceptable Credit Bank**" means a US based bank, or a bank with a major US based branch, acceptable to Buyer and Owner, the long term senior debt obligations of which are rated "A-" or better by S&P or "A2" or better by Moody's (or an equivalent rating from an equivalent rating agency as may be approved by Buyer and Owner), or whose obligations are guaranteed, insured or otherwise credit enhanced by a bank or financial institution the long term senior unsecured debt obligations of which are so rated and is US based or has a major US based branch.

"**Acceptable Subcontractor**" has the meaning set forth in **Section 3.5.1**.

"**Affected Party**" has the meaning set forth in **Section 12.2**.

"**Affiliate**" means with respect to any Person, any other Person that directly or indirectly, through one or more intermediaries, controls, is controlled by or is under common control with, such Person.

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"**Agreed Rate**" has the meaning set forth in **Section17.8**.

"**Agreement**" means this Equipment Purchase Agreement, including all exhibits, schedules, and supplements hereto (each of which is hereby incorporated herein by reference), as amended from time to time.

"**Agreement Price**" means the total amount payable by Buyer to WFGD Supplier for the Equipment and Materials supplied, the other Work provided or performed, and other obligations of WFGD Supplier under this Agreement, as set forth in **Exhibit C** (Agreement Price and Milestone Payment and Termination Schedules) as it may be subsequently adjusted by Change Order pursuant to the terms of this Agreement.

"**Air Emissions Tests**" means the tests set forth in **Exhibit G** (Guarantees and Performance Guarantee Test Protocol) to determine whether the Guaranteed Air Emissions have been achieved.

"**Applicable Law**" means any applicable statute, law (including common law), rule, treaty, regulation, Codes and Standards, ordinance, permit, approval, injunction, judgment, decree, writ, order, or the like, including NERC Requirements and the Permits, when issued, enacted, or promulgated by a Governmental Authority and interpretations thereof by a Governmental Authority that are applicable to the Work, the Facility, the WFGD or the performance of the Owner, Buyer or WFGD Supplier under this Agreement.

"**Arbitration Range**" has the meaning set forth in **Section 15.1**.

"**At Risk Amounts**" means with respect to a claim (e.g., a warranty claim or an indemnification claim) against the WFGD Supplier under this Agreement, the maximum amount of cost or expense to which the WFGD Supplier is exposed (or, if the claim is for WFGD Supplier to perform Work (e.g., warranty Work), Buyer or Owner's maximum expense to perform the Work if WFGD does not do so properly) with respect to the claim (determined by Buyer in its sole discretion); in determining such maximum amount, Buyer will only reduce it for possible insurance coverage to the extent that WFGD carries insurance from which Buyer can be certain Buyer will collect in connection with the Claim.

"**Business Day**" means Days other than Saturdays, Sundays and holidays observed by the United States Federal government, the Commonwealth of Kentucky, or Owner.

"**Buydown Performance Guarantees**" has the meaning set forth in **Section 8.1**.

"**Buyer**" means Owner but, following the assignment of this Agreement by Owner to Contractor in accordance with **Section 17.3**, means Contractor.

"**Buyer Indemnitee(s)**" has the meaning set forth in **Section 10.1**.

"**Certificate of Commercial Operation**" means the certificate in the form of **Exhibit F-2** (Certificates) provided pursuant to **Section 8.3.**

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"**Certificate of Final Completion**" means the certificate in the form of **Exhibit F-2** (Certificates) provided pursuant to **Section 8.4.**

"**Change in Law**" means an amendment, modification, or change of Applicable Law enacted, adopted, or promulgated after the Effective Date by a Governmental Authority. None of the following shall constitute a Change in Law hereunder: (i) a change in Applicable Law with respect to (a) taxes or levies assessed on the basis of WFGD Supplier's income, profits, revenues, gross receipts; (b) other taxes, duties or imposts for which WFGD Supplier is responsible hereunder; (c) taxes, levies or withholdings that vary the compensation, benefits, or amounts to be paid to, on behalf of or on account of WFGD Supplier's or its Subcontractors' employees; and (ii) changes in Applicable Law enacted, published, or issued before the Effective Date, whether or not such changes became effective after the Effective Date.

"**Change Order**" has the meaning set forth in **Section 4.1.**

"**Claims**" has the meaning set forth in **Section 3.4.2.**

"**Claim Notice**" has the meaning set forth in **Section 10.2.1.**

"**Climatic Conditions**" means weather conditions at the Job Site or at the principal facilities where the Work is to be performed, including wind, hurricane forces, microbursts, precipitation (rain, snow, ice, hail, flooding), and lightning which, based on weather data for such locations during the ten (10) years prior to the Effective Date, would not reasonably have been expected to occur.

"**Codes and Standards**" means the most recent edition of the codes, standards, and guidelines applicable to the Work, including those listed in **Exhibit N** (Codes and Standards).

"**Commercial Operation**" will be determined on a WFGD by WFGD basis and will have been achieved for a WFGD when all of the following have occurred with respect to that WFGD: (i) WFGD Supplier shall have completed all of its training obligations to be completed as described in **Exhibit U** (Training), including delivery of all required training manuals and information; (ii) the WFGD Supplier shall have delivered all drawings, documents and manuals required to be delivered as set forth in **Exhibit D** (Project Schedule and Key Dates); (iii) the WFGD Supplier shall have delivered the Equipment and Materials to the Job Site to the extent necessary for the WFGD to be capable of being operated safely and in compliance with Applicable Laws, Prudent Utility Practices, and Permits; (iv) the WFGD is capable of being operated in the normal course of business up to the full Unit generating capacity; (v) all Performance Guarantees (other than Buydown Performance Guarantees and Guaranteed Availability) have been simultaneously achieved in a Commercial Operation Test; (vi) final versions of the Operating and Maintenance Manuals prepared in accordance with **Exhibit V** (Operating and Maintenance Manuals) have been delivered and approved by Buyer and Owner; (vii) the WFGD Supplier has provided Buyer written notice certifying that all the preceding conditions have been satisfied, (viii) all Special Tools have been delivered to Owner; (ix) WFGD Supplier has paid all liquidated damages due and owing pursuant to **Exhibit J** (Liquidated Damages) (other than those related to Buydown Performance Guarantees) and other amounts then due and owing hereunder; (x) Buyer has achieved "Commercial Operation" as

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defined in the Prime Contract (or, if there is no Prime Contract, the project has reached a level of completion commensurate with commercial operation in accordance with Prudent Utility Practices); and (xi) all non-critical punch list items previously identified in connection with the Work have been remedied. Although Commercial Operation hereunder cannot be achieved unless the project has achieved the standard in **clause (x)** above, WFGD Supplier's obligation hereunder is to perform the Work under this Agreement and the WFGD Supplier is not obligated to perform work that is not part of the Work under this Agreement.

"**Commercial Operation Date**" means the date on which Commercial Operation is achieved.

"**Commercial Operation Test**" has the meaning set forth in **Exhibit G** (Guarantees and Performance Guarantee Test Protocol).

"**Complete Delivery/Erection**" means all items of Equipment and Materials (including all components thereof) required to be delivered prior to a Guaranteed Delivery Milestone Date have been delivered to the Job Site in accordance with the terms of this Agreement; **provided, however**, (i) with respect to the Stebbins Scope, the term "Complete Delivery/Erection" includes the erection of the absorber tower and (ii) the failure of WFGD Supplier to deliver minor items that do not, individually or in the aggregate, adversely affect the progress or cost of Buyer's performance shall not prevent a delivery from being considered a Complete Delivery/Erection if, and only if, WFGD Supplier thereafter timely provides such items to Buyer so as not to adversely affect the progress or cost of Buyer's performance.

"**Component Extended Warranty Period**" means any extended warranty period for specific components of the WFGD set forth in **Exhibit Y**.

"**Confidential Information**" has the meaning set forth in **Section 17.7**.

"**Contractor**" means the Person with whom the Owner enters into the Prime Contract.

"**Corrective Action**" has the meaning set forth in **Section 9.3**.

"**Day**" means a calendar day, including Saturdays, Sundays, and legal holidays, except that, if a payment obligation to be performed under this Agreement falls due on a calendar day that is not a Business Day, the payment obligation shall be due on the next Business Day thereafter.

"**DBE**" means Disadvantaged Business Enterprise.

"**Defects**" (or other derivations thereof such as "Defective") has the meaning set forth in **Section 9.3**.

"**D/E Defect**" means any item of Equipment and Materials (or any component thereof) required to be delivered to Buyer prior to a Guaranteed Delivery Milestone Date that: (i) has suffered damage prior to or upon (a) with respect to the Initial Stebbins Scope, completion of the Initial Stebbins Work, (b) with respect to the Stebbins Scope other than the Initial Stebbins

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Work, completion of the Stebbins Scope, and (c) with respect to all other Work, delivery to the Job Site or (ii) is Defective; **provided, however**, (i) with respect to the Stebbins Scope, D/E Defect also includes any Defect in erection and (ii) minor damages or Defects in such Equipment and Materials (and, with respect to the Stebbins Scope, erection) that do not, individually or in the aggregate, adversely affect the progress or cost of Buyer's performance are not to be considered D/E Defects if, and only if, WFGD Supplier thereafter timely corrects such damage, Defects, or both, so as not to adversely affect the progress or cost of Buyer's performance.

"**Dispute**" means any claim, dispute, or other controversy between the Parties arising out of or relating to this Agreement.

"**Effective Date**" means the date set forth in the first paragraph of this Agreement.

"**Equipment and Materials**" means any materials, supplies, apparatus, devices, machinery, equipment, parts, tools, Special Tools, components, instruments, appliances, spare parts and appurtenances thereto that are (i) to be incorporated into, or supplied with, the WFGD or the Unit in connection with the installation of the WFGD and (ii) furnished or required to be furnished (explicitly or by inference taking into consideration the Project Requirements) by WFGD Supplier pursuant to **Exhibit A** (Technical Specification).

"**Existing Facilities**" means structures, installations, roadways, walkways, natural features, and the existing generating units, including the Unit, and auxiliary and support facilities located on the Generating Station Site, including all existing facilities used in connection with the generation of electricity; the transportation, handling or storage of fuel; or the transmission of electricity.

"**Final Completion**" shall be deemed to have occurred when all of the following have occurred in respect of the Work: (i) Commercial Operation has been achieved; (ii) all Performance Guarantees other than Buydown Performance Guarantees have been achieved and each Buydown Performance Guarantee has either been achieved or its applicable liquidated damages have been paid by WFGD Supplier; (iii) all manuals, submittals, and other documents required to be delivered to Buyer hereunder have been delivered and are complete and in final form; (iv) all liquidated damages for which WFGD Supplier is liable pursuant to **Exhibit J** (Liquidated Damages) and all other amounts owed by WFGD Supplier to Buyer under this Agreement, if any, have been paid to Buyer; (v) all Work has been completed other than Work or other obligations that require future performance (*e.g.*, warranty Work and indemnification obligations); and (vi) Buyer has achieved "Final Completion" as defined in the Prime Contract (or, if there is no Prime Contract, the project has reached a level of completion commensurate with final completion in accordance with Prudent Utility Practices). Although Final Completion hereunder cannot be achieved unless the project has achieved the standard in clause (vi) above, WFGD Supplier's obligation hereunder is to perform the Work under this Agreement and the WFGD Supplier is not obligated to perform work that is not part of the Work under this Agreement.

"**Financing**" means any form of construction, interim, long-term debt, lease, tax-exempt, recourse, non-recourse, equity or other form of funding, or refinancing that Owner or an Affiliate

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of Owner obtains, utilizes or attempts to obtain or utilize in connection with Owner's obligations hereunder.

"**Financing Parties**" means any Person that provides Financing, or credit support for Financing, or any trustee(s) acting in connection therewith, and their respective successors and assigns.

"**Force Majeure**" means any condition, event, or circumstance, including the examples set forth below, but only if, and to the extent: (i) such condition, event, or circumstance is not within the reasonable control of the Party affected; (ii) such condition, event or circumstance, despite the exercise of reasonable diligence, could not be prevented, avoided or removed by such Party; (iii) such condition, event, or circumstance has a material adverse effect on the ability of the affected Party to fulfill its obligations under this Agreement; (iv) the affected Party has taken all reasonable precautions, due care and reasonable alternative measures in order to avoid the effect of such condition, event, or circumstance on the affected Party's ability to fulfill its obligations under this Agreement and to mitigate the consequences thereof; and (v) such condition, event, or circumstance is not the result of any failure of such Party to perform any of its obligations under this Agreement. By way of example, such events, conditions and circumstances shall include war, rebellion, sabotage, civil strife, insurrection, public disorder, Climatic Conditions, earthquake, quarantine, acts of terrorism, industry-wide or national strikes, and Changes in Law. Notwithstanding the foregoing, Force Majeure shall not include the following events, conditions, or circumstances:

(i) late delivery of Equipment and Materials required for the Work whether caused by congestion at a Subcontractor's plant or elsewhere; oversold market conditions; inefficiencies; transportation delays (except to the extent such delay is directly due to the occurrence of an independent condition, event, or circumstance described in and meeting the conditions of the first full paragraph of this definition); or other similar circumstances;

(ii) shortages of supervisors; labor; or Equipment and Materials (except to the extent caused by the occurrence of an independent condition, event, or circumstance described in and meeting the conditions of the first full paragraph of this definition);

(iii) late performance as a consequence of any violation of Applicable Law or decisions of a Governmental Authority related to the conduct of WFGD Supplier's or any Subcontractor's business, including insolvency or any delay related to the economic, commercial or labor circumstances of WFGD Supplier, any Subcontractor or other business conducted by WFGD Supplier or any Subcontractor;

(iv) breakdown, loss, or damage to Equipment or Materials except where such breakdown, loss, or damage is directly due to the occurrence of an independent condition, event, or circumstance

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described in and meeting the conditions of the first full paragraph of this definition;

(v) failure of a Party to pay amounts due and owing under this Agreement;

(vi) strikes or other labor disturbances affecting WFGD Supplier or any of its Subcontractors, except as expressly set forth in the examples described in the first full paragraph of this definition;

(vii) increased costs of the Work, general economic or industry conditions; or

(viii) weather conditions other than Climatic Conditions.

"**General Services Agreement**" means the then current agreement which Owner generally uses to contract for goods or services, a copy of which, as of the date hereof, has been provided to WFGD Supplier.

"**Generating Station Site**" means the site, as more particularly described in **Exhibit S** (Site).

"**Governmental Authority**" means any federal, state, county, regional, city, parish or local governmental or quasi-governmental body, agency, authority, branch department, arbitrator, court or any subdivision, instrumentality or agency thereof, having, or claiming, a regulatory interest in, or jurisdiction over, the Work (or any portion thereof), the Equipment and Materials, the WFGD, the Unit, the Generating Station Site, this Agreement or one or more of the Parties.

"**Guaranteed Air Emissions**" has the meaning set forth in **Exhibit G** (Guarantees and Performance Guarantee Test Protocol).

"**Guaranteed Commercial Operation Date**" means August 21, 2015, with respect to the WFGD for Units 1 & 2 and February 20, 2015, with respect to the WFGD for Unit 4, as such dates may be extended pursuant to the Prime Contract; **provided, however**, if such date is extended pursuant to the Prime Contract more than forty-five (45) Days or adjusted to an earlier date than the date set forth above, such extension or adjustment shall be made pursuant to **Section 4.1**.

"**Guaranteed Milestone Dates**" means the WFGD Supplier's guaranteed milestone dates with respect to the Work, as set forth in **Exhibit D** (Project Schedule and Key Dates).

"**Guaranteed Final Completion Date**" means for each WFGD, ninety (90) Days following the Guaranteed Commercial Operation Date for that WFGD.

"**Guaranteed Performance Period**" means for a WFGD, the period from Commercial Operation of such WFGD until the earlier to occur of December 31, 2018 (plus the number of

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Days, if any, that WFGD causes in whole or in part a delay in the achievement of Commercial Operation beyond the Guaranteed Commercial Operation Date for that WFGD), and the second anniversary of Commercial Operation for such WFGD.

"**Hazardous Substance**" means: (i) any chemicals, materials, substances, or wastes which are now or hereafter defined as or included in the definition of "hazardous substance," "hazardous material," "hazardous waste," "solid waste," "toxic substance," "extremely hazardous substance," "pollutant," "contaminant," or words of similar import under any Applicable Law; (ii) any petroleum, petroleum products (including crude oil or any fraction thereof), natural gas, natural gas liquids, liquefied natural gas or synthetic gas useable for fuel (or mixtures of natural gas and such synthetic gas), or oil and gas exploration or production waste, polychlorinated biphenyls, asbestos-containing materials, mercury, urea formaldehyde insulation, radioactivity and lead-based paints or any other substance that has been contaminated, polluted or made toxic; or (iii) any other chemical, material, substances, waste, or mixture thereof which is prohibited, limited, or regulated pursuant to, or that could reasonably be expected to give rise to liability under, any Applicable Law.

"**Hold Point**" means an inspection point with respect to which WFGD Supplier may not proceed further with respect to the Work unless and until Buyer has either: (i) inspected the applicable Work and authorized WFGD Supplier to proceed or (ii) waived such inspection in writing.

"**Indemnified Parties**" has the meaning set forth in **Section 10.2.1.**

"**Indemnified Party**" has the meaning set forth in **Section 10.2.1.**

"**Information**" means, except as specifically excluded in **Exhibit X** (Submittals, Review, and Hold Points), all drawings; documents; manuals; training materials; operating, maintenance, and other guidelines and procedures; and other data, trade secrets, and information supplied by WFGD Supplier, whether directly itself or indirectly through its Subcontractors, whether paper or electronic media, in performance of the Work under this Agreement which would be reasonably useful or necessary in connection with Owner's operation, maintenance, repair, modification, or use of the WFGD.

"**Initial Stebbins Work**" means the absorber tower erection Work is complete (except for the absorber tower floor) and turned over to Buyer to install the WFGD internals.

"**Inspection Period**" means the seven (7) Day period following each delivery to the Job Site of the Equipment and Materials required to be delivered hereunder by and in respect of a Guaranteed Delivery Milestone Date.

"**Insolvency Event**" means, with respect to the Person: (i) the Person's (a) failure to generally pay its debts as they become due, (b) admission in writing of its inability to pay its debts as they become due or (c) making a general assignment for the benefit of creditors; (ii) any proceeding being instituted by or against the Person seeking: (a) to adjudicate it as bankrupt or insolvent, (b) liquidation, winding up, reorganization, arrangement, adjustment, protection, relief or composition of it or its debts under any Applicable Law relating to bankruptcy, insolvency,

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reorganization or relief of debtors or (c) the entry of an order for relief or the appointment of a receiver, trustee, custodian or other similar official for it or for any substantial part of its property and, in the case of any such proceeding instituted against the person, either such proceeding remains undismissed for a period of thirty (30) Days or any of the actions sought in such proceeding occur; or (iii) the Person's taking any action to authorize any of the actions set forth above in this definition.

"**Intellectual Property**" means all patents, patent applications, copyrights, trade secrets, and other intellectual property rights.

"**Job Site**" means that portion of the Generating Station Site on which the WFGD shall be installed and other areas necessary for the performance of the Work, as more particularly described in **Exhibit S** (Site).

"**Job Site Field Services**" means the services described in **Article 9** of **Exhibit A** (Technical Specification).

"**Kentucky Sales Taxes**" has the meaning set forth in **Section 5.7.4.**

"**Key Personnel**" has the meaning set forth in **Section 3.3.**

"**LCs**" has the meaning set forth in **Section 17.22.**

"**LD Criteria**" has the meaning set forth in **Section 7.1.**

"**Liabilities**" has the meaning set forth in **Section 3.4.2.**

"**Lien Indemnitees**" has the meaning set forth in **Section 5.5.**

"**Liens**" has the meaning specified in **Section 5.5.**

"**Major Subcontractor**" means a Subcontractor providing labor, materials or Equipment and Materials in relation to the Work under this Agreement which has a value of fifty thousand dollars ($50,000) or more.

"**MBEs**" means Minority Business Enterprise.

"**Moody's**" means Moody's Investor Services, Inc. or its successor.

"**NERC**" means the North American Electric Reliability Corporation.

"**NERC Requirements**" has the meaning set forth in **Section 3.17.**

"**Notice**" has the meaning set forth in **Section 15.2.1.**

"**Operating and Maintenance Manuals**" has the meaning set forth in **Exhibit V** (Operating and Maintenance Manuals).

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"**Operating Hours**" means hours when the Unit is combusting fuel.

"**Owner**" means Louisville Gas and Electric Company and its permitted assigns and successors.

"**Owner Engineer**" means the engineer designated by Owner to perform technical oversight services.

"**Parent Guarantee**" means the guarantee of Babcock Power, Inc. in the form set forth in **Exhibit F-8** (Parent Guarantee).

"**Party**" or "**Parties**" means one or more of Owner, Buyer, and WFGD Supplier.

"**Performance Guarantee Tests**" means the tests to determine whether the Performance Guarantees have been achieved.

"**Performance Guarantee Test Procedures**" has the meaning set forth in **Section 8.2**.

"**Performance Guarantees**" has the meaning set forth in **Exhibit G** (Guarantees and Performance Guarantee Test Protocol).

"**Performance Letter of Credit**" means an irrevocable, standby letter of credit, that may be increased by amendment from time to time and issued by an Acceptable Credit Bank to which Buyer is a beneficiary, and which (i) has a stated expiration date of not earlier than three hundred sixty four (364) Days (or such longer term as may be commercially available) after the date of the original issuance or any renewal thereof; (ii) automatically renews or permits Buyer, on the signature of an authorized representative, to draw on sight all or any portion of the stated amount if not renewed on or prior to the thirtieth (30^{th}) Day prior to any expiration date; (iii) is payable or negotiable at an office of such Acceptable Credit Bank located in the United States; (iv) is payable in U.S. Dollars in immediately available funds; (v) is governed by International Standby Practices (ISP 98) and any amendments or revisions thereto, and, to the extent not governed thereby, the laws of the state in which its principal office is located; (vi) is drawable upon issuance of a drawing certificate signed by an authorized representative of Buyer stating that Buyer is entitled to be paid under this Agreement; and (vii) is otherwise in the form set forth in **Exhibit F-10** (Performance Letter of Credit).

"**Permit**" means any waiver, exemption, variance, franchise, permit, authorization, approval, identification number, inspection, certification, license, clearance or similar order, filing, registration, application of, from or to any Governmental Authority.

"**Person**" means any individual, company, corporation, firm, joint venture, partnership, association, limited liability entity, organization, trust, Governmental Authority or similar entity.

"**Prime Contract**" means an agreement for the engineering, procurement and/or construction of the WFGD (including balance of plant) between Owner and Contractor.

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"**Prime Rate**" means the per annum (365 or 366 Days, as appropriate) prime rate as published from time to time in the "Money Rates" table of The Wall Street Journal, **provided, however,** if more than one such prime rate is published, the average shall be used for purposes of this Agreement, unless an equivalent bank rate is agreed to by the Parties.

"**Professional Standards**" means those standards and practices used by, and the degree of skill and judgment exercised by, recognized United States equipment vendors when performing first class quality services or providing first class quality equipment and materials in connection with retrofitting operating coal-fired generation facilities with new air quality control systems of a scale similar to the WFGD.

"**Project Requirements**" means with respect to the Work or the WFGD or any portion of either or both: (i) Applicable Law; (ii) Codes and Standards; (iii) the provisions of this Agreement; (iv) the requirements and warranties of Subcontractors, including Equipment and Materials Subcontractors; (v) the requirements of insurers providing insurance pursuant to **Article XIV** (Insurance); (vi) the Operating and Maintenance Manuals; and (vii) Professional Standards.

"**Prudent Utility Practices**" means the practices, methods, materials, supplies, equipment, and standards of safety, performance, and service that are commonly applied in the electric utility industry in the United States to operate and maintain generating facilities similar to the Unit, including the use of, and adherence to, equipment, practices and methods, applicable industry codes, standards, and regulations that in the exercise of reasonable judgment and in light of the facts and circumstances known at the time the decision was made would be reasonably expected to accomplish the desired result while protecting the WFGD, the Existing Facilities, the interconnection facilities, individuals, and the environment from damage, loss or injury. Prudent Utility Practices are not intended to be limited to the optimum practice or method to the exclusion of all others, but rather to be a spectrum of possible, but reasonable practices and methods having due regard for vendor warranty requirements, Applicable Law, and the operating and maintenance procedures of co-located generation and associated facilities.

"**Records**" has the meaning set forth in **Section 17.20.**

"**Reduced Retainage Amount**" has the meaning set forth in **Section 5.4.2.**

"**Relieved Delay**" has the meaning set forth in **Section 4.1.**

"**Response**" has the meaning set forth in **Section 15.2.2.**

"**Retainage**" has the meaning set forth in **Section 5.4.1.**

"**Retainage Amount**" has the meaning set forth in **Section 5.4.1.**

"**Sales Taxes**" has the meaning set forth in **Section 5.7.1.**

"**S&P**" means the Standard & Poor's Rating Group (a division of McGraw-Hill, Inc.) or its successor.

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"**Senior Officer**" has the meaning set forth in **Section 15.1.**

"**Special Tools**" means tools that are described in **Exhibit A** (Technical Specification) or are provided by WFGD Supplier or any Subcontractor for the installation, checking, inspection, operation, repair, or maintenance of the Equipment and Materials.

"**Specialty Supplier**" means any Subcontractor providing Materials or Equipment for which either (i) there are not at least four competitive alternative suppliers of replacement parts for such Materials and Equipment or (ii) there are not at least four competitive vendors that provide maintenance and repair services with respect to all of the Materials and Equipment provided by that Subcontractor.

"**Stebbins Scope**" means the portion of the Work in which WFGD Supplier provides the Equipment and Materials for, and erects the, absorber tower portion of the WFGD.

"**Subcontractor**" means and refers to a Person, including Affiliates (at any tier), that has a contract, agreement, or other arrangement with WFGD Supplier to perform a portion of the Work, including the supply of Equipment and Materials or services in connection with the Work.

"**Start-Up**" following the commencement of an outage (of any kind), means the time that the Unit, as improved by the WFGD, is released to station operations.

"**Taxes**" means all taxes, assessments, levies, duties, franchises, fees, charges and withholdings of any kind whatsoever and all penalties, fines, additions to tax and interest thereon.

"**Technical Specification**" has the meaning set forth in **Exhibit A** (Technical Specification).

"**Tie-in**" shall be deemed to have occurred when the WFGD has been properly completed (including certification of the continuous emissions and opacity monitors required to be installed or adjusted as part of the Work) and integrated into the Unit, and the Unit, as improved by the WFGD, is ready for Start-Up.

"**Tie-in Outage**" means the scheduled outage period of the Unit, during which time Buyer must complete Tie-in, it being understood that WFGD Supplier is entitled to access during such outage period from the point that it is safe to access the Unit to and until Start-Up.

"**Third Party**" means any Person other than WFGD Supplier, Buyer, and Owner or their respective Affiliates.

"**Total Liability Limitation**" means an amount equal to one hundred percent (100%) of the Agreement Price.

"**Unit**" means an existing coal-fired unit operating on the Generating Station Site to which a WFGD is to be added as identified in **Exhibit A** (Technical Specification).

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"**Warranty**" has the meaning set forth in **Section 9.1.**

"**Warranty Period**" has the meaning set forth in **Section 9.2.**

"**WBE**" means Women Business Enterprise.

"**Work**" means all of the obligations work, services, Equipment and Materials, and consumables to be performed or provided by WFGD Supplier pursuant to this Agreement, including, design, engineering, manufacturing, procurement, transportation, expediting, storage, training, technical advisory services, Job Site Field Services, start-up, commissioning, testing, and other services provided in connection with the Equipment and Materials or the WFGD, including items that are necessary or appropriate to complete the WFGD, achieve Final Completion, and fulfill WFGD Supplier's obligations during the Warranty Period, the Component Extended Warranty Period, if any, or both, in accordance with this Agreement, including any services provided by WFGD Supplier to Buyer prior to the Effective Date. Upon exercise by Buyer of an option as stated in **Exhibit O** by the validity date for such option as stated in **Exhibit O**, the Work shall specifically include such option and the Agreement Price shall be adjusted accordingly by way of Change Order in accordance with **Exhibit O.**

"**WFGD**" means the whole or, where the context admits, part of the wet flue gas desulphurization system to be supplied by the WFGD Supplier pursuant to this Agreement for installation and incorporation into the Unit, including the Equipment and Materials required (explicitly or by inference taking into consideration the Project Requirements) by **Exhibit A** (Technical Specification).

"**WFGD Competitors**" means Hitachi Power Systems America, Ltd., Alstom Power Inc., Siemens Power Corporation, Advatech, LLC, Babcock & Wilcox Power Generation Group, Inc., Mitsubishi Power Systems Americas, Inc., Chiyoda Corporation, and such other entities that after the date of this Agreement enter into the business of supplying WFGD technology in competition with WFGD Supplier.

"**WFGD Supplier**" has the meaning set forth in the preamble to this Agreement.

"**WFGD Supplier Basis of Bid**" has the meaning set forth in **Section 4.6.**

"**WFGD Supplier Taxes**" has the meaning set forth in **Section 5.7.1.**

"**WFGD Supplier's Representative**" has the meaning set forth in **Section 3.3.**

1.2 Entire Agreement

This Agreement, including the exhibits attached hereto (which are specifically made a part hereof by reference), embody the entire agreement between Buyer and WFGD Supplier. The Parties are not bound by or liable for any statement, representation, promise or understanding not set forth herein. Nothing contained in proposals, correspondence, discussions, order acknowledgements or any other forms shall have any effect on this Agreement unless specifically incorporated herein. In the event of a conflict between the body of this Agreement

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and the exhibits, the body of this Agreement shall govern. In the event of a conflict in an exhibit, the requirement most favorable to Buyer shall take precedence.

1.3 Contract Interpretation

In this Agreement, unless the context otherwise requires:

(i) the singular includes the plural and vice versa;

(ii) reference to any Person includes such Person's successors and assigns, to the extent that such successors and assigns are permitted by this Agreement, and reference to a Person in a particular capacity excludes such Person in any other capacity;

(iii) reference to any agreement (including this Agreement), document, insurance policy or instrument means such agreement, document or instrument as amended or modified and in effect from time to time in accordance with the terms thereof;

(iv) any accounting term used and not otherwise defined in the Agreement has the meaning assigned to such term in accordance with generally accepted accounting principles consistently applied;

(v) "including" (and "include") means: (a) including without limiting the generality of any description preceding such term and (b) with respect to any description following such term, means "including, without limitation" or "including, but not limited to";

(vi) reference to Applicable Law means Applicable Law as amended, modified, codified or reenacted, in whole or in part, and in effect from time to time;

(vii) when applied to Equipment and Materials, "furnish" "provide" or words of similar import means to secure, pay for, deliver to the Job Site (or other portions of the Generating Station Site, as appropriate), unload those items of Equipment and Materials for which the Work includes erection, construction, installation, or similar services (including uncrating and storage per manufacturer's recommendations), inspect, witness the unloading, uncrating, and storage per manufacturer's recommendations, report in writing to Buyer any issues detected in the above inspections and witnessing, and any other services or activities appropriate to that portion of the Work;

(viii) when applied to Equipment and Materials, "install" or "installation" or words of similar import mean to assemble, place in position, incorporate, adjust, clean, make fit for use and any other services or activities appropriate to that portion of the Work;

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(ix) unless the context specifically requires otherwise, the terms "approval," "consent," "accept," "acceptance," "authorization," and terms of similar import will be deemed to be followed by the phrase "which shall not be unreasonably withheld, unreasonably conditioned or unreasonably delayed";

(x) the words "shall" and "will" have equal force and effect;

(xi) the words "herein," "hereof," or "hereunder" or similar terms refer to this Agreement as a whole and not to any specific section or article;

(xii) the table of contents and article, section and exhibit titles and similar headings are inserted for convenience only and are not to be used for the purposes of construing or interpreting this Agreement;

(xiii) the Work is intended to be a term that encompasses all of the necessary performance obligations of WFGD Supplier. Any listing of types of work such as "construct," "erect," "check" or "align" is not meant to be exclusive in the context of this Agreement or exclude similar or other services or activities appropriate to that portion of the Work;

(xiv) words and abbreviations not defined in this Agreement which have well known technical or design, engineering or construction industry meanings are used in this Agreement in accordance with such recognized meanings;

(xv) all Information to be supplied under this Agreement shall be provided in the English language;

(xvi) all units of measurement shall be specified in dimensions customarily used in the United States; and

(xvii) where there are no stated time periods or express remedies, either or both Parties shall act in a commercially reasonable manner, taking into consideration Owner's need to operate the Units in compliance with Applicable Law.

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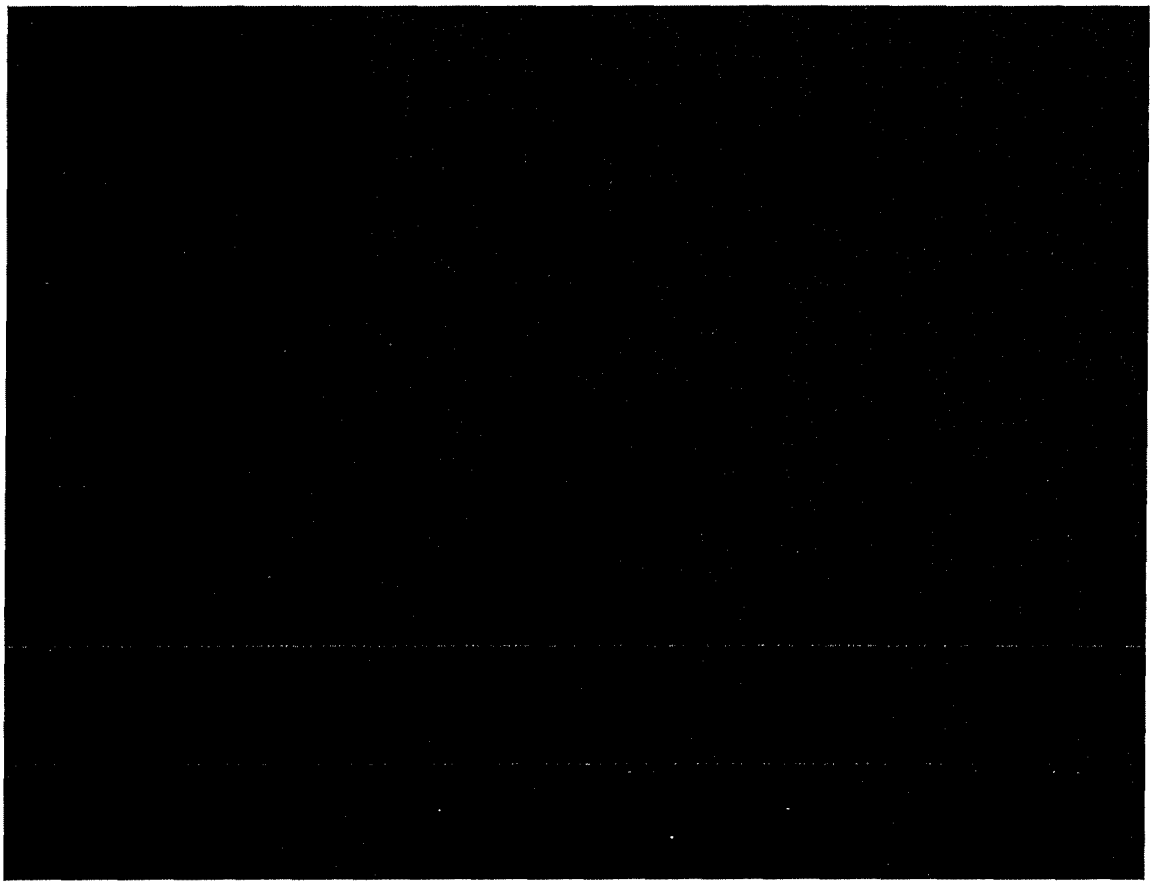
ARTICLE II

GENERAL PROVISIONS

2.1 Independent Contractor

2.1.1 Independent Contractor. WFGD Supplier represents that it is fully experienced, properly qualified, registered, licensed, equipped, organized and financed to perform the Work under this Agreement. WFGD Supplier shall act as an independent contractor and not as an agent of Buyer in performing this Agreement, maintaining complete control over its employees, representatives and all of its Subcontractors. WFGD Supplier shall not perform any act or make any representation to any Person to the effect that WFGD Supplier, or any of its personnel or Subcontractors, is the agent, representative, employee or servant of Buyer.

2.1.2 Right to Control. Buyer neither has the right to control, nor has any actual, potential or other control over the methods and means by which WFGD Supplier or any of its Subcontractors conduct their respective independent business operations, except as provided in **Section 4.3.2.**



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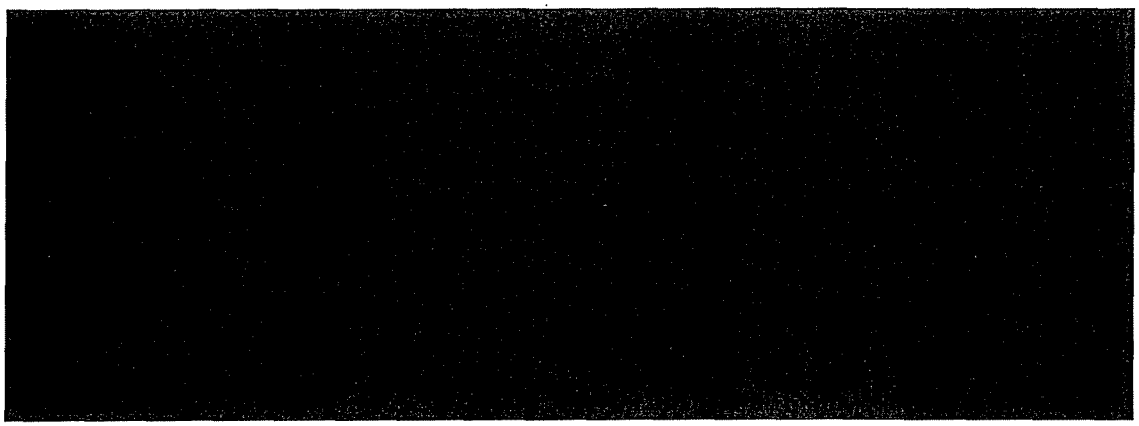

ARTICLE III

WFGD SUPPLIER'S RESPONSIBILITIES

3.1 The Work

3.1.1 Scope of Work. WFGD Supplier shall provide the Equipment and Materials and the WFGD and perform the Work in accordance with the provisions of this Agreement, including **Exhibit A** (Technical Specification).

3.2 Project Investigation

WFGD Supplier represents that it has had the full opportunity to examine the Generating Station Site and the Units, that it has satisfied itself as to the requirements of this Agreement and that it has exercised reasonable diligence with respect to all conditions which may affect its performance under this Agreement, including, as applicable, labor conditions and availability, the condition of the Job Site, terminal points, and the Unit and access thereto, matters that may affect shipping and delivery of all components of the WFGD, including Equipment and Materials, to the Job Site, including the condition of roads and the availability of rail or other forms of transportation and local weather conditions. WFGD Supplier further represents that this Agreement and the Guaranteed Milestone Dates have been determined with due regard to all such requirements and conditions which do and may affect this Agreement; and that its entry into this Agreement has not been induced either wholly or in part by any promises, representations or statements made by or on behalf of Owner, Buyer, or their respective agents or representatives, other than those set forth in this Agreement. WFGD Supplier acknowledges and accepts the risk of mistake or error with respect to all matters within the scope of its investigation and agrees that it shall not be entitled to, and shall make no claim for, any additional compensation or damages of any kind or character or seek any extension of time should any of the requirements or conditions applicable to this Agreement be different from or in addition to those identified by WFGD Supplier through such investigation. If WFGD Supplier encounters unknown, concealed or man-made subsurface conditions or archaeological finds or artifacts at the Job Site, WFGD Supplier shall give Buyer and Owner prompt notice of such conditions or findings. Information provided by Buyer or Owner with respect to the Generating Station Site, the Job Site and the Unit in specifications, drawings or otherwise is made without representation or warranty of any nature by Buyer or Owner, its accuracy is not guaranteed by Buyer or Owner,

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and, other than as set forth in MSS-1 through MSS-7 of Exhibit S, is furnished solely for the convenience of WFGD Supplier.

3.3 Key Personnel

Exhibit K (Key Personnel) contains a list of WFGD Supplier's key personnel who shall be responsible for supervising the performance of WFGD Supplier's obligations hereunder (the "**Key Personnel**"). WFGD Supplier shall designate in writing from among its Key Personnel an authorized representative, project manager and project engineer acceptable to Buyer to represent and act for and have authority to bind WFGD Supplier (any such individual, "**WFGD Supplier's Representative**"). During periods when Work is suspended, arrangements shall be made for an authorized representative acceptable to Buyer for any emergency that may be required. All written communications given to such WFGD Supplier's Representative by Buyer in accordance with this Agreement shall be binding on WFGD Supplier. Notification of changes of WFGD Supplier's Representatives shall be provided by WFGD Supplier in advance, in writing, to Buyer. WFGD Supplier shall provide competent and suitable qualified personnel to perform the Work and supply the Equipment and Materials, and shall be solely responsible for all labor and personnel required in connection with the Work and supply of the Equipment and Materials, including: (i) professional engineers licensed to perform engineering services in accordance with Applicable Law and qualified to perform the type of engineering services required by WFGD Supplier hereunder and (ii) supervisory personnel who have the experience and authority to supervise and manage the Work on behalf of WFGD Supplier. WFGD Supplier shall in good faith consult with Buyer prior to removing or replacing any Key Personnel. The impact associated with the replacement or renewal of any such Key Personnel shall be borne by WFGD Supplier. If, at any time during the performance of the Work, any of WFGD Supplier's personnel becomes unacceptable to Buyer, then, upon notice from Buyer to such effect, WFGD Supplier and Buyer shall discuss such issue and attempt to resolve any problem involving WFGD Supplier's personnel. If such attempt to resolve such problem is not successful in the reasonable judgment of Buyer, WFGD Supplier shall replace such individual as soon as possible consistent with a diligent effort to find a suitable replacement and shall in good faith consult with Buyer regarding such replacement. WFGD Supplier shall at all times maintain good discipline and order with respect to personnel engaged in Work at the Generating Station Site.

3.4 Compliance

3.4.1 Representation. WFGD Supplier represents that the WFGD shall be produced, sold, delivered, and furnished in strict compliance with Applicable Law. WFGD Supplier shall execute and deliver to Buyer any documents as may be required to effect or to evidence such compliance.

3.4.2 Indemnification. WFGD Supplier shall indemnify, defend, and hold harmless the Indemnified Parties from and against any and all claims, causes of action, proceedings, demands or suits (collectively, "**Claims**") and any and all judgments, liabilities, losses, expenses, damages, injuries, fines, penalties, including court costs, reasonable attorneys' fees and costs (whether incurred as the result of a third-party claim or a claim to enforce any indemnity obligation of WFGD

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Supplier), and pre- and post-judgment interest (collectively, "**Liabilities**") arising from or based on and to the extent attributable to any actual or asserted violation of Applicable Laws by WFGD Supplier.

3.4.3 Settlement of Claims. WFGD Supplier shall not, under any circumstances, apply to or enter into negotiations with any Governmental Authority for acceptance of variations from or revisions to Applicable Law relating to safety or health, or air, water, ground, or noise pollution relating to this Agreement or the performance thereof without Buyer's prior written approval.

3.4.4 Export and Import Rules. WFGD Supplier shall comply with all applicable export or import rules and regulations in the performance of the Work. When required by the shipping/delivery terms of this Agreement, WFGD Supplier shall obtain any necessary export license in a timely manner to avoid delivery delays. When Buyer is required by the shipping/delivery terms of this Agreement to obtain any necessary import license, or to meet the import rules and regulations of the destination country, WFGD Supplier shall provide in a timely manner all necessary compliance assistance and documentation to Buyer and its agents. WFGD Supplier shall indemnify, defend and hold the Indemnified Parties harmless from any Claims and Liabilities caused by WFGD Supplier's failure to comply with applicable export and import rules and regulations or to comply with its export and import obligations under this Agreement. The indemnification and other provisions of this **Section 3.4.4** shall survive the termination, cancellation or expiration of this Agreement.

3.4.5 Compliance with Applicable Law. WFGD Supplier shall comply, and shall require its Subcontractors to comply, with all Applicable Law in effect from time to time relating to the Work, the WFGD and the Unit and shall give all applicable notices pertaining thereto. WFGD Supplier shall ensure that the WFGD, as designed, engineered, and manufactured, complies with and, when operated in compliance with the Operating and Maintenance Manuals, is capable of complying with all Applicable Law.

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3.5 Subcontractors.

3.5.1 Use of Subcontractors. WFGD Supplier shall have the right to utilize any Subcontractor set forth on **Exhibit E** (Acceptable Materials and Equipment Suppliers) in connection with the Work (each, an "**Acceptable Subcontractor**"). If WFGD Supplier seeks to utilize any Subcontractor not set forth on **Exhibit E** (Acceptable Material and Equipment Suppliers) for a portion of the Work, WFGD Supplier shall notify Buyer in writing of the name of such Subcontractor proposed to be used in connection with the Work, and shall not contract for any part of the Work with any Subcontractor not included on **Exhibit E** (Acceptable Materials and Equipment Suppliers) without the prior written authorization of Buyer. Buyer shall make a decision to approve or disapprove such proposed Subcontractor within ten (10) Days after Buyer receives WFGD Supplier's notice of WFGD Supplier's intention to use such Subcontractor and reasonable documentation justifying WFGD Supplier's choice of such Subcontractor. WFGD Supplier may have portions of the Work performed by its Affiliates or their personnel, in which event WFGD Supplier shall be fully responsible for such portions of the Work as if it had been performed by WFGD Supplier, and Buyer shall look solely to WFGD Supplier in connection with such portions of the Work. WFGD Supplier shall bind all Subcontractors to terms that protect Buyer's and Owner's rights and benefits hereunder and are otherwise not in conflict with the provisions of this Agreement applicable to the subcontracted Work, **provided however**, without otherwise limiting WFGD Supplier's obligations hereunder, WFGD Supplier is not obligated to obtain warranty durations from Subcontractors that are identical to the warranty durations hereunder (but WFGD Supplier does have an obligation to obtain certain warranties with respect to certain portions of the Work as set forth in **Section 3.5.5**).

3.5.2 No Contractual Relationship. Neither this Agreement nor any contract with a Subcontractor shall create any contractual relationship between any Subcontractor and Buyer, nor any payment or other obligation on the part of Buyer to any Subcontractor.

3.5.3 Responsibility. Notwithstanding the existence of any contract with a Subcontractor, WFGD Supplier shall be fully responsible for the Work and the WFGD as if no such other contract existed and the performance of or failure to perform the Work is the responsibility of WFGD Supplier hereunder.

3.5.4 Quality Control. WFGD Supplier shall ensure that all Subcontractors establish and implement a quality control system in their work and manufacturing processes which assures that all subcontracted Work or Equipment and Materials shall meet the performance standards required of WFGD Supplier under this Agreement.

3.5.5 Certain Provisions in Major Subcontracts. All contracts entered into between WFGD Supplier and its Major Subcontractors shall contain

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provisions, which WFGD Supplier may not waive, release, modify or impair: (i) giving WFGD Supplier an unrestricted right, without the consent of the Major Subcontractor, making such contract (and associated security) and any or all benefits, interests, rights, and causes of action arising under it assignable to Buyer or Owner (and such assignment right shall be assigned as part of such assignment), upon Buyer's written request following termination of this Agreement; (ii) complying with the provisions of **Section 5.5**; (iii) authorizing either Buyer, Owner, or WFGD Supplier to enforce all guarantees and warranties, including as provided in **Sections 6.1.4 and 9.9** (provided, that except to the extent that such right to enforce is provided to Buyer or Owner under this Agreement, WFGD Supplier shall only be required to obtain such right to enforce to the extent WFGD Supplier is able to do so through commercially reasonable efforts); (iv) requiring Major Subcontractors that shall have a presence on the Generating Station Site to comply with the safety plan provided for in **Section 3.12.2(ii)** of this Agreement; (v) indemnifying Buyer and Owner on the terms and conditions set forth in **Section 10.1**; (vi) causing Major Subcontractors of Equipment and Materials or materials, upon the request of Buyer, to segregate such Equipment and Materials or materials at their fabrication facilities and identify Buyer's property as such as provided for in **Section 2.2.1**; and (vii) with respect to the components set forth in **Exhibit Y** (Component Extended Warranty), provide warranties substantially on the same terms as in **Article IX** of this Agreement, but with the warranty period as set forth for that component in **Exhibit Y**(Component Extended Warranty). As a condition of subcontracting with a Specialty Supplier, WFGD Supplier shall use its commercially reasonable efforts to require each Specialty Supplier to sign the Owner's General Services Agreement for work, equipment, or materials related to the WFGD but not part of the Work. WFGD Supplier shall notify Buyer when it enters into any subcontract(s) or other arrangements with a Major Subcontractor and shall promptly provide Buyer with an unpriced electronic copy of such subcontracts and all change orders and amendments thereto.

3.5.6 Copies. Upon the request of Buyer, WFGD Supplier shall provide copies of all agreements entered into between WFGD Supplier and WFGD Supplier's Subcontractors related to the Work or the Equipment and Materials with the pricing provisions redacted.

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3.6 Quality Standards

3.6.1 Quality Control. WFGD Supplier shall ensure that the WFGD and the Equipment and Materials comply with the standards of quality control required by Codes and Standards or as specified by this Agreement, or, in the absence thereof, Professional Standards. Buyer's quality control representatives shall be afforded escorted access, at no cost, during working hours to plants of WFGD Supplier and WFGD Supplier agrees to procure a similar right for Buyer and Owner for quality control purposes with respect to WFGD Supplier's Subcontractors in order to monitor compliance with quality requirements. Buyer's right to inspect, examine, and test the Equipment and Materials shall extend through the manufacturing process, the time of shipment and a reasonable time after arrival at the final destination. WFGD Supplier's failure to adhere to the standards of quality required under this Agreement shall be deemed to be reasonable grounds for insecurity. Buyer may demand in writing that WFGD Supplier provide adequate assurances of WFGD Supplier's ability to meet such standards.

3.6.2 Adequate Assurances. If, in Buyer's opinion, WFGD Supplier's quality control standards do not comply with the requirements of this **Section 3.6**, Buyer may provide a written notice requesting that WFGD Supplier provide adequate assurances, in writing, demonstrating that corrective measures have been effected. If, within three (3) Days from Buyer's notice, WFGD Supplier has not provided either the adequate assurances or remedied the condition so as to be in compliance with the requirements of this Agreement, Buyer may establish a corrective action plan which may, in part, include the assignment of in-shop inspection personnel to periodically visit and, if necessary, reside at the manufacturing location(s), as appropriate. WFGD Supplier shall cooperate with Buyer in the implementation of such plan. Reasonable costs incurred by Buyer in the implementation of such plan shall be charged to WFGD Supplier.

3.6.3 No Additional Charge to Buyer. Notwithstanding the foregoing, WFGD Supplier shall be solely responsible for the quality control of its operations and that of its Subcontractors, and any activities performed by Buyer shall not result in any additional charges to Buyer and do not affect WFGD Supplier's obligation to perform in accordance with the requirements established by this Agreement.

3.6.4 Shipment. WFGD Supplier shall not ship the Equipment and Materials that fails either the standards of quality required under this Agreement or as to which WFGD Supplier has failed to exercise the quality control standards applicable under this Agreement.

3.6.5 Failure to Inspect. The making or failure to make an inspection, examination or test of, or payment for, or acceptance of the Equipment and Materials by Buyer in no way shall relieve the WFGD Supplier from its obligation to conform to all of the requirements of this Agreement and shall in no way impair Buyer's right to require the correction of Defective Equipment and Materials, or to

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avail itself of any other remedies to which Buyer may be entitled, notwithstanding Buyer's knowledge of the Defect, its substantiality, or the ease of its discovery.

3.6.6 Discovery of Defects or Non-Conformities. Without otherwise limiting WFGD Supplier's other obligations hereunder, if, at any time prior to the Commercial Operation Date, a problem in the WFGD or the Equipment and Materials develops that could potentially delay the achievement of Commercial Operation or give rise to a claim of Defect, due to any cause, whether originating from the WFGD Supplier's failure to comply with its obligations, or improper maintenance, misuse, or abuse by Buyer, Owner or third parties or other circumstances beyond WFGD Supplier's reasonable control, if Buyer gives WFGD Supplier written notice of the problem, WFGD Supplier shall immediately remedy or fix the portion of the WFGD or the Equipment and Materials thereof or remedy the problem without regard to the origin of the problem. Subsequent to the remedy or fix of the problem, an investigation shall be conducted by Buyer and WFGD Supplier to determine the actual origin of the problem and the party or parties responsible shall bear the cost of the repairs including the repair, replacement, removal, disassembly of any portion of the WFGD supplied by WFGD Supplier (as well as insulation and lagging), transportation, reinstallation, retesting (except for Owner's plant operators, instrumentation and fuel) and re-inspection as may be necessary to correct the nonconformity or defect or demonstrate that the previously defective portion of the WFGD or the Equipment and Materials conforms to the requirements of the Agreement. WFGD Supplier is not obligated to remove or replace structures it did not supply hereunder to gain access to the WFGD or Equipment and Materials it supplied (other than insulation and lagging). Any repairs or work performed by WFGD Supplier that are determined to be the responsibility of Buyer or third parties other than WFGD Supplier's Subcontractors shall be considered a Buyer directed change and WFGD Supplier shall be reimbursed in accordance with **Section 4.1**.

3.6.7 Right to Inspect. Buyer's right with respect to escorted access, and to inspect, observe, examine and test, shall be extended to: (i) Owner; (ii) Owner Engineer; and (iii) subject to WFGD Supplier's reasonable consent, such other Persons as Buyer or Owner may reasonably designate, at no cost.

3.7 Progress, Meetings and Progress Reports

3.7.1 Progress and Meetings. WFGD Supplier shall furnish sufficient forces, manufacturing capacity and Equipment and Materials, and shall work such hours, including extra shifts and overtime operations and shall furnish such other necessaries so as to assure the execution of the Work in accordance with the Guaranteed Milestone Dates and other key dates set forth in **Exhibit D** (Project Schedule and Key Dates). Until Final Completion, WFGD Supplier, upon request by Buyer or Owner, shall attend and participate in meetings in accordance with **Exhibit M** (Meetings and Progress Reports) for the purpose of discussing the status of the Work and anticipating and resolving problems. Such meetings may also

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include other Persons at the invitation of Buyer or Owner, such as consultants of Buyer or Owner; **provided**, that (i) such Persons execute reasonable and customary agreements to maintain Work-related information on a confidential basis and (ii) if such Persons are direct competitors of WFGD Supplier in the business of designing and selling wet flue gas desulphurization systems, WFGD Supplier may reasonably require that they be excluded from those portions of the meeting in which design and performance of the Work and other issues of a commercial nature (e.g. pricing, terms) are discussed. Other Persons invited by WFGD Supplier shall be permitted to attend with the prior consent of Owner. WFGD Supplier shall prepare and distribute notes of each such meeting. Publication or distribution of notes of such meetings shall neither constitute a notice pursuant to **Section 17.19** for any purpose under this Agreement nor a permitted basis to assert claims under this Agreement. No implication whatsoever shall be drawn as consequence of a failure by Buyer or Owner to comment upon or object to meeting notes prepared or distributed by WFGD Supplier.

3.7.2 Progress Reports. On a monthly basis or as otherwise agreed to by Buyer and WFGD Supplier, WFGD Supplier shall prepare and submit a written progress report in a form acceptable to Buyer, which report shall include information on WFGD Supplier's progress in the performance of the Work, including: (i) engineering submittals; (ii) key component procurement; (iii) fabrication, assembly, shop testing, and Buyer-witnessed inspection schedules; (iv) detailed schedules for the delivery of Equipment and Materials and the furnishing of the Work; (v) a listing of any constraints which could affect WFGD Supplier's ability to perform in accordance with this Agreement; and (vi) a certification by WFGD Supplier's Representative or an officer of WFGD Supplier that the information provided pursuant to the foregoing **clauses (i)** through **(v)** is true, correct and complete. WFGD Supplier shall also comply with the requirements of **Exhibit M** (Meetings and Progress Reports).

3.7.3 Impact on Schedule. If, during the performance of this Agreement, WFGD Supplier determines that in order for it to achieve each of the Guaranteed Milestone Delivery Dates and other key dates set forth in **Exhibit D** (Project Schedule and Key Dates), it must make any modification to WFGD Supplier's schedule prior to such dates, WFGD Supplier shall immediately submit such modification to Buyer for review. WFGD Supplier's submittal to Buyer shall include its recommendations and reasonable detail as to how the modified schedule shall allow WFGD Supplier to achieve the dates guaranteed in **Exhibit D** (Project Schedule and Key Dates). WFGD Supplier's submittal of these recommendations and its review by Buyer shall not relieve WFGD Supplier of its responsibilities and duties under this Agreement.

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3.8 WFGD Supplier's Drawings and Hold Points

3.8.1 Review of Drawings. Drawings, specifications, and calculations submitted by WFGD Supplier to Buyer with a request for review may be reviewed and commented upon by Buyer. Such review and comment shall relate only to general conformance with the specifications and for confirmation of physical interference of items shown with related systems. Such review and comment shall not relieve WFGD Supplier of responsibility to comply with all requirements of this Agreement. Buyer shall return submitted drawings and data within fifteen (15) Days of receipt.

3.8.2 Release of Drawings. Upon issuance of the release of drawings for engineering, WFGD Supplier shall proceed to meet the respective Guaranteed Milestone Dates. WFGD Supplier shall furnish all submittals and other documentation when and as required by this Agreement.

3.8.3 Return of Drawings. Drawings returned to WFGD Supplier with comments shall be revised to incorporate Buyer's comments as appropriate and returned to Buyer within fifteen (15) Days of receipt of Buyer's comments.

3.8.4 Reviews and Hold Points. Buyer shall be entitled, but not obligated, to review and comment upon the drawings, specifications and submittals of WFGD Supplier and other required submittals in accordance with **Exhibit X** (Submittals, Reviews and Hold Points) prior to WFGD Supplier commencing with any subsequent phase of the Work related to such drawings, specifications or submittals. In addition to the Hold Points set forth in **Exhibit X** (Submittals, Reviews and Hold Points), Buyer or Owner may, subject to **Article IV**, from time to time, designate in writing additional Hold Points.

3.9 Training

WFGD Supplier shall develop and prepare a written description of a program to adequately instruct and train Owner's designated personnel with respect to the operation and maintenance of the Equipment and Materials in accordance with the requirements of **Exhibit U** (Training), together with the proposed materials to be used in the training program, and submit such description and materials to Buyer for review and approval by Buyer and Owner. WFGD Supplier shall train Owner's designated personnel in accordance with the approved training program, and shall provide Owner with paper and electronic copies of the final versions of all materials used in the training program. Owner may record all training sessions and utilize copies of provided materials and replay such recordings for retraining or training of other Owner personnel. WFGD Supplier shall provide technical assistance to Buyer in connection with the development of integrated Unit training procedures for Owner's use following Commercial Operation.

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3.10 Transportation; Shipping

WFGD Supplier shall arrange for all transportation, storage, and transfers of every kind and nature in connection with the Work, and in connection therewith shall develop and prepare a written shipping plan and submit such plan to Buyer for Buyer's review and approval. WFGD Supplier shall satisfy itself as to and shall be fully responsible for the routing for deliveries of the Equipment and Materials, including delivery of heavy, large, or oversize loads to the Job Site. WFGD Supplier shall give reasonable advance notice to Buyer and Owner of all heavy, large or oversize deliveries. Without limiting the foregoing, WFGD Supplier shall, and shall cause its Subcontractors to, comply with the requirements of any applicable insurance coverage regarding shipping.

3.11 Delivery

Delivery of all portions of the WFGD, including Equipment and Materials, shall be DDP (Incoterms 2010) to the Job Site "under the hook" not off-loaded, to an area designated by Buyer for off-loading on the Generating Station Site. All deliveries by WFGD Supplier shall be by rail or truck based on the results of WFGD Supplier's shipping plan prepared in accordance with **Section 3.10**. WFGD Supplier shall remain obligated to complete delivery of the WFGD, including Equipment and Materials, to the Generating Station Site notwithstanding the passage of title pursuant to **Section 2.2.1**.

3.12 On-Site Services

3.12.1 Scope of Services. WFGD Supplier is required to provide technical assistance, expert guidance and direction, including Job Site Field Services to Buyer during delivery, receipt, installation, commissioning, and testing of the WFGD, so as to ensure the WFGD becomes fully operational in accordance with the requirements of this Agreement. WFGD Supplier shall not be compensated for Work WFGD Supplier performs to remediate Defects in the Work that have been caused, in whole or in part, by WFGD Supplier or because of the assistance, guidance, or direction of the personnel of WFGD Supplier or its Subcontractors.

3.12.2 Site Requirements. The following conditions apply to the personnel of WFGD Supplier and its Subcontractors on the Job Site:

(i) Visas, work permits, medical clearances and evacuation shall be the responsibility of WFGD Supplier at no cost to Buyer.

(ii) Personnel of WFGD Supplier and its Subcontractors while at the Job Site shall abide by the safety and health requirements of Buyer and the requirements set forth in **Exhibit H** (Health and Safety Requirements), and shall also comply with the safety, health, and security requirements in effect at the Generating Station Site and perform their services per the Job Site's work day/work week schedule. Personnel of WFGD Supplier and

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WFGD Supplier and its Subcontractors shall be familiar with and observe Applicable Law so as to not endanger Buyer's ability to perform its work.

(iii) WFGD Supplier shall provide continuity of the technical services required under this **Section 3.12**. WFGD Supplier shall obtain Buyer's prior approval for WFGD Supplier's personnel providing Job Site Field Services to leave the Job Site during the installation, commissioning, and testing of the WFGD.

3.13 Labor Disputes

Whenever WFGD Supplier has knowledge that any actual or potential labor dispute is materially delaying or may threaten to materially delay its performance of the Work, WFGD Supplier shall promptly give written notice thereof, including all relevant information with respect thereto, to Buyer.

3.14 Spare Parts

WFGD Supplier shall provide in strict accordance with manufacturer's requirements all spare parts, including start-up and commissioning spare parts prior to Commercial Operation, in accordance with Project Requirements. Spare parts must be equivalent to or better than and interchangeable with the original parts they are intended to replace. Such spare parts must be of the same material, of identical manufacture, and must present the same properties as the corresponding parts of the Equipment and Materials (except to the extent upgraded by the manufacturer thereof). Spare parts must be properly treated and packed for prolonged storage, considering Job Site ambient conditions. All boxes and packing must be labeled, marked and numbered for identification and a detailed packing list shall be provided by WFGD Supplier. Spare parts are to be delivered to storage locations specified by Buyer. WFGD Supplier shall notify Buyer of all necessary precautions for proper storage. WFGD Supplier shall provide spare parts information in a manner fully compatible for downloading into the spare parts monitoring software maintained by Owner. WFGD Supplier shall give Owner the right to purchase, at no more than WFGD Supplier's out-of-pocket cost (without markup), any surplus items of WFGD Supplier on the Job Site upon Final Completion. WFGD Supplier must provide to Buyer a list of strategic and other spare parts that WFGD Supplier and its Subcontractors recommend be purchased to maintain reliable operations of the WFGD. This spare parts list shall identify the price of each such part (which shall be valid for no less than twelve (12) months), the OEM and other vendors, the OEM's part name and the OEM's part number, expected useful life and typical delivery lead times. Such list shall be delivered no later than two hundred and ten (210) Days prior to the Guaranteed Commercial Operation Date. WFGD Supplier agrees to purchase additional spare parts requested by Owner from such list that are not included in **Exhibit A** (Technical Specification), the actual direct cost of such spare parts plus a markup as provided in **Exhibit R** (Rates) shall be charged to Owner. WFGD Supplier shall cooperate with Owner to determine the best pricing for obtaining spare parts.

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3.15 Operating and Maintenance Manuals

WFGD Supplier shall prepare and provide to Buyer and Owner no less than ninety (90) Days prior to the achievement of Commercial Operation the Operating and Maintenance Manuals in accordance with the requirements of **Exhibit V** (Operating and Maintenance Manuals).

3.16 No First of a Kind

Without the prior written consent of Buyer and Owner, the Equipment and Materials shall not include prototype equipment, meaning any equipment or component thereof that is at that stage in the evolutionary developmental process where the design, functionality, environmental suitability, material composition, scale, reliability, maintainability, and other operational characteristics of the equipment or any component thereof has not been substantiated by at least two (2) full operating years of commercial experience.

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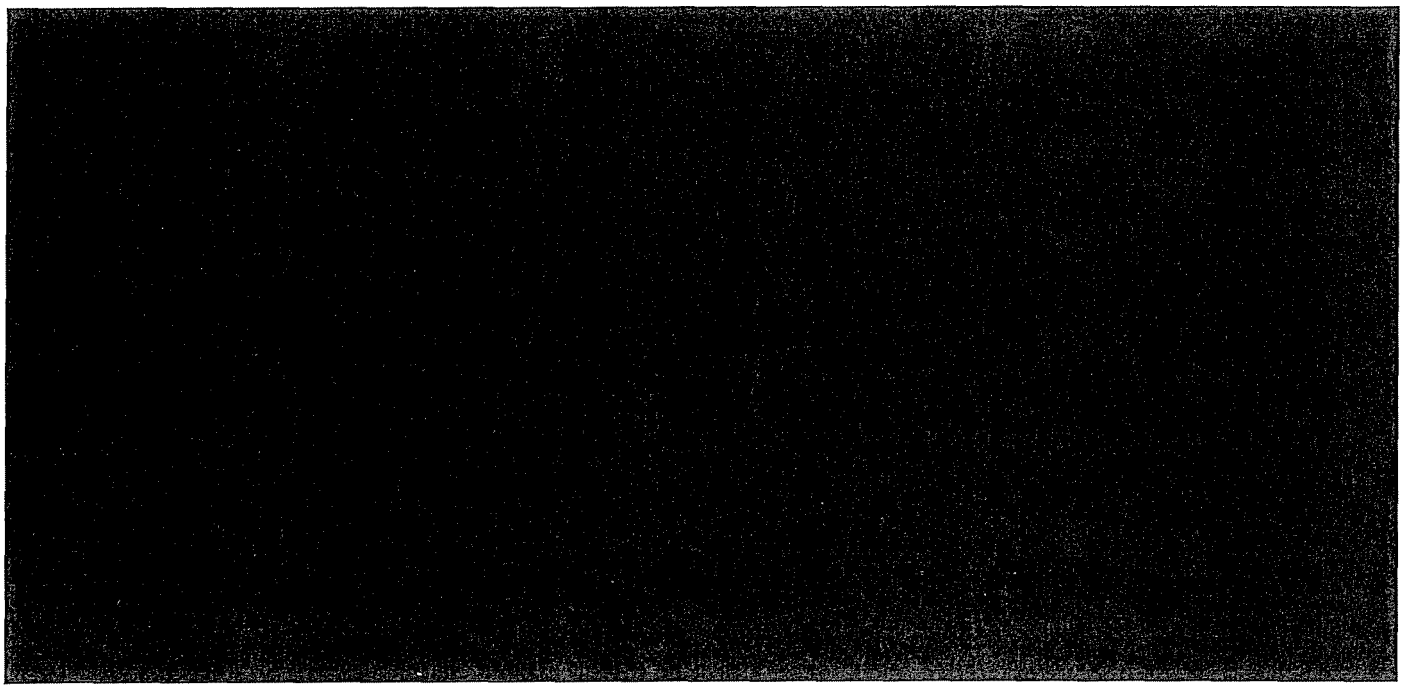

ARTICLE IV

BUYER'S RIGHTS AND OBLIGATIONS

4.1 Changes

Buyer may at any time direct, in writing, changes to the Work, including changes in any one or more of the following: (i) drawings or specifications; (ii) additions to or deletions from quantities ordered or the Work; (iii) delivery schedule; (iv) method of shipment or packing; (v) place of delivery; and (vi) repairs as required as a result of damage or non-conformance not caused by WFGD Supplier or its Subcontractors. WFGD Supplier will be entitled to a change for any delay (a "**Relieved Delay**") caused by an act or omission of Buyer (or its other subcontractors) (or Owner (or its other subcontractors)) which (x) is either (a) a breach of Buyer's obligations under this Agreement or (b) not in accord with Prudent Utility Practices, and (y) adversely affects WFGD Supplier's performance of the Work, and is not caused by the act or omission of WFGD Supplier, one or more Subcontractors, or others for whom WFGD Supplier is responsible, and which: (a) affects WFGD Supplier's cost to perform the Work or (b) causes WFGD Supplier a delay in the delivery schedule as set forth in **Exhibit D** (Project Schedule and Key Dates); **provided**, that WFGD Supplier demonstrates and documents such adverse impacts and uses commercially reasonable efforts to mitigate such adverse impacts. If any such change causes an increase or decrease in the cost of or timing required to provide the Equipment and Materials, an equitable adjustment determined in a manner consistent with that utilized in the WFGD Supplier Basis of Bid and **Exhibit R** (Rates) shall be made in the Agreement Price, the milestone payment schedule, and/or delivery schedule and this Agreement shall be modified by written amendments or revisions executed by authorized representatives ("**Change Order**") to reflect such equitable adjustment. Any request by the WFGD Supplier for adjustment under this **Section 4.1** shall be in the form of **Exhibit F-3** (Change Order Form) must be accompanied with

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reasonable supporting documentation and shall be asserted within five (5) Business Days of the WFGD Supplier's knowledge of the occurrence of the Relieved Delay or the date of receipt by the WFGD Supplier from Buyer of the notification of change, as applicable, (or, if five (5) Business Days is not reasonably adequate, then as promptly thereafter as practicable) but in no event later than twenty (20) Days after WFGD Supplier's knowledge of the occurrence of the Relieved Delay or the date of receipt by WFGD Supplier from Buyer of the notification of the change, as applicable, unless the Parties mutually agree to extend the time required to assess and determine the resulting impact. Buyer shall respond to WFGD Supplier's request for adjustment within thirty (30) Days of receipt of WFGD Supplier's notice. However, nothing in this **Section 4.1** shall excuse WFGD Supplier from proceeding with the changes directed by Buyer (or the Work subject to the Relieved Delay), provided however, pending the resolution of the equitable adjustment, WFGD Supplier shall be compensated monthly for its actual, reasonable costs (with no markup) expended (net of costs eliminated) with respect to such changes, to the extent the WFGD Supplier has incurred such net costs and properly documented them to Buyer. The resolution of the equitable adjustment shall include a reconciliation of amounts paid pending the resolution against amounts due pursuant to the resolution. Failure by WFGD Supplier to timely give the required notice hereunder shall preclude WFGD Supplier's right to request any adjustment. All Change Order Work shall be identified and billed for separately on the applicable invoices.

4.2 Suspension

Notwithstanding any other provisions of this Agreement, Buyer may at any time, suspend, or extend the time for, WFGD Supplier's performance, upon written notice of no less than two (2) Business Days of such suspension or extension. Thereafter, WFGD Supplier shall resume performance as directed by Buyer (or as expeditiously as possible after Buyer's notice of resumption of performance). In the event of such suspension or extension, (unless such suspension arises as a result of any fault, Defect or failure to perform which is attributable to WFGD Supplier), WFGD Supplier shall be entitled to monthly reimbursement for additional direct costs reasonably and necessarily incurred by WFGD Supplier in effectuating such suspension or extension period plus a mark-up as set forth in **Exhibit R** (Rates), to the extent that such additional costs are actually incurred, if claimed within thirty (30) Days after Buyer's notice to resume the Work. WFGD Supplier shall use all reasonable efforts to minimize such suspension costs. Any suspension under this **Section 4.2** will not suspend a Party's obligation to make payments of amounts due and owing prior to such suspension or for milestones achieved prior to the suspension. At any time during such a suspension (other than a suspension arising as a result of any fault, Defect or failure to perform which is attributable to WFGD Supplier) that has lasted for more than one year, the WFGD Supplier may terminate this Agreement by giving notice of termination to Buyer. Any such termination will be treated as a termination by Buyer for its convenience under **Section 6.1**.

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4.3 Expediting

4.3.1 Buyer's Right to Expedite. The Equipment and Materials, including as provided in connection with any Warranty Work, shall be subject to expediting by Buyer. Buyer, Owner, and/or Owner Engineer shall, upon reasonable notice to WFGD Supplier, be afforded free access during working hours to WFGD Supplier's plants (WFGD Supplier may, at its option, assign a person to accompany personnel from Buyer, Owner, and/or Owner Engineer and if such escort is provided by WFGD Supplier then Buyer, Owner, and/or Owner Engineer shall allow the escort to accompany them), and WFGD Supplier agrees to procure a similar right for Buyer for expediting purposes with respect to WFGD Supplier's Subcontractors. WFGD Supplier shall notify Buyer in writing of any actual or anticipated delays immediately upon discovery. Such notice shall include an estimated period of delay, cause, and corrective actions being taken. Slippage in WFGD Supplier's schedule which may impact the achievement of any of the Guaranteed Milestone Dates or any other key date set forth in **Exhibit D** (Project Schedule and Key Dates) may be deemed to be reasonable grounds for insecurity in which event Buyer may demand in writing that WFGD Supplier provide adequate assurances that WFGD Supplier shall perform on time.

4.3.2 Schedule Recovery. If, in Buyer's opinion, WFGD Supplier's actual progress is insufficient to comply with the schedule requirements of this Agreement, Buyer may provide a written notice requesting that WFGD Supplier provide adequate assurances, in writing, demonstrating that corrective measures have been effected to meet such requirements. If, within three (3) Days from Buyer's notice, WFGD Supplier has not provided either the adequate assurances or remedied the insufficient progress to Buyer's reasonable satisfaction, Buyer, in addition to other remedies it may have under this Agreement, may establish a reasonable corrective action plan which may, in part, include the assignment of in-shop expediting personnel to periodically visit and, if necessary, reside at the manufacturing location(s), as appropriate. Costs incurred by Buyer in performance of such corrective action plan shall be administered and charged to WFGD Supplier in accordance with **Section 5.6**.

4.3.3 No Additional Charges. Notwithstanding the foregoing, WFGD Supplier shall be solely responsible for the expediting activities covering its operations and that of its Subcontractors, and the activities performed by Buyer shall not result in any additional charges to Buyer and shall not affect WFGD Supplier's obligation to perform in accordance with the requirements established by this Agreement.

4.4 Buyer's Use of WFGD Supplier's Supplied Design Data

Changes of critical engineering submittals (that are marked issued for design) such as loads, locations, interfaces, ratings, that cause: (i) material engineering redesign or (ii) engineering rework shall be backchargeable to WFGD Supplier in accordance with **Section 5.6**.

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Changes of critical engineering submittals (that are marked issued for construction) such as loads, locations, interfaces, ratings, that cause: (a) engineering redesign; (b) engineering rework; (c) changes to equipment and materials not supplied by WFGD Supplier; or WFGD Supplier one or more of the foregoing, shall be backchargeable to WFGD Supplier in accordance with **Section 5.6.**

4.5 Deferred Delivery

4.5.1 Storage. Should the Buyer elect to delay delivery as required by this Agreement of some or all of the Equipment and Materials, WFGD Supplier shall store such Equipment and Materials.

4.5.2 Payment of Storage Costs. WFGD Supplier's additional storage and handling costs in accordance with this **Section 4.5** resulting from Buyer's request for delay in delivery shall be paid by Buyer; **provided**, that if WFGD Supplier has received reasonable advance notice prior to shipment and the Equipment and Materials have not departed the manufacturing facility, then WFGD Supplier shall pay for the cost of the first sixty (60) Days of storage.

4.5.3 Impact on Payment Schedule. WFGD Supplier shall be entitled to payment from the Buyer as if shipment and delivery had been made at the time the Equipment and Materials are placed in storage.

4.5.4 Other Conditions Applicable to Storage. If Equipment and Materials are placed in storage in accordance with **Section 4.5.1**, including storage at the facility where manufactured, the following conditions shall apply: (i) for the purposes of the passage of title in accordance with **Section 2.2.1**; the placement of the Equipment and Materials in storage shall be deemed shipment; (ii) when conditions permit, WFGD Supplier shall resume delivery of the Equipment and Materials to the originally agreed point of delivery; (iii) WFGD Supplier shall continue to be liable under this Agreement for meeting the Guaranteed Milestone Dates, as such Guaranteed Milestone Dates may be adjusted as a result of such shipment to storage; (iv) WFGD Supplier shall be responsible for and shall bear any and all risk of loss or damage to the Equipment and Materials until delivery thereof in accordance with the delivery provisions of this Agreement; and (v) WFGD Supplier shall be responsible for maintaining the Equipment and Materials in storage.

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ARTICLE V

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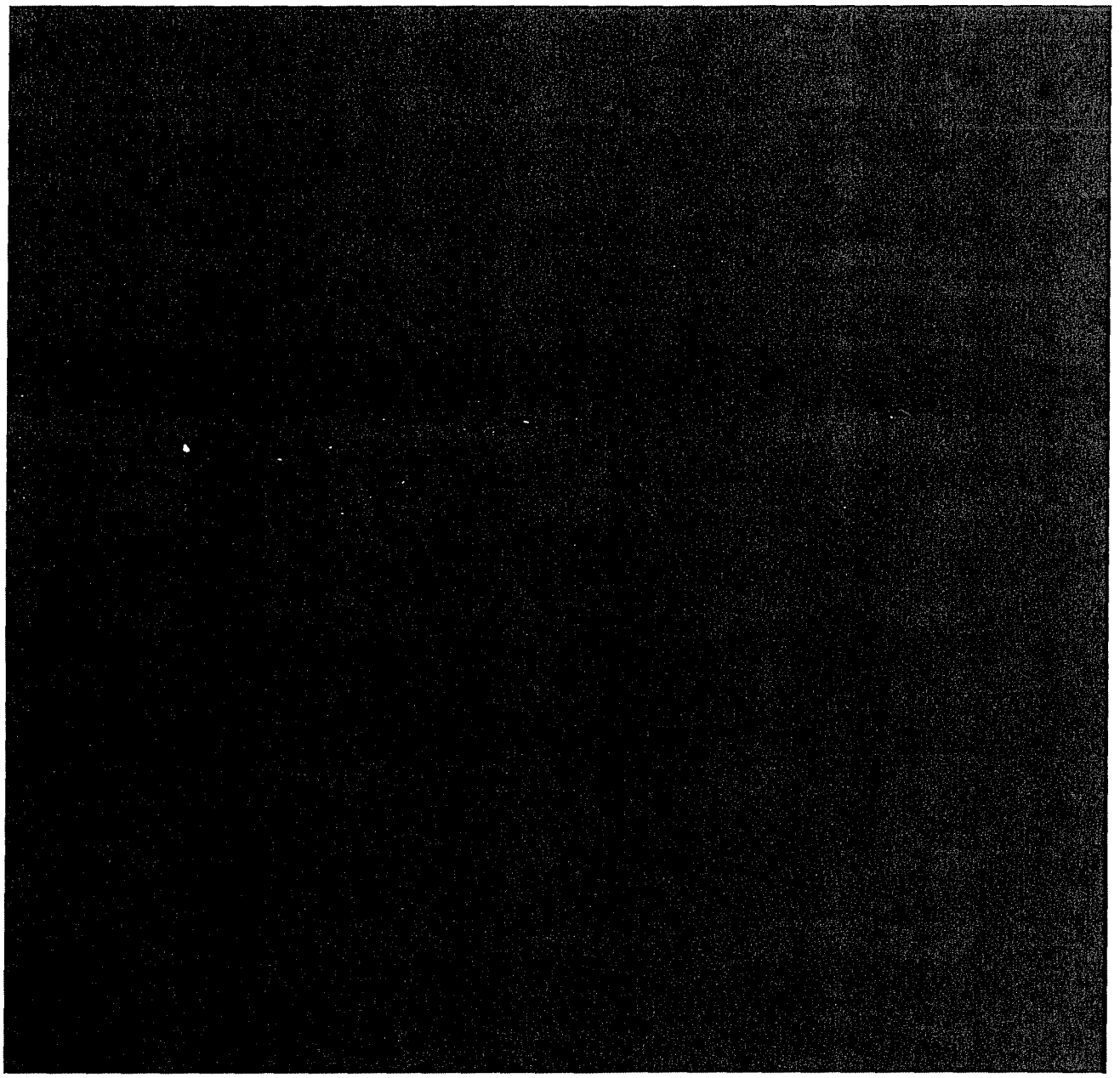

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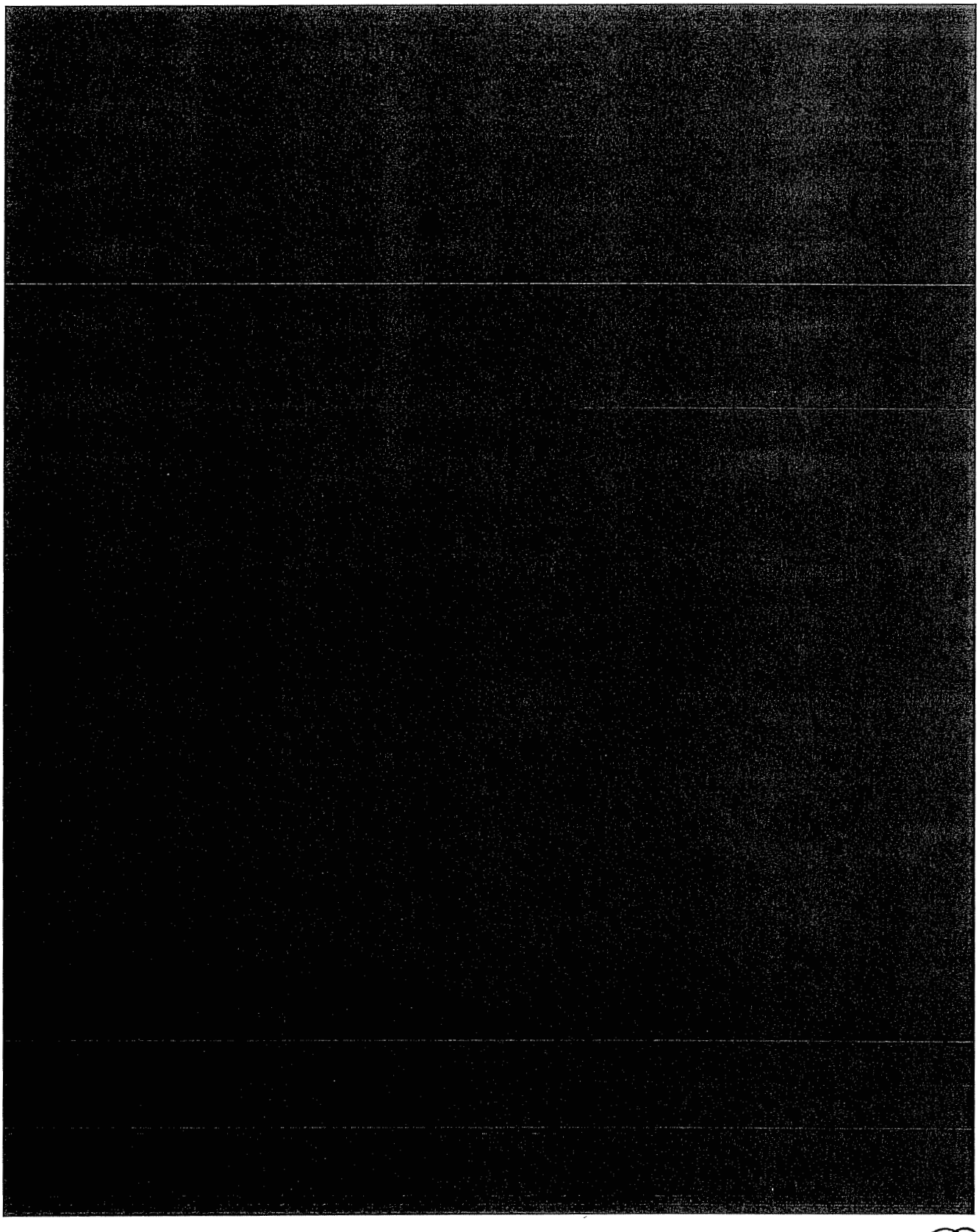

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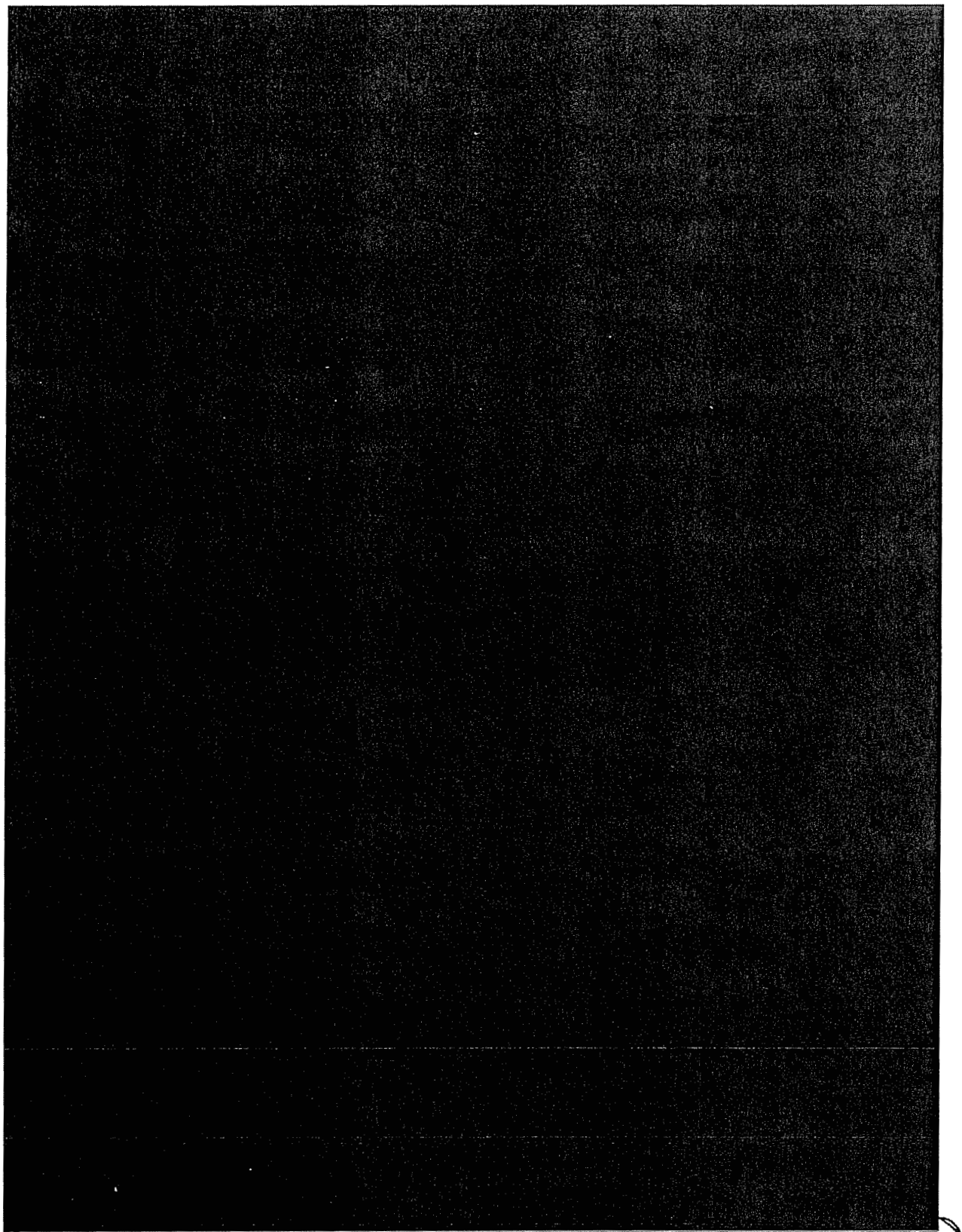

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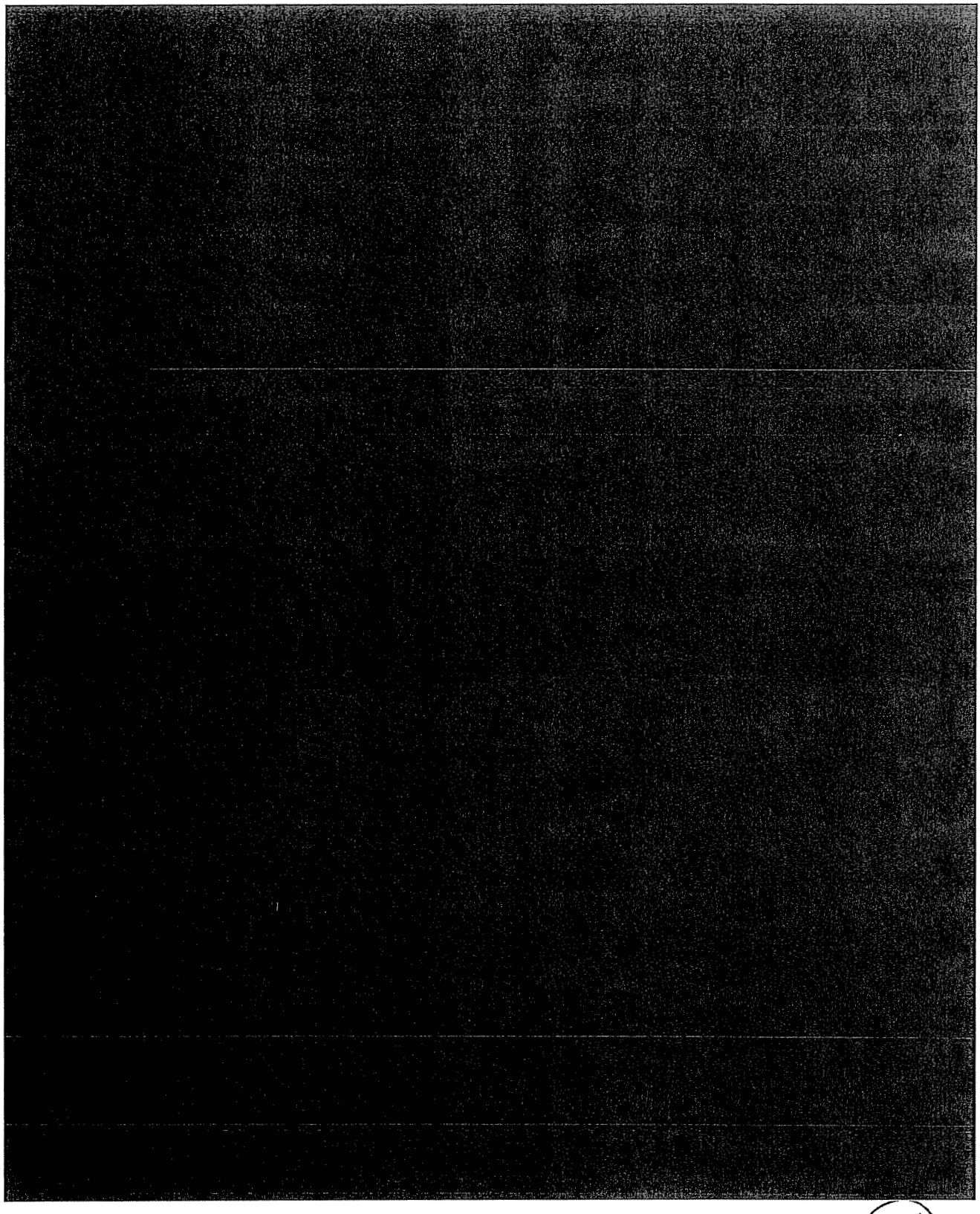

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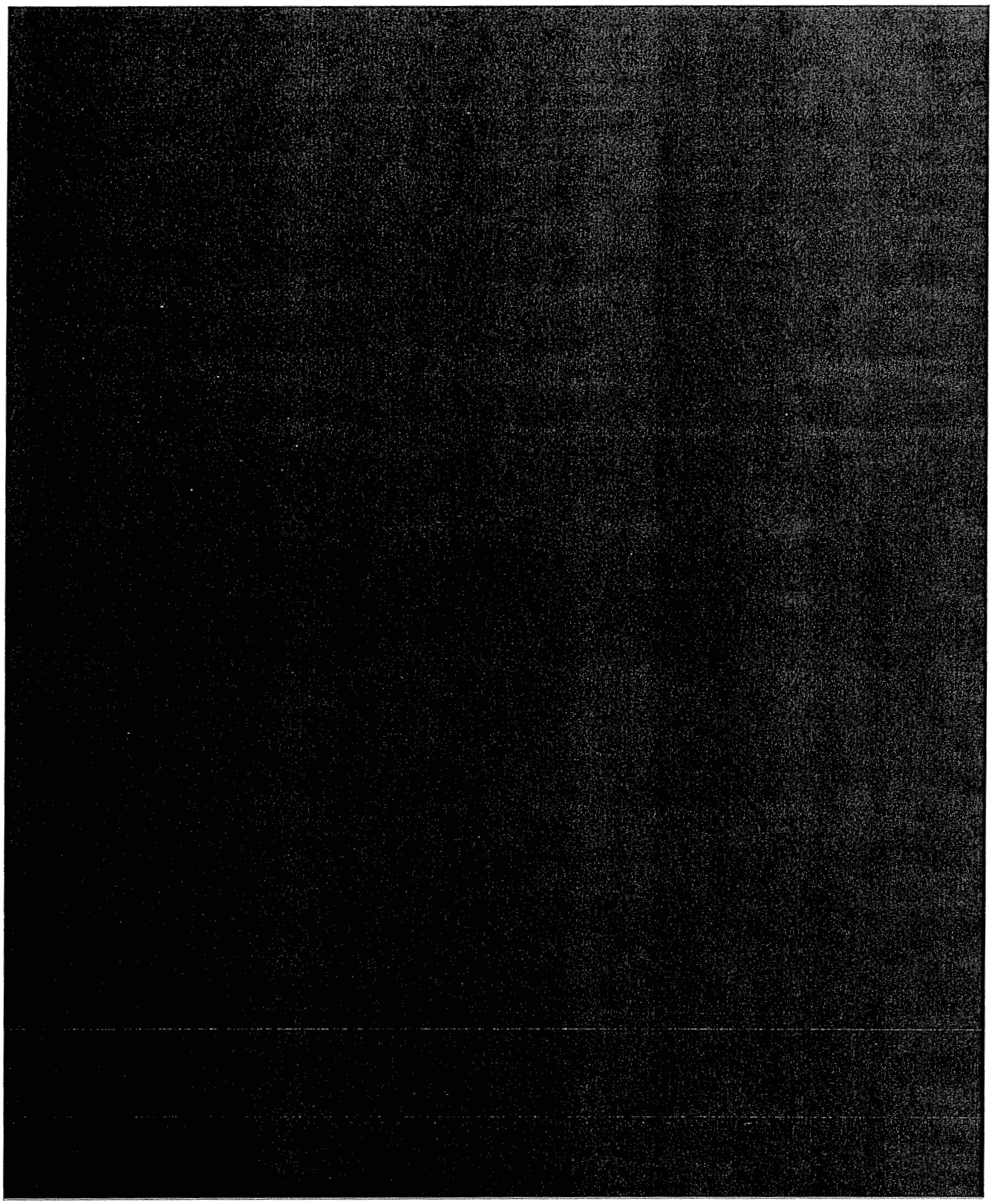

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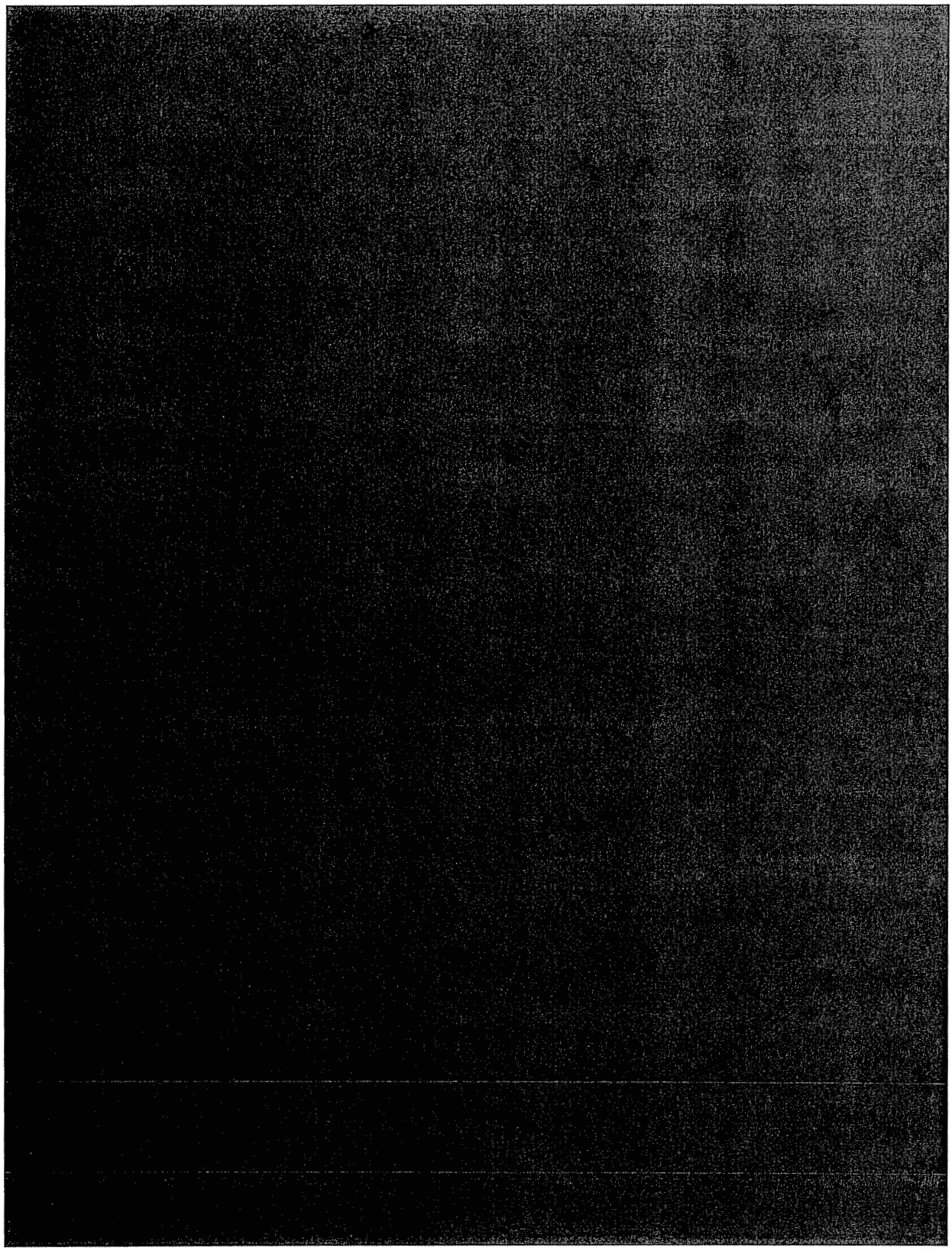

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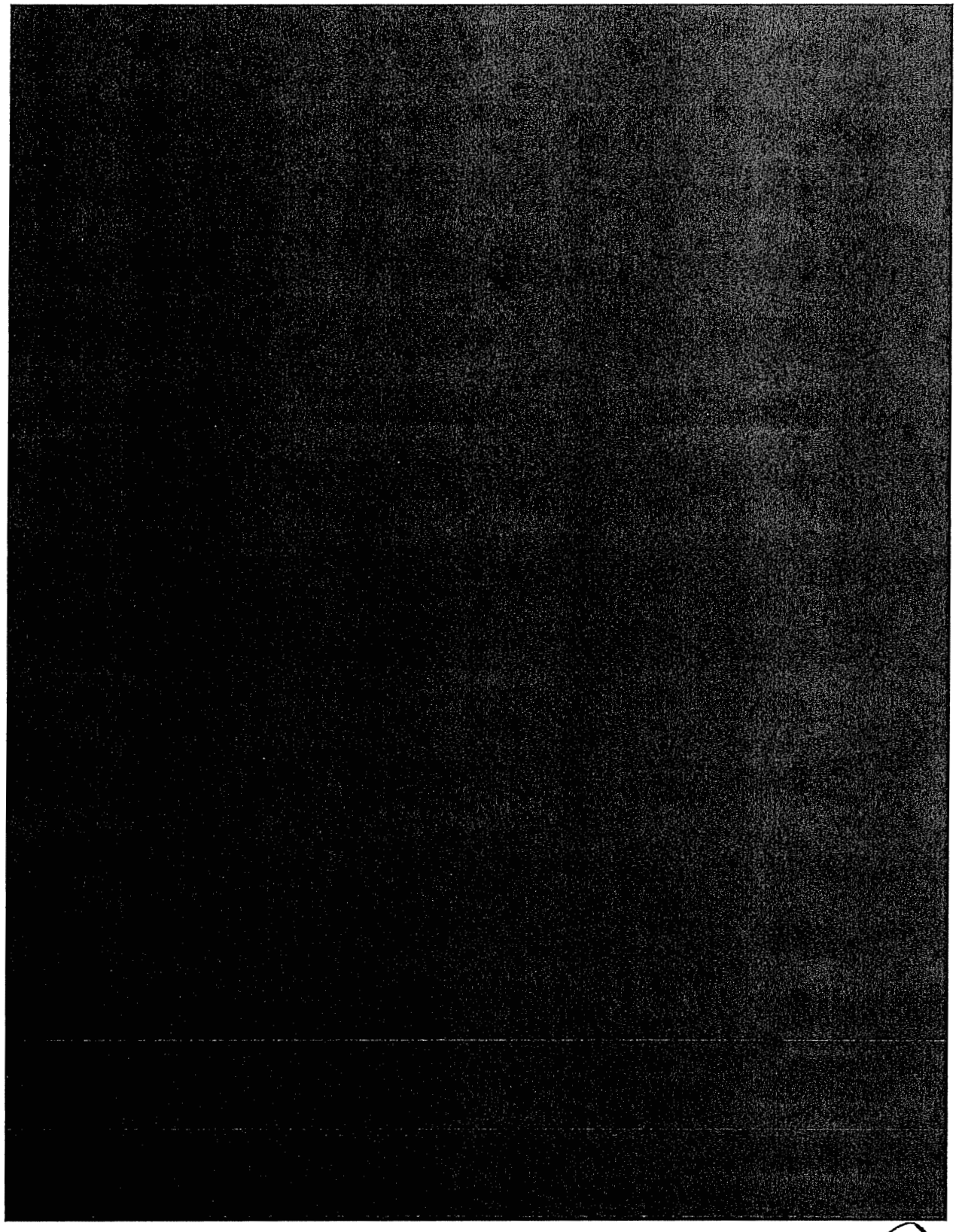

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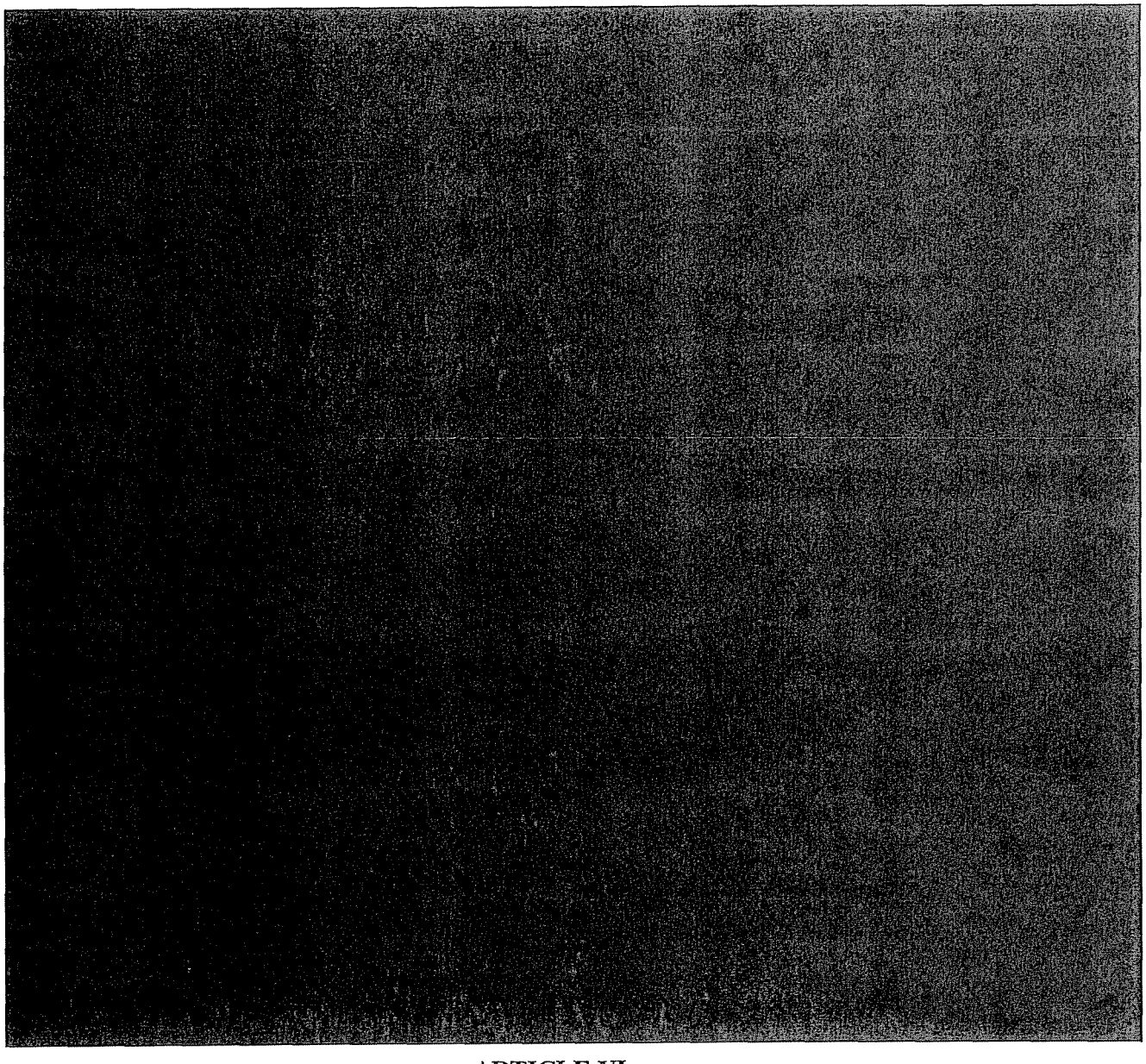

ARTICLE VI

TERMINATION

6.1 Termination for Convenience

6.1.1 Termination. WFGD Supplier's performance under this Agreement may be terminated by Buyer for its convenience in accordance with this **Section 6.1.1** in whole, or, from time to time, in part whenever Buyer shall elect. Any such termination shall be effected by delivery to WFGD Supplier of a notice of termination specifying the extent to which performance under the Agreement is

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terminated, and the date upon which such termination becomes effective. Upon receipt of any such notice, WFGD Supplier shall, unless the notice requires otherwise: (i) immediately discontinue Work on the date and to the extent specified in the notice; (ii) place no further orders for Equipment and Materials other than as may be necessarily required for completion of any portion of the Work that is not terminated; (iii) promptly make every reasonable effort to either obtain cancellation on terms satisfactory to Buyer of all contracts with Subcontractors unless WFGD Supplier is directed by Buyer to take other actions with respect to the same which may include the assignment of all or some of those contracts to Buyer or Buyer's designee on terms satisfactory to such assignee; and (iv) assist Buyer upon request in (a) the maintenance, protection, and disposition of property acquired by Buyer under this Agreement or (b) the enforcement of warranties or guarantees under contracts with Subcontractors. Only Buyer may terminate for convenience.

6.1.2 Termination Payment. Within ninety (90) Days after Buyer delivers a notice of termination for convenience to WFGD Supplier pursuant to **Section 6.1.1**, Buyer shall pay to WFGD Supplier, as full compensation for all Work and as WFGD Supplier's sole and exclusive remedy for such termination: (i) all amounts due and not previously paid to WFGD Supplier for Work including Equipment and Materials, completed in accordance with this Agreement prior to the effective date of termination; (ii) actual cost (plus a reasonable profit of five percent (5%) on the costs incurred) for any Work, including Equipment and Materials, then in production and not paid for under clause (i), above; provided, that no amount shall be paid with respect to Equipment and Materials which are the standard stock of WFGD Supplier or its Subcontractors; and (iii) the reasonable costs of settling and paying claims with respect to cancelled subcontracts. In no event will the aggregate termination payment due to WFGD Supplier pursuant to this **Section 6.1.2** exceed the amount shown on the Termination Payment Schedule as set forth in **Exhibit C** (Agreement Price and Milestone Payment and Termination Schedules) corresponding to the date of termination set forth in such notice, less any payments previously made by Buyer hereunder. Notwithstanding the foregoing, WFGD Supplier shall reduce the amount of the payment to be made by Buyer by the value of undelivered Equipment and Materials that WFGD Supplier does not dispose of as waste.

6.1.3 Liabilities. Notwithstanding a termination for convenience hereunder, the Parties shall remain liable to each other for (i) liabilities that have accrued under other provisions of this Agreement prior to such termination and (ii) obligations under this Agreement that, by their express terms, survive termination.

6.1.4 Continuing Obligations. Upon any full or partial termination of this Agreement pursuant to this **Section 6.1**, WFGD Supplier shall: (i) execute and deliver documents and take reasonable steps, including the assignment of WFGD Supplier's contractual rights, as Buyer may require, for the purpose of fully vesting in Buyer or Buyer's designee all right, title and interest of WFGD Supplier in and to all contracts with Subcontractors which Buyer elects to assume and (ii) execute and

deliver (and use reasonable commercial efforts to cause its Subcontractors to execute and deliver) to Buyer all waivers and releases, in form and substance reasonably acceptable to Buyer for the Work required to establish that the Unit, the Generating Station Site and the Job Site are free from any and all claims or Liens arising out of or in connection with the performance by WFGD Supplier or any Subcontractor of the Work so terminated, but only to the extent that (a) WFGD Supplier has been paid for such Work in accordance with the terms of this Agreement and (b) only with respect to that portion of the Work so terminated, including deliveries of Equipment and Materials purchased.

6.2 Termination for Default

6.2.1 Termination. Buyer may terminate the whole or any part of WFGD Supplier's performance under this Agreement for cause in any one of the following circumstances:

(i) WFGD Supplier substantially fails to: (a) make a Complete Delivery/Erection of the Equipment and Materials without D/E Defects or (b) provide adequate assurances of being able to make such delivery, in either case, by the Guaranteed Delivery Milestone Date for such Equipment and Materials, as applicable;

(ii) WFGD Supplier fails to provide adequate assurance of WFGD Supplier's ability to meet the quality standards of this Agreement pursuant to **Section 3.6**;

(iii) WFGD Supplier abandons or fails to perform any of the other material obligations of this Agreement in accordance with its terms or so fails to make progress as to endanger timely performance of this Agreement;

(iv) an Insolvency Event of WFGD Supplier occurs;

(v) WFGD Supplier makes a material representation which is false or misleading when made;

(vi) WFGD Supplier violates Applicable Law in connection with the performance of or failure to perform the Work, which violation results or could result in a material adverse impact to Buyer;

(vii) WFGD Supplier assigns or transfers this Agreement (or any right or interest herein) in breach of **Section 17.3**;

(viii) WFGD Supplier has caused in whole or in part delays in the achievement of Commercial Operation of a WFGD of more than thirty (30) Days beyond the Guaranteed Commercial Operation Date therefor (provided, that this will instead be sixty (60) Days beyond the Guaranteed Commercial Operation Date if (i) WFGD Supplier diligently and

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continuously pursues actions to achieve Commercial Operation promptly after it caused such delays (ii) WFGD Supplier presents to Buyer and Buyer accepts within the initial thirty (30) Days of such delays a recovery plan that is reasonably likely to require no more than such sixty (60) Days, and (iii) WFGD Supplier's actions under (i), above, comply with and remain on the schedule set forth in such recovery plan); or

(ix) WFGD Supplier has caused in whole or in part delays in the achievement of Final Completion of a WFGD of more than thirty (30) Days beyond the Guaranteed Final Completion Date therefor (provided, that this will instead be sixty (60) Days beyond the Guaranteed Final Completion Date if (i) WFGD Supplier diligently and continuously pursues actions to achieve Final Completion promptly after it caused such delays (ii) WFGD Supplier presents to Buyer and Buyer accepts within the initial thirty (30) Days of such delays a recovery plan that is reasonably likely to require no more than such sixty (60) Days, and (iii) WFGD Supplier's actions under (i), above, comply with and remain on the schedule set forth in such recovery plan); or

(x) WFGD Supplier fails to provide or maintain insurance as required by **Article XIV** and **Exhibit I** (Insurance); or

(xi) an Insolvency Event of the Person providing the Parent Guarantee pursuant to **Section 5.4.6** occurs.

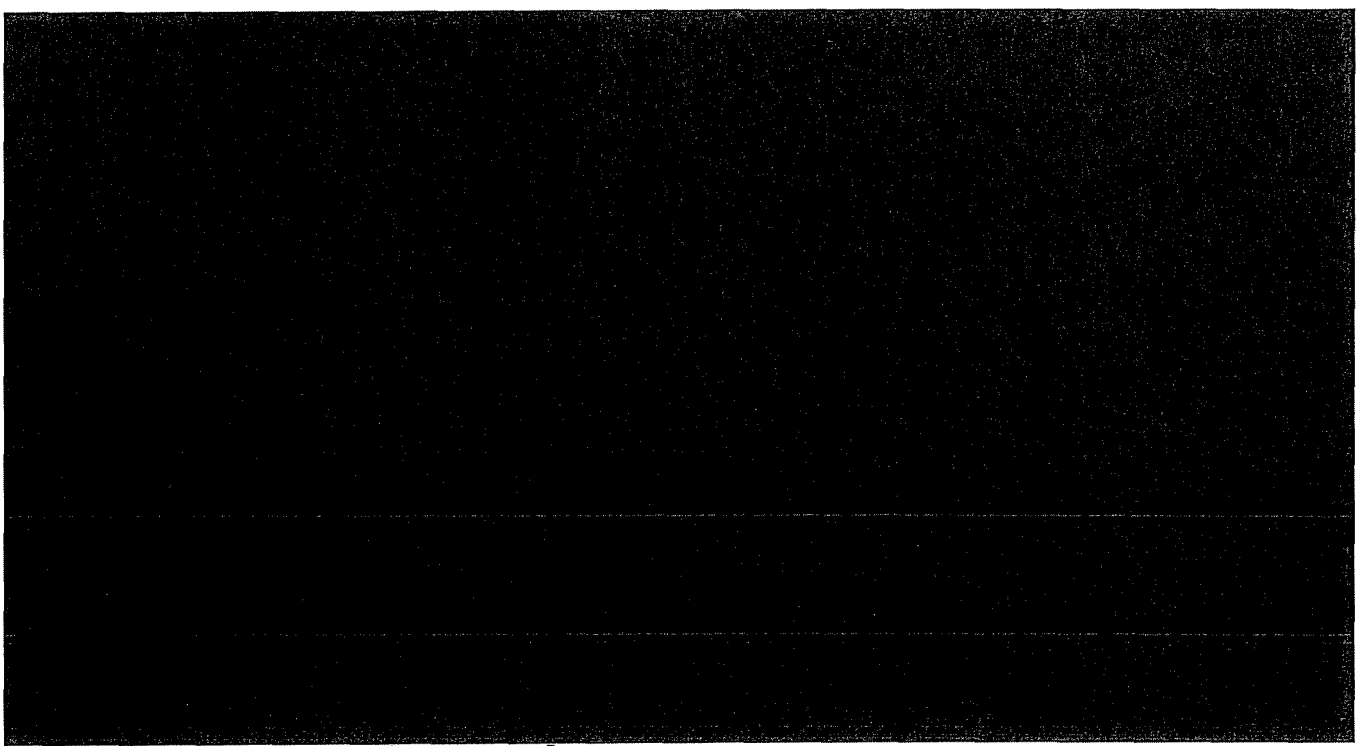
6.2.2 Termination Procedure. In the event of a breach hereunder with respect to **clauses (i), (ii), (iii),** or **(vi)** of **Section 6.2.1**, Buyer shall provide WFGD Supplier with written notice of the nature of the breach and Buyer's intention to terminate for default. WFGD Supplier shall commence implementation of reasonable corrective action to cure such breach within ten (10) Days of such notice, or shall implement a recovery plan acceptable to Buyer and thereafter diligently and continuously pursue actions in accordance with the recovery plan reasonably likely to cure such default within thirty (30) Days of notice thereof; **provided, however**, that if such breach cannot be cured within such thirty (30) Day period despite WFGD Supplier's diligent efforts, WFGD Supplier shall have an additional: (i) sixty (60) Days with respect to **clauses (i)** and **(iii)** of **Section 6.2.1** or (ii) thirty (30 Days with respect to **clauses (ii)** and **(vi)** of **Section 6.2.1**, or, in either case, such additional period of time as mutually agreed by the Parties, to effect such cure so long as supported by an updated recovery plan. If WFGD Supplier does not commence implementation of reasonable corrective action or implement an acceptable recovery plan and thereafter diligently and continuously pursue actions reasonably likely to cure such default within the time periods specified in the preceding sentence, this Agreement may be terminated on written notice by Buyer to WFGD Supplier. WFGD Supplier agrees that, with respect to breaches of **clauses (iv), (v), (vii), (viii), (ix), (x),** or **(xi)** of **Section 6.2.1**, no further notice shall be required and no cure period allowed, and in the event of any such

default Buyer may terminate this Agreement for default upon written notice to WFGD Supplier.

6.2.3 Buyer's Rights. If Buyer terminates this Agreement in whole or in part as provided in this **Section 6.2**, Buyer may: (i) complete the Work, including procuring, upon such terms and in such manner as Buyer may deem appropriate, items of equipment and materials similar to the Equipment and Materials that were to have been provided by WFGD Supplier hereunder and if the cost of completing such Work exceeds the unpaid balance of the Agreement Price, the WFGD Supplier shall be liable to Buyer for such excess or (ii) exercise any other rights or remedies available to Buyer at law or in equity (including damages from WFGD Supplier); **provided, however**, that WFGD Supplier shall continue the performance of this Agreement to the extent not terminated under the provisions of this **Section 6.2**.

6.2.4 Assistance. WFGD Supplier agrees to assist Buyer in the event that a re-procurement action is necessary or Buyer elects to complete the remaining Work as a result of default, by cooperation in the transfer of Information, in the disposition of Work in progress or residual material, and in the performance of other reasonable requests made by Buyer.

6.2.5 No Default. If, after notice of termination of this Agreement under **Section 6.2.2**, it is determined for any reason that Buyer did not have the right to terminate under the provisions of this **Section 6.2**, the rights and obligations of the Parties will be the same as if notice of termination had been issued pursuant to **Section 6.1**.



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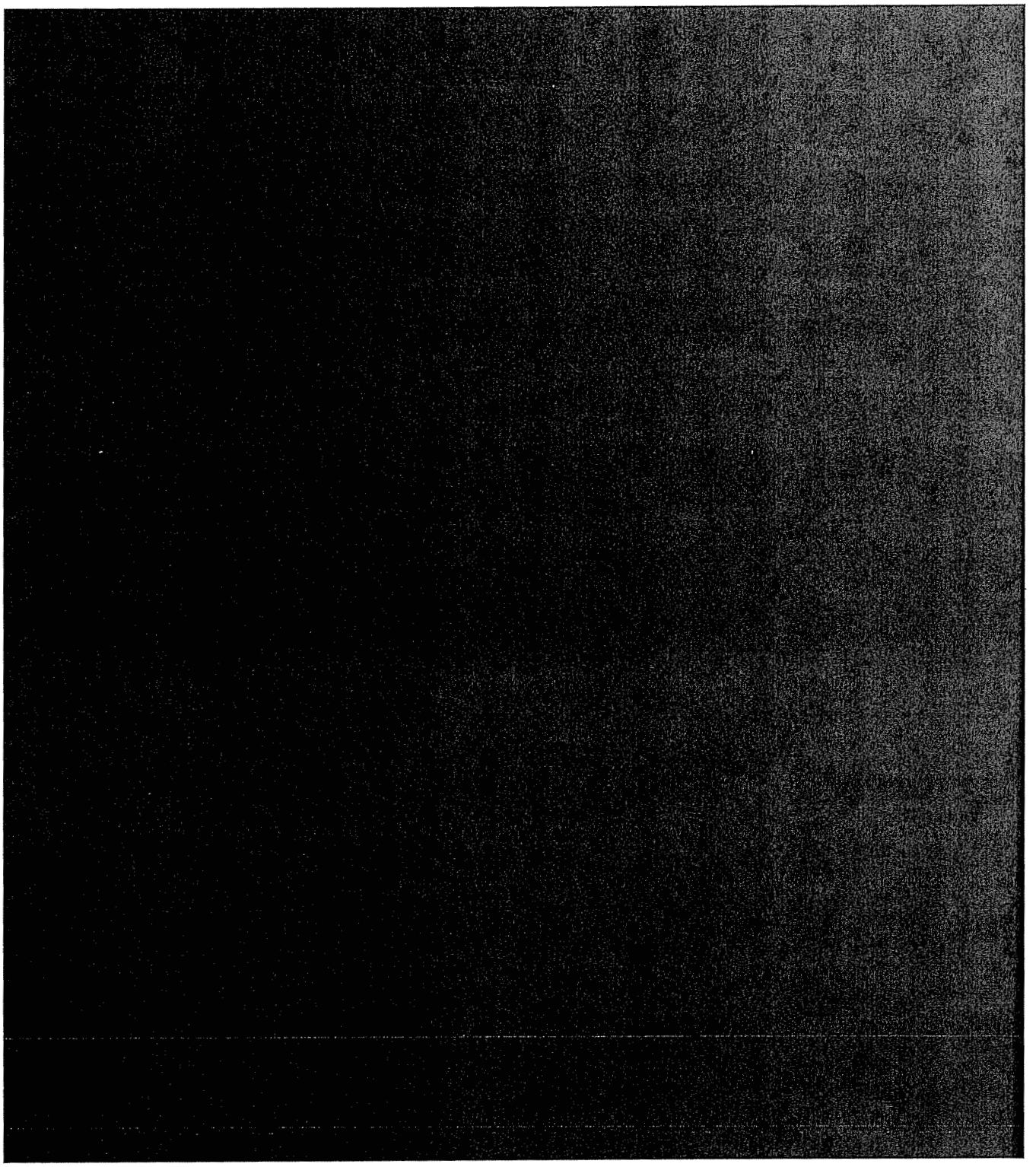

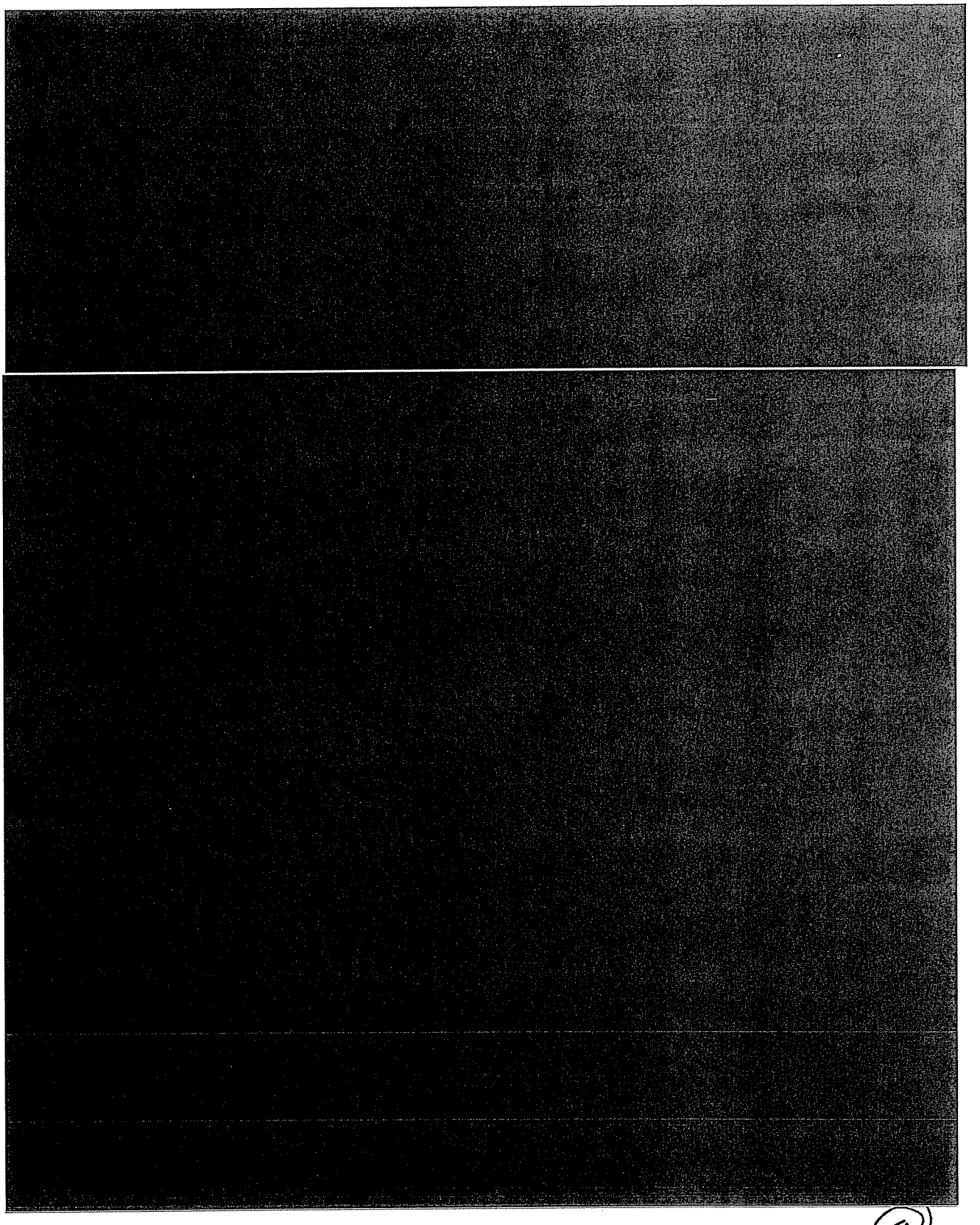

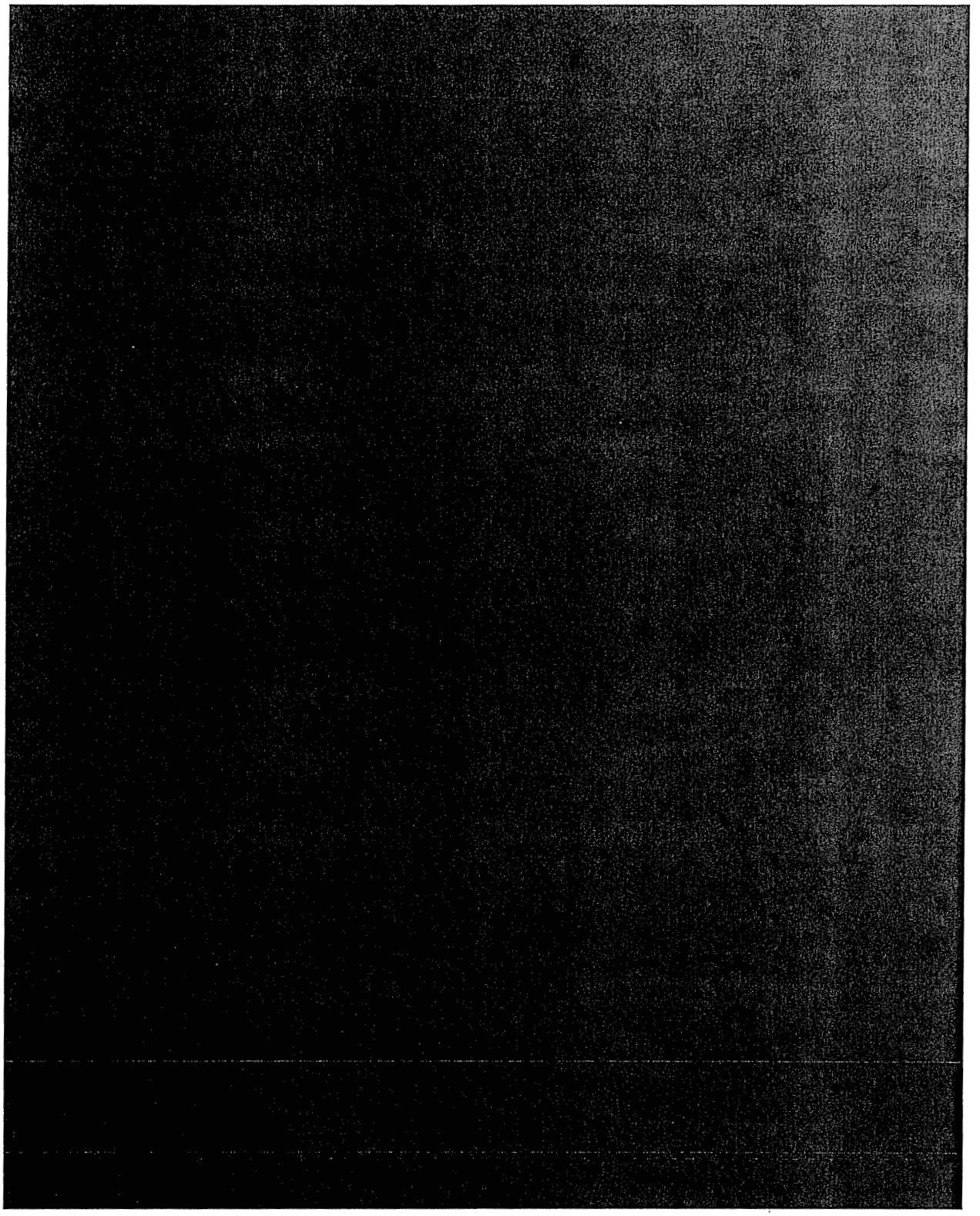

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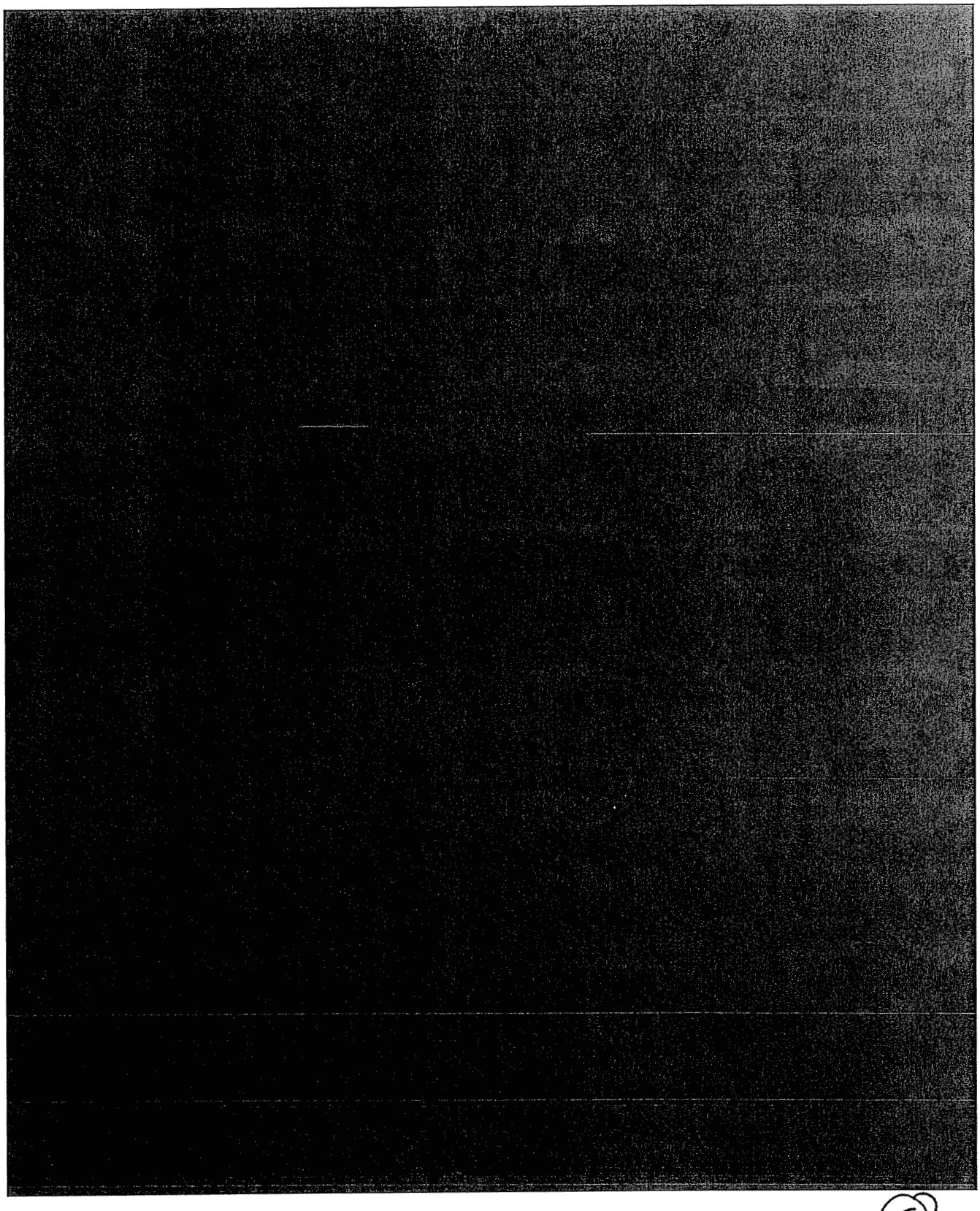

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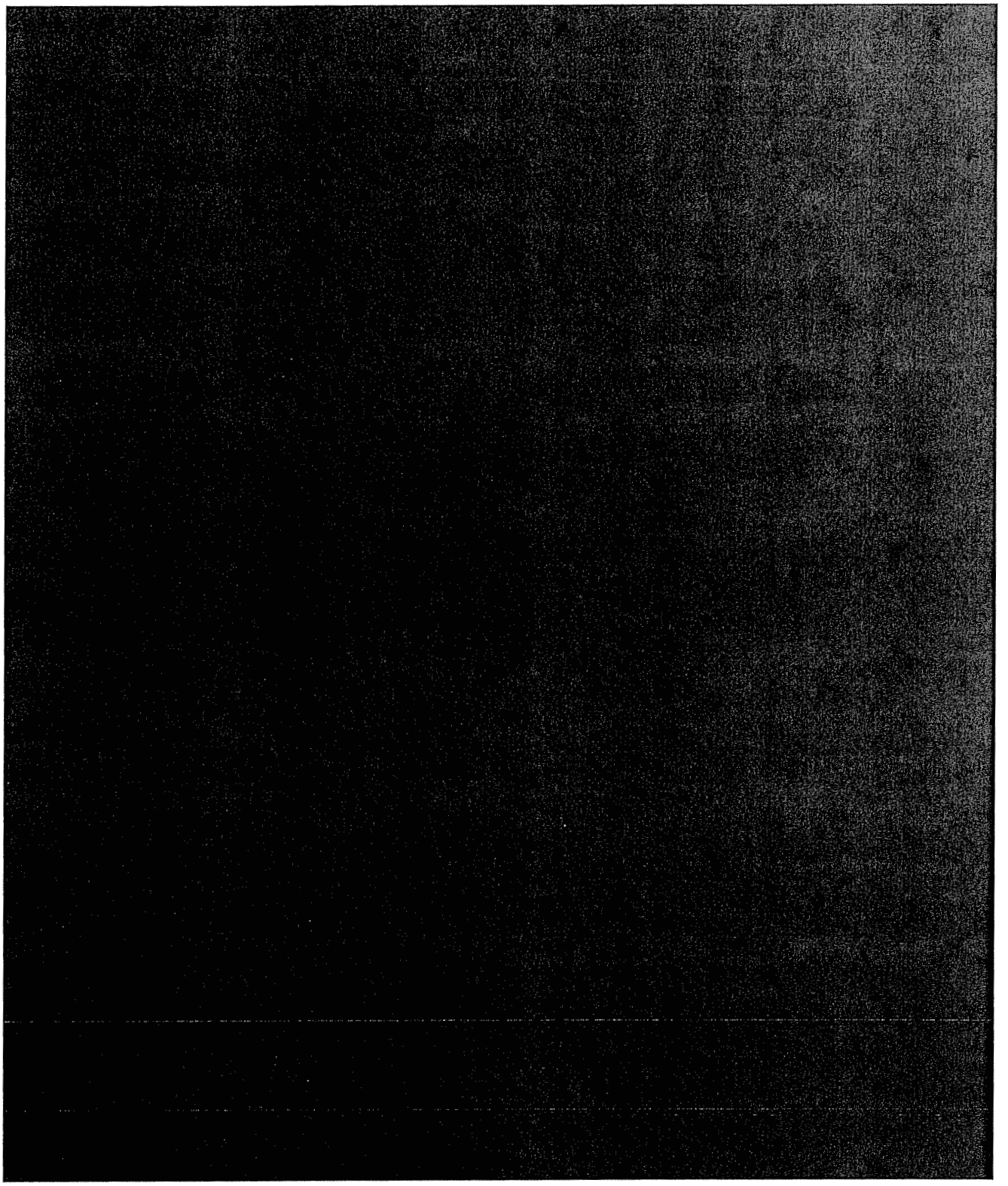

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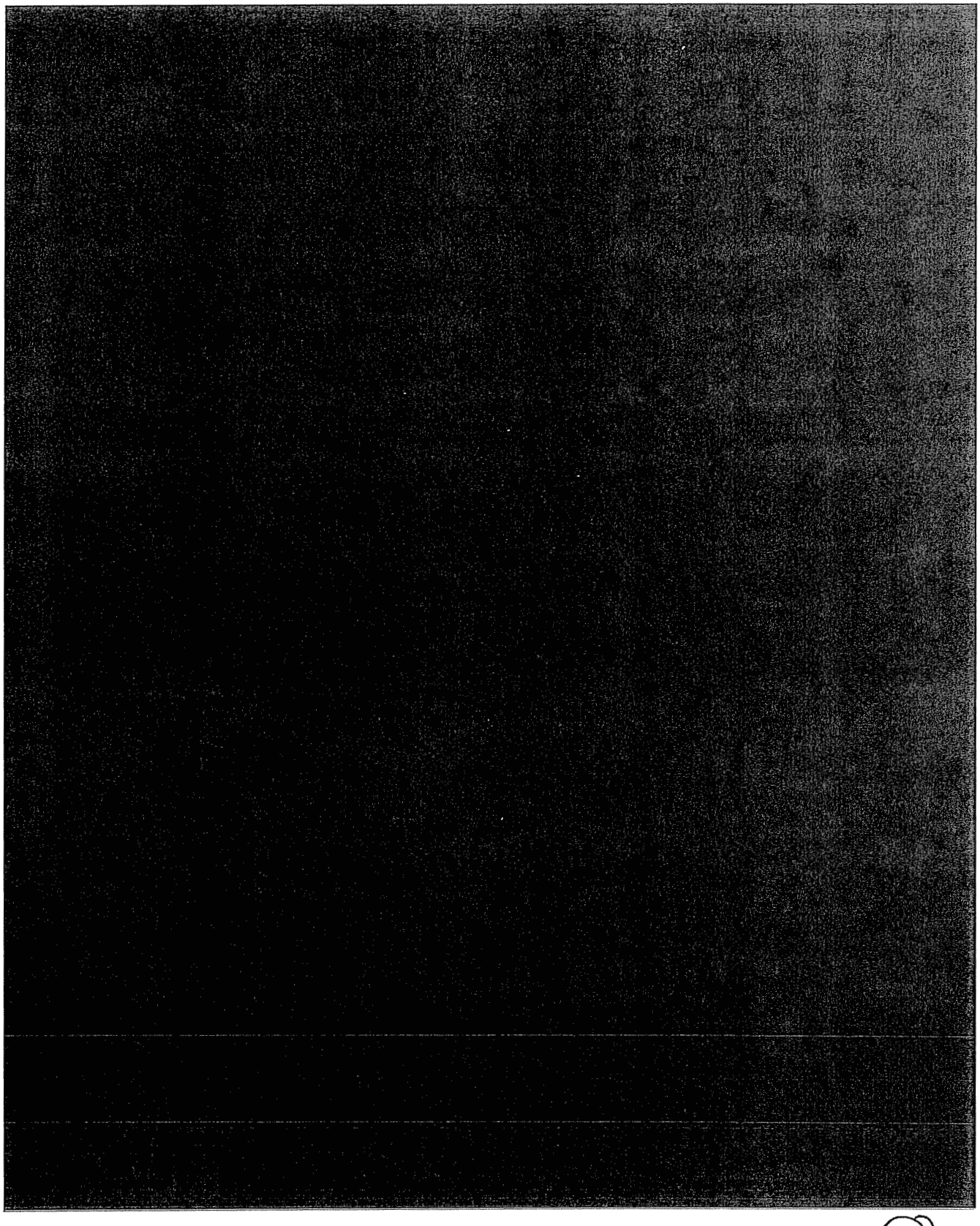

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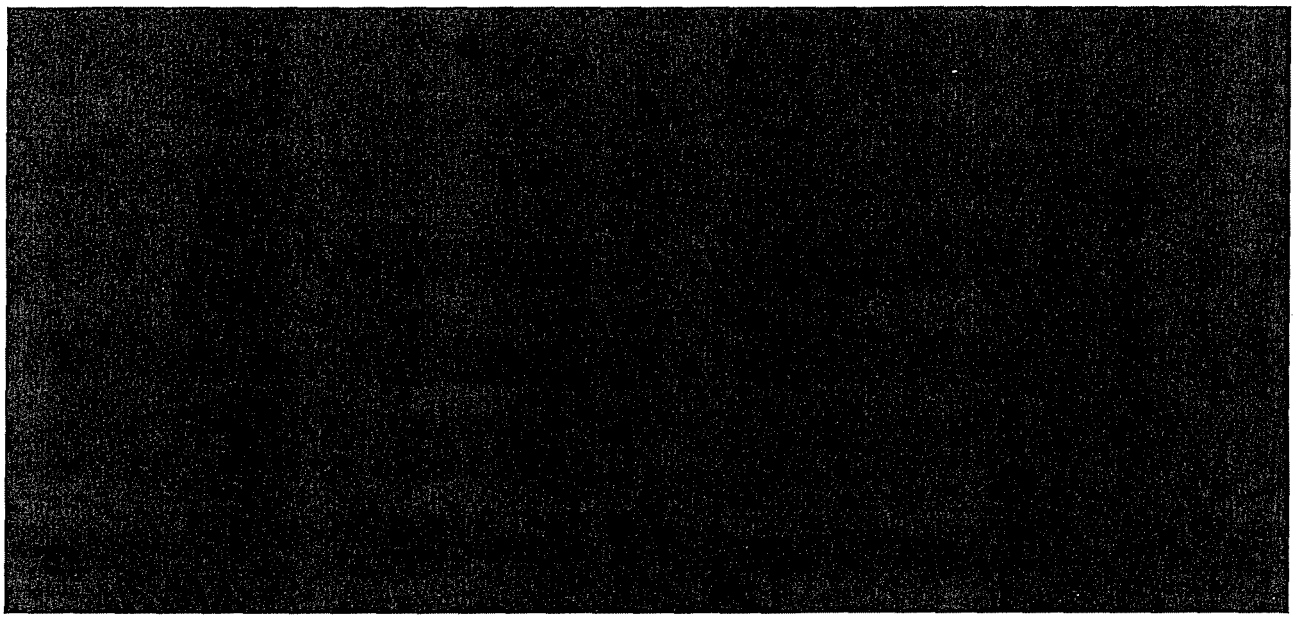

ARTICLE X

GENERAL INDEMNITY

10.1 General Indemnity

To the fullest extent permitted by Applicable Law, WFGD Supplier shall indemnify, defend, and hold harmless Buyer, Owner, Owner Engineer, and the Financing Parties and their respective successors, assigns, officers, directors, members, employees, agents, Affiliates, and representatives (collectively, the "**Buyer Indemnitee(s)**"), from and against any and all Claims and any and all Liabilities (without regard to the legal theory underlying such Claims or Liabilities, including strict liability) to the extent arising from or in connection with: (i) Claims of Third Parties for personal injury (including death) or Third Party property damage attributable to the negligence, gross negligence, willful misconduct, or tortious acts or omissions of WFGD Supplier, its Subcontractors, agents or anyone directly or indirectly employed by them or anyone for whose acts they may be responsible, in connection with the Work or WFGD Supplier's other obligations under this Agreement; (ii) Claims by any Governmental Authority are attributable to violations of Applicable Law and the rectification of the causes of such violations, but limited to the extent such Claims are attributable to the failure to perform the Work in accordance with this Agreement by WFGD Supplier, its Subcontractors, agents, or anyone directly or indirectly employed by them or anyone for whose acts they may be responsible; (iii) Claims by any Governmental Authority for Taxes that are the responsibility of WFGD Supplier hereunder or any of its Subcontractors or any of their respective agents or employees with respect to any payment for the Work made to or earned by WFGD Supplier or any of its Subcontractors or any of their respective agents or employees under this Agreement; **provided, however,** this indemnity shall not apply to the extent any such Claims or Liabilities are attributable to and arise or result from the negligence, gross negligence, willful misconduct, or tortious acts or omissions of Buyer Indemnitees. This indemnification, defense, and hold harmless obligation shall survive the termination or expiration of this Agreement until the expiration of the applicable statutes of

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limitation therefor. In claims against any Buyer Indemnitee under this **Section 10.1** by an employee of WFGD Supplier, a Subcontractor, anyone employed by them or anyone for whose acts they may be liable, the indemnification obligation under this **Section 10.1** is not limited by a limitation on the amount or type of damages, compensation or benefits payable by or for WFGD Supplier, a Subcontractor or any other above referenced Person under compensation acts, disability benefit acts, or other employee benefit acts.

10.2 Defense of Claims or Actions

10.2.1 Notice. If any Claim is made or brought by any Third Party with respect to which a Buyer Indemnitee entitled to indemnity under any indemnification provision of this Agreement, (individually, an "**Indemnified Party**" and collectively, the "**Indemnified Parties**") believes it is entitled to indemnification, the Indemnified Party shall give written notice of such Claim (a "**Claim Notice**") and a copy of the Claim, process and any legal pleading with respect thereto (if and to the extent available to the Indemnified Party) to WFGD Supplier promptly, but in each case within ten (10) Days of being served or otherwise informed of such Claim, process or legal pleading. Failure to give such notice in a timely manner shall not diminish the indemnification obligations of WFGD Supplier under this Agreement except to the extent the failure or delay in giving such notice results in actual and material prejudice to WFGD Supplier. Any Party seeking indemnification hereunder shall deliver to WFGD Supplier a detailed description (including the nature of the Claim and the amount thereof) of each Claim.Assumption of Defense. WFGD Supplier shall have the right to assume the defense of any such Claim. If WFGD Supplier wishes to assume the defense of such Claim, such assumption shall be evidenced by written notice to the Indemnified Parties. After such notice, WFGD Supplier shall engage independent legal counsel of reputable standing selected by WFGD Supplier and reasonably acceptable to the Indemnified Parties, to assume the defense and may contest, pay, subject to **Section 10.2.5**, settle or compromise any such Claim on such terms and conditions as WFGD Supplier may determine. If WFGD Supplier assumes the defense of any such Claim, the Indemnified Parties shall have the right to employ their own counsel, at their own expense; **provided, however**, if the Indemnified Parties have reasonably concluded and specifically notified WFGD Supplier that there may be specific defenses available to the Indemnified Parties which are different from or in conflict with those available to WFGD Supplier, then the Indemnified Parties shall be entitled to retain independent counsel at WFGD Supplier's expense to assume the defense of the Indemnified Parties.

10.2.3 Independent Counsel. If WFGD Supplier does not agree in writing to assume the defense of such Claim, the Indemnified Parties may engage independent counsel of reputable standing selected by them to assume the defense and may contest, pay, settle or compromise any such Claim on such terms and conditions as the Indemnified Parties may determine; **provided, however**, that the Indemnified Parties shall not settle or compromise any Claim without the prior consent of WFGD Supplier if WFGD Supplier acknowledges in writing its liability

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for any Liabilities incurred or required to be paid in respect of such Claim and provide adequate assurances of its ability to satisfy any such Liabilities.

10.2.4 Cooperation. The Indemnified Parties and WFGD Supplier shall cooperate in good faith in connection with any common defense.

10.2.5 Settlement. WFGD Supplier shall not, except with the consent of the Indemnified Parties, enter into any settlement or consent to entry of any judgment that: (i) does not include as an unconditional term thereof the giving by the Person or Persons asserting such Claim to all Indemnified Parties of an unconditional release from all liability with respect to such Claim; (ii) includes a statement as to an admission of fault, culpability or failure to act by or on behalf of any Indemnified Party; or (iii) imposes any conditions, future obligations or limitations on any of the Indemnified Parties; **provided, however**, that for settlements with any Governmental Authority, the consent of the Indemnified Parties shall not be unreasonably withheld or delayed and in making such determination, each Indemnified Party shall exercise its reasonable business judgment (without taking into account the indemnity afforded hereby) consistent with usual and customary settlement terms, conditions and practices for the applicable Governmental Authority.

ARTICLE XI

HAZARDOUS SUBSTANCES

11.1 Compliance

In the performance of this Agreement, WFGD Supplier shall comply with all Applicable Law, including those relating to environmental law, Hazardous Substances and occupational health and safety. If this Agreement calls for the transfer to Buyer by WFGD Supplier of any Hazardous Substance, WFGD Supplier shall provide before or with said transfer an English language Material Safety Data Sheet (Federal OSHA Hazard Communication Standard, 29 CFR 1910.1200 or equivalent form for non-U.S. suppliers) and label which are current, accurate and complete, which include a statement of product hazards and precautions for safe use. Copies of the Material Safety Data Sheet shall include the Agreement number, shipping location, and shall be sent to the shipping location identified in this Agreement at least ten (10) Business Days prior to the delivery of such materials to the Job Site.

11.2 Encountering Hazardous Substances

If, in the course of performance of the Work on the Generating Station Site, WFGD Supplier or its Subcontractors either spills, leaks or releases (including threatened releases) Hazardous Substances or encounters on the Generating Station Site any matter which it reasonably believes is a Hazardous Substance, in such quantities and/or at such levels that may require investigation and/or remediation pursuant to Applicable Law, WFGD Supplier shall immediately suspend the Work in the area affected and immediately report the condition to Buyer orally followed by a written notice. To the extent such condition involves: (i) a

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Hazardous Substance introduced to the Job Site or the Generating Station Site by WFGD Supplier, its Subcontractors or any Person for whom WFGD Supplier or its Subcontractors may be responsible or (ii) a Hazardous Substance contained in or packed with Equipment and Materials provided by WFGD Supplier or its Subcontractors, then any investigation, response, removal, cleanup or other remedial action required by Applicable Law or any Governmental Authority shall be performed by WFGD Supplier or its Subcontractors and any costs and expenses incurred by WFGD Supplier or its Subcontractors shall be at WFGD Supplier's sole cost and expense. If such condition does not involve a Hazardous Substance in such quantities or at such levels that may require investigation or remediation pursuant to Applicable Law, WFGD Supplier shall, promptly after receiving written notice from Buyer authorizing WFGD Supplier to recommence activities in the subject area, resume the portion of the Work that had been suspended. Upon notice to WFGD Supplier, Buyer may, but shall not be obligated to, take responsibility for any investigation, response, removal, cleanup or other remedial action for which WFGD Supplier would otherwise be responsible under this **Section 11.2.**

11.3 WFGD Supplier Obligations

WFGD Supplier shall not generate, dispose, bring, transport or store (and shall prohibit Subcontractors from generating, disposing, bringing, transporting or storing) Hazardous Substances to or on the Job Site or the Generating Station Site, and shall not utilize (and shall prohibit Subcontractors from utilizing) any construction materials or Equipment and Materials (whether or not totally enclosed) containing asbestos, polychlorinated biphenyls, benzene, lead or urea formaldehyde; **provided, however**, WFGD Supplier (and Subcontractors) may use and store in quantities reasonably necessary to perform the Work the following, but only in accordance with Applicable Law and subject to compliance with **Section 11.1** and **Section 11.4**: gasoline, diesel fuel, fuel oil(s), gravel(s), lube oil(s), greases, sealant(s), combustible gases, form oil(s), solvent(s), adhesives, and all other materials, which are used or consumed in or during construction and/or testing of the WFGD and its constituent systems and components thereof. Any other Hazardous Substances brought to or stored on or at the Job Site shall require specific prior written authorization from Buyer and, as a condition of such authorization, WFGD Supplier shall provide Buyer with Materials Safety Data Sheets, in English and properly completed covering any Hazardous Substance furnished under or otherwise associated with the Work (including the Equipment and Materials). WFGD Supplier shall maintain on the Job Site, at all times, complete records and inventories, including Materials Safety Data Sheets, of materials described in this **Section 11.3** that are being used by it or its Subcontractors, or any Persons for whose actions it is responsible on the Job Site. WFGD Supplier shall be responsible for the management, prompt removal, cleanup and off-site disposal of Hazardous Substances: (i) brought to or generated at the Job Site by WFGD Supplier, any Subcontractor or any Person for whose actions WFGD Supplier or any Subcontractor is responsible or (ii) contained in or packed with Equipment and Materials provided by WFGD Supplier or its Subcontractors. WFGD Supplier shall have ownership of and title to Hazardous Substances and contaminated media encountered or created for which it is responsible and shall have sole responsibility in responding to such conditions including complying with reporting obligations, providing for access restrictions and warnings, manifesting and any other obligations under Applicable Law.

11.4 Labeling

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WFGD Supplier and its Subcontractors shall label Hazardous Substances brought to or generated at the Job Site by WFGD Supplier, any Subcontractor or any Person for whose actions WFGD Supplier or any Subcontractor is responsible and train all Persons within their direction and control in the safe usage and handling of such substances and materials, including any training that is required by Applicable Law.

11.5 Indemnity

To the fullest extent permitted by Applicable Law, WFGD Supplier shall indemnify, defend, and hold harmless the Buyer Indemnitees from and against any and all Claims and Liabilities to the extent arising out of or in connection with, and to the extent attributable to, the failure of WFGD Supplier to fulfill the obligations for which WFGD Supplier is responsible under **Article XI**; **provided, however**, this indemnity shall not apply to the extent any such Claims or Liabilities arise or result from the negligent or intentionally wrongful acts or omissions of any Buyer Indemnitee.

ARTICLE XII

FORCE MAJEURE

12.1 Excused Performance

Any obligation of either Party under this Agreement will be excused only to the extent that the Party's inability to perform, or its delay in performance, is caused by Force Majeure. Each Party shall use all reasonable efforts to cure, minimize, mitigate or remedy the effects of the Force Majeure. Notwithstanding that an event of Force Majeure may exist, the provisions of this **Section 12.1** shall not excuse the payment of money due and owing by either Party.

12.2 Notification Obligation

If either Party's ability to perform its obligations under this Agreement is affected by an event of Force Majeure, such Party (the "**Affected Party**") shall provide written notice to the other Party as expeditiously as possible but in any event within five (5) Business Days after it became aware of the occurrence of such Force Majeure event, but in no event later than thirty (30) Days after the occurrence of such Force Majeure event. Such notice shall, to the extent practicable, specify the nature of the occurrence, the reasons why adjustments to this Agreement should be granted, and the projected length of the delay occasioned by reason of such Force Majeure event. Within ten (10) Business Days after submission of such notice, the Affected Party shall provide a more detailed notice of the impact of the occurrence, its recovery plan and a more detailed estimate of the effect on this Agreement. Such notice shall be updated as soon as possible after additional information becomes available to the Affected Party, but in no event less frequently than weekly. If WFGD Supplier fails to provide written notice of an event of Force Majeure within the time specified in this **Section 12.2**, WFGD Supplier's entitlement to adjustments to the Guaranteed Milestone Dates or other key dates set forth in **Exhibit D** (Project Schedule and Key Dates) shall be reduced to the extent Buyer has suffered any material adverse impact as a result of WFGD Supplier's delay in providing such notice. Under no circumstances shall WFGD Supplier be entitled to any additional compensation or damages of any kind or

character as a result of the occurrence of an event of Force Majeure, **provided, however**, if the event of Force Majeure impacts Equipment and Materials that WFGD Supplier had contracted to obtain from an unaffiliated Subcontractor and WFGD Supplier proposes to Buyer that it mitigate the impact of such Force Majeure Event by obtaining such Equipment and Materials from a different unaffiliated Subcontractor, WFGD Supplier shall be relieved of its duty to mitigate by using that particular unaffiliated Subcontractor (but not from pursuing all other avenues of mitigation) if Buyer does not agree that the Agreement Price will be increased (or decreased) by the net difference of the cost (without profit or overhead) of using the new Subcontractor for such Equipment and Materials over (under) the cost (without profit or overhead) of using the existing Subcontractor for such Equipment and Materials (including any costs of mitigation with respect to the Force Majeure event).

12.3 Scope of Suspension; Duty to Mitigate

The suspension of or impact on performance due to an event of Force Majeure must not be of greater scope or longer duration than is required by such event. For purposes of clarity, no obligations or liability under this Agreement that arose and was to be performed before the occurrence of the Force Majeure event will be excused as a result of the occurrence of such event of Force Majeure for any period prior to the occurrence of such event of Force Majeure. The Affected Party shall use all reasonable efforts to:

(i) mitigate the duration of any suspension or delay in, or other impact to the performance of its obligations under this Agreement;

(ii) continue to perform its obligations hereunder; and

(iii) remedy its inability to perform, as applicable.

12.4 WFGD Supplier's Remedy

Provided that WFGD Supplier has strictly complied with the requirements of **Sections 12.2** and **12.3**, if an event of Force Majeure occurs, the Schedule, including the affected Guaranteed Milestone Dates shall be adjusted by the period of time, if any, that WFGD Supplier is actually and demonstrably delayed in the performance of its critical path activities as a result of the impact of the event of Force Majeure.

12.5 Buyer Self-Help

If WFGD Supplier claims that an event of Force Majeure has caused it to suspend or delay performance of Work, and Buyer has given WFGD Supplier reasonable notice of action WFGD Supplier could lawfully and reasonably take to remove or relieve the event of Force Majeure but WFGD Supplier has failed to take such recommended action, Buyer may, at its sole discretion, but without prejudice to its rights against WFGD Supplier under this Agreement, take such action itself to remove or relieve the event of Force Majeure and thereafter require WFGD Supplier to resume full or partial performance of the Work.

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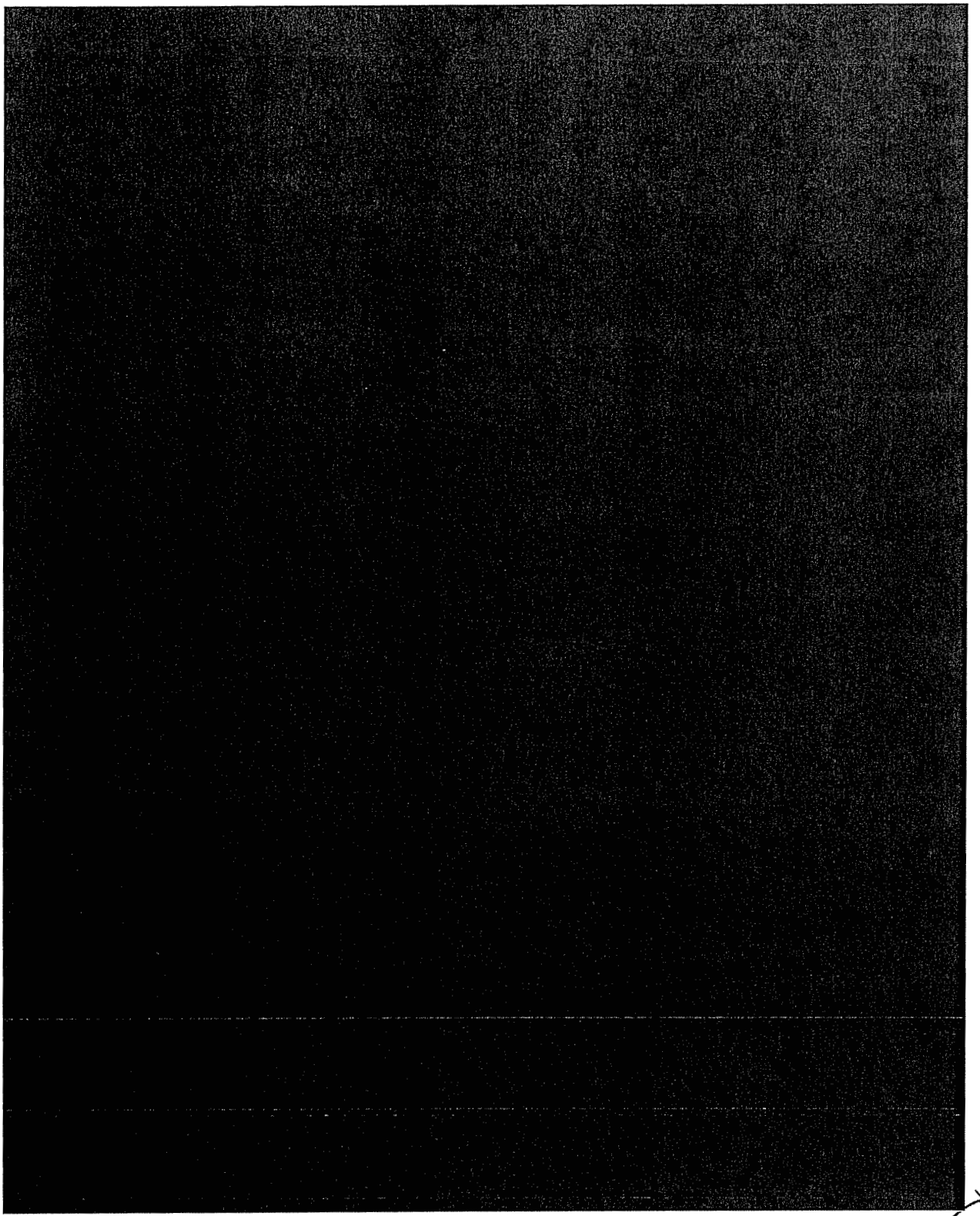
ARTICLE XIII



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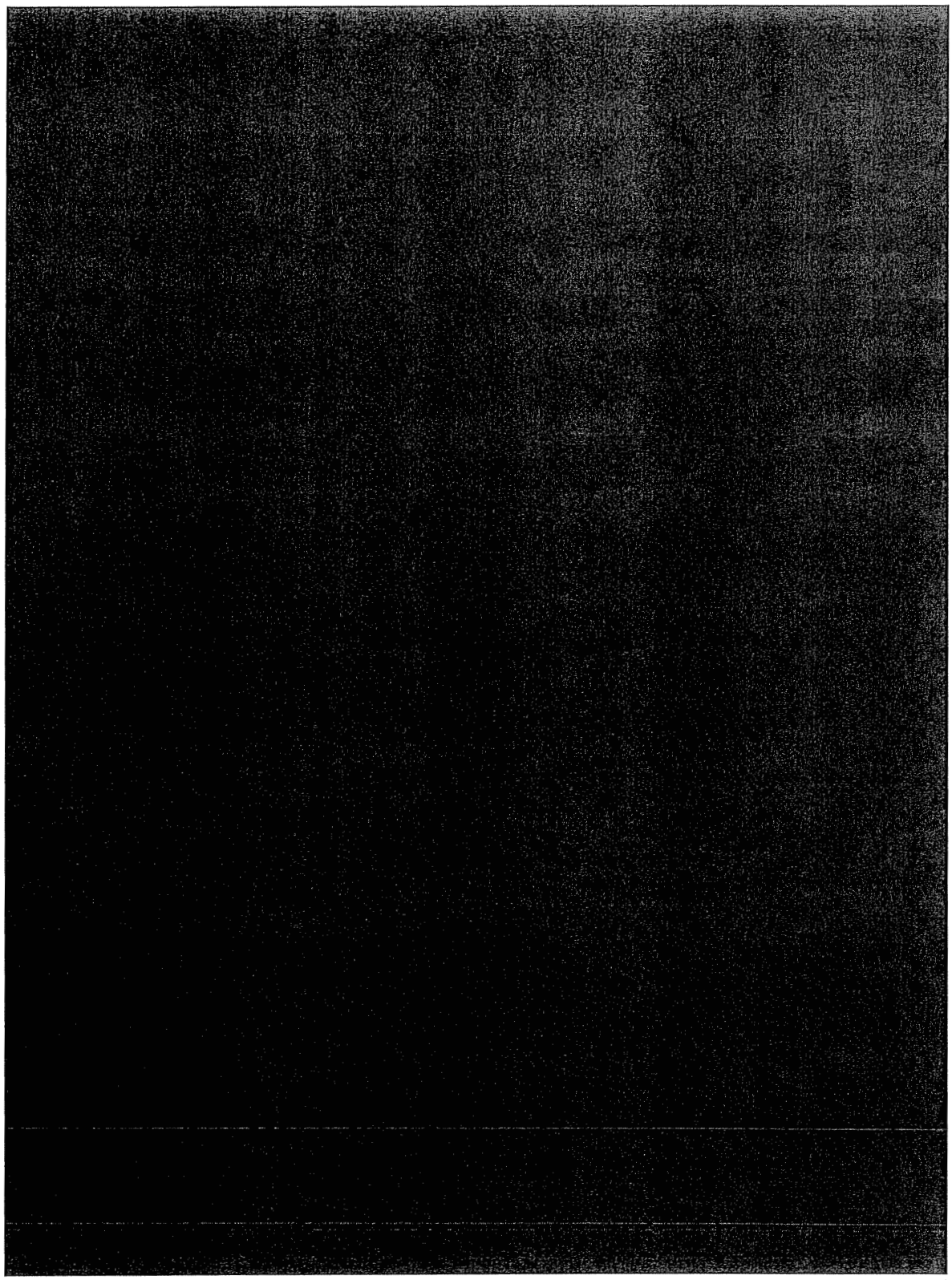

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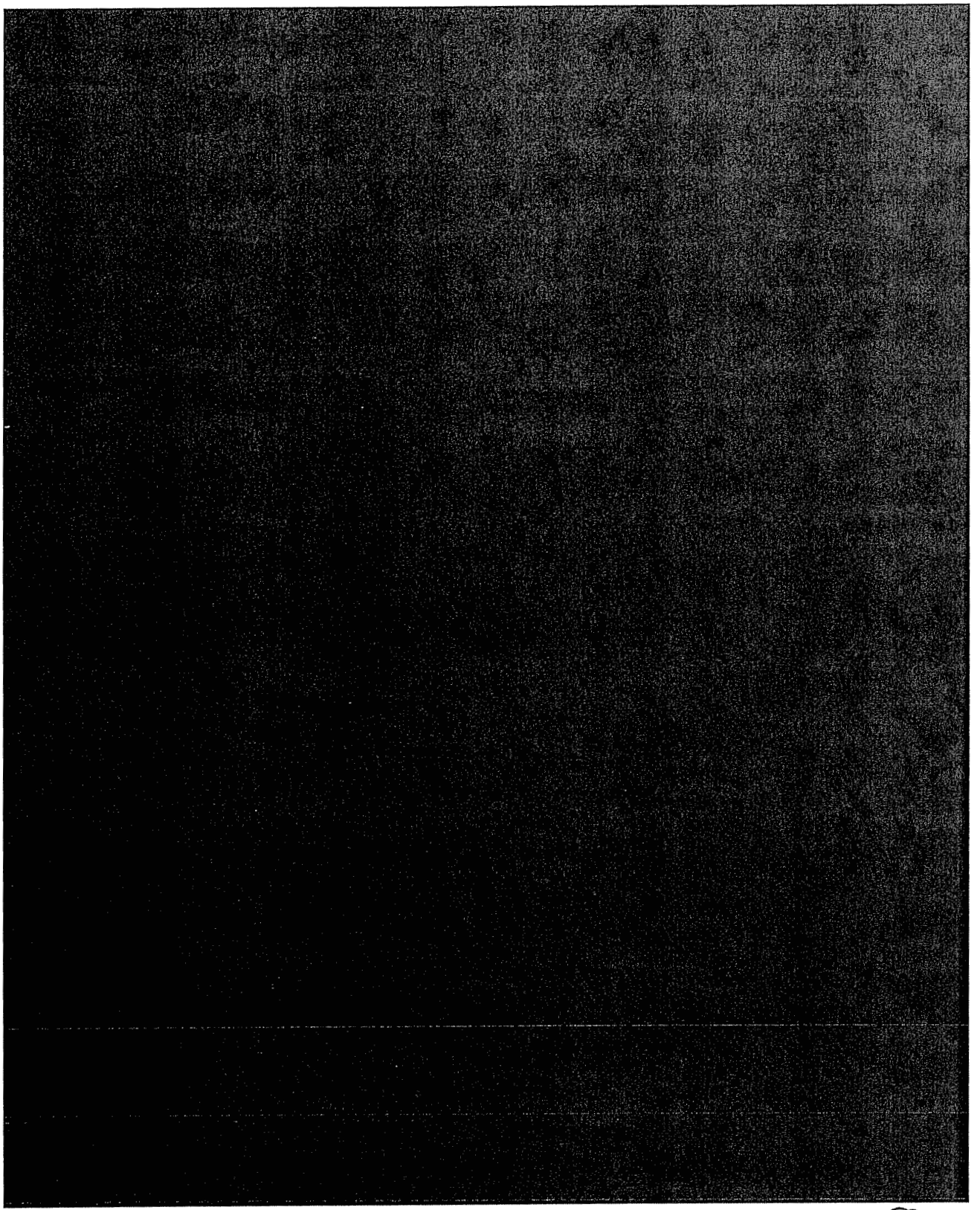

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ARTICLE XIV

INSURANCE

WFGD Supplier (and its Subcontractors) shall provide and maintain the insurance specified in **Exhibit I** (Insurance) in accordance with the terms and provisions thereof. Buyer shall cause the issuer of any all risk builder's risk insurance policy pursuant to which it obtains coverage in connection with the Prime Contract to name WFGD Supplier as an additional insured and waive rights of subrogation against WFGD Supplier. Owner shall cause the issuer of its property insurance policy pursuant to which it obtains coverage on the Existing Facility to waive rights of subrogation against WFGD Supplier.

ARTICLE XV

RESOLUTION OF DISPUTES

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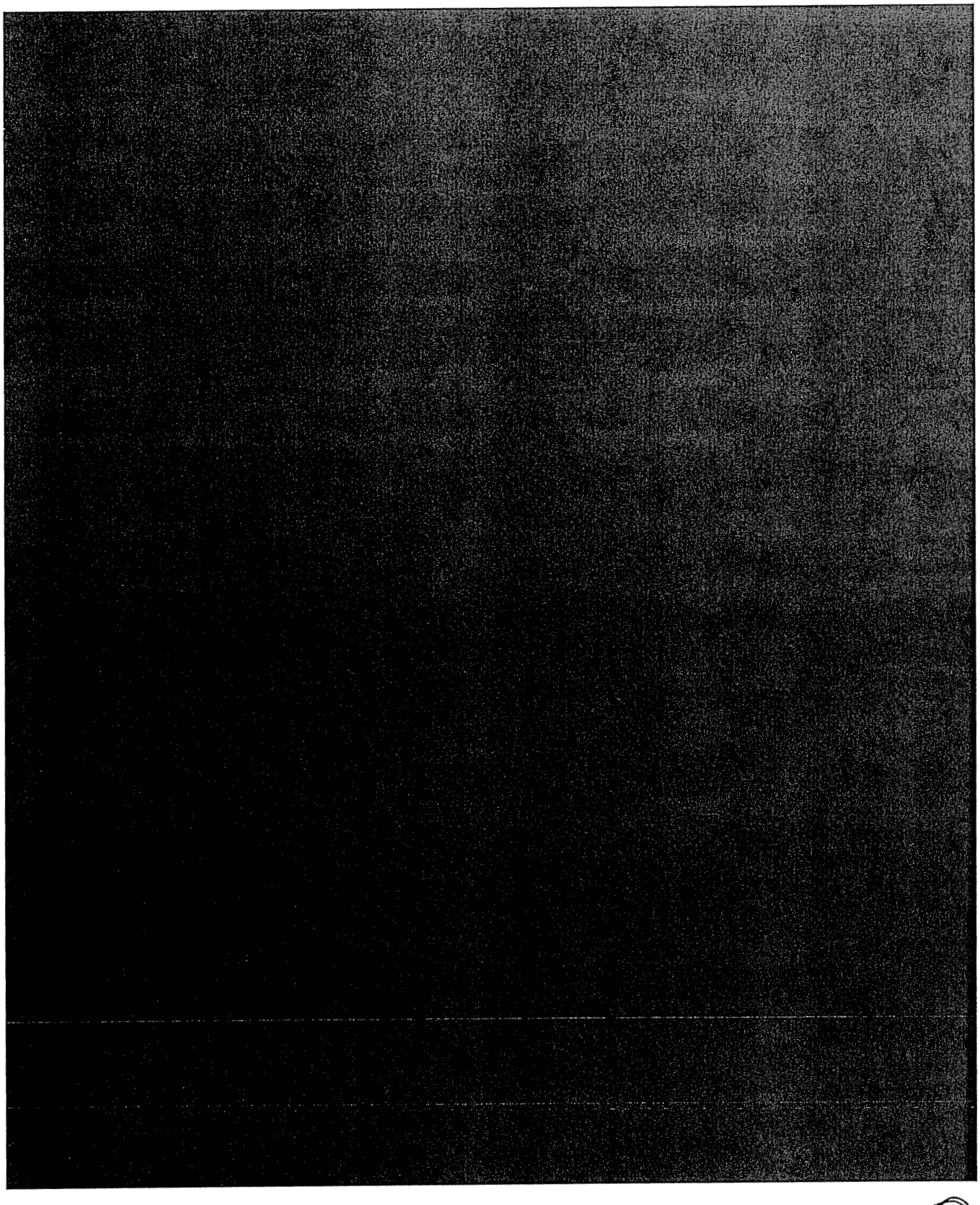

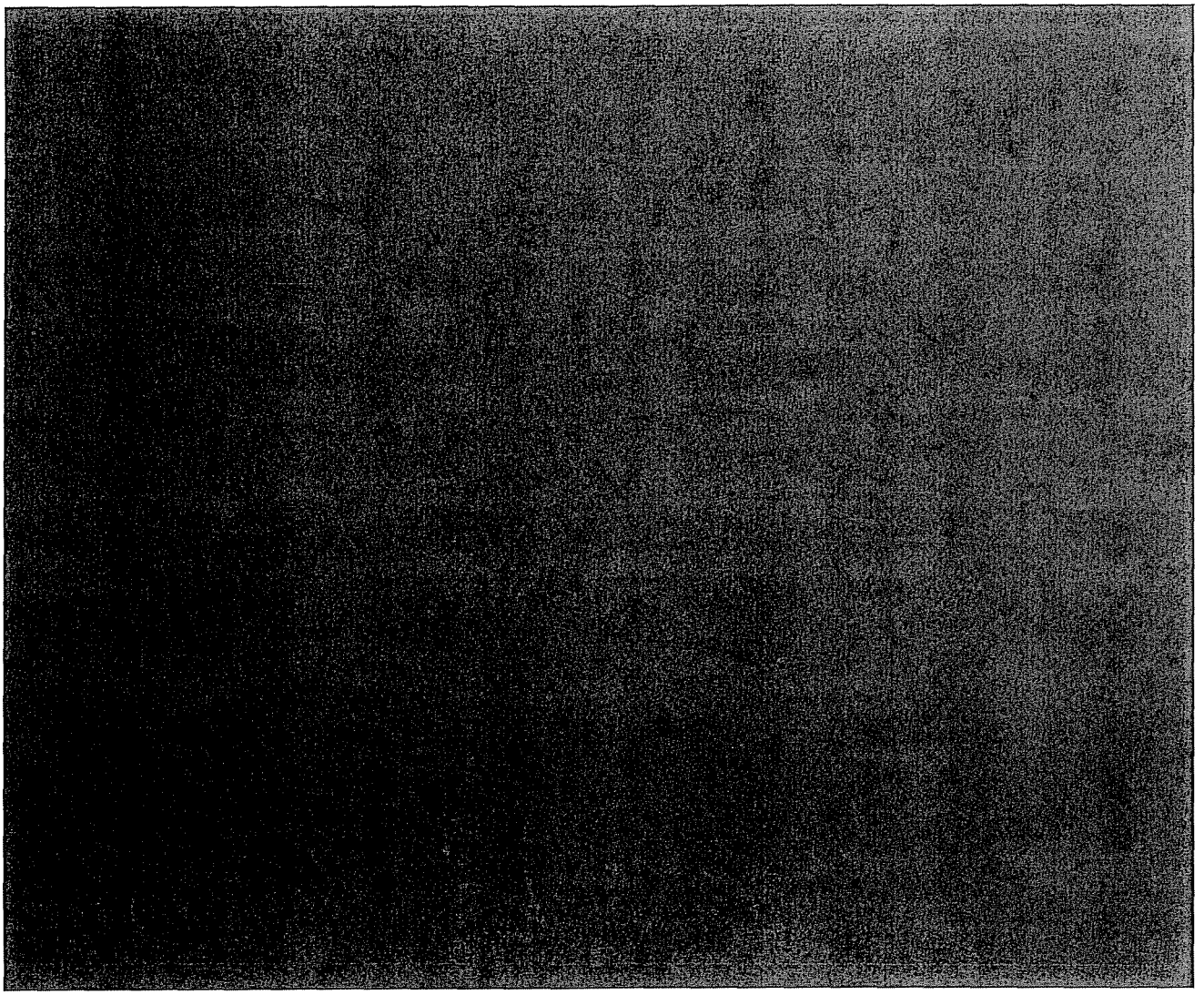

ARTICLE XVI

PROTECTION OF PERSONS AND PROPERTY

16.1 Safety Programs

WFGD Supplier shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of this Agreement, including a fitness for duty policy and other appropriate precautions and programs for areas in and around the Generating Station Site. Within sixty (60) Days of the Effective Date, WFGD Supplier shall prepare and deliver to Buyer a plan to ensure proper health, safety, and environmentally sound practices are employed and enforced in the performance of the Work. At a minimum, such plan shall require WFGD Supplier to comply, and shall cause all Subcontractors to comply, with those rules, regulations and procedures set forth in **Exhibit H** (Health and Safety Requirements). The efficacy or implementation of such plan will not relieve WFGD Supplier of its obligations

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under this Agreement. If Owner or Buyer becomes aware of any Work or the performance of any Work, that it reasonably believes constitutes a threat to the health or safety of persons, property, or the environment, then, without limiting any other rights of Owner or Buyer hereunder, Owner or Buyer may (but will not be obligated to) immediately suspend the performance of the Work and thereafter promptly advise WFGD Supplier of the cause therefor. Such suspension may be maintained until such cause is removed. All of WFGD Supplier or its Subcontractor's costs related to such suspension and any other adverse impact on WFGD Supplier or the Work attributable thereto shall be the responsibility of WFGD Supplier and no relief under this Contract shall be provided. Owner or Buyer, in its reasonable opinion, may exclude from the Generating Station Site any individual whose conduct it believes is prejudicial to safety, health, protection of persons, property, or the environment, or is found or suspected to be in violation or in disregard of the requirements of this Article, this Agreement, or Applicable Law.

16.2 Applicable Law

WFGD Supplier shall give notices and comply with Applicable Law bearing on the safety of Persons, property and the environment or their protection from damage, injury or loss, including all standards of the U.S. Occupational Safety & Health Administration applicable to the Work.

16.3 Safety Precautions

WFGD Supplier shall take all reasonable precautions for safety of, and shall provide all reasonable protection to prevent damage, injury or loss to:

(i) employees and Subcontractors or other individuals performing the Work and all other Persons who may be affected thereby, including other individuals on the Generating Station Site;

(ii) the Work and Equipment, Materials, Consumables, and Construction Aids, whether in storage on or off of the Job Site, under the care, custody or control of WFGD Supplier or Subcontractors; and

(iii) other property at the Generating Station Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, waterways, roadways, structures and utilities, it being agreed that WFGD Supplier will be liable for the cost of damages incurred by Buyer and caused by WFGD Supplier or its Subcontractors.

16.4 Community Relations

WFGD Supplier recognizes the introduction of WFGD Supplier's workforce (and those of its Subcontractors) has the potential to disrupt the local community. WFGD Supplier will proactively alert those individuals for whom it is responsible on the Generating Station Site to exercise due caution entering and leaving the Generating Station Site and to otherwise conduct themselves in a manner consistent with good community relations.

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16.5 Security

WFGD Supplier shall coordinate its Job Site security functions with Buyer's existing security functions so as not to detract from, or impose upon, existing security measures at the Generating Station Site. WFGD Supplier shall erect, maintain, or undertake, as required by existing conditions and the performance of this Agreement, all reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations, and notifying Buyer and users of adjacent sites and utilities.

16.6 Dangerous Materials

When use or storage of dangerous materials or equipment or unusual methods are necessary for execution of the Work, WFGD Supplier shall exercise utmost care and carry on such activities only under the supervision of properly qualified personnel. Explosives shall not be used anywhere on the Generating Station Site, without the prior written consent of Buyer.

16.7 Safety Personnel

WFGD Supplier shall assign at least one full-time safety officer who shall be responsible for introducing, administering, and monitoring procedures to promote safe working conditions on the Job Site (and other areas of the Generating Station Site where Work is to be performed) and compliance with Applicable Law.

16.8 Loading

WFGD Supplier must not load or permit any part of the construction, the Job Site or other portions of the Generating Station Site to be loaded so as to endanger the safety of Persons or property.

16.9 Notices to Buyer

WFGD Supplier shall immediately (and in each case, but in no event later than a period of time equal to one-half the amount of time Buyer has to report any incident to a Governmental Authority) notify Buyer by telephone or messenger of any and all potential lost time accidents, recordable injuries (as defined under OSHA), and any property damage arising out of or in connection with the Work. WFGD Supplier shall provide Buyer with a written report, giving of full details and statements of any witnesses within twenty-four (24) hours of the occurrence of the event.

16.10 Code of Business Conduct

WFGD Supplier hereby acknowledges receipt of the LG&E and KU Services Company Code of Business Conduct and agrees to comply therewith as it may be amended from time to time.

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16.11 Hazards and Training

WFGD Supplier shall furnish adequate numbers of trained, qualified, and experienced personnel and appropriate safety and other equipment in first-class condition, suitable for performance of the Work. Such personnel shall be skilled and properly trained to perform the Work and recognize all hazards associated with the Work. Without limiting the foregoing, WFGD Supplier shall participate in any safety orientation of Owner or Buyer (or any Affiliate) and familiarization initiatives related to safety and shall strictly comply with any monitoring initiatives as determined by Buyer. WFGD Supplier acknowledges that it has inspected all equipment, structures, and property of Owner to determine the existence of hazards incident to working thereon or thereabouts, and has adopted suitable precautions and methods for the protection and safety of its employees and the property.

16.12 Drug and Alcohol

No individual will perform any of the Work while under the influence of any illegal or controlled substance or alcohol. No alcohol may be consumed four (4) hours prior to any individual's performance of the Work or anytime during the workday. An individual will be deemed under the influence of alcohol if a level of .02 percent blood alcohol or greater is found. In addition to the requirements of the drug and alcohol testing program set forth in **Exhibit H** (Health and Safety Requirements), WFGD Supplier shall: (i) institute a random drug and alcohol testing program covering all individuals that will perform any of the Work; (ii) promptly, upon the written request of Buyer, perform drug and/or alcohol tests on all individuals that will perform any of the Work; and (iii) perform drug and alcohol tests on any individual that perform any of the Work under either of the following circumstances: (a) where the individual's performance either contributed to an accident or dangerous condition or cannot be completely discounted as a contributing factor to an accident or dangerous condition which involves actual or undue risk off-site medical treatment of any individual or property damage or (b) where Buyer determines in its sole discretion that there is reasonable cause to believe such individual is using drugs or alcohol or may otherwise be unfit for duty. Individuals tested in accordance with clause (a) or (b) above will not be permitted to perform any Work until the test results are established. WFGD Supplier shall be solely responsible for administering and conducting drug and alcohol testing, as set forth herein. As applicable and in addition to any other requirements under this Agreement, WFGD Supplier shall develop and strictly comply with any and all alcohol and drug testing requirements required by Applicable Law. Notwithstanding anything to the contrary herein, if the rules and regulations of Owner pertaining to the Generating Station Site are at any time more stringent than the requirements of this Agreement, WFGD Supplier will comply and cause its Subcontractors to comply with such more stringent rules and regulations.

ARTICLE XVII

MISCELLANEOUS

17.1 Governing Law

This Agreement is governed by, and construed in accordance with, the laws of the Commonwealth of Kentucky without reference to the conflict of laws rules thereof. Each of the

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Parties hereby agrees that any legal proceedings that may arise under this Agreement shall be brought in the United States District Court for the Western District of Kentucky, located in Louisville (and if such court does not have jurisdiction over a matter at controversy between the Parties, any state court located in Louisville, Kentucky). Accordingly, each of the Parties hereby submits to the jurisdiction of the United States District Court for the Western District of Kentucky, located in Louisville (and if such court does not have jurisdiction over a matter at controversy between the Parties, any state court located in Louisville, Kentucky) for purposes of all legal proceedings that may arise under this Agreement. Each of the Parties irrevocably waives, to the fullest extent permitted by Applicable Law, any objection which it may have or hereafter have to the personal jurisdiction of such court or the laying of the venue of any such proceeding brought in such a court and any claim that any such proceeding brought in such a court has been brought in an inconvenient forum. Each of the Parties to this Agreement hereby consents to process being served in any such proceeding by the mailing of a copy thereof by certified mail, postage prepaid, to its address specified in **Section 17.19** (as it may be changed or provided herein). EACH OF THE PARTIES HEREBY KNOWINGLY, VOLUNTARILY, AND INTENTIONALLY WAIVES ANY RIGHTS IT MAY HAVE TO A TRIAL BY JURY IN RESPECT OF ANY LITIGATION OR ARISING OUT OF, UNDER, OR IN CONNECTION WITH, THIS AGREEMENT AND ALL AGREEMENTS OR ANY OTHER DOCUMENTS ENTERED INTO IN CONNECTION THEREWITH, OR ANY COURSE OF CONDUCT, COURSE OF DEALING, STATEMENTS (WHETHER VERBAL OR WRITTEN), OF THE PARTIES THERETO.

17.2 Entire Agreement

This Agreement represents the entire agreement between Buyer and WFGD Supplier with respect to the subject matter hereof, and supersedes all prior negotiations, binding documents, representations or agreements, whether written or oral. This Agreement may be amended or modified only by a written instrument signed by Buyer and WFGD Supplier as appropriate.

17.3 Assignment

Neither this Agreement nor any rights, duties or obligations hereunder may be assigned in whole or in part by any Party without the express written consent of the other Party, and any such assignment without such written consent is null and void; **provided, however**, that WFGD Supplier acknowledges that Owner, as signatory to this Agreement, intends to assign this Agreement to Contractor contemporaneously with the execution of the Prime Contract and WFGD Supplier hereby consents to such assignment; **provided**, that the Contractor is a construction contractor which is not a WFGD Competitor and which, in the judgment of Owner, exercised in good faith, has sufficient creditworthiness (taking into consideration any parent guarantees or other credit enhancements made available to WFGD Supplier by the Contractor) to fulfill its payment obligations as an assignee of this Agreement. Notwithstanding the foregoing, upon written notice to Buyer, WFGD Supplier may, without such express written consent, assign compensation due or to become due under this Agreement; **provided**, that any assignment of compensation shall be subject to proper set-offs under this Agreement in favor of Buyer, any deductions provided for in this Agreement, and any assurances requested by Buyer. After the

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assignment of this Agreement to Contractor by Owner, Contractor, without the consent of WFGD Supplier (but on notice to WFGD Supplier) may re-assign this Agreement to Owner and Owner may subsequently assign this Agreement to another contractor meeting the requirements of this **Section 17.3**. Upon the assignment of a Party's obligations hereunder to any permitted assignee, and such permitted assignee's assumption in writing of such obligations, such Party shall be deemed released from and shall have no further rights, obligations, responsibilities or liabilities under this Agreement to the extent of those obligations assumed by the assignee; **provided, however**, for the avoidance of doubt, that WFGD Supplier's right to assign contained in **Section 17.3 (a)** will in no event release WFGD Supplier from any obligation under this Agreement. All of the rights, benefits, duties, liabilities and obligations of the Parties hereto shall inure to the benefit of and be binding upon their respective permitted successors and permitted assigns.

17.4 Representations of Buyer and WFGD Supplier

17.4.1 WFGD Supplier's Representations. WFGD Supplier hereby represents and warrants the following to Buyer, on and as of the Effective Date, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement, and the final completion of the Work:

(i) it is a corporation duly organized, validly existing and in good standing under the laws of Delaware; and

(ii) this Agreement has been duly authorized, executed and delivered by it and constitutes the legal, valid and binding agreement of WFGD Supplier, enforceable against WFGD Supplier in accordance with its terms.

17.4.2 Buyer's Representations. Buyer hereby represents and warrants the following to WFGD Supplier, on and as of the Effective Date, which representations and warranties shall survive the execution and delivery of this Agreement, any termination of this Agreement, and the final completion of the Work:

(i) it is a corporation duly organized, validly existing and in good standing under the laws of the Commonwealth of Kentucky; and

(ii) this Agreement has been duly authorized, executed and delivered by it and constitutes the legal, valid and binding agreement of Buyer, enforceable against Buyer in accordance with its terms.

17.5 Non-Waiver

No course of dealing or failure of Buyer or WFGD Supplier to enforce strictly any term, right, or condition of this Agreement may be construed as a waiver of such term, right or condition. No express waiver of any term, right, or condition of this Agreement will operate as a waiver of any other term, right, or condition. A requirement that a WFGD Supplier-furnished

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document shall be submitted for or subject to "Authorization to Proceed", "Approval", "Acceptance", "Review", "Comment", or any combinations of such words or words of like import shall mean, unless the Agreement clearly indicates otherwise, that the WFGD Supplier shall, before implementing the information in the document, submit the document, obtain resolution of any comments and Buyer's authorization to proceed. Such review shall not mean that a complete check will be performed. Any such authorization, approval, acceptance, review, comment, or similar oversight does not constitute acceptance or approval of design details, calculations, analyses, tests, or construction methods or materials developed or selected by WFGD Supplier and will not relieve WFGD Supplier from full compliance with requirements of this Agreement.

17.6 Severability

The invalidity or unenforceability of any portion or provision of this Agreement shall not affect the validity or enforceability of any other portion or provision. Any invalid or unenforceable portion or provision shall be deemed severed from this Agreement. The Parties shall negotiate an equitable adjustment in such portions or provisions of this Agreement to effect the underlying purposes of this Agreement.

17.7 Nondisclosure Except as otherwise required by Applicable Law, the Parties agree not to divulge to Third Parties for a period of five (5) years beginning with the expiration of the Warranty Period in **Section 9.2,** without the prior written consent of other Party, any information obtained from or through the disclosing Party or identified at the time of disclosure in writing as being confidential, including the specific economic terms of this Agreement (but not the form thereof), in connection with the performance of this Agreement unless (i) the information is known to other Party prior to obtaining the same from such Party or is developed or derived by the receiving Party without the aid, application or use of the Confidential Information; (ii) the information is, at the time of disclosure, then in the public domain; (iii) the information is obtained from a third party who did not receive the same directly or indirectly from a Party to this Agreement, its Affiliates or related entities or its customers, and who has no obligation of secrecy with respect thereto; or (iv) is made available to a Governmental Body by the receiving Party, provided, however, that prior to any such disclosure, the receiving Party will give the disclosing Party as much advance notice of the requirement as is practical and legally permissible, will cooperate with the disclosing Party at the disclosing Party's expense to protect against disclosure, and if disclosure is still required, then disclose only such part of the Confidential Information that its legal counsel advises it must disclose in compliance with such law or legal process ("**Confidential Information**"). The Parties further agree they shall use the disclosing Party's Confidential Information solely in connection with and pursuant to this Agreement (and Owner may use WFGD Supplier's Confidential Information to operate, maintain, repair, train personnel, modify, improve, and alter the WFGD, the Equipment and Materials, and any component or replacement thereof through its own employees, its representatives and contractors and their employees, provided however, Buyer and Owner will obtain the prior written consent of WFGD Supplier (which consent will not be unreasonably withheld) before disclosing any intellectual property marked confidential or proprietary to a WFGD Competitor and use reasonable precautions and exercise due care to maintain the confidentiality of the Confidential Information. If so requested by the disclosing Party, receiving

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Party further agrees to require its employees, representatives and its contractors and their employees to execute an appropriate nondisclosure agreement prior to receiving the disclosing Party's Confidential Information.

17.8 Agreed Rate

Any amount not paid when due hereunder shall bear interest at an annual (365 or 366 Days, as appropriate) rate equal to the lesser of: (i) two percent (2%) in excess of the Prime Rate and (ii) the maximum rate permitted by Applicable Law (the "**Agreed Rate**").

17.9 Third Party Beneficiaries

The provisions of this Agreement are intended for the sole benefit of Buyer, Owner, WFGD Supplier, and Buyer Indemnitees and, except to the extent specifically identified herein, there are no third party beneficiaries other than assignees contemplated by the terms hereof.

17.10 Financing Cooperation

WFGD Supplier shall provide such reasonable assistance and cooperation to Buyer as may be necessary for Buyer to secure Financing for the WFGD, including developing and providing information regarding the WFGD reasonably available to WFGD Supplier; making presentations to potential Financing Parties, their consultants and representatives; and responding to any questions or requirements asked or imposed by any Financing Parties. WFGD Supplier hereby consents to the collateral assignment of this Agreement to the Financing Parties. All obligations of the Parties are expressly subject to the execution of final agreements required to close the Financing for the WFGD contemplated by this Agreement. WFGD Supplier also agrees to enter into a consent to collateral assignment with the Financing Parties regarding this Agreement, which consent shall contain such provisions as are typically provided to the Financing Parties, including giving the Financing Parties financial information of WFGD Supplier reasonably satisfactory to Financing Parties, copies of certain notices delivered to Buyer hereunder, and affording the Financing Parties an independent right to cure any Buyer's breaches hereunder. WFGD Supplier shall also provide customary inside counsel legal opinions as required by the Financing Parties.

17.11 Non-Recourse

Anything to the contrary notwithstanding, the obligations of Buyer and Owner under this Agreement: (i) are individual and special obligations of Buyer and do not constitute obligations of (and no recourse shall be had with respect thereto to) any shareholder of Buyer, Owner, any of Buyer's or Owner's Affiliates, or any shareholder, partner, member, officer, director, commissioner or employee of any such Person and (ii) no action shall be brought or maintained against any such partner, Affiliate companies, or any shareholder, partner, member, officer, director, commissioner or employee of any thereof.

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17.12 Time is of the Essence

Subject to the terms and conditions of this Agreement, WFGD Supplier acknowledges that timely achievement of the Guaranteed Delivery Milestone Date and Commercial Operation is essential to Buyer and therefore time is of importance with respect to achieving the Guaranteed Milestone Dates by the dates set forth in **Exhibit D** (Project Schedule and Key Dates), and to achieving the Commercial Operation Date by the Guaranteed Commercial Operation Date.

17.13 Survival

Sections 2.2 (Title and Risk of Loss), **3.4** (Compliance), **3.17** (NERC Critical Infrastructure Security Management Controls) and **5.5** (Liens), and **Articles VII** (Liquidated Damages and Limitations of Liability), **IX** (Warranties and Guaranties), **X** (Indemnity), **XI** (Hazardous Substances), **XIII** (Intellectual Property), **XV** (Resolution of Disputes), and **XVI** (Miscellaneous) of this Agreement, and all other Articles and Sections hereunder providing for indemnification or the limitation or protection against liability shall survive the termination, cancellation, or expiration of this Agreement.

17.14 Provisions Required by Law

Any term or condition required to be contained in this Agreement as a matter of Applicable Law which is not so contained herein is deemed to be incorporated in this Agreement as though originally set forth herein. Any Applicable Law required to be incorporated in agreements such as this one are hereby incorporated herein by reference.

17.15 Joint Effort

Preparation of this Agreement has been a joint effort of the Parties and the resulting document (or any portion thereof) is not to be construed more severely against one of the Parties than against the other.

17.16 Counterparts

This Agreement may be executed in two (2) or more counterparts, each of which is deemed an original, but all of which together shall constitute one and the same instrument.

17.17 Approvals Not to Relieve WFGD Supplier

No review, approval, consent or failure to disapprove, inspect or failure to inspect, or comment on, any matter by or the submission of any drawing or document to, or acquiescence on the part of Buyer shall relieve WFGD Supplier or any liability for any of its obligations under this Agreement or otherwise.

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17.18 Publicity

WFGD Supplier shall obtain Buyer's prior written approval of the text of any external announcement, publication, or other type of public communication concerning the Unit prior to the release of the same by WFGD Supplier.

17.19 Notices

All notices pertaining to this Agreement must be in writing, signed by a duly authorized representative of the Party giving such notice and shall be deemed given when received by personal delivery, recognized express courier, or electronic mail (immediately followed by recognized express courier) to the other Party at all of the addresses designated for that Party below:

If to Owner:

Louisville Gas and Electric Company
820 W. Broadway
Louisville, KY 40202
Attn: Scott Straight
Telephone: 502-627-2701
E-mail: scott.straight@lge-ku.com; and

820 W. Broadway
Louisville, KY 40202
Attn: Tony Ruckriegel
Telephone: 502-627-2760
E-mail: tony.ruckriegel@lge-ku.com; and

220 W. Main St.
Louisville, KY 40232
Attn: Gerald Reynolds, General Counsel
Telephone: 502-627-3450
E-mail: Gerald.Reynolds@lge-ku.com

If to Buyer:

Louisville Gas and Electric Company
820 W. Broadway
Louisville, KY 40202
Attn: Scott Straight
Telephone: 502-627-2701
E-mail: scott.straight@lge-ku.com; and

820 W. Broadway
Louisville, KY 40202
Attn: Tony Ruckriegel

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Telephone: 502-627-2760
E-mail: tony.ruckriegel@lge-ku.com; and

220 W. Main St.
Louisville, KY 40232
Attn: Gerald Reynolds, General Counsel
Telephone: 502-627-3450
E-mail: Gerald.Reynolds@lge-ku.com

If to WFGD Supplier:

Babcock Power Environmental, Inc.
5 Neponset Street
PO Box 15040
Worcester, MA 01615-0040
Attn: Joseph A. Langone
Telephone: 508-854-3793
E-mail: jlangone@babcockpower.com

Addresses may be changed by a Party effective upon receipt of notice of such address change.

17.20 Audit

WFGD Supplier (and its Subcontractors) shall maintain: (i) the WFGD Supplier Basis of Bid; (ii) complete and accurate financial books and records to allow compliance with **Sections 4.1, 4.2, 4.5, 5.5,** and **5.7,** or which relate to any cost-based (*i.e.*, Work not covered by lump-sum prices), components of the Work billed under this Agreement or relating to the quantity of units billed under any unit pricing agreed to by the Parties; and (iii) complete and accurate books and records relating to WFGD Supplier's obligations with respect to Hazardous Substances, testing and inspection of Equipment and Materials, Performance Tests, and the requirements of **Section 17.14** (all the foregoing hereinafter referred to as "**Records**") for a minimum of five (5) years following the completion of any major Work performed under the Warranty (or following Final Completion if no major Warranty Work is performed after Final Completion) . All such Records must be open to inspection and subject to audit and reproduction during normal working hours by Buyer or Owner or their respective authorized representatives to the extent necessary to adequately permit evaluation and verification of any invoices, payments, time sheets, or claims based on WFGD Supplier's actual costs incurred in the performance or delivery of Work under this Agreement. For the purpose of evaluating or verifying such actual or claimed costs, Buyer and Owner and their respective authorized representatives shall have access to Records at any time, including any time after final payment to WFGD Supplier pursuant to this Agreement. Buyer and Owner are not entitled to audit the cost basis for Work performed on a firm price basis, including the basis of WFGD Supplier's or its Subcontractor's internal multipliers; provided, that Buyer and Owner are entitled to access the information necessary to validate the impacts on the firm price of any changes that are calculated on a time and material basis.

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17.21 Equal Employment Opportunity

To the extent applicable, WFGD Supplier shall comply with all of the following provisions, which are incorporated herein by reference: (i) Equal Opportunity regulations set forth in 41 CFR § 60-1.4(a) and (c), prohibiting employment discrimination against any employee or applicant because of race, color, religion, sex, or national origin; (ii) Vietnam Era Veterans Readjustment Assistance Act regulations set forth in 41 CFR § 60-250.4 relating to the employment and advancement of disabled veterans and Vietnam era veterans; (iii) Rehabilitation Act regulations set forth in 41 CFR §60-741.4 relating to the employment and advancement of qualified disabled employees and applicants for employment; (iv) the clause known as "Utilization of Small Business Concerns and Small Business Concerns Owned and Controlled by Socially and Economically Disadvantaged Individuals" set forth in 15 USC § 637(d)(3); and (v) the subcontracting plan requirement set forth in 15 USC § 637(d).

17.22 Minority, Women, Disadvantaged and Local Business Enterprises

Buyer has a "**Supplier Diversity Policy**" to provide the maximum opportunity for Minority Business Enterprises ("**MBEs**"), Women Business Enterprises ("**WBEs**"), Disadvantaged Business Enterprises ("**DBEs**"), and union and non-union local contractors ("**LCs**") to participate as subcontractors for goods and services. As such, every attempt should be made by WFGD Supplier to include MBEs, WBEs, DBEs, and LCs, on subcontract bid lists for the Work. To the extent practicable, this requirement shall be passed down to Subcontractors. WFGD Supplier shall provide a supplier diversity program for the Work. Elements of such a program shall at a minimum include: (i) a goal setting process for identifying MBE/WBE/DBE/LC opportunities for involvement in the Work; (ii) an outreach process to identify and attract possible MBE/WBE/DBE/LC business interest in the Work, including working with local organizations such as Kentuckiana Minority Business Council; (iii) a pre-qualification process to assess the suitability of interested MBEs/WBEs/DBEs/LCs; (iv) a bidding process inclusive of suitable MBEs/WBEs/DBEs/LCs on subcontract bid lists; and (v) a monitoring process to provide statistical reporting on opportunities and utilization. WFGD Supplier shall report to Owner with respect to its compliance with this **Section 17.22** in accordance with **Exhibit F-9** (Second Tier Procurement Program).

17.23 Multiple WFGDs

If **Exhibit A** (Technical Specification) requires the provision of Work with respect to more than one WFGD, the provisions of this Agreement with respect to Commercial Operation, Final Completion, Warranty Period, Performance Guarantees, and Liquidated Damages shall be separately applied to each such WFGD.

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IN WITNESS WHEREOF the Parties have caused this Agreement to be executed by their duly authorized representatives as of the Effective Date.

Louisville Gas and Electric Company, in its capacities as Buyer and Owner

By: Joseph J. Clement
Title: Director, Power Generation Commercial Operations.

Babcock Power Environmental Inc., as WFGD Supplier

By: Joseph R. Langone
Title: VICE PRESIDENT

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Mill Creek Wet Flue Gas Desulphurization (WFGD) Program Technical Specification
(Exhibit A)

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1 GENERAL REQUIREMENTS

1.1 Project Description

Work includes the design, supply, manufacture, fabrication, shop testing, delivery, construction monitoring, instruction, training, commissioning, demonstrating, and placing into commercial operation the facilities for scrubbing *and* in-situ forced oxidation required to retrofit complete functional WFGD systems capable of processing the flue gases from the units. Work includes erection of Stebbins tile absorber module. WFGD systems shall be capable of removal of 98.5% SO_2 without the use of organic acid. With future organic acid addition WFGD systems shall have capability to raise removal efficiency to 99% or to achieve 98.5% removal with any one recycle pump out of operation.

1.2 Work Under this Agreement

WFGD Supplier shall provide design, supply, manufacture, fabrication, shop testing, delivery, construction monitoring, instruction, training, commissioning, demonstration and placement into commercial operation for complete functional and operating limestone based, in-situ forced oxidation WFGD systems to reduce SO_2 emissions from the units. WFGD Supplier shall erect Stebbins tile absorber module. Two systems shall be provided, a system for the combined flue gas flow from Mill Creek Units 1 and 2 and the other system for Mill Creek Unit 4. Mill Creek Units 1 and 2 combine for approximately 660 MW (gross) generating capacity and Mill Creek Unit 4 has an approximate maximum output of 525 MW. Each system shall be complete with all the accessories required for proper operation as described in the following sections of the specification. All interconnecting materials and systems between equipment and components within the limits established by Exhibit T – Terminal Points shall be included unless specifically excluded under Section 1.5, "Items Provided by Buyer." The work under this agreement shall include, but is not limited to, the following:

a. Engineering of all supplied systems and Stebbins tile absorber modules.
b. Design, supply, manufacture, fabrication, shop testing, delivery, erection of Stebbins tile construction monitoring, instruction, training, commissioning, demonstrating, and placing into commercial operation the following equipment and systems:

b.1 Absorber

A free standing Absorber vessels each complete with the following:

- Absorber shell with necessary connections and access openings
- Integral reaction tank at bottom of absorber
- Mist eliminator and mist eliminator washing equipment.

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- Internal slurry distribution piping and spray nozzles. Provide one (1) spare spray level.
- Internal oxidation distribution piping and injectors
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- All field instruments including, as a minimum, density transmitters, mist eliminator DP transmitters, and redundant pH meters.
- Redundant pressure-type level transducers and controls for the reaction vessel. The level transducers shall be provided with flushing systems. The level transducers shall be provided with diaphragms to prevent direct contact with the slurry.
- Recirculation pump sump temporary start-up strainers.
- Gypsum bleed system
- Access and maintenance doors
- Provide Stebbins tile lined concrete inlet duct 15 feet in length (middle of duct, inner vessel wall to end of duct). Incorporate plated anchor bolts at vessel top flanges and "best and latest" flange design at inlet.
- .
-
- Absorber Module to be Stebbins tile with solid C-276 pipe nozzle inserts and solid C-276 internal support members and upper cone.
- Outlet turret (cone and elbow)

b.2 Absorber Recirculation Equipment

Absorber recirculation pumps and motors (number required for design + one standby) complete with:

- Temporary start-up cone strainer (One (1) Strainer supplied per pump)
- Piping, with isolation valves, drains and fittings
- Frame
- Flexible couplings
- Suction and discharge isolation valves, drains and fittings
- Inlet pipe and discharge pipe up to absorber internal piping
- Pipe expansion joints with a removable spool piece for maintenance purposes
- Automatic flushing and draining system to an Buyer furnished trench system
- Mechanical seals with flush water
- All field instruments. At a minimum, a pressure transmitter in the suction piping and a pressure transmitter in the discharge piping of each absorber recirculation pump shall be provided by the WFGD Supplier.
- Instrumentation for absorber recirculation pumps and motors, such as temperature and vibration instrumentation, shall be wired to NEMA 4X junction boxes located on the pump and motor skid by the Supplier.

Raceway and wiring for the instrumentation wiring shall be furnished and installed by the Supplier.

b.3 Oxidation Air Equipment

Oxidation blowers and motors complete with the following:

- Frame
- Flexible couplings
- Silencers
- Valves and fittings
- Common inlet pipe, discharge pipe to absorber internal piping
- Pipe expansion joints
- Oxidation air saturation/quench system
- Each oxidation air blower shall have a stand-alone Allen-Bradley ControlLogix PLC control package with load sharing capabilities. Instrumentation necessary for compressor control and monitoring shall be wired to the PLC. The PLC shall have the capability of Ethernet communications to plant DCS for condition monitoring. All data points shall be accessible via the datalink with the DCS. Supervisory control signals (e.g. Start, Stop, Setpoint, etc.) shall be hardwired to the PLC.
- All field instruments including, as a minimum, oxidation air flow, pressure and temperature transmitters.

b.4 Gypsum Slurry Handling Equipment

- Gypsum slurry pumps and motors that are capable of transporting slurry to the existing dewatering facility.
- Gypsum slurry transfer tanks, also known as hydrocyclone underflow tanks. Gypsum slurry transfer tanks will also be configured to serve as the WFGD absorber slurry holding tank for temporary storage during WFGD outages.
- Agitators for gypsum slurry transfer tanks
- Associated piping, valves, and fittings
- All field instruments

b.5 Hydrocyclone System

- New common hydrocyclone system for Mill Creek Units 1 and 2 to replace existing separate system.
- New hydrocyclone system for Mill Creek Unit 4.
- Hydrocyclone overflow tanks.
- Hydrocyclone feed pumps, also known as bleed pumps.
- Hydrocyclone underflow tanks.

b.6 Deleted

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b.7 Deleted

b.8 Electrical Equipment

- All necessary motors at all voltage levels.
- Design and supply of the internal lighting, receptacles, exit lighting, (internal and external to each building entrance and as required inside each building) and emergency lighting, The Buyer shall supply power feeds to the WFGD Supplier for use in powering the lighting for the buildings. The WFGD Supplier shall furnish the lighting power panels, stepdown transformers as needed for the lighting power supply distribution. Two 480 power feeds for the lighting shall be supplied by the Buyer to each building for the lighting power supply. The WFGD Supplier has the option of providing either a 120V or 277 V lighting system for the buildings. The WFGD Supplier shall furnish a separate raceway and circuits for the emergency lighting system. The emergency lighting system shall be powered from an UPS system provided by the WFGD Supplier. The UPS system shall meet the requirements of UL924. The WFGD Supplier shall furnish all wiring and raceway between the light fixtures inside the building. The electrical equipment, raceway, and wiring for the lighting system shall be installed by the Buyer
- All necessary control and power equipment (control valves, transmitters, tubing, WFGD Supplier's scope of supply required for a fully functional system.
- Skid mounted junction boxes, for equipment located on skids, to serve as interface points for external field wiring.
- Interconnecting control and power wiring between skid mounted equipment and skid mounted interface junction boxes. This wiring shall be wired to a common junction box on the skid for interface to Buyer's field wiring.
- All necessary instrument, power, and control wiring and raceways integral to any skid mounted equipment furnished under these specifications. This shall include terminal blocks and internal wiring to these terminal blocks for equipment requiring external connection.

b.9 Instrumentation and DCS System

- All field instruments, necessary to control the process
- DCS system and interface cabinets will be provided by the Buyer.
- All analytical instrumentation necessary for WFGD operation within the scope of this specification.
- Vibration monitoring shall be provided for all pumps, fans, blowers, motors, and associated gearboxes when the input horsepower is equal

to or greater than 500 hp. Equipment shall be provided with Bently Nevada 3300XL vibration probes (X, Y, key phasor, thrust if applicable, and associated proximitors whenever possible). When proximiter type sensors are not able to be utilized. seismic sensors (accelerometers) shall be used instead.

b.10 Deleted

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b.11 System Demonstration

- Provide testing to confirm that system meets all performance requirements

b.12 Reclaim Water System (from Clearwell Pond), Plant Service Water

- Valves and fittings
- Distribution piping from Buyer's tie-in points
- All field instruments

b.13 Instrument Air

- Shall not be used, nor shall air operated valves be furnished as part of the equipment.

b.14 Miscellaneous

- Provide all process design information including mass balances, water balances.
- Provide all equipment, piping, motors, valves, field instruments and other ancillary equipment required for a complete system.
- For all control systems where control logic/monitoring/alarming is executed in WFGD Supplier furnished control systems, controllers, or PLCs, provide graphic sketches or screen printouts of all required operator graphic displays for remote operation and monitoring in the main control room. Alarm lists shall be provided for the WFGD Supplier's equipment for implementation in the Buyer's DCS system.
- Support engineering services required to provide information for the Buyer to implement the WFGD Supplier furnished control logics and graphics in the Buyer's DCS. If there is a datalink with the Buyer's DCS, the WFGD Supplier shall provide all necessary programming and support services required to design and implement the datalink between the Buyer's control

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systems and the WFGD Supplier's control system. An I/O list for the points to be transmitted across the datalink shall be provided to the Buyer for use in programming this interface in a format acceptable to the Buyer.

- For all control to be implemented in the Buyer's DCS provide all necessary logic diagrams, graphics, I/O assignments, and other required control system design information as required for a complete and functional controls interface for all equipment specified herein. Digital logics and graphics shall follow the Buyer's graphic standards, piping and process colors, and plant standard macros. Digital logic diagrams shall be provided in WFGD Supplier's standard format. Analog logic diagrams shall be provided in vertical SAMA format or as acceptable to the Buyer. I/O databases to be provided in electronic format as well as hardcopy.
- An alarm list shall be provided including the alarm description and recommended setpoints for the alarms.
- Provide training to Buyer operation and maintenance personnel to assure continuous performance upon completion of the commissioning period as specified in Exhibit U - Training.
- Provide start-up supervision for all systems.
- Provide operating instructions and service manuals for all equipment and systems as specified in Exhibit X – Submittals, Review and Hold Points.
- Provide all drawings, including the final "As-Built" drawings and diagrams. Refer to LG&E KU Standard document titled "Specifications for Electronic Submittal of Vendor Documentation."
- Provide all Bills of Materials (BOM's) and lists of recommended spares, for provided equipment, in electronic format (Microsoft Excel)
- Provide motor lists with horsepower ratings, valve lists, pipeline lists, equipment lists, I/O lists, alarm lists, instrument lists, etc, in electronic format (Microsoft Excel).
- Provide itemized list of Capital Property Units consisting of valves 2" and larger and items valued at $2,000 or more.
- Any and all special tools required for maintenance. Special Tools are those special tools, fixtures, and instruments required for the installation, assembly, commissioning, operation, or normal lifecycle maintenance, of equipment furnished by the WFGD Supplier. Special Tools are those tools the design, use, and purpose of which are peculiar to equipment furnished and which are not available from normal wholesale or retail outlets. Standard general purpose tools are not included in this requirement. The Special Tools shall be turned over to and become the property of the Buyer at the completion of the work.

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- Access provisions shall consist of , platforms, walkways, handrails, and guardrails, as indicated on BPEI GA drawings, and necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of individual pieces of equipment and associated components. Arrangement drawings for access provisions shall be provided as part of the Technical Data as specified in Exhibit X – Submittals, Review and Hold Points.
- All monorail beams, hoists and cranes required for efficient maintenance of the supplied equipment.
- Provide system and performance guarantees and correction curves.
- Physical scale flow model and CFD model
- All WFGD Supplier tie-in points supplied by Buyer will be within 10' of the final user.
- Provide to the Buyer design loading and layout for supports as required for all WFGD Supplier provided equipment. Design loading shall be provided for each individual design load case, i.e. dead load, live load, wind load, seismic load etc. All loads transferred to supporting superstructure steel shall be provided.
- Provide the Buyer with the foundation design loading including all loads from any of the WFGD Supplier's equipment applied to the foundation. Design loading shall be provided for each individual design load case, i.e. dead load, live load, wind load, seismic load etc.
- Provide to the Buyer information for the anchorage required for all equipment to be mounted to the foundation or to supporting superstructure steel.
- Provide to the Buyer anchor bolt dimensional layout, anchor bolt diameter, anchor bolt steel grade, minimum required anchor bolt thread length, required anchor bolt projection above the concrete foundation, and any other support or embedment requirements.
- Home office coordination with Buyer, and other parties deemed necessary by the Buyer.
- The following technical documents that were provided with the best and final proposal from BPEI shall become part of the conformed set of technical documents. WFGD Supplier shall participate in meeting, scheduling and reporting activities as specified in Exhibit M – Meetings and Progress Reports.
- The following technical documents that were provided with the proposal shall become part of the conformed set of technical documents. These are intended to further define the equipment/system general scope of supply and level of quality proposed to meet the intent of this specification. Where conflicts arise, the technical specification shall take precedence over the attached technical proposal documents. Detailed design documents shall be submitted for LG&E/KU review and approval in accordance with Exhibit X.

- Process Flow Diagrams
- Piping & Instrument Diagrams
- General Arrangements
- Equipment Lists
- Valve Lists
- Instrumentation Lists
- System I/O Lists
- Electrical Load (Motor) Lists

1.3 Civil Works

N/A

1.4 Other Contracts and Other Activities

N/A

1.5 Items Provided by Buyer

1.5.1 Permanent Facilities

- Limestone unloading, storage and transfer system.
- Gypsum transfer storage and loading for shipment system
- WFGD chimney with liner
- WFGD CEM system equipment (including WFGD inlet SO_2 and CO_2 analyzers)
- Primary power distribution system for 4KV and 480v
- Electrical equipment other than motors and installation
- Instrument and controls equipment installation
- DCS (See Technical Document MSS-1 in Exhibit S – Site and Site Conditions)
- Foundations and concrete embedments
- Ductwork supports
- Erection of WFGD Supplier's Supply except for Stebbins tile absorber module
- Ductwork (except as described under article 1.2b.1)
- Installation of Ductwork
- Insulation and lagging
- Fire protection external to absorber module (dry standpipe and hose system)
- ID fans and drives
- Dewatering Facility (Vacuum Belt Filters and WFGD Byproduct Stack-Out System)
- Clearwell Pond (Reclaim Water) Pumps, piping to a single tie-in point

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- Vibration Monitoring System (except for probes provided with equipment)
- Connection to plant utilities and services at the perimeter of furnished buildings, based on minimization of number of terminal points.

1.5.2 Feed Stock and Services During Commissioning and Testing Period

- Limestone
- Flue Gas
- Operational Staff
- All Water
- Electricity

2 INTERFACE TIE-in Points

Refer to Exhibit T – Terminal Points.

3 DESIGN CONDITIONS

3.1 Site Data

See Technical Document MSS-1 in Exhibit S – Site and Site Conditions

3.2 WFGD Gas Inlet

The design of the WFGD system shall be based on the conditions at the absorber inlet--see Technical Document MSS-3 in Exhibit S – Site and Site Conditions

3.3 Deleted

3.4 Deleted

3.5 Fuel

See Exhibit S -Site and Site Conditions

3.6 Process Water

3.6.1 Cooling Water

Cooling water will be available for equipment cooling requirements (closed heat exchangers). Equipment cooling water will be supplied by the Buyer's Equipment Cooling Water System. Inlet cooling water temperature will not exceed 120°F. Design conditions for cooling water are 150 psig and 150°F. Water quality is shown in Technical Document MSS-7 in Exhibit S – Site and Site Conditions

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WFGD Supplier shall size equipment coolers to limit the temperature rise of the cooling water to no more than 10°F. Pressure drop through the WFGD Supplier's scope of supply shall not exceed 10 psi.

3.6.2 Reclaim Water (Clearwell Pond)

Reclaim water will be available as the primary source of water for makeup to the absorber, mist eliminator wash water, oxidation air quench water, emergency quench water, and for flushing slurry lines. It will be supplied from the Clearwell pond. Piping and component structural design conditions for the system are 150 psig and 120°F. Anticipated quality of the water and operating conditions will be as shown in Technical Document MSS-5 in Exhibit S – Water Analysis

3.7 Service Water

Service water will be available for area wash down and as back up for reclaim water. Piping and component structural design conditions for the Service Water System are 200 psig and 120°F. Anticipated quality of the water and operating conditions are shown in Technical Document MSS-5 in Exhibit S – Water Analysis

3.8 Service Air and Instrument Air

Instrument air will not be available from the existing facilities.

Station air (unfiltered, saturated, at 95 psig nominal pressure) will be available for interconnection of convenience connections but no plant air systems shall be used in the normal operation of the furnished equipment.

3.9 Gypsum Slurry Quality

Gypsum slurry shall be used to produce commercial grade gypsum. The gypsum slurry must meet or exceed the requirements specified in Exhibit G - Guarantees and Performance Test Protocol.

3.10 Particulate Emissions

The particulate emissions shall comply with Exhibit G - Guarantees and Performance Test Protocol.

3.11 Not Used

3.12 Limestone Reagent

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See Technical Document MSS-4 in Exhibit S – Site and Site Conditions for projected limestone analysis.

3.13 Redundancy of Equipment

The components of all systems shall provide reliable service to achieve the system Availability Guarantee and overall reliability requirements. With the requirement for high reliability and extended operating periods between planned outages, the need for equipment redundancy is recognized. WFGD Supplier shall detail the equipment that is deemed critical to the sustained operation of the systems and include the redundancy necessary, as approved by the Buyer, to achieve the stated operational requirements. As a minimum, there shall be one spare spray level and pump and 100% redundant oxidizing air blower. All other equipment shall have 100% redundancy unless approved otherwise by the Buyer. One fully functional extra absorber module agitator shall be provided with each module for redundancy. Provide a minimum L/g of 140 and 98.5% SO_2 removal with any one recirculation pump and its associated spray level out of service.

3.14 Materials of Construction

Extensive consideration of the materials of construction shall be addressed to assure system Availability and Reliability in accordance with the design criteria. Where equipment could expect corrosion, erosion and abrasion problems, WFGD Supplier shall include appropriate high grade materials in the design of the systems. Buyer shall give particular consideration to the suitability of material and has accepted materials of construction as selected during the design review process. The chloride content is expected to be maintained at a maximum of 15,000 parts per million during the initial WFGD operation and later increase to as much as 50,000 parts per million as organic acid is added to the WFGD.

Minimum Standard of Acceptable Materials	
• Absorber outlet turret	Turret shall be a minimum solid 3/16" thick C-276with stainless steel external stiffening as required. 100% seal welded on the inside. A man-way will be provided to accommodate the installation and removal of the Mist Eliminator elements. Provisions will be made in the turret for the attachment of safety cables to assist in the maintenance of the Mist Eliminators. Turret shall be designed with a sealing system to the top of the alloy Absorber.
• Slurry Pump Impellers and Casing • Water Pump Impellers and Casing	For all slurry pumps, except for recycle slurry pumps as approved by Buyer and Owner, provide abrasion resistant, high chromium white iron impellers and casings capable of 50,000 ppm chlorides. Limit all impeller tip speeds to 5,000 feet per minute. All pumps, except recycle slurry pumps, shall have mechanical seals with flush water and either gear drives or direct drives. All gear drives shall have 1.5 service factors and designed for continuous duty. Gear boxes shall be externally water cooled. All motors shall have 1.15 service factors and be designed for continuous duty. Except for recycle slurry pumps, a maximum of three different gear box and motor ratios should be used. Motor frames shall be identical. All pumps except for recycle slurry pumps as approved by Buyer and Owner, shall be direct drive or direct drive with geared speed reduction. No belt drives shall be used on any pump.

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• Bolt coatings	All piping flanges, adapter plates, valves, and other field assembled connections shall have threaded fasteners that are coated with anti-seize coating prior to assembly.
• Non-asbestos tags	All gaskets, packings, boots, and expansion joints shall have permanent tags attached clearly stating "non-asbestos". All non-asbestos tags shall be manufactured from type 316L SS and permanently attached to all flanges, packing bonnets, etc. and shall be field applied during construction. Minimum lettering size on all non-asbestos tags shall be ½".
• Grating	All grating shall be galvanized and serrated with a minimum bar width of 3/16" width and minimum 1-1/4" depth. All grating, handrail, ladders, and toe plates shall be installed in compliance with all KYOSH standards.
• Wet Dry Interface	Wet dry interface areas at the inlet of the WFGD shall be designed and modeled to minimize the size of the wet/dry area, eliminate moisture blow back into the inlet ducts, and minimize buildup on the floors. To this end, the cross section of the wet/dry area shall not be increased as the flue gas enters the modules. Maintain constant flue gas velocity from the ducts to the modules. Inlet transition duct shall be constructed from Stebbins tile lined concrete 15 feet in length (middle of duct, inner vessel wall to end of duct).

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• Absorber vessel	Module of Stebbins tile with C-276 nozzles inserts and internal support members.. Provide sumps and manual drains and 6' x 8' minimum equipment access door in module bottom. Slope floors to drains and sumps. All doors and drains shall be flush with the floor. WFGD Supplier shall provide erosion protection from agitator scouring action.
• Agitators	All agitators shall be gear driven with a minimum 1.5 service factor and be designed for continuous service. All motors shall have 1.15 service factors and be designed for continuous duty. For the WFGD modules use C-276 shafts and ceramic filled epoxy composite coated duplex blades with tip velocities limited to 2,000 feet per minute in order to prevent blade erosion. For agitators other than module agitators, use solid alloy material for shafts and ceramic filled epoxy composite coated duplex for blades consistent with service. All agitators shall have vacuum bonded ceramic coating on blades. No rubber lined agitator blades or shafts shall be used in any service. Design all agitators for ease of maintenance and removal. All seals must be replaceable with the WFGD in service.
• Absorber design	Design all modules, ducts, and stiffeners for thermal expansion during upset conditions caused by air heater stalls, slurry pump failures, or station black outs. All absorber internals shall be completely seal welded.

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• Absorber spray headers and fittings	The maximum allowable slurry velocity to be 8.0 fps. FRP with high temperature and flame resistant resin and minimum .15"-.2" interior abrasion resistant lining everywhere and minimum .2" exterior abrasion resistant lining inside modules. FRP headers to be flanged. Branches shall have long radius entries. Spray headers shall have the capacity to support worker safety harness attachments and scaffolding. Install permanent anchor points for safety belt anchors to be used during scaffold erection. Strategically place doors in module to facilitate scaffold installation. Use dedicated headers for each pump with hydraulic knife gate valves on the inlet and outlet of the pumps. Headers shall be self-draining with automatic drain valves.

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• Absorber spray headers and fittings (continued)	Recycle pump inlet knife gate valves shall have Alloy C-276 blades. Recycle pump discharge knife gate valves shall have duplex stainless steel 255 blades (UNS 32550). All suction knife gate valves shall have natural rubber sleeves, and all discharge knife gate valves will have EPDM sleeves. The internal diameter of the valve shall match the internal diameter of the pipe. Removable piping spool pieces shall be provided to allow for disassembly of the pump.
• Absorber spray nozzles	Silicon carbide bolted on with C-276 bolts.
• Absorber internals	Solid C-276 100% seal welded on the inside. All alloy material to be designed to eliminate the possibility of failure due to strain hardening or fatigue. Limit all deflections to l/360 and perform dynamic analysis on all members, to ensure no fatigue failure occurs from vibrations or thermal growth.
• Mist eliminator	FRP with high temperature and flame resistant resin. (Maximum 12 fps flow through mist eliminators.) Provide method for safe attachments for worker safety harnesses that allow for safe maintenance work and inspection. Provide access to platform for storage capacity outside the module to layout all mist eliminators in a single layer.
• Recirculation piping	FRP (.15"-.2" interior abrasion resistant lining) maximum 8.3 fps for slurry recycle discharge pipe, 8.0 fps for all other pipe. (Rubber lining not allowed.) Design shall be such that pump start/stops have minimum negative impact on the piping.
• Slurry and process water piping	FRP (.15"-.2" interior abrasion resistant lining required for slurry pipe) maximum 8.3 fps for slurry recycle discharge pipe, 8.0 fps for all other slurry pipe, 10.0 fps for water pipe. No rubber lined piping shall be used in any service.

4 PERFORMANCE GUARANTEES

Refer to Exhibit G – Guarantees and Performance Test Protocol.

5 GENERAL DESIGN SPECIFICATIONS

5.1 General

5.1.1 The WFGD system shall be designed to operate at the conditions specified in Section 3 over a design life of 30 years with minimum maintenance and high reliability. Plant operation shall be assumed to be 24 hours/day, 365 days/year except during planned unit outages. Operation will range from minimum to maximum load, varying daily with system demands. The equipment may also be subjected to cycling service, experiencing frequent startups and shutdowns.

5.1.2 Each WFGD system will consist of one (1) vertical absorber vessel with integral reaction tank, dedicated recycle spray pumps and oxidation air system and other components as identified herein.

5.1.3 The equipment and materials identified in these specifications are intended to be the minimum suitable for the intended service. They are not intended to limit the WFGD Supplier's responsibility for proper design and selection of equipment and materials.

5.1.4 The WFGD Supplier's WFGD system arrangement shall be generally based on the space limitations shown in the site arrangement drawings in Exhibit S - Site and Site Conditions. Final arrangement of the WFGD equipment is subject to review and acceptance by the Buyer. WFGD Supplier shall participate in design reviews on a periodic basis, as designated by the Buyer, to verify equipment placement, accessibility, tie-ins, etc. Modifications may be required to the WFGD Supplier's layout as project development progresses. WFGD Supplier shall incorporate these changes at no additional cost to the Buyer as long as significant additional materials are not required.

5.1.5 All skids, modules, vessels, components, etc. shall be pre-assembled to the maximum extent feasible prior to site delivery. WFGD Supplier shall package and design components such that no work is done at the site that could have been done prior to shipment.

5.1.6 The absorber shall be capable of withstanding an internal excursion design pressure of +35"/-6" wg. Design temperature for absorber shall be the capability of withstanding an air heater upset with temperatures up to 750°F for one hour.

Loadings due to ash fallout, slurry accumulation, and thermal loadings experienced during normal and abnormal operating modes, ice and snow loads, and seismic loads shall not result in permanent deformation of the structure or any support member.

5.1.7 The use of asbestos, lead and/or mercury or material containing asbestos, lead and/or mercury shall not be permitted. All pumps, side-entering agitators, and valves shall be provided with "NON-ASBESTOS" tags. This information may be placed on the name plate or on a separate stainless steel tag permanently attached by rivets or welding. Where piping flanges are used, at least one flange shall be tagged "NON-ASBESTOS" with a welded or riveted stainless steel tag.

5.1.8 The WFGD Supplier shall provide all permanent and temporary instrument taps, test and sample points and ports, and all other connections for equipment in the WFGD Supplier's scope required for system operation and monitoring and to allow complete and accurate testing and/or demonstration of fulfillment of guarantees. The layout shall accommodate the use of acceptable tests in accordance with EPA methods of 40CFR Part 60 and applicable State codes.

5.1.9 Slurry piping shall be equipped with sealed diaphragm or full stream sensor type pressure taps on top of the header.

5.1.10 For slurry service, knife-gate type valves shall be used in lieu of plug type valves, where applicable. Knife-gate valves shall not be used for modulating flows. Slurry valves shall be located in vertical sections of piping to minimize accumulation of slurry in horizontal piping. Valves shall not be located over equipment. Final layout and alignment of all knife-gate valves shall be reviewed with Buyer.

5.1.11 All slurry piping shall be drainable and no slurry piping shall be run below grade or contain pockets for accumulation of solids. Slurry piping within the module shall be designed for inspection and maintenance external live loads of 100 pounds per square foot based on the pipe being in the aged condition. The absorber recycle slurry piping which is internal to the absorber shall be capable of safely supporting maintenance personnel and equipment as well as the weight of any scale or solids without deformation or failure of the piping, nozzles, or support structure. The WFGD Supplier shall take into account the physical/chemical properties of FRP pipe and required warranties in the design of the absorber recycle slurry piping/nozzle and support system. The WFGD Supplier shall provide structural members to adequately support the absorber recycle slurry piping/nozzles and external loads. All mist eliminator wash pipe inside the module shall be self-draining.

5.1.12 The design, including placement of equipment, shall include both a constructability review and a maintenance plan including access and removal path(s). WFGD Supplier shall provide a constructability/maintenance/removal study for Buyer's approval. The maintenance removal plan shall show that all WFGD equipment, components, and parts are accessible for inspection, maintenance, replacement, operation, and testing. Buyer will pay particular attention to the placement of valves, instruments and other devices requiring operator action or maintenance activities. The constructability review shall address the site facilities, location, methods of shipment, and other topics critical to the fabrication and erection of the system components. The study shall include drawings and narrative.

5.1.13 The equipment layout shall provide operation and routine maintenance access to Equipment and devices without the need for portable ladders and lifts.

5.1.14 Exhibit E - Acceptable Equipment and Material Suppliers List identifies the Buyer's currently acceptable suppliers. Deviations from this list will only be considered as alternatives to the base bid and the WFGD Supplier shall not deviate from this list unless explicitly granted in a written waiver from the Buyer.

5.1.15 All WFGD Supplier supplied equipment shall be shop wired and tested to the fullest extent possible prior to shipping.

5.1.16 The equipment shall be controlled and monitored from a centralized operating and control system to permit safe and efficient operation in all modes and configurations. Fully automatic sequence and modulating control systems shall be provided incorporating high reliability, full load following capabilities with fail-safe features. This shall be the preferred method of operation but the capability for full manual operation from the CCR shall be possible. The automation and monitoring systems shall be designed to the number of operating personnel required to operate and maintain the equipment.

5.1.17 All PLC or microprocessor-based control packages shall be capable of remote control and monitoring from the Buyer's Honeywell DCS. If the control package includes 20 or more I/O points, the interface with the DCS shall be through Ethernet communications with all alarm, control and monitoring parameters controllable and retrievable through the interface. If a communications based interface is not provided, then each alarm parameter shall be provided with fail-safe open-to-alarm dry contacts to be hard wired to the DCS. See Section 6.8.

5.1.18 All equipment start/stop commands and running status indication will be hardwired to DCS. In addition all critical control analog parameters shall be hardwired via a 4-20 mA signal. (All wiring by Buyer.)

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5.1.19 Actuators for WFGD Supplier supplied valves shall be furnished in accordance with the Actuator Requirements specification.

5.1.20 Guards shall be provided for all exposed shafting and pinch points.

5.1.21 Locations for supports supplied by the WFGD Supplier that are to be attached to Buyer's structures shall be identified by the WFGD Supplier on physical layout drawings. WFGD Supplier shall identify the location, type of support, loads and movements at the support location.

5.1.22 WFGD Supplier shall include connections on both sides of isolation valves and at vertical risers in WFGD Supplier-supplied slurry piping for flush water and drains. All flush water and drain valves shall be supplied with automatic actuators. Secondary manual drains shall be provided on all pipes and tanks.

5.1.23 All seal water and flush water lines shall include check valves.

5.1.24 Flanged connections for rodding and cleaning shall be provided adjacent to all valves in limestone slurry service.

5.1.25 Minimum velocity in slurry lines shall be 5.0 FPS for entrainment purposes. Maximum velocity shall be limited to 8.0 FPS; except slurry recycle discharge piping shall be limited to 8.3 FPS. Long radius elbows shall be used for slurry service. An isolation valve shall be installed at the discharge of every slurry pump. Open cone silicon carbide nozzles shall be used on spray headers and shall be attached to the headers with a flanged connection.

Where FRP piping is used inside the modules, high temperature, flame resistant, and flame retardant resin shall be used. Internal FRP piping shall be designed and supported such that no structural failure shall occur if there is a high temperature excursion of 350 degrees F for one hour with no liquid inside the pipe. FRP pipe inside the modules shall be flame resistant and flame retardant and shall not burn if the temperature inside the modules reaches 800 degrees F for one hour with no liquid inside the pipe.

The interior abrasion resistant lining in all FRP slurry piping shall be a minimum .15-.2 inch thickness. The minimum thickness of the exterior abrasion resistant coating on all interior spray headers shall be .2 inches.

FRP piping shall have long reducers with minimum slope.

5.1.26 Maximum velocity in water piping (reclaim, service and well) shall be limited to 10.0 FPS.

5.1.27 Slurry recirculation pumps shall have hydraulically operated knife-gate inlet and outlet isolation valves. Other pipeline valves and drain valves that require opening or closing for system operation shall be equipped with electric motor operators. All outside valves required for system operation shall be electric

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motor operated. Solenoid actuated valves shall not be used unless approved by Buyer.

5.1.28 WFGD Supplier shall perform thermal expansion and deflection calculations for all applicable components. These calculations shall include, but not be limited to, the effects of time sensitive differential thermal gradients and the effects on dissimilar metal expansion. All critical calculations shall be backed up by field or laboratory testing. Copies of all calculations and testing shall be given to the Buyer. If a deviation from the insulation specifications is required to accommodate differential expansion, a variance must be requested in writing from the Buyer. In the unlikely event that an air heater should stall, the WFGD structure shall be designed to withstand the thermal shock associated. Thermal shock will be temperature of 750°F for one hour. The WFGD Supplier shall take special care to design the module to withstand this shock.

Alloy members are much more susceptible to fatigue failure than are carbon steel members. The WFGD Supplier shall limit the vibration and deflection of all alloy members and shall perform design calculations to verify that no failure shall occur. Internal alloy bracing, alloy oxidation air supports, alloy oxidation air piping, alloy spray header support systems, and alloy air lance support systems shall be analyzed to ensure that deflections and vibration shall not cause premature failure. Copies of all calculations shall be furnished to the Buyer. In no case shall the slenderness ratio Kl/r (effective length/minimum radius of gyration) exceed 100 for alloy members in these categories. Further, for structures listed in the above categories, the allowable deflection shall not exceed L/240 for the dead loads applied and L/360 for the live loads and impact loads applied.

All tanks used in slurry service shall meet the minimum requirements of API 650. In addition to these requirements, the tank side walls shall be designed to withstand the forces induced by flow into and out of the tank, the effects of agitation, the effects of thermal growth and thermal gradients, the maximum theoretical density of the slurry prior to precipitation, the effects of erosion over a 30 year useful life, and shall be designed to withstand the passive pressure of a wall of solids deposited against the internal walls of the tank. For design of solids deposited against the walls of the tank, it shall be assumed, as a minimum, that the solids will be stacked along the walls of the tank all the way up to the surface of the liquid. Copies of all calculations and testing shall be furnished to the Buyer.

5.1.29 All welding shall be performed in accordance with the Welding Requirements specification in Technical Supplementals 01400, as applicable. WFGD Supplier shall note the additional limitation that no downhill welding shall be allowed on carbon steel materials.

5.1.30 All equipment and components provided by WFGD Supplier shall be new and of proven, rugged, reliable design entirely suitable for continuous, utility application dependable service. No equipment shall be furnished that does not have a history of satisfactory performance under similar operating conditions.

5.1.31 All pressure, temperature, level, position, flow and other instrumentation shall have local indication and be capable of continuous DCS communication. Local indication is not required for thermocouples or RTDs wired directly to the DCS.

5.1.32 Easily removable sections of piping shall be provided at equipment connections to facilitate maintenance.

5.1.33 Piping expansion joints onto major equipment connections to be provided.

5.1.34 Lifting lugs required for maintenance handling shall be provided for all equipment supplied.

5.1.35 Carbon steel components shall not be welded to any alloy pressure retaining part without the use of an intermediate alloy or alloy poison pad.

5.1.36 All carbon steel surfaces not to be insulated shall be shop-primed.

5.1.37 All temporary shipping braces and stiffeners shall be provided and shall be painted yellow.

5.1.38 The WFGD shall be designed such that (i) there will be no more than the equivalent of one-half inch of solids or scale deposited on the absorber internal walls; (ii) there will be no more than the equivalent of one-half inch of solids or scale deposited on the reaction tank walls above or below the surface of the slurry within the absorber; (iii) there will be no more than the equivalent of one-quarter inches of solids or scale deposited in the area of the wet/dry interface during the Warranty Period; and (iv) there will be no more than the equivalent of one half inch of solids or scale deposited within the slurry recycle pump piping from the pump suction to the spray nozzles or any other piping within the scope of Work containing process liquor during the Warranty Period.

5.1.39 The WFGD shall be designed such that (i) the usable volume of the sump shall not decrease by more than 5% when the FGD is in operation; (ii) the maximum accumulation of solids in the in the absorber sump, when the liquid is drained by gravity or pumped, shall not exceed the equivalent of one inch average depth and any accumulated solids can be removed from the absorber sump in less than seventy-two (72) hours using WFGD Supplier furnished equipment, procedures, and systems; and (iii) the FGD system absorber cone outlet ductwork shall not accumulate more than an average of seventy-five (75) pounds of material (solids and liquid) per square yard of surface, whether on a vertical, sloping, or horizontal plane.

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5.2 Design Codes and Standards

Work shall be designed and installed in accordance with the latest issue of the applicable Standards and Design Codes as specified in Exhibit N - Codes and Standards.

5.3 Operational Disturbances

The design of WFGD equipment and all related services shall be such that at no single component shall limit, cause derates, or impact upon the existing operating of the generating unit.

5.4 SO_2 Emissions Control

WFGD shall be designed to treat flue gas flow within the performance condition limits in Section 3.2.

The absorber shall be designed to achieve a minimum of 98.5% SO_2 removal at 6.33 lbs/MMBtu inlet SO_2 loading, without chemical enhancements and without utilizing the spare recirculation pump.

5.5 WFGD Flue Gas Pressure Drop

The design criteria for the flue gas pressure drop is such that after a one year period of essentially continuous operation of the boiler and WFGD, the pressure drop across the spray tower section of WFGD – defined as being from the inlet flange to the spray tower to a point just upstream of the first section of mist elimination – shall not increase over a one year period by more than 5% above the pressure drop measured during clean tower operation.

5.6 Deleted

5.7 Reliability, Availability and Maintainability

The operational life required of the WFGD is 30 years. Continuous full load operation of the WFGD is required for this 30-year period with minimum scheduled downtime for inspections and maintenance. Scheduled outages for major inspections and/or maintenance shall not be less than two-year intervals with the initial scheduled outage anticipated three years after start-up and subsequent to Substantial Completion or Commercial Operation being achieved.

The WFGD system shall be designed for automatic operation including automatic pump start/stop sequencing (start/stop/drain/flush). Manual operation of the WFGD system, equipment, and subsystems by the Buyer's operators shall be limited to the greatest extent possible.

Reliability of operation and availability, together with cycle efficiency and fuel flexibility, are prime requirements. The WFGD shall be designed to achieve the Performance Guarantees and the Availability Guarantee, as specified in Exhibit G - Guarantees and Performance Test Protocol, over its design life if operated and maintained in accordance with WFGD Supplier supplied and Buyer approved and agreed operation and maintenance procedures.

During the design phase WFGD Supplier shall implement a Reliability, Availability and Maintainability (RAM) program as described in IEC 300-2 (1995) or EN 60300-2 (1996) and submitted for Buyer's approval. The program shall provide Buyer with confidence that the Availability Guarantee shall be achieved. The program shall ensure that adequate effort is brought to bear on RAM during all phases (conception and definition, design and development, manufacturing and installation, commissioning, operation and maintenance) of WFGD. A similar approach shall be adopted by WFGD Supplier for the individual equipment items within each system, stating an expected availability and demonstrating how it shall be achieved.

5.8 Reagent

Limestone, as specified, shall be the reagent used in the WFGDs. Performance of the system may, at some future date, be enhanced by the addition of organic acids. For demonstration of the Performance and Availability Guarantees, the system shall be operated without the use of any such enhancement chemicals.

5.9 Oxidation

In-situ oxidation of the recirculation sump slurry shall be achieved through introduction of oxidation air into the absorber sump. Oxidation sufficient to produce commercial grade gypsum is required. WFGD Supplier assumes no natural oxidation in their design calculations.

5.10 Water Use and Reclaim

Bleed slurry shall be removed from the absorber and dewatered. It is anticipated that the WFGD shall operate in a 'closed loop' mode, with the only liquid discharge being a system bleed originating from the hydrocyclone overflow tank to control chloride levels and fine solids content. The clarified overflow from the dewatering processes shall be drained to the settling pond prior to discharge to the Ohio River.

5.11 Future Organic Acid Addition

Provision shall be made for future organic acid addition to the reaction tank. Future organic acid addition shall increase WFGD sulphur removal efficiency to 99% and to 98.5% with one less recirculation pump in service than the design without inorganic acid. WFGD System shall be properly designed for elimination of bleed stream for chloride level control when organic acid addition is begun. Anticipated WFGD system equilibrium chlorides will be 50,000 ppm at that time.

5.12 Deleted

6 SYSTEM COMPONENTS

6.1 Deleted

6.2 ID Fans

The ID fans will be provided by the Buyer. WFGD Supplier is to provide technical/engineering assistance in the specification and sizing of the ID Fans on a cost reimbursable basis.

6.3 WFGD System

6.3.1 One (1) 100% vertical absorber module for Unit 1/2 and one (1) 100% vertical absorber module for Unit 4, each with integral reaction tanks shall be supplied complete with internal spray piping, oxidation air piping, agitators, recycle pumps and other items as described herein. All WFGD Supplier-supplied equipment and components shall be designed to accommodate the chemical, temperature, atmospheric, vibrational and other variable conditions encountered for the specified service.

6.3.2 The absorber slurry spray system shall be capable of providing intimate contact between the flue gas and the slurry droplets. Slurry shall be distributed throughout the entire cross section of the absorber module to accomplish this contact and minimize flue gas channeling and bypass.

6.3.3 Uniform gas flow distribution in the absorber, including mist eliminator sections, shall be achieved. Flow measurements, as measured within ten (10) feet above the mist eliminator outlet, at each traverse point shall be within 15% of an equal split (i.e., between 85% and 115% of average gas flow rate) evaluated at three (3) flow test conditions.

6.3.4 The absorber and internal spray system shall be designed for and/or include the following design features:

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a. The absorber module shall be constructed to form a water-tight and gas-tight envelope. Module shall be in accordance with ASTM D 4618. (Additional requirements contained elsewhere in these specifications)

b. Either tray or open type tower design may be offered.

c. Counter-current design shall be provided. Superficial gas velocity chosen for design of the vessel shall be based on WFGD Supplier's previous successful experience in this specific application. WFGD Supplier shall clearly identify the design parameters in the proposal and shall provide references for operating projects for which these parameters were successfully applied. No 'first-of-a-kind', un-proven criteria will be considered.

d. The minimum L/g ratio for all spray towers shall be 140. WFGD Supplier's design proposing different values shall be justified with examples provided for successful operation under power plant applications that are similar to those presented in this specification.

e. Nominal slurry flow-to-gas ratio per spray level shall be limited based on WFGD Supplier's experience and justified with examples provided for successful operation under power plant applications that are similar to those presented in this specification. WFGD Supplier shall identify the number and arrangement of nozzles for each spray level and the nozzle capacity(ies).

f. Spray nozzles shall be connected to the spray piping using flanged connections and shall be arranged to facilitate removal and re-installation. Spray headers and nozzles shall be designed such that when pumps are shut down, slurry in each spray header shall drain through the recycle piping and spray nozzles to the sump.

g. All internal piping, mist eliminators, or other internals within the absorber shall be designed for a minimum live load of 100 psf. This does not include the dead load, operating loads, cleaning loads or construction loads that also must be accommodated in the design. Supports and attachments shall be designed to limit vibration.

h. All gratings are to be serrated and galvanized, constructed of 1¼ x 3/16 bars as a minimum.

i. Spray headers shall include provisions for clean-out. This shall include full size (to a maximum of 12") top and bottom connections inside the vessel at the leading end of the header, plus a full size (to a maximum of 12") top connection at the terminal end of the header. This may include, but not necessarily be limited to, nozzles located at the end of spray lines (to prevent material accumulation at the end of runs), rod-out connections at nozzle locations, and other provisions as appropriate for the WFGD Supplier's design).

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j. WFGD Supplier shall identify the number of spray levels being proposed. The quantity shall include one spare spray level for redundancy. The WFGD system shall meet specifications with any one (1) level out of service; and shall be tested accordingly.

k. A dedicated recycle slurry pump shall be supplied for each spray level, including the spare level. Design features and criteria shall include:

(1) Pumps shall not be manifolded together on either suction or discharge sides.

(2) Pumps shall be as detailed in this specification.

(3) Hydraulically-actuated knife gate valves shall be provided on both the suction and discharge sides of the pumps. The actuator shall be sized to allow closure in a scaled condition. WFGD Supplier shall include one (1) hydraulic supply system for the actuators consisting of a single reservoir, two (2) 100% hydraulic pumps and all necessary piping, fittings, valves, controls, etc. to form a complete system. The system shall be designed for use with a fire-resistant hydraulic oil. Pump motor speeds shall be no greater than 1800 rpm.

(4) A single temporary cone-type strainer shall be supplied for each pump to be used, if required, during commissioning, and removed once system cleanliness has been achieved.

l. Where WFGD design employs trays, all slurry spray piping should be located above trays.

m. Provisions for attachment of scaffolding, platforms, and other items associated with maintenance activities shall be incorporated. WFGD Supplier shall describe special features (such as internal tie-offs) that enhance the ability to maintain and inspect the internals in the maintenance/access study described elsewhere in this specification.

n. Automatic flush water valves and low point drains shall be provided for all limestone slurry lines. In addition, hose connections shall be supplied at all locations where automatic flush lines are applied for manual use in the event of a failure in the automatic flushing equipment.

o. Reaction tanks (module sumps) shall be sized to provide a minimum residency time in all module sumps of 15 hours. The sizing shall be sufficient to minimize scaling.

p. Tank shall include a gas-tight overflow and drain connections sized to accommodate the necessary gravity flows. WFGD Supplier will route the drains and overflow to a trench within the absorber building.

q. WFGD Supplier shall include automatic controls and control system descriptions for pH, density, and for tank level control.

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r. Side-mounted agitators shall be provided, as detailed in this specification. There shall be a minimum of six (6) but final quantity and arrangement shall be based on WFGD Supplier's design. WFGD Supplier shall conduct a fluid model test to verify the final locations based on preventing pump cavitation, minimizing solids buildup during operation and providing the ability to re-suspend settled solids after a 24 hour outage.

s. At least two (2) levels of mist eliminators or equivalent shall be included, as detailed in this specification.

t. Tank shall include forced oxidation headers, as detailed in this specification.

u. The WFGD Supplier shall design the slurry system to minimize the formation of scale, fouling of surfaces or the accumulation of solids on surfaces of the WFGD system. All solids shall be kept in suspension and during upset conditions; any resulting deposits will be soft and easily removed by systems included by the WFGD Supplier with the WFGD system.

v. Not used.

6.3.5 Mist eliminators (ME) shall be of vertical flow design and incorporate at least two (2) removable levels. Design features shall include:

a. Multiple passes (minimum of three) at each level.

b. Sections sized for removal from WFGD Supplier-supplied access door located at the mist eliminator levels.

c. Designed for full range of operating conditions, including the washing operation. In addition, the maximum velocity associated with the ME design shall be based on the maximum performance condition specified in Section 3 and 10% blockage of flow area. In no case shall the velocity through the mist eliminators exceed 12 FPS.

d. Wash water piping and nozzles shall be of a fixed grid design and shall be located at the bottom of the first stage and at both the top and bottom of the second stage. Top level nozzles for the second stage shall be blanked-off initially, but shall be available for later use as desired by the Buyer. Wash nozzles shall have a full cone spray with no more than 90° spray angle. WFGD Supplier shall identify the minimum wash rates (in gpm/ft2) for each upper and lower spray.

e. Separation between the upper recycle spray level and the Mist Eliminator shall be a minimum of six (6) feet.

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f. Separation between the two ME levels shall be determined by the approved ME manufacturer (Munters Model DV-210) and as selected by Owner and Buyer..

g. Minimum height above the ME to the absorber outlet shall be ten (10) feet. This shall include a minimum one (1) foot disengagement zone starting above the outlet of the second ME in which the diameter of the absorber vessel does not change

h. ME shall be designed to remove 99.5% of droplets greater than 40 microns in size while minimizing pressure drop and solids buildup.

i. Provisions for measuring pressure drop across the ME shall be provided.

j. For the performance guarantee, the pressure drop and carryover associated with the mist eliminator shall be calculated based on 10% blockage and the maximum performance condition in Section 3.

k. Mist eliminator shall be designed to meet performance guarantees at maximum performance conditions in Section 3 plus an additional 10% air in-leakage. This requirement is intended to allow the mist eliminator to operate with a limited amount of air in-leakage through the ducts, precipitator, etc. that may occur as a result of system erosion or corrosion.

l. Mist eliminators shall be FRP. High temperature, flame resistant, and flame retardant resin shall be used. Internal FRP mist eliminators shall be designed and supported such that no structural failure shall occur if there is a high temperature excursion of 350 degrees F for one hour with no liquid inside the module. FRP mist eliminators inside the modules shall be flame resistant and flame retardant and shall not burn if the temperature inside the modules reaches 750 degrees F for one hour with no liquid inside the modules.

m. Safe access for inspection and cleaning of the mist eliminators.

6.3.6 WFGD Supplier shall supply all slurry recirculation piping, valves, instrumentation and supports, both internal to the absorber and external. Piping shall be adequately supported to limit vibration on the recycle pumps and at the absorber to acceptable levels. The piping shall be arranged to include all necessary cleaning, flushing and drain provisions required for operation and maintenance of the system. This shall include an automatic drain connection at the low point in the pipe on the suction side of the recycle slurry pumps located between the isolation valve and the pump for draining each recycle slurry circulating line. Also, a flush valve shall be included on the discharge side of the pump to be used for flushing.

6.3.7 The WFGD system shall be provided with appropriate instrumentation and control devices to automatically protect the absorber and outlet duct materials during flue gas excursions, and the loss of recycle pumps

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6.3.8 All slurry piping in the WFGD system shall be in accordance with this specification's materials of construction requirements. All FRP piping , except for internals and large bore slurry recycle piping, shall be structurally designed for minimum pressure/temperature rating of 150 psig at 200^0F with a maximum service temperature of 180^0F. FRP internal spray headers and large bore slurry recycle piping shall be designed for a maximum service pressure/temperature rating of 40 psig at 155^0F.

6.3.9 An in-situ forced oxidation system which is capable of producing commercial grade salable gypsum shall be provided. The oxidation system shall include the following equipment and design provisions:

a) Lance type system shall be provided. WFGD Supplier shall fully explain the system being offered and identify any particular advantages to the system quoted. Final arrangement will be based on the results of the model study described elsewhere in this specification.

b) Air blowers complete with motors, base plates, inlet/outlet silencers, control valves and primary control elements. WFGD Supplier shall provide vibration monitoring equipment for each oxidation blower. Vibration monitoring equipment shall report vibration levels to the Buyer's DCS.

c) All internal piping and supports for the reaction tank.

d) For sparge grid design, nozzles shall be replaceable.

e) A minimum O/SO_2 molar ratio of 2.4 shall be used for blower sizing.

f) The WFGD Supplier shall identify the minimum recommended liquid height.

g) Oxidation air inlet isolation valves to the absorber shall be motor operated knife gate design.

h) WFGD Supplier shall include direct injection quench cooling of the oxidation air.

i) WFGD Supplier assumes no natural oxidation in their design calculations.

6.3.10 The absorber module shall include a sufficient number of hinged and/or bolted manways and access to provide easy access to all areas of the absorber reaction tank and ductwork including each spray section, and each mist eliminator section. Access doors shall be sized to allow removal of any/all absorber internals. Reaction tank doors shall be flush with the floor. Access doors shall be rectangular, quick access 24"W x 36"H (minimum) with the exception of the inlet duct access door which shall be a minimum rectangular size of 24"W x 48"H.

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6.3.11 Access designs should take into consideration the following:

a) Doors and manways shall include davits as required to safely gain access and to permit easy replacement of the closure.

b) Internal and/or external handholds mounted on door frames shall be included inside and outside all module and duct doors, based on location and the proximity of platforms and other access provisions.

c) Hinged doors shall include provisions for locking the door in the open position.

d) Sealing design shall take into account gasket shrinkage and shall also 'capture' the gasket material in-place to facilitate closure and zero-leakage.

e) Where required to facilitate maintenance activities, piping, baffles, supports and other internals located at or near door accesses shall include removable sections.

6.3.12 Deleted

6.3.13 WFGD Supplier shall furnish a complete mist eliminator wash system. Valves shall be provided for automated operation.

6.3.14 Design of all components shall be such that welding in the field is minimized. A field welding plan shall be produced by the WFGD Supplier and provided to Buyer for review and approval prior to releasing any materials for fabrication.

6.3.15 WFGD Supplier shall pay particular attention to the design of internal piping, supports, baffles, maintenance structures and other internal components. Vibrations are to be minimized and deflections appropriately limited to prevent strain-hardening of alloy and other materials. WFGD Supplier shall submit calculations for Buyer's approval prior to release of materials for fabrication. The calculations shall address such items as flow, operating temperature, temperature excursions, dead loads, live loads, reaction forces from agitators, flue gas flows, recycle slurry spray flows, mist eliminator wash flows, deflections, vibration, and other design factors appropriate to the operating environment of the components. See Section 5.1.27 for additional requirements.

6.3.16 A plan shall be provided for the safe maintenance of mist eliminators.

6.3.17 External absorber flanges shall be 150# flanges per ANSI B16.5 for flanges below 12" diameter. 12" diameter absorber drain and overflow nozzles shall be AWWA Class D flanges. Absorber agitator flanges shall match the agitator mounting flanges. Other flanges from 12" to 24" shall match the piping specifications unless a deviation is approved by the Buyer. Flanges above 24" diameter to be AWWA Class D.

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6.3.18 Carbon steel embed plates shall be provided in the absorber module exterior wall at each absorber agitator for Buyer's use for agitator maintenance.

6.3.19 Access door shall be provided in the absorber module below the lowest spray level in the absorber. Other access doors as per the following table:

Access Door Description	Quantity	Size (W" x H")
Unit 1/2 WFGD		
Maintenance Door @ Absorber Sump Base	1	72" x 96"
Personnel Door @ Absorber Sump Base	1	36" x 84"
Access Door @ Absorber Sump	1	36"D
Access Door @ Maintenance Platform Level	1	48" x 48"
Access Door @ Each Spray Level	3	36"D
Access Door @ Mist Eliminator Level	1	36" x 48"
Unit 4 WFGD		
Maintenance Door @ Absorber Sump Base	1	72" x 96"
Personnel Door @ Absorber Sump Base	1	36" x 84"
Access Door @ Absorber Sump	1	36"D
Access Door @ Maintenance Platform Level	1	48" x 48"
Access Door @ Each Spray Level	3	36"D
Access Door @ Mist Eliminator Level	1	36" x 48"

6.3.20 Hydrocyclone System shall include one hydrocyclone cluster with 40 percent redundant cluster per WFGD system. The hydrocyclone design and sizing shall be set by the WFGD Supplier as part of the overall process design. .

a) The hydrocyclone cluster shall consist of a bank of hydrocyclones, knife gate isolation valves for each hydrocyclone, radial feed distributor, underflow and overflow launders, and structural steel support. The cluster design shall permit easy removal of cyclones without the disassembly of the feed manifold or disturbing other cyclones on the cluster. The hydrocyclone cluster shall be completely assembled before shipment.

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b) Any unused connections on the feed distributor shall be fitted with blank flanges. A pressure gauge shall be furnished and mounted on the feed distributor.

c) The underflow and overflow launders shall be furnished with a single ANSI Class 150 flanged connection. All wetted surfaces shall be ceramic lined except for the feed distributor. The underflow and overflow launders shall be fitted with removable splash guards or covers. The splash guards shall be easily removed for launder inspection.

d) The hydrocyclones shall be of the high efficiency, ceramic-lined, sectionalized design. Various sized, or adjustable, rubber apex liners shall be furnished for the commissioning of the hydrocyclones. One set of ceramic apex lines will be supplied in the desired size, determined during equipment commissioning.

e) The hydrocyclone cluster shall be constructed of the following material.

Hydrocyclone body	Carbon steel with ceramic liner
Hydrocyclone apex	Replaceable internal ceramic liner
Overflow launder	A36 carbon steel with ceramic liner
Underflow launder	A36 carbon steel with ceramic liner
Feed distributor	A36 carbon steel with rubber liner

f) Hydrocyclone feed pumps, also known as bleed pumps, shall be furnished to forward slurry from minimum absorber liquid level to maximum recommended hydrocyclone elevation at the rate specified in section 5.10. Bleed pumps shall be able to recirculate slurry to the absorber.

g) Hydrocyclone overflow tank shall serve as a receiver for pumps provided by others to return water to the absorber or forward it for other uses.

h) Hydrocyclone underflow tanks, also known as gypsum slurry transfer tanks, shall receive the contents of the absorber and lead to the pumps leading to the existing dewatering facility (discussed in 1.2, b.4). In addition, pump capacity shall be such that the absorber can be emptied in 12 hours.

6.4 Emergency Quench System

6.4.1 Deleted

6.4.2 An emergency flue gas quench system shall be provided to protect the absorber and internals from high temperatures. This system shall be capable of reducing the temperature to a level where no temporary or permanent damage occurs to the absorber internals, linings, mist eliminators, stack, or other furnished equipment. It should be fast- acting and fail-safe in design. High temperatures may occur as a result of an air preheater or absorber recycle pump failure or site

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loss of power. The condition and duration of flue gas temperature excursions as a result of these failures shall be considered to be 750^{0}F for 30 minutes. All required internal provisions such as supplemental or separate water spray headers shall be provided, and all external actuating valves shall be provided for the quench water flowrate deemed necessary by the WFGD Supplier. In addition, a functional description of the Emergency Quench System shall be provided to facilitate interconnection of this system to the appropriate plant (Emergency Quench) water supply. Favorable consideration will be made for systems requiring lower water supply pressure. The last actuating valve furnished in the Emergency Quench water supply shall have all wetted materials of C-276.

6.4.3 Deleted

6.5 Pumps

6.5.1 Pumps shall be furnished with pump and driver mounted on a common base plate where practical. Pumps shall be complete with all instrumentation and appurtenances required for a complete system. Guards shall completely enclose all rotating components and shall comply with all OSHA/KYOSH requirements.

6.5.2 Spare parts for all pumps of the same size and model shall be interchangeable.

6.5.3 Pumps and pump materials shall be of a design that has successful operational experience in the intended service.

6.5.4 Pumps, motors, reducers and base plates shall be furnished with lifting lugs or eyebolts to facilitate equipment installation and removal.

6.5.5 100 Ohm platinum RTDs shall be provided for all pump bearings on pumps with a motor rated 100 HP or greater. Ungrounded ISA Type E thermocouples will be provided for all process control and alarming.

6.5.6 All pumps shall be provided with mechanical shaft seals with flush water. Cartridge-type seals are considered undesirable.

6.5.7 Each pump shall be a heavy duty slurry pump of the type and construction regularly used in WFGD systems and shall have a proven record of reliability. The following design features and criteria shall be included:

a. Pumps shall not be manifolded on the suction side.

b. Pumps shall be horizontally –mounted, centrifugal type with vertically split casings.

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c. All slurry pumps, except recycle slurry pumps, shall have abrasion resistant, high chromium white iron cases and impellers.

d. Water pumps shall be alloy specifically suited for the intended service. WFGD Supplier's supply shall take into account the fluid properties, rotational speed and service duty when selecting materials of construction and other pump design specifics.

e. Normal operating point of the pump shall be within + 10% and -20% of the pump best efficiency point (BEP).

f. Pumps shall be either direct drive or driven through a reducer. Belt-driven pumps shall not be allowed. Casing/Impeller combinations shall be sized to allow at least a 5% increase in head at the rated capacity by installing a larger diameter impeller of the same hydraulic pattern. Motors shall be sized to accommodate this margin without using the service factor.

g. Provisions for axial adjustment of the impeller shall be included to allow wear compensation.

h. Pump motors shall have a maximum speed of 1800 rpm or 5000 FPM impeller tip speed.

i. Pump flanges shall be of through-bolt design.

j. Pumps and motors shall have external markings showing the direction of rotation.

k. Pump discharge elbows (increasers) shall be ceramic lined and readily repairable and replaceable.

6.5.8 Reference lists for similar service applications and sizes shall be included for pumps quoted.

6.5.9 There shall be no special purging or liquid fill requirements allowed for normal starting of pumps; applies to pumps and piping.

6.5.10 See Section 1.2, b.9 for instrumentation requirements.

6.6 Tanks

6.6.1 All metal tanks shall be designed, fabricated, and erected in accordance with API standard 650. See also 5.1.27 for additional requirements.

6.6.2 For the integral absorber reaction tank, particular design attention shall be applied by the WFGD Supplier to maximum deflections; solids accumulation (i.e. weight and hydraulic thrust effects), internal attachments and abrasion protection from agitator induced flow wear and recycle slurry sprays. Calculations shall be submitted as identified in Section 5.1.27.

6.6.3 All FRP tanks shall be fabricated by filament winding or contact molding. Filament wound tanks shall be designed, fabricated, and tested in accordance with ASTM Specification 0-3299. All contact molded tanks shall be designed, fabricated, and tested in accordance with ASTM Specification 0-4097. A gel coat or pigment shall be used on the exterior coat of the tank after inspections are complete. An ultraviolet absorber for improved weather resistance shall also be added to the exterior surfaces of all tanks located outdoors, or all tanks that may be stored outdoors for an extended period of time.

6.6.4 All tanks shall be provided complete with all overflows, drains, baffles, skirts, wear plates, instruments, and any other connections or appurtenances required for a complete installation. The reaction tank shall also be furnished with gas seals.

6.6.5 All tanks will be provided with a sump and drain connection so that the tank can be completely drained. Minimum sump size shall be 2 ft x 2 ft x 2 ft. The floors of all tanks shall slope towards their respective internal sumps. The sumps shall be located adjacent to the access door.

6.6.6 All flanged piping connections shall have Class 150 rated flanges in accordance with ANSI B16.5.

6.6.7 All slurry tanks shall have at least two 36 inch diameter manways in the tank shell and cleanout drains for cleanout. Water tanks shall have at least one 36 inch diameter manway in the tank shell. A davit or similar device shall be provided to facilitate manway removal.

6.6.8 Reaction tank shall include a six (6) feet wide by eight (8) feet high removable door panel for entry of mechanical cleanout equipment. A davit or similar device shall be provided to facilitate door removal. A separate personnel access door shall also be included. The size of this door shall be three (3) feet wide by seven (7) feet high. Removable sections of internal components shall be included, as required to provide full access through the door panel. Doors shall be flush with the floor.

6.6.9 Internal and external handholds shall be provided at all manways to facilitate entry/exit.

6.6.10 Tanks shall be complete with bottoms of materials similar to sidewalls.

6.6.11 Module shall have 3'- 0" diameter access door at bottom of reaction tank.

6.7 Agitators

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6.7.1 Each agitator shall consist of the following components.

a. Shafts and impellers.

b. Integral drive with motor, couplings, gear reducers, and all required guards. Guards shall completely cover all exposed rotating components. AGMA service factor of 1.5 and shall be of helical or spiral-bevel gear design.

c. Splash lubrication system (no oil pumps).

d. Mounting base and complete support system.

e. Auxiliary piping (as required) for cooling.

f. Vibration alarm switch.

g. Other equipment or material as required for a complete unit.

6.7.2 Agitators shall be a turbine type design suitable for continuous operation at all tank liquid levels. Tip speeds shall be based on WFGD Supplier's successful experience in similar applications. WFGD agitators shall have maximum tip velocities of 2,000 feet per minute in order to prevent blade erosion. WFGD Supplier to define minimum liquid level.

6.7.3 Agitators shall be sized in accordance with the following requirements:

a. Keep all solids suspended and off the bottom of the tank.

b. Capable of maintaining a uniform solids suspension.

c. Capable of re-suspending settled solids.

d. Capable of being maintained and removed with ease.

e. Supports and attachments for all agitators shall be designed such that the loss of one agitator blade will not cause the support system to fail or vibrate excessively.

6.7.4 In addition, agitators for the reaction tank shall be sized in accordance with the following requirements:

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a. Designed so that the failure of any one agitator shall not cause blockage of a pump suction, damage to other agitators or shutdown of the WFGD system.

b. Located in accordance with the model study described elsewhere in this specification.

6.7.5 Each agitator assembly (motor, gearbox, and agitator) shall be sized such that, as a minimum, the design point operating torque is less than 75% of the rated torque for the assembly.

6.7.6 Agitator shafts to be constructed of solid alloy with a design safety factor of 2.0.

6.7.7 Agitator motor and shaft bearings shall be selected for a minimum B10 life of 150,000 hours.

6.8 Instrumentation and Controls

The DCS will be provided by the Buyer. Basic I/O lists, alarm list, logic diagrams, recommended graphic sketches, system descriptions, and other required control system design information shall be provided by the WFGD Supplier as required to develop a complete and functional controls design for all equipment to be controlled and/or monitored by the Buyer's DCS. This information will be used to develop the detailed cable termination drawings and DCS programming.

Digital logic diagrams shall be provided in WFGD Supplier's standard format. Digital logics and graphics shall follow the Buyer's graphic standards, piping and process colors, and plant standard macros. Analog logic diagrams shall be provided in vertical SAMA format or as acceptable to the Buyer. I/O point list shall be provided in electronic format as well as hardcopy.

The WFGD Supplier shall attend the Buyer's DCS Factory Acceptance Test (FAT) to verify the implementation of the WFGD Supplier-furnished control logics and graphics.

All trips and interlocks deemed to be critical to Unit safety shall be hardwired.

All instrumentation shall be HART communications capable, where available.

Continuous analog monitoring shall be used in lieu of high or low level/pressure/flow switches for the processes.

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Instrumentation contact with slurry shall be kept to minimum using non-contacting devices or through the use of diaphragm seals.

6.9 Physical Scale Model, CFD Model and Model Demonstration Tests

6.9.1 The WFGD Supplier shall provide, three- dimensional physical scale model and CFD model studies for both the gas flow path and for the reaction tank agitator design/layout. WFGD Supplier shall be responsible for producing and providing a protocol document describing the specific objectives of the studies, the detailed criteria for the models and the outline of the tests to be performed. The document shall be subject to review and approval by the Buyer and Owner. WFGD Supplier shall also be responsible for final reports of the testing and submittal to the Buyer and Owner. The model studies must be satisfactorily completed and approved by the Buyer and Owner prior to fabrication of the absorber and ductwork. Buyer and Owner shall have full access to flow models and tests performed with models.

WFGD Supplier shall construct physical flow models for each of the WFGDs in order to execute the Pressure Drop Optimization Test, Slurry Distribution Test, Agitator Mixing Test, and Flue Gas Velocity Distribution Test collectively (the "**Model Demonstration Tests**"). For the physical flow model, the WFGD Supplier shall construct three-dimensional physical scale models of the ductwork from the baghouse outlet through the WFGD and to a point scaled at 100 feet inside the chimney. A scale model (1/12 scale) will be constructed and Model Demonstration Tests will be run for observing the dust distribution, layout, gas flows, liquid entrainment, temperature deviation, CEMS certification, flow devices, reaction tank agitators, and erosion issues from Full Load to Low Load.

All Model Demonstration Tests will be measured only in the physical flow models.

6.9.2 The physical gas flow and liquid entrainment model study of the Wet Flue Gas Desulphurization System gas path, including the wet/dry interface, shall be performed to examine and to optimize the design and performance of the WFGD System at all operating conditions.

6.9.3 The scope of the model studies shall include the following requirements, conditions and areas of the WFGD system:

i. Conduct model tests and continue model testing until all problem areas related to gas flow, gas flow distribution, particulate fallout, pressure drop, mist elimination, agitator design, damper design, slurry distribution, etc., have been identified and eliminated;

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ii. CFD models will be run for observing and resolving issues related to the dust distribution, gas flows, liquid entrainment, temperature deviation, CEMS certification, flow devices, reaction tank agitators, and erosion from Full Load to Low Load.

iii. The design and construction of the physical flow model must simulate full-scale flow patterns, velocity profiles, damper design, mist elimination, slurry distribution, and agitator design in the model of the ductwork and equipment. The CFD model must depict the full-size flow patterns, velocity profiles, damper design, mist elimination, slurry distribution, and agitator design. All internal structural members three (3) inches in diameter or greater must be modeled in both physical and CFD models;

iv. Determine gas pressure and velocity distributions throughout the duct system and WFGD equipment model;

v. During flow model testing, a variety of flow correction and mixing devices will be installed, modeled and tested by WFGD Supplier to demonstrate the requirements of uniform gas flow conditions including how the results can be extrapolated to the full size system, must include, but not be limited to, the following:
    1. Pressure drop and requirements to minimize pressure drop in ductwork and WFGD while demonstrating the flue gas distribution requirements;
    2. Flow distribution at the WFGD inlet and requirements to provide even gas flow distribution to the WFGD
    3. Flow distribution and requirements to provide even fly ash, and gas flow distribution to the WFGD
    4. Recommendations for locations of test ports

vi. The modeling firm shall utilize smoke, oil mist, fly ash simulation materials, or other Owner approved material for flow visualization in the physical flow model to evaluate flue gas flow patterns throughout the duct and absorber vessel, from the outlets of the existing ESPs to the point where laminar flow is achieved in the chimney;

vii. Provide complete listing of all pressure drop data for locations immediately upstream and downstream of areas of interest before and after a corrective device is added. Pressure taps in the physical flow model must be located before and after each corrective device;

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viii. Modify models and/or add corrective devices to solve problems; rerun model tests; continue these activities until an economical solution has been determined for all problem areas;

ix. Provide Buyer and Owner with a schedule of model testing activities at least sixty (60) Days prior to the commencement of model testing and update the schedule at least 14 days in advance of model testing;

x. The WFGD Supplier shall perform any other flow model tests that it deems necessary to optimize the performance of system. Buyer and Owner have the right to attend and observe the testing;

xi. Observe dynamic and geometric similitude in all phases of the model study;

xii. Record all physical model testing with video camera(s) and digital media for future reference;

xiii. Liquid entrainment from the mist eliminators to just above the CEM port in the chimney, but no less than two diameters above the breeching, with suitable resistance to model the chimney losses;

xiv. Ten (10) percent difference (spread) between flow contribution from each of the two (2) induced draft fans of each Mill Creek unit between Units 1 and 2 with any fan having the higher flow rate. Ten (10) percent difference (spread) between flow contribution from each of the four (4) induced draft fans of Mill Creek Unit 4 with any fan having the higher flow rate;

xv. Twenty (20) degrees Fahrenheit temperature difference between induced draft fan flue gas discharges with either fan having the higher temperature;

xvi. Single induced draft fan operation up to 60% flow from any induced draft fan;

xvii. Flow distribution modeling necessary to obtain certification of the chimney continuous emission monitoring system;

xviii. Addition of flow devices necessary to obtain within 15% of an equal split distribution at the flow measuring locations;

xix. Flow distribution modeling will be deemed successful if the average of the flow measurements at each traverse point is within 15% of an equal split (i.e., 85% minimum and 115% maximum flows of

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average gas flow) evaluated at any three (3) or more equally spaced flue gas flow test conditions selected by the Buyer;

xx. Flow model tests shall be done for flue gas flows over the entire operating load range between the performance condition limits in Section 3.2; and

xxi. The Physical and CFD Model Tests shall:

a) Determine gas pressure throughout the duct system
b) Determine the velocity distributions throughout the duct system
c) Identify areas of flow separation or undesirable turbulence
d) Determine flow control of flue gas including dampers and internal piping
e) Determine and assess slurry distribution piping and nozzles, mist eliminator systems, and other absorber internals
f) Determine and resolve solids build up concerns
g) Determine optimized duct layout
h) Confirm pressure drop measurement design criteria for Buyer's fans
i) Design reaction tank systems to meet requirements of this Exhibit A

6.9.4 A model study shall be performed to determine the optimum agitator selection and arrangement in the reaction tank. Agitator quantity, size and operational characteristics and placement within the reaction tank shall be modeled. The intent of the model is to verify that the final layout of the agitators:

a. provides sufficient mixing of the tank contents, both during normal operation and during the re-suspension phase after a 24 hour shutdown,

b. does not interfere with recycle pump operation (cavitation or loss of capacity),

c. minimizes hide-out and accumulation of solids during normal operation,

d. minimizes and locates areas of high erosion potential

6.9.5 All instrumentation used in the models shall be calibrated against a validated laboratory standard device.

6.9.6 The model studies shall in no way relieve the WFGD Supplier from providing a full scale system which meets all the contractual performance guarantees for the

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range of conditions covered in Exhibit G - Guarantees and Performance Test Protocol

6.9.7 The physical model and CFD models are the property of Owner. The WFGD Supplier shall store the physical model for a minimum period not ending less than one (1) year after Commercial Operation. Owner has an option to take delivery of the model on notice to WFGD Supplier before the end of such period at Owner's cost. If Owner elects not to take possession of the model WFGD Supplier shall dispose of the model

6.9.8 Not Used

6.9.9 Pressure Drop Optimization Test.

"Pressure Drop Optimization Test" means the set of tests performed by the WFGD Supplier on the physical flow model that are performed to minimize pressure loss in the WFGD while simultaneously achieving all required Model Demonstration Test protocol agreed to by both WFGD Supplier, Buyer, and Owner.

As a minimum, pressure loss data shall be provided at the following locations:

1. Baghouse Outlet
2. Wet Dry Interface
3. Above each spray level
4. Above each mist eliminator level
5. Test port locations.
6. Stack breaching
7. 100 ft into the stack

6.9.10 Slurry Distribution Test

"Slurry Distribution" means the distribution of the slurry in the flue gas below each spray level. The WFGD Supplier guarantees that the Slurry Distribution below each layer of sprays will cover 100% of the overall absorber area and that there will be no flue gas wall sneakage. The Slurry Distribution is to be proven by the WFGD Supplier during the Model Demonstration Tests via the performance of the Slurry Distribution Test. The **"Slurry Distribution Test"** means the set of tests performed by the WFGD Supplier on the physical flow model that are run to show the slurry characteristics of the WFGD. This guarantee will be demonstrated based on the results of the physical flow model study. Slurry Distribution Tests will be defined in the model demonstration testing protocols prepared by the WFGD Supplier and approved by Buyer and Owner.

6.9.11 Agitator Mixing Test

"Agitator Mixing" means the mixing of the solids in the absorber slurry. The WFGD Supplier will provide a design (i) such that the Agitator Mixing will provide

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sufficient mixing of tank contents during normal operation and during 24-hour re-suspension phase after a shutdown, (ii) such that the agitator operation does not interfere with recycle pump operation, (iii) for minimization of hide-out and accumulation of solids during normal operation, and (v) for minimization of erosion. The Agitator Mixing is to be proven by the WFGD Supplier during the Model Demonstration Tests via the performance of the Agitator Mixing Test. The **"Agitator Mixing Test"** means the set of tests performed by the WFGD Supplier on the physical flow model that are run to show the absorber solids characteristics of the WFGD. This guarantee will be demonstrated based on the results of the physical flow model study. Agitator Mixing Tests will be defined in the model demonstration testing protocols prepared by the WFGD Supplier and approved by Buyer and Owner.

6.9.12 Flue Gas Velocity Distribution Test

"Flue Gas Velocity Distribution Test" means the set of tests performed by the WFGD Supplier on the physical flow model that are run to determine whether the flue gas velocity distribution characteristics of the WFGD as set forth below have been achieved. The following performance guidelines shall be used to demonstrate the uniform gas profile conditions are achieved in the flow model test and to identify areas of flow separation or undesirable turbulence. These guidelines indicate minimum performance only, and WFGD Supplier is responsible for achieving better than indicated performance where required to demonstrate the Performance Guarantees. Design shall minimize pressure loss while achieving all the requirements below:

1. Flue Gas Velocity Profile:
   a. First spray level
      i. 100% of the overall area shall be within +/- 20% of the arithmetic mean.
      ii. 80% of the overall area shall be within +/- 10% of the arithmetic mean.

2. Temperature Profile
   a. First WFGD Spray Level
      i. 100% of the overall area shall be within +/- 20°F of the arithmetic mean.

Achievement of these requirements must be demonstrated based on the results of the physical flow model study. Flue Gas Velocity Distribution Tests will be further defined in the mutually approved model demonstration testing protocols. As a minimum, WFGD Supplier shall provide velocity distribution data at the following locations:

1. Baghouse Outlet
2. Wet Dry Interface

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3. Above each spray level
4. Above each mist eliminator level
5. Test port locations.
6. Stack breaching
7. 100 ft into the stack

6.9.13 Model Demonstration Test Reports

Following the completion of the physical and CFD model test runs, WFGD Supplier shall provide a report to the Buyer and Owner that indicates devices required to be installed in the flue gas path necessary to obtain the specified gas distribution, to minimize blowback in the inlet duct upstream of the wet/dry interface, to collect moisture fallout in the WFGD outlet duct and the chimney, to prevent re-entrainment of moisture and to best locate process, sampling and test instrumentation

WFGD Supplier shall provide Buyer and Owner with a draft copy of the test report within thirty (30) Days after completion of all model tests and six copies of the final test report within fifteen (15) Days after receipt of comments to the draft copy by the Buyer and Owner. WFGD Supplier shall take into account all comments received in the final test report. At a minimum, the test report shall contain at least the following:

1. Complete explanation of test procedures including flow rates, pressures, calculations and assumptions. List and justify deviations in dynamic and geometric similitude by model from full-size installation.
2. A scale drawing of full-size installation showing any modifications made and devices added to ductwork as a result of study.
3. Isovelocity diagrams and histograms, indicating the root mean square (RMS) velocity deviation and mean velocity, at strategic points which shall include, but not be limited to, following:
   (i) Baghouse outlet
   (ii) Wet dry interface
   (iii) Above each spray level
   (iv) Above each mist eliminator level
   (v) Stack breaching
   (vi) Test port locations
   (vii) 100 ft into the stack
4. A complete description of the physical flow model testing, and CFD flow model simulations, including a description of the actual testing and CFD modeling process; and installation or modeling of flow correction and mixing devices.

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5. Recommendations and conclusions covering methods to provide the following results:
   (i) Meet Model Demonstration Test Requirements: Pressure Drop Optimization Test, Slurry Distribution Test, Agitator Mixing Test, and Flue Gas Velocity Distribution Test
   (ii) Minimize pressure drop in ductwork and WFGD
   (iii) Minimize areas of erosion
   (iv) Produce and maintain adequate temperature, slurry distribution, agitator mixing, and gas flow distribution throughout the WFGD Supplier's scope of supply
6. Video of test runs with commentary in English.

6.10 Field Testing

6.10.1 All system demonstrations, equipment capacities and Performance Guarantees shall be proven and verified by field testing by WFGD Supplier. Any and all labor, equipment and materials required to make equipment ready to test and to make adjustments and repairs during testing shall be provided by the Buyer. Smoke tests and hydrostatic tests shall be performed by the Buyer to detect ducting system and piping leaks.

6.10.2 Selection and payment of the independent third-party performance testing sub-Contractor(s) for the WFGD process and systems demonstrations for the Performance Guarantees shall be by Buyer.

7 QUALITY ASSURANCE

WFGD Supplier shall implement a Quality Control program covering all phases of the project including design, manufacturing, and construction. This Quality Control program should be in accordance with ISO 9000.

WFGD Supplier shall provide Buyer with a complete Inspection and Test Plan identifying key witness, hold and acceptance points.

Buyer shall have unfettered access to WFGD Suppliers, their sub-Contractors and all sub-suppliers facilities and manufacturing locations, at all reasonable times.

8 TESTS AND INSPECTIONS

8.1 The WFGD Supplier shall agree to and provide all guarantees and warranties as specified in Exhibit G - Guarantees and Performance Test Protocol and in the commercial sections.

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8.2 The WFGD Supplier shall make all tests necessary to ensure that material, equipment and workmanship are of the required degree specified herein and shall fully comply with the laws and regulations of the state of installation (including National Board registration requirements). Documents shall contain all necessary identification and shall comply with all requirements of the State of Kentucky and the Buyer's Inspection Agency and Insurance Company. All WFGD Supplier supplied equipment shall be designed, fabricated, tested and stamped in accordance with the codes and standards referenced in the Exhibit N - Codes and Standards.

8.3 Data reports which have been partially completed in the shop and requiring final completion after field welding, inspection, and testing shall be retained in the WFGD Supplier's files until such time as field welding of the piping is imminent. Prior to forwarding such reports to the erection site, the WFGD Supplier shall obtain, and retain in the WFGD Supplier's files, at least three photographic copies of the original document for use in the event of loss of the original. After completion of all necessary data, these reports shall be submitted to the Buyer..

8.4 All hardware and software specified shall be tested in the WFGD Supplier's shop prior to shipment.

8.5 All parts and components, not specifically covered by a code or ordinance listed in the Exhibit N – Codes and Standards which will be subject to water or air pressure, shall be tested to a hydraulic pressure of one and one half times the design pressure of the components. Under no conditions shall water below 70^0F be used for the hydrotest of any pressure vessel.

8.6 The WFGD Supplier shall make manufacturing tests and shop performance tests of all equipment to demonstrate proper operation and to verify guaranteed performance. The tests shall generally follow WFGD Supplier's standard but must include the following:

a. Static balance and overspeed test of rotating parts.

b. Hydrostatic tests of casings and other pressure parts at 1.5 times design pressure.

c. Porosity test of equipment components and welds.

8.7 A copy of each required manufacturing and shop performance test and inspection identifying successful completion shall be submitted to the Buyer before the equipment is shipped.

8.8 Buyer shall have full access to the equipment during the process of fabrication and testing. WFGD Supplier shall notify the Buyer in writing four (4) weeks prior to hydrostatic and functional tests to allow for witness at Buyer discretion.

8.9 Pumps shall be tested as follows:

8.9.1 All wetted pressure retaining parts of all pumps shall receive hydrostatic testing to 150% of the design pressure. Visible leakage or failure to hold test pressure for a period of ten minutes shall be unacceptable. Following testing, pump shall be thoroughly cleaned and dried.

8.9.2 One pump of each size, except for lubrication system pumps, and each service (i.e., 1 recycle pump), shall be shop performance tested using clear water. The pump shall be tested at full speed for total dynamic head and flow from shutoff (zero flow) to maximum expected run out. Data for a minimum of five (5) test points shall be taken over this range. BHPR, efficiency, and vibration shall also be determined for each test point. Performance test acceptance criteria shall be in accordance with Hydraulic Institute Standards.

8.10 Deleted

8.11. Deleted

8.12 Piping shall be hydrostatically tested in accordance with ANSI B31.1 at 1.5 times the design pressure. Manufacture of all pressure piping and vessels shall also be in accordance with all of the requirements of the State of Kentucky and Factory Mutual Company. WFGD Supplier's recycle header testing procedure shall be submitted for approval by Buyer. WFGD Supplier shall furnish copies of all manufacturers' U-1 code data forms to the Buyer.

8.13 Control panels shall be subjected to a complete functional test prior to shipment. Field controls and instruments may be simulated as necessary to accomplish testing. These tests shall be witnessed by the Buyer..

8.14. Motors shall be tested as specified in the Large Squirrel Cage Induction Motors specification or the Squirrel Cage Induction Motors specification, as applicable.

8.15. The test procedures, acceptance criteria, and test reports shall be supplied by the WFGD Supplier for all tests performed.

8.16 The Buyer shall be informed during manufacture of any major problems or rework that may affect delivery of the equipment as scheduled.

8.17 Hydrostatic and air pressurization tests of components shall be performed before the component has its corrosion lining installed.

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8.18 All gas side test ports shall be located and designed in accordance with USEPA test methods. All test ports shall be accessible by platforms. All test connections shall be leak tight and shall be flanged to allow easy access to test ports.

8.19. Compressors or blowers shall be tested and inspected as follows:

8.19.1 All pressure-retaining components and pressure-retaining welds on the compressor units, intercoolers, and after coolers shall be examined in accordance with ASME VIII.

8.19.2 The basis of acceptance of all nondestructive testing shall be in accordance with ASME VIII.

8.19.3 Each impeller shall be given an overspeed test of 115% of its maximum continuous operating speed. After the overspeed tests, the impeller shall be examined by either the liquid penetrant or magnetic particle method. The Buyer's QC representative shall verify that the overspeed tests and the post-test nondestructive examination have been made.

8.19.4 Each compressor, cooler, filter, and other pressure vessels shall be hydrostatically tested at 1 1/2 times the design pressure. These tests shall be in accordance with code requirements where applicable.

8.19.5 Each component, subassembly, or assembled system shall be hydrostatically tested at 1 1/2 times the system design pressure.

8.19.6 Cooling water jackets and other components of the system subject to cooling water shall be hydrostatically tested at 1 1/2 times the cooling water system design pressure but not less than 115 psig.

8.19.7 Hydrostatic tests shall be maintained for duration of at least 30 minutes to permit examination of parts under pressure. The basis for acceptance shall be no leakage.

8.19.8 The compressors shall be run at maximum continuous (100%) speed for 4 hours after the bearing temperatures have stabilized. Facilities to ensure against entrance of oil into the compressor shall be in operation throughout the test.

8.19.9 During running tests, mechanical operation of all equipment shall be satisfactory. Vibration measurements shall be recorded throughout the operating speed range and shall not exceed the limits specified. While operating at maximum continuous speed, a search shall be made for amplitude peaks at other than running frequencies. All purchased vibration probes and

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detectors shall be in use during the mechanical running test. Shop test facilities shall include instrumentation to measure frequency, peak-to-peak displacement, phase shift, and x-y presentation.

8.19.10 During the mechanical running test, the WFGD Supplier shall demonstrate the proper functioning of the capacity controls by partially loading the compressor.

8.19.11 If dismantling of the compressor, bearings, or oil system is required for improvement of operation, the initial running test will not be acceptable and final tests shall be run after corrections are made.

8.19.12 An air performance test shall be conducted in accordance with ASME PTC 10, Class I. The WFGD Supplier shall submit eight copies of the proposed test procedures, including arrangement drawings or sketches, to the Buyer for review and comment. A minimum of five points shall be taken. Demonstration of capacity control functioning may be conducted as a part of the performance test.

8.19.13 The data accumulated during the performance test shall be sufficient to plot the following curves:

a. Discharge pressure as a function of flow in SCFM with constant suction pressure.

b. Suction pressure as a function of flow in SCFM with constant discharge pressure.

c. Brake horsepower as a function of flow in SCFM with varying suction pressure and constant discharge pressure.

9 TECHNICAL DIRECTION

9.1 The WFGD Supplier shall furnish the supervisory and consulting services of qualified technical personnel as required to successfully erect, checkout, startup, and to successfully demonstrate the WFGD Supplier's scope of supply and to train the Buyer's personnel. The WFGD Supplier's personnel shall place special emphasis on safety in the providing of these services. Training shall be in accordance with Exhibit U - Training.

9.2 The WFGD Supplier's erection supervisor(s) shall provide direction and consultation as required to facilitate safe erection and/or installation including, but not limited to:

9.2.1 Technical support and direction for the proper receiving, handling and storage of WFGD Supplier supplied equipment and materials.

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9.2.2 Technical support and direction for the proper and efficient erection and/or installation of all WFGD Supplier supplied equipment and materials.

9.2.3 Near term and long term planning, sequencing and scheduling consultation. The WFGD Supplier shall provide and maintain a current listing of check and hold points for all work.

9.2.4 Sequential acceptance of the step by step erection and/or installation of all WFGD Supplier supplied equipment and materials. The WFGD Supplier's representative shall provide timely written acceptance of erection and/or installation work.

9.2.5 Quality control inspection of workmanship to WFGD Supplier's standards.

9.2.6 Determination of the need for and the coordination of the services of specialists required for the proper erection and/or installation of the WFGD Supplier's supplied scope.

9.3 The WFGD Supplier's start-up supervisor(s) shall provide direction and consultation as required to accomplish the safe and complete start-up and tuning of the entire WFGD System including, but not limited to:

9.3.1 Determination as to the readiness of equipment and systems for checkout, startup and performance testing procedures.

9.3.2 Near term and long term planning, sequencing and scheduling consultation. The WFGD Supplier shall provide and maintain a current listing of check and hold points for all work.

9.3.3 Technical support and consultation in the start-up and initial operation of all equipment furnished, including equipment furnished by WFGD Supplier's sub-vendors.

9.3.4 Instruction of the Buyer's operating personnel in the start-up, operating, and shutdown procedures (normal and emergency) recommended by the WFGD Supplier.

9.3.5 Participation in the factory checkout of all WFGD Supplier supplied control systems and the Buyer's DCS control system. The WFGD Supplier shall attend the Buyer's DCS Factory Acceptance Test (FAT) to verify the implementation of the WFGD Supplier-furnished control logics and graphics.

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9.3.6 Participation in the WFGD Supplier's class room training program to provide hands on and installation specific input to the program. Training shall be in accordance with Exhibit U - Training.

9.3.7 Technical support, including instrumentation and maintenance personnel, during initial system operation including all tuning of WFGD Supplier supplied logic and controls.

9.3.8 Determination of the need for and coordination of the services of specialists required for the proper checkout and/or startup of the WFGD Supplier's supplied scope.

9.3.9 Technical support for performance testing.

9.4 The WFGD Supplier shall provide a formal training program for the Buyer's operating and maintenance personnel as specified in Exhibit U - Training.

END OF WFGD TECHNICAL SPECIFICATION

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TABLE OF CONTENTS 01400 TECHNICAL SUPPLEMENTALS

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E000 Electrical Equipment and System Voltages
(Source: 22May09 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

Power Supply Code	Continuous Voltage (Volts)	Momentary Voltage Dip to X% of Nominal	Frequency (Hz)	Configuration	System Grounding	Transfer to Alternate Source	Max Sym Short-Circuit Amps
MV-1 Medium Voltage (	4160 Nom 4400 Max 3744 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Low Resistance (IT)	User Defined Other	50,000 (3-Ph) 1,500 (L-G)
MV-3 Medium Voltage	13800 Nom 14520 Max 12420 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	Low Resistance (IT)	User Defined Other	50,000 (3-Ph) 1,500 (L-G)
LV-1 Low Voltage (Power)	480 Nom 508 Max 432 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 3 Wire, Wye (3/PE)	High Resistance (IT) for Units 1 and 2, Solidly Grounded (TN) for Unit 4	User Defined Other	65,000 (3-Ph) 10 (L-G)
LV-2 Low Voltage (Lighting)	480Y/277 Nom 508Y/293 Max 432Y/249 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN)	N/A	10,000 (3-Ph) 10,000 (L-G)
LV-3 Low Voltage (Power)	208Y/120 Nom 220Y/127 Max 187Y/108 Min	80	60 Nom 61.5 Max 58.5 Min	3-Phase, 4 Wire, Wye (3/N/PE)	Solidly Grounded (TN)	N/A	10,000 (3-Ph) 10,000 (L-G)
UPS-1 UPS Power	120 Nom 127 Max 108 Min	80	60 Nom 61.5 Max 58.5 Min	Single-Phase, 2 Wire (1/N/PE)	Solidly Grounded (TN)	Static 1/2 Cycle	10,000 (L-L) 10,000 (L-G)
DC-1 DC Power	125 Nom 140 Max 100 Min	70	N/A	Two-Pole	Ungrounded	N/A	42,000 (P-P)
CP-1 Control Power (AC)	120 Nom 127 Max 108 Min	80	60 Nom 61.5 Max 58.5 Min	Single-Phase, 2 Wire (1/N/PE)	Solidly Grounded (TN)	N/A	10,000 (L-L) 10,000 (L-G)

*7200 volts Max is the maximum voltage for nominal 6900 volt systems fed from 6900 volt contactors, due to the 7200 volt maximum rating for 6900 volt contactors.

Definitions: N – neutral; PE – protective earth conductor; IT - unearthed transformer neutral; TN - transformer neutral earthed, frame connected to neutral

E100 Wiring Methods, Cable, and Raceway
(Source: 05Feb07 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

E100.1 General Requirements
In general, all devices furnished under these specifications and requiring electrical connections shall be designed for wiring into electrical enclosures with terminal blocks. Terminal blocks shall be furnished for conductors requiring connection to circuits external to the specified equipment, for internal circuits crossing shipping splits, and where equipment parts replacement and maintenance will be facilitated.

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Splices will not be permitted.

Unless otherwise specified, one spare normally open and one spare normally closed contact on each control switch and lockout relay shall be wired out to terminal blocks.

All wiring leaving an enclosure shall leave from terminal blocks and not from other devices in the enclosure.

Auxiliary equipment such as terminal blocks, auxiliary relays, or contactors shall be readily accessible. Auxiliary equipment shall be located in compartments, enclosures, or junction boxes in such an arrangement that service personnel will have direct access to the equipment without removal of barriers, cover plates, or wiring.

Terminal blocks for external connections shall be grouped in the instrument and control compartment for easy accessibility, unrestricted by interference from structural members and instruments. Sufficient space shall be provided on each side of each terminal block to allow an orderly arrangement of all leads to be terminated on the block.

Terminal blocks shall not be mounted in compartments containing uninsulated conductors operating at voltages above 1000 volts.

Electrical enclosures shall use protective barriers or other means of isolation so that 480V sources and voltages are not accessible during routine maintenance and inspection of the equipment. The protective barriers shall be removable so that maintenance and inspection of the 480V sources and voltage when necessary.

When current transformers are supplied with the equipment furnished under these specifications, a shorting type terminal block shall be installed at an accessible location for each set of current transformers. The shorting terminal blocks shall be the nearest to the current transformers. No other shorting type terminal blocks are required unless specified otherwise. The shorting terminal blocks shall be furnished with white marking strips.

For safety reasons, the current transformer shall be grounded but the grounding shall occur only at the shorting terminal blocks. The grounding conductor shall be identified so that it may be disconnected in the field as required.

Materials containing asbestos or PVC shall not be used in any of the wiring devices or cable.

Control conductors 8 AWG and smaller shall be terminated with compression type connectors properly sized for the conductor and the terminal. Terminal connectors for connecting to screw terminals shall be preinsulated ring type or preinsulated snap spade type terminal connectors. Except for internal wiring of factory prewired electronic system cabinets, crimping ferrules with plastic insulating sleeves shall be provided on all stranded control conductors that are to be terminated to compression Type IEC terminal blocks. Conductors for current transformer circuits shall be terminated with preinsulated ring type terminal connectors.

Each terminal block, terminal, conductor, relay, breaker, fuse block, and other auxiliary devices shall be permanently labeled to coincide with the identification indicated on the drawings. All terminals provided for termination of external circuits shall be identified by inscribing terminal designations acceptable to the Buyer on the terminal block white marking strips with permanent black ink. All internal wiring terminations shall be identified by printing on conductor identification sleeves. A conductor identification sleeve shall be provided on each end of each internal conductor. Each sleeve shall be marked with the opposite end destination identification using permanent black ink. Conductor identification shall be permanent, unaffected by age, heat, or solvents and not easily dislodged. Adhesive labels are not acceptable.

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The arrangement of connections on terminal blocks shall be acceptable to the Buyer.

All connections requiring disconnect plug and receptacle type devices shall be provided with factory terminated conductors on each plug and receptacle. Plugs and receptacles shall be factory wired into junction boxes containing terminal blocks for external connections. All conductors on the disconnect portion of plug-receptacle assemblies shall be in a common jacket. The plug-receptacle assemblies shall have provisions for locking the devices together. The assembly shall also be watertight when installed outdoors.

All temporary wiring installed in the factory for equipment testing shall be removed prior to shipment of the equipment.

Reference to NEC means the codes and standards as defined by the USA National Electrical Code, ANSI/NFPA 70.

E100.2 Equipment Safety Grounding (Earthing)
All electrical equipment that is part of an integral shipping unit or assembly shall be furnished with a bare copper grounding pad. The pad shall be suitable for field connection to the station ground grid by others.

Isolated logic system or single-point ground connections required for proper operation of electronic equipment shall be insulated from the equipment safety ground. Such connections will be extended, using insulated cable, to a single termination point suitable for field connections to the appropriate ground system by others.

Electrical equipment requiring grounding provisions shall include all enclosures containing electrical connections or bare conductors with the exception of control devices, such as solenoids, pressure switches, and limit switches, unless such devices require grounding for proper operation.

The raceway system shall not be considered to be a ground conductor except for itself. All metal conduits containing power circuits shall be provided with grounding type bushings and shall be wired together inside enclosures and connected internally to the enclosure grounding pad or grounding bus with bare copper conductor. The grounding bushing ground conductor shall be sized in accordance with NEC or other internationally recognized standard but shall not be less than 8 AWG bare copper conductor.

Ground conductors shall be soft drawn, bare stranded copper strand Class B as defined in NEMA WC 3 (formerly ICEA S-19-81). All clamps, conductors, bolts, washers, nuts, and other hardware used with the grounding system shall be copper.

E100.3 Electrical Interconnections
All electrical interconnections between devices, panels, and boxes shall use the following wiring methods as specified on the table at the end of this section:

> Nonarmored Cable. Nonarmored cable which is continuously supported and protected by conduit or installed in cable tray.

The installation of the cable and raceway system shall meet the requirements of NEC or other internationally recognized standard.

E100.4 Cable
Unless otherwise specified on the table at the end of this section, nonarmored cable shall meet the following minimum requirements:

> Stranded copper conductors.

Flame retardant ethylene propylene rubber (FREPR) insulation with CSPE or CPE jackets on power cables.

Tefzel (ETFE) insulation and jacket on instrument and control cables.

Minimum size of 14 AWG for control cables.

Minimum size of 12 AWG for power cables.

Minimum size of 10 AWG for current transformer cables.

Minimum size of 12 AWG for potential transformer cables.

Minimum size of 18 AWG for instrument and thermocouple extension cables.

Minimum size of 12 AWG for lighting/receptacle cables.

General service power and control cables, integral to the equipment furnished but not internal wiring of control cabinets or panels, shall be rated for the maximum service voltage but not less than 600 volts.

Cables which are routed through environmental conditions that differ along the cable run shall be selected using the environmental condition that results in the largest cable size.

All thermocouple cable shall use solid conductors with twisted and shielded pairs. Unless otherwise noted, insulation shall be color coded in accordance with ISA-MC96.1. This requirement also applies to thermocouple extension wire which is furnished internal to WFGD Supplier-furnished equipment.

All instrument cable shall use stranded copper conductors with twisted and shielded pairs or triads. These requirements also apply to instrument cable which is furnished internal to WFGD Supplier-furnished equipment.

Shielding of thermocouple and instrument cables shall consist of aluminum-polyester tape and copper drain wire.

Finished cables shall be capable of passing the IEEE 1202 (70,000 Btu/h) vertical tray flame test. This requirement also applies to multi-conductor control cable, instrumentation cable, and thermocouple cable which are furnished internal to WFGD Supplier-furnished equipment including control panels and cabinets.

Single conductor cables used for internal wiring of control panels and cabinets shall be Type SIS or MTW.

Additional requirements as defined in each applicable section.

E100.5 Conduit

All conduit interconnections between devices, panels, boxes, and fittings shall be rigid aluminum metal conduit which conforms to NEMA C80.1 and UL 6. All conduit connections shall be of the threaded type, and all conduit shall be rigid aluminum; couplings, and fittings shall be suitable for use with rigid aluminum conduit. Liquid tight flexible metal conduit may be used as long as the length does not exceed 3 feet. All conduit which enters the top of an enclosure or which enters outdoor enclosures shall enter through raintight steel or malleable iron hubs or threaded openings.

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All liquidtight flexible metal conduit shall be constructed of continuously interlocked rust resistant metal core. Conduit shall be coated with sunlight resistant thermoplastic jacket. The conduit shall also resist heat, oil, and chemical breakdown and shall be UL listed. High temperature liquidtight flexible metal conduit shall be used when the temperature conditions warrant its use.

One exterior locknut, one interior locknut, and one bushing shall be provided at the termination of each rigid metal conduit not terminated in a hub.

Grounding type insulated bushings with insulating inserts in metal housings shall be provided on all conduits not terminated in hubs and couplings. Bushings shall be galvanized.

All conduit fittings shall conform to the requirements of UL 514. All liquidtight flexible metal conduit fittings shall be aluminum insulated throat.

Conduit fittings used on outdoor equipment shall be gasketed.

All conduit shall be installed in exposed runs parallel or perpendicular to dominant surfaces with right angle turns made of symmetrical bends or fittings. Conduit shall be supported by means of conduit clamps and clamp-backs.

Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a hole shall be drilled in the bottom of a pull box or conduit fitting provided in the low point of the conduit run.

E100.6 Cable Tray

All cable trays furnished and installed by the WFGD Supplier shall be in accordance with this specification and/or drawings included with this specification. Cable tray components shall include cable tray, fittings, supports, accessories, and hardware required for a complete system.

Cable tray and associated component materials shall conform to the requirements of NEMA VE-1 for metal cable trays, NEMA FG-1 for fiberglass cable trays, and these specifications. In case of conflict between the NEMA standards publications and these specifications, the requirements of these specifications shall govern to the extent of such conflict. All cable tray components for similar cable tray materials shall be manufactured by the same manufacturer. Specific cable tray sizes and routing as required by the Buyer shall be as indicated on the drawings.

Cable tray shall be aluminum ladder type tray with a 9 inch rung spacing on centers and shall be fabricated from copper free aluminum or aluminum alloy unless noted otherwise on the drawings or technical sections. Cable tray shall have a 4 inch loading depth with a minimum NEMA 20C classification. The rung spacing shall be maintained at the center line of all horizontal and vertical elbows. Individual rungs shall provide a minimum of 1 inch of cable support surface. Individual rungs shall support, without collapse, a 200 lb concentrated load applied at the mid-span of the rung, over and above the NEMA rated cable load with a 1.5 safety factor. All cable tray fittings shall have concentric curved radius fittings.

Cable trays in outdoor areas and buildings shall be provided with continuous covers. The cable trays in electrical rooms do not require covers.

Hardware for aluminum cable tray shall be case hardened galvanized steel suitable for indoor and outdoor use. Hardware for aluminum cable tray in corrosive areas shall be Type 316 stainless steel.

Cable trays shall be cut to length as required. The trays shall be cut with saws and all surfaces over which the conductors and cables will be laid shall be ground or filed to remove any sharp edges which could cause damage to the cable jacket or insulation, either during installation or in normal service.

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Cable trays shall be bracket supported from walls or columns and hanger supported from overhead structural members, at intervals not exceeding 12 feet, when measured along tray center lines between supports. All fittings shall be supported in accordance with NEMA VE-2 for metal trays.

Cable tray supports shall be capable of supporting the uniform weight of the trays, plus their NEMA rated cable loads, plus a 200 pound concentrated load without exceeding the allowable load limit for any element of the support system with a minimum safety factor of 2.0.

A 2/0 AWG (bare, stranded copper, grounding conductor shall be installed on all power level cable trays containing single conductor power cables. The tray grounding conductor shall be installed on the outside of the tray side rails, along the entire length of the trays, attaching to each tray fitting and to each straight section of tray at 6 foot maximum intervals. The tray grounding conductor shall be attached to the trays using bolted ground clamps and shall be connected to the enclosure grounding system. Splices for the tray grounding conductor shall be made using compression connectors.

Cable trays containing multi-conductor power, control, or instrument cables shall not require a continuous ground conductor installed along the tray. These tray levels shall be grounded by means of a ground jumper extended from the tray side rail to the continuous ground conductor installed along a power level cable tray, to building steel, or to the enclosure grounding system.

Cable tray covers shall be installed for indoor cable trays at the following locations with the type of cover indicated. (Also refer to National Electrical Code (NEC) Article 392.6(D).) Cable tray covers shall be furnished with side flanges for strength:

Ventilated covers shall be installed on accessible vertical ladder type trays, starting 1 foot below the access floor or platform and extending to a height of 8 feet above the access floor or platform.

Covers shall be installed on horizontal trays located under grating floors, platforms, or insulated pipe. Covers shall extend at least 2 feet beyond the portion of the tray directly exposed beneath the grating floor, platform, or insulated pipe. Covers may be omitted on lower stacked ladder type trays where a covered tray at a higher elevation in the stack provides complete vertical shielding to the lower trays. Covers in these areas shall be as follows:

Power trays - tight-fitting, ventilated covers or raised solid covers.

Control and instrument trays - tight-fitting or raised solid covers.

Solid covers shall be installed on all trays where there is potential for accumulation of oil or other combustible materials on the cables.

E100.7 Not Used.

E100.8 Terminations

The capacities of conduit entrances and terminal enclosures for terminating the Buyer's cable shall be coordinated with the Buyer. Final sizes shall be acceptable to the Buyer.

The following criteria apply to wiring methods, cable, and raceway specified herein:

Wiring Methods, Cable, and Raceway	
Electrical Interconnections Between Electrical Enclosures, Devices, or Lighting	Nonarmored cable routed in tray and/or conduit

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Wiring Methods, Cable, and Raceway	
Thermocouple Cable Insulation Color Coding	ISA-MC96.1
Cable - Additional Requirements	600 volt multi-conductor power and control cable shall supply power to loads at 480 VAC and 250 VDC or less. 600 volt single-conductor power cable shall have FR-EPR insulation with no jacket or FR-EPR insulation with CSPE jacket. 600 volt multi-conductor power and control cable shall have Tefzel (ETFE) insulation and jacket. All cables shall be UL listed for tray installation. Instrument cable shall be twisted shielded pairs or triads with 600 volt class insulation (minimum). This cable shall have Tefzel (ETFE) insulation and jacket . Single and multiple pairs shall have an overall shield. Multiple pairs shall also have pairs shielded. Thermocouple extension cable shall be rated 600 volts Switchboard and panel wire shall be multi-stranded Type SIS VW-1, XLPE insulated for 600 volts.

E210 Electrical Enclosure Assemblies
(Source: 14Apr04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

E210.1 General Requirements
Electrical enclosures shall be in accordance with the tables at the end of this section and the following.

Electrical enclosures constructed from steel plate shall be reinforced as required to provide a true surface and adequate support for devices mounted thereon. Enclosures shall be of adequate strength to support mounted components during shipment.

Junction boxes and pull boxes shall be provided without knockouts.

All junction boxes or pull boxes 4 inch trade size or smaller in any dimension shall be galvanized malleable iron or acceptable equal cast ferrous metal.

NEMA 4X enclosures shall be provided for electrical equipment, enclosures, and pull boxes when the electrical equipment, enclosures, or pull boxes are located outdoors, indoor areas that are subject to washdown, ash or coal dust accumulation, or where exposed to slurry.

If epoxy coatings are specified, the coating shall consist of a coat of zinc rich epoxy primer followed by a finish coat of epoxy.

All enclosures shall be manufactured from materials that will not degrade when subjected to sunlight.

Junction boxes, electrical control panels, and cabinets shall be provided with an identification nameplate mounted on the front of the enclosure. The nameplate inscription shall be acceptable to the Buyer.

E210.2 Electrical Enclosure Heating
Where electrical enclosure heating is specified, electrical space heaters, one adjustable thermostat, one fuse and fuse block or circuit breaker or other means of disconnect shall be provided completely wired in

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the enclosure. The space heaters, thermostat, and circuit disconnect device shall not interfere with normal cable entrance into the enclosure or with maintenance or replacement of devices within the enclosure. Normal use of space heaters shall not change or discolor any painted surface.

Unless otherwise indicated, the operating range of the thermostat shall be coordinated with the project ambient temperature conditions.

Space heater capacity shall be as required to maintain the enclosure internal temperature above the dew point under the specified site conditions.

Space heater sheaths shall be of a corrosion-resistant, nonoxidizing material.

Location	Classification	NEMA Std. 250	Materials
Indoor Dry	Nonhazardous	Type 12	Galvanized sheet steel
Indoor Wet	Nonhazardous	Type 4X	Copper free aluminum
Outdoor or in Wet/Chemical Corrosive Areas (including flyash, lime, or limestone slurry areas)	Nonhazardous	Type 4X	Fiberglass reinforced resin or 316SS.

Enclosure Space Heaters	
Rated Voltage	240 volts ac
Power Source	
Power Supply Code	LV-3
Voltage	120 volts

E220 Electrical Equipment in Hazardous Areas
(Source: 27Jan04 - Revised by Project: N/A)

All electrical equipment and devices located in areas subject to hazardous area classifications shall be furnished with a nameplate stating the equipment classification. The nameplate data shall include the Class or Zone, Division, Group, and Operating Temperature Designations as applicable to the design standard used to classify the areas. Classification identification nameplates and attachment pins shall be corrosion-resistant metal.

E230 Control Panel Lighting and Receptacles
(Source: 20May11 - Revised by Project: N/A)

Wiring Devices					
Description	Rated Voltage	Frequency	Ampacity	Configuration	Grade
Receptacle	120	60 Hz	20 A	NEMA 5-20R GFCI	Industrial
Light Switch (may use door operated switch in lieu	120	60 Hz	20 A	Single pole	Industrial

Wiring Devices					
Description	Rated Voltage	Frequency	Ampacity	Configuration	Grade
of light switch					

Lighting						
Application	Fixture	Lamp	Ballast	Rated Voltage	Frequency	Illumination
Control Panel Interior	Fluorescent	T-8	Electronic	120	60 Hz	30-fc

E300 Electronic Systems and Components
(Source: 14Apr04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

Internal wiring of factory prewired electronic systems in cabinets may be installed according to the WFGD Supplier's standard as to wire size, insulation, and method of termination on internal equipment except that insulation for all wiring shall meet the UL 1581 VW-1 flame test. Conductor identification may be done by insulation color coding noted on the drawings or by printed wiring lists.

The electronic systems shall be tested and verified capable of providing surge withstand capability in accordance with the requirements of ANSI C37.90.1.

All electrical equipment containing electronic logic systems shall be tested in accordance with the manufacturer's standard tests for a minimum of 48 hours under power prior to shipment from the factory. The system shall be tested as a complete assembly. Testing of individual components or modules will not be acceptable as system tests. The system test shall include a means of confirming the logic or mathematical design response of the system by simulating changes in system input. The test shall verify correct operation of the system at both high and low power source voltage limits.

E400 Motor Control
(Source: 14Apr04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

The ac and dc motor starters specified to be furnished with the equipment shall conform to the requirements herein and shall be manufactured to the standards identified herein. The general requirements apply to all standards.

E400.1 General Requirements
Each starter that interfaces with the Buyer's control system shall be provided with terminal blocks for termination of the Buyer's cable.

The interrupting capacity of each combination starter (direct on-line starter, unless otherwise specified) shall be sufficient for the available fault current without damage to the breaker or to the starter.

Each 3-phase, ac single-speed starter shall be furnished with one 3-phase set of manually reset thermal overload relays. Each 3-phase, ac two-speed starter shall be furnished with two 3-phase sets of manually reset thermal overload relays. Each overload relay shall have a trip class suitable for proper operation and protection of the equipment served by the starter.

Auxiliary contacts shall be mechanically operated by the starter contactor. Unless otherwise specified, the quantity of auxiliary contacts for starters that interface with the Buyer's control system shall be as required by the WFGD Supplier's design. A minimum of one normally open and two normally closed contacts shall be wired to terminal blocks for Buyer's use.

For each ac starter, a dry type control power transformer shall be furnished complete with each primary lead fused and one secondary lead fused with the other secondary lead grounded (earthed). The primary leads shall be connected to two phases of the power conducting circuits.

Large ac size starters which require line voltage to energize the operating starter coils shall be equipped with auxiliary interposing relays for use in the operating coil circuit. These interposing relays shall be operated from the low voltage circuit of the control transformers.

Starters shall be equipped with a 120VAC start relay and 120VAC stop relay wired for three wire control. A start shall be accomplished by momentary (5 second) pulse from the DCS start output. A stop shall be accomplished by a momentary pulse from the DCS stop output..

Starters shall also be equipped with a dry "a" contact for DCS running input. In addition, a 120VAC relay shall be provided and wired to be energized at all times the starter has power available. A dry "a" contact from this relay shall be used for DCS power available input.

Two-speed starters and reversing starters, where required, shall be mechanically and electrically interlocked so that only one set of contacts can be closed at any one time.

Unless otherwise specified, any starter that uses remote control from the Buyer's control system shall be provided with an interposing relay to interface with the contactor coil if the contactor coil inrush exceeds 600 volt-amperes.

Any dc starter that uses remote control from the Buyer's control system shall have arc suppression devices installed across the contactor coil (or interposing relay coil) to protect the remote signal source.

Single-phase ac starters shall be similar to 3-phase starters, except that a single-phase set of manually reset thermal overload relays shall be provided, and control power transformers will not be required if the line voltage is the same value as the specified control voltage.

Ac contactors shall be similar to ac starters, except that no overload protection shall be required.

E400.2 NEMA - Combination AC Motor Starters
Combination ac motor starters shall be in accordance with NEMA ICS 2 and shall consist of the following:

An isolating device consisting of a 3-phase molded (moulded) case adjustable magnetic trip only circuit breaker.

Contactors with manually reset thermal overload relays.

Ac operating coils at specified control voltage.

E400.3 Not Used.

E400.4 DC Motor Starters
Magnetic starters for dc motors shall include, but not be limited to, the following:

DC operating coils.

Contactors at specified control voltage.

Starting resistors as required to limit the inrush current to approximately 350-500 percent of motor full load current (to be finalized during detailed design).

A shunt field slide wire resistor.

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For non-reversing contactors, six electrically separate contactor auxiliary contacts (three normally open and three normally closed); for reversing contactors, the same quantity of contacts per contactor.

One overload relay. The overload relay shall provide an alarm (Form C contact) and shall not trip the dc motor.

For non-reversing contactors, a means to monitor the integrity of the shunt field and main contactor coil (to warn operator that the dc starter and its timing scheme are not armed) shall be provided and shall be the WFGD Supplier's standard design. A normally open and normally closed contact of the coil monitor relay shall be wired out to terminal block for external use. For reversing contactors, the monitoring scheme shall be as for non-reversing contactors for the contactor considered critical by Buyer.

A space heater wired out to terminal block points.

All auxiliary and overload contacts shall be wired to terminal blocks for external use.

The dc motor starters design shall be coordinated with the characteristics of the motors that the starters are intended to operate.

Unless otherwise specified, the following criteria apply to the starters specified to be furnished:

Standard to Which Motor Starters Shall Be Manufactured	NEMA
AC Motor Starter Control Voltage	120 volts, 60 hertz
DC Motor Starter Control Voltage	125 volts dc
Spare Terminal Points	20 percent

E410 VFDs for Induction Motors 50 HP or Less
(Source: 14Apr04 - Revised by Project: 19JUL2011, Revised by Package: 18Aug11)

E410.1 General
This section covers requirements for variable frequency drive (VFD) systems for 3-phase induction motors. Each system shall include a VFD and an inverter fed motor.

E410.2 Design Requirements
Each VFD shall take a 3-phase fixed voltage and frequency input and convert it to a 3-phase variable voltage and frequency output. Each VFD shall provide ac power for stepless motor speed control.

Each VFD input shall consist of a six-pulse minimum full wave diode bridge rectifier to convert incoming fixed voltage and frequency to a fixed dc voltage. Each output shall be of the pulse width modulated type that uses insulated gate bipolar transistor (IGBT) technology.

Each VFD shall be supplied with an ac input line reactor with a nominal impedance of 5 percent.

Each VFD and motor shall be able to provide rated output at a switching frequency of 8 kilohertz minimum.

A door mounted membrane keypad with integral two line, 24 character LCD display shall be furnished for each VFD and shall allow the operator to control each VFD and set the drive parameters. Each keypad shall include the following features:

The digital display shall present all diagnostic messages and parameter values in English engineering units when accessed, without the use of codes.

Each keypad module shall contain a self-test software program that can be activated to verify proper keypad operations.

Each digital keypad shall allow the operator to enter exact numerical settings in English engineering units. A plain English user menu shall be provided in the software as a guide to parameter setting (rather than codes). Drive parameters shall be factory set in EEPROM and resettable in the field through the keypad. Password security shall be available to protect drive parameters from unauthorized personnel. The EEPROM stored drive variables must be able to be transferred to new boards to reprogram spare boards.

Each digital display shall simultaneously show the following:

Speed demand in percent.

Output current in amperes.

Frequency in hertz or rpm.

Control mode of Manual/Automatic.

Total 3-phase kW or output volts.

All VFD components, including the input line reactors, shall be factory mounted and wired in a dead front, grounded, enclosure. If a free-standing enclosure is provided, it shall be suitable for mounting on a concrete pad. Enclosures shall be suitable for the location installed in accordance with the following table:

Location	Classification	NEMA Std. 250	Materials
Indoor Dry	Nonhazardous	Type 12	Galvanized sheet steel
Indoor Wet or Outdoor	Nonhazardous	Type 4	Copper free aluminum
Wet-Chemical Corrosive	Nonhazardous	Type 4X	Fiberglass reinforced resin

E410.3 Motors

Each motor provided shall be specifically selected for service with a variable frequency type speed controller and shall be derated as required to compensate for the harmonic heating effects and reduced self-cooling capability at low speed operation. Each motor shall have a Class F insulation system and shall not exceed a Class B temperature rise when operating in the installed condition at full load with power received from the VFD. All motors used with VFDs shall be supplied with full phase insulation on the stator coil end turns, and each motor shall meet the requirements of NEMA MG 1, Part 31. Each motor shall also be designed to be continuously pulsed at the motor terminals with a voltage of 1600 volts.

Fan, compressor, and pump motor RPM shall not exceed 1800 RPM.

E410.4 Factory Tests
Power transistors, silicon controlled rectifiers (SCRs), and diodes shall be factory tested to ensure correct function and high reliability.

Each VFD shall be functionally tested with its motor to ensure that if the drive is operated according to the manufacturer's instructions, the VFD and its motor will run properly. Each VFD and motor shall be run for a minimum of 24 hours at the factory prior to shipment.

E510 Molded Case Circuit Breakers
(Source: 14Apr04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

Unless otherwise specified, molded case circuit breakers used in equipment furnished under these specifications shall have a symmetrical RMS ampere interrupting capacity equal to or greater than the maximum short-circuit current values specified on the E000 Electrical Equipment and System Voltages Supplemental Specification for the appropriate Power Supply Code.

The breakers shall have a thermal magnetic type trip and shall be in accordance with UL. In addition to the ac interrupting ratings, all single-pole breakers, 2-pole breakers, and 3-pole breakers shall have the following minimum dc interrupting ratings:

Single-pole breakers	10,000 amperes at 125 volts dc
2-pole breakers	10,000 amperes at 250 volts dc
3-pole breakers	10,000 amperes at 250 volts dc

If the Power Supply Code is not specified at the time of purchase order, the WFGD Supplier shall furnish, at no additional charge, molded case breakers that meet or exceed system short-circuit requirements as determined during detailed design.

E520 Terminal Blocks and Fuse Holders
(Source: 27Jan04 - Revised by Project: N/A)

E520.1 General
In general, manufacturer standard terminal blocks will be accepted provided they meet the requirements of this specification and quality levels equivalent to the manufacturer's terminal blocks listed in the table at the end of this section. Self-stripping terminal blocks, multiple deck (step type) terminal blocks, and angled terminal blocks will not be acceptable. Screw type terminals suitable for ring lug termination shall be furnished for all current transformer secondary lead connections.

Each terminal block shall be provided with a unique identifier. All terminal points shall have provisions to be uniquely identified on the terminal block white marking strip and, where permitted by the safety codes and standards, shall be without covers. Spare points shall be provided with blank strips that can be field marked with a permanent ink marking pen. Spare (unused) terminals shall be furnished evenly distributed on the terminal blocks for circuit modifications. No fewer than two spare unused terminals shall be furnished for every ten terminals used. Fuses may be mounted on terminal blocks.

Terminal blocks shall be manufactured from materials that will not support combustion. Terminal blocks shall meet the Inflammability Class V0 rating in accordance with UL 94. All terminal blocks, except internal terminal blocks in factory prewired electronic systems cabinets and terminal blocks for thermocouple extension wire, shall be rated for 600 volts or greater. No more than two conductors shall be terminated at one connection point. For terminal blocks interfacing with the Buyer's field cabling, one side of the terminal block shall be used by the equipment manufacturer for factory wiring and the other side of the terminal block shall be reserved for the Buyer's field cabling terminations.

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E520.2 Compression Clamp Modular Terminal Blocks (IEC Requirements)
The modular terminal block systems shall be complete with mounting rails, end brackets, fixing brackets, covers, and test plugs as required. Terminal block colors shall be as follows: red for ungrounded power conductors, blue for power circuit neutral conductors, yellow-green for all ground conductors, and gray for all control circuit conductors.

Terminal spacing on compression clamp terminal blocks shall be capable of terminating 20 AWG (0.5 mm^2) to 8 AWG (10 mm^2) wire and shall have point-to-point spacing of not less than 0.315 inch (8 mm). The clamping parts shall be made of copper alloys that are resistant to stress corrosion cracking. The clamping parts shall be designed to maintain a spring-like force when gripping the conductor. The copper alloy surface of the clamping units shall be protected by galvanic plating. The terminal screw shall be bronze and protected with galvanic plating. When possible, jumpering between adjacent terminal points shall be achieved with fixed bridges. All terminal screws shall be tightened with a calibrated screwdriver, and set to the recommended torques provided by the terminal block manufacturer. Torque values shall be approximately 1.5 times the test torque values defined in IEC 947-1, but approximately 40 percent below the fracture torque of the terminal screw.

For installations requiring "Increased Safety" terminal blocks, the terminal blocks shall have a CENELEC Certification Code marked on the terminal block.

Knife disconnect terminal blocks shall be suitable for terminating 20 AWG (0.5 mm^2) to 12 AWG (4 mm^2). The knife disconnect shall be permanently attached to the block, shall have a continuous ampere rating of 15 amperes, and shall have a voltage rating of 600 volts or greater. Test ports shall be provided on both sides of the knife disconnect.

Mounting rails shall be of a top hat construction in accordance with EN 50 022. Rails not used as a grounding conductor shall be manufactured from steel with a corrosion-resistant coating. Rails used as a grounding conductor shall be manufactured from copper.

E520.3 Strap Screw Terminal Blocks
Strap screw terminal blocks shall be of heavy-duty construction capable of terminating a conductor from 16 AWG (1.5 mm^2) to 10 AWG (6 mm^2). The point-to-point spacing shall not be less than 0.375 inch (9.5 mm).

E520.4 Power Terminal Blocks
Power terminal blocks shall be used for conductors 8 AWG (10 mm^2) and larger.

E520.5 Thermocouple Terminal Blocks
Thermocouple terminal blocks shall be provided for terminating thermocouple extension cable. The terminal blocks shall be capable of terminating solid conductors ranging from 20 AWG (0.5 mm^2) to 16 AWG (1.5 mm^2). The current carrying parts of the terminal block shall be of the same materials as the thermocouple extension wire. Termination points for extending the shield wire of the thermocouple extension cable shall be provided adjacent to the block or shall be integral to the block.

E520.6 Fuse Holders for Power Circuits
When fuses rated from 1 to 30 amperes at 250 volts maximum are required, the fuse holders shall be suitable for 30 ampere, 250 volt, Class H cartridge fuses. The fuse holders shall be in accordance with ANSI/UL 521, shall have a withstand rating of 10,000 rms symmetrical amperes, and shall have reinforced fuse contact clips.

The bases shall be molded phenolic, polyester, or other plastic having a Flammability Rating of V-0 when tested in accordance with UL 94. Porcelain, slate, and marble are not acceptable materials for fuse holder bases.

The following criteria shall apply to terminal blocks and fuse holders:

Terminal Blocks and Fuse Holders				
Terminal Block Type	**Applications**	**Acceptable Termination Methods**	**Acceptable Construction**	**Acceptable Suppliers**
Feed-Through	Thermocouple Extension Wire	Strap Screw, Compression	Manufacturer's Standard	Manufacturer's Standard
Feed-Through	DCS I/O and PLC I/O	Compression, Strap Screw	Modular, Rail, Grouped Block, Bolted	Manufacturer's Standard
Feed-Through	General Purpose	Strap Screw	Grouped Block, Bolted, Modular, Rail	Select from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer-Approved Equal
Shorting	Current Transformer	Strap Screw	Grouped Block, Bolted	Select from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer-Approved Equal
Power	600 Volt Power (8 AWG through 4/0 AWG [10 mm^2 through 95 mm^2])	Screw, Compression, Stud	Grouped Block, Bolted	Manufacturer's Standard

E530 Electrical Accessories
(Source: 08Mar10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

E530.1 Electrical Indicating Instruments
All metering devices shall be designed for flush mounting. All analog instrument scales shall consist of black markings on a white background.

All instrumentation with current elements shall be designed for use with current transformers having high overcurrent capability. The current elements shall be capable of 10 times the rated end scale overload values for a period of 1/2 second duration for a minimum of nine successive overloads with 1 minute between overloads without exceeding the deviations defined in the specified standard. Switchboard meters shall not open the circuit when subjected to 30 times the rated secondary current of the associated current transformer circuit for a period of 2 seconds.

The electrical indicating instruments shall be as specified on the E530 Electrical Accessory Devices - Supplemental Requirements sheets.

E530.2 Control Relays
General service auxiliary relays shall be selected from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer approved equal. Where current carrying requirements exceed the capacity of the general service auxiliary relays, auxiliary relays shall be selected from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer approved equal.

Timing relays for general service where the delay period is 1 minute or less shall be either pneumatic or solid-state. Timing relays for critical service shall be solid-state. Timing relays shall be selected from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer approved equal.

If the WFGD Supplier proposes the use of auxiliary or timing relays other than the ones listed above, technical data sheets for the proposed relays shall be submitted for approval by the Buyer.

Unless otherwise specified, dc relays that interface with the Buyer's control system shall have a diode surge suppressor installed across the relay coil.

E530.3 Electrical Switches
Control switches shall be 600 volt, 20 ampere, multistage, rotary type. Unless otherwise specified, switches shall have black, fixed, modern, pistol grip type handles and engraved black plastic escutcheon plates with targets.

Push buttons and selector switches shall be heavy-duty oiltight.

The electrical switches shall be as specified on the E530 Electrical Accessory Devices - Supplemental Requirements sheets.

E530.4 Indicating Lights
Indicating lights for local control stations shall be heavy-duty oiltight and shall permit light changing from the front. Luminous output shall be suitable for the location and ambient lighting conditions. Unless otherwise specified, LED type indicators are required.

Indicating light lens colors shall be coordinated with the indicated conditions identified on the E530 Electrical Accessory Devices - Supplemental Requirements sheets. Indicating lights shall be energized when the condition exists and shall be de-energized when the condition does not exist.

E530.5 Contacts
Contact ratings for all electrical accessory devices shall be suitable for interface with the Buyer's control system. The Buyer's control system interrogation voltages will range up to 230 volts ac and between 24 and 250 volts dc.

All contacts that interface with the Buyer's control system shall be electrically "dry." Solid-state switches or triac outputs are not acceptable for contacts that interface with the Buyer's electronic control system.

Alarm contacts shall consist of one normally open and one normally closed contact "Form C."

Electrical accessory device contacts, including alarm contacts, wired to the Buyer's control system consisting of DCS or PLC I/O cards, shall be suitable for switching currents in the milliampere range for wetting voltages of either 120V AC or 48V DC.. The electrical accessory device contacts, including alarm contacts, shall allow the Buyer's I/O cards to distinguish between a normally open and a normally closed contact.

E530.6 Fuses
Fuses shall be provided with ampere ratings sized for the application. The types and manufacturers of fuses shall be as specified on the E530 Electrical Accessory Devices - Supplemental Requirements sheets.

E530.7 Colors of Indicating Devices and Actuators
Coding of indicating devices and switch actuators (push button, knob, selector switch, or handle) shall be subject to Buyer review. If words or recognized abbreviations are required to describe the function of the indicating device or actuator, the language used shall be English. Indicating lights shall be energized when the condition described in the following table exists, and shall be de-energized when the condition does not exist. Unless permitted otherwise in the individual equipment specification, indicating light lens colors and CRT graphic display colors shall be as specified on the E530 Electrical Accessory Devices - Supplemental Requirements sheets.

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E530 Electrical Accessory Devices - Supplemental Requirements

Colors of Indicating Devices			
Color	**Meaning**	**Explanation**	**Examples**
Green	Equipment de-energized; process stopped	Normal off condition requiring no action by the operator	Motor stopped; valve (damper) closed; breaker open, contactor de-energized
Red	Equipment energized; process normal	Normal running condition requiring no action by the operator	Motor running; valve (damper) open; breaker closed, contactor energized; process within normal limits;
White	Power Available	Normal condition requiring no action by the operator	Cabinet/panel power available
Blue	Emergency or Abnormal Condition	Abnormal condition requiring monitoring and./or intervention by the operator; dangerous condition requiring immediate action by the operator	Pressure or temperature beyond safe limits; loss of critical process,, motor trip; breaker trip, contactor trip; tripping by a protective device or interlock; electrical lockout relay tripped; position change from normal; pressure or temperature beyond normal limits; overload
Amber	Permissive or "In Auto"	Equipment start permissive; equipment protective relay reset, equipment in automatic mode.	General information; electrical lockout relay reset; equipment in automatic mode.

Colors of Actuators		
Color	**Meaning**	**Examples**
Red	Emergency	Emergency-stop/off
Black	Normal stop/off	Normal stop; open breaker, contactor de-energized
Black	Normal start/on	Normal start; closed breaker, energize contactor

Electrical Switches		
Application	**Description**	**Supplier/Style**
Control Switches	Control Panel	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Push Buttons and Selector Switches	Control Panel or Local	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Toggle Switches	Control Panel	Selected from Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal

Fuses and Fuse Blocks	
Application	**Supplier/Style**
Slow Blow Fuses	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Fast Acting Fuses	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Extremely Fast Acting Fuses	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal

Electrical Indicating Instruments								
		Input Range						
Meter Type	**Standard**	**Voltage Element**	**Current Element**	**Transducer**	**Supplier**	**Accuracy Class (% of Full Scale Value)**	**Size (approximate)**	**Display**
Panel Meter		0-150 V	0-5 A	4-20 mA	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal	3	3.5 in^2	Analog and Digital LCD
Switch-Board Meters		0-150 V	0-5 A	4-20 mA	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved	1	4.5 in^2	Analog and Digital LCD

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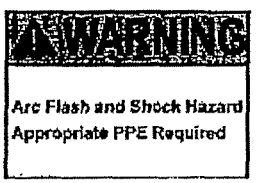
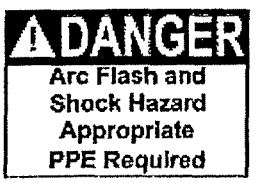
Electrical Indicating Instruments								
		Input Range						
Meter Type	Standard	Voltage Element	Current Element	Transducer	Supplier	Accuracy Class (% of Full Scale Value)	Size (approximate)	Display
					Equal			

E530.8 Hazard Warning Labels

The WFGD Supplier shall furnish generic labels warning of arc flash and shock hazard, requiring appropriate personnel protection equipment (PPE) to be worn. The labels shall be in accordance with National Electrical Code (NEC) 110.16 Flash Protection and shall be furnished for all medium voltage (MV) and low voltage (LV) switchgear, panel boards, control panels, and motor control centers. The labels shall be located in a clearly visible area at each point of access to the equipment. Equipment access includes but is not limited to breaker, starter, rear access, panel board, and auxiliary compartment doors. Labels provided shall be in accordance with ANSI Z535.4 and either one of the examples below:





Signs shall use black lettering and border on white background. The top banner background shall be orange for Warning signs and red for Danger signs, in accordance with safety colors defined in ANSI Z535.1.

E635 Medium Voltage Induction Motors

(Source: 29Apr10 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

E635.1 General

E635.1.1 Scope of Supply

Scope of supply shall include furnishing the medium voltage induction motors as specified herein and on the E635 Medium Voltage Induction Motors Specification Sheets at the end of this section.

E635.1.2 Codes and Standards

Work performed under these specifications shall be done in accordance with the codes and standards as defined herein and in Exhibit N – Codes and Standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Buyer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
NEMA/IEEE designed motors	NEMA MG1, IEEE C50.41, IEEE 112, IEEE 522

E635.1.3 Acceptable Suppliers of Components

Refer to Exhibit E - Acceptable Equipment and Material Supplier List. If a nonlisted supplier that is considered to provide an equivalent level of quality is proposed, this supplier must be identified and

supporting testimony provided. Acceptance of the supplier as a substitute is at the discretion of the Buyer.

E635.1.4 Test Requirements
Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these specifications. Test procedures shall be in accordance with IEEE and NEMA, test procedures for 3-phase induction motors. The routine tests listed in NEMA shall be performed on each motor. Optional tests may be performed to determine the efficiency and power factor for each motor when specified.

This testing is to be considered part of the defined Scope of Work, and all associated costs are the responsibility of the WFGD Supplier unless specifically identified as a Bid Option or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the WFGD Supplier is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Copies of reports of the quality control tests and inspections for each motor shall be submitted prior to shipment of the motor from the manufacturer's factory.

Tests	In Accordance With	Conducted By
ANSI designed motors	NEMA MG1, ANSI C50.41, IEEE 112, IEEE 522	Motor manufacturer
Efficiency	IEEE 112, Method F1	Motor manufacturer
Power Factor	IEEE 112	Motor manufacturer

E635.2 Products

E635.2.1 Design and Construction
Motors shall be designed for direct-on-line (full voltage) starting and shall be capable of at least three (3) consecutive successful starts (one start and acceleration to full speed - when initially at stabilized ambient temperature condition ("cold"), followed immediately by a trip and second start accelerating up to full rated speed again), with both starts at 100 percent rated voltage or at minimum starting voltage as specified herein, whichever case is more stringent. Also, the motor shall be capable of two (2) consecutive starts with the motor initially at a temperature not exceeding its rated-load operation temperature (hot starts). All motors shall be capable of continuous running duty in the specified ambient temperature. The motor safe stall time, for all motors, shall be greater than the motor acceleration time at the minimum starting voltage.

E635.2.1.1 Nameplates. All motor nameplate data shall conform to the requirements of the standards listed in Article E635.1.2. The following additional nameplate data shall be included:

Insulation system class designation.

Motor horsepower rating at the site elevation, or derating factor.

Maximum ambient temperature for which motor is designed and temperature rise by resistance.

Starting capabilities at rated volts and at minimum starting voltage (may be a separate nameplate):

Number of successive starts (coasting to a rest between starts) allowable after the following:

Motor initially at maximum specified ambient temperature.

Motor driving maximum expected operating load in the maximum specified ambient temperature and coasting to a stop.

Cooling period required after completion of the preceding maximum number of starts before making an additional start with the motor in the following conditions:

Motor running driving maximum expected operating load in the maximum specified ambient temperature.

Motor running with the driven equipment uncoupled.

Motor at rest after being de-energized on reaching rated speed.

Direction of rotation and voltage sequence.

For dual voltage rated or multispeed motors, connection diagram for the specified voltage or the specified speeds.

For motors with connections to an external lubricant recirculating system, or with an integral forced lubrication system, oil pressure and oil flow required.

Type and grade of bearing lubricant, attached adjacent to lubricant filling devices.

For motors with current transformers for differential protection, connection diagram indicating motor lead terminal connections.

For motors with air filters, recommended set point for differential pressure device, attached on or near device enclosure.

All motor nameplates and attachment pins shall be corrosion-resistant metal.

E635.2.1.2 Enclosures. Enclosure parts for all motors (e.g., frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable. Cooling fans, when provided, shall be bidirectional to allow for continuous motor operation in either a clockwise or counterclockwise direction. Specific cases where such a fan is impractical for mechanical reasons shall be brought to the attention of the Buyer.

When air filters are specified on the E635 Specification Sheets, removable washable impingement type air filters shall be furnished.

Motors shall be provided with totally enclosed fan cooled (TEFC) enclosures when the motors are located outdoors, in corrosive environments, or in areas subject to washdown (any location where ash, coal, or slurry might be present). Otherwise, motor enclosures shall be weather protected, Type II (WPII).

Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

Totally enclosed motors shall be furnished with drain holes and rotating shaft seals and bearing housing seals (Inproseal or equal approved by Buyer). Drain holes shall be provided with combination water drain-breather plugs.

When totally enclosed fan cooled enclosures (IP54, IC411) are specified on the E635 Specification Sheets, the WFGD Supplier shall have the option of selecting from one of the following enclosure constructions:

Totally Enclosed Fan Cooled	IP54	IC411
Totally Enclosed Tube Cooled	IP54	IC511
Totally Enclosed Air-to-Air Cooled	IP54	IC611

External cooling fans for fan cooled motors shall be fabricated of brass, bronze, aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic.

Totally enclosed motors shall have all exposed metal surfaces protected with a corrosion-resistant polyester or epoxy paint or coating and shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with a corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. The stator air gap surfaces may be protected with a vacuum pressure impregnation coating. Bolts, nuts, screws, and other hardware items shall be corrosion-resistant or zinc dichromate treated metal. Motors furnished with sleeve type bearings shall have a rotating labyrinth shaft seal furnished on the shaft extension end of the motor.

E635.2.1.3 Air Filter Pressure Differential Devices. A pressure differential transmitter shall be provided at the air inlet of all motors furnished with air filters capable of providing a 4-20 mA signal to the Buyer's DCS. Applicable pressure setpoints shall be provided.

E635.2.1.4 Insulation and Windings. All stator coils shall use copper conductors, shall be form-wound, and shall be insulated with mica based materials. All stator winding materials shall have a Class F [311° F] thermal classification and shall use a vacuum pressure impregnation (VPI) system.

All multiturn form-wound stator coils shall have adequate turn-to-turn insulation to enable them to pass the Figure 1 Alternative Coil Impulse Voltage Withstand Envelope, which is described in IEEE Standard 522.

E635.2.1.5 Temperature Rise. Provide motors with Class F vacuum pressure impregnated insulation with actual temperature rise limited to Class B measured by resistance at the 1 .15 service factor load in accordance with the applicable IEEE Standards..

E635.2.1.6 Space Heaters. All motors shall have space heaters. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle and supplied at the specific voltage on the E635 Specification Sheets. Heaters shall be located and insulated so that they do not damage motor components or finish.

E635.2.1.7 Terminal Housings. A terminal housing for power leads and a separate accessory terminal housing for accessory leads shall be furnished on all motors. All terminal housings shall be externally mounted on the motor frame enclosure. Location and dimensions of terminal housings, including conduit opening quantity and location, shall be acceptable to the Buyer.

Terminal housings for all motors shall be cast iron or sheet steel. Minimum protection requirements shall be equivalent to NEMA 4.

All motor leads located in the housings shall be permanently marked for ease of identification.

A separate accessory terminal housing shall be provided for space heater leads, temperature detector leads, differential pressure switches, and other similar accessory equipment leads. It shall be complete with screw type terminal blocks for termination of such leads. Each terminal in the blocks shall be identified and marked for its respective leads. Accessory terminal housings shall be accessible from outside the motor.

When current transformers for motor differential protection are specified on the E635 Specification Sheets, the current transformers shall be mounted in the power lead terminal housing and terminated in an accessory terminal housing on shorting type terminal blocks.

Motor power lead terminal housings shall be large enough to provide working space for the field fabrication of stress relief kits for shielded cable within the housing and to contain the stress relief kits after fabrication whenever incoming power supply shielded cable is specified on the E635 Specification Sheets. In those cases, the minimum distance from the motor leads to the cable entrance plate of the motor terminal box shall be as follows:

Motors with cable leads - 24 inches.

Motors with bus bar leads - 36 inches.

E635.2.1.8 Leads. All leads, including motor power leads, current transformer leads, space heater leads, temperature detector leads, and alarm device leads, shall be wired into their respective terminal housings. Each lead marking shall be visible after taping of the terminals.

All motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing or on the nameplate and the leads marked for phase sequence to correspond to the direction of rotation and supply voltage sequence.

Leads for dual voltage rated or for multispeed motors shall be easily connected or reconnected in the terminal housing for the operating voltage or for the specified speeds.

When current transformers for motor differential protection are specified on the E635 Specification Sheets for single-speed motors, the motor phase leads shall be wired to the motor power lead terminal housing for connection for self-balancing current type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding wye or delta connections shall be completed at the factory, leaving only three leads, T1, T2, T3, for field connection in the power lead terminal housing. The wye or delta connection shall be completed in a manner that will allow easy access to the end of each phase for field testing.

When current transformers for motor differential protection are specified on the E635 Specification Sheets for two-speed motors, the motor phase leads shall be wired to the power lead terminal housing for connection for self-balancing current type differential protection. Each current transformer shall encircle all power leads to the associated winding. The motor winding wye or delta connections shall be completed at the factory, leaving only six leads, T1, T2, T3, T4, T5, T6, for field connection in the power lead terminal housing. The wye or delta connections shall be completed in a manner that will allow easy access to each end of each phase for field testing.

Cable motor leads shall use stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal.

E635.2.1.9 Bearings. The type of bearing furnished shall be as specified on the E635 Specification Sheets or the motor supplier shall determine the type of bearing to be furnished based upon the load, speed, and thrust conditions of the driven equipment. If a bearing type deviates from the specification sheets, the WFGD Supplier shall request approval for the deviation prior to proceeding with manufacturing.

Thrust bearings for vertical motors shall have a life as specified on the E635 Specification Sheets and shall be capable of operating for extended periods of time at any of the thrust loadings imposed by the specific piece of driven equipment during startup/shutdown and normal operation without damage to the bearing, the motor frame, or other motor parts.

E635.2.1.9.1 Hydrodynamic type bearings. Sleeve bearings for horizontal motors shall be oil ring lubricated type. The bearings, end bells, and bearing housings shall be split type when available. Except for totally enclosed motors, air gap measurement holes or other acceptable means shall be provided in each motor end housing for checking air gap of sleeve bearing motors.

Sleeve bearings on horizontal motors shall be designed and located centrally, with respect to running magnetic center, to prevent the rotor axial thrust from being continuously applied against either end of the bearing. The motors shall be capable of withstanding, without damage, the axial thrusts that are developed when the motor is initially energized.

Vertical motors provided with tilting pad or flat land type thrust bearings shall have oil lubricated split sleeve or tilting pad upper guide bearings. The WFGD Supplier's design shall eliminate the possibility of the "whirl" phenomenon associated with the rotor. The lower bearing housing design shall also provide for required clearance or end-play resulting from thermal growth in the rotor shaft.

Hydrodynamic bearings shall be sized for a maximum load of 300 psi at normal or rated operating conditions, and a maximum load of 450 psi at all expected operating conditions including startup or shutdown transients.

E635.2.1.9.2 Bearing lubrication system. Unless specified otherwise on the E635 Specification Sheets, bearing lubrication shall be furnished by an internal lubricant recirculation system. Oil reservoir capacity and ventilation of the bearing housing and oil reservoir shall be as required to adequately maintain cooling of the oil and bearings in accordance with the bearing WFGD Supplier's requirements.

E635.2.1.9.3 Antifriction bearings. Antifriction bearings for horizontal shaft motors shall be designed and fabricated to have a life as specified on the E635 Specification Sheets. Antifriction bearings shall be grease lubricated except where the specified speed and thrust require oil lubrication for the specified life. Grease lubricated bearings shall be self-lubricating and regreaseable.

Motors furnished with spherical roller thrust bearings shall be furnished with deep groove radial guide bearings.

E635.2.1.9.4 Miscellaneous bearing requirements. All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings and shall be provided with pipes and drain plugs. Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor. Filler caps or grease fittings for lubrication shall be arranged for safe, easy addition of lubricant from the outside of the motor while the motor is in service.

All oil lubricated bearings shall be provided with oil level sight glasses marked for required oil level at motor running and standstill. Plastic sight windows or bottles shall be of a material not adversely affected by continuous exposure to sunlight.

Insulation shall be provided when required to prevent circulation of shaft current on bearings, on bearing temperature detectors, or on oil piping connections.

Bearing lubricants shall contain a corrosion inhibitor. The type and grade of lubricant shall be indicated on a nameplate attached to the motor frame or end shield adjacent to the lubricant filling device. The WFGD Supplier shall furnish all lubrication information required to assure proper equipment startup and subsequent bearing maintenance.

Motors using sleeve type radial bearings shall have the housings drilled and tapped in accordance with API-670 for possible use of proximity probes.

E635.2.1.10 Oil Lubrication Systems. If an external lubricant recirculating system is provided, the WFGD Supplier shall furnish pipe taps for oil inlet and outlet connections in addition to the internal lubricant recirculating system previously specified. Pipe taps for vertical motors shall be arranged to recirculate oil from the motor thrust bearing oil reservoir for cooling. The WFGD Supplier's lubrication system shall maintain proper lubrication and cooling of the bearings over the complete performance range of the external lubricant recirculating system. The internal lubricant recirculating system shall provide proper lubrication and cooling of the bearings during startup and coast-down with no oil flow from the external lubricant recirculating system.

Where water cooling of bearing oil is required, the WFGD Supplier shall furnish pipe taps for the water inlet and outlet connections. The WFGD Supplier's lubrication system shall maintain proper cooling of the oil and bearings under the cooling water conditions specified.

Sufficient oil cooling (external or internal) shall be provided to maintain the oil sump temperature at or below 160° F at the specified ambient condition. The probability of reverse rotation or emergence shutdown shall be considered in the bearing design details.

E635.2.1.11 Rotors. All induction motors shall have squirrel-cage rotors. Rotors shall be adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors may be die-cast aluminum construction for ratings up to 750 hp. Above 750 hp, the rotors shall be copper or copper alloy cage material except that aluminum cage materials will be considered on 2-pole motors only.

All fabricated cage rotor bars shall be installed using swaging or wedging or other proven method acceptable to the Buyer to prevent rotor bar vibration.

All motor rotating components shall be dynamically balanced after mounting on the shaft. Motor vibration shall not exceed the peak-to-peak amplitude values as defined in NEMA MG-1 (for motors <500 hp) and ANSI/API 541 (for motors ≥500 hp).

The minimum clearance space required for removal of the rotor shall be indicated on both the E635 Specification Sheets and on the dimensional outline drawing.

E635.2.1.12 Shafts. All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

The output shafts of motors furnished with sleeve bearings shall be circumscribed with permanent marks indicating the motor magnetic center and end float limits when level and running at rated speed. A permanent, identified reference point shall be indicated or attached to the bearing housing or shaft seal. The markings shall be easily identifiable for use during motor installation.

For horizontal sleeve bearing motors, the rotor end float and coupling end play shall be in accordance with NEMA requirements. The distance from the magnetic center line mark to each end float limit mark shall be not less than 37.5 percent of the total rotor end float.

E635.2.1.13 Ground Connectors. Each motor shall be furnished with a grounding connector attached to the motor frame inside the power lead terminal housing. The grounding connector may be a lug or terminal or other acceptable grounding connector. Ground cable size will be as indicated on the E635 Specification Sheets.

E635.2.1.14 Grounding Pads. External grounding pads shall be provided in at least two locations (near mounting feet at opposite corners).

E635.2.1.15 Torque Characteristics. Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine at minimum specified starting voltage. Load-torque characteristics will be furnished by the driven equipment supplier; however, the responsibility for successful starting under the given conditions shall rest with the motor manufacturer.

E635.2.1.16 Couplings. For motors purchased separately from the driven equipment, coupling drawings or templates for shaft machining will be provided by the Buyer. Half couplings will be supplied to the WFGD Supplier by the driven equipment supplier. The WFGD Supplier shall mount and secure the half couplings to the motor shafts.

E635.2.1.17 Tachometer/controller. When the X seconds value listed in the motor data sheet line item requirement labeled "Motor safe stall time at minimum starting voltage shall not be less than motor acceleration time at minimum voltage plus X seconds" is not possible or cannot be decreased to a lesser integer value greater than 0 seconds (as determined by all of the Acceptable Suppliers), a tachometer/controller shall be furnished for each motor. The tachometer/controller shall have two auxiliary relays, each with Form C contacts, and the relays shall be configurable as either latching or auto reset. The tachometer/controller shall be programmable to allow one auxiliary relay to energize at a motor speed slightly above zero speed (motor shaft just rotating), and the other auxiliary relay to energize at a speed near rated speed. The auxiliary relay contacts are intended to be used in conjunction with motor protective relays by others to prevent motor feeder trip during motor acceleration. Speed sensor and accessories required to support operation of the tachometer/controller shall also be provided as required. The tachometer/controller shall be Tachtrol 3 by AI-TEK, or Buyer approved equal.

E635.2.1.18 Soleplates. Soleplates shall be furnished when specified on the E635 Specification Sheets. Soleplate drawings shall be furnished indicating the size and location of the anchor bolts holding each soleplate to the concrete foundation and all mounting, alignment, and connection details and procedures. Motor mounting bolts shall be furnished with each soleplate. All foundation anchor bolts, washers, and nuts will be furnished by others.

Soleplate anchor bolt cross-sectional area shall not be less than the cross-sectional area of the motor mounting bolts. Anchor bolt holes shall be shop drilled and shall be oversized 1/4 inch in diameter. The anchor bolts shall be located under the motor, and all projections, including washers and nuts, shall clear the motor and its appurtenances completely. Grout holes shall be provided in the central portion of each soleplate. Motor mounting holes shall be drilled and tapped.

Motors shall be designed to permit convenient access for drilling vertically through the motor feet for installation of tapered dowel pins after the motors are mounted with driven equipment. Where motor design requires angle drilling of dowel pin holes through the motor feet, the WFGD Supplier shall start the dowel pin holes at the required angle, and shall drill each hole to a depth not less than one-half the thickness of the motor feet. The tapered dowel pins shall be furnished by the WFGD Supplier.

E635.2.1.19 Critical Speeds. Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent (or at least 15% for well damped resonant frequencies (having amplification factors less than 5.0) subject to approval by Buyer)above or below, preferably above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

E635.2.1.20 Temperature Detectors. Thermocouple type temperature detectors shall be single-element ungrounded, of ISA type as specified on the E635 Specification Sheets. All temperature detectors shall be ungrounded with detector leads wired to terminal blocks furnished in the accessory terminal housings. A grounding terminal for each temperature detector shall be included with the detector lead terminals. The grounding terminals shall be provided with internal wiring to a common ground connection. The internal wiring shall be removable.

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E635.2.1.20.1 Bearing temperature detectors. Bearing temperature detectors shall be provided as specified on the E635 Specification Sheets. Each detector shall be complete with a detector head and holder assembly; the detector temperature-sensitive tip shall be hermetically sealed.

Where sleeve type bearings are furnished, each detector tip shall be held in intimate contact with the outside diameter of the bearing babbitt not more than 1/8 inch from the shaft surface of the bearing.

E635.2.1.20.2 Winding temperature detectors. Winding temperature detectors shall be provided as specified on the E635 Specification Sheets. Temperature detector and detector lead insulation class shall be the same as the stator coil insulation class.

When resistance temperature detectors (RTDs) are specified, they shall be of the 3 wire type. All leads of a given RTD shall be electrically isolated from the leads of the next RTD. The motor supplier shall clearly indicate on the motor wiring diagrams which winding (phase) of the motor is monitored by each winding temperature detector.

E635.2.1.21 Current Transformers. Current transformers shall be furnished as specified on the E635 Specification Sheets. Current transformer relaying accuracy and ratio will be provided by Buyer during detailed design.

E635.2.1.22 Vibration Transducer Mounting. When specified on the E635 Specification Sheets, a vibration transducer mounting for field installation of a Buyer-furnished vibration transducer shall be provided on the drive shaft bearing housing of the motor. The vibration transducer and monitoring equipment will be furnished under separate specifications.

E635.2.1.23 Variations from Rated Voltage and Rated Frequency. Unless specified otherwise on the E635 Specification Sheets, induction motors shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency as follows:

80-110% of rated voltage with rated frequency continuously.

70% of rated voltage with rated frequency continuously for a period of less than 60 seconds.

A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed ± 5 percent of rated frequency.

E635.2.2 Motor Efficiency Contract Price Adjustments
Any motor which, upon test, is found to have an efficiency value less than the value stated in the proposal data shall have the contract price reduced. The price reduction will be the difference between the guaranteed efficiency obtained from the values stated on the E635 Specification Sheets and the actual efficiency as determined from test values multiplied by the appropriate dollar values given on the E635 Specification Sheets. The price reduction will be invoked for each motor of a given motor design based on the testing of one motor of that design.

E635.2.3 Drawings and Engineering Data
Motor dimensional drawings shall be provided in accordance with Exhibit X – Submittals, Review and Hold Points and include the following information:

Complete nameplate data.

Equivalent AC motor circuit with all parameters provided so that the motor can be properly modeled in the Buyer's AC system analysis software (SKM Powertools)

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Rotor weight and motor total weight.

Special requirements, if any, for provisions by others for control of shaft end float during starting, operating, or stopping of the motor.

E635.2.4 Superimposed Motor Driven Equipment Speed-Torque Curves and Supporting Tabulated Data
The WFGD Supplier shall furnish superimposed speed-torque curves for each motor driven equipment match. Speed-torque curves shall include the motor speed-torque curves at minimum specified starting voltage at 100 percent voltage and at 110 percent rated voltage, superimposed on the driven equipment speed-torque curve during acceleration. Additionally, for high inertia loads, the tabulated data from which each curve was prepared shall be submitted. If the driven equipment configuration allows for both an open inlet condition and a closed inlet/startup condition, driven equipment speed-torque curves and associated tabulated data shall be provided for both conditions. Motors shall not be released for manufacture until the WFGD Supplier's match of motor driven equipment speed-torque curves is acceptable to the Engineer.

E635.2.5 Superimposed Thermal Limit and Time-Current Curves and Supporting Tabulated Data
The WFGD Supplier shall submit a motor thermal limit curve superimposed on time-current curves during acceleration of the driven equipment for each motor. For high inertia loads, tabulated data from which the curve was prepared shall be submitted.

The thermal limit curve for each motor shall be based on initial motor parts temperatures equal to the service factor load operating temperatures in the maximum specified ambient. Each thermal limit curve shall include the following components:

Locked-rotor thermal limit for values of current from 110 percent rated voltage to the minimum specified starting voltage.

Accelerating thermal limit for values of current from locked-rotor current to the current at breakdown torque, at minimum specified starting voltage.

Running overload thermal limit at rated voltage, for values of current from the current at service factor load torque to the current at breakdown torque.

For each motor, time-current curves during acceleration of the driven equipment shall include acceleration at minimum specified starting voltage, acceleration at 100 percent rated voltage and acceleration at 110 percent rated voltage.

E635.2.6 Motor Current Versus Speed Curves and Supporting Tabulated Data
The WFGD Supplier shall submit the motor's current versus speed curves at minimum specified starting voltage, 100 percent voltage, and at 110 percent rated voltage. Additionally, for high inertia loads, the tabulated data from which each curve was prepared shall be submitted.

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E635 Medium Voltage Induction Motors Specification Sheet

This motor data sheet is applicable for motors with nameplate ratings	
Including and below	20,000 hp
Including and above	250 hp
Manufacturing Standard	NEMA/IEEE
Motor Sizing Criteria	The motor nameplate horsepower rating (kW) multiplied by the motor nameplate service factor shall be at least 15 percent greater than the driven equipment operating range maximum brake horsepower (kW).
Mounting arrangement	Horizontal shaft
Rated voltage (volts) / frequency (hertz)	4000 volts / 60 hertz (200-2,999HP), 13,200 volts / 60 hertz (3,000-20,000HP)
Maximum ambient temperature, (°C)	In accordance with Exhibit S – Site and Site Conditions
Minimum ambient temperature, (°C)	In accordance with Exhibit S – Site and Site Conditions
Altitude	Less than 3,300 ft above sea level
Duty	Continuous
Efficiency, minimum (percent)	Premium
The following features shall be provided:	
Feature	**NEMA**
n	NEMA Class F; sealed with abrasion resistant coating on stator winding
e / degree of protection	Totally enclosed fan cooled when located outdoors, in corrosive environments, or subject to washdown (any location where ash, coal, or slurry might be present). preferred. Otherwise, enclosures shall be weather protected, Type II.
Temperature rise	NEMA Class B measured by resistance at the 1.15 service factor load
of cooling	Not Applicable
us classification	Not Applicable
Enclosure openings shall be covered with screens manufactured from the following materials:	Stainless Steel
Air filters	Stainless steel air filters shall be provided.
Heat exchangers required?	No
	Source of Water to Heat Exchangers
Bearing heat exchanger	Not Applicable
Enclosure heat exchanger	Not Applicable
No-load sound produced by the motor at 1 meter (dBA)	Per V100
Full-load starts per year	1,000
Surge protection to be located in motor terminal box	For 13.2kV motors only.

Current transformers	Current transformers shall be provided for each stator winding for a self-balancing current type differential protection for motors greater than 5000 HP.			
Stator winding temperature detectors	RTDs - 100 ohm platinum (six per motor)			
Starting voltage range:	Minimum	80 percent	Maximum	110 percent
Starting current during a full voltage across-the-line start shall not exceed percent of rated current	600			
Motor safe stall time at minimum starting voltage shall not be less than motor acceleration time at minimum voltage plus	4 seconds (see Sections 2.1 and 2.1.17)			
Incoming power supply cable and terminations	Shielded cable with stress relief kits installed in conduit			
Ground connectors in motor terminal box shall accept ground cable size of	4/0 AWG			
Anticondensation space heaters	Space heaters shall be provided. Space heater circuits exceeding 1200 watts shall be configured 3-phase.			
Space heaters shall be rated	120 VAC			
Space heaters shall be energized at	120 VAC (1200 watts or less), 208 VAC (> 1200 watts)			
The following dollar value will be used to evaluate motor energy losses at driven equipment maximum brake horsepower (kW) as defined on the motor proposal data sheet:				
Dollars (US) / kW	$7,000			
Special features and accessories:				
Vibration transducer mounting pad: vibration transducers and associated proximitors for motors (Bently Nevada XL3300) larger than 499 HP				
Half-coupling supplied by the Buyer				
Shaft end key				
Shaft end keys for both shaft ends				
Soleplates	Soleplates for motors shall be provided for all motors not mounted on a common skid with the driven equipment.			
Bearings shall have a life when operating under the load, speed, and thrust requirements of the driven equipment of not less than	To be determined during detailed design			
Horizontal motor bearing type	Either sleeve bearings or antifriction bearings			
Antifriction bearings shall have an ABMA (American Bearing Manufacturer's Association) L10 life of not less than the following when operating under the load, speed, and thrust requirements of the driven equipment:				
Connection to Driven Equipment	**Hours**			
Direct	40,000			
Vertical thrust				
Maximum upward			lb	
Continuous upward			lb	
Maximum downward			lb	
Continuous downward			lb	

Bearing temperature detectors shall be furnished	Two on each motor bearing
Bearing temperature detectors shall be	100 ohm platinum RTDs
Bearing lubrication system	Oil rings
Bearing lubrication system cooling	Self-cooled
Winding Temperature detectors	100 ohm platinum RTDs (two per winding)
Windings	Copper
Vibration detectors	Two per bearing (X & Y) for motors larger than 499 HP
Terminal box	Size for two conductor sizes larger than normal; stress relief terminations
Tests	ANSI C50.41 routing tests and current balance check, no load; locked rotor current measurement at rated frequency and fractional voltage; bearing temperature test;
Incoming cable type	Shielded cable in conduit and cable tray.
Operating torque	90 percent of full-load torque at 85 percent of rated voltage and 92 percent of rated frequency for a period of 10 minutes without injury. Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine, at minimum specified starting voltage. Unless specified otherwise, motor torque in percent full-load torque at rated voltage and frequency shall be not less than 200 breakdown, 85 pull-up, and 90 locked-rotor
Supplier	Refer to Exhibit E - Acceptable Equipment and Material Supplier List.

E640 Low Voltage Induction Motors
(Source: 21Dec07 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

E640.1 General

E640.1.1 Scope of Supply
Scope of supply shall include furnishing the low voltage induction motors as specified herein and the E640 Low Voltage Induction Motors Specification Sheets at the end of this section.

E640.1.2 Codes and Standards
Work performed under these specifications shall be done in accordance with the codes and standards as defined herein and in Exhibit N – Codes and Standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Buyer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
NEMA/IEEE designed motors	NEMA MG1, IEEE C50.41 (for motors larger than 440 series frame), IEEE 112

E640.1.3 Acceptable Suppliers of Components

Refer to Exhibit E - Acceptable Equipment and Material Supplier List. If a nonlisted supplier that is considered to provide an equivalent level of quality is proposed, this supplier must be identified and supporting testimony provided. Acceptance of the supplier as a substitute is at the discretion of the Buyer.

E640.1.4 Test Requirements
Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these specifications. Test procedures shall be in accordance with IEEE and NEMA test procedures for 3-phase induction motors. The routine tests listed in NEMA or IEC shall be performed on each motor by the motor manufacturer.

This testing is to be considered part of the defined scope of work, and all associated costs are the responsibility of the WFGD Supplier unless specifically identified as a Bid Option or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the WFGD Supplier is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Copies of reports of the quality control tests and inspections for each motor shall be submitted prior to shipment of the motor from the manufacturer's factory.

Tests	In Accordance With	Conducted By
NEMA/IEEE designed motors	NEMA MG1, IEEE 112, NEMA C50.41	Motor manufacturer

E640.2 Products

E640.2.1 Design and Construction
Motors shall be designed for direct-on-line (full voltage) starting. All motors shall be capable of continuous running duty in the specified ambient. Intermittent duty motors may be furnished where recognized and defined as standard by the equipment standards and codes.

All motors shall be provided with a service factor of 1.15 and designed for continuous operation.

E640.2.1.1 Nameplates. All motor nameplate data shall conform to the requirements of the standards listed in Article E640.1.2. The following additional nameplate data shall be included:

Insulation system class designation.

Maximum ambient temperature for which motor is designed and temperature rise by resistance.

Starting limitations, if any.

Direction of rotation and voltage sequence.

Type and grade of bearing lubricant, attached adjacent to lubricant filling devices.

Complete nameplate data shall be included on the motor dimensional drawing submitted for final review. All motor nameplates and attachment pins shall be corrosion-resistant metal.

E640.2.1.2 Enclosures. Enclosure parts for all motors (e.g., frames, bearing brackets, terminal housings, external fan covers) shall be made of cast iron, cast steel, sheet steel, or steel plates. Aluminum enclosure parts are not acceptable.

Motors located in areas classified as hazardous shall be furnished with enclosures certified for use in the classified area.

Totally enclosed motors shall be furnished with drain holes and rotating shaft seals and bearing housing seals (Inproseal or equal approved by Buyer). Drain holes shall be provided with combination water drain-breather plugs. External cooling fans for fan cooled motors shall be fabricated of brass, bronze, or aluminum alloy containing not more than 0.2 percent copper, malleable iron, or plastic. All plastic fans shall be fabricated of a reinforced thermosetting plastic.

Totally enclosed motors shall have all exposed metal surfaces protected with a corrosion-resistant polyester or epoxy paint or coating and shall have enclosure interior surfaces and the stator and rotor air gap surfaces protected with a corrosion-resistant alkyd enamel or with polyester or epoxy paint or coating. Bolts, nuts, screws, and other hardware items shall be corrosion-resistant or zinc dichromate treated metal.

E640.2.1.3 Insulation and Windings. All stator winding materials shall have a Class F 311° F (155° C) or higher thermal classification. The stator insulation system shall include two dips and bakes of varnish or, alternatively (subject to approval by Buyer), may use materials and a process that has been proven to completely eliminate voids in the stator slots and between the stator conductors. All insulated stator conductors shall be copper.

E640.2.1.4 Temperature Rise. Provide motors with Class F insulation with actual temperature rise limited to Class B measured by resistance at the 1.15 service factor load in accordance with the applicable IEEE Standards..

E640.2.1.5 Space Heaters. Space heaters shall be furnished as specified on the E640 Specification Sheets. Heaters shall be located and insulated so they do not damage motor components or finish. Space heaters shall be sized as required to maintain the motor internal temperature above the dew point when the motor is idle.

E640.2.1.6 Terminal Housings. A single terminal housing for motor power leads and accessory leads shall be furnished on all motors. All terminal housings shall be externally mounted on the motor frame enclosure. Terminal housings for all motors shall be cast iron or sheet steel. Minimum protection requirements shall be equivalent to NEMA 4. All motors shall be furnished with an oversized terminal housing. Location and dimensions of terminal housings shall be acceptable to the Buyer.

E640.2.1.7 Leads. All leads, including motor power leads, space heater leads, and temperature sensing device leads, shall be wired into the terminal housing. All motor leads located in the housings shall be permanently marked for ease of identification.

All motors shall have the direction of rotation marked by an arrow mounted visibly on the stator frame near the terminal housing or on the nameplate and the leads marked for phase sequence to correspond to the direction of rotation and supply voltage sequence.

Cable motor leads shall use stranded copper conductors insulated with silicone rubber covered with a glass braid or acceptable equal.

E640.2.1.8 Ground Connectors. Each motor shall be furnished with a grounding connector attached to the motor frame inside the motor terminal housing. The grounding connector may be a lug or terminal or other acceptable grounding connector. The grounding connector size shall be in accordance with NEC requirements based on the motor full load amperes unless otherwise specified on the E640 Specification Sheets. Motors 50HP and above shall be provided with an external grounding pad or grounding lug capable of receiving a 4/0 ground cable.

E640.2.1.9 Bearings. The WFGD Supplier shall determine the type of bearings to be furnished based upon the load, speed, and thrust conditions of the driven equipment. All bearing mountings shall be designed to prevent the entrance of lubricant into the motor enclosure or dirt into the bearings. Bearings and bearing housings shall be designed to permit disassembly in the field for inspection of the bearings or removal of the rotor.

Antifriction bearings shall be designed and fabricated to have a life as specified on the E640 Specification Sheets. Antifriction bearings shall be grease lubricated, self-lubricating, and regreaseable. Grease fittings for lubrication shall be arranged for safe, easy addition of lubricant from the outside of the motor while the motor is in service.

Bearing lubricants shall contain a corrosion inhibitor. The type and grade of lubricant shall be indicated on a nameplate attached to the motor frame or end shield adjacent to the lubricant filling device. The WFGD Supplier shall furnish all lubrication information required to assure proper equipment startup and subsequent bearing maintenance.

E640.2.1.10 Rotors. All induction motors shall have squirrel-cage rotors. Rotors shall be adequately sized to avoid overheating during acceleration of the motor and driven equipment. Rotors shall be die-cast aluminum construction or shall have copper or copper alloy cage material except that aluminum cage materials will be considered on 2-pole motors only.

All fabricated cage rotor bars shall be installed using swaging or wedging or other proven method acceptable to the Buyer to prevent rotor bar vibration.

E640.2.1.11 Shafts. All shafts shall be solid. Each shaft shall be furnished with a corrosion-resistant treatment or shall be made of a corrosion-resistant material.

E640.2.1.12 Torque Characteristics. Breakaway, run-up/pull-up, and pull-out/breakdown torque shall at all times be at least 10 percent higher than the load-torque of the driven machine, even at minimum specified starting voltage. Load-torque characteristics will be furnished by the driven equipment supplier; however, the responsibility for successful starting under the given conditions rests with the motor manufacturer.

E640.2.1.13 Critical Speeds. Motors shall be designed to keep torsional and rotational natural frequencies of vibration at least 25 percent (or at least 15 percent for well damped resonant frequencies (having amplification factors less than 5.0) subject to approval by Buyer) above or below, preferably above, the motor rated speed ranges to avoid resonant vibration over the operating speed range of the equipment-motor unit.

E640.2.1.14 Variations from Rated Voltage and Rated Frequency. Unless specified otherwise in Articles E640.1.2 through E640.1.4, induction motors shall operate successfully under running conditions at rated load with a variation in the voltage or the frequency as follows:

80-110% of rated voltage with rated frequency continuously.

70% of rated voltage with rated frequency continuously for a period of less than 60 seconds.

A combined variation in voltage and frequency of 10 percent (sum of absolute values) of the rated values, provided the frequency variation does not exceed plus or minus 5 percent of rated frequency.

E640.3 Drawings and Engineering Data
Motor dimensional drawings shall be provided in accordance with Exhibit X – Submittals, Review and Hold Points and include the following information:

E642.1.1 Scope of Supply
The scope of supply shall include furnishing the single-phase induction motors as defined herein and on the E642 Single-Phase Induction Motors Specification Sheet at the end of this section.

E642.1.2 Codes and Standards
Work performed under these specifications shall be done in accordance with the codes and standardsas defined herein and in Exhibit N – Codes and Standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall apply. These references shall govern the work except where they conflict with the Buyer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
NEMA/ANSI designed motors	NEMA MG1, IEEE 114

E642.1.3 Acceptable Suppliers of Components
Refer to Exhibit E - Acceptable Equipment and Material Supplier List. If a nonlisted supplier that is considered to provide an equivalent level of quality is proposed, this supplier must be identified and supporting testimony provided. Acceptance of the supplier as a substitute is at the discretion of the Buyer.

E642.1.4 Test Requirements
Each motor shall be tested and inspected at the manufacturer's factory to determine that it is free from electrical or mechanical defects and to provide assurance that it meets the requirements of these specifications. Test procedures for single-phase motors shall be in accordance with IEEE and NEMA test procedures for single-phase induction motors.

This testing is to be considered part of the defined scope of work, and all associated costs are the responsibility of the WFGD Supplier unless specifically identified as a Bid Option or Buyer-conducted. Tests identified as an option are to be priced separately. If identified as Buyer-conducted, costs for the initial test will be the responsibility of the Buyer. However, the WFGD Supplier is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With	Conducted By
NEMA/IEEE designed motors	NEMA MG1, IEEE 114	WFGD Supplier

E642.2 Products
Single-phase motors furnished under these specifications, including gear motors and those constructed integrally with the driven equipment, shall be of the manufacturer's proven design. Motors shall be designed for direct-on-line (full voltage) starting, frequent starting where required, and shall be suitable for continuous running duty in the specified ambient. Intermittent duty motors may be furnished where recognized and defined as standard by the equipment standards and codes.

E642.2.1 Design and Construction
The type, design, and construction of each motor shall be coordinated with the driven equipment requirements as specified in the individual technical sections.

All motors shall have a service factor of 1.15 and designed for continuous operation.

E642.2.1.1 Enclosures. All motors shall be self-ventilated. Motors shall be totally enclosed unless specified otherwise. Frames, brackets, external terminal housings where furnished, and fan covers for fan cooled motors shall be cast iron. All exposed metal surfaces shall be protected, where practical, with

a corrosion-resistant paint or coating. Exposed unpainted and uncoated surfaces shall be of a corrosion-resistant metal.

Motors located in classified hazardous areas shall be furnished with enclosures certified for use in the classified area.

E642.2.1.2 Insulation and Windings. Motors shall have either a Class B 266° F (130° C) or a Class F 311° F (155° C) insulation system. The motor temperature rise shall be in accordance with values for Class B insulation when a Class B insulation system is used, and with values for Class F insulation when a Class F insulation system is used. All insulated stator conductors shall be copper.

E642.2.1.3 Terminal Housings. An externally mounted terminal housing shall be provided.

E642.2.1.4 Leads. Terminal identification shall be furnished. Where supplied, terminal boards shall be fabricated of nonhygroscopic material. Permanent instructions for making these connections shall be furnished inside the terminal housing or on the motor frame or nameplate.

E642.2.1.5 Terminals. Cable type leads shall be provided with compression type connectors.

E642.2.1.6 Ground Connectors. All motors, including those with resilient mountings, shall be furnished with a ground connection. A ground connector shall be provided inside the motor terminal housing.

E642.2.1.7 Bearings. Bearings shall be double sealed ball bearings.

E642.2.1.8 Shafts. Shafts of motors shall be furnished with corrosion-resistant treatment or shall be of a corrosion-resistant metal.

E642.2.1.9 Capacitors. Capacitors, as required, shall be furnished in removable metal enclosures mounted on the motor frame.

E642.2.1.10 Thermal Protection. Manual reset thermal protection, for both stalled rotor and overload protection, shall be furnished on all motors.

E642.2.1.11 Torque Characteristics. The torque characteristics of all motors at the starting voltage specified on the E642 Specification Sheets shall be as required to accelerate to full speed the inertia loads of the motor and driven equipment without damage to the motor or the equipment. All motors shall be designed and fabricated to withstand the forces of across-the-line starting.

E642.2.2 Assembly. All motors shall be completely assembled with the driven equipment, lubricated, and ready for operation.

E642 Single-Phase Induction Motors Specification Sheet

Application	Indoor or outdoor areas, general purpose		
This motor data sheet is applicable for motors with nameplate ratings			
Less than:	1/4 hp		
Rated voltage / frequency	115 volts / 60 Hz		
Motors shall be manufactured to	NEMA/IEEE Standards		
The following features shall be provided:			
Feature		**NEMA/IEEE**	
Enclosure/degree of protection		Totally enclosed fan-cooled	
Method of cooling		Not Applicable	
Hazardous classification		Not Applicable	
Maximum ambient temperature, °F		In accordance with Exhibit S – Site and Site Conditions	
Minimum ambient temperature, °F		In accordance with Exhibit S – Site and Site Conditions	
Starting voltage range			
Minimum (percent)		80	
Maximum (percent)		110	
Altitude above sea level		Less than 3,300 ft	
Motor nameplate horsepower multiplied by the motor nameplate service factor for NEMA/IEEE motors shall be at least 15 percent greater than the driven equipment operating range maximum brake horsepower.			
Additional Requirements:			

E645 Electric Actuators

(Source: 27Jun08 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

E645.1 General

E645.1.1 Performance and Design Requirements

Performance and design requirements are defined herein and on the E645 Specification Sheets.

E645.1.2 Codes and Standards

Work performed under these specifications shall be done in accordance with the codes and standards as defined herein and in Exhibit N -- Codes and Standards. Unless otherwise specified, the applicable governing edition and addenda to be used for all references to codes or standards specified herein shall be interpreted to be the jurisdictionally approved edition and addenda. If a code or standard is not jurisdictionally mandated, then the current edition and addenda in effect at the date of this document shall

apply. These references shall govern the work except where they conflict with the Buyer's specifications. In case of conflict, the latter shall govern to the extent of such difference:

Work	In Accordance With
ANSI designed	NEMA, IEEE

E645.1.3 Acceptable Suppliers of Components
Refer to Exhibit E - Acceptable Equipment and Material Supplier List. Only the listed suppliers are recognized as maintaining the level of quality of workmanship required by these specifications.

E645.1.4 Test Requirements
The following testing shall be conducted in accordance with the specified source. This testing is to be considered part of the defined Scope of Work:

Tests	In Accordance With	Conducted By
Routine shop tests	Each actuator shall be installed on the driven equipment and shop operated to test functions. If the actuator is not factory installed on the driven equipment, the actuator shall be separately tested by the manufacturer prior to shipment.	Manufacturer and WFGD Supplier

E645.1.5 Technical Attachments
The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under the defined Scope of Work:

Document Number/Description	Title	Revision

E645.2 Products

E645.2.1 General
Except as indicated otherwise herein, these specifications are applicable to all electric actuators (electric motor driven actuators) furnished under this purchase order.

The electric actuators shall be designed specifically for heavy-duty power plant service. Electric actuators shall have all metal gear trains. Fiber gears are not acceptable for the transmission components developing output effort.

Operating speeds, differential and static process line pressures, and process line flow rates, when specified by the Buyer, are included on the prime equipment specification sheets, supporting lists, or other Technical Sections. Where the operating speeds and differential and static pressures are not specified by the Buyer, the operating speeds and torques shall be coordinated by the WFGD Supplier with the actuated equipment requirements and shall be acceptable to the Buyer.

E645.2.2 Rating, Design, and Construction
Unless specified otherwise on the E645 Specification Sheets, electric actuators, complete with motor and accessories, shall be designed for high torque, reversing service in an ambient temperature range in

accordance with Exhibit S – Site and Site Conditions. Electric actuators shall have self-locking gear ratios. Motors shall have Class F nonhygroscopic sealed insulation.

All motors shall be designed for direct on-line (full voltage) starting. The motor nameplate voltage and frequency shall be as specified on the E645 Specification Sheets.

Alternating current motors shall be of the squirrel-cage induction type. Direct current motors shall be of the shunt-wound type.

For non-modulating service, motor starting torque shall not be less than 500 percent of rated full load torque. The motor time rating for normal opening and closing service shall not be less than whichever of the following is greatest:

> Electric actuators specified for non-modulating service shall be capable of three successive open-close operations with no time interval between operations, when operating at an average load of 33 percent maximum driven equipment torque in ambient temperature, as specified in Exhibit S – Site and Site Conditions.
>
> As specified elsewhere.
>
> As required for the service.
>
> 15 minutes at maximum driven equipment torque in ambient temperature as specified in Exhibit S – Site and Site Conditions.

For actuators specified for modulating service, motor starting torque shall be not less than the full load torque rating of the actuator. The motor time rating for modulating service shall not be less than whichever of the following is greatest:

> Electric actuators specified for modulating service shall be capable of continuous modulation with not less than 60 starts / stops per minute at full rated torque without overheating or requiring separate cooling provisions.
>
> As specified elsewhere.
>
> As required for the service.

Sufficient torque shall be provided to open or close the valve, gate, or damper against maximum differential pressure, static pressure, and seating or unseating torque at any voltage range between minimum and maximum voltage range specified on the E645 Specification Sheets.

Where a globe or nonreturn valve is specified as a hydrostatic test boundary in the Valve List, the gear operator shall be sized to be self-locking to maintain the closed valve position when the specified hydrostatic test pressure is applied under the seat. Where not specified as a hydrostatic test boundary, gear operators shall be self-locking for design pressure only.

Electric actuators shall be furnished with cast iron, cast aluminum alloy, or steel enclosures. The operators shall be totally enclosed, nonventilated, weatherproof, and dust-tight, suitable for outdoor service. Each valve actuator shall be provided with a weather tight, closed end, metallic valve stem cover of the appropriate length.

Enclosures for electric actuators to be located in hazardous locations shall have a nameplate identifying hazardous area rating of the electric actuators and the name of the certifying institution. The surface temperature for electric actuators with dust ignition proof features shall not exceed 248° F. Hazardous

area enclosures shall have weatherproof features conforming to the dust and water requirements of either NEMA Type 4 enclosures.

Antifriction bearings shall have a minimum rating life of not less than 15,000 hours. Motor leads shall be terminated in the limit switch compartment.

Each electric actuator shall be supplied with a single-phase space heater located in the limit switch compartment. Each electric actuator provided with a motor 7-1/2 horsepower or larger shall also be supplied with a single-phase space heater located in the motor. Motor space heater leads shall be terminated in the limit switch compartment. Space heater voltage shall be as specified on the E645 Specification Sheets. If the WFGD Supplier's design requires enclosures equipped with drain plugs to control condensation, the drain plugs shall be combination water drain-breather type.

A handwheel and declutching mechanism shall be provided to allow handwheel engagement at any time, except when the motor is energized. Actuators are to automatically revert back to motor operation, disengaging the handwheel, upon energizing the motor. Clockwise operation of the handwheel shall provide a closing action of the valve, gate, or damper. Rim pull shall not exceed 80 pounds.

A local mechanical dial position indicator; continuously indicating the exact (0 to 100 percent) position of the valve, gate, or damper; shall be provided.

Electric actuators shall be designed for installation in any position without lubricant leakage or other operating difficulties.

Each electric actuator shall provide the following switch functions:

Two auxiliary switches at each end of travel.

Four auxiliary switches; each set of two switches shall be independently adjustable to trip at any position between the fully open and fully closed positions.

Torque and thrust loads in both closing and opening directions shall be limited by torque limit switches. Each torque switch shall be independently adjustable and shall permit settings between rated full load torque and 40 percent or less of that value. A means shall be provided to prevent nuisance tripping of the opening torque switch caused by transient high loads during the initial unseating period. A similar device shall be provided for the closing torque switch on those valves where backseating of the valve is recommended by the valve manufacturer.

The electric actuator limit switches and torque switches (or equivalent torque sensing devices), electric actuator space heater, and motor space heater (when applicable) shall be wired in accordance with manufacturer's standard wiring diagram drawing numbers as indicated on the E645 Specification Sheets. Provisions shall be provided to terminate Buyer's field cable at terminal points that can be made accessible during operation of the actuator. The actuator terminal box shall be sized large enough to dress out and terminate a maximum conductor size of 12 AWG for control conductors and 10 AWG for power conductors from the Buyer.

For non-modulating actuators, unless an integral starter is specified on the E645 Specification Sheets to be supplied with the actuator, the Buyer will supply a remotely mounted reversing starter to operate the actuator. The Buyer's reversing starter control circuit voltage and frequency shall be as specified on the E645 Specification Sheets.

E645.2.3 Integral Local Control Station
If an integral local control station is specified on the E645 Specification Sheets, the control station shall consist of an "open-stop-close" push-button station with indicating lights and an integral selector switch

that is padlockable in the "off" position. The push buttons and selector switch shall be accessible from outside the enclosure.

E645.2.4 Continuous Position Feedback
Whenever continuous position feedback is specified on the E645 Specification Sheets or in equipment lists, the WFGD Supplier shall provide a 2 wire optically isolated 4 to 20 mA output signal which is proportional to operator position. The accuracy of this system shall be ±1 percent linear over the full range of the output.

E645.2.5 Integral Starters
Whenever integral starters are specified on the E645 Specification Sheets, the electric actuator shall be complete with a close-coupled power disconnect switch or circuit breaker capable of being locked in the open position, forward and reverse contactors, control power transformer, and motor overload protection devices. Unless otherwise specified, the power disconnect switch or circuit breaker shall be weatherproof, dust-tight and suitable for outdoor service and rated to withstand (disconnect switch) or interrupt (circuit breaker) at least 5,000 amperes rms short-circuit current. Motor overload devices shall be wired to de-energize the contactors on motor overload, and shall be capable of either automatic or manual reset. Motor thermal sensing devices with automatic reset may be used instead of motor overload devices provided it is the manufacturer's standard practice. The forward and reverse contactors shall be mechanically and electrically interlocked to ensure that only one contactor coil can be energized at a time. A normally open auxiliary contact from both the forward and reverse contactors shall be provided and wired out to a terminal block for Buyer use to monitor valve actuator opening/closing. The primary winding of the control power transformer, complete with two primary fuses, shall be connected to two of the three incoming power source phases. Each ungrounded conductor on the control power transformer secondary shall be fused. The primary and secondary winding fuses shall be easily replaceable without removing any internal components. The control power transformer shall have the necessary taps and capacity as required to energize the contactor coils, actuator and motor space heaters, and internal electrical controls. The control power transformer secondary voltage and frequency shall be as specified on the E645 Specification Sheets.

Protective devices for dc motors shall not trip or open the contactor for locked-rotor currents. Overload devices shall have contact closure for remote alarm on motor overload. The dc starter shall be mounted separately from the electric actuator. The control circuit voltage shall be as specified on the E645 Specification Sheets.

E645.2.6 Not Used.

E645.2.7 WFGD Supplier's Responsibility for Specification Transmittal
The WFGD Supplier shall submit a copy of this entire section along with the E645 Specification Sheets to the electric actuator supplier with the contract for electric actuators.

E645 Non Modulating Electric Actuators Specification Sheet

Electric Actuators		
Driven Equipment Name	**ID Number**	**Application**
		General usage, nonmodulating
Nameplate voltage/frequency/phase		460 volts/60 hertz/3-phase
Maximum voltage, volts		506
Minimum voltage, volts		414
Control circuit, voltage/frequency/phase		120 volts/60 hertz/single-phase
Space heater, voltage/frequency/phase		Powered from control circuit voltage
Degree of protection		NEMA Type 4
Continuous position feedback mechanism		None
Integral local control station		Yes
Integral starter		Yes
Local diagnostics port on each actuator		Manufacturer's standard
Baud rate		500,000
Integral electric actuator control package with network communications		No
Network protocol		Not Applicable
Baud rate		Not Applicable
Network electrical standard		Not Applicable
Transmission media		Not Applicable
Type of host controller (by Buyer)		Not Applicable
Controller manufacturer		Not Applicable
Additional Requirements		

E645 Modulating Electric Actuators Specification Sheet

Electric Actuators		
Driven Equipment Name	**ID Number**	**Application**
		General usage, modulating, nominal ¼ turn adjustable for zero and 100% control signal
Nameplate voltage/frequency/phase		460 volts/60 hertz/3-phase, 120volts/60 Hz 1-phase
Maximum voltage, volts		506 3-phase; 130 1-phase
Minimum voltage, volts		414 3-phase; 100 1-phase
Control circuit, voltage/frequency/phase		120 volts/60 hertz/single-phase
Space heater, voltage/frequency/phase		Powered from control circuit voltage
Degree of protection		NEMA Type 4
Control (Positioning) Signal to Positioner		4-20 mA dc equivalent to 90° rotation (adjustable), powered externally
Continuous position feedback mechanism		Yes, 4-20 mA dc, powered from drive (or externally)
Integral local control station		Yes
Integral starter		Yes
Local diagnostics port on each actuator		Manufacturer's standard
Baud rate		500,000
Drive Arm		Yes, Adjustable for zero and 100 % position
Integral electric actuator control package with network communications		Yes
Network protocol		Hart Communicator Protocol
Additional Requirements	Space Heater Hazardous Area Construction	

K100 Instrumentation
(Source: 30Mar2011 - Revised by Project: 19Jul11, Revised by Package: 18Aug11)

The tables at the end of this section identify specific project requirements.

K100.1 General Requirements
Unless specified otherwise in other sections, all instrumentation components furnished with equipment shall be in accordance with the following articles.

As a general rule, process transmitters shall be used in lieu of process switches, as transmitters provide better accuracy and reliability, and allow for process monitoring. However, vibration switches may be used on agitators.

Continuously reading transmitters are preferred over switches for all process monitoring applications. Process switches shall not be used without the written consent of the Buyer.
The use of local indicators, such as temperature level, and pressure indicators, shall be limited. Level and pressure measurements shall be input to DCS with the use of transmitters. Transmitters shall be provided with local indication. Temperatures shall be monitored with thermocouples and RTDs.

In some instances, such as duct temperature measurements, multiple temperature sensors shall be required for input to the DCS which will be averaged for the desired process measurement..

Instrument air for pneumatic instrument and control devices will be clean, dry, and oil free.

All instrumentation shall be provided with a stainless steel tag, which shall be attached with rivets or stainless steel wire. The tagging convention used for the tag numbers shall follow the equipment tagging convention which is in use for the project site where the equipment is being installed.

All instruments requiring electrical wiring shall be provided with threaded connections to either 3/4 inch (preferred) or 1/2 inch conduit as appropriate.

Electrical housings shall be dustproof and moisture-proof in accordance with NEMA 4. If the electrical equipment is located outdoors or if located indoors in corrosive areas where there is a potential for exposure to flyash, coal, or slurry, NEMA 4X enclosures shall be provided for the electrical equipment. If the electrical equipment is installed in a hazardous area, the electrical equipment shall be of a design suitable for the specific area classification.

Components of the instrument that contact the process media shall be stainless steel or a material suitable for service approved by the Buyer. Coatings shall not be considered adequate protection to resist process corrosion.

Pressure and differential pressure measuring instruments for corrosive or thick, plugging process fluids shall be equipped with a flanged or threaded remote diaphragm seal assembly complete with flushing connection. The seal diaphragm and housing material shall be suitable for the service required. Capillary tubing shall be armored 316 stainless steel. Capillary tubing is to be kept to a minimum length to reduce the effect of ambient heating on the capillary fill fluid.

Pressure instruments shall be capable of withstanding sustained over-pressurization to 150 percent of the maximum service pressure, or the system design pressure, whichever is greater, with no subsequent loss of function or change in measurement accuracy.

The process connection on each pressure instrument shall be 1/2 inch MNPT for bottom connection static pressure indicators, at least 1/4 inch FNPT for draft differential pressure devices, and at least 1/4 inch FNPT for all others.

Instruments shall be calibrated in the factory. Calibration ranges shall be suitable for the process conditions. The instruments shall be calibrated so that the normal readings fall somewhere near two-thirds of the calibrated span. Certified calibration sheets shall be furnished for each instrument with a copy included with shipment of each device and in the instruction manual.

Contact ratings shall be as specified in Section E530, Article E530.5 Contacts.

For instrumentation that is supplied skid mounted or installed on package equipment, the instrument installations shall be designed for maintenance and local display viewing accessibility without the use of ladders or scaffolds. For skids that require freeze protection of the instrumentation by the Buyer, space shall be provided to install insulation and freeze protection boxes around the instruments and tubing.

Where applicable, the instrumentation shall be installed with unions, isolation valves, or flanges so that the instrument can be easily removed for maintenance. The installation of the equipment shall be approved and acceptable to the Buyer. Space shall be provided for removal of instrumentation from the piping or equipment when the piping is routed or when the equipment is located in the plant arrangements.

The WFGD Supplier shall furnish, as a deliverable, ISA-format datasheets for all WFGD Supplier-provided instruments.

K100.2 Local Indicators
Each local indicator shall have the service legend engraved on the dial or have a tag, engraved with the Buyer's ID number and the service legend, attached to it. Each tag shall be engraved laminated phenolic or stainless steel. Legend and tag number will be provided by the Buyer.

The scale range of each indicator shall be selected so that the normal operating condition is approximately mid scale (between one third and two thirds of full scale of the dial). Except for pressure differential gauges, rotary type indicator full scale pointer travel shall be a minimum of 270 degrees. Indicator dial size shall be at least 4-1/2 inches. Accuracy of pressure indicators shall be ±0.5 percent of full scale range. Accuracy of temperature indicators shall be ±0.1 percent of full scale range.

Differential pressure indicator full scale pointer travel shall be at least 80 degrees. Indicator dial size shall be at least 4 inches. Accuracy shall be 2 to 4 percent of full scale range.

K100.2.1 Pressure Indicators (Gauges)
Each static pressure indicator shall be equipped with a pressure relief device designed to protect the operator from high pressure blowout of the indicator. Each indicator shall have a stainless steel movement, wetted parts, and socket unless the application requires other materials. The housing shall be dust- and moisture-resistant and shall be furnished with laminated safety glass. Each indicator shall be provided with overpressure stops to protect against pressure surges outside the scale range limits. Each pressure indicator indicating supply air pressure to an instrument shall be in accordance with the WFGD Supplier's standards.

Where pressure oscillations are expected, a pulsation dampener shall be furnished on each indicator to protect against process fluid oscillations of ±3 percent or more of the full scale range. The pulsation dampener shall be adjustable with the pressure indicator installed on the process line. If approved by the Buyer, WFGD Supplier may provide mechanical/anti-flutter linkage gauge dampening instead of a separate dampener. Mechanical linkage dampers shall be proven to provide the 3 percent level of dampening specified.

Preformed coil pipe siphons or straight siphons shall be furnished for gauges where hot condensable vapors or steam are present. Siphon materials shall be suitable for the process design temperature and pressure, and shall have 1/2 inch threaded connections.

Indicators for outdoor liquid processes that can freeze at 32° F (or below) shall be furnished with a silicone fill and diaphragm seal. Seals shall include 316 stainless steel welded diaphragms and bottom housings with 1/2 inch FNPT process connections. Silicone fill and seal attachment shall be done at the factory.

Pressure Indicator	
Material Wetted Parts	**Acceptable Supplier/Model**
Suitable for process fluid (316 SS minimum or Buyer approved alternative)	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.2.2 Temperature Indicators
Each temperature indicator for local mounting shall be a bimetal or gas actuated, filled thermal system type, gauge with at least a 5 inch dial having an every-angle adjustability. Temperature indicators shall be furnished with a compression union so that the stem will bottom out when placed in the thermowell. Gas actuated systems shall only be used where a direct mounting does not allow for easy viewing.

Each gas actuated indicator shall be furnished with armored stainless steel capillary tubing of the length required for the installation. If required, thermowells with lagging extensions shall be furnished for all indicators and shall be as specified under the article entitled Thermowells, Protecting Tubes, and Test Wells, except that extension nipples shall not be furnished for temperature indicators.

Temperature Indicator			
Description	**Construction**	**Switch Contact Ratings**	**Acceptable Supplier/Model**
Bimetallic	5-inch dial, every angle adjustable	N/A	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.3 Process Actuated Switches
As a general rule, process transmitters shall be used in lieu of process switches, as transmitters provide better accuracy and reliability, and allow for process monitoring.

Process switches shall not be used without the written consent of the Buyer.

Switch contacts shall be at least of one SPDT element. Where multiple pole switches are furnished for one trip (actuation) point, actuation and reset of all poles shall occur simultaneously. Switch contact shall be of the snap-acting type. Mercury wetted switch contacts shall not be used without Buyer's approval. Switch set point shall be field adjustable and tamperproof. Range, repeatability, deadband, and overpressure capability shall be acceptable to the Buyer.

Pressure switches shall be furnished with factory installed isolation/test manifolds. Static pressure service devices shall be furnished with two-valve manifolds.

Differential pressure service devices shall be furnished with three-valve manifolds that include isolation and equalization valves and test ports with plugs.

Manifolds shall be compliant with ASME B31.1 requirements, and shall include Grafoil packing with stainless steel construction.

Other Buyer approved materials shall be used if stainless steel is not suitable for the process.

K100.3.1 Pressure and Temperature Switches
Pressure switch accuracy shall be ±1 percent of full scale range. Pressure switch sensing elements shall be bellows, diaphragm, or piston. Wetted parts shall be suitable for the application.

Temperature switch accuracy shall be ±2 percent of full scale range. Each temperature switch shall be furnished with a thermowell (as specified under Thermowells, Protecting Tubes, and Test Wells). Each temperature switch sensing element shall be of the bimetal or filled thermal system type.

Pressure Switch						
Description	**Switch Contacts**	**Material Wetted Parts**	**Manifold?**	**Fail-Safe?**	**Deadband**	**Acceptable Supplier/ Model**
Pressure Switch - Gauge	SPDT	Stainless Steel or Buyer approved alternative	No	N/A	Manufacturer's Standard	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Purchase Approved Equal
Pressure Switch - Differential (Static Pressure < 500 psi)	DPDT	Stainless Steel or Buyer approved alternative	Yes	N/A	1%	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Purchase Approved Equal
Pressure Switch - Differential (Static Pressure > 500 psi)	DPDT	Stainless Steel or Buyer approved alternative	Yes	N/A	2%	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Purchase Approved Equal

Temperature Switch			
Description	**Construction**	**Switch Contact Ratings**	**Acceptable Supplier/Model**
Gas Filled	Filled thermal system assembly, with thermowell	5A at 120 VAC	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Purchase Approved Equal

K100.3.2 Float Type Level Switches
Cages of float type level switches shall be compliant with ASME B31.1.

Level switches shall be of the all-welded construction type. Each instrument shall have a float, body construction, and switch element appropriate for the application. The switch element shall be magnetically coupled to the float or displacers.

Level switches for sump and similar open pit applications shall be cable-mounted displacement style switches. Switches shall include sealed enclosed housings and SPDT snap-acting switch contacts. Mercury contacts are not permitted. Rolling ball style contacts are not allowed. Cable shall be suitably rated for full liquid immersion and shall be furnished in appropriate length to wire to the WFGD Supplier's termination panel.

Level Switch - Enclosed Cage					
Switch Contacts	**Deadband**	**Switch Construction**	**Cage Construction**	**Material Wetted Parts**	**Acceptable Supplier/Model**
2SPDT	Manufacturer's Standard	Snap Acting	B31.1	Stainless Steel or Buyer approved alternative	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Level Switch - Float Type					
Switch Contacts	**Deadband**	**Switch Construction**	**Cage Construction**	**Material Wetted Parts**	**Acceptable Supplier/Model**
SPDT	Manufacturer's Standard	Snap Acting	N/A	Manufacturer's Standard	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.3.3 Flow Switches
Flow switches shall generally be piston type with an integral indicator. Switch wetted parts shall be suitable for the process fluid.

Flow Switch			
Switch Contacts	**Deadband**	**Material Wetted Parts**	**Acceptable Supplier/Model**
SPDT		Application specific	Manufacturer's standard

K100.4 Temperature Element Assemblies
Each temperature element assembly shall be a thermocouple or resistance temperature detector equipped with a thermowell. Each temperature element and thermowell shall be spring-loaded and furnished as a complete assembly, including well, nipple-union-nipple, and weatherproof connecting head.

K100.4.1 Thermocouples
Each thermocouple shall be furnished packed in a stainless steel sheath with magnesium oxide insulation and shall have an ungrounded measuring junction. Each thermocouple shall be in accordance with the table attached at the end of this section unless otherwise specified, and shall meet the standard limits of error specified in ANSI MC96.1. Extension wire shall be coordinated with the thermocouple type.

K100.4.2 Resistance Temperature Detectors (RTDs)
Each RTD shall be in accordance with the table attached at the end of this section unless otherwise specified, with stainless steel sheath, packed in magnesium oxide. Each RTD shall meet the standard limits of error.

Temperature Element				
Description	**Grounding**	**Construction**	**Switch Contact Ratings**	**Acceptable Supplier/Model**
Thermocouple	Ungrounded	ISA Type E (Chromel-Constantan) with EX Extension Wiring	N/A	Refer to Exhibit E - Acceptable Equipment and Material Supplier List
Resistance Temperature Detector	N/A	Pt 100-ohm (at 0°C), 3-wire type	N/A	Refer to Exhibit E - Acceptable Equipment and Material Supplier List
Special Requirements:	Type E thermocouples are the Buyer's standard thermocouple. If the temperature requirements exceed the Type E application, then ISA Type K thermocouples shall be supplied. RTDs shall only used only when an equipment supplier feels it is prudent for a performance reason.			

K100.5 Thermowells, Protecting Tubes, and Test Wells
Thermowells or protecting tubes shall be provided for all instruments such that the Buyer has the ability to remove the associated temperature instrument while the unit is in service or on-line without harm to personnel or adverse impact on the operation of the unit or equipment.

Thermowells shall be one-piece construction from barstock, with suitable provisions for attachment to the pipe. Welded thermowell tips are not acceptable. When boss/'o-let fittings are used in alloy or non-alloy piping, the fitting material shall match the pipe material. Wells shall be stepless (except for air and flue gas applications) tapered construction.

Thermowells for thermocouples, RTDs and thermometers shall have an inner bore of 0.260 inch. Test wells shall have an inner bore of 0.385 inch, which will permit interchangeability of dial thermometers, test thermometers, thermocouples and RTDs. Thermowell outside diameter at the large end of the taper shall be approximately the same as the root diameter of the threads.

Thermowell accessories for thermocouples and RTDs shall include extension nipple-union-nipples and connection heads. Connection heads shall be weatherproof with screwed covers and connection blocks of appropriate design for the temperature detectors installed. Connection heads shall include grounding screws. Each thermowell shall be furnished with a 6 inch stainless steel nipple-union-nipple assembly in addition to a lagging extension if required to keep the thermocouple head away from the insulation and lagging.

Each element shall be furnished with separate positive and negative terminals for extension wire connection and with a grounding screw for termination of each extension wire shield. Terminal blocks shall be dual style for two temperature elements.

Terminal blocks shall be brass compression style on a ceramic baseplate.

Test wells without permanently installed temperature detectors shall have lagging extensions as needed to clear insulation. Test wells shall be supplied with a stainless steel plug or cap for closure. A stainless steel captive chain shall be included to connect the plug or cap to the test well.

Each duct temperature sensor shall be equipped with a protecting tube. Each protecting tube shall be 1 inch OD standard weight pipe, stainless steel unless otherwise specified, with a bushing provided to

make a 2 inch NPT threaded connection to the duct wall, allowing a variable insertion length into the duct. After the protecting tube has been inserted through the bushing, it will be seal welded to the bushing.

Thermowell material is dictated by the piping material, and essentially falls into one of two categories, e.g., wells installed into alloy pipe and wells installed into non-alloy pipe.

Material for thermowells used in alloy pipe for steam systems, typically ASTM A335 GR P11, P22, P91, or P92, shall match the pipe material using the corresponding ASTM material designation for forged pipe fittings (typically ASTM A182 GR F11, F22, F91, or F92 for steam) when installed using a fitting or in-line welded connection.

Thermowells in non-alloy pipe using a threaded installation shall be constructed of ASTM A479 316 stainless steel. The exception to this requirement is for water-wetted boiler piping and water-wetted non-boiler external piping as defined by ASME BPVC and B31.1. For these ASME defined water-wetted applications, well material shall be in compliance with the ASME codes (i.e., match the pipe material). Wells that are to be in-line welded in non-alloy or any other pipe shall match the pipe material.

K100.6 Transmitters

Transmitters for the measurement of static pressure, differential pressure, level, or flow shall be microprocessor-based and of the 2 wire design. Transmitter sensing element shall be of the diaphragm or capsule type. All wetted parts shall be stainless steel unless the application requires another material.

Tamperproof zero and span adjustment shall be provided. Transmitter accuracy shall be ±0.10 percent of calibrated span or better. Transmitter housing shall be dustproof and moisture-proof.

All transmitters shall be furnished with integral local indicators.

Transmitters shall be furnished with integral manifolds factory attached to the transmitter. Static pressure service transmitters shall be furnished with two-valve manifolds.

Differential pressure service devices shall be furnished with three-valve manifolds that include isolation and equalization valves and test ports with plugs.

Manifolds shall be compliant with ASME B31.1 requirements and shall include grafoil packing with stainless steel.

Manifolds may be constructed of other Buyer-approved materials if required for process compatibility. Transmitters shall be furnished with universal mounting brackets.

Where static pressure transmitters are used for outdoor level service on liquids that can freeze, integral diaphragm seals shall be furnished. Seals shall be stainless steel as a minimum, direct mount flanged style and include flushing rings with plugged ports.

Pressure Transmitter (Static and Differential Types)				
Description	**Transmitter Output**	**Manifold?**	**Material Wetted Parts**	**Acceptable Supplier/Model**
Pressure Transmitter	4-20 mA 2-wire w/HART	Yes	Stainless Steel or Buyer approved alternative	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Pressure Transmitter (Static and Differential Types)				
Description	**Transmitter Output**	**Manifold?**	**Material Wetted Parts**	**Acceptable Supplier/Model**
Level Transmitter	4-20 mA 2-wire w/HART	Yes	Stainless Steel or Buyer approved alternative	Refer to Exhibit E - Acceptable Equipment and Material Supplier List
Flow Transmitter	4-20 mA 2-wire w/HART	Yes	Stainless Steel or Buyer approved alternative	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Flow Transmitter (Nondifferential Pressure Types)			
Transmitter Output	**Energizing Power**	**Material Wetted Parts**	**Acceptable Supplier/Model**
4-20 mA	24 VDC (for 2-wire) 120 VAC (for 4-wire)	Stainless Steel or Buyer approved alternative	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Level Transmitter					
Transmitter Output	**Energizing Power**	**Material Wetted Parts**	**Cage Material**	**Cage Construction**	**Acceptable Supplier/Model**
4-20 mA	24 VDC (for 2-wire) 120VAC (for 4-wire)	Stainless Steel	Manufacturer's Standard	B31.1	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.7 Solenoid Valves

Solenoid valves shall be selected to incorporate body construction, trim materials, and internal arrangements suitable to the application. Each solenoid coil shall be UL listed Class H high temperature construction and shall be suitable for continuous duty.

Solenoid valve construction and CV (orifice size) shall be suitable for the service. Where the manufacturers/models listed below do not meet the process requirements, Buyer approved alternates may be furnished.

Solenoid valves used in non-hazardous service shall include terminal blocks in NEMA 4 enclosures for customer connections.

Solenoid valves used as pilot valves on air actuators shall be pre-tubed. Arrangement shall allow venting of air from the actuator. Normally, three-way valves will be sufficient. However, four-way valves are required for all operators employing springless operation.

Solenoid Valve			
Coil Type	**Coil Rating**	**Manual Operator**	**Acceptable Supplier/Model**
Type H	120 VAC, 60 Hz	Yes	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal

The manufacturer's standard solenoid valves may be furnished for the following applications: dust collector pulse air, hydraulic fluids, and gauged solenoids within an enclosure.

K100.8 Position Switches

Position switches shall be provided for the indication of each remotely actuated device. These devices include, but are not limited to, the following:

Valves.

Dampers.

Gates.

Electric/Pneumatic Drives with Linkages.

Position switches are not required on pilot solenoids or primary drive motors.

Position switches shall be provided in both the "Open" and "Closed" positions of these devices. For devices that modulate in severe service applications (i.e., are controlled by an external modulating signal), a proximity position switch shall be provided in the de-energized position of the device. This includes services such as steam bypass and boiler feed pump recirculation. Additional position switches shall be provided as specified herein.

Top-mounted beacon style indicator and limit switch assemblies shall be furnished for rotary/quarter turn rack & pinion style actuators. Position switch actuation points shall be field adjustable. The limit switch compartment shall also include terminations for the solenoid valve. Beacon indicator color shall be black and yellow.

Switch - Lever			
Description	**Switch Contacts**	**Deadband**	**Acceptable Supplier/Model**
Position Switch – Mechanically Actuated	DPDT	Manufacturer's Standard	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Switch - Proximity			
Description	**Switch Contacts**	**Deadband**	**Acceptable Supplier/Model**
Proximity (Leverless)	DPDT	Manufacturer's Standard	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.9 Pneumatic Valve Positioners and Position Transmitters

Each valve positioner shall be microprocessor based electronic-to-pneumatic design. Each valve positioner shall be designed for a 4-20 mA input range unless otherwise specified and an output signal from zero to the full supply air pressure required by the actuator. Each positioner shall be equipped with a filter regulator air supply set mounted on the valve yoke. Each positioner shall be capable of split-range

sequencing and direct or reverse action. Other features shall include speed and gain adjustment, failure mode choice, noninteractive adjustments, easy pilot access for cleaning, characterization, automatic zero/span calibration, and "HART" protocol for valve position feedback, configuration, and calibration. Position transmitters shall be integral to valve positioners and, if required, shall produce 4-20 mA output in direct relationship to the valve position. The output signal shall be 2 wire, isolated and ±1.0 percent linear.

Positioner			
Manual Operator	**Input Signal**	**Acceptable Supplier/Model**	**Special Requirements**
No	4-20 mA 2-wire	Refer to Exhibit E - Acceptable Equipment and Material Supplier List	Positioner shall be smart type with integral position feedback transmitter

Local Controllers			
Type	**Input Signal**	**Output Signal**	**Acceptable Supplier/Model**
Pneumatic	Process	3-15 psig	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

Filter Regulators		
Type	**Output Range**	**Acceptable Supplier/Model**
Small – Volume Regulator with Filter and Outlet Pressure Gauge	3 to 80 psig	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.10 Radio Frequency Probe Type Level Devices
Each radio frequency (RF) probe type level instrument system shall be constructed to withstand the service conditions of the application. Each level instrument system shall be designed to ignore material buildup or coating on the sensing element and only respond to changes in level. Where required by the manufacturer's design, each level instrument system furnished shall be complete with suitable RF interference filters to eliminate the effect of other transceivers operated in the area. Each point type system output shall use double-pole, double-throw (dpdt) output contacts.

In each application that requires the electronics unit to be mounted separately from the probe, the necessary cable shall be furnished to connect the sensing probe(s) to the separately mounted electronics enclosure. The cable shall be suitable for the environment in which it is installed and shall have the necessary mechanical strength to be pulled through conduit. A factory installed connector shall be installed on only one cable end when the cable is to be installed in conduit. A field installed cable termination kit shall be furnished for the other end.

K100.11 Not Used

K100.12 Not Used

K100.13 Signal Converters

Electric to Pneumatic			
Input Signal	**Output Signal**	**Enclosure**	**Acceptable Supplier/Model**
4-20 mA	3-15 psi	Dustproof and Weatherproof	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.14 Primary Flow Element
Flowmeters shall be furnished as specified and shall generally consist of orifice plate type flow elements, nozzles, and pitot tubes.

Flow elements for general service shall be orifice plates or flow nozzles designed in accordance with ASME MFC-3M-2004. Flow elements for air/gas flow may be nozzles, venturi, or low loss pitot tubes.

The WFGD Supplier shall submit detailed flow calculations and data sheets for each primary flow element that establishes final beta ratios and differential pressure drops, based on the preliminary data sheets. The WFGD Supplier provided flow calculations shall be the basis for the calibration of the corresponding flow transmitters.

The WFGD Supplier shall be responsible for verifying physical properties used in calculations, such as viscosity, density, and isentropic expansion coefficient, of the specified fluid or gas at the temperatures and pressures specified on the data sheets.

Orifice plates shall be sized to operate as follows:

- For gases and vapors, differentials between 20 and 100 inches of water are preferred. The ratio of differential pressure to static pressure shall be < 1.0 to maintain the expansion adjustment factor within its empirical correlation in accordance with ASME MFC 3M, AGA Report #3, and ISO 5167. In other words, the differential pressure, expressed in inches water column, shall never be more than the inlet pressure expressed in psia.
- For liquids, a differential of 100~200 inches of water is preferred.
- Beta ratio shall range between 0.3 and 0.65, with 0.4 to 0.6 preferred.

In circumstances where a larger range than noted above is required, it is more desirable to increase the meter differential than to increase the meter run pipe diameter.

Orifice plates shall be thin plate square edge concentric orifice plates. Orifice plates shall be constructed of materials suitable to the process conditions.

Each orifice plate shall be furnished with a handle on which the tag number, material, orifice (bore) diameter, the word "INLET," the pipe inside diameter, and the type of orifice plate ("FLANGE TAP") are stamped and electro-etched. The data shall appear on the inlet side (side installed facing upstream) and shall be located on the handle so that it can be read without removing the orifice plate from the pipeline.

Pitot tubes shall be averaging style, reverse/impact style and include any required straightening vanes, shrouds, etc. to ensure reliable/accurate flow measurement as required for the application. Pitot tubes shall include chamfered pressure ports as required for high angle of attack installations.

Flow nozzles shall be of the ASME long radius weld-in low or high beta ratio type nozzles. Flow nozzles shall be constructed of materials suitable for the process conditions. Flow nozzles shall be constructed so that they can be welded between two adjacent sections of pipe. Where the two pipe sections meet, the nozzle shall include a 1/4 inch wide raised shoulder around the perimeter of the nozzle. The shoulder

shall provide the weld root gap between the two pipe sections. Flow nozzles may also be insertion-type, to be mounted between piping flanges. This allows removal for maintenance or replacement in slurry, corrosive or erosive services.

Essential data shall be stamped on a sheet metal tag suitable for tack welding to a steel band. The piping fabricator shall be responsible for permanently attaching the tag to the pipe exterior near the nozzle inlet with a steel band.

The essential data to be stamped shall include the following:

Flow element tag number.

Flow element serial number.

Actual bored pipe diameter.

Actual bored nozzle diameter.

Flow direction.

Flow Element Type	Acceptable Supplier
Orifice plates, flow nozzles, venturis, pitot tubes	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K100.15 Vibration Switches
Vibration switches shall not be used on any equipment except for the agitators. Except for the agitators, if the vibration of a piece of equipment must be monitored, vibration probes or transmitters shall be provided.

K100.16 Vibration Transmitters
The WFGD Supplier shall select, design, and furnish vibration transmitter devices suitable for the service. Transmitters for vibration velocity or proximity shall be furnished as specified. Each device shall transmit a 4-20 mA signal that is proportional to peak velocity or proximity. Devices shall be 24 VDC loop powered. Loop power shall be furnished by the Buyer. Transmitter range shall be in English units and specified by the driven equipment and motor manufacturer. Range shall be compatible with the expected vibration conditions associated with the equipment. High pass or low pass filtering shall be provided if recommended by the supplier. Other filtering devices shall be provided as required to shield the transmitters against ambient electrical noise from sources such as medium voltage switching equipment, variable frequency drives, plant radios, and other RF interferences

Unless specified elsewhere, vibration probe selection shall be dictated by the equipment manufacturer based on their experience and success with specific technologies. All vibration probes shall include loop powered 4-20 mA NEMA 4 rated transmitters for wiring to the Customer's monitoring equipment. Where no recommendation is provided (either by the manufacturer or elsewhere in this specification), velocity probes or accelerometers shall generally be used for anti-friction style bearings (roller bearings), for fans, for recycle pumps, gear reducers and for casing vibrations. Proximity probes shall be used for sleeve-style/oil supported bearings or other applications where differential movement between the rotor and the bearing housing can be detected, such as for the recycle pump motors.

WFGD Supplier shall ensure that the proximity probe is compatible with the rotor shaft material. Proximity probe calibration shall be conducted in the probe manufacturer's shop using target materials that match the rotor shaft.

Vibration transducers and associated proximitors shall be provided on all motors greater than 499 HP, and all associated gear boxes, fans, compressors, etc. when the associated motor horsepower is greater than 499 HP.

Transmitters shall be installed on equipment by the manufacturer and factory wired to terminal blocks in a skid mounted, common NEMA 4 junction box.

Vibration Transmitters				
Description	**Transmitter Output**	**Construction**	**Voltage**	**Acceptable Supplier/Model**
Vibration Transmitter (velocity or proximity)	4-20 mA 2-wire	NEMA 4	24 VDC	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

K120 Instrument Valves and Instrument Primary Piping and/or Tubing
(Source: 16Feb10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

K120.1 General Requirements
All instrument primary piping and tubing, instrument valve manifolds, instrument shutoff valves, instrument check valves, instrument equalizing valves, and instrument blowdown valves shall be supplied, installed and tested in accordance with ASME B31.1 - Power Piping and Technical Supplemental M200 in accordance with the piping material specification.

Where applicable, the instrumentation shall be installed with unions, isolation valves, or flanges so that the instrument can be easily removed for maintenance. The installation of the equipment shall be approved and acceptable to the Buyer. Space shall be provided for removal of instrumentation from the piping or equipment when the piping is routed or when the equipment is located in the plant arrangements.

Instrument primary piping and tubing is defined as the piping or tubing from the process connection root valve to the blowdown and the instrument valves or manifold.

Changes in tubing direction shall be made only with tube fittings or tube bending. Tubing bends shall be made without reducing the internal diameter of the tubing. All tubing shall be thoroughly cleaned of burrs and blown clean with dry compressed air after installation, but prior to attachment to devices at either end. Chemical cleaning may be required, based on tubing exposure to process chemicals.

K120.2 Instrument Primary Piping
Instrument primary piping external to instrument enclosures or racks shall meet the requirements stated in M200.

K120.3 Instrument Primary Tubing
Tubing shall be supported to allow thermal expansion, minimize vibration and protect it from damage. Tubing shall be continuously supported. Fittings shall be offset or raised to allow wrench clearance for installation/removal. Support using connection to structural steel is allowable when it provides equivalent protection from damage and vibration.

Instrument tubing sensing lines shall be installed as short as possible, yet consistent with slope requirements:

- Gas or condensable vapors – 1/2 inch or more per foot run of slope down to tap.
- Liquid – 1/2 inch or more per foot run of slope down to the instrument.

Electric traced tubing shall be assembled using the manufacturer's splice kits. In no case shall trace tubing be field spliced using any other method. It is imperative that tracing shall cover the entire process tubing run, from and including piping block valves to and including the instrument itself.

Plastic covered copper tubing shall not be used.

All instrument tubing shall be a minimum of ½ inch OD, 316L, SS, minimum wall.

K120.4 Control and Instrument Enclosure/Rack Tubing
Instrument tubing within enclosures or racks shall be arranged to allow any device to be serviced, disconnected, or removed from the enclosure or rack without disconnecting tubing to other devices. Tubing for external connections shall be terminated on a bulkhead plate, utilizing bulkhead fittings for enclosures, or unions for open racks. Each bulkhead termination shall be identified with a nameplate.

K120.5 Instrument Valves and Valve Manifolds
Each pressure instrument shall be installed downstream of an instrument shutoff valve or instrument valve manifold designed for instrument shutoff service. The instrument shutoff valve or instrument valve manifold shall be in addition to the process instrument isolation (root) valve for the instrument.

Each static pressure instrument shall be provided with a two-valve manifold. Alternatively, direct mounted static pressure indicators may be furnished with a plugged tee.

Each differential pressure instrument shall be provided with a three-valve manifold that includes isolation and equalization valves, and test ports with plugs.

Each instrument valve manifold shall be provided with integral dual ferrule grip type tube fittings for process connections.

Instrument valves and manifolds shall be compliant with ASME B31.1 and shall include Grafoil packing with stainless steel construction or suitable materials in accordance with the piping specification.

Other Buyer-approved materials shall be used if stainless steel is not suitable for the service.

K120.6 Blowdown Valves
A blowdown valve shall be provided for each instrument primary line except oil, draft, and vacuum services. Each blowdown valve shall have a globe pattern design, stainless steel construction, a Grafoil packed stem, and a minimum 0.25 inch orifice.

K120.7 Instrument Valves, Fittings, and Support Tray

Instrument Process Components	Acceptable Supplier/Model
Tubing - Grip Type Fittings	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Tubing - Socket-Weld Fittings	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Valve Manifolds	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal

Instrument Process Components	Acceptable Supplier/Model
Instrument Shutoff Valve	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Instrument Equalizing Valve	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Instrument Blowdown Valve	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal
Instrument Tubing Support Tray	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer Approved Equal

K120.8 Instrument Installation Details
Instrument installation details shall be submitted for approval for each instrument supplied. The instrument installation details furnished shall show all valves, instrument manifolds, tubing, fittings, and devices from the instrument isolation (root) valves required to support installation of the instrument. The instrument installation details shall include a bill of materials in sufficient detail to support procurement of materials. The instrument installation details and associated bill of materials shall identify the WFGD Supplier's scope of supply and the Buyer's scope of supply.

Inline instruments, level gauge glasses and other bridle-mounted instrument installations shall be shown either on installation detail drawings or on dimensioned piping drawings.

M110 Enclosed Gear Drive Units
(Source: 27Jan04 - Revised by Project: N/A)

Enclosed gear drive units furnished with equipment shall be designed for continuous service and in accordance with the most current AGMA standards for the type of gear drive being furnished.

Each gear drive unit shall be capable of withstanding the motor torques developed during start, acceleration, and deceleration (if stalled).

M120 Shaft Couplings
(Source: 27Jan04 - Revised by Project: N/A)

Shaft couplings shall be used between all drives and driven equipment. Couplings shall be attached to driver and driven shafts by press fits and keys. Unless otherwise specified, couplings shall be of the non-lubricated all metal flexible disk type, with spacers of sufficient length to permit maintenance of the equipment seals and bearings without disturbing either the main motor or the equipment main connections. Couplings for motors with ratings less than 250 hp may have elastomeric rather than metal flexible elements.

Shaft couplings shall be sized to transmit the maximum brake power requirements of the driven equipment with a service factor of not less than 2.

M130 Equipment Bases
(Source: 27Jan04 - Revised by Project: N/A)

Baseplates shall be cast iron or fabricated steel and shall support the unit and its drive assembly (if applicable). Each baseplate shall have pads for anchoring the units. Grout holes shall be provided to allow proper installation of flowable grout. Baseplates for equipment subject to water or oil leakage shall be provided with a raised lip perimeter suitable for collecting all leakages and shall have an ANSI B1.20.1 threaded drain connection.

M140 Rotating Equipment Design Criteria
(Source: 27Jan04 - Revised by Project: N/A)

All rotating parts shall be true and balanced. All rotating equipment shall be balanced at the factory. Excessive noise or vibration, in the opinion of the Buyer, will be cause for rejection of the equipment.

All rotating equipment shall be designed such that shaft critical frequencies do not occur within ±25 percent of the operating frequency.

Electric motors shall be balanced by the manufacturer in accordance with NEMA standards. All other rotating equipment shall be factory balanced to a level such that vibration displacement in mils peak-to-peak is not more than indicated as "FAIR" in ASME Publication 67-PEM-14, "Vibration Tolerances in Industry," or as required for reliability and longevity, whichever requirement, as determined by the Buyer, is more stringent.

All gear boxes, speed reducers, valve operators, and damper operators shall be designed with a 1.5 service factor and be designed for continuous operation. All motors shall have a 1.15 service factor and be designed for continuous operation. All motors in a corrosive environment, located outdoors, or subject to washdown (any area where there is ash, coal dust, or slurry is present) shall be TEFC.

M200 Piping
(Source: 19Dec09 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

All piping and pipe supports shall be in accordance with ASME B31.1 - Power Piping. Materials and wall thickness of piping and fittings will be selected based on design conditions established for the piping system. The following minimum requirements shall apply:

Table 1 - General Pipe and Tubing Selection Criteria

			Minimum Wall Thickness		
Material	**Typical Standard**	**Typical Temperature Range**	**Diameter Less Than or Equal to 2 Inches**	**Diameter Greater Than 2 Inches**	**Notes**

Table 1 - General Pipe and Tubing Selection Criteria					
			Minimum Wall Thickness		
Material	**Typical Standard**	**Typical Temperature Range**	**Diameter Less Than or Equal to 2 Inches**	**Diameter Greater Than 2 Inches**	**Notes**
Carbon steel	A53, A106, A134, A672, AWWA	-20° F to 800° F (-29° C to 425° C)	Sch XS	Std wt	For lined pipe, other criteria may be used as approved by Buyer. AWWA is used for large diameter water service only.
Stainless steel	A312	-20° F to 1,200° F (-29° C to 650° C)	Sch 10S	Sch 10S	Min carbon 0.04 percent
SS tubing	A213 316L. minimum ½" OD Min wall thickness	-20° F to 1,200° F (-29° C to 650° C)	Refer to Table 4	--	U not allowed, min carbon 0.04 percent for supercritical services or for flowing services with temperatures >1000° F, Rockwell hardness less than B90 (B80 or less preferred)
Concrete cylinder pipe	AWWA	32° F to 150° F (0° C to 65° C)	--	Varies	Specific type of pipe varies
HDPE	ASTM D3350	0° F to 120° F	SDR 11	SDR17	Air, slurry, ash, or water service (PE100 resin or heavier wall required for compressed air service).
PVC/CPVC	D1785 F441	40° F to 180° F (5° C to 82° C)	Sch 40	Sch 40	Use with Buyer approval only
Ductile/Cast Iron	C151 A123	40° F to 215° F (5° C to 102° C)	--	Class 50	--
FRP	Varies	40° F to 210° F (5° C to 100° C)	Varies	Varies	Use with Buyer approval only
Use Schedule 40CS for house air and 304 SS Schedule 40S for instrument air.					

Pipe 2" and smaller shall be socket welded. Pipe larger than 2" shall be butt welded and flanged. Threaded pipe may be used for fire protection and plumbing only.

The following pipe sizes shall be used for carbon steel and low/intermediate alloy steel. Other sizes shall not be used:

Table 2 - Carbon/Low Alloy Pipe			
NPS	**Service**	**Schedules**	**Connections**
1 inch	All	XS, XXS	SW or flanged
2 inch	All	XS, 160, XXS	SW or flanged
2-1/2 inch and up	All	Std wt min	BW or flanged

The following pipe sizes shall be used for stainless steel pipe. Other sizes shall not be used:

Table 3 - Stainless Steel Pipe			
NPS	**Service**	**Schedules**	**Connections**
1 inch	All	10S, 40S, 80S	SW or flanged
2 inch	All	10S, 40S, 80S	SW or flanged
2-1/2 inch and up	All	10S and up	BW or flanged

The following tubing specifications shall be used for chemical feed, instrumentation, compressed air, and sample line systems.

Tubing material shall be stainless steel tubing and shall be joined with automatic butt-welding fittings, grip fittings, or socket-welded fittings as described below:

Table 4 - Tubing Requirements	
Tubing Design Parameter	**Project Design Basis**
Tubing fittings (wall less than or equal to 0.083 inch)	316 SS butt-weld or grip type fittings
Tubing fittings (wall greater than 0.083 inch)	316 SS butt-weld or socket-weld fittings
Tubing direction changes	Tubing fitting or bending (bending will affect pressure and temperature rating)
Tubing supports	Per B31.1 and as required to allow thermal expansion or to protect tube from damage

Table 4 - Tubing Requirements	
Tubing Design Parameter	**Project Design Basis**
Tubing design pressure and temperature	In accordance with mechanical design criteria for process pipe and B31.1
Tubing Sizing	
Pressure measurement tubing, sample lines, chemical lines, compressed air	1/2 inch OD with nominal wall thickness of 0.049, 0.065, or 0.083 inch, depending on process design pressures and temperatures and B31.1. Actual minimum wall thickness (accounting for tolerances allowed by the material specification) must meet or exceed the requirements of B31.1.
Sample lines, compressed air	3/8 inch OD with nominal wall thickness of 0.049, 0.065, or 0.083 inch, depending on process design pressures and temperatures and B31.1. Actual minimum wall thickness (accounting for tolerances allowed by the material specification) must meet or exceed the requirements of B31.1.
Flow and level measurement by differential pressure	Use pressure tubing criteria except for steam applications with condensate pots (piped)
Using separate instrument manifolds (not direct mounted)	1/4 inch OD with minimal wall thickness of 0.049 inch as flex lines (less than 36 inch length)
Note: Direct manifold mounting to the instrument is preferred.	

Seam Welded Pipe

Seam welded pipe shall not be used.

Table 5 - Not Used

Fittings, Flanges, and Valves

Fittings, flanges, and valves shall be in accordance with the requirements which follow:

Table 6 - Fittings and Flanges	
System/Application	**Limitations**
Fittings 2-1/2 inches and larger	Butt-weld type, in accordance with ASME B16.9
Fittings 2 inches and smaller	Forged steel socket-welded type, in accordance with ANSI B16.11
Flanges, nonmetallic with metallic backing ring	Flat faced slip-on or socket-welded for thermal or solvent welding

Flanges, cast iron or steel, to mate with nonmetallic flanges	Flat faced slip-on type or threaded, in accordance with B16.5
Flanges, 150 class	Raised face weld neck or slip-on type, in accordance with B16.5
Flanges, 300 class and higher	Raised face weld neck type only, in accordance with B16.5
Grooved pipe joints	Rolled or cut grooved joints in accordance with AWWA C-606 (rolled grooves preferred)
Crimp type joints	Not allowed

All welded fittings shall be of the same material as the pipe. Forged steel socket-welded and threaded fittings shall have the minimum class rating described below:

Table 7 - Forged Steel Fittings Minimum Class Ratings		
Pipe Wall Thickness	**Threaded Fittings**	**Socket-Welded Fittings**
Schedule 80 and less	3,000	3,000
Over Schedule 80 to Schedule 160	3,000	6,000
Over Schedule 160 to Schedule XXS	6,000	9,000

Integrally reinforced branch fittings shall have the minimum class rating described below. All welded fittings shall be of the same material as the header pipe. Fittings between dissimilar branch/header materials shall be considered on a case-by-case basis:

Table 8 - Integrally Reinforced Branch Fittings Minimum Class Ratings		
Pipe Wall Thickness	**Threaded Fittings**	**Socket-Welded Fittings**
Schedule 80 and less	3,000	3,000
Over Schedule 80 to Schedule 160	6,000	6,000
Over Schedule 160 to Schedule XXS	9,000*	9,000
Fitting supplier must verify that the class is suitable for the application.		

Table 9 - Valves	
System/Application	**Limitations**
2-1/2 inch and larger	Carbon steel, stainless steel, or other, corresponding to pipe material; ASME Pressure Class 150 minimum; butt-welded, flanged, or grooved ends; cast or forged steel bodies, with pressure/temperature ratings in accordance with ANSI B16.34

Table 9 - Valves	
System/Application	**Limitations**
2 inch and smaller	Carbon steel, ASME Pressure Class 600 minimum, socket-welded ends, forged steel bodies, with pressure/temperature ratings in accordance with ASME B16.34. Control valves and other special applications may deviate from these requirements.

Joints shall be provided as required to facilitate assembly or disassembly of equipment. Pipe unions shall not be used.

Pipe ends for socket-welded connections shall be reamed to full inside diameter to remove all burrs and obstructions. Fittings shall be used for all changes in direction.

Butt-weld end preparations shall be in accordance with Technical Supplemental Q210, Welding of Power Piping.

Gaskets

Some chemical and glycol systems may require the use of different gasket materials. Gaskets shall be as follows:

Table 10 - Gaskets		
Joint	**Gasket**	**Limitations**
Class 150 SW flanges and RF SO flanges	1/16 inch compressed fiber type, nonasbestos	Class 150 systems or lower within temperature limits of gasket material
FF, nonmetallic, and cast iron flanges	1/8 inch red rubber type (EPDM for hot service)	With backing rings as needed. Up to 150° F only; above 150° F to 215° F, use EPDM.
RF flanges (except as above)	Spiral wound type, nonasbestos	--
Grooved pipe joints	EPDM (water) or nitrile (air) rubber	Cold air and water systems (less than or equal to 215° F and less than or equal to 300 psig)
Bell and spigot cast iron and ductile iron	EPDM	Gravity drains less than or equal to 215° F and roof conduits
Mechanical joints and bell and spigot cast iron and ductile iron with restrained joints	EPDM	Cold water systems (less than or equal to 215° F and less than or equal to 300 psig)

M200.1 Flow Accelerated Corrosion
In addition to the above requirements, piping components in applications that could be subject to flow accelerated corrosion (FAC) shall be in accordance with the following. Industry experience has shown

that carbon steel piping with fluid temperatures less than 500° F and greater than 200° F is susceptible to FAC. To resist the effects of FAC, carbon steel piping with operating temperatures in this range shall have a chromium equivalent of 0.16 percent or greater (including pipe and weld consumables for the root pass). Chromium equivalent is defined as follows:

$$CrEq = Cr + 0.19\ Mo + 0.4\ Cu$$

where:

CrEq is chromium equivalent,
Cr is percent chromium
Mo is percent molybdenum, and
Cu is percent copper.

The percent chromium, Cr, shall be a minimum of 0.1 percent. Material/mill test certificates, including chromium content, shall be provided for all carbon steel components with operating temperatures in this range. In addition, a corrosion allowance of 0.0625 inch shall be provided for carbon steel piping with operating temperatures in this range.

M201 Filament Wound Pipe (FRP)
(Source: 28Sept11 (LG&E/KU) - Revised by Project: N/A)

M201.1 Scope
This Specification defines the requirements of all FRP Fabrication external and internal to the absorber vessel used for the Wet Flue Gas Desulfurization System (FGD). This will include materials of construction, workmanship, design requirements, inspection, and testing of FRP pipe. Piping shall be used in process piping systems exhibiting aggressive chemical environments at service temperatures up to a maximum of 180°F.

M201.2 Fabrication Details
- All elbows shall be long radius type (1 1/2" dia.). (No miter elbows).
- All bolts for recycle pipe and oxidation air pipe, if used, shall have double nuts inside the absorber.
- Concentricity of adjacent parts and alignment of internal surfaces shall be within 1/16 inch.

M201.3 Resins
- The resin used shall be Dow Chemical Derakane 411-45, Hetron (Ashland Chemical) FR 922, Corezyn (Interplastics) 8710 (or 8300), Atlac 580 Vinylester, or purchaser approved equal throughout. The pipe manufacturer must have satisfactory experience with the resin.
- Resins shall be classified as Class 1. The erosion barrier shall consist of silica carbide unless otherwise approved by the Buyer.
- Resins shall not contain fillers or pigments unless otherwise specified and the selected resin shall be used throughout all layers of the pipe, fitting walls and flanges. Pipe shall contain corrosion resistant high temperature and flame resistant resin and glass. (No hazardous chemicals allowed.)
- Chemical surfacing mat (veil) shall be Type "C" (chemical) glass, 10-20 mils thick, with a silane finish and binder compatible with the specified resin.
- An inner surface reinforced with an organic surfacing veil followed by Type "C" veil is required for all services. The organic veil shall be Nexus Type 100-10 Open Style (12-16 mils), Dacron Polyester, or approved equal.
- Chopped strand mat shall be Type "E" (electrical-borosilicate) glass, 1-1/2 oz per square foot, with a silane finish and a styrene-soluble reactive binder compatible with the specified resin.

- Continuous roving used for filament winding shall be Type "E" glass with a silane finish.
- Woven roving shall be Type "E" glass, nominal 24 oz/square yard with a silane finish.

M201.4 Construction

- Filament wound FRP pipe shall conform to the requirements of ASTM D 2310 and D 2996 and this Specification. The pipe shall meet or exceed the requirements of Type 1, Grade 2, Class E, and have an inner and outer resin-rich corrosion liner as required.
- The inner surface shall be an integral layer of resin and chemical surfacing mat to resist abrasion and corrosion. For all slurry pipe, the interior surface layer shall contain a minimum .2" abrasion resistant silicon carbide lining. The veil shall be wound into the resin, completely wet out and have at least a 1 inch over-lap. The abrasion resistant lining shall not be part of the structural design. Mist eliminator wash pipe shall not require erosion liners. FRP oxidation air pipe, if used, shall require an abrasion resistant lining on the exterior only.
- The interior layer shall be composed of resin and chopped strand "E" glass mat. The mat fibers shall be 1 to 2 inches in length and bonded into a mat form using a resin that is compatible with the selected pipe resin. The mat shall be wound in the resin with at least a 1 inch overlap and assuring a complete wet out of the fibers.
- The surface of the exterior layer shall contain a minimum .2" exterior abrasion resistant silicon carbide lining inside modules. All piping shall be protected by adding an ultraviolet inhibitor to the final resin coat.
- The design pressure will be specified by the Supplier. These thicknesses are required for the exterior layer (structural layer). The total wall thickness shall consist of the exterior layer plus the abrasion/corrosion liner.
- For pipe sizes 1"-12" diameter, the method of joining for straight runs over 60 feet shall be an adhesive bonded, tapered bell and spigot joint. For straight runs of pipe, furnish flanges at every 120 feet. For sizes 12" diameter and above, all recycle pipe of any size, all assemblies and manifolds of any size, all pipe inside the absorber building of any size, the tapered butt joint or butt and strap joint shall be used.
- A data sheet shall be prepared by the manufacturer for each section or production lot of the pipe. Two copies of the data shall be shipped with the pipe after inspection has been completed. No pipe shall be shipped until the inspection has been made.
- The following information shall be supplied with the bid or quotation unless otherwise noted:
    a) Description of construction to be employed for pipe and fittings.
    b) Resin system to be used including catalysts.
    c) Silicon carbide content of abrasion resistant layer.
    d) Safety plan for controlling environmental and fire hazards.
    e) Internal absorber assembly plan showing locations of assembly flanges and clean outs inside the absorber module.
- The Buyer requires the filament wound FRP pipe manufacturer to be RPS, Ershigs, An-Cor, PPP, Fibrex or Buyer approved equal.
- The manufacturer shall employ qualified Quality Control inspectors who are empowered to approve or reject materials and products in accordance with the guidelines established by the manufacturer's Quality Assurance Program. The Quality Assurance Program shall be submitted to the Owner for review and approval.

M220 Compressed Air Piping and Tubing
(Source: 01Mar11 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

M220.1 General Requirements
Compressed air piping and tubing shall comply with the requirements of ASME B31.1 - Power Piping or ASME B31.3 – Process Piping, as applicable.

Compressed air piping and tubing within control and instrument enclosures/racks shall be arranged to allow any device to be serviced, disconnected, or removed from the enclosure without disconnecting piping or tubing to other devices. Piping and tubing for external connections shall be terminated on a bulkhead plate utilizing bulkhead fittings for enclosures or unions for open racks. Each bulkhead termination shall be identified by nameplates.

Where the Victaulic PressFit® system is used, air supply shutoff valves shall be brass or stainless steel full ported ball valves with virgin TFE seats and seals and shall be provided for common air supply headers and for each individual air user.

Air user isolation ball valves shall include a lockable handle.

All tubing shall be thoroughly cleaned of burrs and blown clean with dry compressed air after routing but prior to attachment to devices at either end.

For tubing lines less than 1/2 inch nominal size, tubing runs greater than 3 feet shall be supported to allow thermal expansion or to protect tube from damage. When tubing lines are 1/2 inch nominal size or larger, supports for both horizontal and vertical tubing runs shall be furnished at intervals not to exceed 5 feet. Tubing runs shall be supported as required to minimize vibration and tube damage. Tubing runs shall slope downward to low point drains or filter regulators and drains. Tubing bends shall be made without reducing the internal diameter of the tubing.

Piping and tubing schematic, connection, and interconnection diagrams for each air user shall be submitted to the Buyer for acceptance.

M220.2 Signal Air
Signal air consists of air tubing used for the transmission of modulated pneumatic commands to control equipment such as valves or dampers. Signal air tubing is most commonly found on pneumatically actuated valves between the positioner and the actuator.

Signal air lines shall be 1/4 inch outside diameter, 316 stainless steel tubing, ASTM A213, with 0.049 inch wall thickness, joined with grip type stainless steel fittings.

M220.3 Supply Air
Supply air consists of main and branch air header piping used to provide pneumatic power to equipment such as skids, control valves, damper drives, or other devices.

Supply air lines 3/4 inch nominal size and larger shall be Victaulic stainless steel press-fit system with Nitrile O-rings. All changes in direction shall be made with fittings. Low points shall be provided with drain legs and drain valves. Supply air lines 1/2 inch outside diameter and smaller shall be ASTM A213, 0.049 inch wall thickness, 316 stainless steel tubing, joined with grip type stainless steel compression fittings.

Flexible hoses are the preferred means to connect supply air lines to air users. Threaded stainless steel Schedule 80 nipples (less than 2 inches long) and fittings may be used to connect air supply line accessories.

Compressed Air Valves				
Valve	**Material**	**Pressure Rating, psi**	**Temperature Rating, °F**	**Acceptable Supplier/Model**

Compressed Air Valves				
Valve	**Material**	**Pressure Rating, psi**	**Temperature Rating, °F**	**Acceptable Supplier/Model**
Regulating Valve	Stainless Steel	150	400	Manufacturer's Standard as acceptable to the Buyer
Shutoff Valve	Stainless Steel	150	250	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer approved equal
Drain Valve	Stainless Steel	150	400	Refer to Exhibit E - Acceptable Equipment and Material Supplier List or Buyer approved equal

Compressed Air Fittings		
Fitting	**Fitting Acceptable Material**	**Acceptable Supplier/Model**
Grip/compression style	Stainless Steel	Refer to Exhibit E - Acceptable Equipment and Material Supplier List
Threaded	Stainless Steel	Refer to Exhibit E - Acceptable Equipment and Material Supplier List

M400 Safety Guards
(Source: 20May04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

Guards shall be provided for protection of personnel from all exposed moving and/or rotating machine elements. Guards shall be in accordance with OSHA requirements and as specified herein.

Each guard shall be fabricated from ASTM A36 steel plate having a minimum thickness of 3/16 inch and designed for easy installation and removal. Necessary supports and accessories shall be furnished with each guard.

Guards for outdoor installation shall be galvanized.

M400.1 Horizontal Shaft Equipment
Safety guards for horizontal shafts, shaft couplings, belt sheaves, etc., shall be of the inverted "U" design with sides extending to the equipment base or baseplate.

M400.2 Vertical Shaft Equipment
Safety guards for vertical shafts, shaft couplings, etc., shall be of 360 degree construction with bolted vertical joints. Hinged sections shall be provided for inspection of couplings and glands, and shall be sized to allow removal of couplings and glands without complete guard removal.

M500 Lubrication Systems
(Source: 27Jan04 - Revised by Project: N/A)

Equipment shall be lubricated by systems designed for continuous operation. Lubrication systems shall not waste lubricants and shall not require attention during startup and shutdown or routine inspection more frequently than once weekly.

Oil lubricant level indicators shall be furnished and marked to indicate proper levels under both standstill and operating conditions.

M710 Compressed Air
(Source: 27Jan04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

Filtered, dried, oil free compressed air will be supplied for operation of pneumatic instruments and control valves. Normal service air will be supplied for operation of other pneumatic devices. The compressed air will be supplied at receiver pressure varying from 60 to 150 psi.

Pressure regulators with pressure gauges shall be provided for pneumatic devices which operate at pressure levels less than maximum receiver pressure. Where pneumatic drives operate at full receiver air supply pressure, air filters shall be furnished. Air filters shall be provided with pressure gauges.

M720 Equipment Cooling Water
(Source: 27Jan04 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

Plant cooling water will be available at the specified pressure and temperature for cooling bearings, drives, and other equipment located in the main plant area. A complete listing of all equipment requiring cooling water shall be submitted, including flows, pressure drops, and temperature rise or heat load. Equipment using cooling water shall be designed for 150 psig design pressure. Cooling water pressure drop across any equipment shall not exceed 10 psi.

The plant cooling water characteristics are described in Exhibit S – Site and Site Conditions. The quality of the plant cooling water will also be impacted by adding suitable inhibitors.

Q100 Special Requirements for AQCS Welding

1.0 In order to prevent the corrosive buildup of flue gas and ash, the internal members and internal walls of all equipment, both alloy and carbon steel, that are exposed to flue gas or slurry, shall be seal welded on the inside. Additionally, the internal members and walls of all tanks and silos shall be seal welded on the inside. All seal welds shall be at least the thickness of the thinnest plate being joined up to ¼". As-welded surfaces are permitted; however, the surfaces of welds shall be uniform in width and size throughout their full length and shall be free from coarse ripples, grooves, overlaps, abrupt ridges, and valleys. The surface condition of the finished welds shall be suitable for the proper interpretation of nondestructive examinations. Applicable additional requirements are listed below. If the surface of the weld requires grinding to meet the above criteria, care shall be taken to avoid reducing the weld or base material below the minimum required thickness.

2.0 All tanks and silos shall be constructed in accordance with API 650. In no case shall any silo or tank be designed to contain materials with a specific gravity less than 1.0.

3.0 The minimum thickness of carbon steel plate exposed to flue gas shall be ¼".

4.0 The goal of these specifications is to ensure that all welds provide structural integrity and that all welds exposed to flue gas and slurry, both alloy and carbon steel, provide an erosion proof and corrosion proof barrier and that there are no crevices or voids that can accumulate corrosive ash or slurry deposits. To this end, butt welding shall be the preferred method of joining flue gas barrier plate such as duct walls, PJFF walls, etc. Where butt welding is not practical, lap joints shall be made using double fillet welds on the inside and outside of the plate. All filet welds used as a gas barrier shall have a minimum thickness equal to the thinnest plate being joined. Where the plate is exposed to flue gas on two sides, both sides shall be seal welded. Where stiffeners are installed on the inside face of duct walls or equipment walls, the stiffeners shall be seal welded all around to preclude build up of ash or slurry in crevices.

5.0 All carbon steel flue gas containing ducts and equipment, including but not limited to PJFF, precipitators, etc., shall be subject to a "diesel test" to be performed with an environmentally friendly diesel substitute. This test shall be in addition to the required visual inspection by a CWI. (All alloy welds shall be tested by vacuum box testing and or die penetrate testing as described below.) The diesel test shall be performed on all fabricated components before they leave the shop and again for all assembled components after they are erected but before they are insulated or painted. Procedures for this test must be approved by the Buyer prior to start of work.

6.0 All alloy lining sheets, such as those being applied around the doors and expansion joints and those used to line ducts shall be detailed in such a way as to minimize the number of joints and welds. As an example, in order to install two feet of wall paper around duct doors, furnish two "L" shaped plates. All cut sheets and alloy lining details must be submitted to and approved by the Buyer. Drawings for every detail must be submitted. For duct lining projects, avoid welding in corners by bending lining sheets in corners.

7.0 For corrosion resistant stainless steel and nickel alloys, pulsed arc MIG shall be used for all welding with the exception that tacking and minor repairs may be performed by TIG welding.

8.0 In addition to requirements listed below, these additional requirements shall apply to structural work:

8.1 BUTT JOINT SPLICES

8.1.1 All butt joint splices in columns and beams shall have 100 percent radiographic or ultrasonic examination.

8.2 COMPLETE JOINT PENETRATION T-JOINTS

Pulsed only is allowed for corrosion resistant alloys with the use of GTAW for minor repairs and tacking.)

4.2 The short circulating transfer mode of GMAW shall not be used for any ASME or National Board welding. This method may be used for other codes and non-code work for the root pass welding of pipe or sheet not exceeding .188" in thickness.

4.3 All low hydrogen electrodes shall be kept dry. Electrodes from an open container shall be properly maintained in a rod oven. Welders shall use working personal hot boxes to maintain their rods' dryness.

5.0 VISUAL INSPECTION

5.1 All welders shall ensure proper cleaning and fit up of their work prior to starting. They shall clean and make initial inspection of their own work prior to moving on to other work. Personnel performing final visual inspection of welds shall be qualified and currently certified as a Certified Welding Inspector in accordance with the American Welding Society, AWS QC 1, Standard for Qualification and Certification of Welding Inspectors. No welding shall take place until the welding inspector examines the work to ensure that it is properly cleaned and fit. Welds shall not be given final visual examination until they are thoroughly cleaned. A minimum of one inspector shall be available for each site and shift where welding is taking place.

6.0 NONDESTRUCTIVE EXAMINATION

6.1 If required by the contract, procedures meeting the requirements of ASNT SNT-TC-1A shall be submitted to the LG&E-KU engineer for approval.

6.2 Personnel performing the NDE shall meet the requirements of ASNT SNT-TC-IA. Personnel responsible for interpreting the test results shall be certified as either a Level II or Level III examiner.

6.3 LG&E-KU may remove test coupons and/or order NDE by an independent laboratory or testing contractor in addition to any examinations specified in the contract. If the welds are found to be defective, the WFGD Supplier shall pay for the tests and shall cover the cost of correcting the weld defects. Weld acceptance standards shall be per the referenced code.

6.4 All NDE shall be documented and a copy of the results submitted to the LG&E-KU engineer when available

6.5 All testing, NDE, heat treating, material certification, radiographic film, etc., shall be stored for a minimum of 5 years. Records shall be made available to LG&E-KU upon request.

Q102 LG&E-KU WFGD Supplier Welding Procedure Requirements

1.0 GENERAL

1.1 This specification covers the welding requirements the WFGD Supplier shall meet for work on boilers, attachments, pressure vessels, piping systems, including process piping systems, AQCS equipment, fans, chimneys and all other work located at LG&E-KU power stations.

1.2 This specification supersedes Specifications A and B (no date), and all previous revisions of this specification, PPD-CWP-0001.

1.3 Individual paragraphs have not been annotated in this revision due to the extensive number of revisions to the text.

2.0 CODES, STANDARDS, and SPECIFICATIONS

2.1 Listed below, from the highest to the lowest, is the specification hierarchy.

2.1.1 The Contract

2.1.2 The specific LG&E-KU fabrication/weld specification

2.1.3 PPD-CWP-0001

2.1.4 Commonwealth of Kentucky, Boiler and Pressure Vessel and Pressure Piping Law and Rules and Regulations, latest revision

2.1.5 ANSI/NB-23, National Board Inspection Code (NBIC), latest revision

2.1.6 The ASME Boiler and Pressure Vessel Code (B&PVC), latest revision

a) Section I Rules for Construction of Power Boilers

b) Section II Materials (Parts A, B, C, and D)

c) Section IV Rules for Construction of Heating Boilers

d) Section V Nondestructive Examination

e) Section VI Recommended Rules for the Care and Operation of Heating Boilers

f) Section VII Recommended Guidelines for the Care of Power Boilers

g) Section VIII Rules for Construction of Pressure Vessels

h) Section IX Welding and Brazing Qualifications

2.1.7 ASME B31.1 Power Piping

2.1.8 ASME B31.3 Process Piping

2.2 Unless otherwise specified, the latest edition of the specification shall be used.

2.3 Any conflicts or discrepancies shall be brought to the attention of the LG&E-KU engineer for resolution.

2.4 Work on structural steel, plate, and sheet for AQCS equipment and duct shall have welders qualified per ASME Section IX and work shall be performed in accordance with AWS D1.1 and per the recommendations of NACE except as otherwise specified herein.

3.0 WFGD SUPPLIER REQUIREMENTS

JAL AFC

3.1 The WFGD Supplier shall hold a valid Contractor's License issued by the Commissioner or the Chief Boiler Inspector (see reference 2.1.4, paragraph KRS 236.210).

3.2 The WFGD Supplier shall obtain a permit before the start of work from the jurisdictional authority of the Commonwealth of Kentucky to perform "major" boiler repairs as defined in reference 2.1.4, paragraph KRS 236.240.

3.2.1 In the case of emergency repairs, the WFGD Supplier shall obtain the permit immediately following the repairs.

3.2.2 The WFGD Supplier shall pay all fees associated with the obtaining of the permit, including the actual permit fees.

3.2.3 The WFGD Supplier shall notify his/her own Authorized Inspector (AI) of any repairs made by the WFGD Supplier and shall follow the requirements set forth by his/her own AI concerning required boiler hydrostatic pressure testing and/or nondestructive testing.

3.2.4 The AI shall sign the permit and the WFGD Supplier shall submit the permit to the Commonwealth of Kentucky as set forth in reference 2.1.4.

3.2.5 The WFGD Supplier shall utilize LG&E-KU approved welding procedures and welders meeting the requirements of ASME B&PVC Section IX.

3.2.6 Welding procedures and welders shall be approved by LG&E-KU's QA/QC department prior to the start of the work.

3.3 The WFGD Supplier shall have a Quality Control system meeting the intent of the ASME B&PV Code and the National Board as a minimum.

3.4 The WFGD Supplier's supervision shall be experienced and knowledgeable of the work to be performed. Failure to comply will constitute a breach of contract.

4.0 WFGD SUPPLIER SUBMITTALS

4.1 Unless already on file, the WFGD Supplier shall submit the following to the LG&E-KU engineer for review prior to the start of work.

4.1.1 A copy of the WFGD Supplier's quality control manual.

4.1.2 A copy of all of the WFGD Supplier's pertinent weld procedures (WPS) and procedure qualification records (PQR).

4.1.3 A copy of each welder's qualification tests (WPQ).

4.1.4 A copy of the WFGD Supplier's Commonwealth of Kentucky Contractor's License per reference 2.1.4.

4.1.5 A copy of all current ASME stamps and the NBIC's R stamp that the WFGD Supplier holds.

5.0 WELDING REQUIREMENTS

5.1 Except as otherwise amended in this specification, the WFGD Supplier's welding procedures (WPS) and/or QC manual shall meet or address the following additional welding requirements:

5.1.1 Details of the storage and handling of low hydrogen electrodes.

5.1.2 Filler metals used in the joining of P-S stainless steels to P-1, P-3, P-4, and P-S carbon and alloy steels used in high temperature service (e.g., the boiler reheater and superheater), shall conform to one or more of the following:

a) Inco 112

b) Inco 182

c) ERNiCrMo-3

d) ERNiCrMo-4

5.1.3 The peening of welds is not permitted.

5.1.4 All vertical welds shall be up for carbon steels.

5.1.5 Vertical down welds are allowed for stainless and nickel base alloys.

5.1.6 Stainless steels and nickel base alloys shall not be gouged by thermal methods.

5.1.7 Carbon steel tools shall not be used on stainless steels or nickel base alloys.

5.1.8 All requirements for the WPS shall apply to the PQR.

5.1.9 Welders shall be qualified by the WFGD Supplier to the requirements of ASME Section IX.

5.1.10 All WFGD Supplier welding shall be documented as to date, method used, weld procedure (WPS/PQR), welder, and location.

6.0 ASME B31.3 PROCESS PIPING

6.1 This ASME code specification typically applies to process piping found in petroleum refineries, chemical and paper plants, and related processing plants and terminals.

6.2 This code does not apply to power boilers, tubes, headers, pressure vessels, heat exchangers, etc., which typically comprise the boiler and its power piping.

6.3 This code does apply to raw, intermediate, and finished chemicals; petroleum products; gas, steam, air and water (but only to the extent that it does not apply to power boilers or associated piping); fluidized solids; refrigerants; and cryogenic fluids.

6.4 This code does not apply to the fresh water or cooling tower piping systems, or to fire protection systems (NFPA).

6.5 This code does apply to pressurized water systems including high pressure systems exceeding the nominal rating (pressure and temperature) allowed for ASME B16.5 PN 420 (Class 2500) fittings, flanges, etc.

6.6 Contact QA/QC to determine if this specification applies in part or in whole to pressurized systems.

6.7 If the pressure and temperature rating of the piping system exceeds that allowed per ASME B16.5 PN 420, additional rules including charpy impact requirements will apply to welding procedures and welders, the 100% radiographic inspection of each weld, and the non-use of socket weld fittings and flanges will be mandatory. Contact QA/QC for all the particulars.

6.8 This code does not apply to piping for fuel gas from the point of delivery to the connection of each fuel utilization device.

Q103 Welder Qualification Test Requirements

1.0 GENERAL

1.1 This Specification sets forth the visual inspection requirements for welder bend test specimens after bending, unless modified by the contract.

1.2 Requirements for macro etching, if required, are stated in the contract.

1.3 This specification is in addition to and supersedes any other referenced specification, i.e., ASME, AWS, etc.

2.0 DEFINITIONS

2.1 ROUNDED INDICATIONS

2.1.1 Porosity and inclusions, such as slag or tungsten, are defined as rounded indications when their length is up to three times their width. These indications may be circular, elliptical, or irregular in shape; may have tails; and may vary in density.

2.2 LINEAR INDICATIONS

2.2.1 Cracks, incomplete fusion or penetration, and slag when their length is greater than three times their width.

3.0 WELDER TEST REQUIREMENTS

3.1 After the welder has completed his/her qualification plates and the bend specimens have been cut and bent, the individual test specimens shall be visually examined by LG&E-KU's representative.

3.2 The requirements are as follows:

3.2.1 Rounded Indications: the sum of the length of all visible rounded indications shall not exceed 1/16" when each individual indication's length is added together. See Figure 1.

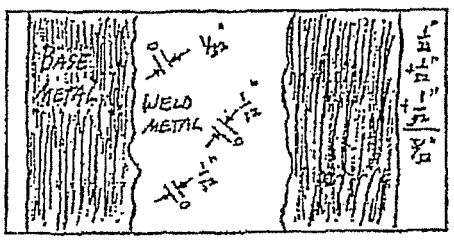

Figure 1 - Rounded Indication example – rejectable.

3.2.2 Rounded Indications: three or more rounded indications in a row are rejectable regardless of the sum of the total lengths of each indication as determined in paragraph 3.2.1. The line may be straight or curved. See Figure 2.

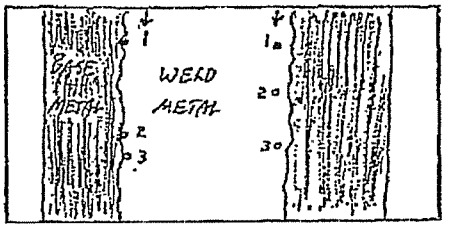

Figure 2 – Rounded Indications in a line example – rejectable.

3.2.3 Linear Indications: the sum of the length of all visible linear indications shall not exceed 1/8" when each individual indication's length is added together. See Figure 3.

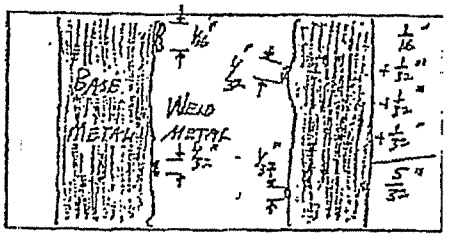

Figure 3 – Linear Indication Example – rejectable.

3.2.4 Linear + Rounded Indications: the combined sum of the individual lengths of rounded and linear indications shall not exceed 1/8".

Q104 Welding of Stainless Steel and Nickel Alloy Materials

If handling alloy material, follow this guideline.

1.0 GENERAL

1.1 DESCRIPTION: This Division includes erection and fabrication of stainless steel and nickel alloy materials.

1.2 RELATED WORK SPECIFIED ELSEWHERE: Appendix A specifies minimum standards for material furnished by WFGD Supplier.

1.3 QUALITY ASSURANCE:

1.3.1 Applicable Standards:

a) American National Standards Institute (ANSI):

i. Z49.1 – Safety in Welding and Cutting.

b) American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code:

i. Section V – Nondestructive Examinations.

ii. Section IX – Welding and Brazing Qualifications.

c) American Society of Testing and Materials (ASTM):

i. A240 – Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate

ii. A380 – Standard recommended practice for cleaning and descaling stainless steel parts, equipment and systems.

iii. B575 – Standard specification for low-carbon nickel-molybdenum-chromium alloy plate, sheet, and strip.

d) American Welding Society (AWS):

i. A5.II – Specification for nickel alloy covered welding rods and electrodes.

ii. A5.I4 – Specification for nickel alloy bare welding rods and electrodes.

iii. QCI – Standard for qualification and certification of welding inspectors.

iv. D1.1 – Structural welding Code.

e) Steel structures painting council (SSPC):

i. SP10 – Near-white blast cleaning.

f) National Association of Corrosion Engineers (NACE).

1.3.2 Welder Qualifications:

a) All welders shall be qualified by the WFGD Supplier in accordance with Section IX of the ASME Boiler and Pressure Vessel code.

b) Each welder shall qualify for each welding procedure specification he or she is to use and on the same type of equipment.

c) These tests shall be used to determine whether or not a welder can produce high quality welds in the construction. All welders shall be retested at a maximum interval of 12 months.

d) The tests shall meet, as a minimum, the surface requirements of production welds and radiographic requirements showing complete fusion, complete penetration, and no indications over 1/32".

e) The Buyer/engineer shall be given the opportunity to witness all testing. Tests shall be conducted at the site for field erected work.

f) WFGD Supplier shall bear all costs for qualifying welders including cost of materials, testing, and requalification.

g) During welding, the Buyer, engineer, or authorized inspector can require requalification of any welder who has produced an unacceptable weld. The Buyer/engineer shall remove welders from welding after two unacceptable welds.

1.3.3 Welding Procedures:

a) Welding procedures shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel code. Each test coupon shall also be radiographed.

b) The welding shall be directed by Welding Procedure Specifications (WPS) which will be unique for each different weld (different as per welding parameters such as material, joint geometry, number of passes, position, etc.).

c) Welding Procedure Specifications shall be developed and qualified by the WFGD Supplier.

d) All welding shall be done strictly within the limits of an applicable Welding Procedure Specification.

e) Welding procedures for alloys:

i. Each welding procedure to be used for alloys shall be qualified on the form and arrangement that will be used in construction and with materials that are specified for base material, alloys, and weld metal.

ii. Welds shall be made in each of the positions that are to be used in construction.

iii. The welding procedures shall comply with all applicable portions herein.

iv. One specimen from each position to be qualified shall be sectioned, polished, and etched to show clearly the demarcation between the fusion zone and the base metal.

v. For the procedure to quality, the specimen shall show complete fusion and complete penetration and no cracks [under visual examination without magnification].

vi. Four shear tests shall be made on each welding procedure for all alloy work in order to verify design shear strengths. Shear tests shall be performed by an independent testing laboratory acceptable to the Buyer, selected and paid for by the WFGD Supplier.

f) Welding procedure specifications for stainless steel and nickel alloy welding shall be in accordance with the recommendations of the nickel alloy and stainless steel sheet manufacturers.

g) The WFGD Supplier shall bear all costs for developing and qualifying welding procedures, including materials, testing and requalification's.

h) Welding procedures and qualification test dates shall be submitted by the WFGD Supplier and approved by the Buyer/engineer prior to WFGD Supplier beginning any welding.

i) WFGD Supplier shall prepare a production sample for each procedure to be used. The sample shall be inspected and approved by the Buyer/engineer prior to production welding. All production welding shall meet or exceed the quality of the approved sample.

1.3.4 Inspection:

a) By WFGD Supplier:

i. The WFGD Supplier shall perform visual inspection of all welds, including cleaning and fitting, using a Certified Welding Inspector (CWI) qualified per AWS standard QC1.

ii. The WFGD Supplier shall provide one full-time AWS Certified Welding Inspector per site and shift.

iii. The WFGD Supplier shall inspect the work in a timely manner so as to expose any welding problems as they develop. The WFGD Supplier shall also correct the problems in a timely fashion.

iv. The welding inspector shall visually inspect all in-process and final welds for conformance with the contract documents.

v. The WFGD Supplier shall be responsible for all surface preparation required for inspection purposes regardless of who performs the inspection.

vi. The WFGD Supplier shall be required to perform all repair work regardless of who identifies the defective welds.

vii. Nondestructive examinations will be performed by an independent, qualified inspection agency, which will be selected and paid for by the WFGD Supplier then approved by the Buyer.

viii. Retests due to unacceptable welds will be at WFGD Supplier's expense.

ix. All nondestructive examinations will be in accordance with Section V of the ASME Boiler and Pressure Vessel Code. The amount of weld testing will be as specified below.

x. Requirements for stainless steel wall paper and structural work exposed to flue gas.

a. WFGD Supplier shall visually inspect 100% of all work, mark and repair all defects, repeat visual inspection and repair until there are no visual defects.

b. After final visual inspection and repair of defects discovered during visual inspection, WFGD Supplier shall perform liquid penetrate examination on 100% of work, mark and repair all indications, and retest and repair until no indications are found.

xi. Requirements for high nickel alloy wallpaper and structural work exposed to flue gas or slurry.

a. WFGD Supplier shall visually inspect 100% of all work, mark and repair all defects, repeat visual inspection and repair until there are no visual defects.

xii. For all nickel based alloy work, including lining, plates, and structural members, that will be exposed to slurry or flue gas, WFGD Supplier shall perform vacuum box testing on all welds, and mark and repair all leaks. Repeat testing and repair until no leaks are found. For nickel based alloy work where there are corners and areas not accessible to vacuum box testing, work shall be tested with liquid penetrate. All roll bond cladding welds shall be tested with liquid penetrate and, as required by API 650 or AWS, radiographic examination.

xiii. The Buyer, Buyer's inspector, and engineer shall be provided access by the WFGD Supplier to visually inspect or perform nondestructive testing on all welds.

xiv. All complete penetration groove welds will be subject to radiographic examination.

b) Acceptance criteria: Acceptance criteria for all welding shall be as defined in the AWS D1.1 Structural welding code unless otherwise specified herein.

1.4 SUBMITTALS:

1.4.1 Compliance submittals:

a) Submit as specified in General Conditions.

b) Includes but is not limited to the following

i. Welder qualifications.

ii. Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) for all material and joint configurations.

iii. Procedures for handling the nickel alloy and stainless steel materials and welding electrodes. As a minimum these procedures shall meet the material suppliers' recommendations. Refer to Appendix A for minimum Buyer requirements.

iv. Procedures for cleaning and grinding the nickel alloy and stainless steel materials and welded joints.

v. Procedures for cutting and forming the nickel alloy and stainless steel materials.

vi. Erection procedures including method and sequence of erection.

vii. Method for repairing welds.

viii. Material certifications for all welding materials.

ix. Fabrication and erection drawings for all lining work.

x. Weekly inspection reports by Certified Welding Inspector.

c) Welder qualifications and welding procedures shall be submitted and approved by the Buyer/Engineer prior to beginning of construction.

d) The WFGD Supplier shall maintain a record of all welding procedure tests, welder qualifications, material certifications, etc. Records shall be kept at the WFGD Supplier's field office.

1.5 DELIVERY, STORAGE, AND HANDLING:

1.5.1 Any Buyer-furnished material will be stored at the Station. Unless specifically indicated, WFGD Supplier shall furnish all material.

1.5.2 WFGD Supplier shall transport Buyer-furnished material from point of storage to point of fabrication and or erection.

1.5.3 WFGD Supplier shall handle all material with extreme care to avoid damage and iron or carbon contamination. The Buyer reserves the right to reject any material damaged by the WFGD Supplier. Such damaged material shall be replaced by the WFGD Supplier. At the Buyer's option, damaged or contaminated material may be repaired or cleaned. Such repair or cleaning shall take place immediately upon discovery and the work process shall not continue unless approved cleaning or repair has taken place.

1.5.4 No carbon steel lifting clamps are permitted. Use only new stainless steel lifting clamps, nylon strings, etc.

1.5.5 WFGD Supplier shall mark all alloy materials such that they are distinguishable from other alloy or carbon steel materials and keep separated. These marks are to be of such a nature that their presence on the completed lining will not contribute to corrosion of the alloy lining. Use high-purity ink, laboratory certified action markers as manufactured by Mark-tex Corporation, Englewood, New Jersey 07631.

1.5.6 Refer to Appendix A for minimum requirements for handling alloys.

2.0 EQUIPMENT AND MATERIALS

2.1 FOR BUYER SUPPLIED MATERIAL:

2.1.1 Any scrap material shall be turned over to the Buyer for salvage value, with alloy identification maintained.

2.2 WELDING MATERIALS:

2.2.1 Welding electrodes for all nickel alloy and stainless steel welding shall be furnished by the WFGD Supplier, unless otherwise specified.

2.2.2 Electrodes used for welding C-276 nickel alloy to C-276 nickel alloy, to stainless steel, or to A36 steel shall conform to AWS Standard A5.14 classification ER Ni Cr Mo-4 with the exception that electrodes used for welding C-276 roll bonded alloy to C-276 roll bonded alloy shall be ER Ni Cr Mo-14.

2.2.3 Electrodes used for welding stainless steel to stainless steel, or to A36 steel shall conform to AWS Standard A5.14 classification ER Ni Cr Mo-3.

2.2.4 Electrodes used for welding Inconel 686 to Inconel 686, to C-276, to stainless steel, or to A36 steel shall conform to AWS Standard A5.14 classification ER Ni Cr Mo-14.

2.2.5 Electrodes used for welding C-2000 to C-2000, to C-276, to stainless steel, or to A36 steel shall conform to AWS Standard A5.14 classification ER Ni Cr Mo-17.

2.2.6 WFGD Supplier shall submit material certifications on all welding materials.

2.3 WELDING EQUIPMENT

2.3.1 All welding equipment shall be furnished by the WFGD Supplier.

2.3.2 Quantity of welding equipment used shall be sufficient to meet the construction schedule specified. Include adequate backup equipment in case of mechanical breakdowns.

3.0 PERFORMANCE

3.1 FABRICATION AND INSTALLATION OF ALLOY

3.1.1 WFGD Supplier shall install a total system on areas indicated.

3.1.2 Where WFGD Supplier is to apply alloys to existing structures, the following comments apply:

a) The drawings indicate theoretical or approximate dimensions and elevations and shall not be used for fabrication of the lining sheets. Existing module walls and ductwork may be out-of-round, out-of-square, out-of-plumb, wavy, poorly fit-up, etc. WFGD Supplier shall take his own dimensions to be used for sheet fabrication.

b) Lining details not shown shall be approved by the Buyer/engineer prior to the WFGD Supplier proceeding with the work.

c) For welding to existing steel, prepare all existing surfaces to be lined up by blast cleaning to near white metal in accordance with SSPC SP-10 or by grinding the carbon steel down to clean base metal in the area to be welded.

d) If deoxyaluminate or similar product is used by the WFGD Supplier to prevent surface rust bloom, the WFGD Supplier shall use this product in the welding procedure qualifications.

e) Preroll, cut and form lining sheets as required to match existing surfaces and corners to be lined. WFGD Supplier shall take field measurements to verify existing dimensions prior to cutting and fitting lining sheets.

3.1.3 Materials shall be cut to length as required by shearing, thermal cutting using plasma arc, air carbon-arc or other appropriate means. Cutting techniques which contaminate the metal with carbon are prohibited. (Unless approved otherwise by Buyer, in order to minimize welding and material wastage, hold sheets in coil form at mills and cut to length once final cut sheets are prepared.)

3.1.4 Staging or scaffolding shall be furnished, installed and removed by the WFGD Supplier. Carbon steel brackets shall not be welded to or come in contact with the stainless steel materials. Brackets shall not be supported from the existing lining.

3.1.5 Install materials as specified.

3.1.6 Lining installation shall start at the top of the area to be lined.

3.1.7 The best side of each sheet shall be placed on the inside or wetted side of absorber or ductwork.

3.1.8 The use of clips or attachments welded to the wetted or inside of the sheets to align the sheets is prohibited.

3.1.9 Lining sheets shall be pressed against the walls to ensure contact wherever possible. Existing welds shall be ground flush to module where required to ensure good fit-up of new lining sheets. Edges of sheets at weld seams shall have full contact with the walls.

3.1.10 All structural attachments shall be made to the base metal. The wall paper or roll bonded lining shall not be used to support any internals, pipe supports, or structural members.

3.1.11 Joints between adjacent wallpaper lining sheets (for sheets more than 1/16" thick) shall be square groove, butt joints wherever possible. Butt joint welds shall have complete joint penetration with a minimum of a 1/4-inch of fusion to the carbon steel backing. Size and location of all plug welds shall be as indicated by engineering calculations but in no case shall they be less than 1" in diameter and 16" on center. All plug welds shall be covered by a minimum 1.5" diameter cap of the same material as the lining. (In order to not build up pressure under the cap during welding, the plug welds must be installed such that they have an approximately 1/16" vent.)

3.1.12 Lap joints, where indicated for wallpaper applications (for 1/16" sheets), shall have a minimum lap of 1-inch. The sheets forming a lap joint shall be held on as close contact as possible during welding and in no instance be separated more than 1/16-inch. Fillet leg size shall be increased where separation is 1/16-inch. The size and location of welds for alloy wallpaper lap installation shall be in accordance with the engineering calculations but in no case shall the underlying sheets be attached with less than 1/16" fillet welds stitch welded with 2 inches of weld on 6 inch centers. Size and location of all plug welds shall be as indicated by engineering calculations but in no case shall they be less than 1" in diameter and 16" on center. All plug welds shall be covered by a minimum 1.5" diameter cap of the same material as the lining. (In order to not build up pressure under the cap during welding, the plug welds must be installed such that they have an approximately 1/16" vent.)

3.2 CLEANING AND GRINDING

3.2.1 All stainless steel and nickel alloy materials shall be cleaned prior to welding in accordance with ASTM A380. WFGD Supplier shall thoroughly clean all oil and grease from areas to be welded using an approved solvent, such as Methyl Ethyl Ketone (MEK).

3.2.2 Existing carbon steel base metal shall be blast cleaned to SSPC SP-10 or ground clean to remove any contaminates prior to welding.

3.2.3 Carbon steel tools are not permitted. Hammers, fitting bars, and hand wire brushes shall be stainless steel or stainless steel clad to prevent carbon steel contact.

3.2.4 Grinding wheels, abrasive disc and abrasive belts shall be of silicon carbide or alumina abrasives. Wheels, discs, and belts shall be new to avoid iron contamination. Power wire brushes are not permitted.

3.2.5 All tools used on the stainless steel or nickel alloys shall be distinctively marked and used only on the stainless steels or nickel alloys. No tools used on carbon steel shall be allowed to be used on the stainless steels or nickel alloys.

3.2.6 Splatter next to welds and on any surface shall be ground to clean base metal.

3.2.7 Care shall be taken so that weld splatter, grinding dust, cutting slag, etc. do not directly impinge on alloy materials.

a) All heat tints shall be removed by the use of 3M Company medium cutting and polishing utilized wheels or by paste-pickle cleansing with a nitric-hydrofluoric acid solution in accordance with ASTM A380, Code D.

3.3 WELDING

3.3.1 All welding shall be done in accordance with written welding procedure specifications that have been qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

3.3.2 All welding shall be by the pulsed gas metal arc welding (GMAW-P).

3.3.3 Filler metal transfer for the GMAW process shall be by pulsed-arc.

3.3.4 Shielding gas shall be 75 percent argon and 25 percent helium or a WFGD Supplier's alternate that has been approved by the Buyer/engineer.

3.3.5 TIG welding may be used for tacking or minor repairs.

3.3.6 All welding variables shall be approved by the Buyer/engineer.

3.3.7 Welding shall be of low heat input to avoid carbide precipitation and molybdenum segregation and hot cracking. Use stringer beads only. In no case shall heat input exceed 40,000 joules per inch. Interpass temperatures shall not exceed 350 degrees F. Remove all dirt, contamination, and oil using grinding and or solvents and moisture using preheat from all weld surfaces prior to welding.

3.3.8 Weld beads shall be slightly convex in profile to minimize hot cracking tendencies. Concave beads are prohibited.

3.3.9 Weld beads shall have one smooth and regular surface contour without abrupt changes. Starts and stops shall be blended together smoothly. Use backstep technique at all stops to avoid crater cracks.

3.3.10 Surface contour of all completed welds shall be installed so that there are no nonrelevant indications under liquid penetrate inspection.

3.3.11 Groove weld reinforcement shall not exceed 1/16-inch.

3.3.12 WFGD Supplier shall provide minimum preheat at 60 degrees F by a method that will not contaminate the material surface, such as indirect heat, natural gas or infrared. Fuel oil heaters are not allowed.

a) There shall be no weld or joint geometries which would allow a scale to build up or provide a crevice for corrosion.

3.3.13 No weld defects such as undercut, lack of fusion, porosity, excessive reinforcement, cracks, or weld splatter are permitted.

3.3.14 All welded joints that will be exposed to flue gas or slurry shall be completely seal welded.

3.3.15 WFGD Supplier shall provide mechanical ventilation in enclosed areas during welding as required by sections 7 and 8 of ANSI Z49.1.

3.4 REPAIR OF DEFECTIVE WELDS

3.4.1 WFGD Supplier shall repair or replace all welds found to be defective.

3.4.2 Do not heal cracks or wash out defects by remelting weld beads or covering with additional weld metal.

3.4.3 Stainless welds shall be inspected for heat tint by the WFGD Supplier. All heat tints shall be removed.

3.4.4 Weld repair procedures shall be developed and qualified by the WFGD Supplier and shall include a method for documenting the repair made.

3.4.5 Alloy weld repair procedures shall be in accordance with the recommendations of the nickel alloy and stainless steel manufacturers.

3.4.6 Procedures for repairing welds shall be submitted and approved by the Buyer/engineer prior to beginning and repair work.

3.4.7 Repair procedures shall include verification of defect removal by the AWS Certified Welding Inspector.

Q105 Welding of Low Carbon Stainless Steel and High Nickel Alloy in AQCS Applications

This section outlines instructions for Handling and Welding of Low Carbon Stainless Steel and High Nickel Alloy in AQCS Applications. (Referred to in this section as alloys)

1.0 PURPOSE

1.1 This is an instruction for storage, handling and welding of alloys for use in AQCS Applications.

1.2 The reason for these instructions is to prevent contamination of the gas side surfaces (side opposite stiffeners) of alloy material with carbon steel and to eliminate carbon contamination of the weld joints.

2.0 DEFINITIONS

2.1 CARBON CONTAMINATION

2.1.1 The presence of foreign material, such as grease, oil, paint, iron or rust on surfaces adjacent to the areas to be welded which may be detrimental to the corrosion resistance of the material.

2.2 CARBON STEEL CONTAMINATION

2.2.1 The presence of iron impregnated on the alloy, usually in the form of heavy rust deposits or carbon weld spatter. If left on the gas side surfaces of the alloy under the operating environment, this carbon steel may continue to rust, producing an undesirable oxide and pitting.

3.0 RESPONSIBILITIES

3.1 The WFGD Supplier is responsible for implementing this procedure.

3.2 The WFGD Supplier is responsible for auditing compliance with this procedure, performing the required inspections and maintaining the necessary records.

4.0 SPECIAL TOOLS

4.1 All special tools which are used on alloys should not have been used on any other material. A system should be devised to assure that proper tools are used, such as separate storage of special tools and/or color coding.

4.2 WIRE BRUSHES

4.2.1 Clean stainless steel brushes should be used. The 309/304 wire brushes acceptable as long as they are clean, and not previously used on any other material. A typical supplier is PPG Industries, 3221 Frederick Avenue, Baltimore, MD 21229. Type KY-167 Knot type wheel, .016 stainless wires.

4.3 GRINDING WHEELS

4.3.1 Grinding wheels should be aluminum oxide, silicon carbide, impregnated fabric, or grinding wheels of these grits bonded with resin or rubber. Grinding wheels bonded with neoprene or other rubber compositions with halide in their chemical formula are not to be used. Typical brand name wheel would be Type 27, A-24SHG; Galaxy which, can be obtained at: III Abrasive products, P.O. Box 88 Tiffin, OH 44883.

a) Grinding wheels and brushes which do not allow contact of holding nut with alloy should be used where possible.

4.4 CHIPPING HAMMERS

4.4.1 Only stainless chipping hammers should be used. If procurement becomes a problem, carbon steel hammers can be buttered with austenitic steel filler rod or stick electrode (i.e., 304, 309, 316, 317, 316L. 317L) or a hammer made from stainless rod and ground down to a point.

4.5 SCAFFOLDING

4.5.1 Any gas side carbon steel attachments welded to the steel must be removed prior to cleaning. If stainless steel buffer pads are not used, the surface must be cleaned and repaired as per paragraph 6.4.3 prior to the system going into operation.

5.0 GENERAL HANDLING

5.1 During all handling operations of the alloy plates, precautions should be taken to minimize the contact time between the gas side surface of the plates with any carbon or other ferritic steel materials.

5.2 Where welding or burning operations are performed (such as removal of carbon steel shipping braces) near the gas side surfaces of the alloy, the stainless must be protected from spatter (cover or use anti-spatter spay containing no Halides/Chlorides) and contamination.

6.0 PROCEDURES

6.1 UNLOADING, HANDLING, & STORAGE

6.1.1 In order to minimize cleaning, alloys should be unloaded and handled with the provided lifting lugs or with plate clamps put on the stiffeners whenever possible. Use of plate clamps on the alloy itself should be used only where other methods are not practical.

6.1.2 Care should be taken to prevent severe buckling of the plates during handling (special spreader beams are suggested) and storage.

6.1.3 The alloy plates should be laid down horizontally, face to face, on wood dunnage in the storage yard. Care should be taken to prevent contact between the carbon steel stiffeners and the gas side surfaces of the plates. Material should be arranged in storage to minimize puddling or rain water on the plates and to minimize run off onto the gas side surfaces of the plates.

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6.1.4 Care should be taken to avoid unnecessary sliding of the gas side surface of the plates against each other or other materials as gouging may occur which would require repair in final cleaning.

6.2 ASSEMBLY

6.2.1 All reasonable precautions shall be taken to prevent carbon steel contamination of the gas side surfaces of the alloy plates during assembly (i.e., use of special tools, protection from weld spatter, etc.).

6.2.2 During assembly and fit-up of plates, only low carbon stainless steel bolts shall be used when the bolts will penetrate the gas side surface. These bolts are provided as contract material for alignment only. The erection contractor is responsible for integrity and stability of the components during erection. After erection, patch any holes placed in stiffeners for lifting purposes.

6.2.3 Oxyacetylene torches or any other source of heat should be used to heat the alloy for straightening, bending, etc. only when cold methods are impractical. This can reduce the resistance of alloys to various forms of corrosion.

6.3 WELDING

6.3.1 Prior to welding clean the welding groove and adjacent heat affected surfaces with stainless brushes (about one inch on each side of the groove).

6.3.2 After brushing and prior to welding, the entire welding surface should be cleaned with one of the following solutions: Chlorathene (Dow type is Nu form No. 100-71-71 or equal). Isopropyl Alcohol, Acetone or tech solvent #200A. Extreme caution should be used with these agents as they are volatile. Smoking or burning should not be allowed in the area of cleaning. Chlorathene is the safest of the solvents listed and should be used whenever possible. Rules of OSHA must be complied with at all times. The surfaces to be welded are to be clean to the extent that no dirt or extraneous material is visible when examined without magnification.

6.3.3 Special attention to the welding materials as specified on the construction drawings is required. When ordering welding materials, the vendor certification of the material content must be procured.

6.3.4 Cleaning tools shall be as specified in Section 4.0.

6.3.5 Crevices and cracks should be removed by chipping, grinding and, if necessary, rewelded.

6.4 FINAL CLEANING

6.4.1 After welding on the entire unit or a section is complete, a final cleaning of the gas side surfaces shall be performed to remove all carbon steel contamination (see Paragraph 2.2) and weld spatter.

6.4.2 Surface discoloration caused by rusty water runoff, etc. need not be removed provided there is no evidence of scale deposit or roughened surface associated with the discoloration.

6.4.3 Contamination can be removed by sanding, wire brushing or grinding as required.

6.4.4 Cleaning tools shall be as specified in section 4.0.

6.4.5 Significant indentations that are caused by removal of carbon steel contamination and any cracks or crevices deeper than 1/16" shall be rewelded using filler metal as specified in Paragraph 6.3 and re-conditioned by grinding and blending. Indentations less than 1/16" shall be re-conditioned by grinding and blending.

7.0 INSPECTIONS

7.1 A receiving inspection shall be performed. Any nonconformance noted shall be reviewed with the Quality Control Superintendent. Of special concern is contamination resulting from improper loading or shipping (see applicable Engineering Standards).

7.2 The QC Superintendent shall periodically inspect storage area to ensure that unloading and storage requirements are being adhered to.

7.3 In addition to constant monitoring by all supervision, the QC Superintendent shall periodically inspect the assembly and welding operations to assure reasonable compliance with this procedure.

7.4 After welding is complete, sectionally or entirely, the QC Superintendent shall visually inspect the gas side surface of the alloy plate for carbon contamination, gouges, scratches, weld spatter or other impregnations. After further clean up, as additional inspection shall be made.

7.5 Inspections, other than the receiving inspection, shall be documented on Reports of Inspections.

S100 Seismic Design
(Source: 09Jun10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

S100.1 General
This article specifies the general criteria and procedures that shall be used to ensure that structures, components, and equipment meet performance objectives during and following a seismic event. The intent of these procedures is to minimize the hazard to human life. Buildings and structures may be damaged but remain suitable for occupancy and use, albeit in an impaired condition. The damage is anticipated to be repairable. Components and equipment are expected to remain in place without collapsing or breaking away from supports, and to remain intact to the extent that they do not create an ignition hazard or release hazardous materials.

The building structural system shall provide a continuous load path or paths, with adequate strength and stiffness to transfer all seismic forces from the point of application to the final point of resistance.

Components and equipment shall be attached so that seismic forces are transferred to the structural system of the building. These attachments shall be bolted, welded, or otherwise positively fastened. Frictional resistance due to gravity shall not be considered in evaluating the required resistance to seismic forces.

For seismic design of vessels, tanks, and other components, contents that are flammable, explosive, corrosive, acidic, caustic, toxic, or that otherwise present a danger to the general public if released shall be considered hazardous materials.

Seismic design shall be performed in accordance with the building code specified in Exhibit S – Site and Site Conditions, along with the applicable edition (as required by the specified building code) of the following references:

American Institute of Steel Construction (AISC), AISC 360, "Specification for Structural Steel Buildings."

American Institute of Steel Construction (AISC), AISC 341, "Seismic Provisions for Structural Steel Buildings."

American Society of Mechanical Engineers (ASME), "Boiler and Pressure Vessel Code" and all addenda.

American National Standards Institute (ANSI), "ASME Code for Pressure Piping, ASME B31.1, Power Piping."

Manufacturers Standardization Society of the Valve and Fitting Industry (MSS), MSS SP-58, "Pipe Hangers and Supports - Materials, Design, and Manufacture."

Other nationally recognized and accepted design standards and references as appropriate.

S100.2 Seismic Forces
Seismic forces shall be determined from the basic seismic parameters given in Exhibit S – Site and Site Conditions. The design forces and their distribution over the height of the building or structure shall be determined using a linearly elastic analysis model and the procedures listed in the specified building code. Load combinations, including seismic, shall be in accordance with the specified building code.

Hydrodynamic effects of contents shall be considered in the seismic design of vessels and tanks as required by the specified building code. Seismic dynamic forces shall be considered in the seismic design of below ground structures in addition to the static soil pressures.

S100.3 Seismic Design

S100.3.1 Buildings
Buildings shall provide sufficient strength and ductility to resist the specified seismic effects and may use any of the basic structural systems permitted by the specified building code. Usage of structural systems shall be in accordance with the limitations prescribed in the specified building code. The effects of both plan and vertical irregularities shall be considered, as required by the specified building code.

Buildings shall be seismically analyzed using either Equivalent Lateral Forces or Modal Analysis in accordance with the specified building code and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code.

"W" for buildings shall include the total dead load, the total operating weight of permanent equipment and the effective contents of vessels, and applicable portions of other loads, as required by the specified building code.

S100.3.2 Nonbuilding Structures
Nonbuilding structures include all self-supporting structures, other than buildings, bridges, and dams, that are supported by the earth; that carry gravity loads; and that may be required to resist seismic effects. These include, but are not limited to, heat recovery steam generators (HRSGs), cooling towers, electrostatic precipitators, fabric filters, stacks, chimneys, conveyor support structures, pipe racks, trussed towers, transmission towers and poles, tanks, vessels, bins, and hoppers. Design of nonbuilding structures shall provide sufficient strength and ductility, consistent with the requirements for buildings, to resist the specified seismic effects.

Nonbuilding structures shall be seismically analyzed using either Equivalent Lateral Forces or Modal Analysis in accordance with the specified building code, and shall meet all of the design, proportioning, detailing, inspection, and quality assurance provisions of the specified building code and other referenced codes.

"W" for nonbuilding structures shall include all dead load as defined for buildings, and shall also include all normal operating contents of tanks, vessels, bins, and piping.

Seismic design of reinforced concrete chimneys shall use the Dynamic Response Spectrum Analysis method of ACI 307. Seismic design of steel stacks shall also use the Dynamic Response Spectrum Analysis method. The analytical model used in the dynamic analysis of these structures shall be sufficiently refined to represent variations of chimney, stack, and liner masses; variations of stiffness; and the foundation support condition.

S100.4 Documentation
Complete structural support and anchorage details shall be shown on all drawings, including the size of members, details of connections, anchor bolt sizes, etc.

The following seismic design data shall be indicated on the design drawings:

Occupancy Category.

Mapped Spectral Response Accelerations, S_s and S_1.

Spectral Response Coefficients, S_{DS} and S_{D1}.

Site Class.

Seismic Design Category.

For Structures and Nonbuilding Structures Similar to Buildings:

Importance Factor, I.

Basic Seismic Force Resisting System.

Design Base Shear.

Seismic Response Coefficient, C_s.

Response Modification Factor, R.

Overstrength Factor, Ω_o

Analysis Procedure.

Seismic Drift.

Seismic Detailing.

For Nonstructural Components Including Equipment:

Component Importance Factor, I_p.

Seismic Design Force, F_p.

Component Response Modification Factor, R_p.

Component Amplification Factor, a_p.

Equipment and component drawings shall indicate the total load and/or loads to be transmitted to the structure that must ultimately restrain the components, equipment, or structure. This information shall include the weight, dimensions locating the center of gravity of the component or equipment, or the seismic design forces (magnitude, direction, and location) acting on the supports.

If requested by the Buyer, design calculations shall be submitted for all structures, equipment, or components which are designed in accordance with this Supplemental Specification. If requested by the Buyer, these calculations shall be certified by a professional engineer registered in the State of Kentucky.

S200 Miscellaneous Equipment Access Provisions
(Source: 22Oct10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

This Supplemental Specification covers design and fabrication requirements for the access provisions to individual pieces of equipment.

Access provisions shall consist of stairs, platforms, walkways, handrails, and guardrails necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of individual pieces of equipment and associated components. Arrangement drawings for access provisions shall be provided as part of the Technical Data. Ladders shall not be considered suitable for access to equipment.

Provide platforms and stairs to access all equipment including but not limited to all instruments, valves, motors, dampers, packing, bearings, expansion joints, test ports etc. Platforms shall be sufficient so that equipment such as expansion joints can be changed out without additional scaffolding. In order to prevent conduction of heat away for hot surfaces and prevent water from entering hot surfaces, hot surfaces of ducts and equipment shall not be used for supporting platforms or walkways. Support all platforms and walkways from structural steel.

S200.1 Design Criteria
Access provisions shall conform to all applicable codes and standards and the following minimum requirements. Design shall be to the most restrictive requirements of all applicable codes and standards as defined in Exhibit N – Codes and Standards.

As a minimum, all egress paths and equipment access provisions shall be designed to comply with OSHA, and NFPA 101 Regulations, including all addenda and interpretations. Application of these regulations shall be based on their literal translation.

S200.1.1 Support Steel
Platform and walkways supporting steel shall be designed for a minimum live load in accordance with Technical Supplemental Specification S300. Stairway supporting steel shall be designed for a minimum live load in accordance with Technical Supplemental Specification S300. Fixed stairways shall also be designed for a minimum moving concentrated load of 1,000 pounds as specified in OSHA 29CFR-1910.24(c). Vertical live load deflection of steel framing members shall not exceed 1/360 of the span length. The length of landing platforms, measured in direction of travel, shall be, as a minimum, equal to the stair width, but shall not exceed 4 feet where the stairway has a straight run. Platforms shall have lateral bracing as required for rigidity and stability.

S200.1.2 Platforms and Walkways
Platforms and walkways shall be a minimum of 36 inches wide. Platforms and walkways shall be provided with guardrails.

S200.1.3 Stairs
Stairs shall be a minimum of 30 inches wide and shall be the preferred method of egress and access. Treads and risers shall be in accordance with OSHA and Section 40.2.5.2 of NFPA 101. Minimum concentrated load on stair treads (on area of 4 square inches) is 300 pounds. The tread depth shall be exclusive of nosings or projection. Vertical distance between floor and landing shall not exceed 12 feet. Vertical headroom clearance shall be 7 feet minimum at projections above the stairs. Stair stringers shall be not less than 10 inches in depth, and 15.3 pounds per foot channels. Slip resistant nosing shall be supplied with stair treads. Stairs shall be provided with handrails and guardrails in accordance with S200.1.4 Guardrails and Handrails.

S200.1.4 Guardrails and Handrails
Guardrails and handrails shall be designed to comply with OSHA, NFPA 101 Regulations, and all other applicable codes and standards as defined in Exhibit N – Codes and Standards. Design shall be to the most restrictive requirements of the referenced codes. All open stairs shall have a combination guardrail/handrail system as described in the codes. The upper surface of the top rail of guardrails shall be 42 inches above the surface of platforms, walkways, and stair treads in line with face of riser at the forward edge of the tread. Handrails on stairs shall be supported by brackets from the guardrail posts with the upper surface of the handrail 34 inches above the surface of stair treads in line with face of riser at the forward edge of the tread.

Railings shall be designed to meet the design loading requirements of OSHA, NFPA 101 Regulations, and other applicable codes and standards as defined in Exhibit N – Codes and Standards. Steel posts shall be vertical and uniformly spaced with 7 feet maximum spacing, or less as required for the post,

railings, and connections to conform to the design loading requirements of the applicable codes and standards. Handrails shall be 1-1/2 inch nominal diameter steel pipe.

Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Welded joints shall be of the flush type. Members shall be neatly coped and continuously welded at all junctions of posts and rails. Flattening of the rail or post ends at junctions of posts and rails will not be permitted. Fittings or other connectors shall not be used at junctions of posts and rails. For galvanized railings, joints shall have internal openings so there are no closed or blind sections of pipe. When the bottom of the handrail post is closed, a drain hole shall be provided on the vertical side of the post near the bottom.

All welding shall be done neatly and substantially, with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush.

All angles, offsets, and other changes in alignment of railings shall be made with accurately mitered joints, welded railing fittings, or smooth radius shop bends.

Install guardrails inside of ducts at all elevation changes and include 1/8" corrosion allowance on guardrails inside of the gas stream.

S200.1.5 Kickplates
Kickplates shall be provided for platforms, on equipment roofs as required, and as necessary for personnel protection and safety. Kickplates shall project a minimum of 4 inches. Minimum thickness of kickplates shall be 1/4 inch. Kickplates on roofs shall be notched for drainage. Openings in grating panels shall be provided with kickplates.

S200.1.6 Ladders
Ladders may be used in lieu of stairways for emergency egress only and where applicable codes and standards allow. Egress provisions must meet codes and standards criteria for ladder use. Ladders shall be designed to meet the design loading requirements and other specified requirements of OSHA, ANSI, and NFPA 101 Regulations, and all other applicable codes and standards as defined in Exhibit N – Codes and Standards.

Ladders shall not be less than 18 inches wide with 3/4 inch diameter solid steel rungs spaced 12 inches center-to-center. The distance of the first rung at the bottom of the ladder may range up to 14 inches from the surface below. The top rung shall be level with the landing or platform. Ladder side rails shall be steel bars not smaller than 3 inches by 1/2 inch. Ladder side rails shall be punched for the rungs. Rungs shall be extended to within 1/8 inch of the outside rail surface, and the remaining 1/8 inch shall be plug welded. Rungs shall be continuously fillet welded inside each rail surface. Ladder supports shall be steel brackets not less than 4 inches by 1/2 inch, spaced not more than 18 feet vertically center-to-center. The center of the rung shall be no less than 7 inches (horizontal measure) from the nearest permanent objects. Cages shall be provided on ladders where the length of climb is more than 20 feet. Where the length of climb is less than 20 feet but the top of ladder is more than 20 feet above adjoining surfaces (fall potential to the ground, roofs or floors), cages shall also be provided. Ladder side rails shall extend a minimum of 3 feet 6 inches above the top of floors and be flared to a minimum clear width of 24 inches for walk-through access, and extend a minimum of 4 feet 0 inches for side access ladders.

Self-closing gates shall be provided at all ladder entrances (chains shall not be used).

S200.2 Materials
Materials used shall be equal to or exceed the following minimal requirements:

Steel framing, kickplates, angles	ASTM A36
Ladders	ASTM A36

Connection bolts for steel framing	ASTM A325, Type 1, with washers and nuts
Rectangular bar grating 1-1/4 inch minimum depth (serrated for exterior use)	ANSI/NAAMM MGB531, W-19-4
Stair tread grating	Same as rectangular grating except bearing bars not less than 3/16 inch by 1 inch for lengths up to and including 3 feet and less. Bearing bar spacing not to exceed 1-3/16 inch
Stair tread fasteners (furnish with stair treads)	Galvanized 3/8 inch minimum diameter bolts conforming to ASTM A307, Grade A with lock washers and nuts
Nosing	Slip resistant checkered plate or acceptable equal
Guardrails and handrails - posts and rails (minimum size and strength)	ASTM A53, Type E or S, Grade B, 1-1/2 inch nominal diameter pipe, Rails Schedule 40, Posts Schedule 80, or acceptable equal
Optional rail fittings for angles, offsets, and other changes in alignment	R&B Wagner railing fittings with Wedgelock welding connectors at each end. (Slip-on fittings using set screws and open seam fittings are not acceptable.)

S200.3 Coatings
Coatings shall be in accordance with the following:

Structural steel framing, kickplates, and angles not shop attached to grating and guardrails	In accordance with Technical Supplemental Specification Q300 in Section 01400
Rectangular bar grating, stair treads, nosings, guardrails, and handrails	Hot-dip galvanized in accordance with ASTM A123 and A153 after shop fabrication completed

S200.4 Welding
Welding shall be in accordance with the applicable requirements of Technical Supplemental Specifications Q100 and Q121 in this Section 01400.

S200.5 Technical Attachments
The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under this Technical Supplemental Specification:

Document Number/Description	Title	Revision
81112-DS-0064	Typical Guardrail and Stair Rail Conforming to IBC 2003, 2006 & 2009 for Areas Not Accessible to the Public	9

Document Number/Description	Title	Revision
81112-DS-0071	Typical Ladder Details	8

S201 Major Equipment and Structure Access Provisions
(Source: 22Oct10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

This Supplemental Specification covers design and fabrication requirements for the access provisions to structures and major or multiple pieces of equipment.

Access provisions shall consist of stairs, platforms, walkways, handrails, guardrails, and ladders necessary to provide complete and convenient access for operation, inspection, testing, and maintenance of major or multiple pieces of equipment. Arrangement drawings for access provisions shall be provided as part of the Technical Data.

S201.1 Design Criteria
Access provisions shall conform to all applicable codes and standards and the following minimum requirements. Design shall be to the most restrictive requirements of all applicable codes and standards as defined in Exhibit N – Codes and Standards.

As a minimum, all egress paths and access provisions shall be designed to comply with the governing building code, OSHA, and NFPA 101 Regulations, including all addenda and interpretations. Application of these regulations shall be based on their literal translation.

S201.1.1 Support Steel
Platform and walkways supporting steel shall be designed for a minimum live load in accordance with Technical Supplemental Specification S300. Stairway supporting steel shall be designed for a minimum live load in accordance with Technical Supplemental Specification S300. Fixed stairways shall also be designed for a minimum moving concentrated load of 1,000 pounds as specified in OSHA 29CFR-1910.24(c). Vertical live load deflection of steel framing members shall not exceed 1/360 of the span length. The length of landing platforms, measured in direction of travel, shall be, as a minimum, equal to the stair width, but shall not exceed 4 feet where the stairway has a straight run. Platforms shall have lateral bracing as required for rigidity and stability.

S201.1.2 Platforms and Walkways
Platforms and walkways shall be a minimum of 36 inches wide. Platforms and walkways shall be provided with guardrails.

S201.1.3 Stairs
Stairs shall be a minimum of 36 inches wide and shall be the preferred method of access. Treads and risers shall be in accordance with the governing building code, OSHA, and NFPA 101. Minimum concentrated load on stair treads (on area of 4 square inches) is 300 pounds. The tread depth shall be exclusive of nosings or projection. Vertical distance between floor and landing shall not exceed 12 feet. Vertical headroom clearance shall be 7 feet minimum at projections above the stairs. Stair stringers shall be not less than 10 inches in depth, and 15.3 pounds per foot channels. Slip resistant nosing shall be supplied with stair treads. Stairs shall be provided with handrails and guardrails in accordance with S201.1.4 Guardrails and Handrails.

S201.1.4 Guardrails and Handrails
Guardrails and handrails shall be designed to comply with the governing building code, OSHA, and NFPA 101 Regulations, and all other applicable codes and standards as defined in Exhibit N – Codes and Standards. Design shall be to the most restrictive requirements of the referenced codes. All open stairs shall have a combination guardrail/handrail system as described in the codes. The upper surface of the

top rail of guardrails shall be 42 inches above the surface of platforms, walkways, and stair treads in line with face of riser at the forward edge of the tread. Handrails on stairs shall be supported by brackets from the guardrail posts with the upper surface of the handrail 34 inches above the surface of stair treads in line with face of riser at the forward edge of the tread.

Railings shall be designed to meet the design loading requirements of the governing building code and other applicable codes and standards. Steel posts shall be vertical and uniformly spaced with 7 feet maximum spacing, or less as required for the post, railings, and connections to conform to the design loading requirements of the applicable codes and standards. Handrails shall be 1-1/2 inch nominal diameter steel pipe.

Railings shall be smooth, with all projecting joints and sharp corners ground smooth. Welded joints shall be of the flush type. Members shall be neatly coped and continuously welded at all junctions of posts and rails. Flattening of the rail or post ends at junctions of posts and rails will not be permitted. Fittings or other connectors shall not be used at junctions of posts and rails. For galvanized railings, joints shall have internal openings so there are no closed or blind sections of pipe. When the bottom of the handrail post is closed, a drain hole shall be provided on the vertical side of the post near the bottom.

All welding shall be done neatly and substantially, with all fillets dressed to uniform radius, all excess metal removed, and all welds ground smooth and flush.

All angles, offsets, and other changes in alignment of railings shall be made with accurately mitered joints, welded railing fittings, or smooth radius shop bends.

S201.1.5 Kickplates
Kickplates shall be provided for platforms, on equipment roofs as required, and as necessary for personnel protection and safety. Kickplates shall project a minimum of 4 inches. Minimum thickness of kickplates shall be 1/4 inch. Kickplates on roofs shall be notched for drainage. Openings in grating panels shall be provided with kickplates.

S201.1.6 Ladders
Ladders may be used in lieu of stairways for emergency egress only and where applicable codes and standards allow. Egress provisions must meet codes and standards criteria for ladder use. Ladders shall be designed to meet the design loading requirements and other specified requirements of the governing building code, OSHA, ANSI, and NFPA 101 Regulations, and all other applicable codes and standards as defined in Exhibit N – Codes and Standards.

Ladders shall not be less than 18 inches wide with 3/4 inch diameter solid steel rungs spaced 12 inches (center-to-center. The distance of the first rung at the bottom of the ladder may range up to 14 inches from the surface below. The top rung shall be level with the landing or platform. Ladder side rails shall be steel bars not smaller than 3 inches by 1/2 inch. Ladder side rails shall be punched for the rungs. Rungs shall be extended to within 1/8 inch of the outside rail surface, and the remaining 1/8 inch shall be plug welded. Rungs shall be continuously fillet welded inside each rail surface. Ladder supports shall be steel brackets not less than 4 inches by 1/2 inch, spaced not more than 18 feet vertically center-to-center. The center of the rung shall be no less than 7 inches (horizontal measure) from the nearest permanent object. Cages shall be provided on ladders where the length of climb is more than 20 feet. Where the length of climb is less than 20 feet but the top of ladder is more than 20 feet above adjoining surfaces (fall potential to the ground, roofs or floors), cages shall also be provided. Ladder side rails shall extend a minimum of 3 feet 6 inches above the top of floors and be flared to a minimum clear width of 24 inches for walk-through access, and extend a minimum of 4 feet 0 inches for side access ladders.

Self-closing gates shall be provided at all ladder entrances (chains shall not be used).

S201.2 Materials
Materials used shall be equal to or exceed the following minimal requirements:

Steel framing, kickplates, angles	ASTM A36
Ladders	ASTM A36
Connection bolts for steel framing	ASTM A325, Type 1, with washers and nuts
Rectangular bar grating 1-1/4 inch minimum depth (serrated for exterior use)	ANSI/NAAMM MGB531, W-19-4
Stair tread grating	Same as rectangular grating except bearing bars not less than 3/16 inch by 1 inch for lengths up to and including 3 feet and less. Bearing bar spacing not to exceed 1-3/16 inch
Stair tread fasteners (furnish with stair treads)	Galvanized 3/8 inch minimum diameter bolts conforming to ASTM A307, Grade A with lock washers and nuts
Nosing	Slip resistant checkered plate or acceptable equal
Guardrails and handrails - posts and rails (minimum size and strength)	ASTM A53, Type E or S, Grade B, 1-1/2 inch nominal diameter pipe, Rails Schedule 40, Posts Schedule 80, or acceptable equal
Optional rail fittings for angles, offsets, and other changes in alignment	R&B Wagner railing fittings with Wedgelock welding connectors at each end. (Slip-on fittings using set screws and open seam fittings are not acceptable.)

S201.3 Coatings
Coatings shall be in accordance with the following:

Structural steel framing, kickplates, and angles not shop attached to grating and guardrails	In accordance with Technical Supplemental Specification Q300 in Section 01400
Rectangular bar grating, stair treads, nosings, guardrails, and handrails	Hot-dip galvanized in accordance with ASTM A123 and A153 after shop fabrication completed

S201.4 Welding
Welding shall be in accordance with the applicable requirements of Technical Supplemental Specifications Q100 and Q121 in this Section 01400.

S201.5 Technical Attachments
The following attachments accompany these specifications in either paper or electronic format. The information contained in these documents constitutes requirements under this Technical Supplemental Specification:

Document Number/Description	Title	Revision

JFU JAC

Document Number/Description	Title	Revision
81112-DS-0064	Typical Guardrail and Stair Rail Conforming to IBC 2003, 2006 & 2009 for Areas Not Accessible to the Public	9
81112-DS-0071	Typical Ladder Details	8

S300 Structural Design Loads
(Source: 25Mar08 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

S300.1 General
Design loads for all buildings, structures, structural elements and components, handrails, guardrails, and connections shall be determined according to the criteria specified in this section, unless the governing building code specified in Exhibit S – Site and Site Conditions requires more severe design conditions. Loads imposed on structural systems from the weight of all temporary and permanent construction, occupants and their possessions, environmental effects, differential settlement, and restrained dimensional changes shall be considered.

The live loads used in the design of buildings and structures shall be the maximum loads likely to be imposed by the intended use or occupancy, but shall not be less than the minimum uniform live loads presented in Section S300.3, unless allowed by the governing building code. Components of the structural system may be designed for a reduced live load in accordance with the governing building code. Roofs shall be designed to preclude instability resulting from ponding effects by ensuring adequate primary and secondary drainage systems, slope, and member stiffness.

Structural elements supporting major equipment shall be designed for the greater of the uniform live load or the loading imposed by the actual equipment.

Construction or crane access considerations may dictate the use of temporary structural systems. Special considerations shall be made to ensure the stability and integrity of the structures during any periods involving use of temporary bracing systems.

S300.2 Design Loads
Design loads shall be in accordance with the following.

Load Types	Criteria/Source
Dead Loads	ASCE 7, Tables C3-1 and C3-2.
Pipe Support, major piping	Specifically determined, including thermal and dynamic loads, and verified against final pipe routing and analysis.
Pipe Support, other piping and electrical conduit and cable tray	Design for not to exceed uniform area loads, plus a concentrated phantom load located to create maximum moment and shear as a representation for the future actual loads if actual loads are not available to support the detailed design. Selected area loads and phantom loads shall be verified such that the resultant stresses from actual loads do not exceed the design stresses generated from the area and phantom loads.

Load Types	Criteria/Source
Live Loads	WFGD Supplier's calculated weight of the contents of tanks, silos, bins, hoppers; movable loads, such as people, equipment, tools, and components during construction, operations, and maintenance; maximum loads likely to be imposed by intended use or occupancy, but not less than the loads in Section S300.3, nor actual equipment weight.
Impact Loads	Section S300.3 loads allow for ordinary impact conditions. Reciprocating or rotating machinery, elevators, cranes, pumps, and compressors shall have specific calculations addressing dynamic forces. Impact loads shall be as specified in ASCE 7 Sections 4.7 and 4.10 unless analysis indicates higher values are required.
Wind Loads, buildings and structures	Basic design wind speed shall be in accordance with Exhibit S -- Site and Site Conditions. No shielding shall be permitted for ground conditions or for adjacent structural members. Importance Factor, when required, shall be for structures supporting emergency services.
Snow Load	Minimum ground snow load shall be in accordance with Exhibit S – Site and Site Conditions. Drift loads shall be applied to roof discontinuities and roof regions shielded by large roof-mounted equipment or machine penthouses.
Ice Loads	Applicable to steel lattice type structures and guy cables. Ice accretion shall be in accordance with Exhibit S – Site and Site Conditions. An ice density of 57 pounds/ft^3 shall be used.
Seismic Loads, buildings (by building, if appropriate)	Seismic loads for buildings shall be accordance with Exhibit S – Site and Site Conditions and Supplemental Specification S100.
Seismic Loads, components and attachments	Seismic loads for components and attachments shall be accordance with Exhibit S – Site and Site Conditions Supplemental Specification S100. Amplification and response modification factors shall be in accordance with ASCE 7, Subsection 9.6.3.

S300.3 Minimum Uniform Live Loads
Minimum uniform live loads shall be in accordance with the following.

Area	Live Load, psf

Grating Floors	60
Roofs	20
Stairs	100

S400 Standard Supplier Load Tables for Equipment and Components
(Source: 25Mar08 - Revised by Project: 18Aug11)

S400.1 General
This article specifies the WFGD Supplier load information that shall be provided for all components (including tanks, vessels, and piping or cable tray systems) and all equipment or skid mounted equipment that is directly supported by the Buyer's structural steel and/or concrete foundations, unless noted otherwise within these specifications. Accurate and properly formatted loads are critical to ensure that communication of load information between the WFGD Supplier and Buyer is consistent and inherently clear.

S400.2 Load Table Requirements
The Standard Supplier Load Table for Equipment included at the end of this section shall be used to convey the WFGD Supplier's load information to the Buyer. A load table or load list on the WFGD Supplier's drawings does not constitute compliance with this requirement. An electronic copy of this table shall be downloaded from the following website (no password required), electronically completed, and submitted by the dates shown in the Schedule of Submittals.

http://www.bv.com/downloads/Forms/Energy/SupplierLoadTableEquipmentAndComponents.xls

The WFGD Supplier shall submit this table in its original file format (.xls) for all load submittals for every individual piece of equipment where load is transferred to the Buyer's support structure(s). This load information shall also be shown on the appropriate WFGD Supplier drawings. The WFGD Supplier's name, the equipment name, and revision block data shall be provided for every submittal of loads.

S400.2.1 Revision Block Data
The revision number shall be entered for every load submittal. Alphabetic revision numbers shall be used for all preliminary load submittals, starting with revision "A". Numeric revision numbers shall be used for all "not-to-exceed" and final/certified load submittals, starting with revision "0". The date and description blocks shall also be completed for each load submittal.

S400.2.2 Load Classifications

S400.2.2.1 Preliminary Loads. Preliminary loads are defined as loads that are not to be used for detailed design by the Buyer. Preliminary loads shall not be submitted when Not-to-Exceed (NTE) or certified loads have been requested. Preliminary loads shall be based on data that is representative of the structure or equipment being supplied without excessive safety factors on the loads. Any load submittal classified as "preliminary" in the load table shall be in accordance with the load classification noted in the Schedule of Submittals.

S400.2.2.2 Not-To-Exceed (NTE) Loads. NTE loads are defined as loads that may be used for detailed design by the Buyer but are not classified as final or certified loads in accordance with Section S400.2.2.3. NTE loads are generally submitted by the WFGD Supplier when certified load information is not available but the Buyer needs to begin detailed design of the supporting structure(s). NTE loads shall be based on data that is representative of the equipment being supplied without excessive safety factors on the loads. It is expected that final loads will not exceed the NTE loads. Any load submittal classified as "Not-to-Exceed" in the load table shall be in accordance with the load classifications as noted in the Schedule of Submittals.

If the WFGD Supplier anticipates that previously submitted NTE loads may be more than or significantly less than the certified loads for any piece of equipment and/or load case, the WFGD Supplier shall notify the Buyer as soon as they are aware of this situation and re-submit the load tables with the updated NTE loads soon thereafter.

S400.2.2.3 Final (Certified) Loads. Certified loads are defined as loads that have been verified as final and accurate by the WFGD Supplier and which may be used for detailed design by the Buyer. Certified loads shall be submitted by the WFGD Supplier as soon as the verified load information becomes available. Certified loads shall be submitted by the WFGD Supplier regardless of whether NTE loads were submitted at a prior date. Any load submittal classified as "final" or "certified" in the load table shall be in accordance with the load classifications as noted in the Schedule of Submittals.

Supplier Load Table for Equipment and Components

Purchase Order No: XXXXXX.YY.ZZZZ
Supplier Name: XYZ Company
Equipment Name: Equipment 1

Rev.	Date	Load Class.*	Revision Description

* - Load classifications are Preliminary, Not-to-Exceed (NTE), and Final/Certified

Units: All units are in kips and feet
Notation: +/- X (horiz) as shown on supplier dwgs
+/- Y (horiz) as shown on vendor dwgs
+Z is vertical (down); -Z is vertical (up)
+/- M in accordance with the "right-hand" rule
Supplier loads and moments shall be calculated at the interface elevation with the Purchaser's supporting structure

Equip or Support ID	Dead Load (Min**)			Dead Load (Normal)			Live Load (Vertical)			Snow Load		
	Z	Mx	My	Z	Mx	My	Z	Mx	My	Z	Mx	My

** - Minimum Dead Load is the "reliable" dead load available to resist uplift.

Equip or Support ID	+X Seismic Load			-X Seismic Load			+Y Seismic Load			-Y Seismic Load			Z Seismic Ld	
	X	My	Mz	X	My	Mz	Y	Mx	Mz	Y	Mx	Mz	+Z	-Z

Equip or Support ID	+X Wind Load			-X Wind Load			+Y Wind Load			-Y Wind Load		
	X	My	Mz	X	My	Mz	Y	Mx	Mz	Y	Mx	Mz

Equip or Support ID	Other Load						*Other Load*					
	X	Y	Z	Mx	My	Mz	X	Y	Z	Mx	My	Mz

V100 Noise Abatement
(Source: 18Jun10 - Revised by Project: 14Jul11, Revised by Package: 18Aug11)

The near-field noise emissions for each equipment component furnished under these specifications shall not exceed a spatially-averaged free-field A-weighted sound pressure level of 85 dBA (referenced to 20 micropascals) measured along the equipment envelope at a height of 5 feet above floor/ground level and any personnel platform during normal operation. The equipment envelope is defined as the perimeter line that completely encompasses the equipment package at a distance of 3 feet horizontally from the equipment face. The near-field noise emissions include the contribution of all noise associated with the equipment component. Normal operation includes all operating conditions up to the equipment rated capacity exclusive of start-up, shut-down, and upset conditions.

Where the drive motors, variable frequency drives (VFDs), or mechanical drives for the equipment are also furnished under these specifications, the total combined near-field sound pressure level of the motor, VFD, or mechanical drive and the driven equipment measured as a single component, operating at design load, shall not exceed a spatially-averaged free-field A-weighted sound pressure level of 85 dBA (referenced to 20 micropascals) measured along the equipment envelope.

During off-normal and intermittent operation such as start-up, shut-down, and upset conditions the equipment sound pressure level shall not exceed a maximum of 110 dBA at all locations along the equipment envelope, including platform areas, that are normally accessible by personnel.

WFGD Supplier shall identify any equipment which may not comply with the 85 dBA criteria and shall obtain Buyer's written approval for each such deviation based on WFGD Supplier's predicted noise emissions level.

Compliance with the near-field noise emissions requirement shall be determined in accordance with industry standard ASME PTC-36. Compliance shall be based on not exceeding the allowable sound pressure level including background sound level corrections and excluding any correction for measurement uncertainties.

LG&E Mill Creek WFGD Systems Units 1 & 2
Agreement Price and Milestone Payment and Termination Schedules

Invoice Month	Milestone(s)	Milestone Amount	Monthly Invoice Amount	Cumulative Invoiced Amount
Apr-12				
	BPEI Receives Notice to Proceed			
	Develop Recycle Pump D&R Dvlpmt			
	Agitr Sump/Reaction Tk D&R Dvlpmt			
	Oxidation Air D&R Dvlpmt			
	Mist Eliminator D&R Dvlpmt			
	RFQ Recycle Pumps Spec Docs			
	Purchase Absorber Cap Raw Materials			
	Absorber Tower Arrangements			
	Negotiate/Award Absorber Tower PO			
	Vessel Engineering			
	Develop/Issue "IFI" P&ID's			
	*General Arrangement Absorber IFI			
	External Recycle Piping Arr't - IFI			
	Vessel Engineering			
	(Vessel) Procurement			
	Absorber Sizing			
	CCD Development for FRP			
May-12				
	Requisition Oxidation Air Blower			
	Recycle Spray Nozzles RFQ Spec Docs			
	Knifegate Valves RFQ Spec Docs			
	Requisition Recycle Spray Nozzles			
	Emergency Quench Nozzles RFQ Spec Docs			
	Requisition Emergency Quench Nozzles			
	Requisition Mist Eliminators			
	Develop "IFA" Anchor Bolt & Embed Item Require.			
	Plant General Arrangement IFA			
	Recycle Spray Nozzles (D&R's)			
	Emergency Quench Spray Nozzles (D&R's)			
	Oxidation Air Blower (D&R's)			
	IFI Process Flow Diagrams			
	IFI Flue Gas Path Pressure Drop Calculation			
	Valve List (IFI)			
	Pipe Line List (IFI)			
	Mist Eliminators (D&R's)			
	Develop/Issue "IFI" Instrument List			
	Requisition Knifegate Valves			
	Vessel Engineering			
Jun-12				
	Hydraulic Pump System RFQ Spec Docs			
	Absorber Spray Headers Arrangement			
	Abs Cap/Outlet Duct Arrg			
	Absorber Cap Access Arr't			
	Quench Water Piping Arrangement IFA			
	IFA Process Flow Diagrams			
	Vessel Engineering			
	Award Mist Eliminators PO			
Jul-12				
	Requisition Hydraulic Pump System			
	Absorber Cap Seal Specification			
	Spray Header Truss Details			
	Mist Eliminator Supports Arrangement/Details			
	Abs Cap/Outlet Duct Details			
	Pipe Line List (IFA)			
	Valve List (IFA)			
	Baseline Gas Flow Study Conform. Sizes to KU			
	IFD Flue Gas Path Pressure Drop Calculation			
	Gas Side Pressure Drop			
	Issue "IFA" P&ID's			
	Develop/Draw "IFA" P&ID's			
	IFA DCS I/O Lists			
	Develop/Issue "IFA" Instrument List			
	IFA Electric Motor List			
	Issue PO for Absorber Cap			
	Recycle Spray Nozzles Hardware Award PO			
	Mist Eliminator Supports Award PO			
	Award Hydraulic Pump System PO			
	Award Bleed Pumps PO			
	Award HydroCyclone PO			

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Invoice Month	Milestone(s)	Milestone Amount	Monthly Invoice Amount	Cumulative Invoiced Amount
	(Vessel) Engineering	[redacted]		
Aug-12				
	Absorber Cap Access Arr't			
	Absorber Platforms Arr't IFA			
	Oxidation Air Piping Arrangement IFA			
	IFI Binary Logic Diagrams			
	IFI Analog Logic Diagrams			
	SA Absorber Platforms Design			
	Abs Spray Header Support Design			
	Vessel Engineering			
Sep-12				
	ABS Overflow Piping Arrangement			
	Process Water Piping Arrangement			
	External Recycle Piping Arr't IFA			
	Flush Water Piping Arrangement IFA			
	Develop Cert Absorber Anchors & Embedded Items			
	Mist Eliminator Supply Pipe Details IFA			
	Absorber Cap Gasket/Ex Joint D&R			
	Plant General Arrangement IFD			
	Issue System Process Description IFD			
	IFD Process Flow Diagrams			
	Issue Functional Description IFD			
	IFA Electrical Consumers List			
	Issue PO for Spray Header Supports			
	(Vessel) Engineering			
	Issue PO for Quench Water Piping			
	Issue RFQ Absorber Cap Gasket			
	Recycle Piping PO			
	Procure Quench Water Piping Raw Materials			
Oct-12				
	Gyp Slurry Bleed/Sample Arrt/Dtls			
	Reclaim Water Piping Arr't -IFA			
	Flush Water Piping Details IFC			
	Develop "IFD" P&ID's			
	Absorber Vessel Wall Ring Design to DG			
	SA Gypsum Slurry Bleed/Sample R/A			
	SA Gypsum Slurry Bleed/Sample			
	(Vessel) Engineering			
Nov-12				
	ABS Overflow Piping Details			
	Gypsum Slurry Bleed/Sample IFC			
	Ex Rcyl Expansion Joint D&R/Sketches			
	Issue/Review "IFD" P&ID's			
	Valve List (IFD)			
	Pipe Line List (IFD)			
	IFA Binary Logics			
	IFA Analog Logics			
	Instrument Specifications			
	I&C Develop/Draw "IFD" P&ID's			
	IFD DCS I/O Lists			
	Issue PO for Gypsum Slurry Bleed/Sample			
	Issue Absorber Cap Gasket PO			
	Vessel Material			
	(Vessel) Engineering			
Dec-12				
	Actuated Valves RFQ Spec Docs			
	Manual Lined Valves RFQ Spec Docs			
	Rev & Approve Spray Header Supports Drawings.			
	Vessel Fabrication & Erection Support			
	Absorber Vessel Wall Ring Arrangement			
	Award Ex Joint/Piping PO			
	Mist Eliminator Supply Piping Drawings			
	Fabricate Absorber Cap Gasket			
	Fabricate Absorber Cap Seal			
	Recycle Spray Nozzles Hardware Fabrication			
Jan-13				
	Requisition Actuated Valves			
	Requisition Manual Lined Valves			
	Regn Absorber Vessel Wall Rings			
	Develop "IFA" Utility Req (Service Air/Power)			
	Dev "IFA" BOM for Customer (Shippable Comp List)			
	(Vessel) Materials			
	(Vessel) Material Delivery			
	Absorber Vessel Wall Rings PO			
	Issue Pressure Instrumentation PO			
	Issue PH Instrumentation PO			
	Issue Temperature Instrumentation PO			

Invoice Month	Milestone(s)	Milestone Amount	Monthly Invoice Amount	Cumulative Invoiced Amount
	Issue Density Instrumentation PO	[redacted]		
	Issue Level Instrumentation PO			
Feb-13				
	Award Manual Lined PO			
	(Vessel) Material Delivery			
	Fabricate Absorber Spray Headers			
	Recycle Spray Nozzles Assembly & Fabrication			
	Emergency Quench/Humidification Nozzle Fab			
	Knifegate Valves Assemby & Fabrication			
Mar-13				
	IFA Instrument Install Detail w/O&M			
	Issue PO for ABS Overflow Piping			
	SA Reclaim Water Piping R/A 106720100F			
	(Vessel) Rebar			
	(Vessel) Proprietary Material			
	(Vessel) Material Delivery			
Apr-13				
	IFA Instrument Wiring Diagrams			
	IFD Instrument Location Drawings			
	(Vessel) Engineering			
	(Vessel) Material Delivery			
	Bleed Pumps Assemby & Fabrication			
May-13				
	Develop "IFC" P&ID's			
	IFC Instrument List			
	IFC Electrical Consumers/Motor List			
	Review IFC Functional Description			
	IFC Electrical Motor List			
	QA Recycle Pumps			
	(Vessel) Material Delivery			
	Delivery of Recycle Spray Nozzles Hardware			
Jun-13				
	Valve Data Sheets (Control & Relief Vlvs) (Aux)			
	Plant General Arrangement IFC			
	External Recycle Piping IFC			
	*Motor Data Sheets (IFC)			
	IFA Alarm List & Setpoint List			
	(Vessel) Material Delivery			
	Delivery of Absorber Spray Headers			
Jul-13				
	IFC Instrument Location Dwgs			
	IFC Instrument Install. Details			
	(Vessel) Material Delivery			
	Deliver Absorber Cap Seal			
	Recycle Spray Nozzles Delivery			
	Fabricate Absorber Cap			
	Actuated Vlvs Assemby & Fabrication			
	Manual Lined Vlvs Assemby & Fabrication			
Aug-13				
	Quench Water Piping Details IFC			
	Reclaim Water Piping Arr't - IFC			
	(Vessel) Material Delivery			
	Recycle Piping Fabrication			
	Absorber Vessel Wall Rings Fabrication			
	Fabricate Abs Spray Header Supports			
Sep-13				
	(Vessel) Material Delivery			
	Fabricate Absorber Cap Access			
	Fabricate Quench Water Piping			
	Ex Joint/Piping Delivery			
	Recycle Piping Delivery			
	External Recycle Piping Supports Delivery			
	Mist Eliminator Fabrication Supply Piping			
	Delivery of Absorber Cap Access			
	Actuated Vlvs Delivery			
	Manual Lined Vlvs Delivery			
	Hydraulic Pump System Assemby & Fabrication			
Oct-13				
	(Vessel) Material Delivery			
	Deliver Oxidation Air Blower			
	Delivery of Absorber Cap			
	Fabricate Oxidation Air Pipe			
	Deliver Level Instrumentation			
	Deliver Pressure Instrumentation			
	Delivery of Abs Spray Header Supports			
Nov-13				

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Invoice Month	Milestone(s)	[redacted]
	(Vessel) Material Delivery	
	Mist Eliminator Delivery Supports	
	Recycle Pumps Delivery	
	Deliver PH Instrumentation	
	Mist Eliminator Delivery Supply Piping	
	Deliver Absorber Cap Gasket	
	Absorber Vessel Wall Rings Delivery	
	Hydraulic Pump System Delivery	
	Deliver Temperature Instrumentation	
	Delivery of Quench Water Piping	
	Fabricate Reclaim Water Pipe	
Dec-13		
	Emergency Quench/Humidification Nozzle Delivery	
	Delivery of Oxidation Air Piping	
	Knifegate Valves Delivery	
Jan-14		
	Bleed Pumps Delivery	
	Mist Eliminators Delivery	
	Limestone Feed Ext Piping Arr/IFC	
	Develop & Issue Operating Proceedures	
	Fabricate ABS Overflow Piping	
	Fabricate Limestone Feed/Slurry Bleed Ext Piping	
	Fabricate Gypsum Slurry Bleed/Sample	
Feb-14		
	Reqn. External Recycle Piping Supports	
	I&C Review IFD Functional Description	
	Delivery of ABS Overflow Piping	
	Delivery of Reclaim Water Piping	
	Delivery of Limestone Feed/Slurry Bleed Piping	
	Delivery of Gypsum Slurry Bleed/Sample	
	Delivery of Process Water Piping	
	Agitators Abs Sump/React Tnk Delivery	
Mar-14		
	HydroCyclone Delivery	
	Construction Support	
Apr-14		
	Construction Support	
May-14		
	Construction Support	
Jun-14		
	Construction Support	
Jul-14		
	Construction Support	
Aug-14		
	Construction Support	
Sep-14		
	Construction Support	
Oct-14		
	Construction Support	
Nov-14		
	Construction Support	
Dec-14		
	Start-up Support	
Jan-15		
	Start-up Support	
Feb-15		
	Start-up Support	
Mar-15		
	Start-up Support	
Apr-15		
	Start-up Support	
May-15		
	Start-up Support	
Jun-15		
	Start-up Support	
Jul-15		
	Start-up Support	
Aug-15		
	Start-up Support	
Sep-15		
	Start-up Support	
Nov-15		
	Start-up Support	
Dec-15		
	Start-up Support	
	Total Contract Value	

LG&E Mill Creek WFGD Systems Unit 4
Agreement Price and Milestone Payment and Termination Schedules

Invoice Month	Milestone's)	[redacted]
Apr-12		
	BPEI Receives Notice to Proceed	
	Develop Recycle Pump D&R Development	
	Agitr Sump/Reaction Tk D&R Development	
	Oxidation Air D&R Development	
	Mist Eliminator D&R Development	
	RFQ Recycle Pumps Spec Docs	
	Purchase Absorber Cap Raw Materials	
	Absorber Tower Arrangements	
	Negotiate/Award Absorber Tower PO	
	Vessel Engineering	
	Develop/Issue "IFI" P&ID's	
	*General Arrangement Absorber IFI	
	External Recycle Piping Arr't - IFI	
	Vessel Engineering	
	(Vessel) Procurement	
	Absorber Sizing	
	CCD Development for FRP	
May-12		
	Requisition Oxidation Air Blower	
	Recycle Spray Nozzles RFQ Spec Docs	
	Knifegate Vlvs RFQ Spec Docs	
	Requisition Recycle Spray Nozzles	
	Emergency Quench Nozzles RFQ Spec Docs	
	Requisition Emergency Quench Nozzles	
	Requisition Mist Eliminators	
	Develop "IFA" Anchor Bolt & Embed Item Require.	
	Plant General Arrangement IFA	
	Recycle Spray Nozzles (D&R's)	
	Emergency Quench Spray Nozzles (D&R's)	
	Oxidation Air Blower (D&R's)	
	IFI Process Flow Diagrams	
	IFI Flue Gas Path Pressure Drop Calculation	
	Valve List (IFI)	
	Pipe Line List (IFI)	
	Mist Eliminators (D&R's)	
	Develop/Issue "IFI" Instrument List	
	Requisition Knifegate Valves	
	Vessel Engineering	
Jun-12		
	Hydraulic Pump System RFQ Spec Docs	
	Absorber Spray Headers Arrangement	
	Abs Cap/Outlet Duct Arrg	
	Absorber Cap Access Arr't	
	Quench Water Piping Arrangement IFA	
	IFA Process Flow Diagrams	
	Vessel Engineering	
	Award Mist Eliminators PO	
Jul-12		
	Requisition Hydraulic Pump System	
	Absorber Cap Seal Specification	
	Spray Header Truss Dtls	
	Mist Eliminator Supports Arr/Details	
	Abs Cap/Outlet Duct Details	
	Pipe Line List (IFA)	
	Valve List (IFA)	
	Baseline Gas Flow Study Conform. Sizes to KU	
	IFD Flue Gas Path Pressure Drop Calculation	
	Gas Side Pressure Drop	
	Issue "IFA" P&ID's	
	Develop/Draw "IFA" P&ID's	
	IFA DCS I/O Lists	
	Develop/Issue "IFA" Instrument List	
	IFA Electric Motor List	
	Issue PO for Absorber Cap	
	Recycle Spray Nozzles Hardware Award PO	
	Mist Eliminator Supports Award PO	
	Award Hydraulic Pump System PO	
	Award Bleed Pumps PO	
	Award HydroCyclone PO	

Invoice Month	Milestone's)
	(Vessel) Engineering
Aug-12	
	Absorber Cap Access Arr't
	Absorber Platforms Arr't IFA
	Oxidation Air Piping Arra IFA
	IFI Binary Logic Diagrams
	IFI Analog Logic Diagrams
	SA Absorber Platforms Design
	Abs Spray Header Support Dsgn
	Vessel Engineering
Sep-12	
	ABS Overflow Piping Arrangement
	Process Water Piping Arrangement
	External Recycle Piping Arr't IFA
	Flush Water Piping Arrangement IFA
	Develop Cert Absorber Anchors & Embedded Items
	Mist Eliminator Supply Pipe Details IFA
	Absorber Cap Gasket/Ex Joint D&R
	Plant General Arrangement IFD
	Issue System Process Description IFD
	IFD Process Flow Diagrams
	Issue Functional Description IFD
	IFA Electrical Consumers List
	Issue PO for Spray Header Supports
	(Vessel) Engineering
	Issue PO for Quench Water Piping
	Issue RFQ Absorber Cap Gasket
	Recycle Piping PO
	Procure Quench Water Piping Raw Materials
Oct-12	
	Gyp Slurry Bleed/Sample Arrt/Dtls
	Reclaim Water Piping Arr't -IFA
	Flush Water Piping Dtls IFC
	Develop "IFD" P&ID's
	Absorber Vessel Wall Ring Design to DG
	SA Gypsum Slurry Bleed/Sample R/A
	SA Gypsum Slurry Bleed/Sample
	(Vessel) Engineering
Nov-12	
	ABS Overflow Piping Details
	Gypsum Slurry Bleed/Sample IFC
	Ex Rcyl Expansion Joint D&R/Sketches
	Issue/Review "IFD" P&ID's
	Valve List (IFD)
	Pipe Line List (IFD)
	IFA Binary Logics
	IFA Analog Logics
	Instrument Specifications
	I&C Develop/Draw "IFD" P&ID's
	IFD DCS I/O Lists
	Issue PO for Gypsum Slurry Bleed/Sample
	Issue Absorber Cap Gasket PO
	Vessel Material
	(Vessel) Engineering
Dec-12	
	Actuated Vlvs RFQ Spec Docs
	Manual Lined Vlvs RFQ Spec Docs
	Rev & Approve Spray Header Supports Drawings.
	Vessel Fabrication & Erection Support
	Absorber Vessel Wall Ring Arr
	Award Ex Joint/Piping PO
	Mist Eliminator Supply Piping Drawings
	Fabricate Absorber Cap Gasket
	Fabricate Absorber Cap Seal
	Recycle Spray Nozzles Hardware Fabrication
Jan-13	
	Requisition Actuated Vlvs
	Requisition Manual Lined Vlvs
	Requisition Absorber Vessel Wall Rings
	Develop "IFA" Utility Req (Service Air/Power)
	Dev "IFA" BOM for Customer (Shippable Comp List)
	(Vessel) Materials
	(Vessel) Material Delivery
	Absorber Vessel Wall Rings PO
	Issue Pressure Instrumentation PO
	Issue PH Instrumentation PO
	Issue Temperature Instrumentation PO

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Invoice Month	Milestone's)
	Issue Density Instrumentation PO
	Issue Level Instrumentation PO
Feb-13	
	Award Manual Lined PO
	(Vessel) Material Delivery
	Fabricate Absorber Spray Headers
	Recycle Spray Nozzles Assembly & Fabrication
	Emergency Quench/Humidification Nozzle Fab
	Knifegate Valves Assembly & Fabrication
Mar-13	
	IFA Instrument Install Detail w/O&M
	Issue PO for ABS Overflow Piping
	SA Reclaim Water Piping R/A 106720100F
	(Vessel) Rebar
	(Vessel) Proprietary Material
	(Vessel) Material Delivery
Apr-13	
	IFA Instrument Wiring Diagrams
	IFD Instrument Location Drawings
	(Vessel) Engineering
	(Vessel) Material Delivery
	Bleed Pumps Assembly & Fabrication
May-13	
	Develop "IFC" P&ID's
	IFC Instrument List
	IFC Electrical Consumers/Motor List
	Review IFC Functional Description
	IFC Electrical Motor List
	QA Recycle Pumps
	(Vessel) Material Delivery
	Delivery of Recycle Spray Nozzles Hardware
Jun-13	
	Valve Data Sheets (Control & Relief Vlvs) (Aux)
	Plant General Arrangement IFC
	External Recycle Piping IFC
	*Motor Data Sheets (IFC)
	IFA Alarm List & Set point List
	(Vessel) Material Delivery
	Delivery of Absorber Spray Headers
Jul-13	
	IFC Instrument Location Drawings
	IFC Instrument Install. Details
	(Vessel) Material Delivery
	Deliver Absorber Cap Seal
	Recycle Spray Nozzles Delivery
	Fabricate Absorber Cap
	Actuated Vlvs Assembly & Fabrication
	Manual Lined Vlvs Assembly & Fabrication
Aug-13	
	Quench Water Piping Details IFC
	Reclaim Water Piping Arr't - IFC
	(Vessel) Material Delivery
	Recycle Piping Fabrication
	Absorber Vessel Wall Rings Fabrication
	Fabricate Abs Spray Header Supports
Sep-13	
	(Vessel) Material Delivery
	Fabricate Absorber Cap Access
	Fabricate Quench Water Piping
	Ex Joint/Piping Delivery
	Recycle Piping Delivery
	External Recycle Piping Supports Delivery
	Mist Eliminator Fabrication Supply Piping
	Delivery of Absorber Cap Access
	Actuated Vlvs Delivery
	Manual Lined Vlvs Delivery
	Hydraulic Pump System Assembly & Fabrication
Oct-13	
	(Vessel) Material Delivery
	Deliver Oxidation Air Blower
	Delivery of Absorber Cap
	Fabricate Oxidation Air Pipe
	Deliver Level Instrumentation
	Deliver Pressure Instrumentation
	Delivery of Abs Spray Header Supports
Nov-13	
	(Vessel) Material Delivery

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Invoice Month	Milestone's)	[redacted]
	Mist Eliminator Delivery Supports	
	Recycle Pumps Delivery	
	Deliver PH Instrumentation	
	Mist Eliminator Delivery Supply Piping	
	Deliver Absorber Cap Gasket	
	Absorber Vessel Wall Rings Delivery	
	Hydraulic Pump System Delivery	
	Deliver Temperature Instrumentation	
	Delivery of Quench Water Piping	
	Fabricate Reclaim Water Pipe	
Dec-13		
	Emergency Quench/Humidification Nozzle Delivery	
	Delivery of Oxidation Air Piping	
	Knifegate Valves Delivery	
Jan-14		
	Bleed Pumps Delivery	
	Mist Eliminators Delivery	
	Limestone Feed Ext Piping Arr/IFC	
	Develop & Issue Operating Procedures	
	Fabricate ABS Overflow Piping	
	Fabricate Limestone Feed/Slurry Bleed Ext Piping	
	Fabricate Gypsum Slurry Bleed/Sample	
Feb-14		
	Requisition. External Recycle Piping Supports	
	I&C Review IFD Functional Description	
	Delivery of ABS Overflow Piping	
	Delivery of Reclaim Water Piping	
	Delivery of Limestone Feed/Slurry Bleed Piping	
	Delivery of Gypsum Slurry Bleed/Sample	
	Delivery of Process Water Piping	
	Agitators Abs Sump/React Tank Delivery	
Mar-14		
	HydroCyclone Delivery	
	Construction Support	
Apr-14		
	Construction Support	
May-14		
	Construction Support	
Jun-14		
	Construction Support	
Jul-14		
	Construction Support	
Aug-14		
	Construction Support	
Sep-14		
	Construction Support	
Oct-14		
	Construction Support	
Nov-14		
	Construction Support	
Dec-14		
	Start-up Support	
Jan-15		
	Start-up Support	
Feb-15		
	Start-up Support	
Mar-15		
	Start-up Support	
Apr-15		
	Start-up Support	
May-15		
	Start-up Support	
Jun-15		
	Start-up Support	
Jul-15		
	Start-up Support	
Aug-15		
	Start-up Support	
Sep-15		
	Start-up Support	
Nov-15		
	Start-up Support	
Dec-15		
	Start-up Support	
	Total Contract Value	

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LG&E Mill Creek WFGD Systems Unit 4

Agreement Price and Milestone Payment and Termination Schedules

Month	Invoice Month	[redacted]
1	Apr-12	
2	May-12	
3	Jun-12	
4	Jul-12	
5	Aug-12	
6	Sep-12	
7	Oct-12	
8	Nov-12	
9	Dec-12	
10	Jan-13	
11	Feb-13	
12	Mar-13	
13	Apr-13	
14	May-13	
15	Jun-13	
16	Jul-13	
17	Aug-13	
18	Sep-13	
19	Oct-13	
20	Nov-13	
21	Dec-13	
22	Jan-14	
23	Feb-14	
24	Mar-14	
25	Apr-14	
26	May-14	
27	Jun-14	
31	Jul-14	
32	Aug-14	
33	Sep-14	
34	Oct-14	
35	Nov-14	
36	Dec-14	
37	Jan-15	
38	Feb-15	
39	Mar-15	
40	Apr-15	
41	May-15	
42	Jun-15	
43	Jul-15	
44	Aug-15	
45	Sep-15	
46	Oct-15	
47	Nov-15	

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LG&E Mill Creek WFGD Systems Unit 1&2

Agreement Price and Milestone Payment and Termination Schedules

Month	Invoice Month	[redacted]
1	Apr-12	
2	May-12	
3	Jun-12	
4	Jul-12	
5	Aug-12	
6	Sep-12	
7	Oct-12	
8	Nov-12	
9	Dec-12	
10	Jan-13	
11	Feb-13	
12	Mar-13	
13	Apr-13	
14	May-13	
15	Jun-13	
16	Jul-13	
17	Aug-13	
18	Sep-13	
19	Oct-13	
20	Nov-13	
21	Dec-13	
22	Jan-14	
23	Feb-14	
24	Mar-14	
25	Apr-14	
26	May-14	
27	Jun-14	
31	Jul-14	
32	Aug-14	
33	Sep-14	
34	Oct-14	
35	Nov-14	
36	Dec-14	
37	Jan-15	
38	Feb-15	
39	Mar-15	
40	Apr-15	
41	May-15	
42	Jun-15	
43	Jul-15	
44	Aug-15	
45	Sep-15	
46	Oct-15	
47	Nov-15	

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EXHIBIT D

PROJECT SCHEDULE & KEY DATES

UNIT 1&2

Item	Date
Guaranteed Commercial Operation	[redacted]
Guaranteed Final Completion	
Scheduled Outages	
Unit 1 2015 Outage	
Unit 2 2015 Outage	
Unit 4 2014 Outage	

Agreement Schedule

The following Level I schedule is the basis of the Agreement. The Schedule is to be submitted per Unit 1&2 and Unit 4 and as an aggregate schedule in Primavera P6 and PDF format.

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Guaranteed Delivery Milestones and Guaranteed Delivery Milestone Dates
WFGD System for Units1/2

1. Supplier shall commence performance of the Work no later than April 30, 2012 and shall complete Work described below, as set forth herein.
2. Deliveries of Equipment and Materials, excluding Model Study, shall not commence prior to January, 2013.
3. Deliveries shall be completed no later than the following:

	Start	Complete
a. Structural and miscellaneous steel	[redacted]	
b. *Absorber Vessel Erection		
c. Vessel Floor Install		
d. Agitators		
e. Bleed Pumps		
f. Buildings		
g. Cranes & Hoists		
h. Electrical		
i. Expansion Joints(Piping)		
j. Hydrocyclones		
k. I&C		
l. Inlet Duct		
m. Mist Eliminator Panels		
n. Model Study		
o. Outlet Duct		
p. Oxidation Air Blowers		
q. Pipe, Valve, Hangers		
r. R/C Pumps		
s. Tanks		
t. All Other Equipment and Material Not Included Above		

*Absorber Vessel Erection to begin no earlier than Jan 21, 2013 unless agreed upon by WFGD Supplier and Subcontractor

4. Supplier shall notify LG&E of all Subcontractors to be utilized in performance of Work at least forty-eight (48) hours prior to start of Work. Subcontractors will be denied access to LG&E facilities without the required notification.

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EXHIBIT D

PROJECT SCHEDULE & KEY DATES

UNIT 4

Item	Date
Guaranteed Commercial Operation	[redacted]
Guaranteed Final Completion	
Scheduled Outages	
Unit 1 2015 Outage	
Unit 2 2015 Outage	
Unit 4 2014 Outage	

Agreement Schedule

The following Level I schedule is the basis of the Agreement. The Schedule is to be submitted per Unit 1&2 and Unit 4 and as an aggregate schedule in Primavera P6 and PDF format.

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Guaranteed Delivery Milestones and Guaranteed Delivery Milestone Dates
WFGD System for Unit 4

1. Supplier shall commence performance of the Work no later than April 30, 2012 and shall complete Work described below as set forth herein.
2. Deliveries of Equipment and Materials, excluding Model Study, shall not commence prior to January, 2013.
3. Deliveries shall be completed no later than the following:

   a. Structural and miscellaneous steel
   b. *Absorber Vessel Erection Tv
   c. Vessel Floor Install Th
   d. Agitators
   e. Bleed Pumps
   f. Buildings
   g. Cranes & Hoists
   h. Electrical
   i. Expansion Joints(Piping)
   j. Hydrocyclones
   k. I&C
   l. Inlet Duct
   m. Mist Eliminator Panels
   n. Model Study
   o. Outlet Duct
   p. Oxidation Air Blowers
   q. Pipe, Valve, Hangers
   r. R/C Pumps
   s. Tanks
   t. All Other Equipment and Materials Not Included Above

   [redacted]

   *Absorber Vessel Erection to begin no earlier than Feb 6, 2013 unless agreed upon by WFGD Supplier and Subcontractor

4. Supplier shall notify LG&E of all Subcontractors to be utilized in performance of Work at least forty-eight (48) hours prior to start of Work. Subcontractors will be denied access to LG&E facilities without the required notification.

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EXHIBIT E

ACCEPTABLE EQUIPMENT AND MATERIAL SUPPLIER LISTS

The following sub-suppliers have been pre-approved by the Buyer/Engineer to provide the corresponding components. Pre-approval of a supplier for one component category is not blanket acceptance for other components by that supplier. If the WFGD Supplier proposes to substitute a sub-supplier not on this list, then the sub-supplier's credentials shall be submitted to the Buyer/Engineer for approval. Any cost savings to the WFGD Supplier shall be credited to the Owner if a substitute sub-supplier is requested and approved. Sufficient data must be provided to the Engineer in a timely manner to prove that the proposed equipment is of an equivalent quality and has proven operation in similar service conditions, including capacity, to that provided by the pre-approved sub-suppliers. If an offshore sub-supplier is proposed, the WFGD Supplier shall provide information proving satisfactory domestic stockpiling of any required spare parts. Final decision concerning acceptance of an alternate sub-supplier shall be solely at Buyer's discretion.

Where multiple sub-suppliers are identified, those indicated in bold text are preferred by the Buyer and should be used for base bid purposes. Where no sub-supplier is named, the WFGD Supplier shall select based on previous successful service in similar utility power plant applications.

The WFGD Supplier shall indicate on the fill--in data sheets which sub-contractors and/or sub-suppliers shown are to be the source of the indicated equipment and those provided only as "typical" of the intended by the WFGD Supplier.

COMPONENT	PREAPPROVED SUBSUPPLIER
Actuators (Electric motor operated valves)	Rotork (E645.1.3) Limitorque Corp. (E645.1.3) Harold Beck &Sons, Inc. (E645.1.3)
Actuators – Hydraulic	Rotork – On/Off Service **Beck – Modulating Service** REXA – Modulating Service
Agitators (structure integrity is critical in the design)	Lightnin w/ Flak flex wrap coupling & Chesterton live load packing **Ekato**
Air Conditioning Units	**Trane** York International
Air Conditioner (Rooftop)	Trane (15730.1.6) Carrier (15730.1.6) McQuay (15730.1.6) York (15730.1.6)
Air Conditioner (Packaged self-contained)	Trane (15730.1.6) Carrier (15730.1.6) McQuay (15730.1.6) York (15730.1.6)
Air Conditioner (Packaged split system)	Trane (15730.1.6) Carrier (15730.1.6) Lennox (15730.1.6) McQuay (15730.1.6)

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COMPONENT	PREAPPROVED SUBSUPPLIER
	York (15730.1.6)
Air Conditioner (Ductless split system)	Carrier (15730.1.6) Mitsubishi (15730.1.6) Sanyo (15730.1.6)
Air Conditioner (Room, wall mounted)	Carrier (15730.1.6) General Electric (15730.1.6)
Air Handling Unit	Buffalo (15720.1.6) Trane (15720.1.6) Energy Labs (15720.1.6)
ANSI/IEEE Vendors	Cleveland Switchboard (16120.1.6) Cutler-Hammer (16120.1.6) GE Electrical Distribution and Control (16120.1.6) Group Schneider – Square D (16120.1.6) Keystone (16120.1.6) Siemens (16120.1.6)
Area Lighting In-line Fused Connectors	Bussman (16501.1.6)
Auxillary Relays	Allen-Bradley Bulletin 700 Type P (E530.2) Allen-Bradley Bulletin 700 Type PK (E530.2) General Electric Type HFA or HGA (E530.2) Westinghouse Type MG-6 (E530.2) Allen –Bradley Type 700P, IDEC
Ball Mill Grinding System	**FFE Minerals/Fuller-Traylor & Metso steel cap liner** Metso Minerals
Bin Activators	Kinergy Corp. Vibranetics, Division of Carrier Vibra Screw Carman Close
Cable Trays	B-Line Systems Chalfant Products Husky Products (Burndy) P-W Industries T.J. Cope US Gypsum Globe Div.
Cable – Coaxial and Triaxial	Belden Brand Rex Rockbestos
Cable-Medium Voltage Power Cable	Cablec Kerite Okonite Rome Houston Wire & Cable
Cable-600V Power Cable	Brand Rex Cablec Okonite Rockbestos

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Rome Houston Wire & Cable
Cable-600V Control Cable (ETFE/Tefzel Insulated)	Imperial Wire and Cable Basic Wire and Cable Cable USA Okonite TE Wire and Cable Aerospace Wire and Cable Omni Wire
Cable – FiberOptic	3M Chromatic Technologies Brand Rex Corning BIW
Cable – Instrumentation / Thermocouple Extension (ETFE/Tefzel Insulated)	See 600V Control Cable Suppliers
Cathodic Protection	Harco Magna Western Cathodic Engineering Allied Corpro
Caulking Compounds (exposed conditions)	Tremco "Dymonic" (07410.1.6) Pecora "Dynatrol I" (07410.1.6)
Caulking Compounds (Non-exposed conditions)	Tremco Curtain Wall Sealant(07410.1.6)
Caulking Tape	Tremco "MBT" Metal Building Tape (07410.1.6) Pecora "BB-50" ExtruSeal (07410.1.6) Protective Treatment Inc., "606 Sealant Tape" (07410.1.6)
Clarification, Filtration Equipment, and Thickeners	Envirex Graver Water Infilco Degremont L.A. Water Treatment Sanitaire Smith & Loveless Westech Engineering
Reagent Handling	Fairfield Engineering **Metso *Stephens-Adamson*** FMC Dearborn Midwest Roberts & Schaefer
Coil Coating	Heresite (15720.1.6)
Compressed Air Fittings (Grip/Compression Style)	Swagelok (M220.3)
Compressed Air Fittings (Threaded)	Swagelok (M220.3)

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COMPONENT	PREAPPROVED SUBSUPPLIER
Compressors (forced oxidation)	**Atlas Copco** Cooper Industries Ingersoll-Rand Root-Dresser Sullair Turblex
Conduit (aluminum)	Alflex Breeze-Illinois Condux International New Jersey Aluminum Easco Reynolds Metal Company VAW of America, Inc.
Conduit (steel)	Allied Tube and Conduit Clifton Conduit Corp. Republic Steel The Steelduct Co. Torrance Turbine Div. Triangle Conduit/Cable Westmoreland Conduit Wheatland Tube Col Youngstown Sheet and Tube
Conduit (PVC) coated (prefer not to use above ground PVC)	Rob Roy Stahl Ocal Inc.
Connectors (flexible)	Durodyne (15810.1.5) Duroprene (15810.1.5)
Connectors (flexible, insulated)	Durodyne (15810.1.5) Insuflex (15810.1.5)
Connectors (ground) (must be exothermic)	Burndy CADWELD THERMOWELD Thomas & Betts Co.
Contactors	Allen-Bradley (15920.1.5)
Contactors (Lighting)	ASCO (16501.1.6) Cutler-Hammer (16501.1.6) General Electric (16501.1.6) Siemens (16501.1.6) Square D (16501.1.6)
Control Panels	Comsip Customline Hatch Inc. Johnson Controls KEMCO Powell **Sewell**
Control Stations (local)	**Allen Bradley** Crouse Hinds

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Cutler Hammer Square D
Controls Drives – Electric	REXA **Beck**
Control Drives –Pneumatic	Bailey Controls Rosemount (Hagan)
Control Panel (Temperature)	Hoffman Engineering Company (15920.1.5) Honeywell (15920.1.5) Johnson Controls (15920.1.5)
Control Valves and Regulators	**Fisher** Fujikin **(for slurry service)** *Masonelian International*
Control Valves and Regulators (steam service)	**Fisher** Fujiken Copes Vulcan CCI Masonelian International
Control Valves – Rotary	Fisher Controls Jamesbury **Beck** Masonelian International
Controllers (Local)	Fisher 2502 for Level (K100.9) Fisher 4160 or 4195 Series for Pressure (K100.9) Fisher 4166 or 4196 Series for Temperature (K100.9) Foxboro 43AP series (K100.9)
Controllers (Photoelectric)	Fisher Pierce N7790B (16501.1.6)
Convenience Receptacles (Duplex, gray for finished areas, brown for unfinished areas)	Hubbell (Generic Cat. No. 5362) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Convenience Receptacles (Single, gray for finished areas, brown for unfinished areas)	Hubbell (Generic Cat. No. 5361) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Convenience Receptacles (Kitchen Range and Clock Outlet)	Hubbell (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Convenience Receptacles (Isolated Ground)	Hubbell (Generic Cat. No. IG5362) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Convenience Receptacles (Ground Fault Interrupting)	Hubbell (Generic Cat. No. GF20L) (16501.1.6) Pass & Seymour (16501.1.6)

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Convenience Receptacles (Hazardous Rated, Class I, Group D and Class II, Group F areas)	Appleton EFS "U-Line" or Crouse-Hinds ENR Series (16501.1.6)
Corrugated Plate Oil-Water Separators	Great Lakes Environmental Lancy International
Couplings (fluid)	Voith Howden Sirocco
Crane (single girder bridge)	ACCO (Wright) Dwight Foot Harnischfeger (P&H) Philadelphia Tramrail Yale
Crushers	American Pulverizer Metso Penn Crusher Gundlach
Cyclones (slurry)	**Krebs** Technequip Warman
Dampers (guillotine or louver man-safe isolation, or louver control)	**WahlcoMetroflex**
Detectors (Duct mounted ionization)	Electro Signal Lab, Inc., 600 Series (15920.1.5)
Detectors (hopper level – non nuclear)	**Endress Hauser** Siemens Drexelbrook Baker Bonnert
Detectors (liquid level)	**Endress Hauser** **OmartVega** Drexelbrook Engineering Milltronics
Detectors (Resistance Temperature)	Pyromation (K100.4.2) Pico (K100.4.2) STI Manufacturing (K100.4.2) JMS Southeast, Inc. – Statesville, NC USA (K100.4.2) Sandelius Instruments – Houston, TX (K100.4.2) TSC – Garland, TX (K100.4.2)
Device Plates (unfinished areas)	Crouse-Hinds (16501.1.6) Appleton (16501.1.6)
Device Plates (finished areas)	Hubbell (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)

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COMPONENT	PREAPPROVED SUBSUPPLIER
Device Plates (Weatherproof Single Receptacle)	Crouse-Hinds WLRS-1 (16501.1.6) Appleton (16501.1.6)
Device Plates (Weatherproof Duplex Receptacle)	Crouse-Hinds WLRD-1 (16501.1.6) Appleton (16501.1.6)
Device Plates (Weatherproof Switch Device Plates)	Crouse-Hinds DS185 (16501.1.6) Appleton (16501.1.6)
Direct Digital Control System (Temperature Control Panel)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Digital Control System (Network Controllers)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Digital Control System (Application Specific Controllers)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Digital Control System (Operator Programming Unit)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Digital Control System (Temp Sensors & Moister Sensors)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Digital Control System (Pressure Sensors)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Direct Tension Indicators (DTIs)	TurnaSure LLC (05120.1.6
Distributed Control System (DCS)	**Honeywell**
Doors (absorber or duct access doors)	B&W **IMTEC Inc.**
Doors (duct and PJFF)	PSG (double door)
Drains (floor/roof drains)	Burn Jason Smith Wade
Drives – Variable Speed, 600V and Below	**WEG** **Allen Bradley** Emerson

COMPONENT	PREAPPROVED SUBSUPPLIER
	GEC/CEG Electric **Square D** Toshiba – Houston International Reliance Robicon
Duct Slide Plates	American Bearings Merriman Inc. R. M. Engineered Products
Dust Collectors (dry)	**American Air Filter** Flex-Kleen Mikropul
Dust Collectors (wet)	American Air Filter Trimer
Electric Heating Coil	INDEECO (15720.1.6)
Electronic Control Systems (Temperature Control Panels)	Hoffman Engineering Company (15920.1.5)
Electronic Control Systems (Airflow Switches)	Dwyer (15920.1.5)
Electronic Control Systems (Draft Gauges)	Dwyer (15920.1.5)
Electronic Control Systems (Duct Thermostat)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Electronic Control Systems (Fan Control Thermostat)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Electronic Control Systems (Pressurization Sensors & Pressure Indicators)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Electronic Control Systems (Room Thermostats and Humidistats)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Electronic Control Systems (Shielded Room Static Pressure Sensor)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Electronic Control Systems (Static Outside Probe)	Honeywell (15920.1.5) Johnson Controls (15920.1.5) Siemens (15920.1.5) Automatic Logic (15920.1.5)
Elevators	Dover

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Montgomery Otis Schindler/Houghton Westinghouse Murphy
Expansion Joints	Pathway R. M. Engineered Products WahlcoMetroflex EFFOX Papco Branham Baker-Bohnert
Fans (Ceiling mounted centrifugal exhaust fan)	Penn (15830.1.5) Greenheck (15830.1.5) Loren Cook (15830.1.5) Twin City Fan – Commercial (15830.1.5)
Fans (Centrifugal exhaust)	Penn (15830.1.5) Greenheck (15830.1.5) Loren Cook (15830.1.5) Twin City Fan – Commercial (15830.1.5)
Fans (flue gas booster or small)	**Howden** Flaktwoods TLT Babcock
Fans (power roof ventilation wall fans)	Aerovent Buffalo Forge Hartzell Fan Industrial Air Fan
Fans (propeller)	Aerovent (15830.1.5) Hartzell, (15830.1.5) Twin City Fan - Industrial (15830.1.5)
Fans (Venaxial and Tubeaxial)	Aerovent (15830.1.5) Hartzell, (15830.1.5) Twin City Fan - Industrial (15830.1.5)
Fasteners	Best Quality Fabco self-tapping (07410.1.6) Buildex TEKs self-drilling, self-tapping screws (07410.1.6)
Feeders (gravimetric, weigh)	Merrick **Ramsey** Stock
Feeders (volumetric)	Merrick **Ramsey** Stock
Filter Bags	Flakt-Carborundum Menardi Southern

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COMPONENT	PREAPPROVED SUBSUPPLIER
Filter Regulators	Fisher 67CFR (K100.9)
Filters (slurry vacuum dewatering)	Dorr-Oliver Eimco Komline Sanderson
Flourescent Dimming System	Lutron Grafik Eye series (16501.1.6)
Flow Elements	Daniel Industries Fluidic Techniques Vickery-Simms Vickery Simms/Fluidic Techniques (K100.14) Triad (K100.14) Dieterich Standard (K100.14) Primary Flow Signal (K100.14) Daniel Measurement and Control (K100.14)
Fuses (Slow Blow)	Gould Shawmut/GDL (E530.7) Bussman/MDL (E530.7)
Fuses (Fast Acting)	Gould Shawmut/OT (E530.7) Bussman/NON (E530.7)
Fuses (Extremely Fast Acting)	Bussman/KAB (E530.7)
Gravity Roof Ventilators	Burt/Moffit Systems (15861.1.4) Western Canwell (15861.1.4)
Grout	Embeco Five Star
Gypsum/Flyash Material Blending Company	Conversion Systems, Inc.
Heat Exchangers-Plate	APV Crepaco Alfa – Laval Thermal Graham Manufacturing ITT Fluid Technology
Heat Exchangers-Shell/Tube	Hoffman Process Hydro Dyne Manning & Lewis Senior Engineering (Southwest) Struthers Industries Yuba Basco Thermal Transfer Young Radiator
Heat Pump (Packaged Self-contained)	Trane (15730.1.6) Carrier (15730.1.6) Lennox (15730.1.6) McQuay (15730.1.6) York (15730.1.6)
Heat Pump (Packaged Split system)	Train (15730.1.6) Carrier (15730.1.6) McQuay (15730.1.6)

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COMPONENT	PREAPPROVED SUBSUPPLIER
	York (15730.1.6)
Heat Pump (Ductless Split system)	Carrier (15730.1.6) Mitsubishi (15730.1.6) Sanyo (15730.1.6)
Heater (Electric Duct)	Brasch (15760.1.5) Indeeco (15760.1.5)
Heater (Electric Unit)	Brasch (15760.1.5) Modine (15760.1.5) Indeeco (15760.1.5)
Heater (Electric Cabinet)	Brasch (15760.1.5) Modine (15760.1.5) Indeeco (15760.1.5)
Heater (Electric Baseboard)	Brasch (15760.1.5) Modine (15760.1.5) Indeeco (15760.1.5)
Hoists	ACCO (Wright) Chester Columbus McKinnon (CM) Lift-Tech (Shaw/Box/Budgit) Robbins &Myers (R&M) Shepard Niles Yale (A)
Hopper Heaters	**Isopad (Hotfoil)**
Hoses (rubber or wash down)	Gates **Goodall Rubber Co.** Rubber Engineering
HVAC Access Doors	Nailor-Hart Series 800 (15810.1.5)
HVAC Access Panel Latches	Ventlock 310 (15720.1.6)
HVAC Actuators (Damper)	Invensys (15720.1.6) Belimo (15720.1.6 and 15820.1.5) Honeywell (15720.1.6) Johnson (15720.1.6) Siemens (15720.1.6)
HVAC (controls)	**Honeywell Inc.** **Johnson Controls Inc.** Landis & Gyr Powers Inc.
HVAC Dampers	American Warming & Ventilating (15820.1.5) Ruskin Arrow United (15820.1.5) Cesco Products (15820.1.5) Greenheck (15820.1.5)
HVAC Doors (Pressure relief)	Ruskin PRD-18 (15810.1.5)
HVAC Ducts (flexible)	Flexmaster, Type 3M (15810.1.5)

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COMPONENT	PREAPPROVED SUBSUPPLIER
HVAC Ducts (flexible connector/damper)	Flexmaster FLD (15810.1.5)
HVAC Duct Sealant (Outdoor)	Hardcast RTA-50 (15810.1.5) DT Tape (15810.1.5)
HVAC Fans	Twin Cities (15720.1.6) Barry Blower (15720.1.6)
HVAC Fans (Centrifugal)	Aerovent (15830.1.5) Hartzell, (15830.1.5) Twin City Fan - Industrial (15830.1.5)
Indicators (flow)	Universal Rosemont
Indicators (pressure)	Ashcroft 1279SS (K100.2.1) Rosemont Perma-Cal Industries111TIDxxAx3LT (K100.2.1) Weksler AA44 (K100.2.1) US Gauge 1981 (K100.2.1) 3-D Instruments Accu-Drive Series 25 (K100.2.1) Dwyer Series 4000 (K100.2.1)
Indicators (temperature)	**Ashcroft** (K100.2.2) U.S. Gauge (K100.2.2) Wika (K100.2.2)
Induction Motors (Low Voltage)	ABB (E640.1.3) Baldor-Reliance (E640.1.3) General Electric (E640.1.3) Siemens (E640.1.3) Toshiba-USA (E640.1.3) TECO – Westinghouse Motor (E640.1.3) U.S. Motors (E640.1.3) WEG (E640.1.3) Marathon (E640.1.3)
Induction Motors (Medium Voltage)	ABB (E635.1.3) General Electric (E635.1.3) Hitachi (E635.1.3) Hyundai (E635.1.3) Reliance (E635.1.3) Siemens (E635.1.3) TECO – Westinghouse Motor Co. (E635.1.3) WEG (E635.1.3) Marathon (E635.1.3) HICO (E635.1.3)
Instruments (chute plugs)	Drexelbrook **Ramsey tilt switches**
Instruments (fittings)	**CPI Parker**
Instruments (general control and indication)	**General Electric (type CR2940 control switch)** **Honeywell (type CMC control switch)**

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Master Specialties Corporation (indicating lamps) Allen Bradley United Electric
Instruments (laboratory)	Fisher Scientific Mettler Instrument Corp. Perkin Elmer
Instruments - (pressure switches)	SOR **Barksdale** Dwyer United Electric ASCO
Instruments – (solenoids)	**ASCO** **Rexroth** Mac
Instruments - (temperature switches)	ASCO Ashcroft United Electric Controls **Barksdale**
Instruments – Medium Voltage Switchgear (control switches, indicating lamps, etc)	**General Electric (Type SB-1 control switches, ET-16 lamp holder)** ABB Yokogawa Multilin
Instruments – 480V Instrument Metering and Relaying Equipment	**ABB** **General Electric** Westinghouse Yokogawa Multilin
Intra-Plant Communications and Telephone Systems	Comtrol **FEMCO/Gaitronics**
Insulation, building	Certain Teed (15810.1.5) Owens Coming (15810.1.5) Johns-Manville (15810.1.5) Knauf (15810.1.5)
Insulated Rolling Steel Doors	Atlas "Thermal Series" (08330.1.6) Cornell "Thermiser" (08330.1.6) Overhead Door "625" (08330.1.6)
Inverter	Cyberex Elgar Exide Liebert **Solid State Controls**
I/P Converters	**Fischer Controls** Foxboro
Insulation, siding, and roof design for ducts and	Masoneilian International

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COMPONENT	PREAPPROVED SUBSUPPLIER
PJFF insulation (thermal)	**Volunteer Metals** Johns-Manville Corp. *Owens-Corning*
Lamps	General Electric (16501.1.6) Osram Sylvania (16501.1.6) Phillips Lighting (16501.1.6)
Lighting	Abolite **Crouse Hinds** General Electric Holophane *Lithonia*
Lighting (panelboard)	Allen Bradley General Electric ITE Square D
Lighting (Photo electric light)	Sigma Instruments Co. Tork Electric Company
Lighting (receptacles)	***Crouse Hinds Co.*** Hubbell, Inc.
Limit Switches	Crouse Hinds Cutler Hammer Honeywell Namco (Snap Lock) **TopWorx (formerly GO Switch)**
Linings (alloy)	Haynes Int. *Inco Alloys* Rolled Alloys VDM
Linings (alloy clad)	Creusot-Marrell, Inc. Lukens Steel Co.
Linings (borosilicate)	Pennwalt
Linings (ceramic)	**Mechanical Ceramic Solutions(MCS)** C.L. Smith Cerline CBP **Coors** Abresist
Linings (flakeglass)	Ceilcote Dudick Transcoat (Note: websearch showed as oil coat only)
Linings (rubber)	ARDCO Goodyear Polymeric Protective Linings (Goodrich) Rubber Engineering Dudick

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COMPONENT	PREAPPROVED SUBSUPPLIER
Linings (tile)	**Stebbins** Alstom
Local Pneumatic Instrumentation	**Fisher Controls** Foxboro Masonelian International Moore Products
Lubricants Mechanical Seals	Conoco **BWIP Type RIS** **FlowServe (small slurry pumps)**
Meters	**General Electric (Model AB-40 or DB-40)** **Yokogawa (404-253700)**
Meters (gas flow in duct)	Environmental Measurement Research Corp.
Meter (Panel)	Yokogawa (E530.7) Weschler Electric Corporation (E530.7) Crompton Instruments (E530.7)
Meters (pH)	**TBI-Bailey** Yokagawa Honeywell
Meter (Switch-Board)	Yokogawa (E530.7) Weschler Electric Corporation (E530.7) Crompton Instruments (E530.7)
Meters (slurry density)	**Thermomeasuretec Model #3680CA**
Meters (clean water flow)	**Polysonic** Controlotron Yokogawa
Meters (slurry flow—magnetic)	**Krohne** Honeywell Yokogawa
Meters (tank level)	Siemens
Mist Eliminators	Koch Munters
Mixers, Static	Koch Chemineer Lightnin
Model Study (gas flow)	Dynagen **NELS, Inc.** BBP Germany (Note: Did not see outside modeling services listed on website) Ferco Platt Catalyst ESA

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COMPONENT	PREAPPROVED SUBSUPPLIER
Programmable Logic Controllers (PLC)	**Rockwell Control Logics (Allen-Bradley)**
Pugmills	Eagle Iron Works FEECO
Pumps (absorber recycle slurry with RISS seals)	**GIW** ASH (BGA) Warman Denver Townley
Pumps (cantilever)	ASH (BGA) **Hazelton** Lawrence **Warman** Nagle GIW
Pumps – Lube Oil Service	**IMO Delaval** Viking Rivett Tuthill
Pumps – Miscellaneous Service	Flowserve Lawrence Weir KSB
Pumps (Recycle) - Gear Reducers (with external coolers)	**Lufkin**
Pumps (slurry)	ASH (BGA) Denver Hazelton with Inpro Seals Lawrence Warman Townley GIW **Duechting**
Pumps (water, except filtrate pumps)	Durco/Duriron Goulds Flowserve
Receptacles (GFCI)	**Square "D" (Cat. No. GFSR-115-B)** **Bell Faultfinder (Cat. No. 2242-1)**
Relays – Auxiliary Control	Allen Bradley Diversified Electronics General Electric Square D Potter Brumfield Cutler Hammer
Relays – Timing	Agastat (No Air operated)

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Eagle Adalake Potter Brumfield Diversified Electronics Allen Bradley
Relays – Lockout	Electro Switch
Relay Test Switches	**Superior**
Relays – Protective Type for , Motors, Transformers, and Switchgear	ABB General Electric/Multilin
RTDs	Foxboro **Rosemont** Tem-Pro, Inc. Ronan Honeywell
Scales (belt)	Merrick **Ramsey** Thayer Scale Wallace & Tiernan Stock
Siding (exterior)	Robinson Smith Steelite
Signal Converters (electric to pneumatic)	Rosemount 3311 (K100.13) Foxboro E69F (K100.13) ITT – Conoflow GT 8 (K100.13)
Stack Gas Liquid Entrainment Study	Dynagen
Switchboards-AC and DC	ABB General Electric Square D
Switches (Control)	General Electric Type SB-1 with large cover (E530.7) General Electric Type SB-10 with large cover (E530.7) Electro-Switch Type 24 (E530.7) Electro-Switch Type W (E530.7) Electro-Switch Type 20K (E530.7)
Switches (Dimmers)	Lutron "NOVA" series (16501.1.6)
Switches (Level Switch – EnclosedCage, 2SPDT)	Magnetrol (K100.3.2) International (K100.3.2) S-O-R, Inc. (K100.3.2)
Switches (Level Switch – EnclosedCage, SPDT)	Warrick Series "M" (K100.3.2) ITT Flygt ENM 10 Series (K100.3.2)
Switches (Momentary Contact)	Pass & Seymour (16501.1.5) Cooper Wiring (16501.1.5) Leviton (16501.1.5)

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COMPONENT	PREAPPROVED SUBSUPPLIER
Switches (Position Switch – Mechanically Actuated	NAMCO Controls EA-170 (K100.8) Honeywell Microswitch Type LS (K100.8) A-B 802T-ATP (K100.8)
Switches (Proximity)	Topworx (Go Switch) 7G23528-A2 (K100.8)
Switches (Push Buttons and Selector Switches)	Allen Bradley 800H Series, corrosion resistant (E530.7) Square D Class 9001 Type K (E530.7)
Switches (Gas Filled Temp.)	Allen-Bradley Bulletin 837 (K100.3.1) Ashcroft Type 400B (K100.3.1) United Electric Series 400 (K100.3.1) S-O-R, Inc. (K100.3.1)
Switches (Selector)	Allen-Bradley 800H or 800P, Square D (15920.1.5)
Switches (Toggle)	Honeywell Micro Switch Type TL (E530.7)
Switches (Single-pole, gray for finished, brown for unfinished areas)	Hubbell (Generic Cat. No. 1221) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Switches (Two-pole)	Hubbell (Generic Cat. No. 1222) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Switches (Three-way, gray for finished, brown for unfinished areas)	Hubbell (Generic Cat. No. 1223) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Switches (Four-way, gray for finished, brown for unfinished areas)	Hubbell (Generic Cat. No. 1224) (16501.1.6) Pass & Seymour (16501.1.6) Cooper Wiring (16501.1.6) Leviton (16501.1.6)
Switches (Three-way, Four-way,Class I, Group D and Class II, Group F areas)	Appleton (16501.1.6) Crouse-Hinds "EDS" tumbler series (16501.1.6)
Switchgear – Medium Voltage, Metal-clad	Siemens ABB General Electric
Switchgear – 480V Load Centers	ABB General Electric **Square D**
Tags (identification)	AMP **W.H. Brady** Electromark Company Raychem Corporation Stanco Products Inc. The Thomas and Betts Co.

COMPONENT	PREAPPROVED SUBSUPPLIER
Tanks (FRP)	Palmer Manufacturing and Tank Inc. Augusta Fiberglass Ershigs
Tanks (metal)	Chicago Bridge & Iron RECO Rocky Mountain Enerfab Titan A&D Great Basin Industrial
Terminal Block (General Purpose Feed-Through)	Marathon 1500 (E520.6)
Termincal Block (Shorting)	Marathon 1500 (E520.6)
Terminal Strips	Entrelec (15920.1.5) Phoenis (15920.1.5) Weidmuller (15920.1.5) Marathon 1500 (15920.1.5)
Testing (flue gas)	Entropy Radian EDN PGT FERCO Catalyst ESA
Testing (limestone)	Radian FERCO
Thermocouples	RDF Temp-Pro YSI Inc. **Rosemount** Pyco Thermo-Electric Pyromation (K100.4.2) STI Manufacturing (K100.4.2) JMS Southeast, Inc.-Statesville, NC USA (K100.4.2) Sandelius Instruments – Houston, TX (K100.4.2) TSC – Garland, TX (K100.4.2)
Thickener (consultant)	Codan Associates
Thickeners (slurry)	Denver Dorr-Oliver Eimco
Timing Relays	Agastat Series 7000 (E530.2) Agastat Series 7000, Intermatic (15920.1.5)
Tracing – Electrical Heat	Chemelex Nelson Electric **Thermon Manufacturing** Raychem

COMPONENT	PREAPPROVED SUBSUPPLIER
Transducers (electrical)	Moore Industries Rochester Instruments **Scientific Columbus (type VT110A2)** **Transdata (type 10PS501)** **Scientific Columbus (type CT510A2)** **Transdata (type 10CS501)** **Woodex Model DCV-2000X**
Transformers	General Electric (16125.4) Westinghouse Electric Corporation (16125.4) I-T-E Electrical Products (a Division of Siemens Energy & Automation, Inc. (16125.4) Sorgel Electric Corporation (16125.4)
Transformers – Low Voltage Dry Type	General Electric Hevi-Duty ABB Square D Cutler Hammer
Transformers – Power and Loadcenter	**ABB** Siemens Square D General Electric
Transmitters (Electronic Process)	Rosemount, Smart Krohne, Flow transmitters for Limestone Slurry Flow in Absorber Building Endress & Hauser, Flow transmitters in Reagent Preparation Building Honeywell **Yokagawa (Mill Creek preferred)**
Transmitter (Flow)	Rosemount – 3051 C or T (K100.6) Honeywell – ST 3000 (K100.6) Yokogawa – EJA Series (K100.6) Anderson Greenwood, Swagelock, PGI, or Rosemount manifolds (K100.6)
Transmitter (Flow)(Nondifferential Pressure Types)	Micromotion (K100.6) Brooks/Daniel (K100.6) Rosemount (K100.6) Yokogawa (K100.6)
Transmitter (Level)	Rosemount – 3051 C or T (K100.6) Honeywell – ST 3000 (K100.6) Yokogawa – EJA Series (K100.6) Anderson Greenwood, Swagelock, PGI, or Rosemount manifolds (K100.6)
Transmitter (Level)(4-20 mA)	Magnetrol International (K100.6) Fisher Controls (K100.6) Mill tronics (K100.6)

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Rosemount –3051 C or T (K100.6) Honeywell – ST 3000Yokogawa – EJA Series (K100.6) Anderson Greenwood, Swagelock, or PGI manifolds for DP style transmitters (K100.6)
Transmitter (Pressure)	Rosemount – 3051 C or T (K100.6) Honeywell – ST 3000 (K100.6) Yokogawa – EJA Series (K100.6) Anderson Greenwood, Swagelock, PGI, or Rosemount manifolds (K100.6)
Transmitter (Vibration)	Metrix (K100.16) Robertshaw (K100.16) Rockwell/Entek (K100.16) STI (K100.16) Bently Nevada (K100.16)
Tubing – Grip Type Fittings	Swagelok (K120.7)
Tubing - Socket-Weld Fittings	Swagelok (K120.7)
Valve Manifolds	Swagelok (K120.7)
Valves (Air)	Clayton Mark-Pacific Lunkenheimer Powell Rockwell Edward
Valves (Drain)	Swagelok/Ball series 40/60 (M22.3)
Valves (Instrument Blowdown)	Swagelok Stainless Steel, Series SS-6DBS8 with Grafoil Packing (K120.6)
Valves (Instrument Equalizer)	Swagelok Stainless Steel, Series SS-6DBS8 with Grafoil Packing (K120.6)
Valves (Instrument Shutoff)	Swagelok Stainless Steel, Series SS-6DBS8 with Grafoil Packing (K120.6)
Valves (Instrument Tubing Support Tray)	James C. White Company, Inc. Series "Tubetrack" (K120.7)
Valves (Water)	Clayton Mark-pacific Lunkenheimer Powell Rockwell Edward Velan Vogt
Valves (Check) – Insert Type	Keystone/Anderson, Greenwood Power & Process (Technocheck)
Valves (Check) – Tilting Disc	Anchor/Darling Atwood & Morrill Townley

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COMPONENT	PREAPPROVED SUBSUPPLIER
	Pacific
Valves (Manual) – Ball	Anchor/Daring Edwards ITT-Engineered Valve Jenkins Neles-Jamesbury Parker Worcester Valves **Apollo**
Valves (Manual) – Bronze	Jenkins Lunkenheimer William Powell
Valves (Manual) – Butterfly	Anchor/Darling BIF Industries Dezurik Duriron/Durco Fisher Controls International Keystone Neles-Jamesbury Rodney Hunt (Allis Chalmers) Power & Process (Norris) Pratt
Valves (Manual) – Diaphragm (Mfr's Standard Hydrostatic Shell and Seat Tests Required)	Hills-McCanna ITT-Engineered Valve
Valves – Knife Gate (Slurry) Oxidation air isolation to absorber, recycle pump suction and discharge, slurry isolation, slurry drains	Clarkson Newcon Warmann Townley **ITT**
Valves (Manual) – Plug **(Owner prefers Knife Gate type in lieu of plug type for slurry service)**	Duriron/Durco Nordstrom/Tufline (Division of Xomox) Velan Newcon
Valves (Manual) – S.S. and C.S. (2 1/2in. and larger)	Anchor/Darling Crane Edwards Lunkenheimer Pacific Valves Velan William Powell
Valves (Manual) – Slurry Control	Clarkson RKL **Fujikin**
Valves (Manual) – Slurry Control or Isolation (ceramic ball)	**Fujikin** Nil-cor
Valves – Mist Eliminator Water Wash	Keystone w/ stainless steel packing glands

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COMPONENT	PREAPPROVED SUBSUPPLIER
Valves – Cooling Water, Gland Seal Water and Acid Feed Isolation	**Apollo with Bettis Actuator**
Valves (Safety and Relief)	*Consolidated* Crosby *Farris* Lonergan Vickers Fulflo Fluid Controls Dyex-Rivett
Valves (Shutoff)	Swagelok/Ball series 40/60 (M220.3)
Valve (Solenoid) (Type H)	ASCO – EFHB8320G174xx (Brass ExP) (K100.7) ASCO – EFHB8320G200xx (Stainless Steel ExP) (K100.7) ASCO – JKH8320G172xx (Brass NEMA 4,<100 dp) (K100.7) ASCO – JKB8320G174xx (Brass NEMA 4) (K100.7)
Valves – miscellaneous	
Blow down or bleed	Newcon knife gate
Flush water valves	Durco T-Line or Durco Atomax lined ball valves
Tank drains	Newcon
Slurry feed and bypass	Newcon
Slurry pumps suction and discharge	Clarkson (stated earlier)Strahman Ram Valves
Sample valves	Dezurik/Unival ported knife w/ alloy gate
Gypsum tank inlet	Durco Atomac lined ball valves or Durco T-Line
Vibrator	Marton engineering Vibco **Carman**
Wall and Roof Panels	Centria (07410.1.6) Fabral (07410.1.6) Morin (07410.1.6)
Welding Consultants	Nickel Development Institute Theilsch

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EXHIBIT F1

APPLICATION FOR PAYMENT

DATE: _____ WFGD Supplier _____

REQUEST FOR PAYMENT #: _____ CONTRACT #: _____

FOR THE MONTH ENDING: _____

MILESTONES ACHIEVED _____

ADDITIONAL DESCRIPTION: _____

I. GROSS BILLINGS:

	TOTAL THROUGH LAST PERIOD	TOTAL EARNED THIS PERIOD	TOTAL EARNED TO DATE
A: BASE CONTRACT			
B: CHANGE ORDERS			
TOTALS:	_____	_____	_____

II. THIS PERIOD'S BILLING

A.TOTAL VALUE OF MILESTONES ACHIEVED THIS PERIOD: _____

B. AGGREGATE PAYMENT AMOUNT SPECIFIED BY THIS MONTH IN EXHIBIT C: _____

C. SUBTOTAL (LESSER OF A OR B): _____

D. TOTAL DUE THIS MONTH: _____

RESPECTFULLY SUBMITTED BY:

EXHIBIT F2

CERTIFICATES

The following form shall be used for Certificates of Commercial Operation and Final Completion:

CERTIFICATE OF _____

This constitutes the Certificate of _____ as contemplated by the Equipment Purchase Agreement.

Executed on this _____[date] by the Parties on behalf of the Buyer.

Buyer	WFGD Supplier	Owner
By: _____ _____	By: _____ _____	By: _____ _____
Title: _____ _____	Title: _____ _____	Title: _____ _____
Date: _____ _____	Date: _____ _____	Date: _____ _____

EXHIBIT F3

FORM OF CHANGE ORDER

CHANGE ORDER

File No.:

Project:
Project No.:
Date:

Contractor:
Contract For:
Change Order Title:
Change Order No.:
Contract No.:

The Agreement is hereby changed as follows:
Change Description:

Adjustment to Schedule (including change(s) to key dates listed in Exhibit D):

Adjustment to Payment Schedule:

Adjustment to Performance Guarantees:

Other Agreement Adjustments (specify):

Original Contract Price.....
Prior Change Orders Amount.....
Contract Price Prior to this Change Order..
This Change Order Amount.....
Net Contract Price Amount .....

OTHER CONDITIONS:
To the extent stated in this Change Order, the price and time extension in this Change Order is full compensation for all costs and schedule impacts, both direct and indirect, incurred in connection with the conditions giving rise to this Change Order including all applicable markups and fees.

This Change Order, when executed, constitutes a modification to the Agreement, and all provisions of the Agreement, except as modified above or by a previous Change Order, shall apply hereto.

Acceptance for and on behalf of Buyer	Acceptance for and on behalf of WFGD Supplier
By:_____	By:_____
Date: _____	Date: _____
Title: _____	Title: _____
Distribution:	Distribution:
_____	_____
_____	_____

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EXHIBIT F5

LIEN WAIVERS AND GENERAL RELEASE

FORM OF CONDITIONAL PARTIAL LIEN WAIVER TO BE PROVIDED BY MAJOR SUBCONTRACTORS:

Mill Creek WFGD Project (the "Project")

In accord with [insert subcontract name and paragraph(s) reference] the undersigned, for and in consideration of the payments made by Babcock Power Environmental Inc., (the "Company"), to the undersigned, for labor employed in and/or equipment and materials furnished for the construction of the above-referenced Project pursuant to the above-referenced subcontract, hereby certifies as follows:

1. Upon receipt of the sum of _____, the undersigned will have received payment in full, less retainage, for labor employed in, equipment and materials furnished and/or performance of Work for the construction of the Project through the _____ day of _____, 201_and except for receipt of said sum and as an inducement to the Company to make payment of the same, and except for retainage and the following matters [OUTSTANDING CLAIMS TO BE IDENTIFIED], the undersigned hereby affirms that there are no outstanding claims against the Company in connection with any labor employed, work done, equipment and materials furnished or performance of work by the undersigned pursuant to the above-referenced subcontract through such date.

2. The undersigned does hereby waive, release and quit claim in favor of the Buyer of the Project, any owner of the site on which the Project is located, each and every party acquiring title to and interest in and/or making a loan on the Project and the title company or companies examining and/or insuring title to the Project and any and all of their successors and assignees (collectively the "Beneficiaries"), all rights that presently exist or hereafter may accrue to the undersigned to assert a lien, whether contractual, statutory or constitutional, upon the land and improvements comprising the Project which rights have arisen or shall arise out of or in connection with labor employed, equipment and materials furnished or performance of Work pursuant to the above-referenced subcontract and amendments thereto, but only for labor employed and/or equipment and materials furnished and/or work performed through the _____ day of _____, 201_.

3. The undersigned has not assigned any claim against the Company, or any of the other Beneficiaries, nor any lien or right to perfect a lien with respect to the Project, and the undersigned has the right, power and authority to execute this document.

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4. The undersigned warrants that all laborers and subcontractors employed by it in connection with the Project, and all suppliers or materialmen from which it has acquired equipment and materials incorporated into the Project and any lien or bond claimant relating to the undersigned's work in connection with the Project have been paid all amounts due and owing through the ____ day of _____, 201_ and that none of such laborers, subcontractors, suppliers, materialmen, or claimants has any unsatisfied or unbonded lien or claim against the Project through such date except the following matters [OUTSTANDING CLAIMS TO BE IDENTIFIED]. The undersigned further warrants that, to the best of its knowledge and belief, all applicable due and outstanding taxes, fees, contributions and benefits relating directly or indirectly to the undersigned's work and which are the responsibility of the undersigned have been paid in full.

5. No security interest has been given or executed by the undersigned for or in connection with any equipment and materials, appliances, machinery, fixtures or furnishings placed upon or installed in the Project. This Affidavit and Partial Release of Liens is for the benefit of the Company and the Beneficiaries.

This Affidavit and Partial Release of Lien is an independent covenant and will operate and be effective with respect to Work performed, labor employed and/or equipment and materials furnished and/or performance of Work under the above-referenced subcontract and any related supplemental contract or contracts for extra or additional work on the Project performed by the undersigned through the _____ day of _____, 201_.

IN WITNESS WHEREOF, this Affidavit and Partial Release of Lien has been executed on this _____ day of _____, 201_.

WITNESS: (Name)

_____ _____

Subscribed and sworn to me this _____ day of _____, 201_.

_____
Notary Public

My Commission Expires: _____
(Notarial Seal)

FORM OF CONDITIONAL PARTIAL LIEN WAIVER TO BE PROVIDED BY WFGD SUPPLIER:

Mill Creek WFGD Project (the "Project")

In accord with Section 5.1.4 the Equipment Purchase Agreement effective as of _____, 2012, between Babcock Power Environmental Inc. ("WFGD Supplier") and Louisville Gas and Electric Company (the "Buyer"), the WFGD Supplier, for and in consideration of the payments to be made by the Buyer to the WFGD Supplier, for Work performed, labor employed and/or for equipment furnished in connection with the Work pursuant to the above-referenced Agreement, hereby certifies as follows. Capitalized terms used and not defined herein shall have the respective meanings set forth in the Agreement:

1. In conjunction with this lien waiver, WFGD Supplier is submitting an invoice to Buyer in the sum of _____with respect to Work performed, labor employed and/or equipment and materials provided in connection with the construction of the Project for the period the_____ day of _____, 201_ through to the _____ day of_____, 201_.

2. Contingent upon receipt of the sum referenced in paragraph 1 in accordance with the Agreement, the WFGD Supplier does hereby waive, release and quit claim in favor of the Buyer and the Financing Parties and any and all of their successors and assignees (collectively the "Beneficiaries"), all rights that presently exist or hereafter may accrue to the WFGD Supplier to assert a lien, whether contractual, statutory or constitutional, upon the Work and/or all or any portion of the Existing Facilities or any improvements thereon which rights have arisen or arise out of or in connection with the performance of the Work pursuant to the Agreement, but only for Work performed, labor employed and/or equipment furnished through the _____ day of _____, 201_.

3. The WFGD Supplier has not assigned any lien or right to perfect a lien against the Work and/or all or any portion of the Existing Facilities or any improvements thereon, and the WFGD Contractor has the right, power and authority to execute this document.

4. No security interest has been given or executed by the WFGD Supplier for or in connection with any equipment and materials, appliances, machinery, fixtures or furnishings placed upon, provided for or installed as part of the Work and/or on all or any portion of the Existing Facilities. This Affidavit and Partial Release of Liens is for the benefit of the Beneficiaries.

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This Affidavit and Partial Release of Lien is an independent covenant and will operate and be effective with respect to Work performed and labor employed and/or equipment and materials furnished under the Agreement and any related supplemental contract or contracts for extra or additional work performed by the WFGD Supplier in connection with the Project for the period the_____ day of_____, 201_ to the _____ day of_____, 201_.

IN WITNESS WHEREOF, this Affidavit and Partial Release of Lien has been executed on this _____ day of_____, 201_.

WITNESS: (Name)

_____ _____

Subscribed and sworn to me this _____ day of_____, 201_.

_____
Notary Public

My Commission Expires: _____
(Notarial Seal)

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FORM OF FINAL AND FULL LIEN WAIVER TO BE PROVIDED BY MAJOR SUBCONTRACTORS:

Mill Creek WFGD Project (the "Project")

In accord with [insert subcontract name and paragraph(s) reference] the undersigned, for and in consideration of the payments made by _____ (the "Company"), to the undersigned, for labor employed in and/or equipment and materials furnished for the construction of the above-referenced Project pursuant to the above-referenced subcontract, hereby certifies as follows:

1. Upon receipt of the sum of _____, the undersigned will have received final payment in full for all labor employed in and/or equipment and materials furnished and/or performance of Work in connection with the construction of the Project, and except for receipt of said sum and as an inducement to the Company to make payment of the same, and, except for the following matters [OUTSTANDING CLAIMS TO BE IDENTIFIED], the undersigned hereby affirms that there are no outstanding claims against the Company in connection with the Project in connection with any labor employed, equipment and materials furnished and/or performance of Work by the undersigned pursuant to the above-referenced subcontract.

2. In consideration of the payments made to date and upon receipt of the sum of _____, the undersigned does hereby waive, release and quit claim in favor of the Buyer of the Project, any owner of the site on which the Project is located, each and every party acquiring title to and interest in and/or making a loan on the Project and the title company or companies examining and/or insuring title to the Project and any and all of their successors and assignees (collectively, the "Beneficiaries"), all rights that presently exist of hereafter may accrue to the undersigned to assert a lien, whether contractual, statutory or constitutional, upon the land and improvements comprising the Project which rights have arisen or shall arise out of or in connection with labor employed, equipment and materials furnished and/or performance of Work pursuant to the above-referenced subcontract and amendments thereto.

3. The undersigned does hereby forever release, waive, and discharge the Project, the owner of the Project and the other Beneficiaries from any and all causes of action, suits, debts, accounts, damages, encumbrances, judgments, claims, and demands whatsoever (including with respect to all rights that presently exist or hereafter may accrue to the undersigned to assert a lien, whether contractual, statutory or constitutional, upon the land and improvements comprising the Project which rights have arisen or shall arise out of or in connection with labor employed, equipment and materials furnished or performance of Work pursuant to the above-referenced subcontract and amendments thereto), in law or equity which the undersigned and/or its successors and/or assignees ever had, or ever will have against any of them by reason of labor employed in, equipment and materials furnished and/or the performance of Work relating to the construction of the Project; and the undersigned hereby agrees to indemnify and hold the above parties harmless from any and all damages, costs expenses, demands, suits, and legal fees, directly or indirectly relating to any of the foregoing claims or liens.

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4. The undersigned has not and will not assign any claim against the Company, or any of the Beneficiaries, nor any lien or right to perfect a lien against the Project, and the undersigned has the right, power, and authority to execute this Affidavit, Waiver and Release.

5. The undersigned warrants that all laborers and subcontractors employed by it, and all suppliers or materialmen from which it has acquired equipment or materials incorporated into the Project and any lien or bond claimant relating to the undersigned's Work have been paid all amounts due and owing through the date hereof and that none of such laborers, subcontractors, suppliers, materialmen, or claimants has any claim, demand, or lien against the Project through the date hereof except the following matters [OUTSTANDING CLAIMS TO BE IDENTIFIED]. The undersigned further warrants, to the best of its knowledge and belief that all due and outstanding applicable taxes, fees, contributions and benefits relating directly or indirectly to the undersigned's Work and which are the responsibility of the undersigned have been paid in full.

6. No security interest has been given or executed by the undersigned for or in connection with any equipment, materials, appliances, machinery, fixtures, or furnishings placed upon or installed in the Project.

This Affidavit, Waiver of Lien and Release shall be an independent covenant and shall operate and be effective with respect to labor employed, equipment and materials furnished and/or performance of Work under the above-referenced subcontract and any related supplemental contract or contracts for extra or additional Work on the Project performed by the undersigned. This Affidavit of Waiver and Release is for the benefit of the Company and the Beneficiaries.

IN WITNESS WHEREOF, this Affidavit, Waiver of Lien and Release has been executed on this _____ day of _____, 201_.

WITNESS: (Name of Company)

_____ _____

Subscribed, sworn to, and acknowledged before me this _____ day of ___, 201_

_____
Notary Public

My Commission Expires:_____
(Notarial Seal)

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FORM OF FINAL AND FULL LIEN WAIVER TO BE PROVIDED BY WFGD SUPPLIER:

Mill Creek WFGD Project (the "Project")

In accord with Section 5.1.5 of the Equipment Purchase Agreement effective as of _____, 2012, between Babcock Power Environmental Inc. ("WFGD Supplier") and Louisville Gas and Electric Company (the "Buyer") the WFGD Supplier, for and in consideration of the payments made by the Buyer to the WFGD Supplier for Work performed, labor employed in and/or equipment furnished for the construction of the Project pursuant to the above-referenced Agreement, hereby certifies as follows. Capitalized terms used and not defined herein shall have the respective meanings as set forth in the Agreement:

1. Upon receipt of the sum of _____, the WFGD Supplier will have received final payment in full for all Work performed, labor employed in and/or equipment furnished in the construction of the Project, and except for receipt of said final payment and [OUTSTANDING WFGD SUPPLIER CLAIMS TO BE IDENTIFIED], and as an inducement to the Buyer to make such final payment, the WFGD Supplier hereby affirms that there are no other outstanding claims against the Buyer in connection with the Project. The above excludes claims for unreimbursed Sales Taxes for which the WFGD Supplier is entitled to be reimbursed under the Agreement and amounts for which the WFGD Supplier is entitled to indemnity under the Agreement, in each case to the extent not known by WFGD Supplier on the date of this Affidavit.

2. WFGD Supplier does hereby waive, release and quit claim in favor of the Buyer and the Financing Parties and any and all of their successors and assignees (collectively, the "Beneficiaries"), all rights that presently exist of hereafter may accrue to the WFGD Supplier to assert a lien, whether contractual, statutory or constitutional, upon the Project and/or all or any portion of the Existing Facilities or improvements thereon, which rights have arisen or arise out of or in connection with the performance of the Work pursuant to the Agreement.

3. Contingent upon the receipt of the sum of _____, and except with respect to claims identified or referenced in paragraph 1 above, the WFGD Supplier does hereby forever release, waive, and discharge the Beneficiaries from any and all causes of action, suits, debts, accounts, damages, encumbrances, judgments, claims, and demands whatsoever, in law or equity which the WFGD Supplier and/or its successors and/or assignees ever had or ever will have against any of them by reason of non-payment for Work performed, labor employed in and/or Equipment furnished relating to the construction of the Project; and, in accordance with and subject to the terms of the Agreement, the WFGD Supplier hereby agrees to indemnify and hold the above parties harmless from any and all damages, costs expenses, demands, suits, and legal fees, directly or indirectly relating to any of the foregoing claims or liens.

4. The WFGD Supplier has not and will not assign any claim against the Beneficiaries, nor any lien or right to perfect a lien against the Project and/or all or any portion of the Existing Facilities or improvements thereon, and the WFGD Supplier has the right, power, and authority to execute this Affidavit, Waiver and Release.

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5. The WFGD Supplier warrants that all laborers and sub suppliers employed by it, and all suppliers or materialmen from which it has acquired equipment incorporated into the Facility and any lien or bond claimant relating to the WFGD Supplier's work have been paid all amounts due and owing through the date hereof and that none of such laborers, subcontractors, suppliers, materialmen, or claimants has any unsatisfied or un-bonded lien against the Project and/or all or any portion of the Existing Facilities or improvements thereon, through the date hereof. The WFGD Supplier further warrants that all due and outstanding applicable taxes, fees, contributions and benefits relating directly or indirectly to the WFGD Supplier's Work and which are the responsibility of the WFGD Supplier under the Agreement have been paid in full.

6. No security interest has been given or executed by the WFGD Supplier for or in connection with any materials, equipment, appliances, machinery, fixtures, or furnishings placed upon or installed in Projects and/or all or any portion of the Existing Facilities or improvements thereon.

This Affidavit, Waiver of Lien and Release shall be an independent covenant and shall operate and be effective with respect to Work performed, labor employed and/or equipment furnished under the Agreement and any related supplemental contract or contracts for extra or additional work performed by the WFGD Supplier in connection with the Project. This Affidavit of Waiver and Release is for the benefit of the Beneficiaries.

IN WITNESS WHEREOF, this Affidavit, Waiver of Lien and Release has been executed on this _____ day of _____, 201_.

WITNESS: (Name of Company)

_____ _____

Subscribed, sworn to, and acknowledged before me this ____ day of _____, 201_.

_____
Notary Public

My Commission Expires:_____
(Notarial Seal)

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EXHIBIT F8

PARENT GUARANTEE OF WFGD SUPPLIER'S OBLIGATION

_____

_____

Project No. _____

This Guarantee (the "Guarantee") is given as of this _____ day of _____, 2012, by Babcock Power Inc., a Delaware corporation ("Guarantor") to Louisville Gas and Electric Company (the "Buyer").

WHEREAS, Babcock Power Environmental Inc. ("WFGD Supplier") is a wholly-owned subsidiary of Guarantor;

WHEREAS, the Buyer wishes to enter into an Equipment Purchase Agreement with WFGD Supplier with respect to two WFGDs for the Mill Creek Generating Station in Jefferson County, Kentucky (as the same may be amended, modified and supplemented from time to time in accordance with its terms, the "Contract"); and

WHEREAS, the Buyer is willing to enter into the Contract on the condition that the Guarantor enter into this Guarantee; and

WHEREAS, capitalized terms used herein and not otherwise defined shall have the meanings ascribed thereto in the Contract.

NOW, THEREFORE, the Guarantor, in consideration of the foregoing and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, agrees as follows:

1. From and after the date hereof, Guarantor hereby irrevocably and unconditionally guarantees the due and punctual payment and performance by WFGD Supplier of all of its obligations under the Contract, as it from time to time may be amended. Guarantor hereby agrees that its obligations hereunder shall be unconditional, irrespective of the validity, regularity or enforceability of the Contract, any change therein or amendment thereto, the absence of any action to enforce the same, any waiver or consent by the Buyer with respect to any provision thereof, the recovery of any judgment against WFGD Supplier or any action to enforce the same, or any other circumstances which may otherwise constitute a legal or equitable discharge or defense of a guarantor and Guarantor hereby waives presentment, demand of payment, protest or notice with respect to the Contract and the obligations set forth therein or herein. Guarantor covenants that this Guaranty will not be discharged except by complete performance of the obligations contained in the Contract. This is a guaranty of payment and performance, and not of collection, and there shall be no requirement that Buyer first proceed against WFGD Supplier.

2. Guarantor shall be subrogated to all rights of the WFGD Supplier in respect of any amounts paid or obligations performed by Guarantor pursuant to the provisions of this Guaranty; provided, however, that Guarantor shall be entitled to enforce, or to receive any payments arising out of or based upon, such right of subrogation only after all amounts and obligations owed to the Buyer under the Contract have been paid or performed in full.

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3. Notwithstanding any other provision herein to the contrary, Guarantor retains all rights, including, but not limited to, the right to assert any and all claims, defenses, and limitation of liability, possessed by WFGD Supplier under the terms of the Contract or arising from the parties performance or failure to perform thereunder or as may otherwise be available at law or equity that WFGD Supplier would be entitled to assert in its own right had such claim, action or proceeding been asserted or instituted against WFGD Supplier directly.

4. This Guarantee shall be valid until all of the WFGD Supplier obligations under the Contract are discharged. Thereafter, except as otherwise stated in this Guarantee, this Guarantee shall be null and void, whether returned to Guarantor or not.

5. This Guarantee shall be binding upon Guarantor and its successors and assigns. This Guarantee is assignable by the Buyer (to the extent that the assignment is to an assignee that is also assigned all or a portion of Buyer's rights under the Contract) and shall inure to the benefit of the Buyer, its successors and assigns.

6. This Guarantee is direct, and absolute. Without limiting the generality of the foregoing, Guarantor agrees that this Guarantee is not conditioned upon its receipt of any type of notice (including, but not limited to, notice of acceptance of this Guarantee and notice of any developments), and Guarantor hereby waives any right it may otherwise have to same. Further, the Guarantor hereby unconditionally waives, as a condition precedent to the performance of its obligations hereunder, (a) notice of acceptance hereof, (b) notice of any action taken or omitted to be taken by the Buyer in reliance hereon, and (c) any requirement that the Buyer exhaust any right, power or remedy or proceed against the WFGD Supplier under the Contract or any other agreement or instrument referred to therein, or against any other person under any other guarantee of any of WFGD Supplier's obligations under the Contract. Without limiting the generality of the foregoing, it is agreed that the occurrence of any one or more of the following shall not affect the liability of the Guarantor hereunder:

   (i) at any time or from time to time, without notice to the Guarantor, the time for any performance of or compliance with any of WFGD Supplier's obligations under the Contract shall be extended, or such performance or compliance shall be waived;

   (ii) any of the acts mentioned in any of the provisions of the Contract or any other agreement or instrument referred to therein shall be done or omitted;

   (iii) any of WFGD Supplier's obligations under the Contract shall be modified, supplemented or amended in any respect in accordance with the terms of the Contract;

   (iv) the Buyer's acceptance of any instrument in substitution for any claim or debt;

   (v) any leniency or failure to pursue collection by the Buyer with respect to the WFGD Supplier;

   (vi) any release or impairment of collateral, if any, which secures payment of WFGD Supplier's obligations to the Buyer; or

   (vii) the inclusion by any subsequent separate agreement or by any amendment of this Guarantee at a later date of additional guarantors of the obligations guaranteed hereunder; or the subsequent release of any of same.

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7. The Obligations of the Guarantor under this Guarantee shall be automatically reinstated if and to the extent that for any reason any payment by or on behalf of the WFGD Supplier in respect of its obligations under the Contract is rescinded or must be otherwise restored by any holder of any of such obligations, whether as a result of any proceedings in bankruptcy or reorganization or otherwise.

8. The Guarantor represents and warrants to the Buyer that this Guarantee has been duly executed and delivered by the Guarantor and constitutes the legal, valid and binding obligation of the Guarantor, enforceable against the Guarantor in accordance with its terms, except to the extent that such enforceability may be limited by applicable bankruptcy, insolvency, reorganization and similar laws affecting creditors' rights generally, and subject to general principles of equity, including the discretion of a court in granting equitable remedies.

9. This Guarantee is subject to and shall be construed in all respects with United States law as well as laws of the State of Kentucky. The courts in the State of Kentucky are to have exclusive jurisdiction to settle any dispute which may arise out of or in connection with this Guarantee and Guarantor hereby submits itself to the jurisdiction of such courts in connection with such a dispute.

In Witness whereof, Guarantor has caused this Guarantee to be executed and delivered to Buyer in the name and on behalf of Guarantor by one of its representatives who is duly authorized to do so on behalf of Guarantor.

Babcock Power Inc.

By: _____

Title: _____

EXHIBIT F9

LG&E and KU Services Company (LKS) Second Tier Procurement Program

Attached are forms for supplying information to LKS on your company's use of Minority and Women owned Business Enterprises (M/WBEs). You do not have to use the exact form; however, please be sure all the information requested is submitted. **Expenditures for MBEs and WBEs must be supplied separately; please do not combine these expenditures.**

There are two categories of expenditure reporting:

Direct expenditures are those materials and service acquisitions from MWBEs directly attributable to a LKS contract or purchase order. For example-- your company provides general construction services to LKS and you subcontract earthmoving and painting to M/WBEs. In this instance, 100% of the painting and earthmoving expenditures should be reported to LKS. Another example -- your company provides LKS office supplies under a blanket purchase order and you purchase pens, pencils and stationery from M/WBE manufactures. Expenditures for the volumes of these pens, pencils and stationery furnished LKS should be reported at 100%.

Indirect expenditures are those materials and services acquisitions from M/WBEs that cannot be identified or apportioned to any specific customer. For example -- "overhead" items such as paper, computing expenses, or office maintenance incurred by your company. Also included would be any and all materials and services purchased from M/WBEs that are used in the direct production of your product or service. These "indirect expenditures" should be proportionately allocated and reported to as outlined in the example below.

MBE Indirect Allocation" formula $\frac{\text{Your YTD Sales to LKS}}{\text{Total YTD Sales}} = \textbf{Allocation Factor}$

(Total YTD MBE* Indirect Expenditures X Allocation Factor) = **LKS's** MBE Allocation

Example: Your Company's total sales are $50 million; total sales to LKS are $3 million, and total MBE expenditures are $5,000,000.

$$\frac{\$3,000,000}{\$50,000,000} = 0.06$$

5,000,000 X 0.06 = $300,000 (LKS's MBE Allocation)

For both direct and indirect expenditures, please list the names of the MBEs, addresses, and dollar amounts. **Please do not combine WBE and MBE expenditures.**

***Note: A separate and similar calculation should also be made for WBEs.**

Please submit the requested information by the 10th workday of the month following the end of each quarter to:

Stephanie R. Pryor
Manager, Supplier Diversity
LKS
820 W. Broadway
Louisville, KY 40202
(502) 217-4971 Fax

JFC

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_____
(Company Name)

M/WBE Indirect Expenditure Report
LKS Second Tier Program
_____ quarter, 20__

LKS Contract/Purchase Order Number (if applicable):_____

Indirect MBE Expenditure Allocation:
Use Factor from Previous Page

Sales ToLKS $_____

Total MBE Expenditures $_____

Allocation $_____

Indirect WBE Expenditure Allocation:

Sales ToLKS $_____

Total WBE Expenditures $_____

LKS Allocation $_____

Note: See indirect expenditure allocation formula explanation inLKS.'s Second Tier Reporting Program (previous page)

_____ _____ _____
Submitted By Title Date

JFC
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M/WBE Direct Expenditure Report
LKS Second Tier Program
_____ quarter, 20__

Company Name: _____

Address: _____

_____

Telephone: _____

Report Date: _____

Contract/Purchase Order No (if applicable): _____

Submitted By: _____ **Title:** _____

(1)	(2)	(3)		(4)	(5)
WORK DESCRIPTION	SUBCONTRACTING/SUBSUPPLIER NAME CONTACT PERSON & TELEPHONE NO.	TAX ID NO.	MBE/WBE	ORGINAL PROPOSED EXPENDITURES	ACTUAL PAYMENT
		TOTAL			$

REFER TO GUIDELINES ATTACHED TO THIS FORM

LKS

Guidelines for Second Tier (Direct Expenditure) Reporting

Supplier should complete requests 1 through 6, reporting its use of Minority Business Enterprises (MBEs) and Women Business Enterprises (WBEs) in direct connection with the goods/services provided under contracts/purchase orders toLKS.

Supplier should submit quarterly reports in a format equivalent to the attached M/WBE Direct Expenditure Report and send a copy of this form to:

Stephanie R. Pryor
Manager, Supplier Diversity
LKS
820 W. Broadway
Louisville, KY 40202
stephanie.pryor@lge-ku.com
(502) 217-4971 fax

Supplier should provide the following Second-Tier information when submitting its quarterly report on M/WBE expenditures either on the attached "Direct expenditure" form, or in an equivalent format:

1. **Work Description:** a brief statement of the goods/services provided by the M/WBE
2. **Subcontractor/Sub-supplier Name Contact Person & Telephone No.:** the name of a contact within the M/WBE who can verify expenditures made by Suppler.
3. **Tax ID Code** if available.
4. **MBE/WBE:** Designate whether company is an MBE or WBE
5. **Original Proposed Expenditures:** initial estimate of anticipated expenditures with M/WBE
6. **Actual Payment:** total of payments made to the M/WBE through the current reporting period

DEFINITIONS AND TERMS OF MANAGEMENT AND OWNERSHIP

WBE: Woman Business Enterprise: A certified business enterprise that is at least 51% owned by a woman; or, in the case of any publicly owned business, at least 51% of the stock of which is owned by one or more women, and whose management and daily business operations are controlled by one or more women.

MBE: Minority Business Enterprise: A certified business enterprise at least 51% owned by a minority individual or group, or in case of any publicly owned business, at least 51% of the stock of which is owned by one or more minority groups, and, and whose management and daily business operations are controlled by one or more of these individuals. LKS shall presume that minority includes, but is not limited to Black Americans, Hispanic American, Asian Pacific Americans, and other groups.

CONTROL: Exercising the power to make policy decisions.

OPERATE: Being actively involved in the day-to-day management and not merely acting as officer or directors.

LKS

Guidelines for Second Tier (Direct Expenditures Reporting (Cont'd.)

MWBE IDENTIFICATION CODES

1 - African American	3 - Native American	5 - Non-Minority Female
2 - Asian American	4 - Hispanic American	

EXPLANATION OF MWBE CODES

1 - African American: Persons having origin in any black racial groups of Africa.

2 - Asian Americans: Persons having origin in Asia or the India subcontinent, including, but not limited to, persons Japan, China, Vietnam, Samoa, Guam, U.S. Trust Territories of the Pacific, Northern Marinas, Laos, Cambodia, Taiwan, India, Pakistan, and Bangladesh.

3 - Native Americans: Persons having origin in any of the original peoples of North America or the Hawaiian Islands, in particular American India, Eskimos, Aleuts, and Native Hawaiians.

4 -Hispanic Americans: Persons of Mexican, Puerto Rican, Cuban, South or Central American, Caribbean, and other Spanish culture or origin.

5 -Non-Minority Female: Persons of European descent; non-ethnic minority female owned businesses.

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EXHIBIT F-10

FORM OF PERFORMANCE LETTER OF CREDIT

BENEFICIARY: **Louisville Gas and Electric Company,** a Kentucky corporation
820 West Broadway, Louisville, Kentucky 40202
Telephone: (___) ___-____ • *Fax:* (___) ___-____ • *E-mail:* _____@lge-ku.com

Re: **Irrevocable Standby Letter of Credit No. _____**

Issue Date: _____ ___, 20__

We, /Bank Name/, hereby establish in favor of the above-named Beneficiary (the "**Beneficiary**") this Irrevocable Standby Letter of Credit No. _____ (this "**Letter of Credit**") at the request of and for the account of., a corporation, with its principal place of business at ("**WFGD Supplier**"), effective immediately and expiring on the date set forth in numbered **Paragraphs 5** and **6** hereof.

This Letter of Credit, we are informed, is issued pursuant to the terms of the Equipment Purchase Agreement, dated as of _____ ___, 2011, by and between WFGD Supplier and the Beneficiary, as the same may be amended from time to time (the "**Agreement**").

1. Stated Amount. The aggregate amount of funds available under this Letter of Credit shall be U.S. $_____ (_____ United States Dollars), less the aggregate amount of all previous drawings under this Letter of Credit (the "**Stated Amount**"). The Stated Amount may be reduced at any time upon our receipt of a Reduction Certificate executed by the Beneficiary in the form of **Attachment E.**

2. Drawings. A drawing hereunder may be made by the Beneficiary on any Business Day on or prior to the date this Letter of Credit expires by delivering to /Bank Name/, at any time during its business hours on such Business Day, at /_____/ or at such other address as may be designated by written notice delivered to the Beneficiary as contemplated by numbered **Paragraph 9** hereof, an executed original (or, if applicable, a duplicate original issued in accordance with **Paragraph 14**) of this Letter of Credit together with (i) a draw certificate executed by an authorized officer of the Beneficiary in the form of **Attachment A** hereto (the "**Draw Certificate**"), completed and purportedly signed by such authorized officer and (ii) your draft in the form of **Attachment B** hereto (the "**Draft**"), completed and signed by such authorized officer. Partial drawings are permitted. Draw Certificates and Drafts under this Letter of Credit may be presented by you by means of the above documents sent by overnight delivery or courier to /Bank Name/, at its address set forth above, Attention: /_____/ (or at such other address as may be designated by written notice delivered to you as contemplated by numbered **Paragraph 9** hereof). Demand for payment hereunder may be made in the form of facsimile transmission of the document(s) hereunder to. You must confirm our receipt of each telecopied drawing by telephone to. The facsimile drawing must be received by us no later 5:00 P.M. on or before the expiration date of this Letter of Credit and must contain your certification that the original document(s) have been sent to us at the address stated above by overnight courier. We shall be entitled to conclusively rely for all purposes upon each demand for payment made by you hereunder by facsimile, notwithstanding any discrepancies between the demand for payment by facsimile and the documents subsequently received by us from you with respect to the demand for payment. The original documents are not required to be received by us on or before the expiration date.

3. Time and Method for Payment. We hereby agree to honor a drawing hereunder made in compliance with this Letter of Credit by transferring in immediately available funds the amount specified in the Draft delivered to us in connection with such drawing to such account at such bank in the United States as you may specify in your Draw Certificate at the opening of business on the second (2nd)Business Day

succeeding the date of presentation of the conforming Draw Certificate. All amounts to be paid under this Letter of Credit shall be made without set-off or counterclaim by us of any kind.

4. **Non-Conforming Demands.** If a demand for payment made by you hereunder does not, in any instance, conform to the terms and conditions of this Letter of Credit, we shall give you prompt notice, no later than three (3) Business Days following our receipt, that the demand for payment was not effected in accordance with the terms and conditions of this Letter of Credit, stating the reasons therefor and that we will upon your instructions hold any documents at your disposal or return the same to you. Upon being notified that the demand for payment was not effected in conformity with this Letter of Credit, you may correct any such non-conforming demand prior to the date this Letter of Credit expires.

5. **Expiration.** This Letter of Credit shall automatically expire at the close of business on the earlier of one year from the Issue Date specified above (or such later date to which this Letter of Credit may be extended in accordance with the provisions of numbered **Paragraph 6** hereof), or the date on which we receive a Cancellation Certificate in the form of **Attachment C** hereto executed by an authorized officer of the Beneficiary upon receipt of which this Letter of Credit shall be cancelled.

6. **Rollover.** This Letter of Credit shall be deemed automatically extended without amendment for additional periods of one (1) year each from the present or any future expiration date, unless at least thirty (30) days prior to any such expiration date we notify you by registered mail or overnight courier at the above address (or such other address as may be designated by you as contemplated by numbered **Paragraph 9** hereof and as amended accordingly) that we elect not to consider this Letter of Credit extended for any such additional one (1) year period. In the event that thereafter a letter of credit in replacement of this Letter of Credit and satisfactory to you shall not have been delivered to you by the date that is thirty (30) days prior to the expiration date of this Letter of Credit, you may draw upon this Letter of Credit pursuant to numbered **Paragraph 2** hereof in the full amount then available for drawing hereunder. In no event shall this Letter of Credit be automatically extended beyond _____ ___, 20__ (the "**Outside Expiration Date**"); **provided**, that, if SCR Supplier's letter of credit obligations shall remain in effect under the Agreement as of the Outside Expiration Date and you shall not have received by the date that is thirty (30) days prior to the Outside Expiration Date a letter of credit in replacement of this Letter of Credit satisfactory to you, you may draw upon this Letter of Credit pursuant to numbered **Paragraph 2** hereof in the full amount then available for drawing hereunder.

7. **Business Day.** As used herein, "**Business Day**" shall mean any day on which commercial banks are not authorized or required to close in the Commonwealth of Pennsylvania.

8. **Governing Law.** Except as otherwise expressly stated herein, this Letter of Credit shall be governed by the International Standby Practices, International Chamber of Commerce Publication No. 590 ("**ISP 98**") and any amendments or revisions thereto. As to matters not addressed by ISP 98, this Letter of Credit shall be governed by and construed in accordance with the laws of the Commonwealth of Kentucky, without giving effect to any choice of law rules which may direct the application of the laws of another jurisdiction.

9. **Notices.** All communications to you in respect of this Letter of Credit shall be in writing and shall be delivered to the address (or, as applicable, the fax number) shown for you herein or such other address (or applicable fax number) as may from time to time be designated by you in a written notice to us and as amended accordingly. All documents to be presented to us hereunder and all other communications to us in respect of this Letter of Credit, which other communications shall be in writing, shall be delivered to the address (or, as applicable, fax number) for us indicated on the signature page hereof, or such other address (or applicable fax number) as may from time to time be designated by us in a written notice to you.

10. **Irrevocability.** This Letter of Credit is irrevocable.

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11. Transferability. This Letter of Credit is transferable in its entirety, but not in part and may be successively transferred. Only the issuing bank is authorized to act as the transferring bank with respect to the Letter of Credit represented hereby. We shall not recognize any transfer of this Letter of Credit until this original Letter of Credit (or, if applicable, any duplicate original issued pursuant to **Paragraph 14** below), together with any amendment(s) and an appropriately completed and executed Transfer Certificate in the form of **Attachment D** hereto, is received by us and our transfer fee of ¼ of 1% (Minimum $250.00) of the amount transferred is paid to us. The correctness of the signature and title of the person signing the transfer form must be certified by a duly-authorized officer acting in the name and on behalf of the Beneficiary or otherwise be authenticated by your bank. Upon and after any such transfer under this Letter of Credit, all Drafts and related documentation deliverable hereunder must be executed by the transferee as the Beneficiary hereof. This Letter of Credit may not be transferred to any person with which U.S. persons are prohibited from doing business under U.S. foreign assets control regulations or other applicable U.S. laws and regulations.

12. Fees. All fees associated with this Letter of Credit are for account of WFGD Supplier.

13. Complete Agreement. This Letter of Credit sets forth in full our undertaking, and such undertaking shall not in any way be modified, amended, amplified or limited by reference to any document, instrument or agreement referred to herein, except as provided in numbered **Paragraph 8** hereof, **Attachments A, B, C, D** and **E** hereto and the notices referred to herein and any such reference shall not be deemed to incorporate herein by reference any document, instrument or agreement except as set forth above. No amendment or modification of this Letter of Credit may be made without the prior written consent of the Beneficiary and the WFGD Supplier except when the amount of this Letter of Credit is increased.

14. Replacement Instrument. If the original of this Letter of Credit has been lost, stolen, mutilated or destroyed, we will promptly issue to the Beneficiary a duplicate original of this Letter of Credit upon our receipt of our acceptable indemnity letter signed by the Beneficiary.

Sincerely,

/BANK NAME/

_____
(Bank Address)

_____
(City, State, Zip Code)

_____
(Telephone number)

_____
(Authorized Name and Title)

_____
(Authorized Signature)

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ATTACHMENT A

FORM OF DRAW CERTIFICATE

The undersigned hereby certifies to /Bank Name/ (the "**Issuer**"), with reference to Letter of Credit No. _____ (the "**Letter of Credit**") issued by Issuer in favor of the Beneficiary (capitalized terms used and not defined herein shall have the respective meanings set forth in the Letter of Credit), as follows:

(1) The undersigned is the _____ of Louisville Gas and Electric Company (Beneficiary) and is duly authorized by the Beneficiary to execute and deliver this Certificate on behalf of the Beneficiary;

(2) Beneficiary hereby makes demand against the Letter of Credit by presentation of the Draft accompanying this Draw Certificate, for payment of (U.S.$_____), such amount not being in excess of the Stated Amount;

(3) Beneficiary is entitled to draw the amount set forth in clause (2) hereof because the conditions for a drawing pursuant to the Agreement or numbered **Paragraph 6** of the **Letter of Credit** have been met; and

(4) You are hereby directed to make payment of the requested drawing to:

/Insert Wire Instructions/

LOUISVILLE GAS AND ELECTRIC COMPANY
By:_____
Name:_____
Title:_____

Address: _____
_____
_____

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ATTACHMENT B

DRAWING UNDER THE LETTER OF CREDIT NO. ----------

Date:

ON: The first Business Day immediately succeeding the date of presentation

PAY TO: /Beneficiary's Name/

$_____U.S.

FOR VALUE RECEIVED AND CHARGED TO THE ACCOUNT OF LETTER OF CREDIT NO. ____

LOUISVILLE GAS AND ELECTRIC COMPANY
By:_____
Name:_____
Title:_____

Address: _____
_____
_____

ATTACHMENT C

CANCELLATION CERTIFICATE

Letter of Credit No. _____

The undersigned hereby certifies to /Bank Name/ ("**Issuer**"), with reference to Letter of Credit No. _____ issued by Issuer to Louisville Gas and Electric Company (Beneficiary) (the "**Letter of Credit**") that either (i) the terms of the Agreement require the return of this Letter of Credit or (ii) the Agreement has been terminated and WFGD Supplier has satisfied all of its outstanding obligations and paid all amounts remaining due under the Agreement following such termination. Pursuant to numbered **Paragraph 5** thereof, the Letter of Credit shall expire upon Issuer's receipt of this certificate. Attached hereto is the Letter of Credit marked "Canceled". Capitalized terms used and not defined herein shall have the respective meanings set forth in the Letter of Credit.

LOUISVILLE GAS AND ELECTRIC COMPANY
By:_____
Name:_____
Title:_____

Address: _____
_____
_____

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ATTACHMENT D

TRANSFER CERTIFICATE

_____, 20-_

/BANK NAME
AND ADDRESS/

Re: Letter of Credit No. ----------

We request you to transfer all of our rights as Beneficiary under the Letter of Credit referenced above to the Transferee(s), named below:

_____
Name of Transferee(s)

_____
Address(es)

By this transfer, all our rights as the transferor, including all rights to make drawings under the Letter of Credit, go to the Transferee(s). The Transferee(s) shall have sole rights as beneficiary(ies), whether existing now or in the future, including sole rights to agree to any amendments, including increases or extensions or other changes and all references to "Beneficiary" in the Letter of Credit, any drawing certificate in the form of **Attachment A** or the other Attachments to the Letter of Credit shall be deemed to mean the Transferee(s). All amendments will be sent directly to the Transferee(s) without the necessity of consent by or notice to us. Capitalized terms used and not defined herein shall have the respective meanings set forth in the Letter of Credit.

We enclose the original Letter of Credit and any amendments. Please indicate your acceptance of our request for the transfer by endorsing the Letter of Credit and sending it to the Transferee(s) with your customary notice of transfer.

For your transfer fee of $_____.

* Enclosed is our check for $_____

* You may debit my/our Account No._____

_____
NAME OF TRANSFEROR

_____
NAME OF AUTHORIZED SIGNER AND TITLE

_____
AUTHORIZED SIGNATURE

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The signature and title above conform with those shown in our files as authorized to sign for the Beneficiary. Policies governing signature authorization as required for withdrawals from customer accounts shall also be applied to the authorization of signatures on this form. The authorization of the Beneficiary's signature and title on this form also acts to certify that the authorizing financial institution (i) is regulated by a U.S. federal banking agency; (ii) has implemented anti-money laundering policies and procedures that comply with applicable requirements of law, including a Customer Identification Program (CIP) in accordance with Section 326 of the USA PATRIOT Act; (iii) has approved the Beneficiary under its anti-money laundering compliance program; and (iv) acknowledges that *[Bank Name]* is relying on the foregoing certifications pursuant to 31 C.F.R. Section 103.121 (b)(6).

NAME OF BANK

_____

AUTHORIZED SIGNATURE AND TITLE

_____

PHONE NUMBER

_____

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ATTACHMENT E

REDUCTION CERTIFICATE

[Bank Name]
[Address 1]
[Address 2]
Attention:_____

Irrevocable Standby Letter of Credit No. _____

The undersigned hereby certifies to *[Bank name]* (**"Issuer"**), with reference to the above-specified Irrevocable Standby Letter of Credit issued by Issuer to Beneficiary (the **"Letter of Credit"**), that, as of and from the reduction date specified below, the Stated Amount is hereby reduced as set forth below:

Reduction Date	Reduction Amount	Revised Stated Amount
xx-xxx-xx	$xx,xxx.xx	$xx,xxx,xxx.xx

LOUISVILLE GAS AND ELECTRIC COMPANY
By:_____
Name:_____
Title:_____

Address: _____
_____
_____

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EXHIBIT F-11

STATION FORMS

THERMAL HOT WORK PERMIT PROGRAM

AND

DIGGING PERMIT

LG&E AND KU
220 WEST MAIN ST.
LOUISVILLE, KY, 40202

JFC

LG&E AND KU

Thermal Hot Work Permit Program

Authored By: _____

Jeffery O. Gilbert, CIH

Approved By:

Manager, Corporate Health &Safety _____

Barbara Hawkins, RN

Date: _____

Effective Date: December 22, 2011

Next review to be completed by: December 22, 2014

(signed copy on file in Corporate Health & Safety office)

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THERMAL HOT WORK PERMIT PROGRAM

1. PURPOSE

The purpose of this program is to reduce or eliminate the potential for injury to people and damage to property that can result from fires or explosions that arise when thermal hot work is performed outside of a designated safe thermal hot work area.

This program establishes a permit authorization system to ensure that all hazards are evaluated and that appropriate safety measures and controls are taken prior to and during any operation involving open-flames or that produces heat and/or sparks.

This operating procedure is written in accordance with the Occupational Safety and Health Administration's (OSHA) workplace standard, 29 CFR 1910.252, Welding, Cutting and Brazing and the National Fire Protection Association (NFPA) code standard 51B, Fire Prevention in Use of Cutting and Welding Processes.

2. SCOPE

This program is applicable to all LG&E and KU personnel and all contract personnel working at LG&E and KU-owned properties and other locations where LG&E and KU has control over the work to be performed.

3. Responsibility

All employees have responsibility for ensuring compliance with this program, including suspending thermal hot work if conditions become unsafe. Specific responsibilities are:

1) The Corporate Health and Safety Manager shall ensure that:

   a) the written Corporate Thermal Hot Work Permit Program is reviewed and revised, as necessary,

   b) the Business Units are provided assistance in evaluating the applicability and implementation of this program, and

   c) reviews of the program's effectiveness are conducted and documented.

2) Business Unit managers shall:

   a) designate one or more individuals with responsibility for authorizing thermal hot work in areas not specifically designed for such processes,

b) provide resources and enforcement toward the identification, implementation and evaluation of controls to protect workers potentially exposed to the hazards of thermal hot work in the workplace,

c) provide necessary support to ensure documentation of required record keeping activities, and

d) provide necessary supports to ensure employees attend annual training classes.

3) Health and Safety Specialists and Technical Training Consultants are responsible for:

a) reviewing and approving, in coordination with departmental representatives, the locations where thermal hot work permits are required. This can be accomplished by either designating areas where permits are required or identifying areas where permits would, under normal conditions not be required,

b) maintaining a list of areas that are specifically designed for thermal hot work,

4) Supervisor and/or Team Leader are responsible for:

a) ensuring that fire watches are properly trained,

b) ensuring that the proper fire fighting equipment is in working condition, and is available to standby personnel,

c) determining whether combustible materials or other hazards are present or are likely to be present in the work location,

d) periodically monitoring designated areas to be sure that conditions have not become unsafe for thermal hot work,

e) preparing the workplace by:

i) moving the work to a designated safe thermal hot work area or a location free of combustibles and potentially explosive atmospheres, or

ii) if the work cannot be moved, having the combustibles moved to a safe distance (a minimum of 35 feet) from the work area, or

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iii) having the combustibles properly protected against ignition, or

iv) ventilating the area to remove potentially combustible or explosive gases or dusts (**Note:** In areas where there is the possibility of a release of an explosive gas, continuous monitoring of the area with an explosive meter is required.), or

v) scheduling the thermal hot work during a time when combustible materials are not to be in the area.

f) obtaining a thermal hot work permit from an issuing authority for any work that is to be performed outside of a designated safe thermal hot work area.

g) ensuring that workers are provided with and use proper safety equipment, including personal protective equipment and fire extinguishing equipment.

h) when required, designating a properly trained person to serve as a fire watch.

5) The Contractor Proponent will be responsible for ensuring that the duties of the Supervisors and/or Team Leaders are properly executed for tasks involving contractors performing thermal hot work.

6) The Issuing Authority shall:

a) review the permit request and verify that all necessary precautions have been properly taken. If necessary, a visual inspection may be conducted prior to final approval.

b) verify that the buildings fire sprinkler system is in service, where applicable. Determine if the work area has any fire alarm detectors that need to be disabled to prevent false alarms, and appropriately disable only those devices that could be accidentally activated.

c) verify the location, start time and duration of the thermal hot work operation. A thermal hot work permit shall only be valid for the time duration identified. No thermal hot work permit shall exceed the requestor's scheduled shift period unless the requester receives a written approval from the Issuing Authority for an extension.

d) determine whether a fire watch is required for the thermal hot work operation.

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7) The Fire Watch shall be a properly trained person designated by the individual or department requesting the thermal hot work permit, but shall not be the actual employee who is performing the thermal hot work operation.
Specific responsibilities include:

a) having fire extinguishing equipment readily available and be trained in its proper use and limitations.

b) being familiar with facilities and procedures for sounding an alarm in the event of a fire.

c) correcting or stopping any conditions which may lead to a fire and reporting conditions to their department at the earliest opportunity. Attempting to extinguish fires appropriate to the available equipment and level of training, or otherwise activate the fire alarm system.

d) remain at the work site to monitor for smoldering fires while work is in progress and for at least one half hour following job completion. If the fire watch must leave the work site, all thermal hot work must stop.

7) Employees performing thermal hot work shall obtain proper authorization to perform thermal hot work operations via the THERMAL HOT WORK PERMIT and shall handle the equipment safely and use it so as not to endanger lives and property. The employee performing thermal hot work is also responsible for:

a) ensuring full compliance with the requirements of this procedure.

b) being fully qualified to perform required thermal hot work and verify that their equipment and tools are in good working order.

c) using appropriate safety equipment, including eye and face protection, hand protection, body protection, head protection, hearing protection and respiratory protection, as needed.

d) avoiding thermal hot work operations where conditions ARE NOT SAFE.

e) stopping work when conditions change from those set when the work was approved. If the designated fire watch must leave the work site, operations shall cease and the operator shall remain at the work site for at least one half hour following job completion to monitor for fires.

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4. Definitions

Designated Safe Thermal Hot Work Areas are areas that have been designed and constructed for performing work involving open-flames or that produce heat or sparks.

Facility Manager is the senior manager responsible for the physical operations of the facility or his/her designee (i.e., a plant manager at a power generation station or a service center manager at an operations center).

Fire Watch is a person trained to monitor thermal hot work operations. The Fire Watch shall be present during the entire thermal hot work operation and are immediately available to extinguish a fire or take other effective action if needed.

Thermal Hot Work is any work using an open-flame, heat or spark-producing apparatus. Thermal hot work includes, but is not limited to, welding, cutting, burning, grinding, and any related heat-producing jobs that could ignite combustible materials or flammable atmospheres. **Note:** Bolt heaters, car thaw sheds, portable room heaters (where allowed) and thermal weatherization equipment are not considered thermal hot work and do not require permits under this corporate program.

Thermal Hot Work Permit is a special permit, issued by an issuing authority, which authorizes specified thermal hot work at a specific location and time.

Issuing Authority is a person trained and approved by the facility manager or Business Unit manager to issue thermal hot work permits.

5. Thermal Hot Work Requirements

1) Routine thermal hot work operations shall be allowed without the requirement of a permit only in areas that have been designated as a SAFE THERMAL HOT WORK AREA.

2) In areas where it is not practical to move the work to a designated SAFE THERMAL HOT WORK AREA, thermal hot work shall only be permitted once the area is made fire safe by removing combustibles or protecting combustibles from ignition sources.

3) Thermal hot work operations are strictly prohibited under the following conditions:

   a) in areas not designated as SAFE THERMAL HOT WORK AREAS where a proper thermal hot work permit has not been obtained;

   b) in sprinklered buildings while such protection is impaired;

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c) in the presence of explosive atmospheres, such as mixtures of flammable gases, vapors, liquids, or dusts with air; on or in any drum, container or vessel that has not been properly cleaned to remove any possible explosive atmospheres that can develop inside from residual contents; or

d) in areas near the storage of large quantities of flammable or combustible materials that can readily ignite. Note: In coal yards and other coal storage areas, as well as when working on or within 35 feet of coal handling equipment, a thermal hot work permit will always be required and the coal must be adequately protected.

6. Thermal Hot Work Permit Procedures

1) Before a thermal hot work permit is approved and issued, the department or individual requesting the permit shall verify that:

a) all thermal hot work equipment to be used is in satisfactory condition and in good repair.

b) any combustible materials such as paper, wood, textiles, or coal on the floor are swept clear for a radius of 35 feet or protected against ignition by other means. Floors constructed of combustible materials are properly protected by either wetting the surface or covered by fire-resistant shields. Where floors have been wetted down, personnel operating arc welding or cutting equipment shall be protected from possible shock.

c) all combustible materials are relocated at least 35 feet from the work area. Where relocation is not practical, the combustible materials shall be adequately protected.

d) openings or cracks in walls, floors, or ducts and grating surfaces within 35 feet of the work area are tightly covered to prevent the passage of sparks to adjacent areas. Where thermal hot work is done near walls, partitions, ceilings or roofs of combustible construction, fire-resistant shields or guards are provided to prevent ignition.

e) if thermal hot work is to be done on a metal wall, partition, ceiling or roof, that precautions are taken to prevent ignition of combustible materials on the other side, due to conduction or radiation, such as relocation or covering the materials. If the combustible materials can not be relocated or protected, a fire watch shall be provided on the opposite side of the wall where the work is being performed.

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f) no thermal hot work is attempted on a metal partition, wall ceiling or roof having a covering, or on walls or partitions of combustible sandwich-type panel construction.

g) thermal hot work is not undertaken on pipes or other metals that are in contact with combustible walls, partitions, ceilings or roofs, if the work is close enough to cause ignition by conduction.

h) nearby personnel are suitably protected against heat, sparks, slag, etc.

i) where thermal hot work is to be done in close proximity to a sprinkler head, that the head is covered by a wet cloth to prevent activation. The cloth must be removed immediately at the conclusion of the thermal hot work.

2) The department or individual requesting the thermal hot work permit is responsible for designating a fire watch. The fire watch shall:

a) have fire extinguishing equipment readily available and be trained in its use.

b) know how to activate the building's fire alarm system, if applicable, or who to notify in the event of a fire.

c) watch for fires in all exposed areas, and try to extinguish them first only when obviously within the capacity of the equipment available, or otherwise sound the alarm immediately.

d) monitor the work area for at least one half hour after completion of the thermal hot work to detect and extinguish any smoldering fires that may be identified.

3) Once the work area has been properly prepared, the department or individual requesting the thermal hot work permit shall complete the thermal hot work permit form (See *Appendix A* for an example of a thermal hot work permit, the Business Units may create their own form) and request final review and approval from an Issuing Authority. The requestor, Issuing Authority, Fire Watch (when required) and employees performing the thermal hot work shall sign and dated the permit. Once approved, the thermal hot work permit shall be posted in the area where the work is to be performed.

7. Special Precautions

1) When work is stopped for an extended period of time the equipment must be shut down and secured to prevent accidental release of sparks, heat or

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flames. If the work stoppage will exceed the original duration time of the thermal hot work permit, the requester must notify Issuing Authority to have the permit extended or to request issuance of a new permit.

2) When thermal hot work is to be performed in a permit-required confined space or in conjunction with other permits or tags (such as required by the Lockout/Tag Out Program), all of the permits shall be marked so that they are linked to the original work order and to each other.

3) When the operation of equipment would render the area unsafe for thermal hot work, this equipment must be locked and/or tagged out in accordance with the Lockout – Tag Out Program. Both the lockout – tag out documentation and the thermal hot work permit shall be marked so that they are linked to the original work order and to each other.

4) Drums, tanks, containers or any vessel that may have contained chemicals or materials that when heated may produce flammable, explosive or toxic atmospheres shall be thoroughly cleaned and prepared prior to performing any thermal hot work on them.

5) Thermal hot work that must be performed on any utility piping used for the transmission or distribution of flammable gases or liquids shall only be performed by a crew qualified to make hot taps.

6) Contractors shall perform all thermal hot work procedures in accordance with this operating procedure or be able to demonstrate that they have a comparable procedure that meets or exceeds the requirements of this operating procedure.

8. Personal Protective Equipment

Personal protective equipment for eyes, face, head, and extremities, respiratory protection and protective shields and barriers, shall be used and maintained in a sanitary and reliable condition. Selection of appropriate devices should be made in accordance with the Personal Protective Equipment Hazard Assessment Program.

HOT WORK PERMIT

**BEFORE INITIATING HOT WORK, CAN THIS JOB BE AVOIDED?
IS THERE A SAFER WAY?**

This Hot Work Permit is required for any temporary operation involving open flames or producing heat and/or sparks. This includes, but is not limited to: Brazing, Cutting, Grinding, Soldering, Torch Applied Roofing and Welding.

INSTRUCTIONS

1. Firesafety supervisor.
   - A. Verify precautions listed at right (or do not proceed with the work).
   - B. Complete and retain Part 1.
     (Part 1A is a copy for expanded hot work awareness).
   - C. Issue Part 2 to person doing job.

HOT WORK BEING DONE BY
- ☐ EMPLOYEE
- ☐ CONTRACTOR _____

DATE | JOB NUMBER

LOCATION/BUILDING AND FLOOR

NATURE OF JOB

NAME OF PERSON DOING HOT WORK

I verify the above location has been examined, the precautions checked on the Required Precautions Checklist have been taken to prevent fire, and permission is authorized for this work.

SIGNED (Firesafety Supervisor/Operations Supervisor)

PERMIT EXPIRES | DATE | TIME | AM PM

NOTE: EMERGENCY NOTIFICATION ON BACK OF FORM. USE AS APPROPRIATE FOR YOUR FACILITY.

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F2630 (REV. 11/03)
PRINTED IN USA (11/03)

PART 1A

REQUIRED PRECAUTIONS CHECKLIST

3288035

- ☐ Available sprinklers, hose streams and extinguishers are in service/operable.
- ☐ Hot Work equipment in good repair.

Requirements within 35 ft (11 m) of work
- ☐ Flammable liquids, dust, lint and oily deposits removed.
- ☐ Explosive atmosphere in area eliminated.
- ☐ Floors swept clean.
- ☐ Combustible floors wet down, covered with damp sand or fire-resistive sheets.
- ☐ Remove other combustibles where possible. Otherwise protect with fire-resistive tarpaulins or metal shields.
- ☐ All wall and floor openings covered.
- ☐ Fire-resistive tarpaulins suspended beneath work.
- ☐ Protect or shut down ducts and conveyors that might carry sparks to distant combustibles.

Work on walls, ceilings or roofs
- ☐ Construction is noncombustible and without combustible covering or insulation.
- ☐ Combustibles on other side of walls, ceilings or roofs are moved away.

Work on enclosed equipment
- ☐ Enclosed equipment cleaned of all combustibles.
- ☐ Containers purged of flammable liquids/vapors.
- ☐ Pressurized vessels, piping and equipment removed from service, isolated and vented.

Fire watch/Hot Work area monitoring
- ☐ Fire watch will be provided during and for 60 minutes after work, including any coffee or lunch breaks.
- ☐ Fire watch is supplied with suitable extinguishers, and where practical, a charged small hose.
- ☐ Fire watch is trained in use of equipment and in sounding alarm.
- ☐ Fire watch may be required in adjoining areas, above and below.
- ☐ Monitor Hot Work area for 3 hours after job is completed.

Other Precautions Taken:
- ☐ _____

WARNING!

HOT WORK IN PROGRESS WATCH FOR FIRE!

IN CASE OF EMERGENCY:

CALL: _____

AT: _____

WARNING!

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Appendix B: Frequently Asked Questions about the Thermal Hot Work Permit Program

1) What is thermal hot work?

Thermal hot work should not be confused with the practice of working on "live" (energized) electrical equipment, known in the utility industry as 'hot work.'

Thermal hot work is any work using an open-flame, heat or spark-producing apparatus. Thermal hot work includes, but is not limited to, welding, cutting, burning, grinding, and any related heat-producing jobs that could ignite combustible materials or flammable atmospheres. **Note:** Bolt heaters, car thaw sheds, portable room heaters (where allowed) and thermal weatherization equipment are not considered thermal hot work and do not require permits under this corporate program.

2) Who can issue a Thermal Hot Work Permit?

Only individuals, called Issuing Authorities in the corporate program, who have been authorized by one of the Business Unit managers and who have been properly trained can issue thermal hot work permits.

3) Can the Issuing Authority be the same person as the one performing the thermal hot work operation?

An Issuing Authority can perform thermal hot work, however, they can not issue permits to themselves. A second person with authority to issue these permits must issue the permit. The purpose of this requirement is to ensure that all of the proper precautions have been taken prior to initiating thermal hot work.

4) Does the Thermal Hot Work Permit Program apply to shop areas?

Shop areas are addressed in the written program. In most cases, the shops will be designed and maintained to make it safe to perform thermal hot work without the need for a permit. However, if combustibles are present employees must comply with the Thermal Hot Work Permit Program.

5) What does fire watch mean?

A fire watch is an individual trained to monitor thermal hot work operations. The fire watch shall be present during the entire thermal hot work operation and be immediately available to extinguish a fire or take other effective action if needed. The Issuing Authority must determine whether a fire watch is required when assessing the work to be covered by the thermal hot work permit.

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6) Must the employee assigned fire watch duties stay at the job site or can he/she periodically check the work area?

Fire watch must be maintained during the thermal hot work task and for at least a half-hour afterwards. The fire watch must stay at the job site but may be allowed to perform other duties (e.g. put tools away, clean up).

7) Should a crew stop 30 minutes early at the end of the day or will the fire watch stay for 30 minutes on overtime?

The supervisor should decide this on a case-by-case basis based on the urgency of the work. As stated earlier, fire watch can be maintained while clean up of the work site is being performed.

8) What is considered clean?

Elimination of flammable concentrations or potential concentrations of combustible dusts, gases, fumes, vapors, etc.

9) What does the term 35' radius mean? What direction does that include?

A 35-foot radius means 35 feet in every direction from the source of ignition. The distance does not extend beyond non-combustible walls, floors, or ceilings.

10) Specify what it takes to contain hazard to avoid cleaning 35' radius?

Move the work, move the combustibles, or cover or shield all potential combustibles in the 35-foot radius. The intent is prevent fires and make the work safer.

11) Is wetting down an acceptable method of eliminating a fire hazard?

Yes. However, where floors have been wet down, personnel operating arc welding or cutting equipment shall be protected from possible shock. 1910.252(a)(2)(v).

12) Who is responsible for ensuring that equipment needed to comply with the thermal hot work permit program is available when needed? Is it the proper type?

Equipment needs should be evaluated by the departments performing the work. Needed equipment should be ordered through the normal procurement processes.

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Appendix C: Request for Location of Underground Facilities

LG&E C.E. & C.M. Dept.

Request for Location of Underground Facilities
Substation And Power Plants

Location: _____ Date Requested: _____

Description of Work To be Done And Specific Areas Involved:

_____

_____

_____

_____

Date Work To Start: _____

Person requesting Location & Approval : _____

Location Checked and Approved by:

Cane Run Plant: _____ Date: _____

Mill Creek Plant: _____ Date: _____

Trimble County Plant: _____ Date: _____

Electric T & D: _____ Date: _____

Electric Underground: _____ Date: _____

Gas Department: _____ Date: _____

South Central Bell: _____ Date: _____

Other: _____ Date: _____

Specific Instructions (How Close To Dig By Machine/Hand)

_____

_____

_____

Date Permission Given to Dig: _____

Person Notified If Different Than Person Requesting Approval: _____

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EXHIBIT F13

ASSIGNMENT OF WFGD SUPPLIER AGREEMENT

This Assignment and Assumption Agreement (this "**Agreement**") is made and entered into this ___ day of ____, 201_, by and between Louisville Gas and Electric Company, a Kentucky corporation ("**Assignor**"), and_____, a _____corporation ("**Assignee**") (collectively, the "**Parties**" and individually a "**Party**").

WHEREAS, Assignor and Assignee are parties to the _____ Agreement dated as of _____, 201_ (as amended, modified and supplemented from time to time, the "**Prime Contract**"); and

WHEREAS, Assignor has entered into the Equipment Purchase Agreement dated as of _____, [201_] (as amended, modified and supplemented from time to time, the "**WFGD Supplier Contract**") with_____, a _____corporation (the "**WFGD Supplier**"), for the supply of Wet Flue Gas Desulphurization Systems (WFGD); and

WHEREAS, _____("**Guarantor**") has executed the Parent Guarantee dated as of _____, 201_ (as amended, modified and supplemented from time to time, the "**Parent Guarantee**") under which Guarantor guarantees the payment and performance by the WFGD Supplier of its obligations under the WFGD Supplier Contract in favor of Assignor and upon and after assignment of the Prime Contract in favor of the Assignee, subject only to those certain rights and interests of Assignor expressly reserved and to be retained by Assignor under the WFGD Supplier Contract; and

WHEREAS, in accordance with the terms of the Prime Contract, Assignor desires to assign to Assignee, and Assignee desires to assume from Assignor, Assignor's rights and obligations under the WFGD Supplier Contract as and to the extent set forth in this Agreement; and

WHEREAS, in accordance with the terms of the Parent Guarantee, Assignor desires to assign to Assignee all of its right, title and interest in and to the Parent Guarantee as and to the extent set forth in this Agreement.

NOW, THEREFORE, in consideration of the mutual covenants herein contained, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, and intending to be legally bound hereby, the Parties agree as follows:

ARTICLE 1
ASSIGNMENT AND ASSUMPTION

Section 1.1 Effective as of the date hereof, Assignor hereby assigns to Assignee all of its right, title and interest in and to the WFGD Supplier Contract (other than rights accorded to

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the "Owner" as defined thereunder), and Assignee hereby assumes all of Assignor's obligations under the WFGD Supplier Contract.

Section 1.2 Effective as of the date hereof, Assignor hereby assigns to Assignee all of its right, title and interest in and to the Parent Guarantee (other than rights under the Parent Guarantee relating to WFGD Supplier's obligations to the "Owner" under and as defined in the WFGD Supplier Contract).

ARTICLE II
MISCELLANEOUS PROVISIONS

Section 2.1 This Agreement may not be amended, modified or supplemented except pursuant to an instrument in writing signed by the Parties. The failure of any Party to enforce any of the terms and conditions or to exercise any right or privilege under this Agreement shall not be construed as waiving any such term or condition or right or privilege and the same shall continue and remain in force and effect as if no such failure to enforce or exercise has occurred. No waiver shall be valid unless so stated in writing by the Party granting the waiver.

Section 2.2 If any provision of this Agreement is held invalid or unenforceable, all other provisions will not be affected, and with respect to the provision held invalid or unenforceable, the Parties will amend this Agreement as necessary to affect the original intent of the Parties as closely as possible.

Section 2.3 This Agreement shall be governed by and construed in accordance with the laws of the Commonwealth of Kentucky without regard to its rules of conflict of laws that would require the application of laws of a different jurisdiction.

Section 2.4 This Agreement may be executed in counterparts, each of which shall be deemed an original, but all of which together shall constitute one and the same agreement and shall become effective when counterparts have been signed by each of the Parties and delivered to the other Parties. Any counterpart may be executed by facsimile signature or any image transmitted by electronic mail (such as a pdf file) and such facsimile signature or image shall be deemed an original.

Signatures on Next Page

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IN WITNESS WHEREOF, each of the undersigned has caused this Agreement to be duly signed as of the date above written.

LOUISVILLE GAS AND ELECTRIC COMPANY

By: _____
Name:
Title:

ASSIGNEE

By: _____
Name:
Title:

ACKNOWLEDGEMENT:

., a corporation, and, a corporation, hereby acknowledges, agrees and consents as of the date hereof to the assignment and assumption of the WFGD Supplier Contract and the Parent Guarantee pursuant to the terms hereof.

By: _____
Name:
Title:

By: _____
Name:
Title:

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EXHIBIT G

GUARANTEES

AND

PERFORMANCE GUARANTEE TEST PROTOCOL

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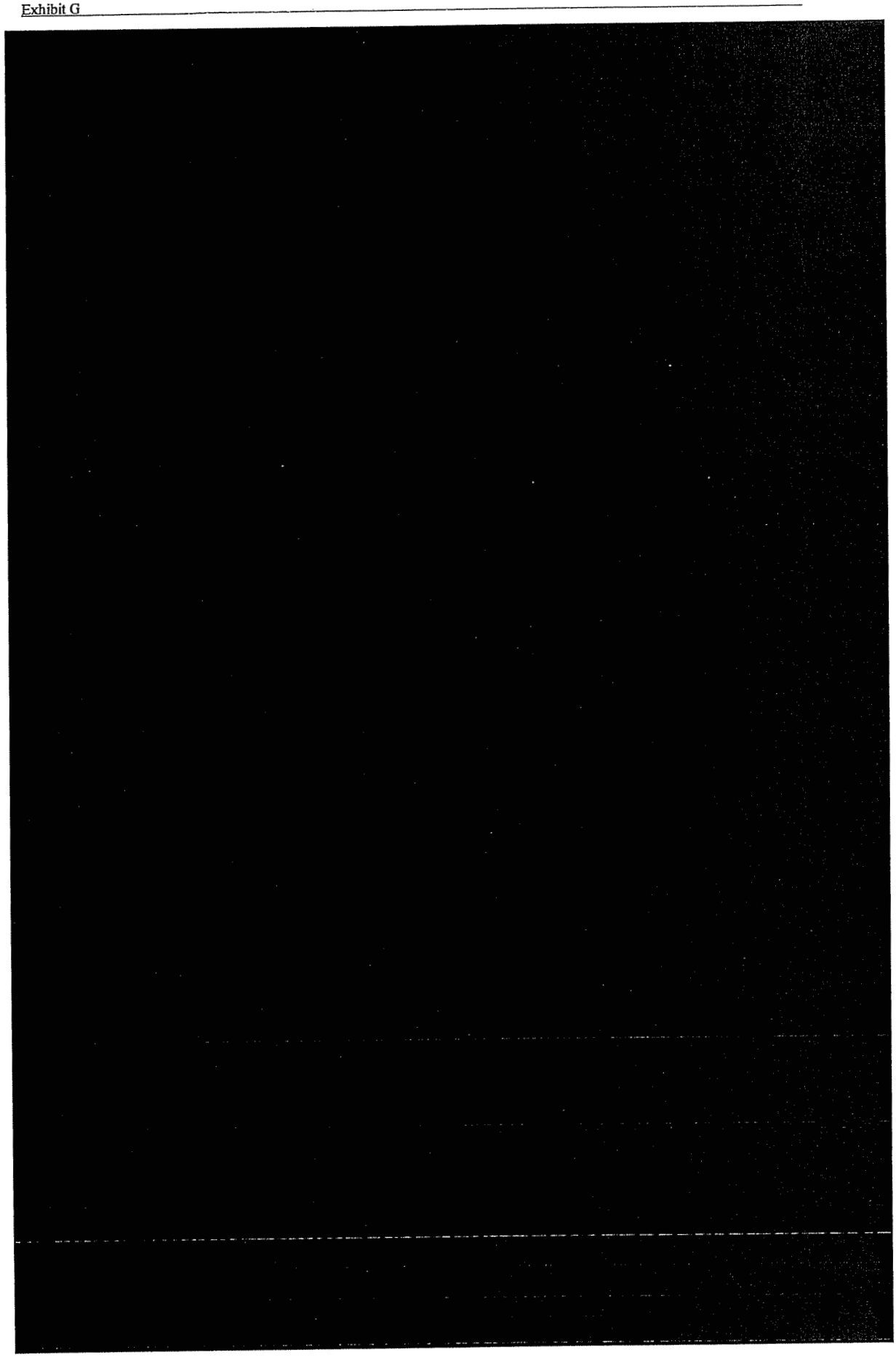

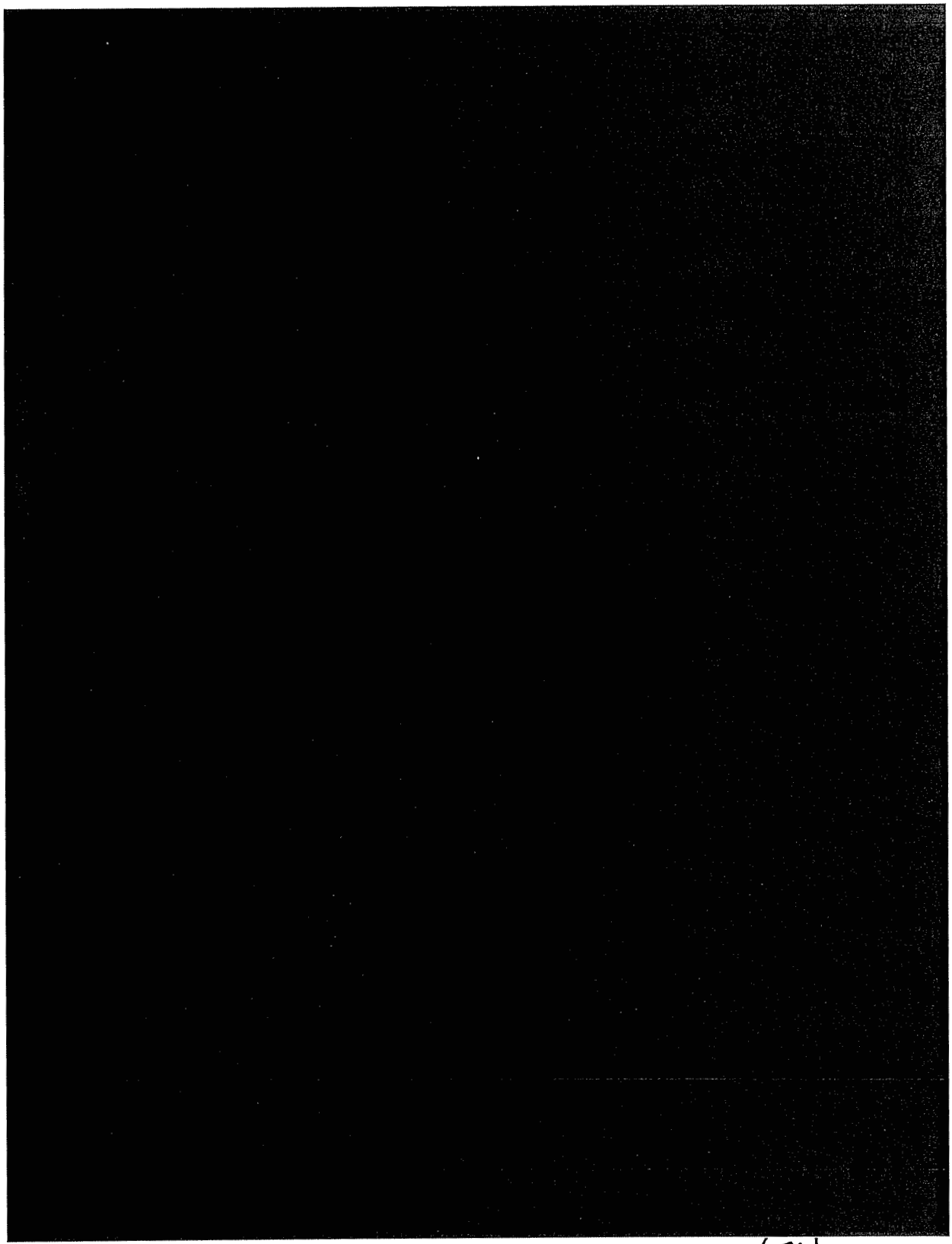

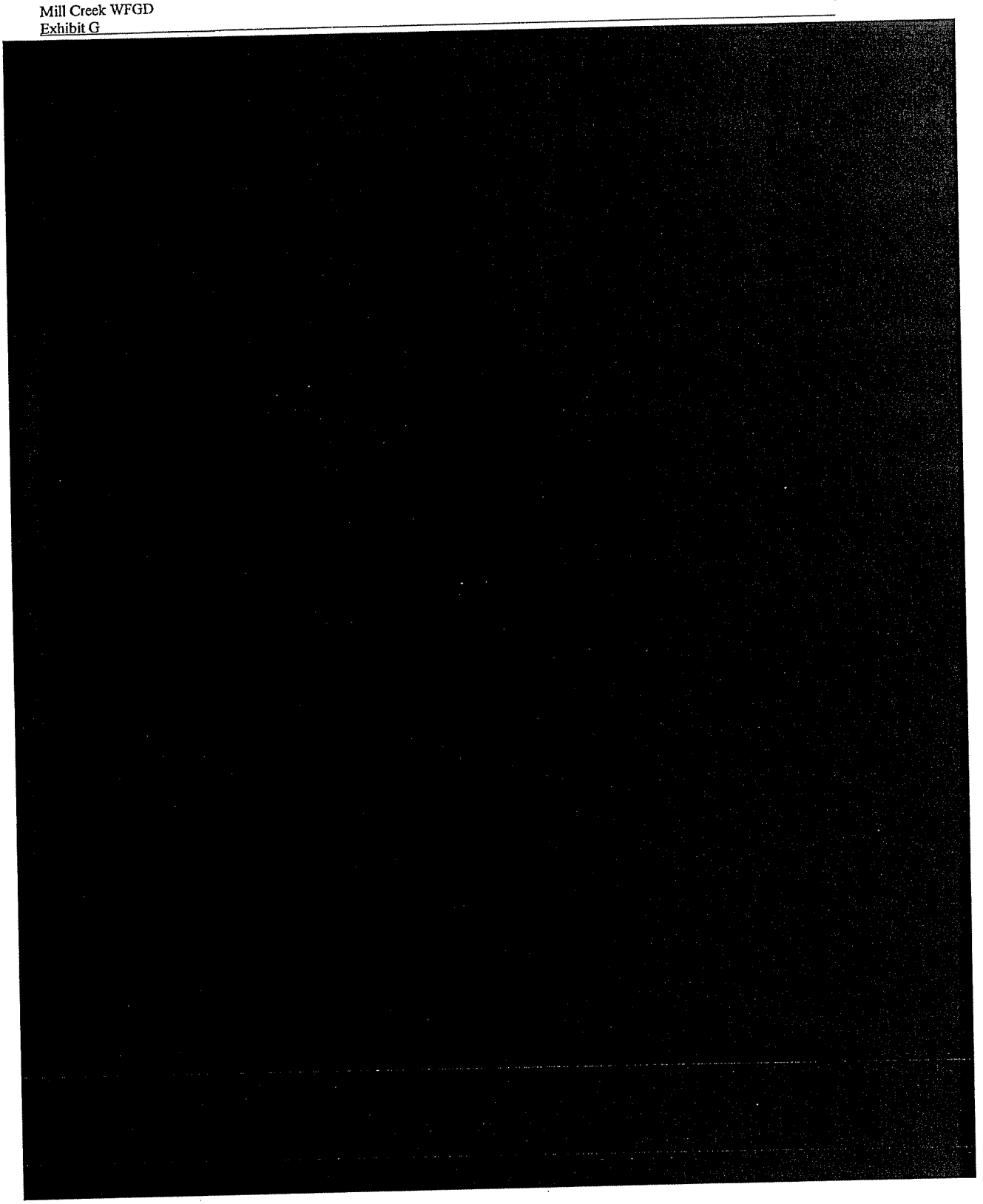

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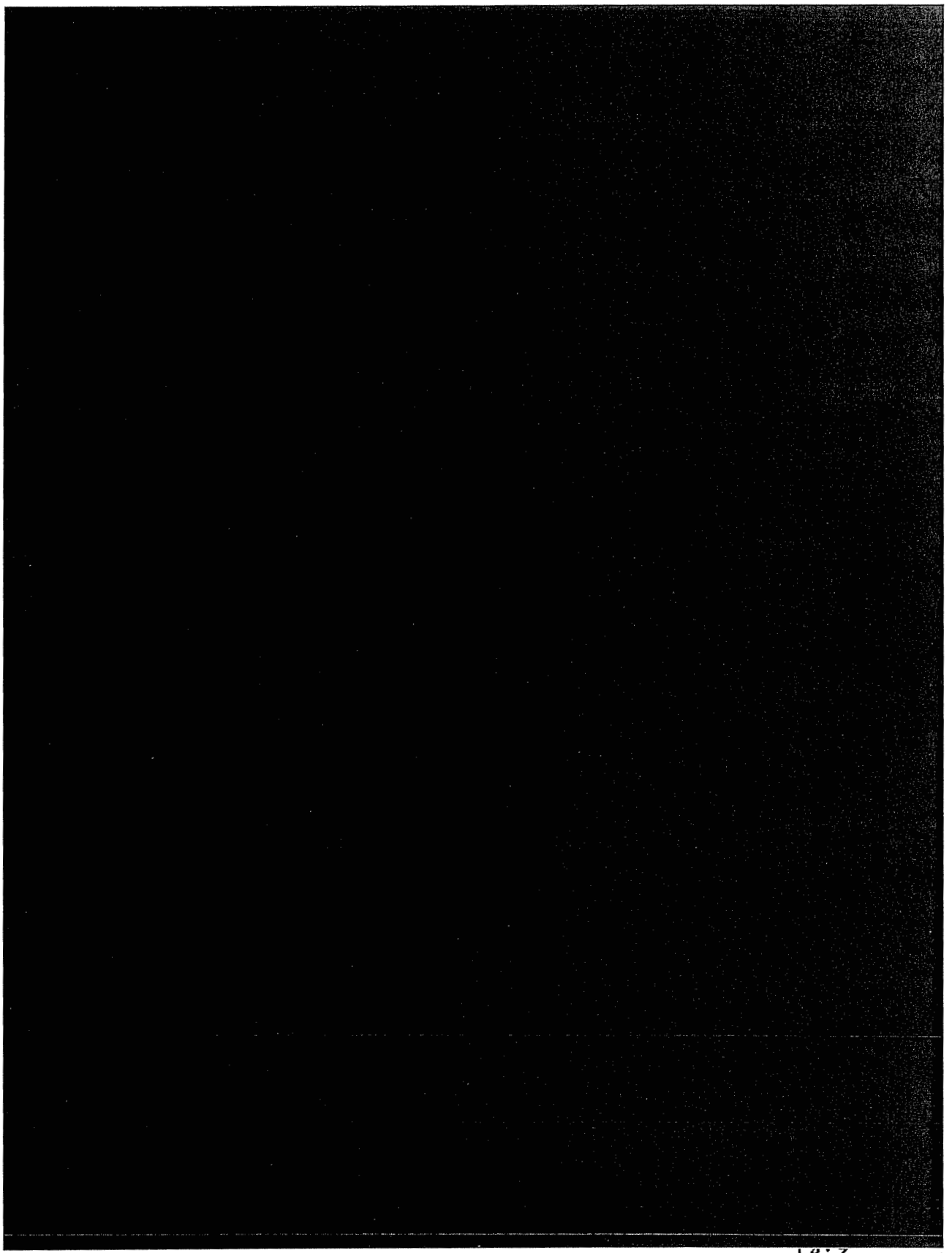

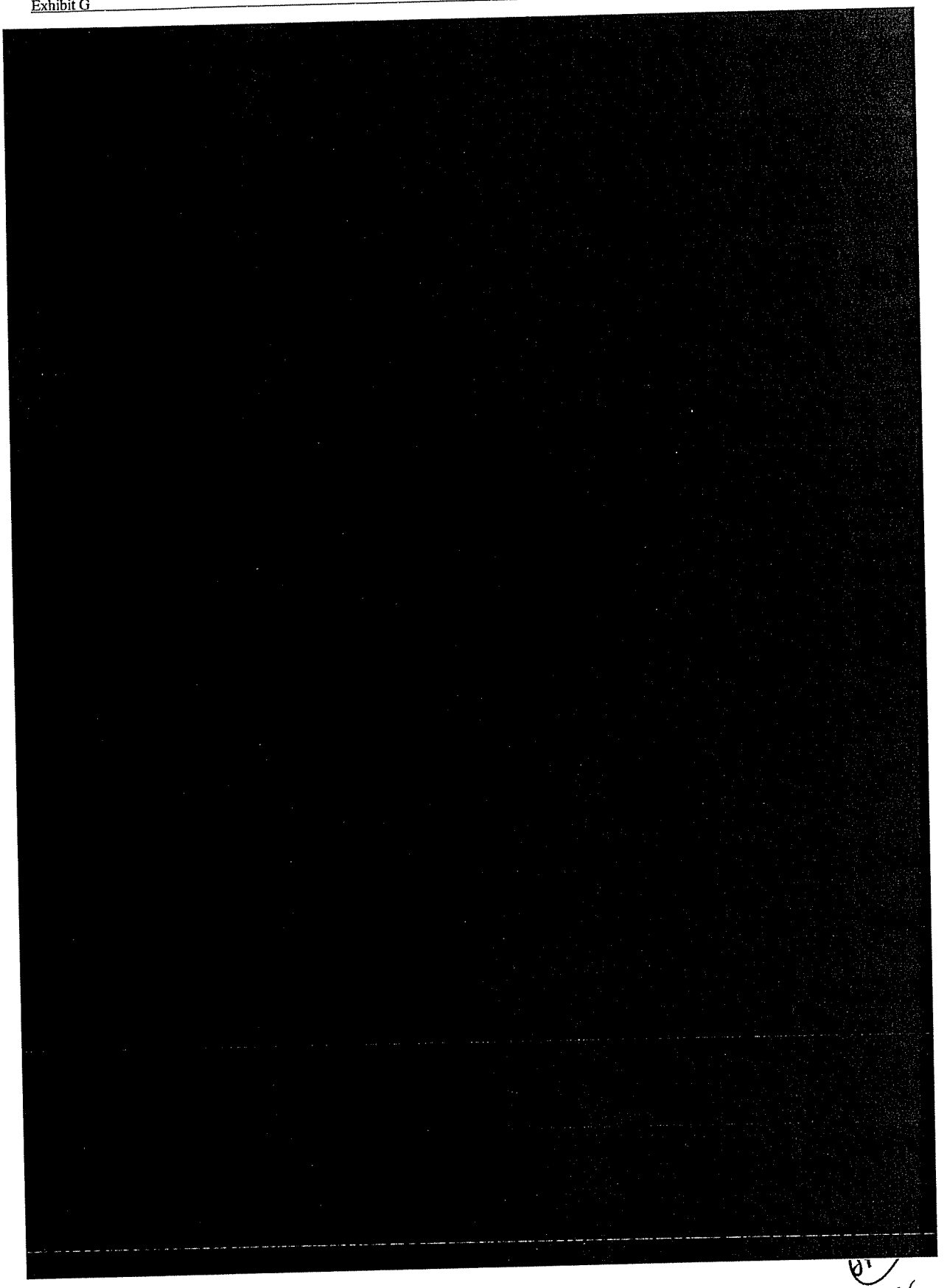

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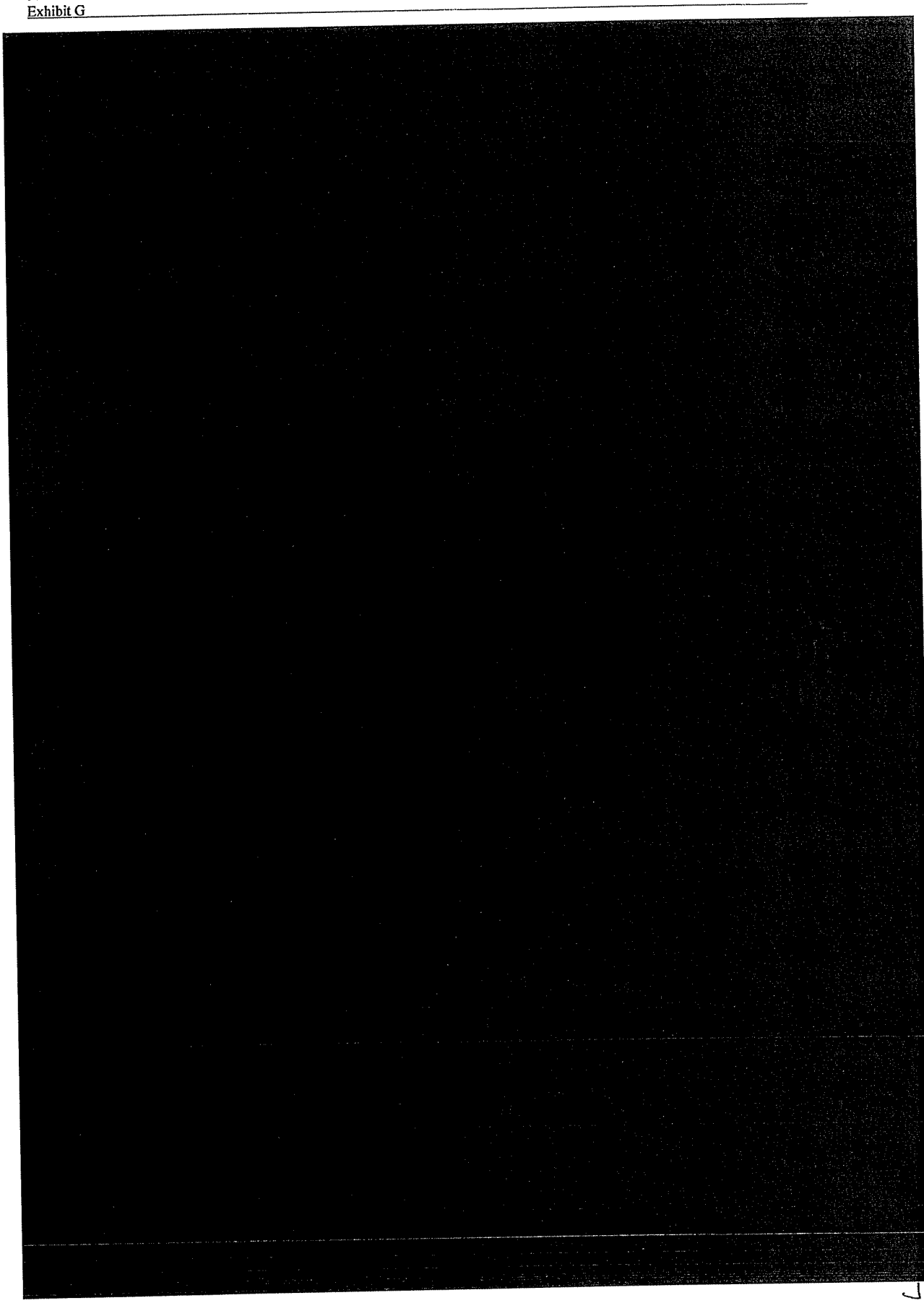

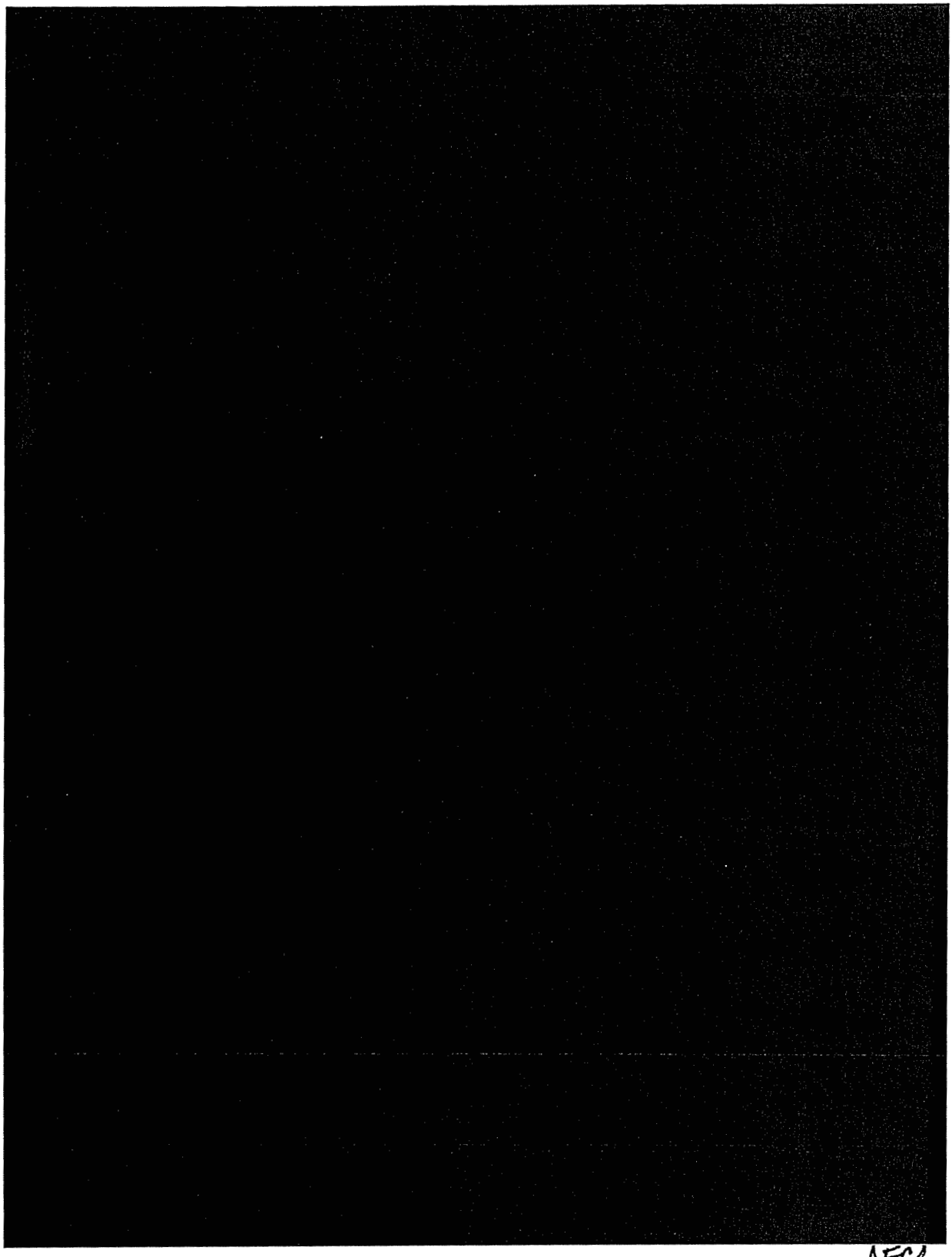

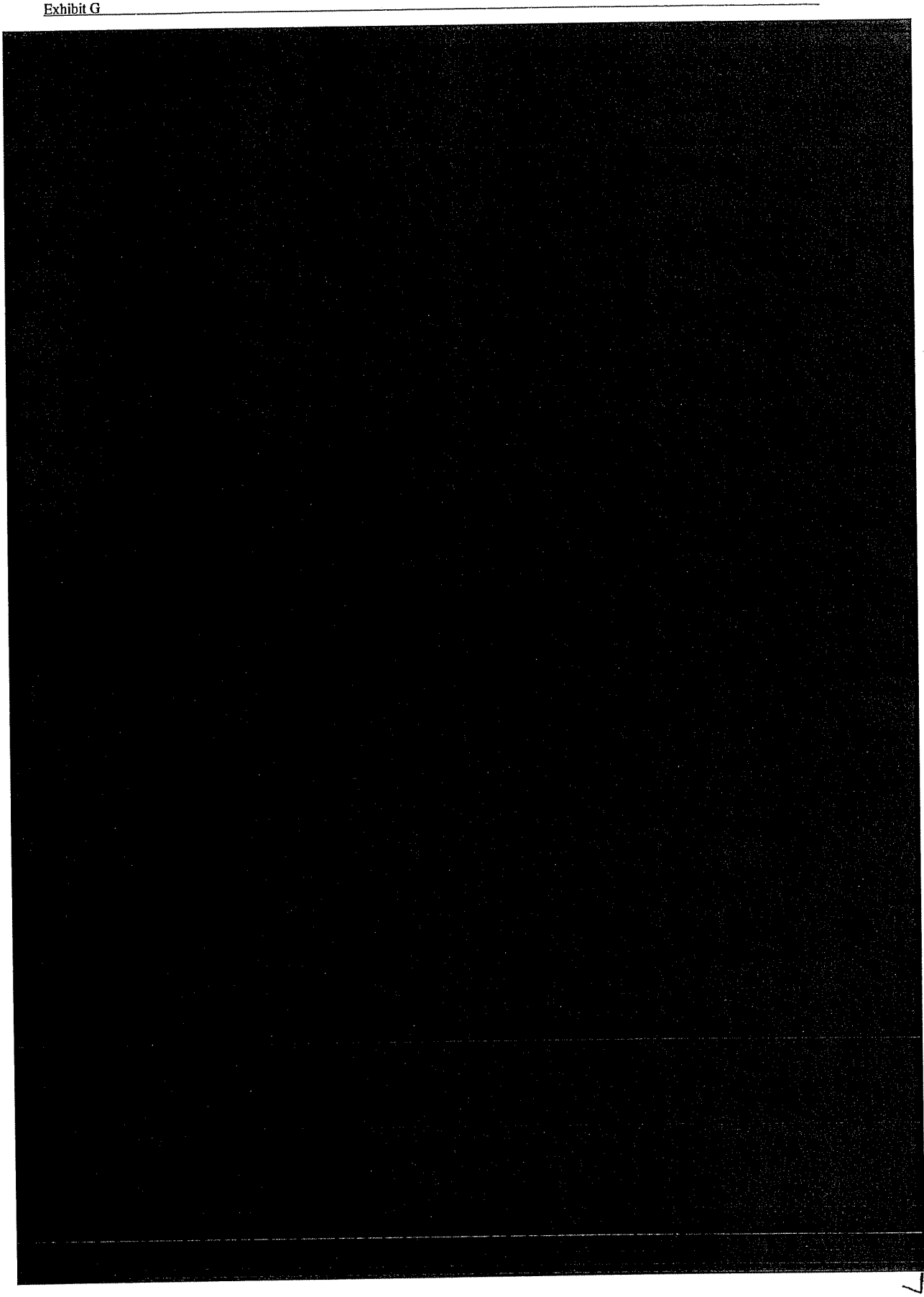

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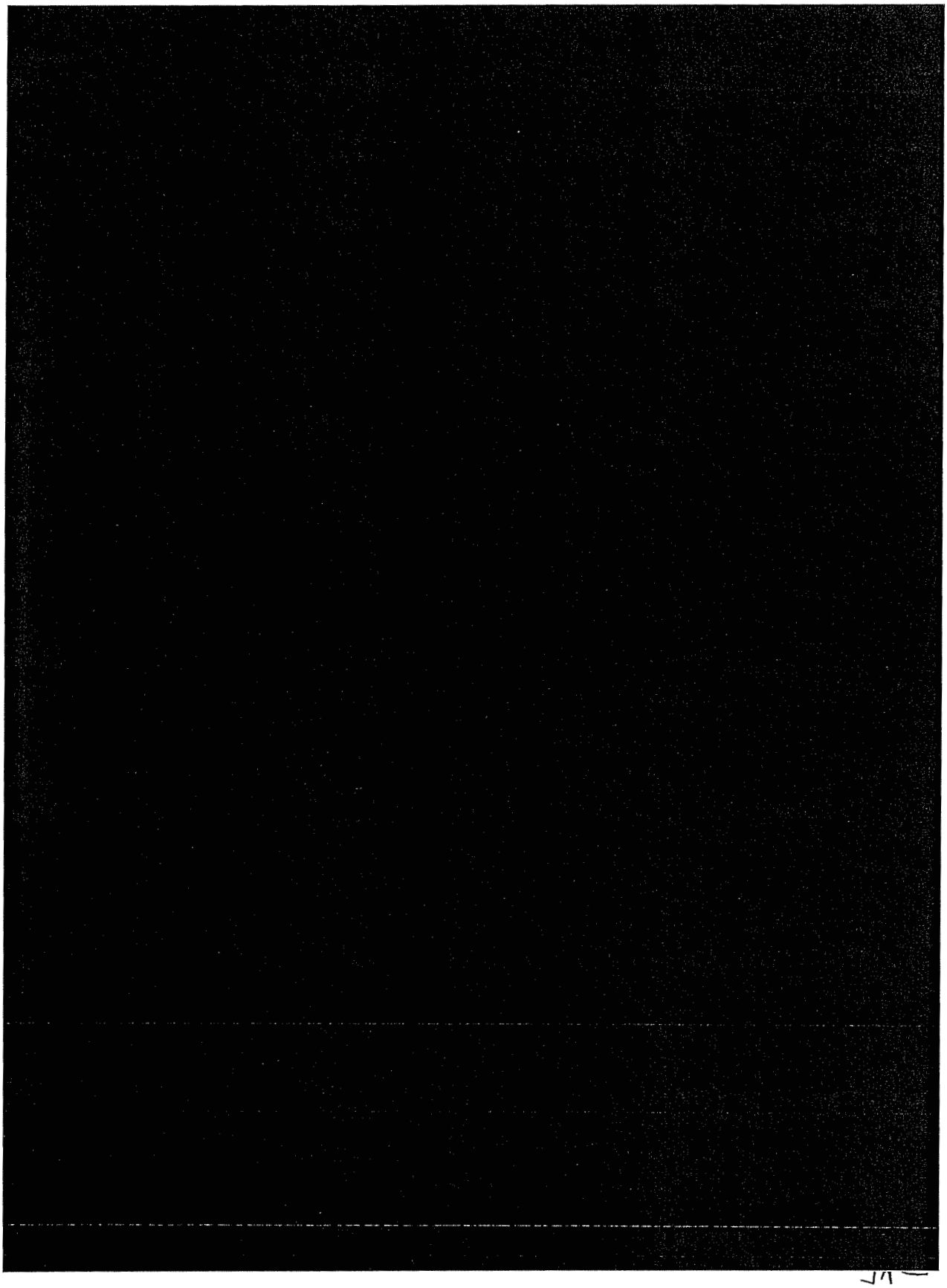

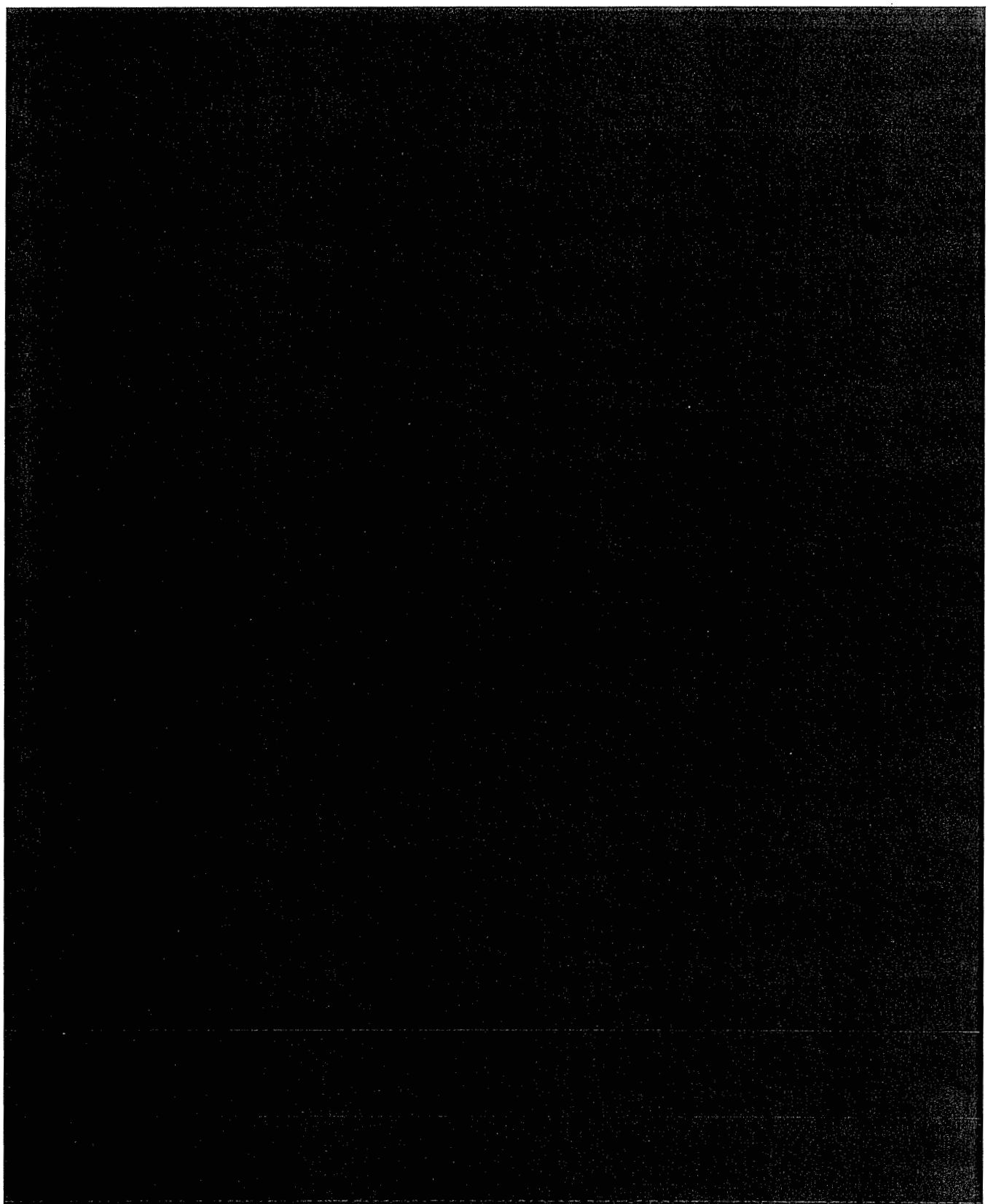

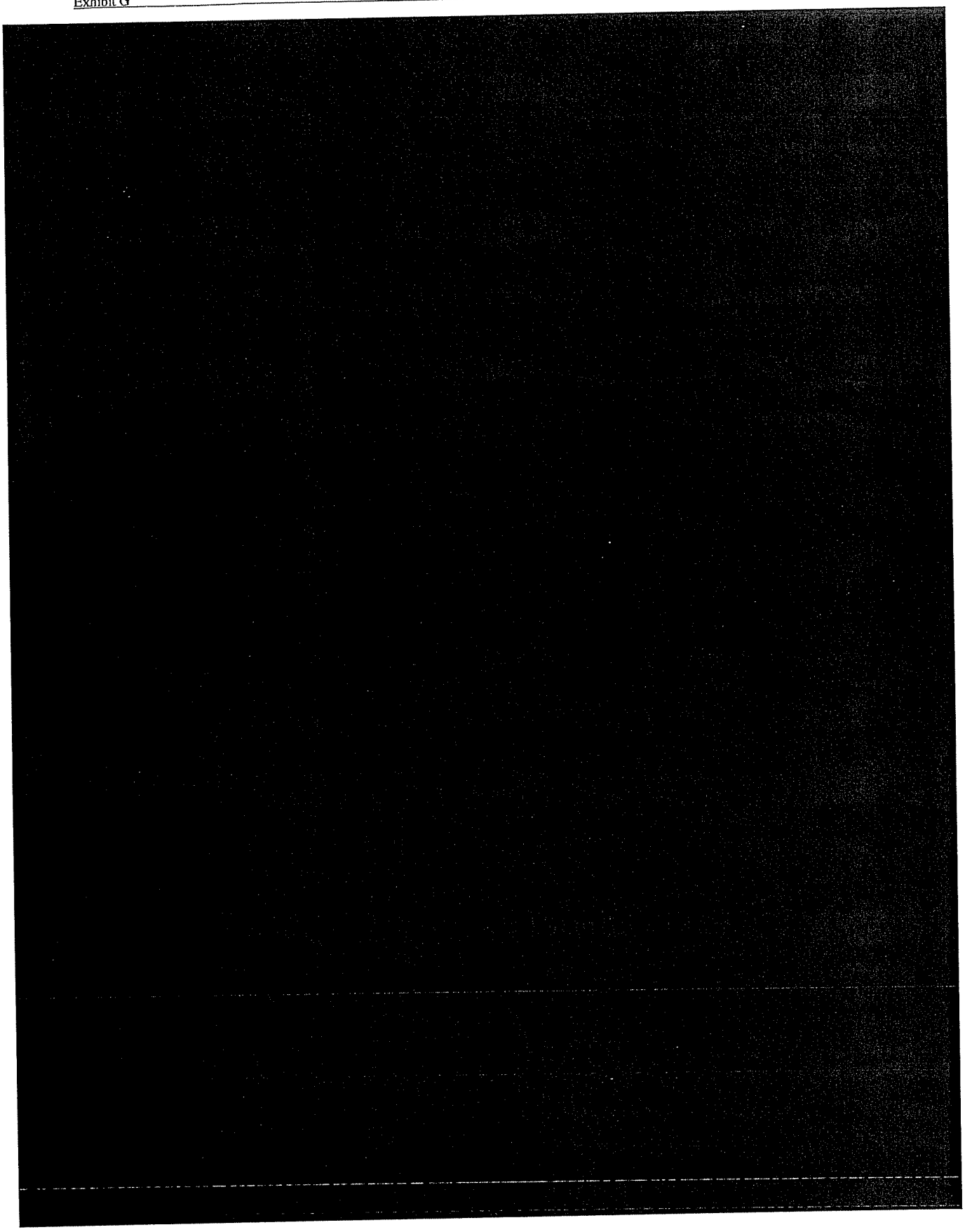

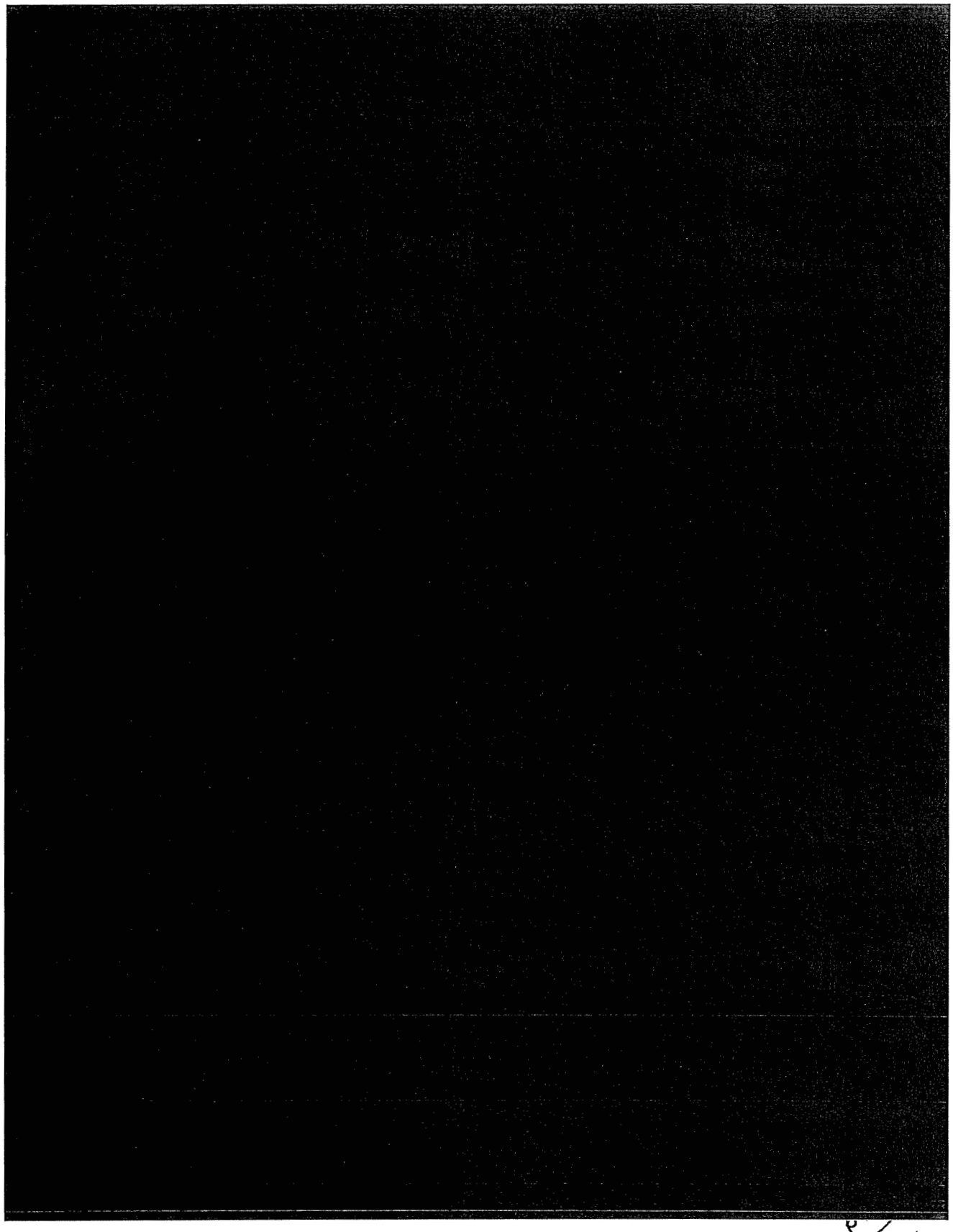

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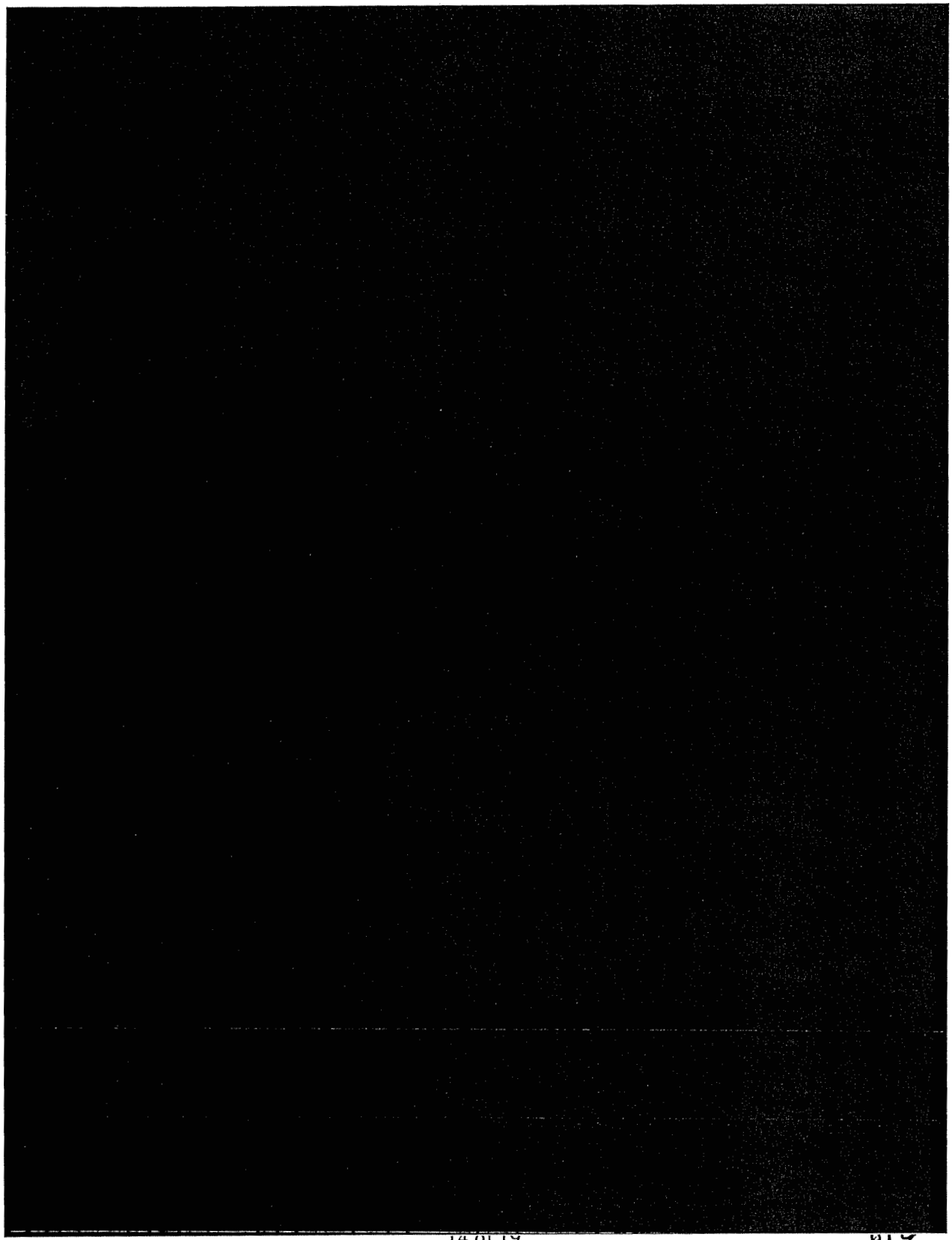

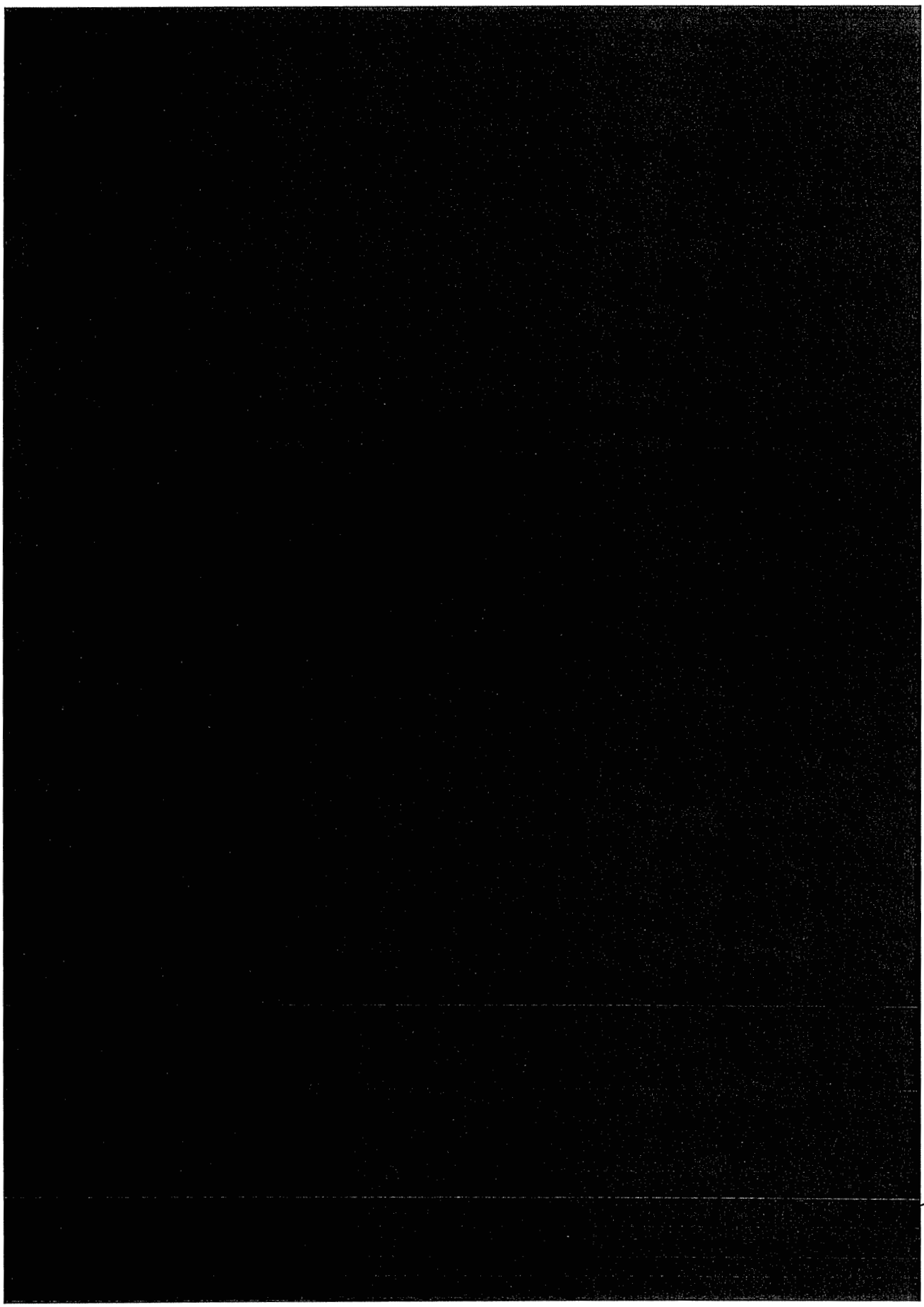

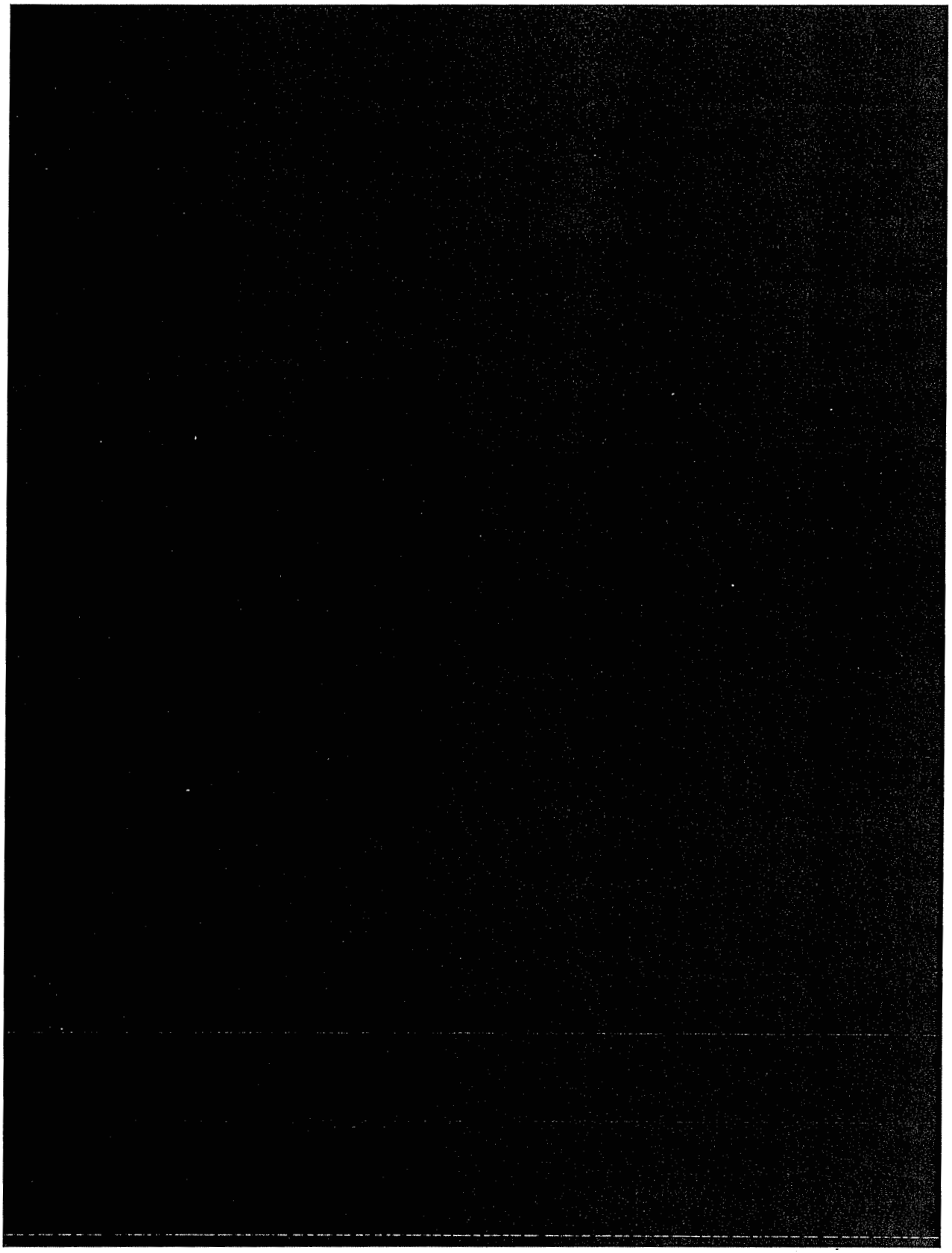

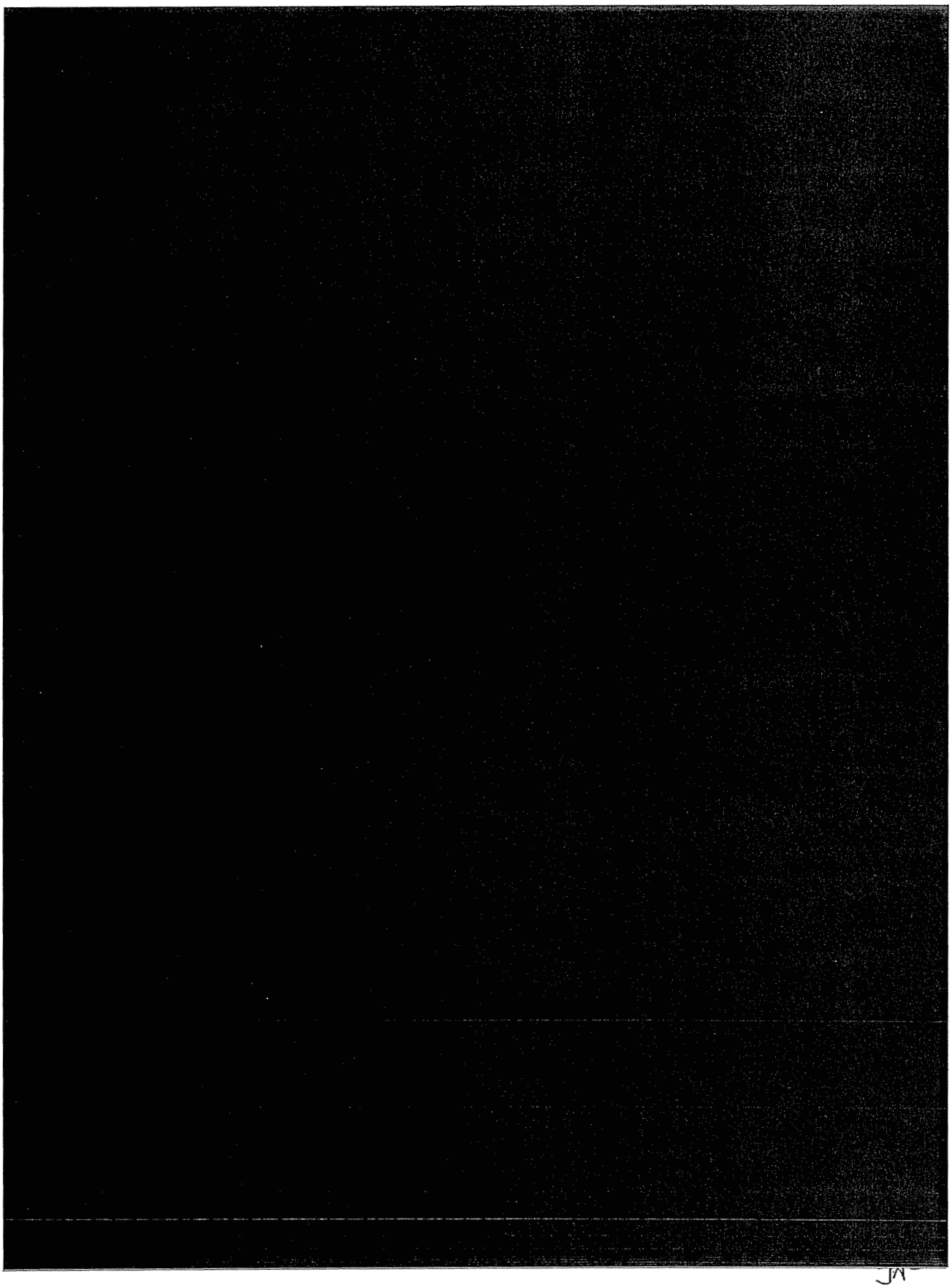

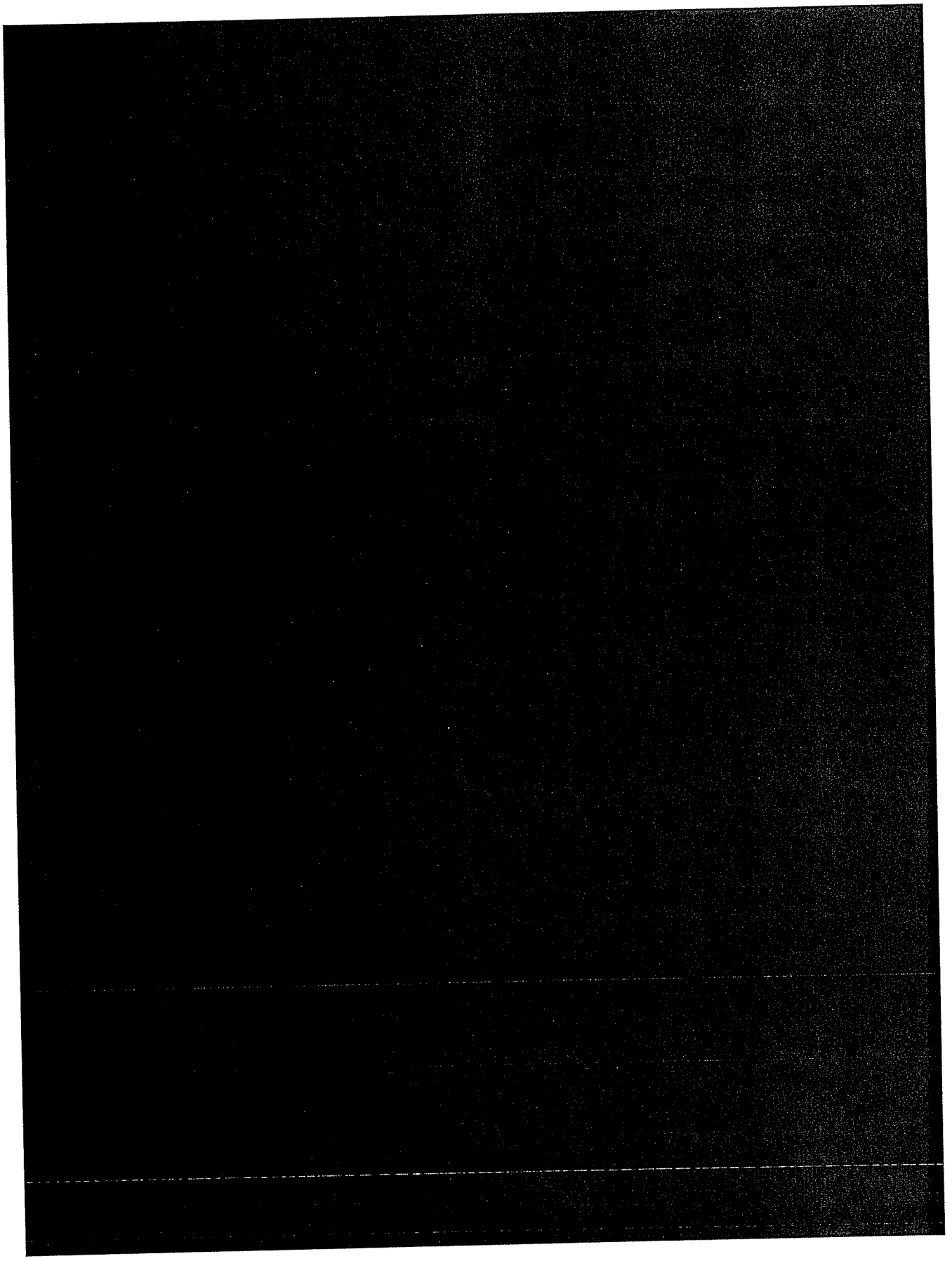

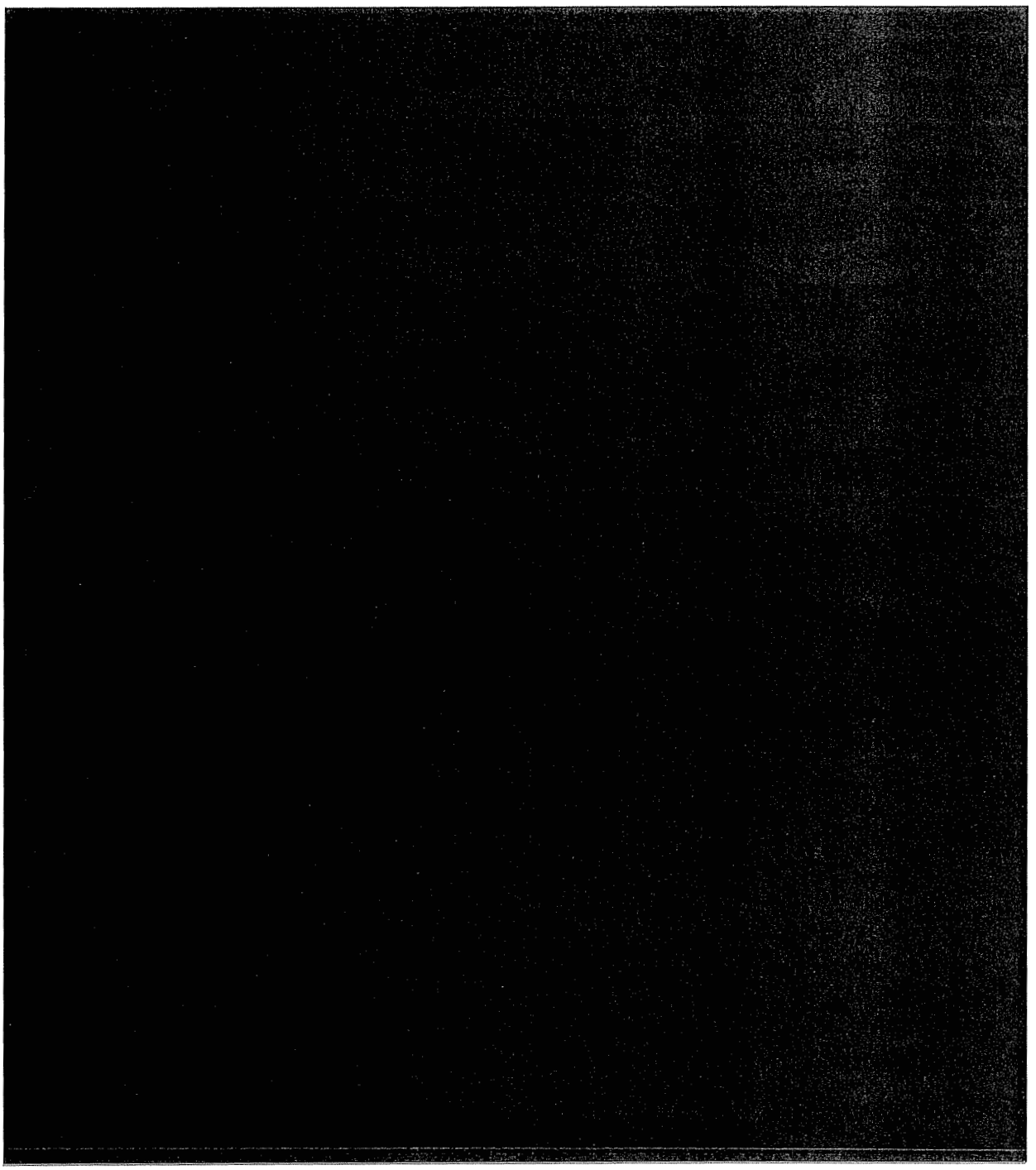

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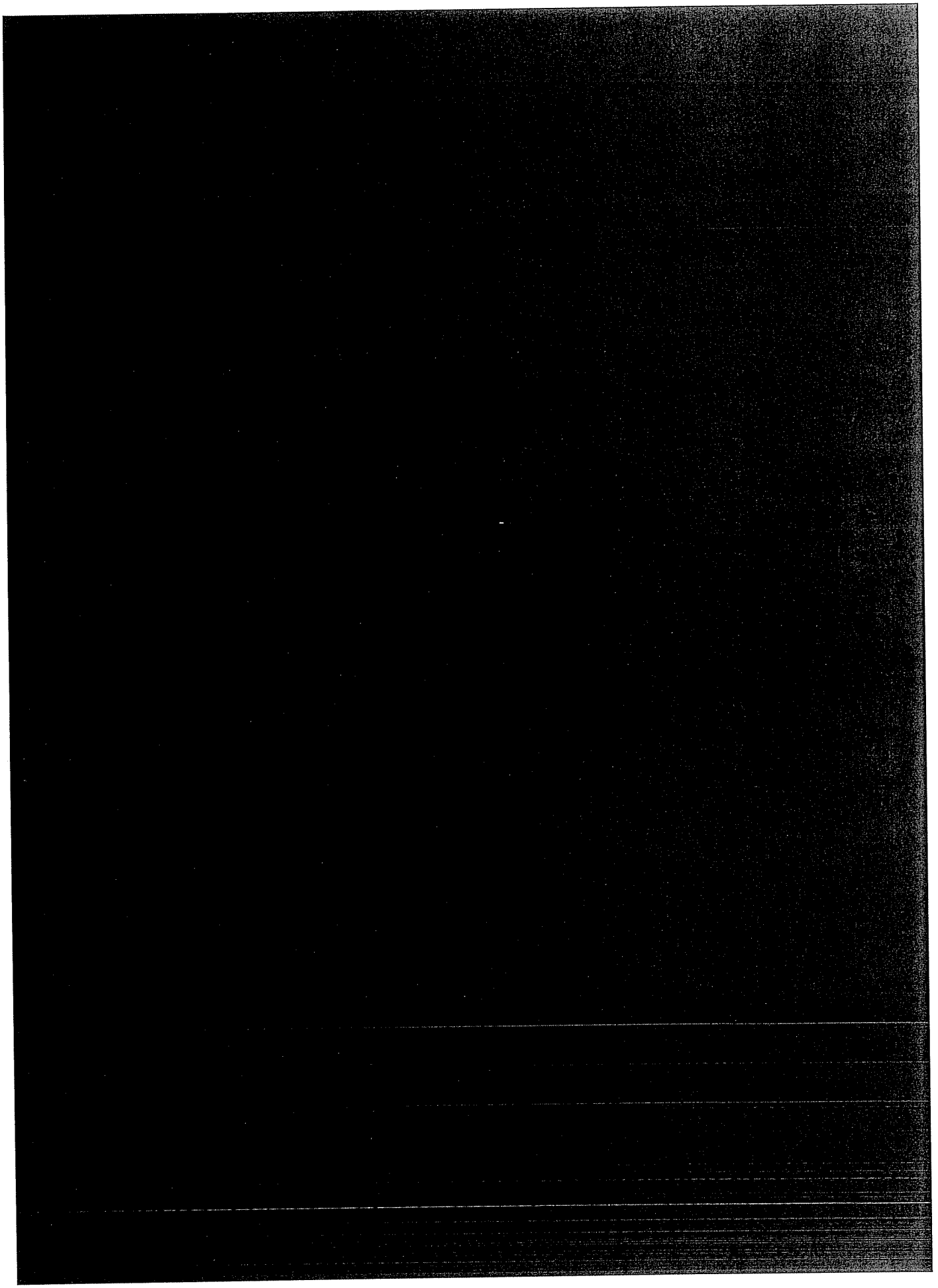

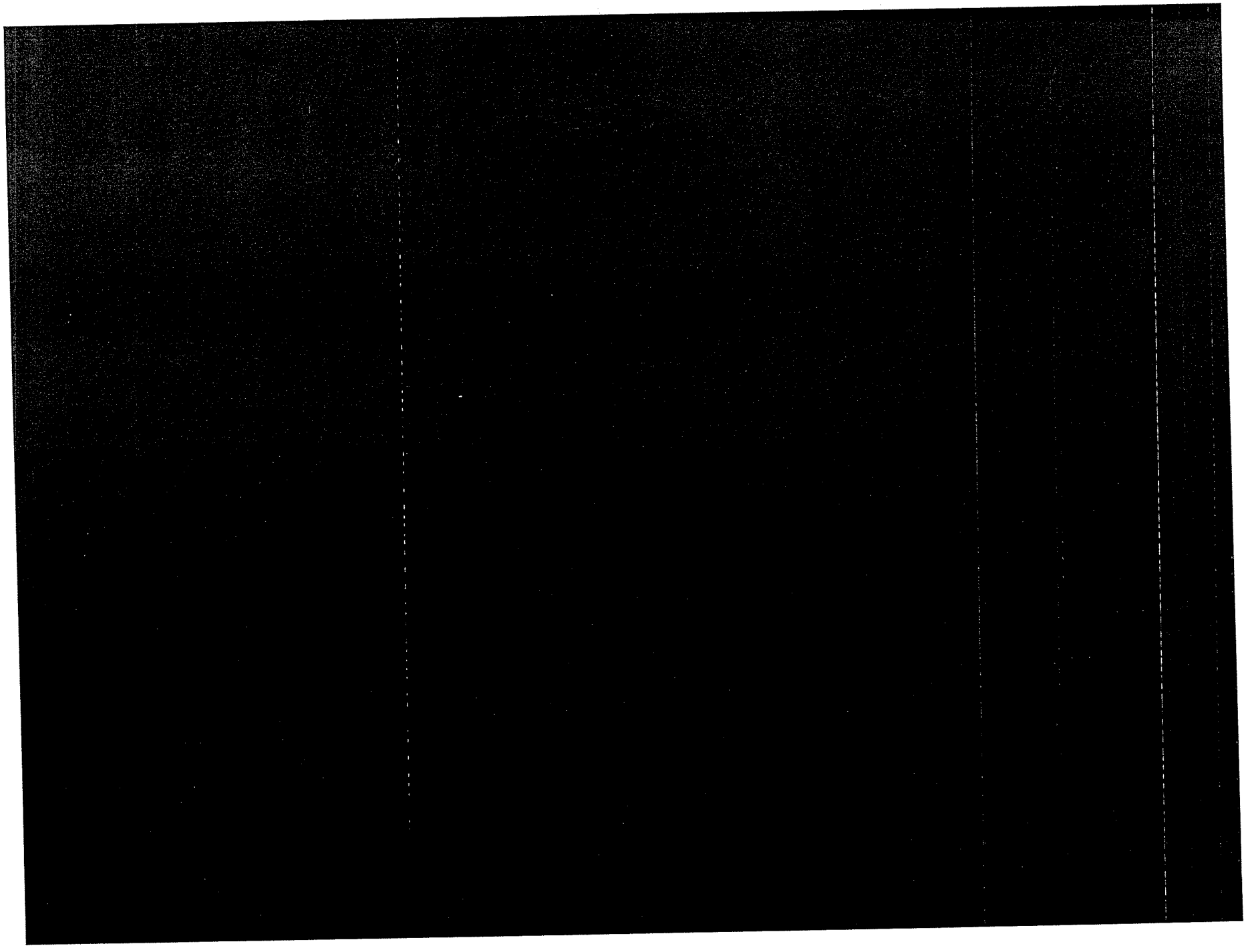

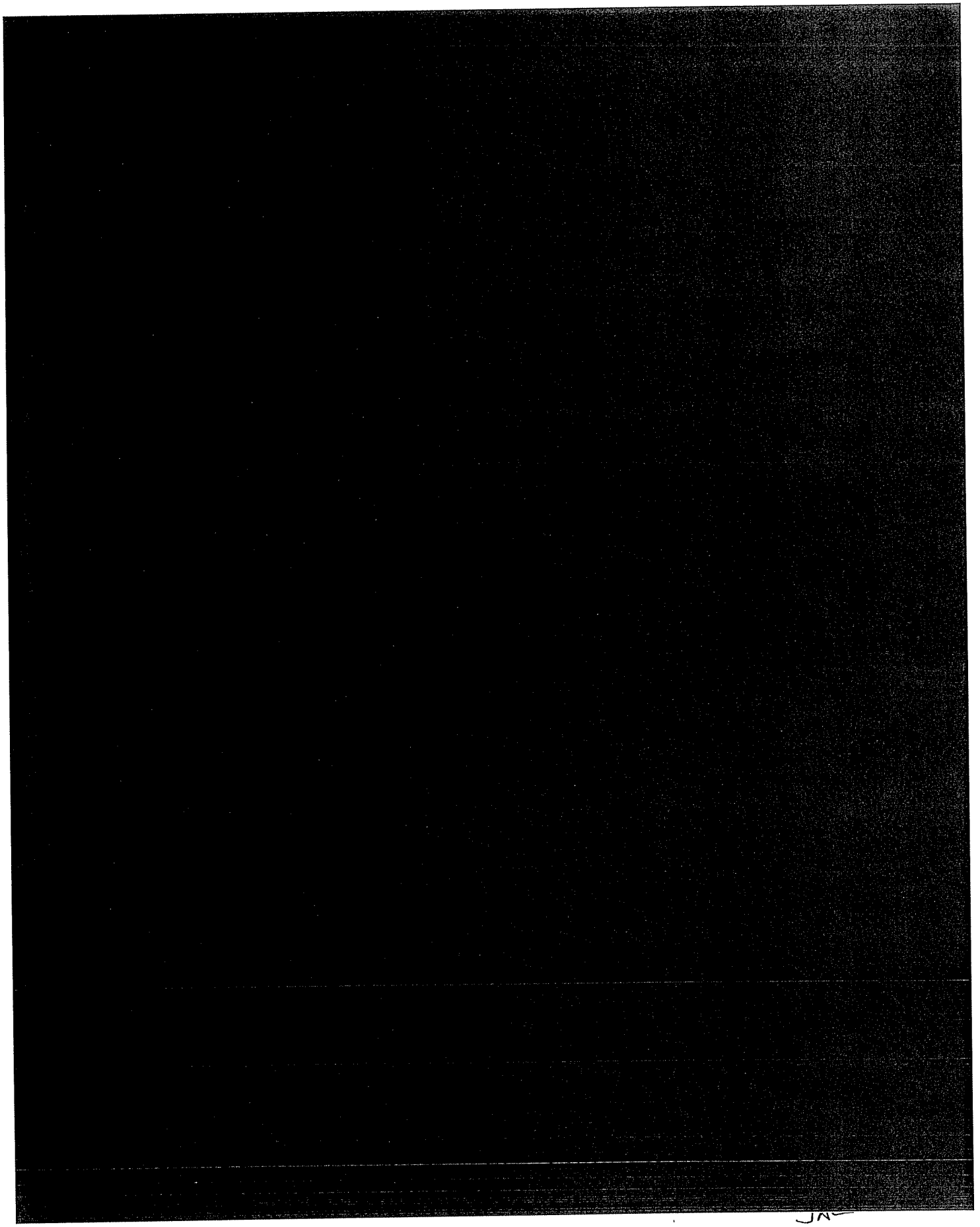

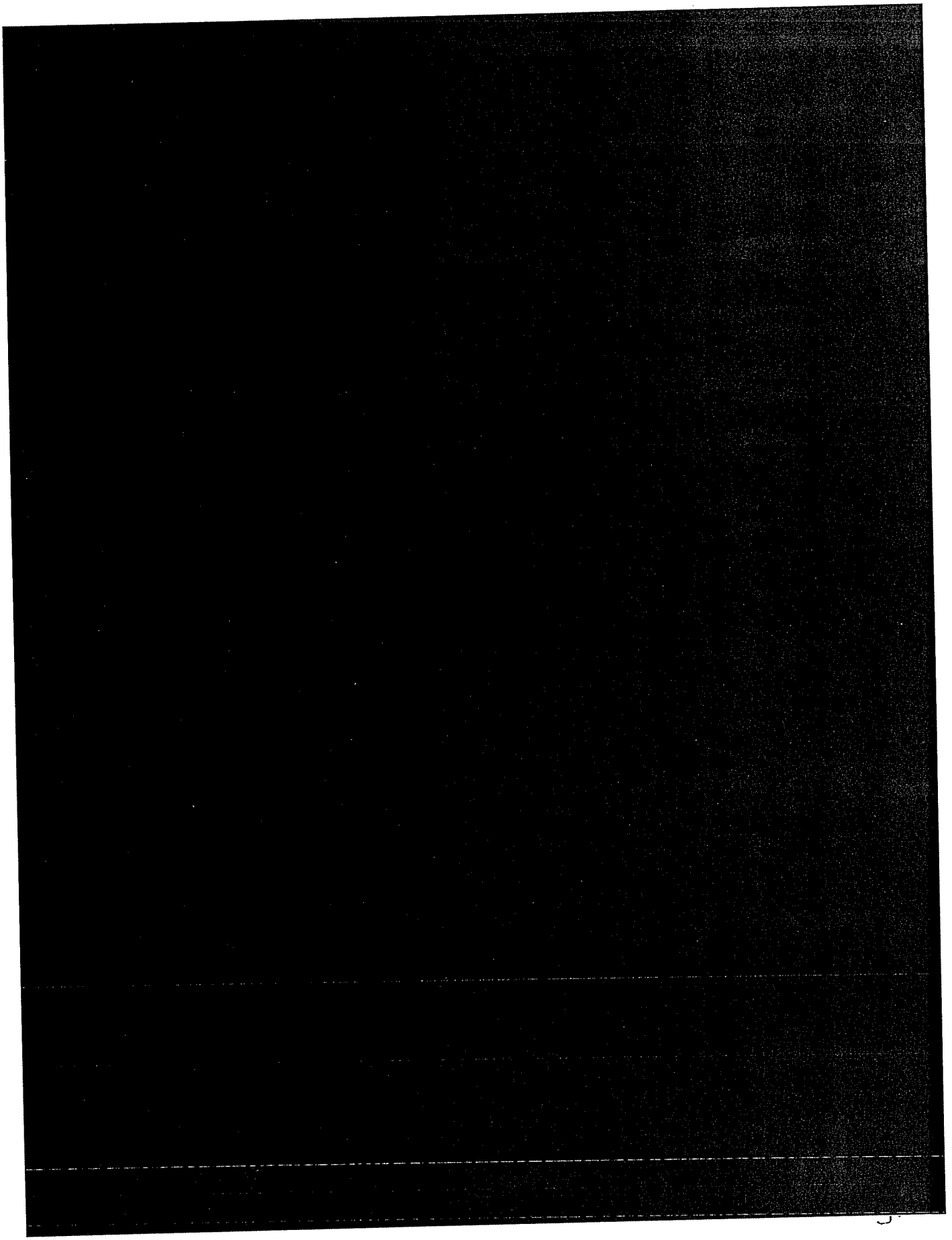

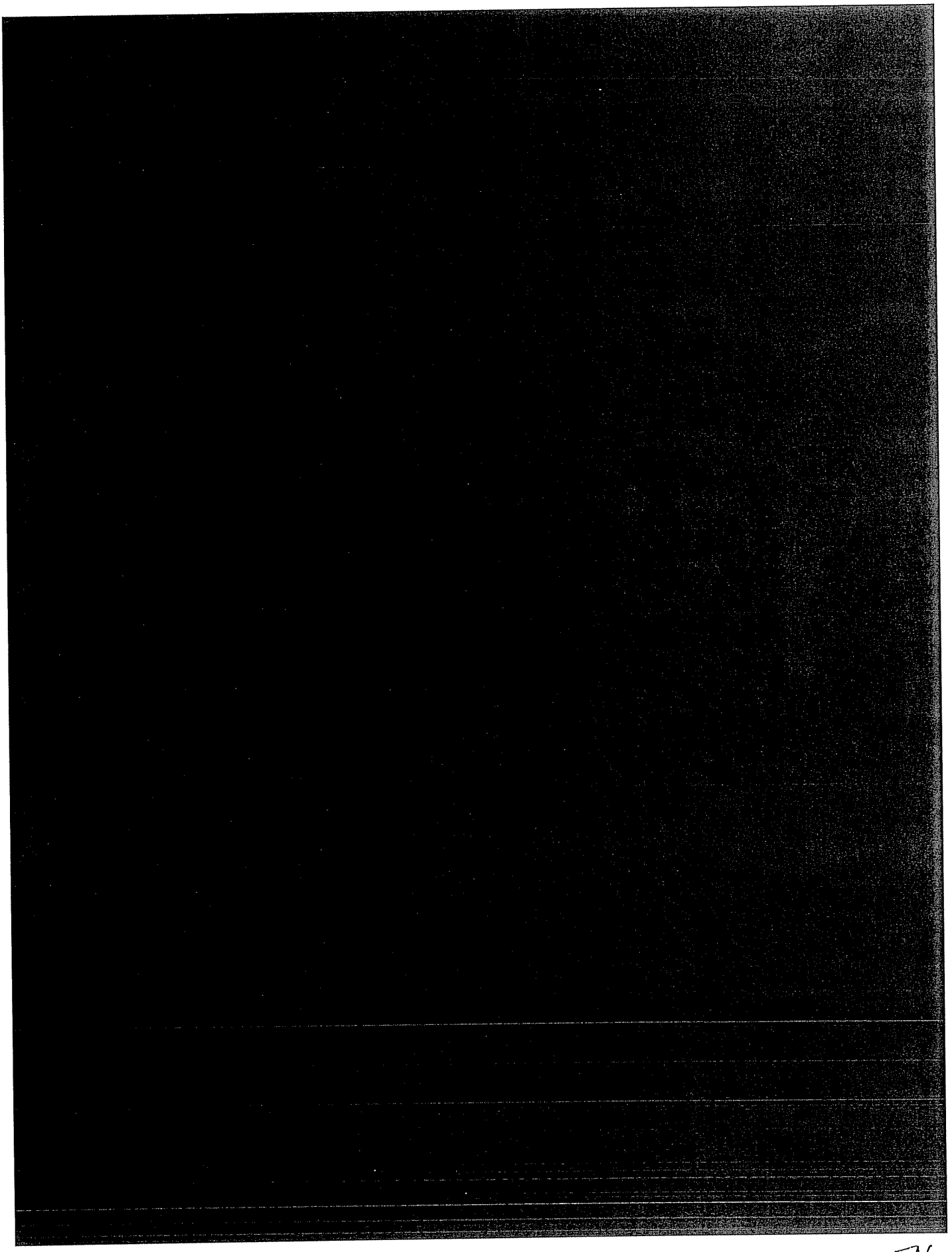

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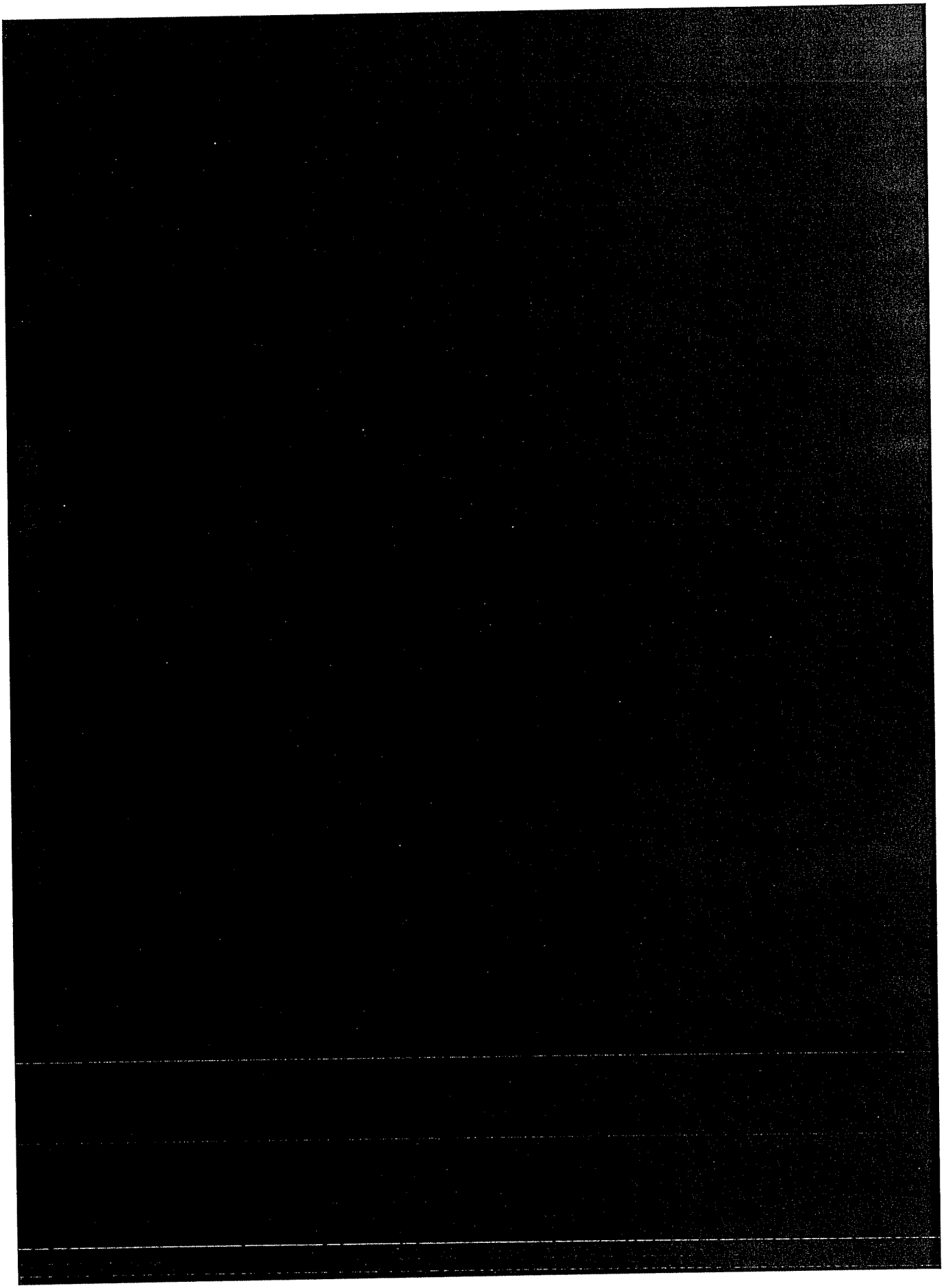

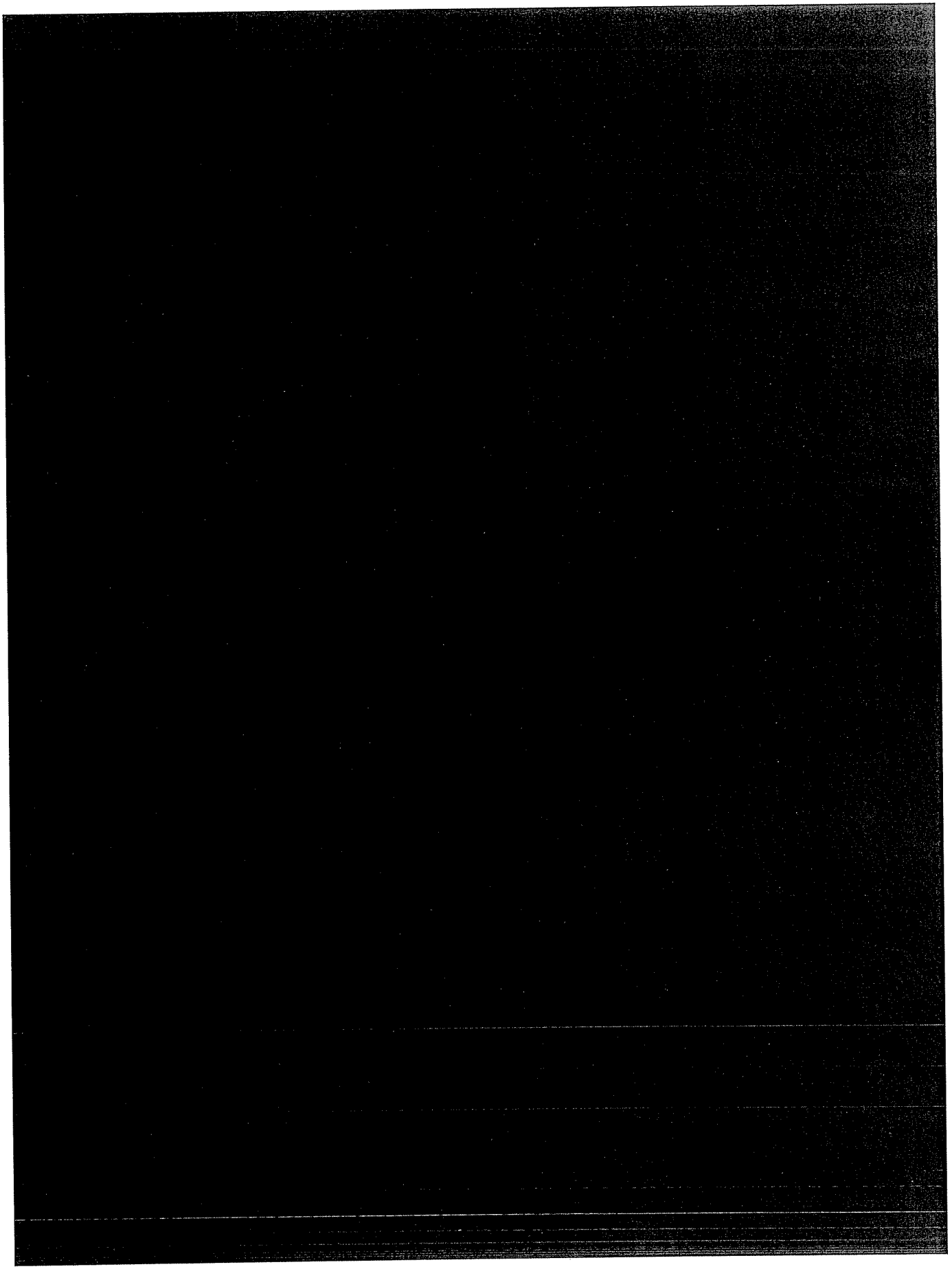

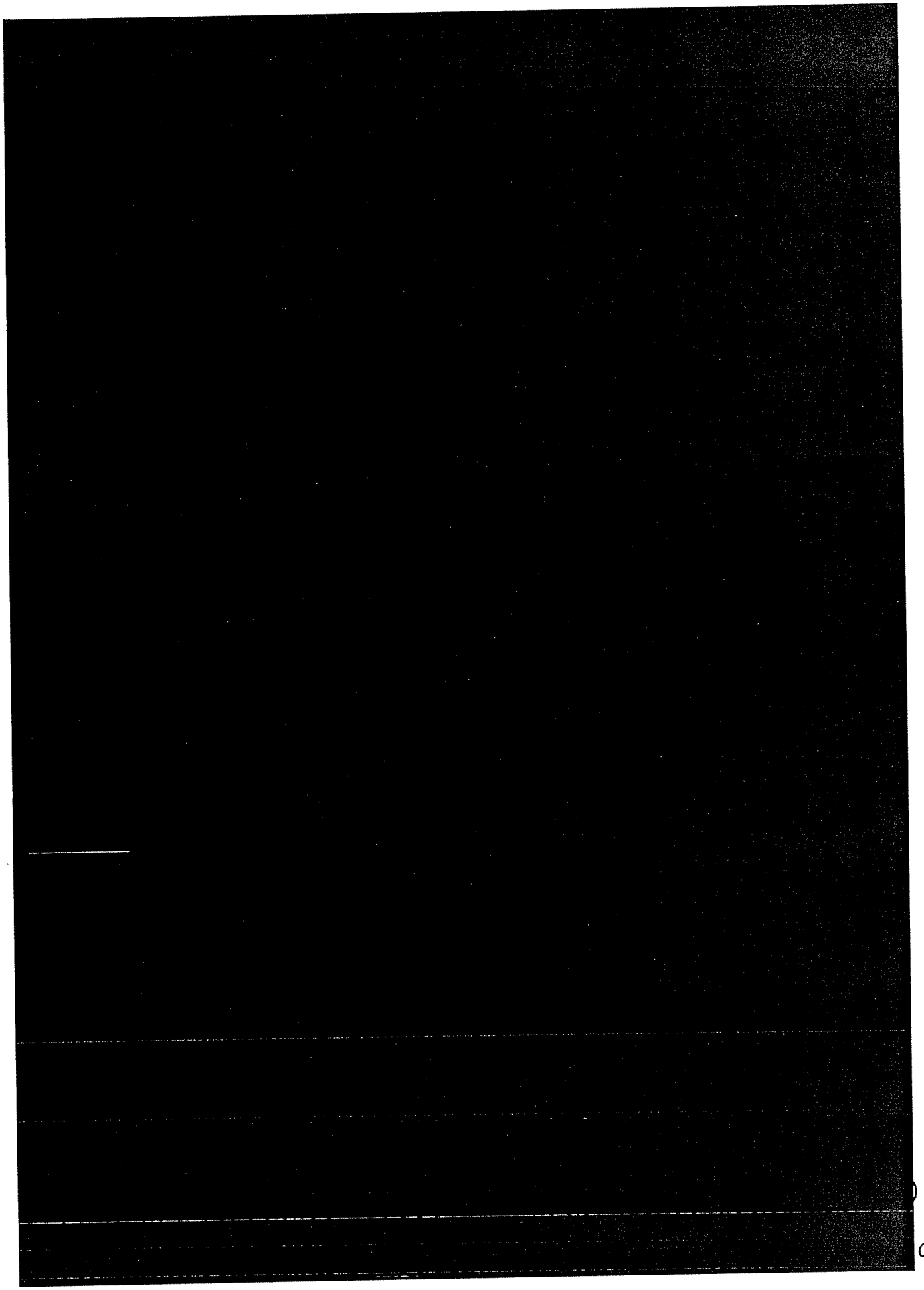

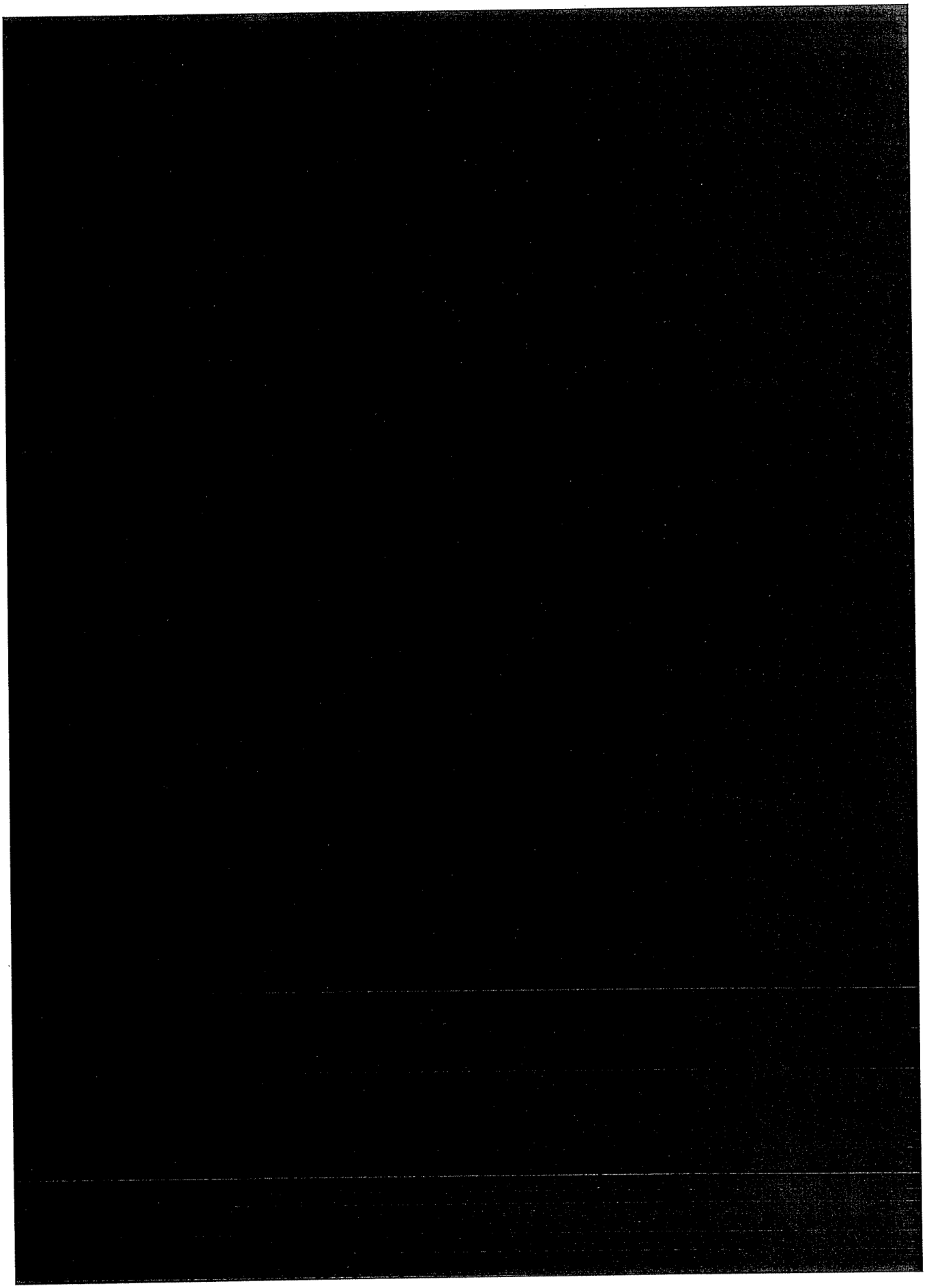

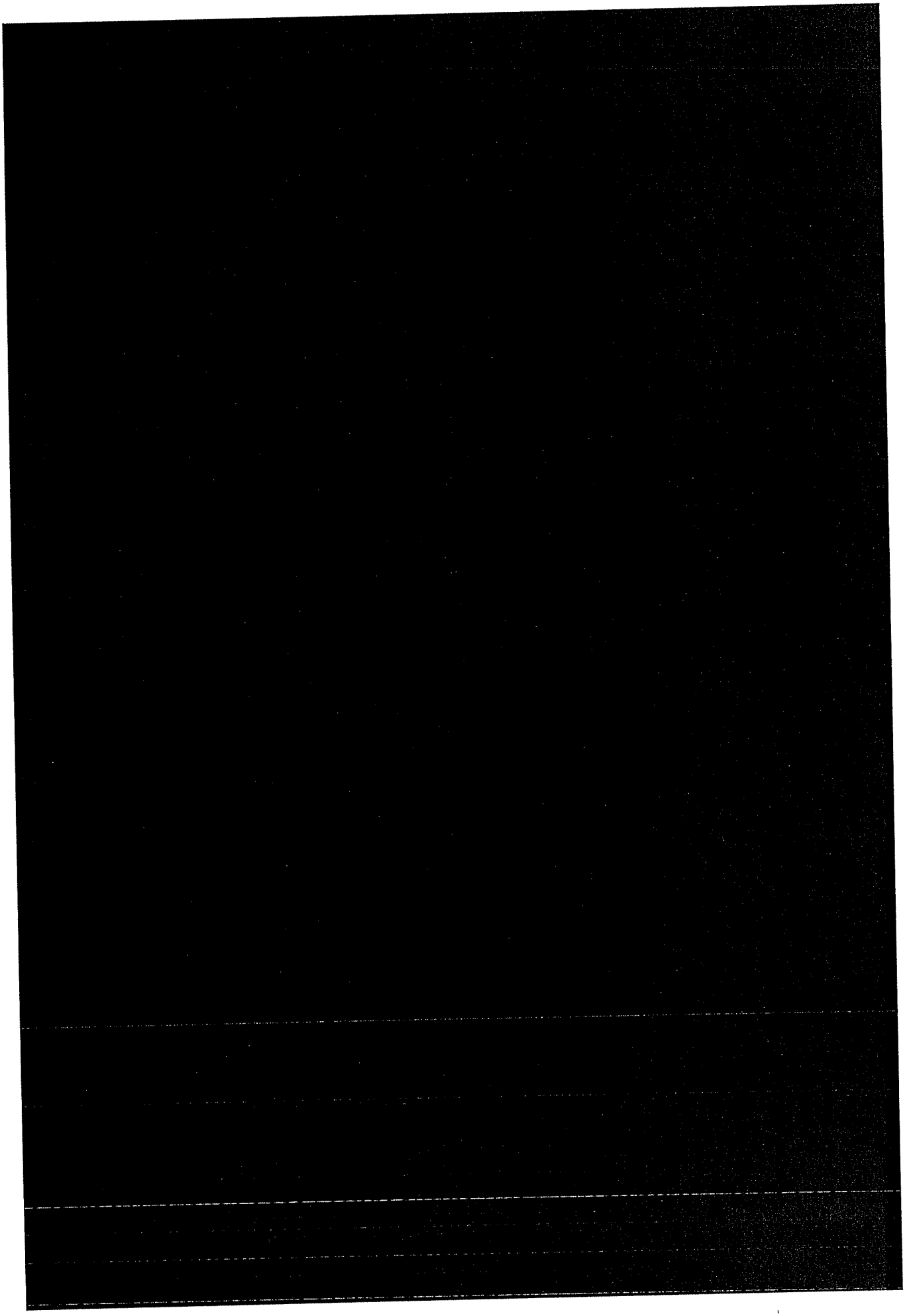

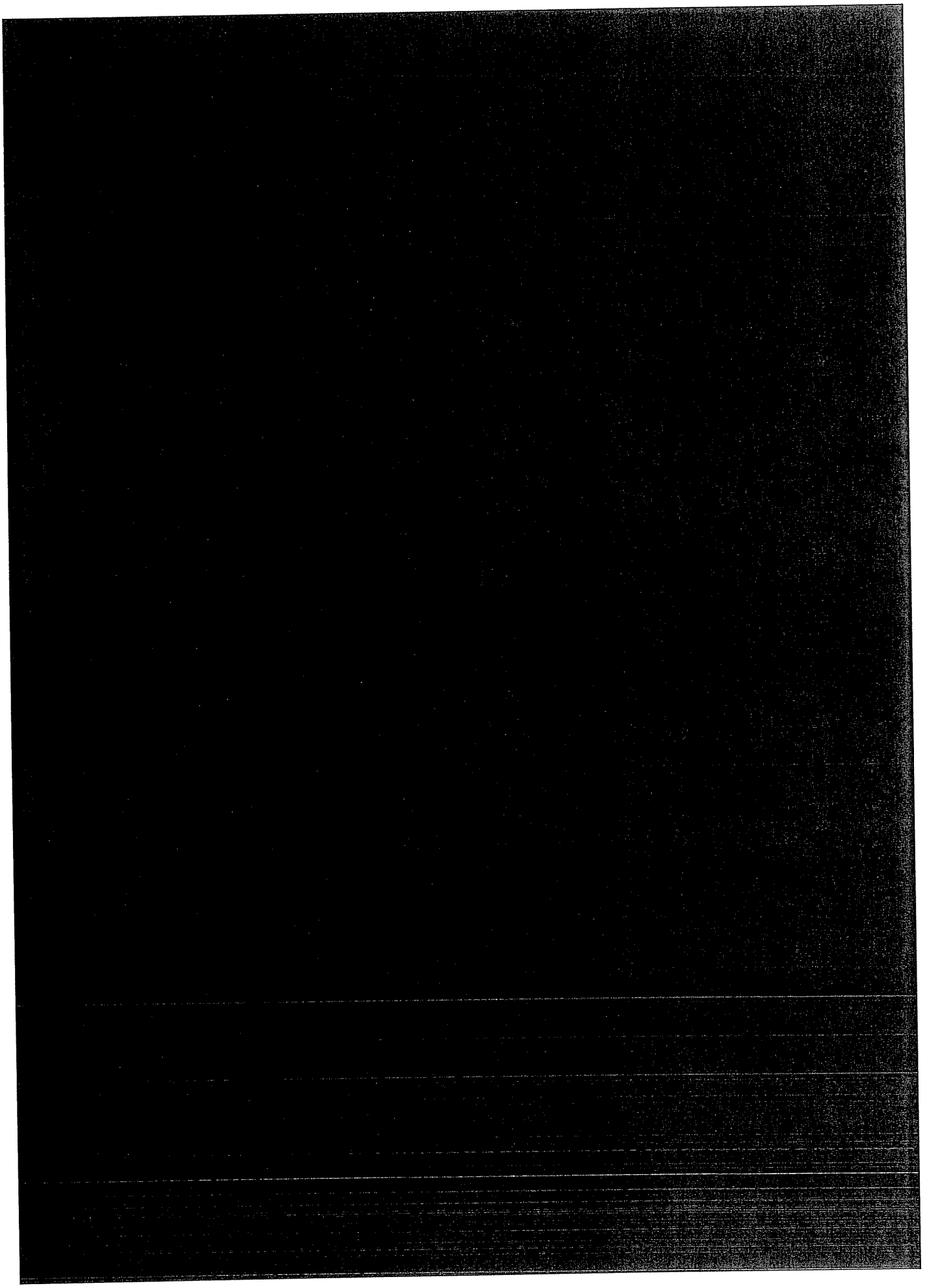

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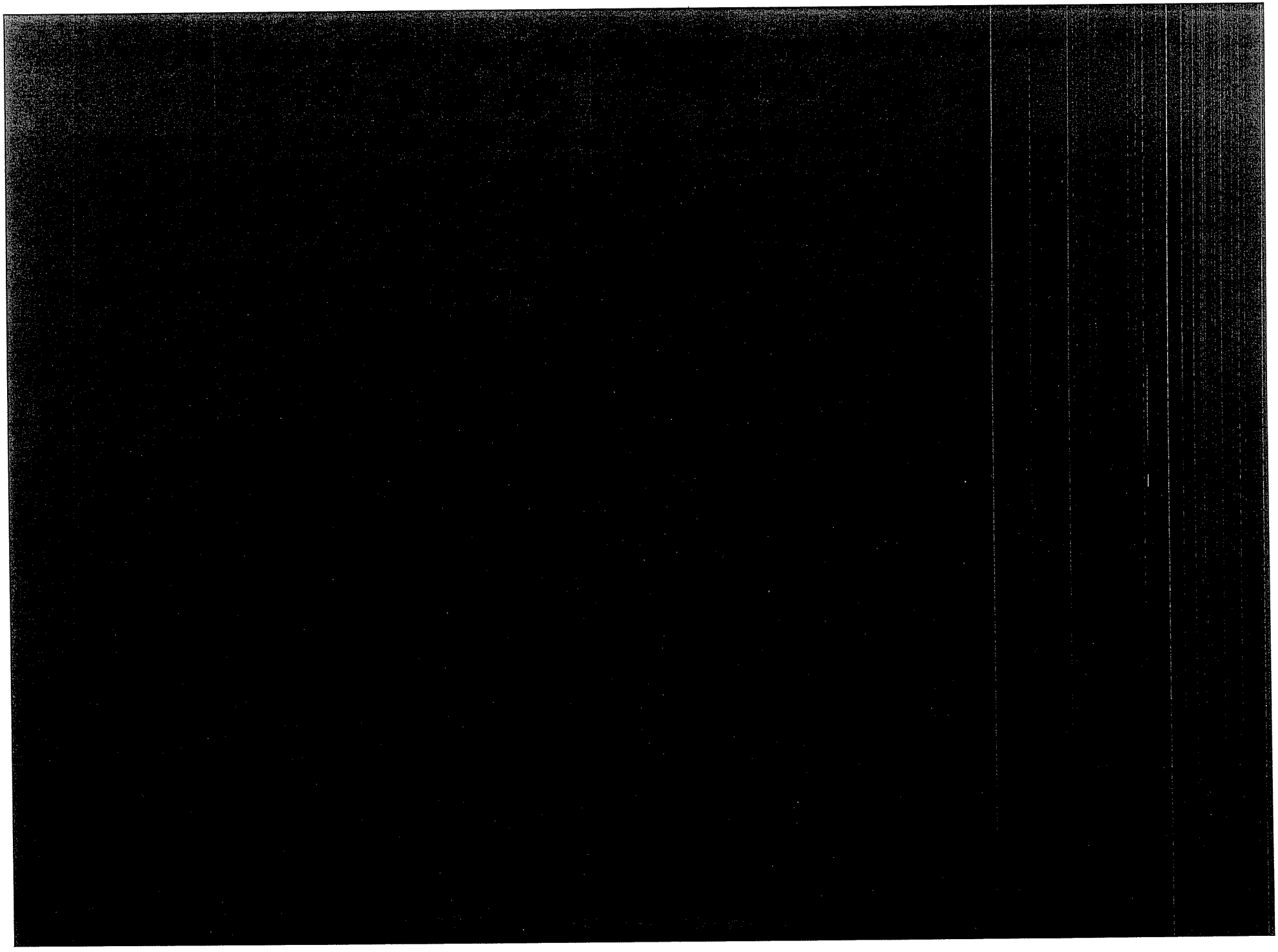

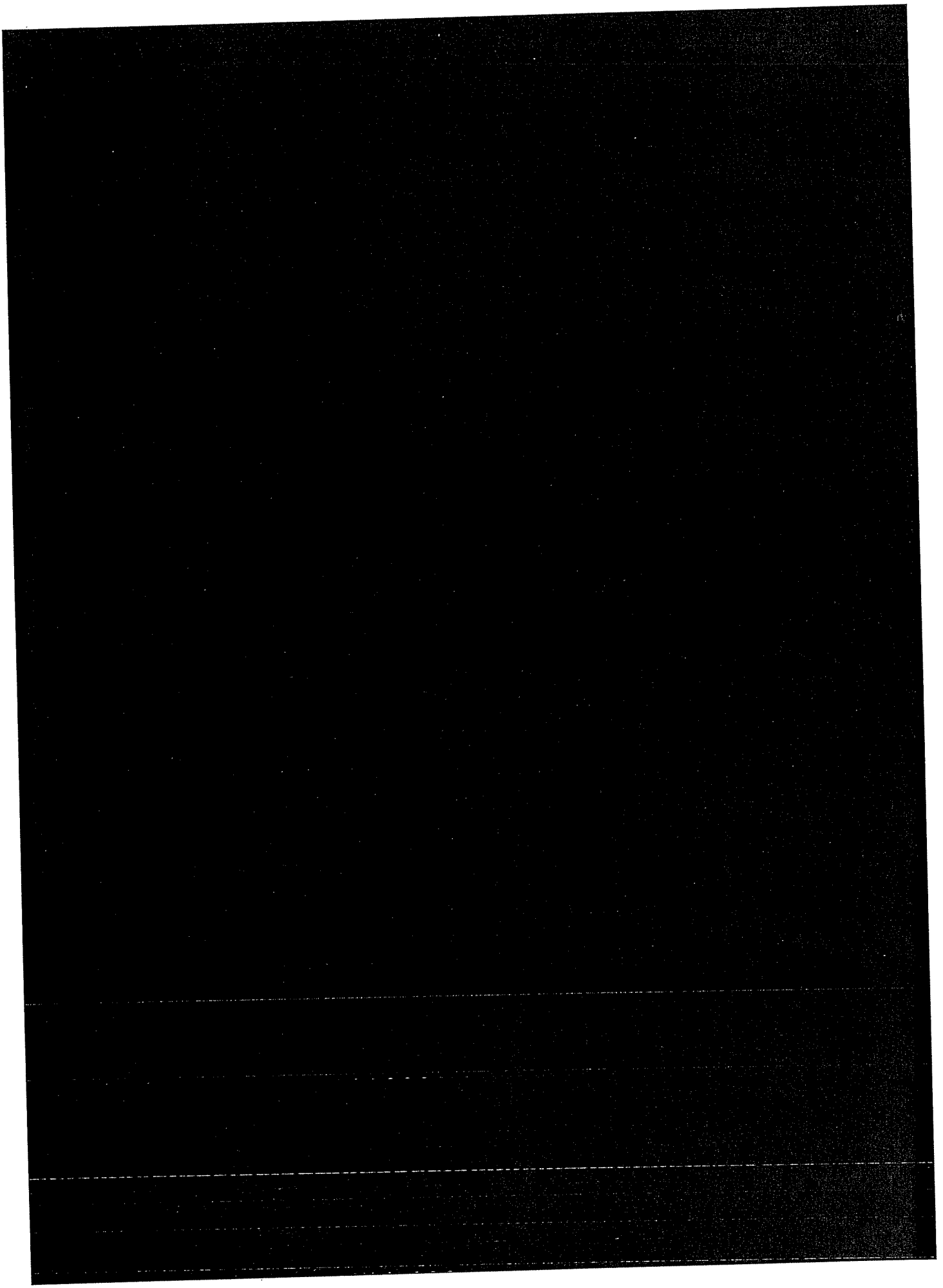

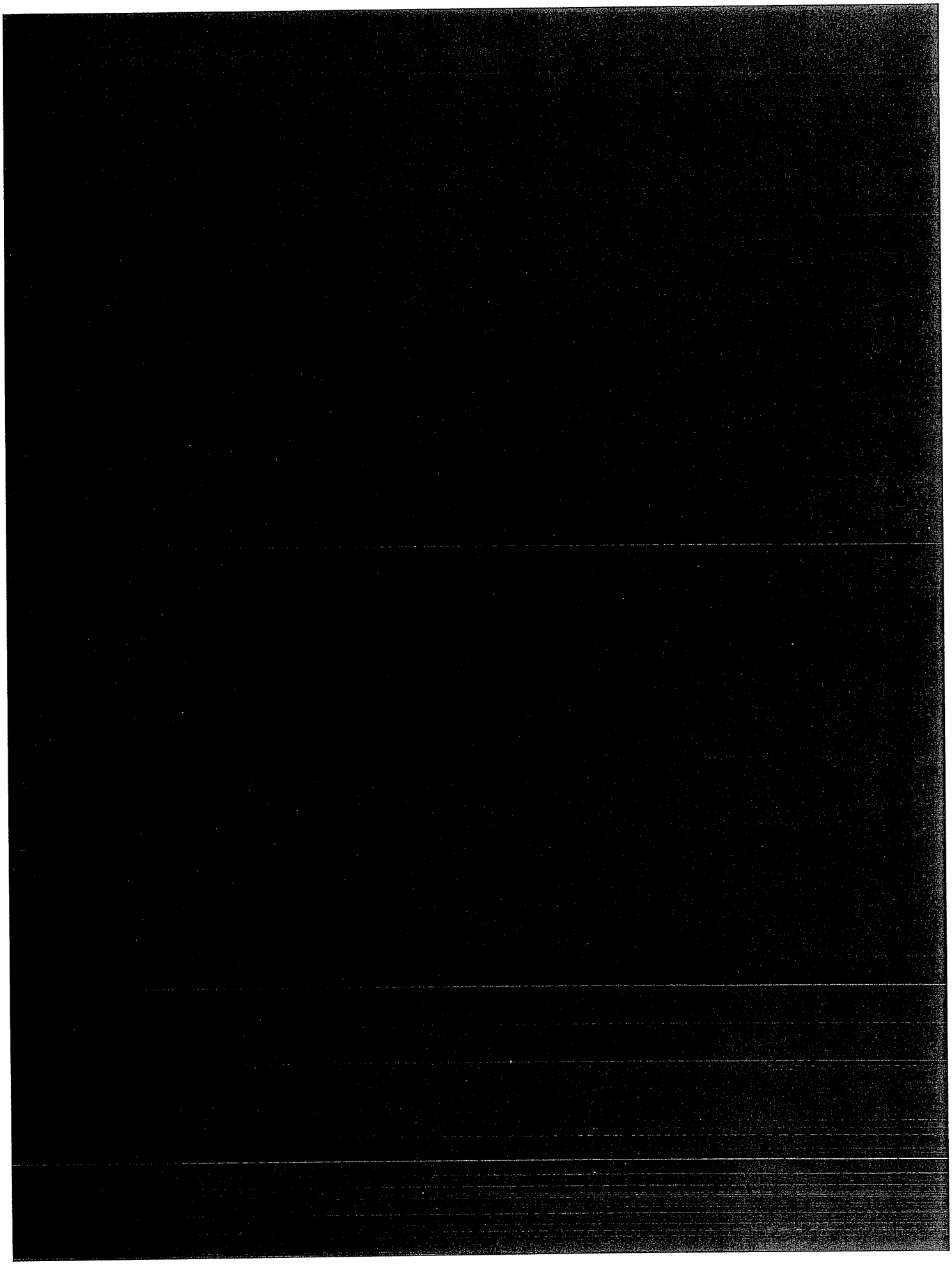

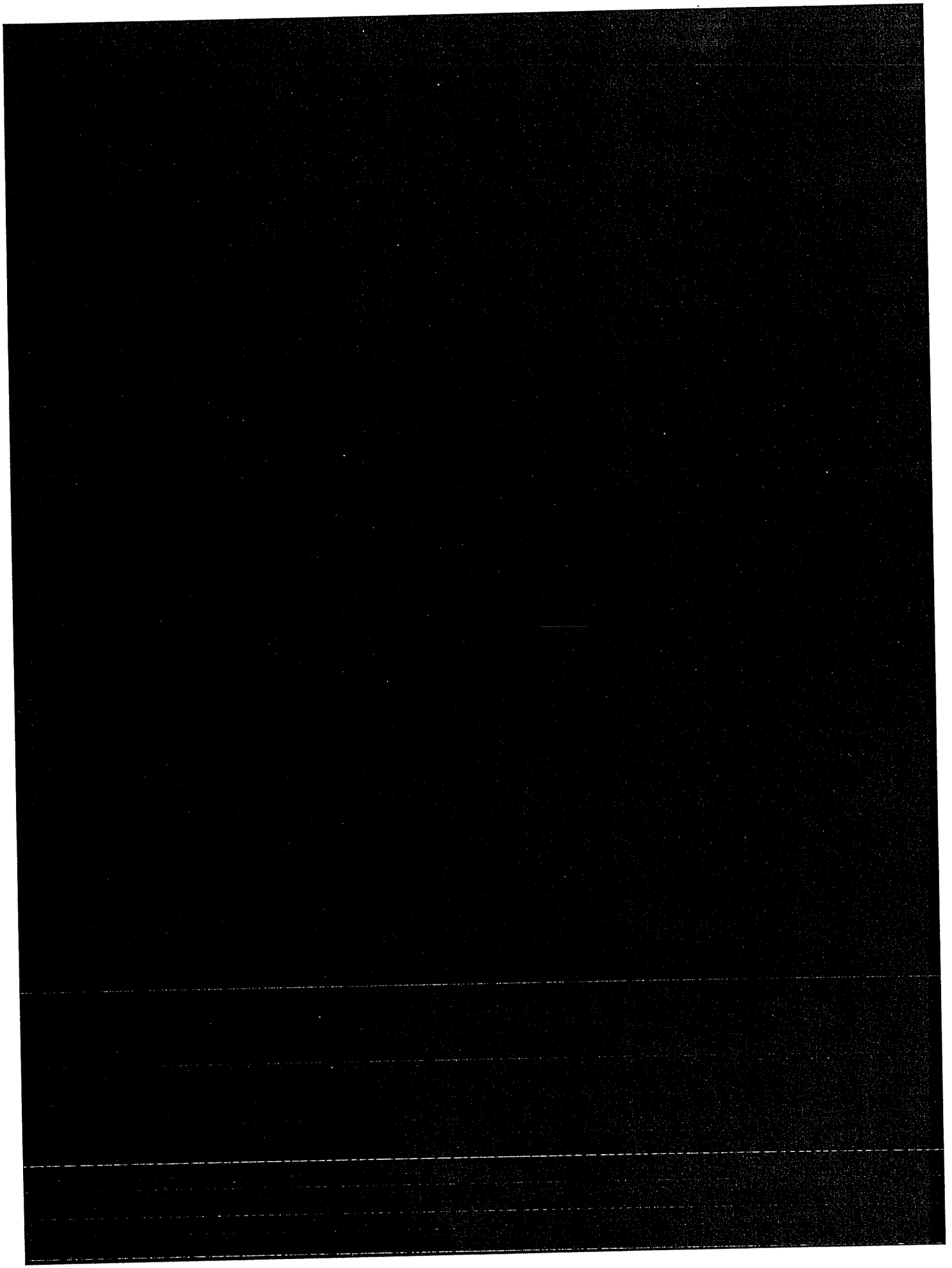

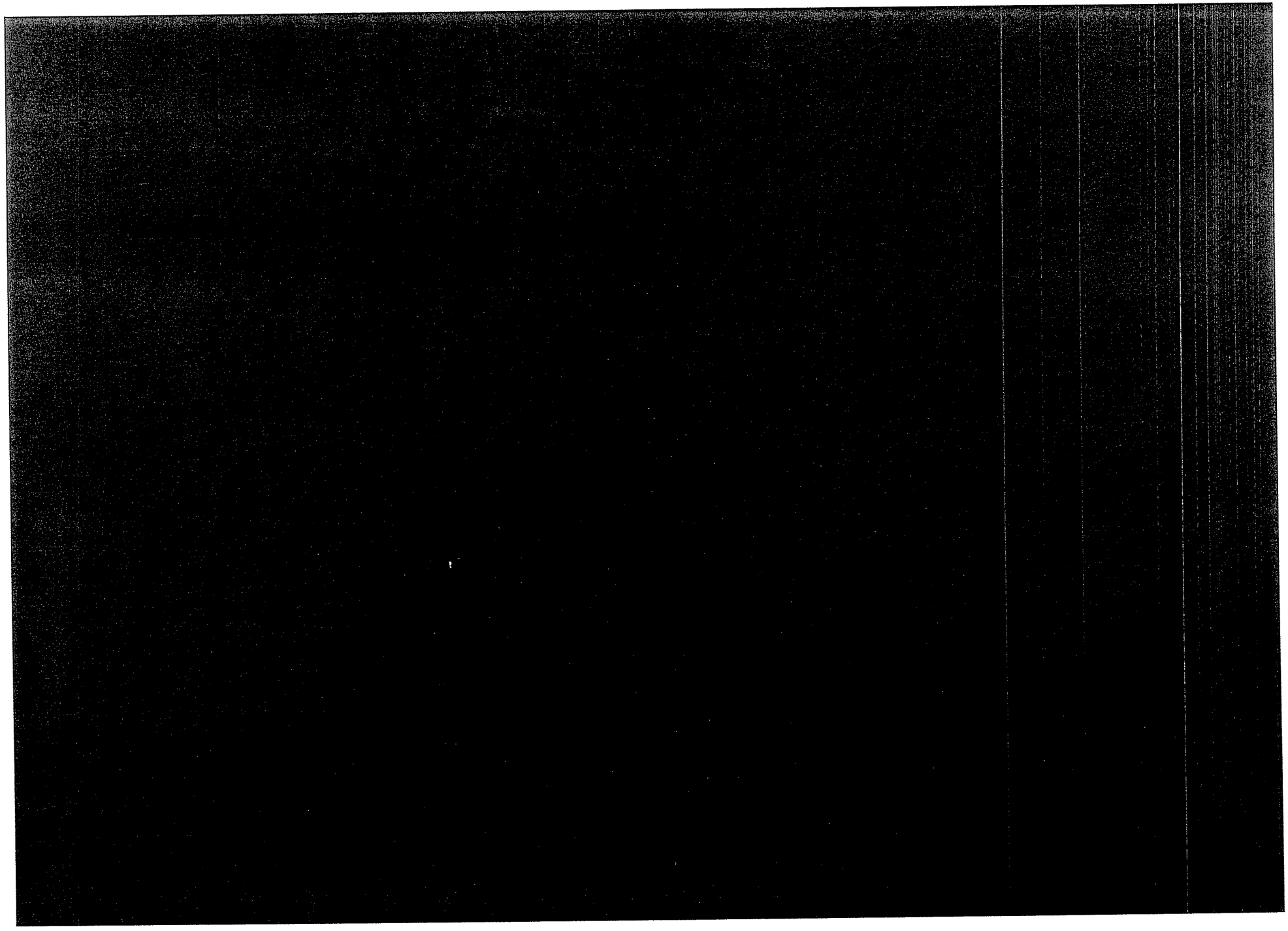

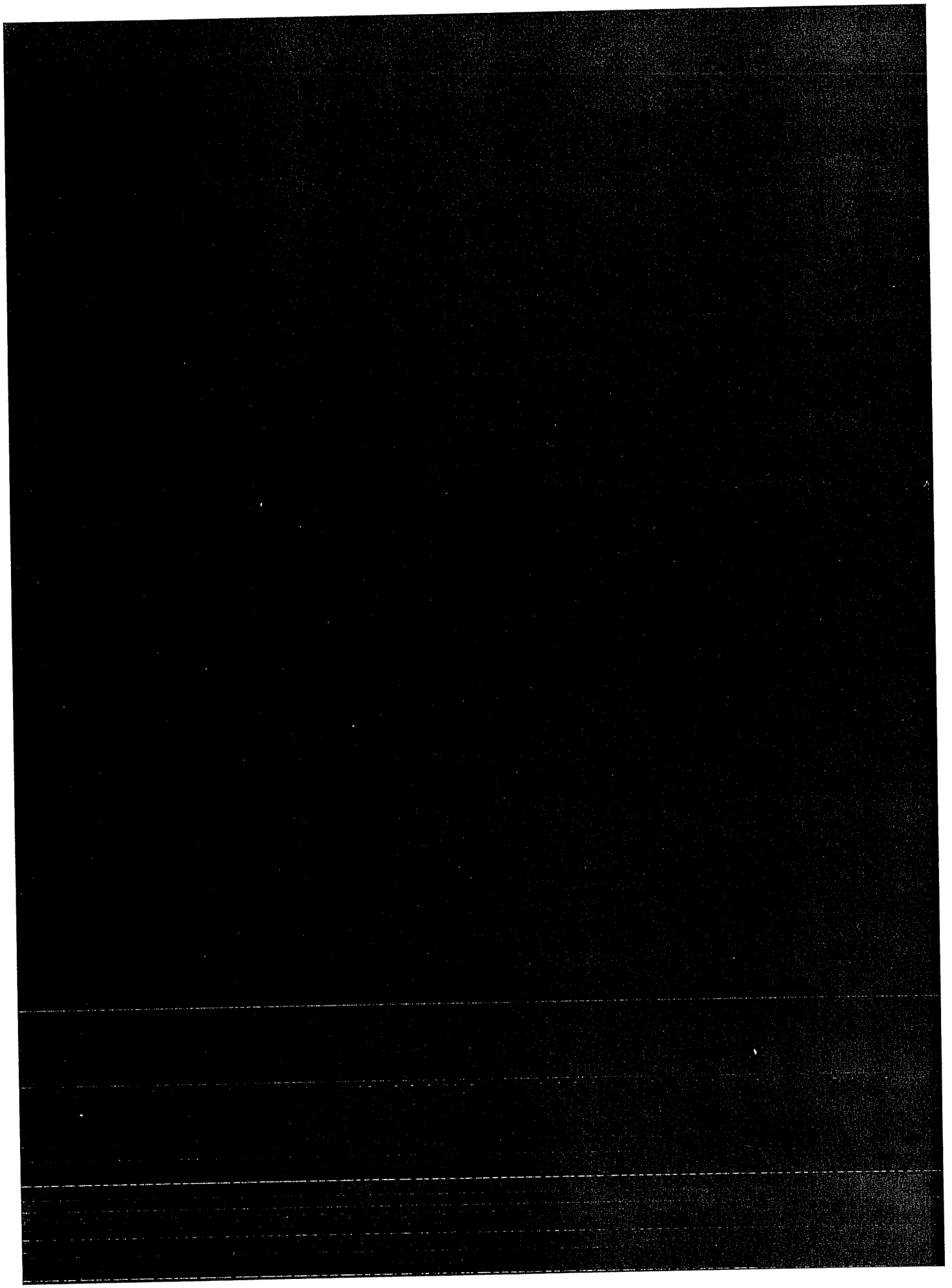

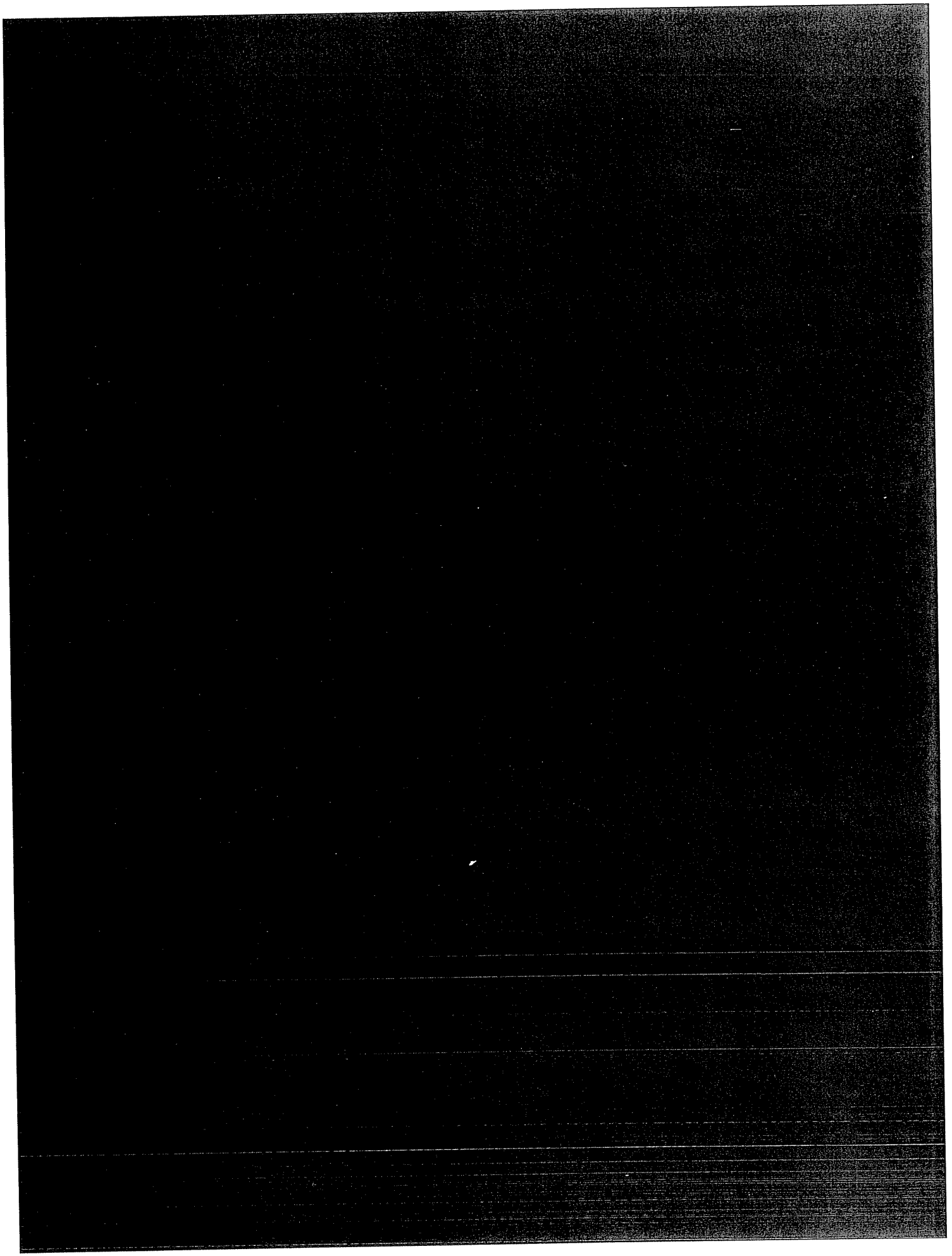

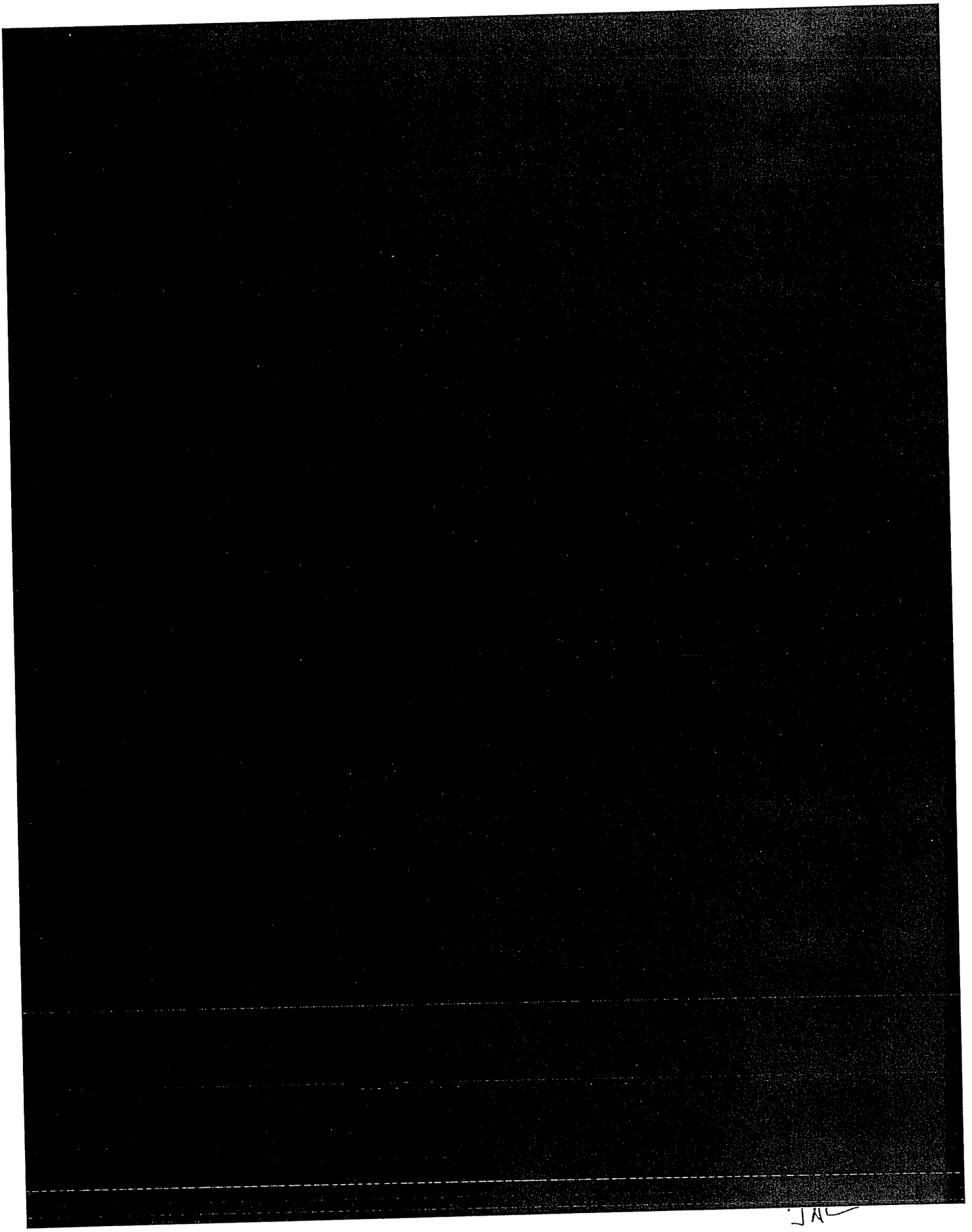

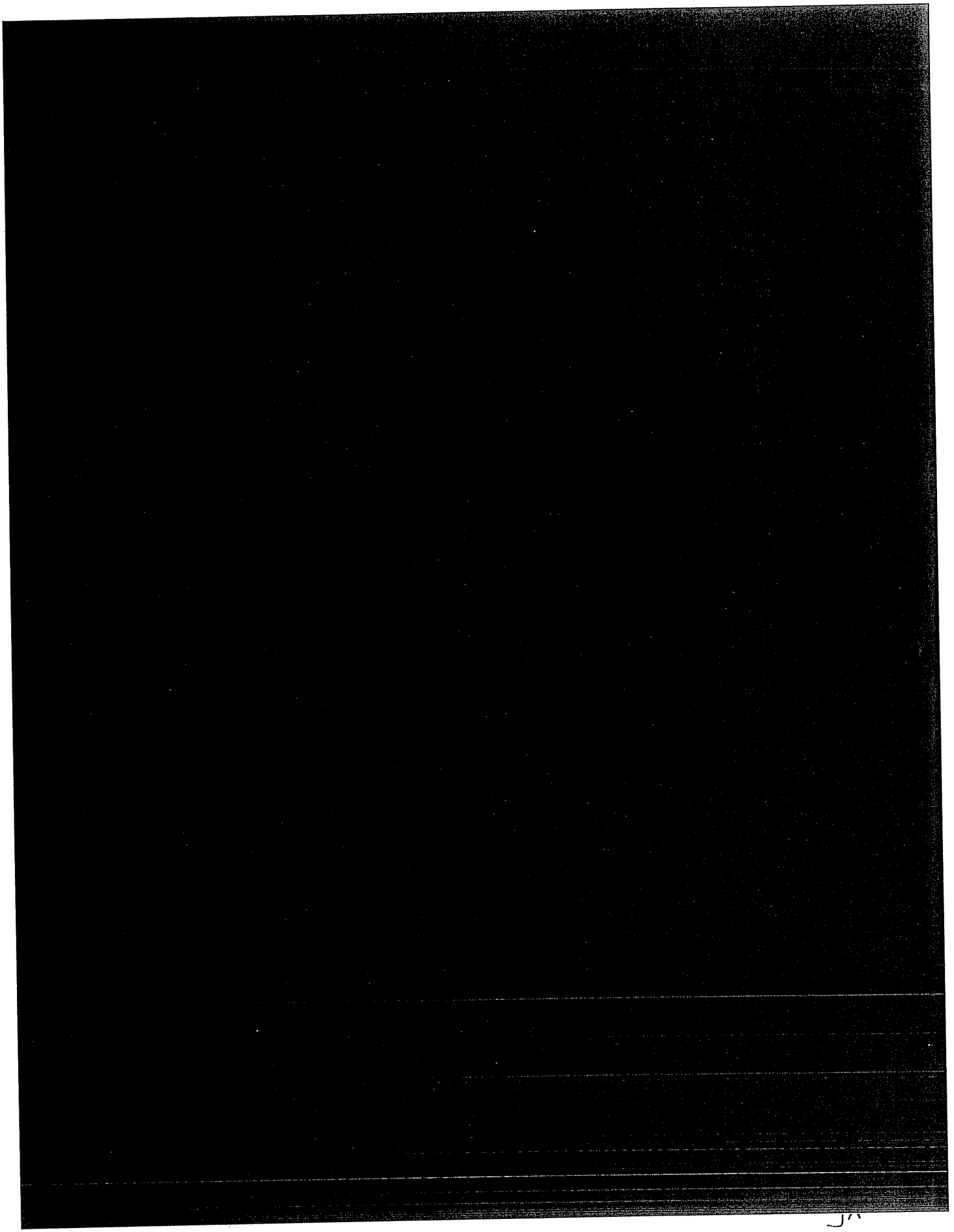

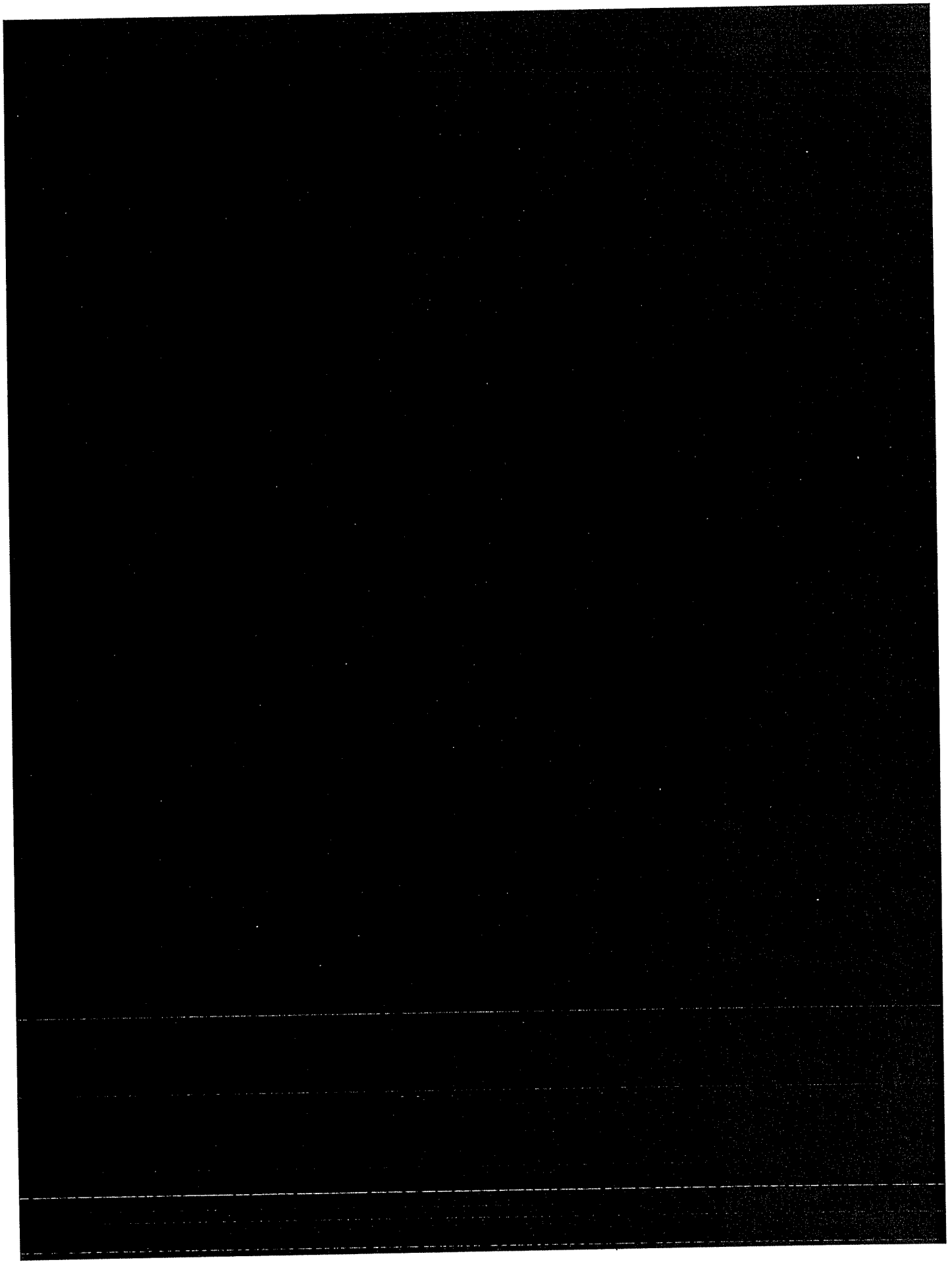

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EXHIBIT H

HEALTH AND SAFETY REQUIREMENTS
Table of Contents

Where applicable within this Exhibit H Contractor means WFGD Supplier and EPC Contractor.

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1.0 Contractor Safety Policy

LG&E and KU Services Company

Contractor / Subcontractor Safety Policy

PURCHASE ORDER #:_____ CONTRACT JOB #:_____

NAME OF CONTRACTOR:

SCOPE OF WORK:

WORK LOCATION:

CONTACT NAME: WORK ORDER #:_____
(AUTHORIZED CONTRACTOR/SUBCONTRACTOR REPRESENTATIVE)

1. Contractor / Subcontractor Safety Policy

General

LG&E and KU Services Company, is committed to safety excellence and in providing a safe and healthful work environment for anyone working on our property. The personal safety and health of each employee, contractor and the safety of the general public are of primary importance to LG&E and KU Services Company. Accordingly, there is no job so important that safety policies and procedures or legal obligations are compromised.

This Policy does not replace the Contractor's/subcontractor's ("Contractor") existing safety and health program(s), provided that their program(s) meet or exceed these and any additional site specific minimum requirements. Contractor's employees not following this Policy will be subject to removal from the job site.

The Contractor is required to comply with all federal and state safety laws and all provisions of the LG&E and KU Services Company, Health & Safety Manual. The Contractor is responsible for conducting its work and activities safely. LG&E and KU Services Company expect and require that you continuously update your employees with respect to safety issues relevant to the work and to take immediate corrective action when your employees violate safety rules or procedures.

It is the responsibility of Contractors' construction managers, superintendents, safety representatives and foremen/supervisors to ensure workers under their supervision maintain safe work areas and perform their tasks in a safe manner. It is also the responsibility of each worker to follow every precaution and LG&E and KU Services Company safety rule and Policy to protect them and their fellow workers.

Contractors are responsible for ensuring that any subcontractors working under their purview are held to the same performance expectations, and therefore this Policy, as the contractor themselves.

2. Scope

General

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This Policy applies to all construction activities performed for LG&E and KU Services Company by Contractor's employees or employees of the Contractor's subcontractors. Construction activities may originate from construction contracts, service contracts, purchase orders, or in-house work orders. This Policy is in addition to the requirements of the General Services Agreement or other contract under which the Contractor is performing construction activities.

3. General Safety Requirements

1. Contractors will comply with all applicable federal and state regulations and the LG&E and KU Services Company safety rules and programs relevant to the work performed.
2. Contractors will ensure that any and all subcontractors working under their purview comply with all applicable federal and state regulations and the LG&E and KU Services Company safety rules and programs relevant to the work performed.
3. Contractors are responsible for their employees and any and all subcontractors working for them. Contractors are responsible for ensuring that the subcontractors follow all provisions of this document. Contractors are responsible for providing their employees, and subcontractors with all information provided by LG&E and KU Services Company regarding:
    * Occupational health and safety;
    * Federal, state and local environmental regulations including LG&E and KU Services Company environmental compliance policies and procedures;
    * Exposure to atmospheric health, serious physical or chemical hazards; and
    * Precautionary measures and procedures for performing the work.
4. All Contractors' employees, and any subcontractor employees, shall receive training under the LG&E and KU Services Company Contractor Health and Safety Passport Program.
5. The LG&E and KU Services Company Policy prohibits the Contractor's employees, agents or representatives from:
    * Consuming or possessing alcohol while on the LG&E and KU Services Company job sites, including the parking lots;
    * Reporting to perform work on the LG&E and KU Services Company job sites with unauthorized drugs on his/her person or while under the influence of drugs or alcohol;
    * Intentionally dumping unauthorized chemicals/materials into a sewer, waterway or on the ground;
    * Mishandling LG&E and KU Services Company waste;
    * Allowing employees to perform work that involves operating heavy equipment or working at elevations when using prescribed medication that can cause drowsiness or otherwise impair the employee's ability to perform the work in a safe manner.
6. The following conduct is prohibited by the Contractor at and about LG&E and KU Services Company property:
    * Theft, horseplay, gambling, sabotage or attempted sabotage.
    * Threatening, intimidating or abusing employees, customers, vendors or guests of LG&E and KU Services Company.
    * Fighting, creating, or inciting a disturbance.

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7. LG&E and KU Services Company have a smoke-free policy in all buildings and vehicles.
8. Attendance at job site safety meetings is required of the Contractor at the discretion of the LG&E and KU Services Company authorized representative. At least one representative of the Contractor will attend such job safety meetings.
9. Any Contractor's employee, who appears sick, extremely tired, or otherwise unable to perform his/her job in a safe manner will be reported to the Contractor's supervision for evaluation and possible removal from the job site.
10. Contractors are responsible for establishing control measures to protect their employees, subcontractors or workers under their control, from exposure to hazards (chemical, atmospheric health and physical) present at the job site.
11. The Contractor must provide electrical ground fault protection for employees using construction power (temporary branch circuits to include extension cords) through the use of approved ground fault circuit interrupters (GFCI). Additionally, Contractors must provide ground fault protection when using permanent facility power and using cord and plug equipment in wet or damp locations. Applies to 120-volt single phase 15 and 20-ampere receptacle outlets.
12. Contractor employees will work in full pants and shirts appropriate for the task being performed and in compliance with appropriate regulations. Shorts and tank tops are not allowed unless otherwise specified. (Some jobs will require wearing long sleeve shirts.)
13. Contractors shall not transport employees in the cargo bed of a truck or trailer.
14. All Contractors must receive authorization from the LG&E and KU Services Company authorized representative, before performing work in areas posted as **"DANGEROUS OR HAZARDOUS."**
15. Employees of Resident Contractors, defined as those Contractors with an annual contract and who provide day-to-day services for LG&E and KU Services Company, shall be required to have a negative drug pre-test when hired and before reporting to work at an LG&E and KU Services Company site. They shall also be required by the Contractor to participate in a drug and alcohol testing program that randomly tests 50% of their employees annually, while working on an LG&E and KU Services Company site.
16. If a Contractor brings "transient" workers on site for "plant outages", "project work" or "major construction", the transient workers shall be required to have a negative drug pre-test when hired and within 7 days before reporting to work at an LG&E and KU Services Company site. The transient contractors are added to testing pool with 100% annual random testing for the duration of the assignment. If a contractor sends one of their workers to another LG&E and KU Services Company site with no interruption of service, no pre-work drug test is required. The worker remains in the 100% annual random testing pool. If a worker reports to another LG&E and KU Services Company site with an interruption in service of thirty days or more, the worker shall be required to have a negative drug test before reporting to work at that site. The worker remains in the 100% annual random testing pool.

4. Specific Safety Requirements

Contractor Safety Qualification

Contractor selection and ultimate certification shall include an evaluation of the Contractor's prior safety performance, current written safety programs, safety training, and qualifications of key Health & Safety (H&S) personnel to assure LG&E and KU Services Company that the Contractor is capable of meeting its

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safety performance goals. Employees of certified Contractors and any subcontractor employees shall undergo "Passport Training" for those designated as Industrial Workers prior to performing work at an LG&E and KU Services Company facility. This by no means will replace regulated compliance training for the work the contractor employee will be performing.

Subcontractor Safety Qualifications

Subject only to the specific exception stated below, any and all subcontractors used by a Contractor to perform work for LG&E and KU Services Company shall meet or exceed the following criteria:

a) The subcontractor's incident rates for the three (3) most recent calendar years do not exceed, in any one (1) year, the industry average, based on NAISC (or SIC), as published by the Bureau of Labor Statistics;
b) The subcontractor has not experienced any employee fatality identified within any of the three (3) most recent calendar years' statistics.
c) The subcontractor has not received any citation, from OSHA, the Kentucky Public Service Commission or any other state agency regulating utilities in the most recent three (3) calendar years; and
d) The subcontractor has a current Workers Compensation Insurance Experience Modification Rate (EMR) less than or equal to 1.0.

LG&E and KU Services Company may, at the sole option of such company, provided written authorization for the use of a subcontractor not meeting the above criteria; provided that such authorization must specifically identify how the subcontractor fails to meet the criteria and state additional protective measures the Contractor shall put in place in order to use such subcontractor. Such authorization may be withdrawn at any time for any reason.

The criteria stated above are minimum standards and Contractors using subcontractors shall seek out subcontractors with the highest safety performance available.

Contractor On-site Health and Safety Representative

The Contractor shall appoint a qualified on-site Health and Safety Representative, accepted by the LG&E and KU Services Company authorized representative, with the authority to enforce all of the safety requirements of this Policy, including implementation of the Contractor's Injury and Illness Prevention Program.

LG&E and KU Services Company authorized representative and H&S will make a risk-based decision as to the qualification level of the Contractor H&S representative. Requirements may range from a full-time on-site safety professional (Certified Safety Professional) to a craft supervisor or "person in charge" with competency as measured by experience training.

Whenever the Contractor has any employees or subcontractors on the job site, the Contractor must have a designated representative on the construction worksite that is knowledgeable of the project's hazards and has full authority to act on behalf of the Contractor. The Contractor's designated representative must make periodic observations of the construction worksite to identify and correct any instances of noncompliance with the project health and safety requirements.

Qualification Evaluation

Based on the level of H&S qualification determined necessary by LG&E and KU Services Company, the Contractor shall submit documentation, for review and acceptance by LG&E and KU Services Company in support of the proposed designated representative. Suggested qualifications may include, but are not limited to:

- Professional certifications (CSP, CIH, ASP, etc.).
- Curriculum detailing work experience and EH&S responsibilities on projects of similar scope for the previous five years, at a minimum.
- Evidence of construction safety training such as the 10-hour or 30-hour OSHA training.
- Proof of "Competent Person" (as defined below) or "Qualified Person" (as defined below) status attained by the proposed on-site H&S representative.

Contractor Health and Safety Representative Responsibilities

The Contractor H&S Representative shall:

- Assist in the development of the contractor's safety plan and job site management system.
- Support training of contractor personnel.
- Evaluate the Contractor's safety process continuously.
- Attend any pre-job meetings to discuss their site-specific safety plan.
- Conduct and formally document job briefings.
- Assist in the identification of jobs requiring a hazard analysis.
- Assist in evaluating potential subcontractors in accordance with this Policy.

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Competent Person

Each Contractor shall provide to LG&E and KU Services Company a written list of those persons designated as a Competent Person, who shall be available at the work site and capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to workers, and who has authorization to take prompt corrective measures to eliminate them. Persons shall be responsible for conducting periodic observations of the job sites, materials and equipment, and shall maintain the accident prevention program. Contractor shall ensure that each Competent Person listed has been trained in the following areas as applicable:

- Asbestos
- Cranes
- Confined Space
- Demolition
- Excavations
- Fall Protection
- Industrial Trucks
- Ladders
- Scaffold
- Steel Erection
- Tower Climbing

5. Health and Safety Management Plan

Prior to commencement of contract work, the Contractor shall develop and submit to the LG&E and KU Services Company authorized representative a written Health & Safety (H&S) Management Plan on how the contract work will be completed without endangering the health and safety of those performing the work or anyone else working in the general area. The H&S Management Plan will be developed for the following higher risk contracts, including projects:

- ❖ All construction projects (new site and refurbishment)
- ❖ Contracts with an estimated value of $250,000 and over
- ❖ Long term contracts (12 months and over)
- ❖ Contracts for which the Contractor will use subcontractors.
- ❖ Contracts that provide a service by performing **high risk*** activities.
- ❖ Any other contracts at the discretion of the contract manager.

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**High risk activities include but are not limited to:*

- *Electrical work requiring an Electrical Work Permit*
- *Asbestos removal*
- *Cooling tower maintenance*
- *Demolition*
- *Hot work in hazardous area*
- *Permit Required Confined Spaces*
- *Scaffolding*
- *Tank cleaning or testing*
- *Welding in hazardous areas*
- *Working at heights*
- *Work on telecommunications towers*
- *Work involving excavations to a depth of more than 4 feet*
- *Work involving the use of explosives*
- *Work on or near pressurized gas pipes*
- *Work over or adjacent to water*
- *Work involving diving*

The Health and Safety Management Plan shall contain at a minimum:

- The name of the On-site Health and Safety representative who is responsible for the implementation of their safety plan.
- LG&E and KU Services Company policy on environment, safety and health.
- LG&E and KU Services Company policy on substance abuse and testing policies if applicable.
- How and when each Contractor will conduct their job briefings.
- Provisions for conducting and documenting weekly job site safety audit/inspections by manager/supervisor level personnel.
- Training methods used to meet OSHA training requirements, and to ensure that safety program requirements are communicated to all Contractor personnel.
- Incident reporting, first aid, and emergency procedures.
- List of all Competent Persons overseeing those tasks in which OSHA requires such person(s), such as excavation, asbestos abatement and scaffolding.

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Subcontractors shall be held to the same level of performance as the Contractor's written H&S Management Plan. The Contractor shall submit written documentation for its subcontractors that demonstrates how their subcontractors shall meet compliance with the site safety plan.

6. Hazard Analysis

Contractor shall complete a "Contractor Safety Management / Project Specific Hazard Analysis" * and a "Contractor Hazard Mitigation Plan"*. These documents shall be submitted to the LG&E and KU Services Company authorized representative prior to the initiation of any work. In addition, a "Quality Assurance Closure Form for Contractors"* shall be completed and submitted to the LG&E and KU Services Company authorized representative at the completion of the project.

* *The Hazard Analysis, Mitigation Plan and Closure Form is presented during the Contractor Passport Train-the-Trainer session.*

All Contractor and subcontractor personnel scheduled to work in the activities identified, shall receive safety training in those activities prior to working on them. (A safety toolbox meeting would be an acceptable forum to meet this requirement). The Contractor shall maintain proof of employee training, and shall make available such proof upon request. Note: This by no means shall replace their regulatory compliance training.

Hazard Analysis Requirements

A hazard analysis shall be written based on the following conditions:

- All major outage work
- Special Projects
- Jobs with the highest injury or illness rates
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents
- Jobs complex enough to require written instructions
- At the discretion of the LG&E and KU Services Company authorized representative

7. Engineered Protective Systems

The Contractor shall submit for review to the LG&E and KU Services Company authorized representative such safety system that is required by regulation to be designed by a registered professional engineer. This review is solely to verify that the Contractor has had the required protective systems prepared and stamped by a registered professional engineer.

LG&E and KU Services Company review of any documents showing the design or construction of protective systems for worker and property protections shall not relieve the Contractor of its obligations to comply with applicable laws and standards for the design and construction of such protective work. Contractor shall indemnify and hold harmless LG&E and KU Services Company and their engineering

personnel from any and all claims, liability, costs, actions and causes of action arising out of or related to the failure of such protective systems. The Contractor shall defend LG&E and KU Services Company, its officers, employees and agents including without limitation engineer personnel, in any litigation or proceeding brought with respect to the failure of such protective systems.

The cost of required safety engineering services required for safety and protective systems shall be borne solely by the Contractor and shall be deemed to have been included in the amount bid for the work as stated in the contract.

8. Safety Training and Education

Contractor shall ensure that its workforce is compliant trained and qualified to perform the work. Contractor shall ensure that all subcontractor employees demonstrate the same level of competence.

Site Orientation

All Contractors / subcontractors shall undergo an LG&E and KU Services Company "site specific" training/orientation prior to engaging in work activities at a generating station. In addition, Contractors that conduct work at LG&E and KU Services Company generation facilities that process ammonia shall also undergo an ammonia awareness training/orientation prior to conducting work.

Contractor employees conducting work in a substation must first complete a Substation Entry training program.

Contractors Pre-job Orientation

Contractor shall require and administer a pre-job orientation to its employees and all subcontractor employees prior to engaging in work activities. Contractor shall maintain on the work site a detailed outline of the orientation and a signed and dated roster of all employees who have completed the orientation. The orientation shall address the following elements at a minimum:

- Employee rights and responsibilities
- Authority and responsibility to issue Stop Work Order
- Alcohol and drug abuse policy
- Contractor's disciplinary procedures
- First aid and medical facilities
- Hazard recognition and procedures for reporting or correcting unsafe conditions or practices
- Procedures for reporting accidents and incidents
- Hazard Communication Program
- Access to employee exposure monitoring data and medical records
- Protection of the environment, including air, water, and storm drains from construction pollutants
- Location of and access to reviewed Health & Safety Management Plan, Project Specific Hazard Analysis, and Hazard Mitigation Plan.
- Location and contents of required postings

Daily Job Briefings

Contractors shall ensure that all of their personnel (employees and sub-contractors) on the job site receive the daily Job Briefing before they start each job. Job Briefings shall discuss, at a minimum, the hazards associated with the job; work procedures involved; special precautions; energy source controls; and personal protection equipment requirements. This job briefing shall be conducted by the contractor's person in charge. Should the scope of the work change, than another job briefing shall be conducted.

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9. Emergency Procedures

An emergency is any situation that poses an immediate threat to life or property. Each Contractor shall maintain one person currently qualified in CPR and First Aid on site at all times. Refer to the site orientation, or the LG&E and KU Services Company authorized representative for specific information for handling of a life threatening or other serious injury, fire, etc. Following the occurrence of an emergency, the contractor shall ensure that all proper incident reports are completed and distributed, and that the LG&E and KU Services Company authorized representative is notified immediately.

Incident Reporting
In the event a job site accident occurs, the Contractor shall immediately implement controls and restrictions on the accident site to ensure the site remains undisturbed until released by the LG&E and KU Services Company authorized representative. All accidents shall be reported to the LG&E and KU Services Company authorized representative immediately after the site is secured. A written incident report shall be furnished within the same day of the incident. A job site accident would include, but not be limited to a fire, explosion, equipment failure, release or exposure to toxic liquids, fumes or vapors, etc.

Near Miss / Injury-free Event
It is the responsibility of the Contractor, to complete all near miss investigations, and to report these occurrences with recommendations / implementation of corrective actions. The report is to be submitted to the LG&E and KU Services Company authorized representative within 24 hours.

Medical Treatment Event
The Contractor shall report all accidents (either occupational injury or illness) requiring medical treatment, as soon as possible, but no later than the end of the work shift, to the LG&E and KU Services Company authorized representative along with a copy of the first report of the injury. Serious injuries (defined as an injury that would require off site medical attention) shall be reported within 15 minutes, even during off shifts. (Review project specific emergency notification procedures.)

Fatality
It is the responsibility of the Contractor to immediately notify LG&E and KU Services Company should a fatality occur. It is the responsibility of the Contractor to notify the Kentucky Occupational Safety & Health, Division of Compliance within the appropriate Kentucky notification periods.

Stop Work Order
A stop work order must be given when imminent danger is identified or where significant damage to equipment or property or environmental degradation could occur if the operation continued. Any employee of a Contractor that observes an imminent-danger situation is responsible for stopping the work and reporting it to their supervisor. When a stop work order is issued, only those areas of a construction project immediately involved in the identified hazardous situation are to be included in the order.

Immediately after stopping work, the person issuing the order, or their supervisor, must report to the LG&E and KU Services Company authorized representative of their action. Work shall not resume until the LG&E and KU Services Company authorized representative has agreed that the imminent danger has been eliminated.

10. Hazard Specific Requirements

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The Contractor will ensure that their employees (and all subcontractor employees) are properly equipped and trained to comply with the LG&E and KU Services Company standards and federal and state regulations; including but not limited to the following:

Asbestos

Blasting and the use of explosives

Chemical Safety/Hazard Communication

Commercial Diving Operations

Confined Space Entry

Control of Energy Sources (Lockout/Tagout)

Crane Operations, including rigging

Electrical

Fall Management (personal fall arrest systems, scaffolding, walking & work surfaces, ladders and floor & wall openings)

Hazardous Waste and Chemical Spills

Hot Work

Personal Protective Equipment (PPE)

Powered Industrial Trucks

Trenching

11. Enforcement

The Contractor is responsible for the health and safety of its employees and any subcontractor employees under their control. Enforcement of this Policy, as well as other recognized safety requirements, is the responsibility of the Contractor. The evaluation does not constitute acceptance of the Contractor's safety programs or work practices nor, in any way relieve a Contractor of full responsibility for meeting all appropriate OSHA regulations to ensure the safety of its employees.

Whenever there is a jurisdictional question of which standard will apply, the most stringent safety practice will take precedence. The Contractor must document exceptions and attach them to this form. Contractors and their employees who do not follow this Policy are subject to removal from the worksite as well as being banned from future LG&E and KU Services Company projects/contracts.

LG&E and KU Services Company reserve the right to evaluate the safety of Contractor's work practices to determine if they meet LG&E and KU Services Company standards and state/ federal regulations. In addition to the audit rights under the applicable contract LG&E and KU Services Company reserve the right to audit any and all documents (job briefings, audits, etc.) at anytime during the course of the work.

12. LG&E and KU Services Company Safety and Health Issues

Contract work may involve use, handling, storage, or work in vicinity of *hazardous chemicals or materials.* (Concerns are Hazard Communication...spill prevention/response).

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Contractor may perform work (operation, maintenance or emergency response function) as necessary.

Contractor may perform *hot work* (e.g. welding, torch cutting, brazing, etc.)

Contract may require Contractor to work in or near *confined spaces*.

Contract work may require using/working under clearance procedures for the control of hazardous energy (*lockout/tagout*).

Contract may involve work on an uncontrolled hazardous substance site, Superfund site, or other contaminated site that could trigger Hazardous Waste Operations and Emergency Response (*HAZWOPER*) planning and training requirements. (Ref: CERCLIS List)

Contract work may involve application, handling or disturbance of *lead*, *cadmium* and/or *zinc chromate containing materials*. An example would be the removal of *toxic surface coatings* (i.e. paint).

Contract work may involve handling, disturbance, abatement or work around *asbestos containing materials* (ACM).

Contract work may involve application of *pesticides, herbicides, etc.*

13. Hazardous Chemical Communication

The following is a list of Hazardous Chemicals and atmospheric contamination that may be encountered at LG&E and KU Services Company sites. It should in no way be deemed as the only contamination that could be encountered at LG&E and KU Services Company sites. Always be aware of the contamination that could be encountered and become familiar with their Material Safety Data Sheets.

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Chemical Name	Formula	Trade Name	Description/ Target Organ
Anhydrous Ammonia	NH3 (99-100%)		Liquid colorless gas or compressed liquid with extremely pungent odor. Targets eyes, skin and respiratory system.
Arsenic	AS	Organic Arsenic	Targets skin, kidneys, liver and resp. system.
Asbestos		Hydrated Mineral	Fibers found in insulation, gaskets, packing, vinyl asbestos flooring, roofing, and other materials. Targets respiratory system. Can cause lung cancer.
Carbon Dioxide	CO_2	Carbonic Acid Gas Dry ice	Targets respiratory system and cardiovascular system
Carbon Monoxide	CO	Flue gas/Monoxide	Colorless, odorless gas. Targets lungs, blood, can be immediately fatal.
Chromium Hexavalent	Cr(VI)	Hexavalent Chromium	Metal that targets the respiratory tract, skin and eyes. Irritant.
Hydrogen Sulfide	H_2S	Sewer gas Hydrosulfuric Acid	Colorless gas with strong rotten egg odor, quick loss of sense of smell, can be immediately fatal.
Hydrogen	H_2	Liquid Gas	Colorless, odorless, targets eyes, skin respiratory system
Lead	Pb	Lead metal	Heavy soft gray metal. Targets eyes, kidneys and blood.
Ozone	O_3	Triatomic Oxygen	Colorless, targets eyes

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			and respiratory sys.
Sulfur Dioxide	SO_2	Sulfuric Acid	Targets eyes, skin, and respiratory sys.

14. Definitions

Competent Person: means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to workers, and who has authorization to take prompt corrective measures to eliminate them.

Qualified Person: is one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems relating to subject matter, the work, or the project.

I have read the LG&E and KU Services Company Contractor Safety Policy as outlined above and I understand and agree to abide by the requirements set forth therein; and confirm this by signing below.

CONTRACTOR SENIOR MANAGER:_____

TITLE:_____

DATE:_____

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3.0 Overview of Passport Program

LG&E AND KU SERVICES COMPANY
OVERVIEW OF PASSPORT PROGRAM

Purpose

Safety is a core value at LG&E and KU Services Company. To enhance the welfare of all who work in and around LG&E and KU Services Company facilities, an enhanced contractor safety program has been developed. Building on internal and external best practices, a cross functional team has developed improvements to the existing "Passport Program." The Passport Program is designed to cover industrial workers. For purposes of this overview, "LG&E and KU Services Company" refers to LG&E and KU. The key components of the program are outlined below.

Process Steps

STEP 1 – CERTIFICATION

All contractors working for LG&E and KU Services Company must be certified prior to entering company work sites or performing any work for the company. This process is administered by Supply Chain Support or as part of the specific project competitive bid process.

As part of the certification process, prime contractors (contractors entering into contracts directly with the company must identify any and all sub-contractors they plan on utilizing in work for the company. Each prime contractor is responsible for ensuring that those identified sub-contractors complete the same information and meet the same performance criteria as the prime contractor is expected to meet. In the event not all subcontractors have been identified prior to certification, the contractor shall notify LG&E and KU Services Company before engaging any subcontractor.

STEP 2 – PASSPORT TRAINING
All industrial workers employed by a certified contractor must complete a training program designed to inform them of the importance of safety and the hazards associated with working in an industrial environment. This training will also identify additional specific OSHA, EPA and DOT compliance training that may be needed in certain situations. Passport training, however, does not take the place of any of the compliance training required by the above listed agencies. **It is the responsibility of the contractor to provide any compliance training required for their employees.**

There are two options available to contractors with regard to the Passport Training:

Option 1 – Train-the-Trainer
LG&E and KU Services Company will provide a curriculum and conduct train-the-trainer sessions at appropriate intervals for the contractor's key safety/training personnel. For those contractors choosing this option, a resume for each prospective trainer must be submitted and must include the following information:

- Training delivery and development experience
- Knowledge of OSHA, DOT, and EPA Standards applicable to the work for which Contractor will be performing
- Health and safety knowledge and experience in managing a health and safety program

By virtue of their attendance and ability to pass a written examination, these key personnel would then be approved to provide training to the contractor's employees to meet the requirements of a "Passport."

NOTE: LG&E and KU Services Company reserves the right to reject any contractor employee as a potential trainer if:

- The above referenced information regarding experience and qualifications is not submitted

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- The information submitted does not adequately indicate the prospective trainer's ability to perform the duties of a trainer for the Passport program.
- The prospective trainer does not complete the required train-the-trainer session, including successfully passing the final examination.

Option 2 – External Provider
External providers of the LG&E and KU Services Company Passport safety training program will also be assessed and certified by a representative from the Business Unit Training group in accordance with Option 1. This will allow certified contractors to seek Passport training for their employees from an external provider at their expense. A list of currently approved external providers is included in your certification packet.

STEP 3 – ATTESTATION FORM
Contractors will be required to attest to the fact that each employee, including subcontractors working on any LG&E and KU Services Company job site or performing any work on LG&E AND KU Services Company project, has received the required Passport training before starting work. The contractor will also attest that all employees are current on all required compliance training for the work that employee will be performing. Although LG&E and KU Services Company will be looking for confirmation that compliance training has been completed, it is not a requirement that the contractor provide training records for all individuals, and LG&E and KU Services Company will not monitor compliance training delivered by contractors to their employees. However, site compliance audits will be routinely performed to ensure the adequacy of the training provided. If an incident occurs, LG&E and KU Services Company will require the contractor involved to provide individual training records as part of the incident investigation process.

Upon successful completion of the required Passport safety training by a contractor's employee, the contractor will enter that employee's name, date of birth and training information into the LG&E and KU Services Company Contractor Health & Safety Data Base @ www.lge-ku.com. An electronic notification will be sent to the appropriate LG&E and KU Services Company representative for Passport authorization. Upon approval (on-line), the contractor will be notified electronically that the Passport has been approved and that the contractor can print and issue a Passport card to the newly entered worker. The card will have an identification number that will associate the worker with his or her records in the database. The contractor's employee must carry this card and valid government issued photo ID at all times while on LG&E and KU Services Company property or job sites.

The Passport does not serve as security clearance for an employee. The Passport merely attests to the fact that the contractor employee has completed all required training. Site access will be handled in accordance with local site access procedures. For long-term contractors, a photo ID with a magnetic strip may also be issued to a contractor's employee for security purposes. For all other employees of contractors, a sign-in sheet may be utilized to track individuals on site.

STEP 4 – SITE SPECIFIC ORIENTATION

Each employee of a contractor working on LG&E and KU Services Company property or job sites must attend a site specific orientation training identifying parking directions, security procedures, site map, emergency evacuation procedures, emergency contact names, medical facility locations, specific alarms, and site-specific hazardous materials. A separate orientation will be required for each generation site at which a contractor's employee works. This orientation will normally occur on the first day of work on the job site.

STEP 5 - HIRING SUBCONTRACTORS

Prime contractors are responsible for ensuring that any subcontractors working for them in any capacity directly or indirectly are held to the same safety performance expectations as the prime contractor itself. The primary contractor shall request and review safety data prior to hiring any subcontractors to assure they meet the standards for favorable under the following safety criteria (LG&E and KU Services Company emphasizes that these criteria are minimum standards):

Safety Criteria – INCIDENT RATES*

Favorable: The three most recent years recordable Incident Rates will be compared to the related industry average in such years for the subcontractors' NAISC (or SIC) classification (as published by the Bureau of Labor Statistics). Subcontractors' Incident Rate shall not exceed the industry average in any related year.

Unfavorable: A single fatality identified within any of the three most recent year's statistics.

Safety Criteria – EMR**

Favorable: Workers Compensation Insurance Experience Modification Rate at or better than the average EMR rating for their industry.

Unfavorable: EMR greater than the industry average for their industry.

Note: Contact the LG&E and KU Services Company safety representative for direction in situations where a particular subcontractor does not meet the criteria due to extremely unique circumstances.

STEP 6 – CONTRACTOR REPORTING REQUIREMENTS

All accidents, injuries, dangerous occurrences and near misses shall be reported as soon as possible to the LG&E and KU Services Company Safety contact for the work site. A soon as possible means as soon as communications can be made without jeopardizing the life or health of any person. LG&E and KU Services Company is subject to various regulatory requirements requiring prompt investigation and reporting of certain events making it essential for all contractors to provide information without delay.

Contractors shall also report statistical information to LG&E and KU Services Company on a monthly basis.
The information required is:

- Number of hours worked at each LG&E and KU Services Company job site
- Number of fatalities, Lost Workday Cases and OSHA Recordable Injuries for each job site.

The preceding month's statistical information shall be entered into the LG&E and KU Services Company Contractor Health & Safety Database by the Contractor by Noon on the 5th working day of the month.

All reporting requirements will include any subcontractors working for the prime contractor.

Administration

- **All personnel working for contractors and subcontractors on LG&E and KU Services Company property or job sites must have a Passport.**
- The passport is valid for 12 months or until revoked by LG&E and KU Services Company, whichever is earlier. Refresher training options will be developed and provided annually
- The expenses of training will be the responsibility of the contractor.
- The contractor is responsible for ensuring that all of the above requirements are met for every individual worker utilized in work on LG&E and KU Services Company property or job sites. This includes all subcontractors utilized directly or indirectly by a prime contractor. The prime contractor will be responsible for ensuring that each subcontractor has met all of the requirements regarding issuance of a Passport and for ensuring that all reporting requirements outlined in Step 5, above, are fulfilled.
- LG&E and KU Services Company reserves the right to revoke any individual's Passport. See Passport Revocation and Reinstatement Guidelines below.
- Site audits will be routinely performed to assess effectiveness of and compliance with the information communicated during the Passport Program. These audits will be conducted by Site Safety, Site Contract Proponents, and Managers.
- Corporate Health & Safety will audit contractors for appropriate drug & alcohol, compliance and Passport training documents.

Passport Revocation and Reinstatement Guidelines

LG&E and KU Services Company reserves the right to revoke any individual's Passport. Passports can be revoked for:

- Failure to comply with safety rules, procedures or programs;
- Failure to comply with drug and alcohol rules or testing requirements;
- Creation of an unsafe condition that has potential to result in death or serious injury; or
- Any reason not violating applicable Federal, state or local law deemed appropriate by the responsible site manager.

If a contractor wishes to request that LG&E and KU Services Company reconsider a revocation decision, the request may in writing to the responsible site manager. LG&E and KU Services Company is not obligated to consider such requests.

A Passport may be reinstated in the sole discretion of LG&E and KU Services Company if the contractor has satisfied the responsible manager that the reason for revocation has been corrected.

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If an individual's Passport is revoked for a second time, the individual will not be allowed to reapply for an LG&E and KU Services Company passport.

**** Incident Rates***

Incident rates can be used to show the relative level of injuries and illnesses among different industries, firms, or operations within a single firm. Rates are computed from the following formula:
# of injuries or illnesses X 200,000 / employee hours worked.

*****Experience Modification Rates for Workers' Compensation Insurance***

The Experience Modification Rate is a widely used indicator of past safety performance. The insurance industry has developed experience rating systems as an equitable means of determining premiums for workers' compensation insurance. These rating systems consider the average workers' compensation losses for a given firm's type of work and amount of payroll and predict the dollar amount of expected losses to be paid by that employer in a designated rating period, usually three years. Rating is based on comparison of firms doing similar types of work, and the employer is rated against the average expected performance in each work classification. Losses incurred by the employer for the rating period are then compared to the expected losses to develop an experience rating.

Workers' compensation insurance premiums for a contractor are adjusted by this rate, which is called the experience modification rate (EMR). Lower rates, meaning that fewer or less severe accidents had occurred than were expected, result in lower insurance costs. The EMR is adjusted annually by using the rate for the first three of the last four years.

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4.0 Contractor Safety Management Project Specific Hazard Analysis

LG&E AND KU SERVICES COMPANY
Contractor Safety Management
Project Specific Hazard Analysis

This Hazard Analysis form and the required subsequent Hazard Mitigation Plan shall be completed by the contractor's designee and shall be submitted to The Company's authorized representative and forwarded to the facility's Health and Safety Specialist prior to the initiation of any work.

Work description and location:

LG&E AND KU SERVICES COMPANY Proponent:

Estimated Total Work Days: Estimated Work Force #:

Equipment Related Compliance and Safety
Will the contractor use any of the following or be exposed to its use by another group:

	Will use it? /May be exposed to its use? /Will work directly with it?			
Abrasive Wheel Machinery	Yes ☐	No ☐	Yes ☐	No ☐
Aerial Work Platform Operation	Yes ☐	No ☐	Yes ☐	No ☒
Barricades	Yes ☐	No ☒	Yes ☐	No ☒
Excavation Equipment	Yes ☐	No ☐	Yes ☐	No ☐
Cranes: overhead ☐ mobile ☐	Yes ☒	No ☐	Yes ☐	No ☐
Forklift Operation	Yes ☒	No ☐	Yes ☒	No ☐
Ground Fault Protection (GFI's/GFCI's)	Yes ☐	No ☐		
Grounding devices and processes (static)	Yes ☐	No ☒	Yes ☒	No ☒
Hand Tools / Power Tools	Yes ☒	No ☐	Yes ☒	No ☒

Specific Hazardous Substances Compliance and Safety

Anhydrous Ammonia	Yes ☐	No ☐	Yes ☐	No ☐
Arsenic	Yes ☐	No ☐	Yes ☐	No ☐
Asbestos	Yes ☐	No ☐	Yes ☐	No ☐
Bloodborne Pathogens (Applies to all)	Yes ☐			
DOT Hazardous Materials	Yes ☒	No ☐	Yes ☐	No ☒
EPA Hazardous Waste	Yes ☒	No ☐	Yes ☐	No ☐
Explosive Gasses, Vapors, or dusts	Yes ☐	No ☐	Yes ☐	No ☒
Hazard Communication (Applies to all)	Yes ☐			
Hexavalent Chromium (Hot Work)	Yes ☐	No ☐	**(Mandatory contact with station H&SS)**	
MSDS's supplied on all materials	Yes ☒	No ☒		
Ionizing Radiation	Yes ☐	No ☐	Yes ☒	No ☐
Lead or other toxic metal concerns	Yes ☐	No ☐	Yes ☐	No ☒
Other / Specify	Yes ☐	No ☐	Yes ☐	No ☒

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Personal Protective Hazard

Which of the following PPE will be required?

Electrical protective equipment	Yes ☐	No ☐
Low voltage gloves (Class 0, 50-600 volts)	Yes ☐	No ☐
Boundary Distances Established and Enforced	Yes ☐	No ☐
Arc Flash PPE	Yes ☐	No ☐
Class 2 600 -15kv gloves/sleeves	Yes ☐	No ☐
Rubber insulated blankets/hoses	Yes ☐	No ☐
What will the exposed voltage level be?		
Eye Protection with side shields (at all times)	Yes ☐	
Goggles: directly vented ☐ indirectly vented ☐	Yes ☐	No ☐
Face Shield	Yes ☐	No ☐
Fall Protection or Prevention	Yes ☐	No ☐
Gloves (Appropriate to the specific task)	Yes ☐	No ☐
Life lines (horizontal or vertical)	Yes ☐	No ☐
Foot Wear: steel toes ☐ electrical hazard rated ☐	Yes ☐	No ☐
Hard Hats (Applies to all)	Yes ☐	No ☐
Hearing Protection (Reduction to <85db. required)	Yes ☐	No ☐
PFD (personal flotation device)	Yes ☐	No ☐
Respiratory Protection	Yes ☐	No ☐
Portable ventilation equipment	Yes ☐	No ☐

Identify the respiratory hazard

Will the contractor have exposure to:

Total dust	Yes ☐	No ☐
Silica	Yes ☐	No ☐
Arsenic / Flyash	Yes ☐	No ☐
Asbestos	Yes ☐	No ☐
Hexavalent Chromium	Yes ☐	No ☐
Lead	Yes ☐	No ☐
SO_2	Yes ☐	No ☐
Others / specify	Yes ☐	No ☐

Has air monitoring been arranged? Yes ☐ No ☐

Has air monitoring been discussed with the facility's Health & Safety Specialist? Yes ☐ No ☐

Work/Safety Procedural Requirements	*Work directly with it:*		*May be exposed to its use by others:*	
Bulk Chemical Unloading	Yes ☐	No ☐	Yes ☐	No ☐
Compressed Gas Cylinders	Yes ☐	No ☐	Yes ☐	No ☐
Confined Space Entry	Yes ☐	No ☐	Yes ☐	No ☐
Specify:				
CPR & First Aid (under 1910.269, > 50 volts)	Yes ☐	No ☐		
Mobile Crane Operator Physicals (3 yr req)	Yes ☐	No ☐		
DOT Commercial Driver's License	Yes ☐	No ☐		
Excavation / Trenching and Shoring	Yes ☐	No ☐	Yes ☐	No ☐
Explosion Hazard (Deslagging / Blasting)	Yes ☐	No ☐	Yes ☐	No ☐
Fire Protection (Hot work, welding & alike)	Yes ☐	No ☐	Yes ☐	No ☐

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Work/Safety Procedural Requirements ***(continued)***	*Work directly with it?*	*May be exposed to* **its use by others?**
Lifting and Rigging	Yes ☐ No ☐	Yes ☐ No ☐
Lockout/Tagout	Yes ☐ No ☐	
Grounding Procedures	Yes ☐ No ☐	

Equipment required to be isolated (list):

Marine Standard	Yes ☐ No ☐	
Scaffold Competent Builder	Yes ☐ No ☐	Yes ☐ No ☐
Scaffold Competent User	Yes ☐ No ☐	Yes ☐ No ☐
Suspended Scaffolding	Yes ☐ No ☐	Yes ☐ No ☐
Work Zone Traffic Safety	Yes ☐ No ☐	Yes ☐ No ☐

Permits

Are there any permits indicated with outside agencies? Yes ☐ No ☐
Asbestos removal, building permits, work zones, RR crossing, environmental impact, etc.)
Detail:

Are there any OSHA related permits? Yes ☐ No ☐
(Permit Required Confined Space Entry, Dig permits and alike)
Detail:

Work Area Lighting

Additional lighting devices will be needed Yes ☐ No ☐

Further instructions:
For each Yes box checked, a Hazard Mitigation Plan must be submitted along with this Hazard Analysis prior to the initiation of any work.

Name of the contracted firm:

Name of the contractor's Health & Safety designee completing this Hazard Analysis:

Date

Phone number

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5.0 Contractor Safety Management Hazard Mitigation Plan

LG&E and KU SERVICES COMPANY
Contractor Safety Management
Hazard Mitigation Plan

This Hazard Mitigation Plan shall be filled in by the contractor's designee and must be submitted to The Company's authorized representative or their designee and forwarded to the facility's Health and Safety Specialist prior to the initiation of any work.

Description of the general job activity (e.g.: replacing duct work, building SCR):

Contractor's site supervisor:

Contractor's site Health and Safety Representative:

Date:

What is the work, what are the hazards, and how will we specifically protect our employees?

Work Task Sequence Identify the principal steps and the sequence of work activities. (e.g.: Entry into an excavation)	**Identify and Analyze the Hazards** Analyze each step for hazards. (e.g.: cave in, falls, confined space entry)	**Hazard Controls** Develop specific controls for each hazard identified. (e.g.: bench or slope or shore, air monitor, barrier, PPE. Be specific)

Work Task Sequence Identify the principal steps and the sequence of work activities.	**Identify and Analyze the Hazards** Analyze each step for hazards.	**Hazard Controls** Develop specific controls for each hazard identified.

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EXHIBIT I

INSURANCE

INSURANCE OBTAINED BY WFGD SUPPLIER

A. WFGD Supplier shall procure, pay premiums, and provide its own insurance coverage during the performance of the Work. At a minimum Buyer requires WFGD Supplier to obtain the following coverages:

WFGD Supplier shall at all times during the period in which the Agreement is in force, provide and maintain insurance, and shall require all Subcontractors of all tiers to provide and maintain insurance of the type and with limits commensurate with what is reasonable given the Subcontractors size and scope of work relative to those stated in this Exhibit I.

Subcontractors are responsible for maintaining, at their own cost, any other insurance they deem necessary.

The insurance specified may be provided in a policy or policies, primary and excess.

WFGD Supplier shall (i) provide and maintain, and shall require any Subcontractor to provide and maintain the following insurance (except that, with regard to Subcontractors it shall be commensurate with what is reasonable given the Subcontractors's size and scope of work relative to the following insurance) and (ii) cause each such insurance policy, except with regard to Workers' Compensation, to name Buyer and Owner and Owner's Engineer as additional insured and waive rights of subrogation against Buyer's, Owner's and Owners Engineer's insurance carrier(s)), and (iii) submit evidence of such coverage (including evidence of Buyer and Owner as additional insured and waiver of subrogation) to Buyer prior to performing any Work on the Mill Creek Site.

(a) **Workers' Compensation and Employer's Liability Policy**, which shall include:

1) Workers' Compensation (Coverage A), with statutory limits, and in accordance with the laws of the state where the Work is performed;
2) Employer's Liability (Coverage B) with minimum limits of One Million Dollars ($1,000,000) Bodily Injury by Accident, each Accident, $1,000,000 Bodily Injury by Disease, each Employee;
3) U.S. Longshore and Harbor Workers Compensation Act coverage;
4) Thirty (30) Day Cancellation Clause; and
5) All States Endorsement.

(b) **Commercial General Liability Policy**, which shall have limits of Two Million Dollars ($2,000,000) each occurrence; Four Million Dollars ($4,000,000) General Aggregate; Four Million Dollars ($4,000,000) Products/Completed Operations Aggregate; Two Million Dollars ($2,000,000) Personal and Advertising Injury, and including:

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1) Thirty (30) Day Cancellation Clause;
2) Blanket Written Contractual Liability WFGD Supplier
3) Broad Form Property Damage; and
4) Insurance for liability arising out of blasting, collapse, and underground damage (deletion of X, C, U Exclusions).
5) Products/completed operations coverage will be renewed for 5 years

(c) **Commercial Automobile Liability Insurance** covering the use of all owned, non-owned, and hired automobiles, with a bodily injury, including death, and property damage combined single minimum limit of One Million Dollars ($1,000,000) each accident with respect to WFGD Supplier's vehicles assigned to or used in performance of Work under this Agreement.

(d) **Umbrella/Excess Liability Insurance** with limits of Three Million Dollars ($3,000,000) per occurrence; and Three Million Dollars ($3,000,000) aggregate, to apply to employer's liability, commercial general liability, and automobile liability. Products/Completed Operations coverage shall be renewed for five years upon Substantial Completion of the work. Umbrella limits can be used to meet underlying requirements.(e) If any fixed wing or rotor craft aircraft will be used by WFGD Supplier in performing the Work, **Aircraft Public Liability Insurance** covering such aircraft whether owned, non-owned, leased, hired or assigned with a combined single minimum limit for bodily injury and property damage of Ten Million Dollars ($10,000,000) including passenger liability coverage.

(f) If any Material and Equipment is shipped via waterways, **Marine Liability - Stevedore Legal Liability and Wharfingers Legal Liability** which shall have limits of Two Million Dollars ($2,000,000) each occurrence; Four Million Dollars ($4,000,000) General Aggregate;

(g) **Professional Liability or Products Liability, whichever is applicable-** with limits of Three Million Dollars ($3,000,000) per claim and Three Million Dollars ($3,000,000) in the aggregate, which insurance shall be on a claims made basis (with a retroactive date satisfactory to Company).

(h) **Cargo Transit Insurance.** During the performance of the Work WFGD Supplier shall carry and maintain Cargo Transit Insurance covering "all risks" of direct physical loss or damage to materials, supplies, and equipment ("goods"). "All Risks" conditions of coverage includes loss due to strikes, riots, civil commotion, terrorism and war as defined in the policy. Coverage shall be in an amount equal to the value of the largest single shipment on a CIF plus 10% basis and shall be subject to a deductible of $100,000 per loss. Coverage commences at the time of first-loading at point of origin through unloading at the Job Site and includes for avoidance of doubt,storage, unloading and reloading at temporary locations and transshipment to the Job Site. WFGD Supplier, Owner, suppliers and vendors shall be included as insured parties as their interests may appear.

B. **Endorsements and Other Requirements.** The insurance carried in accordance with Sections A shall conform with the endorsements requirements as specified below:

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(a) Quality of Insurance Coverage: The above policies to be provided by WFGD Supplier shall be written by insurance companies which are both licensed to do business in the state where the Work will be performed, and either satisfactory to Buyer or having a Best Rating of not less than A-. These policies shall not be materially changed or canceled except with thirty (30) Days written notice to Buyer from WFGD Supplier. Evidence of coverage, notification of cancellation or other changes shall be mailed to Buyer at its address, and to Owner: Attn: Manager, Supply Chain, LG&E and KU Services Company, P.O. Box 32020, Louisville, KY 40232.

(b) Other Notices: WFGD Supplier shall provide notice of any accidents or claims at the Mill Creek Site to Buyer and Owner's Representative.

(c) Certificates of Insurance

- The Certificate shall properly identify the certificate holder as LG&E AND KU SERVICES COMPANY and AFFILIATES.
- Purpose of submitting the certificate is to evidence the coverage in force
- Under no circumstances shall WFGD Supplier or any Subcontractor be permitted to mobilize prior to submitting a certificate acceptable to Buyer. Buyer retains the right to waive this requirement at its sole discretion.
- The Certificate shall evidence prompt notice of cancellation.
- All insurance provided by WFGD Supplier and Subcontractors shall be primary with respect to any insurance available to certificate holder, due to the sole negligence of the WFGD Supplier and/or Subcontractor.
- Automobile Liability and Commercial General Liability shall include Cross Liability Coverage.

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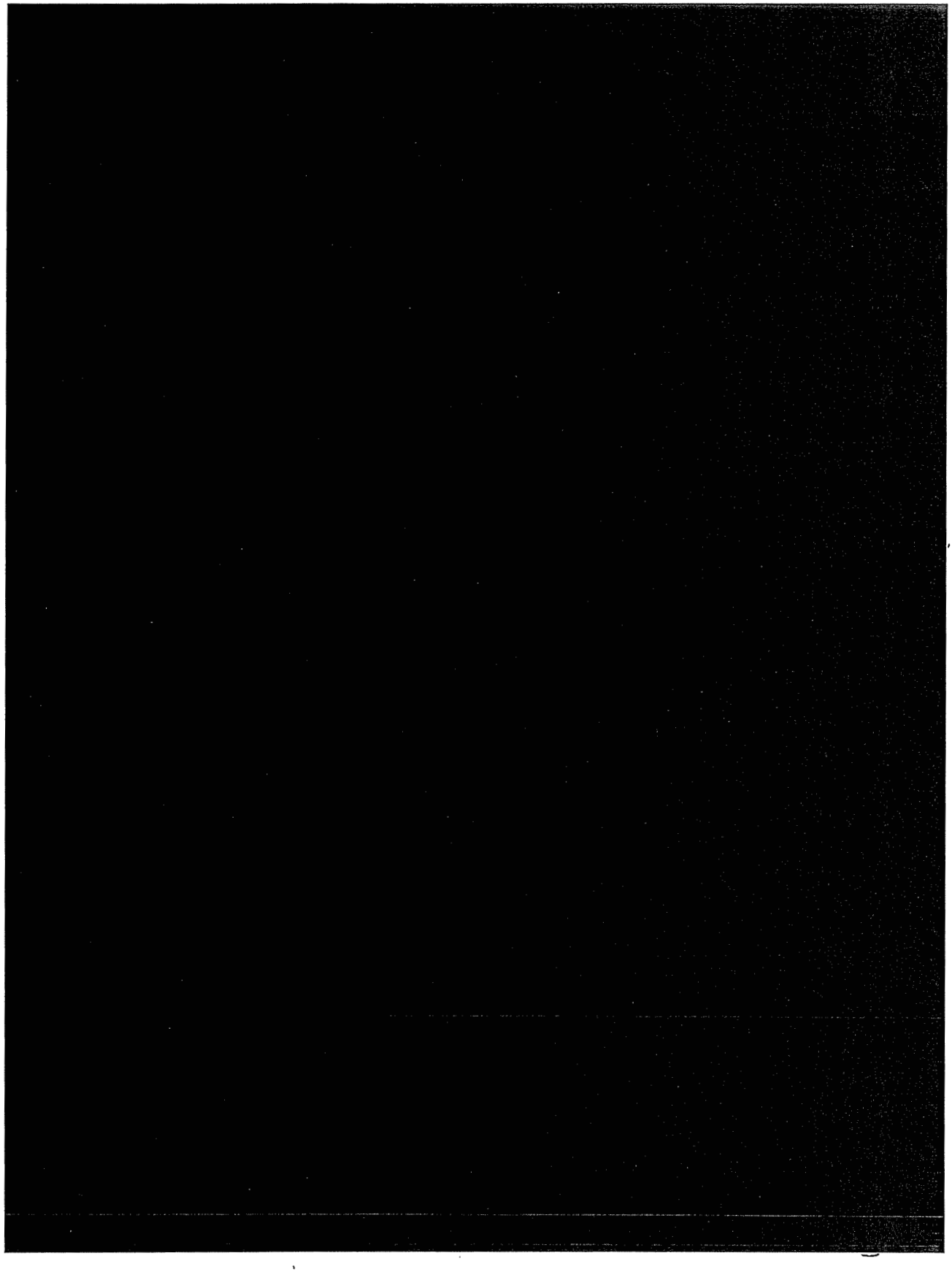

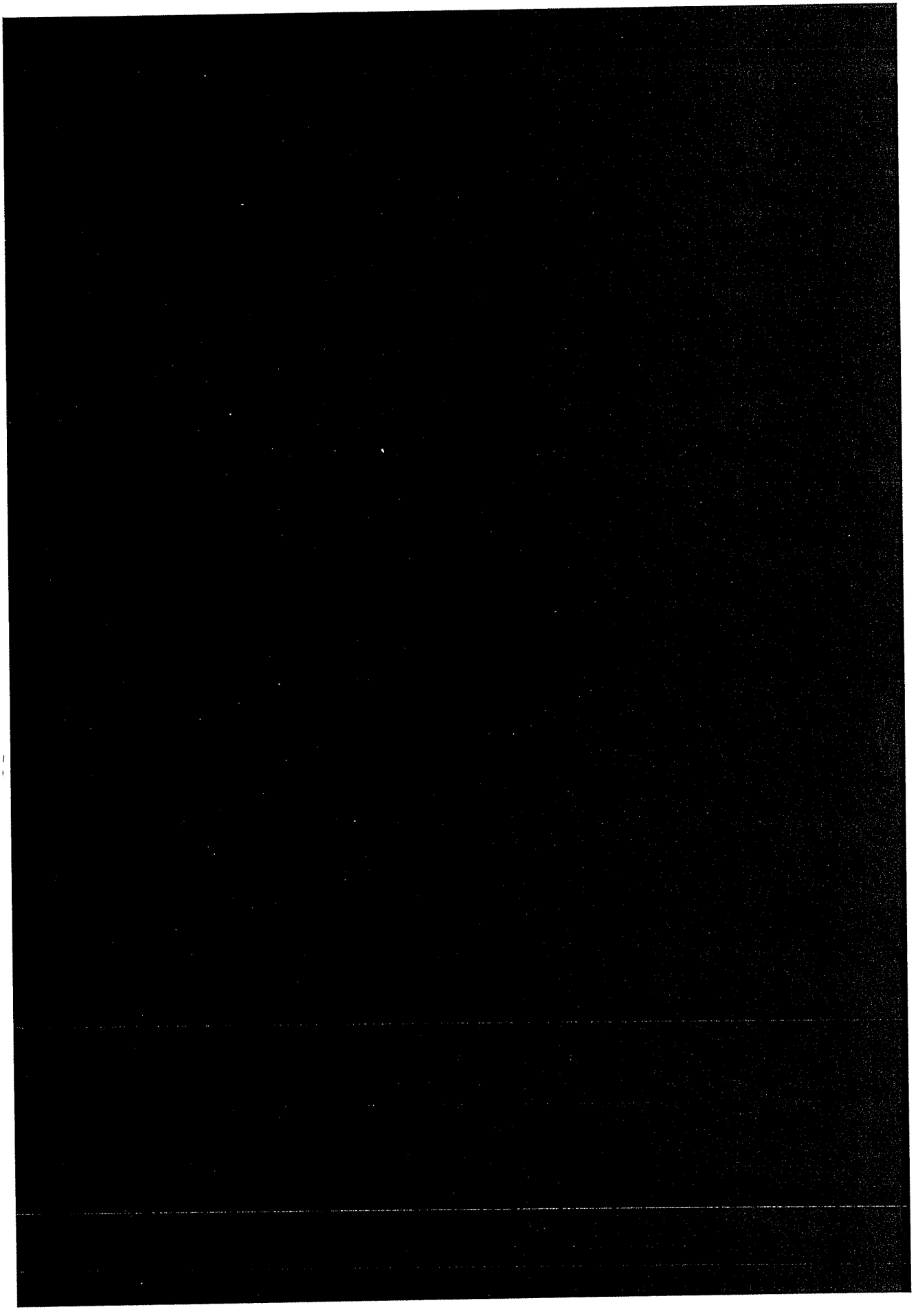

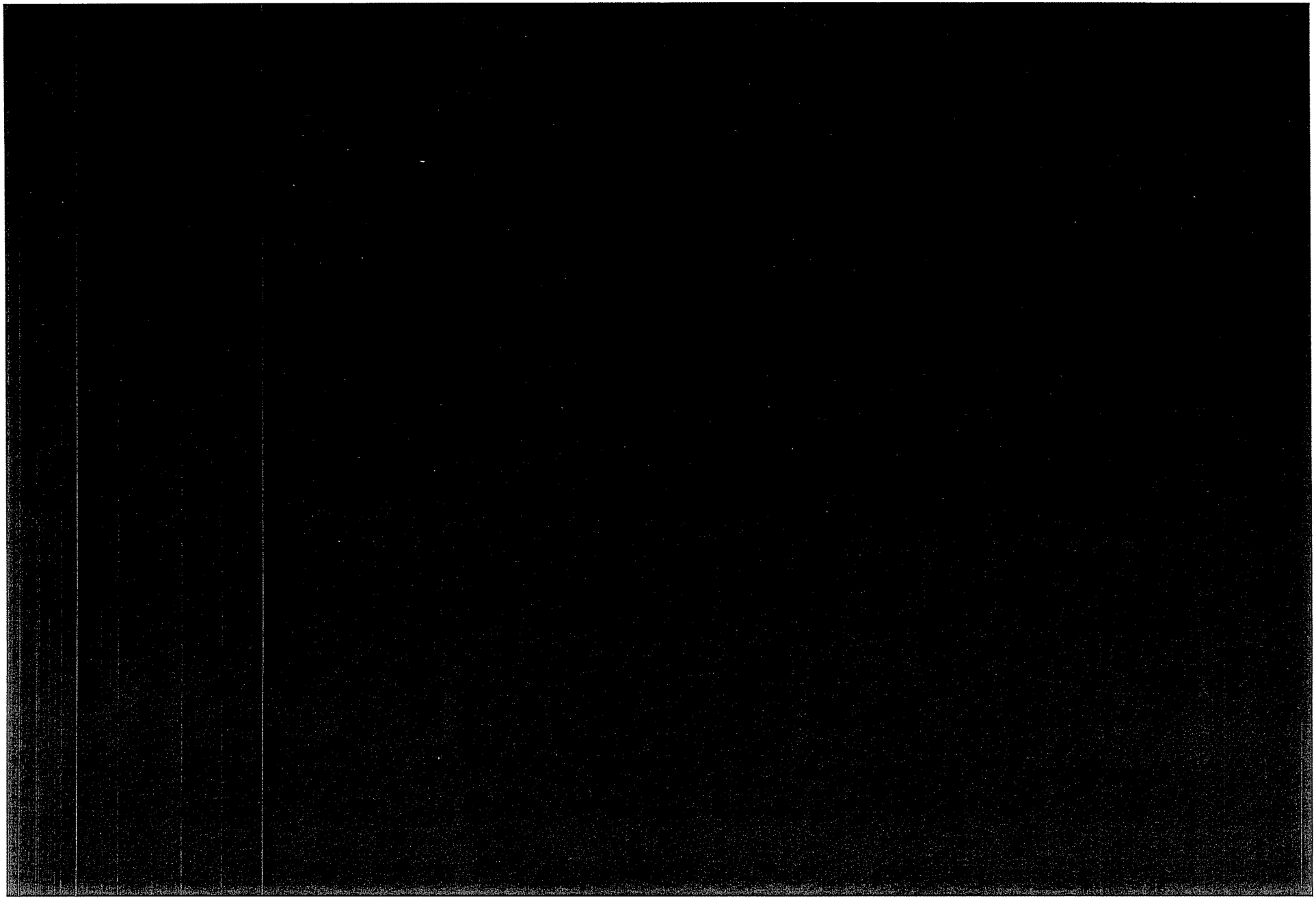

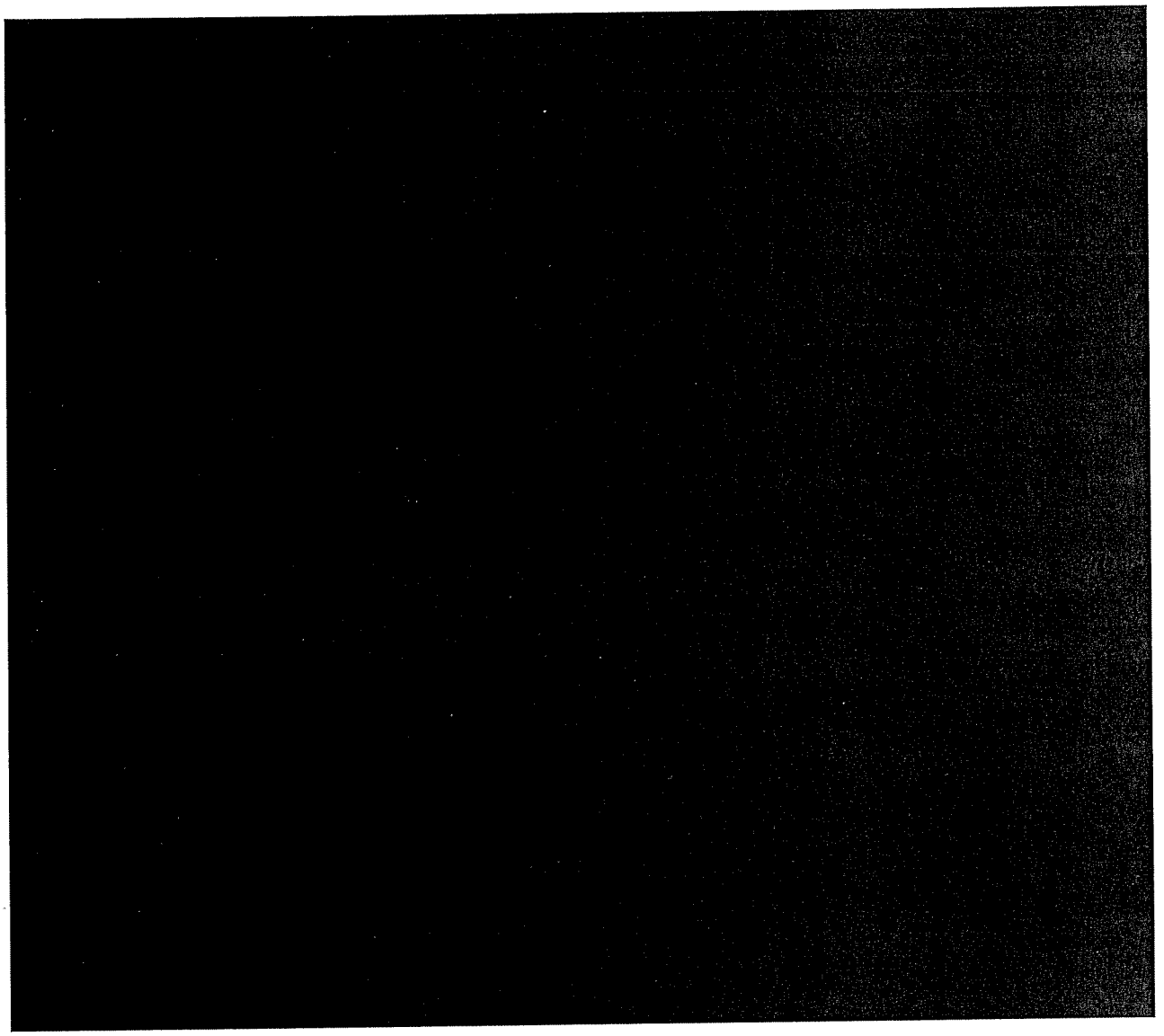

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EXHIBIT K

KEY PERSONNEL

The following organization chart reflects the WFGD Supplier's Key Personnel as of the date of this Agreement. Key Personnel also includes the following individuals' replacements.

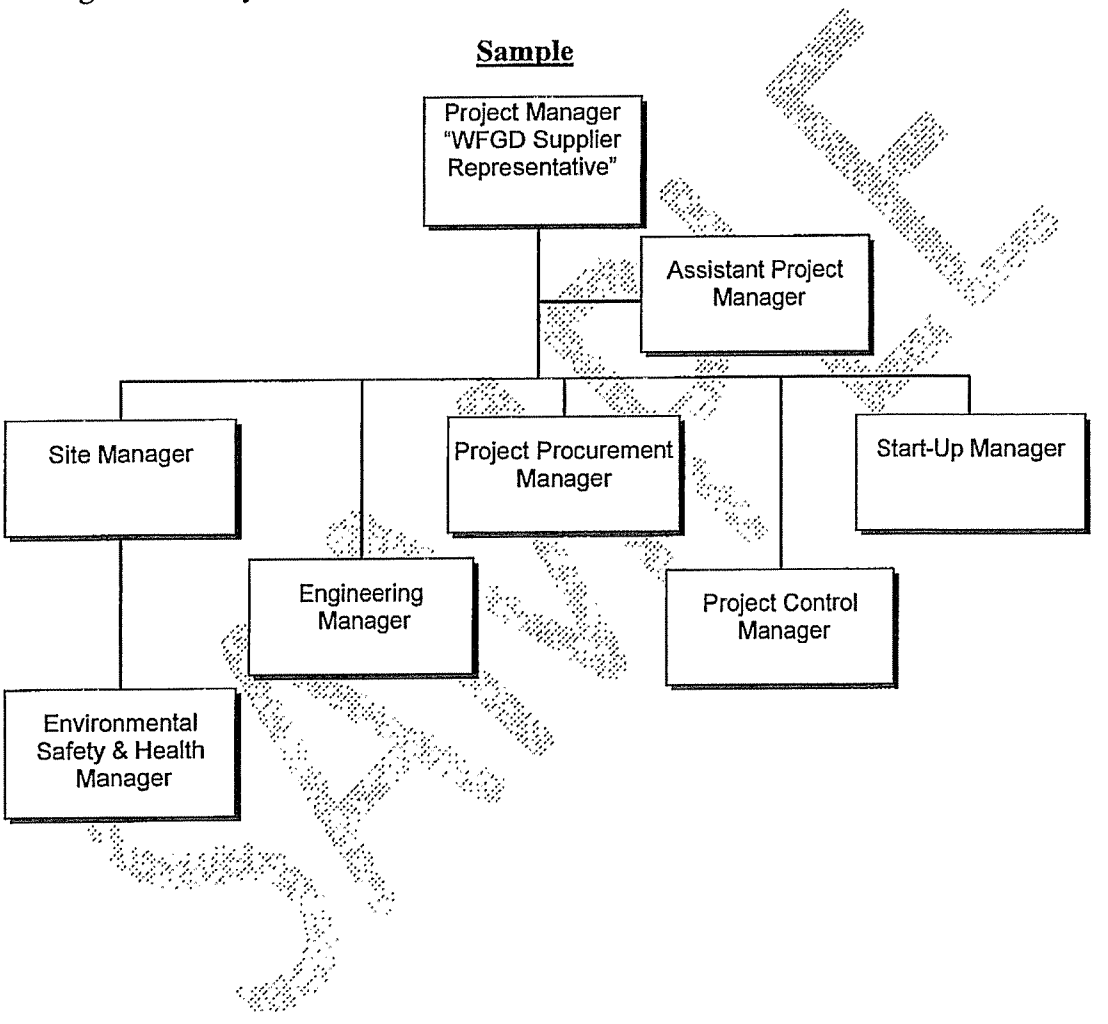

EXHIBIT M
MEETINGS AND PROGRESS REPORTS

1.0 Meetings and Progress Reports Details

1.01 SUMMARY:

A. This section outlines the meeting, scheduling and reporting requirements for the EPC Contract. The WFGD Supplier will provide support for these activities as applicable including attending project meetings.

B. Project Meetings:
   1. Preliminary Conference.
   2. Engineering Coordination Meetings.

C. Schedules and Reports:
   1. Initial Coordination Submittals.
   2. Work Progress Schedule.
   3. Work Progress Reports.
   4. Delivery Schedule.

D. Related Work Specified Elsewhere:
   1. Submittals: Exhibit X
   2. Equipment and Materials: Exhibit E

1.02 PROJECT MEETINGS:

A. Preliminary Conference:
   1. EPC Contractor will conduct a meeting within 20 days after the Effective Date of EPC Contract, to review items stated in the agenda and to establish a working understanding between the parties as to their relationships during performance of the Work. The conference shall be attended by:
      a. Contractor.
      b. Representatives of principal Subcontractors and Suppliers.
      c. EPC Contractor.
      d. Owner's representative(s).
   2. Meeting Agenda:
      a. Projected fabrication/construction schedules.
      b. Project coordination.
      c. Procedures and processing of:
         (1) Substitutions.
         (2) Submittals.
         (3) Change Orders.
         (4) Applications for Payment.
      d. Procedures for testing.
   3. Location of Meeting: Owner's office or by teleconference.
   4. Reporting: EPC Contractor will prepare and distribute minutes of the meeting to each party represented.

B. CFD Physical Flow Modeling Progress Meetings
   1. WFGD Supplier will conduct weekly meetings to update the Buyer and Owner on progress or changes concerning the CFD Physical Flow Modeling Study.
   2. The WFGD Supplier will schedule preliminary testing and final testing visits for the Buyer and Owner at the laboratory performing the CFD Modeling Study. The meetings will be attended by:

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a. WFGD Supplier representative(s)
b. Representatives from modeling subcontractor
c. Buyer and Owner's representative(s)

3. Meeting Agenda
   a. Progress report
   b. Planning and schedule review

C. Engineering Coordination Meetings:
1. EPC Contactor will schedule and conduct a meeting at least monthly for coordination during WFGD Supplier's equipment engineering and design phase of the Work. Meetings shall be attended by:
   a. WFGD Supplier representative(s) including engineering personnel.
   b. Representatives of principal contractors and Suppliers.
   c. Buyer and Owner's representative(s).
2. Meeting Agenda:
   a. Review of action items.
   b. Facility design interfaces.
   c. Equipment and Material procurement status.
   d. Engineering/fabrication/manufacturing schedules.
   e. Requests for information (RFIs).
3. Location of Meetings: Project Site or teleconference.
4. Reporting: EPC Contractor will prepare and distribute minutes of the meetings to each party represented.

1.03 SCHEDULES AND REPORTS:

A. Initial Coordination Submittals: Within the time period(s) defined in Exhibit X, WFGD Supplier shall submit to EPC Contractor and Buyer and Owner for review and acceptance:
1. A preliminary Work progress schedule.
2. A preliminary schedule of Submittals, as stated in Exhibit X.
3. Certification of insurance.

B. Work Progress Schedule:
1. After submittal of preliminary Work progress schedule, submit to EPC Contractor and Owner a detailed Work progress schedule within the time period(s) defined in Exhibit X. Base the schedule on the preliminary Work progress schedule and incorporate review comments and other feedback.
2. The schedule shall show the Work in a graphic format suitable for displaying scheduled and actual progress.
   a. Prepare schedules as a horizontal bar chart with separate bar for each major portion of the Work or operation.
   b. The schedule shall also show the Work broken down into major phases and key items with the dates Work is expected to begin and be completed. Sequence of listings shall be in the chronological order of the start of each item of Work.
   c. Scale and spacing shall allow space for notations and revisions.
   d. Sheet size: Minimum 11 x 17.
3. Provide sub-schedules to define critical portions of entire schedules.
4. Coordinate Work progress schedule with Work progress reports and delivery schedule.
5. EPC Contractor will review and comment on Work progress schedule:
   a. WFGD Supplier shall print and distribute copies of the accepted schedule to Buyer and Owner, Suppliers, and other parties required to comply with scheduled dates.
6. WFGD Supplier shall not change the accepted Work progress schedule without prior concurrence of Buyer and Owner.

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7. Submit to Buyer and Owner an updated schedule at least once monthly. Schedule shall show actual progress and any proposed changes in the schedule of remaining Work.

C. Work Progress Reports:
   1. Submit monthly a report on actual Work progress. More frequent reports may be required should the Work fall behind the accepted schedule.
   2. Work progress reports shall consist of marked copies of prints made from the accepted Work progress schedule, and a narrative report which shall include but not be limited to the following:
      a. A description of current and anticipated delaying factors, if any.
      b. Impact of possible delaying factors.
      c. Proposed corrective actions.
   3. A Work progress report shall accompany each application for partial payment. Work reported complete but not readily apparent to Buyer and Owner must be substantiated with supporting data.
   4. Should operations fall behind accepted schedule to an extent that completion of Work within the Exhibit D schedule appears doubtful, WFGD Supplier shall, report the recovery plan and corrective actions to get back on schedule to Buyer and Owner.

D. Delivery Schedule:
   1. Within 30 days after the Effective Date of the Agreement, Buyer and Owner and WFGD Supplier shall agree on a delivery schedule for all Equipment and Materials to be furnished for which the delivery time is not named in the Bid or specified.
   2. Actual delivery dates shall be subject to the ability of Buyers or Owner's or to receive and care for the delivered items.
   3. WFGD Supplier shall notify EPC Contractor and Buyer and Owner at least two weeks in advance of any delivery date, and shall not make any shipments without written approval.
   4. No delivery will be approved until proper Submittals pertaining to storage and installation have been received and accepted.
   5. Any items delivered without written approval may be returned to the point of origin, or unloaded and stored at a place and in a manner determined by Buyer, and WFGD Supplier will be charged with any additional expense resulting there from.

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2.0 Meeting Notes Template

MILL CREEK WFGD

Document No.:
Date Issued:

Meeting Notes

☐ **Meeting** ☐ **Telecom** ☐ **Conference Report**

Distribution:	**Date, Time & Place:**
Subject:	**Participants:**
Originated By:	**Recorded By:**

Action Item	**Assigned to/Status**

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3.0 Progress Report Table of Contents

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EXHIBIT N
CODES AND STANDARDS

Work shall be designed and installed in accordance with the latest issue of the applicable Codes and Standards appropriate to the duty, operational requirements, statutory obligations and environmental conditions specified.

In addition to those Codes and Standards mentioned in Exhibit A of the Agreement and unless otherwise specified, where applicable, the following Codes and Standards of the latest issue in effect at date of this Agreement shall form a part of the Agreement. The following is not a comprehensive list.

Codes and Standards

AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Boiler Manufacturer's Association
ACI	American Concrete Institute
ADA	Americans with Disabilities Act
ADC	Air Diffusion Council
AFBMA	Anti-friction Bearing Manufacturer's Association
AGA	American Gas Association
AGMA	American Gear Manufacturer's Association
AISC	American Institute for Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
AMCA	Air Moving and Conditioning
ANSI	American National Standards Institute
API	American Petroleum Institute
ARI	Air-conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society of Nondestructive Testing
ASTM	American Society for Testing and Materials
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CAGI	Compressed Air and Gas Institute
CEMA	Conveyor Equipment Manufacturers Association
CENELEC	European Committee for Electrotechnical Standardization
CFR	Code of Federal Regulations requirements
CGA	Compressed Gas Association
CMMA	Crane Manufacturer's Association of America
CTI	Cooling Tower Institute
DOT	U.S. Department of Transportation
EJMA	Expansion Joint Manufacturing Association
EN	European Standards

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EPA	U.S. Environmental Protection Agency
FM	Factory Mutual Classifications
HEI	Heat Exchange Institute
HIS	Hydraulic Institute Standards
IBC	International Building Code
IEC	International Electrotechnical Commission
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineers Society
IESNA	Illuminating Engineers Society of North America
ISA	Instrument Society of America
ISO	International Standards Organization
KBC	Kentucky Building Code
KFC	Kentucky Fire Code
KYOSHA	Kentucky Occupational Safety and Health Administration
MBMA	Metal Building Manufacturer's Association
MSEC	Minnesota State Energy Code
MSS	Manufacturer's Standardization Society of the Valve and Fittings Industry
NAAMA	National Association of Architectural Metal Manufacturer's Metal Bar Grating Manual
NAIMA	North American Insulation Manufacturers Association
NACE	National Association of Corrosion Engineers
NAFM	National Association of Fan Manufacturer's
NBC	National Building Code
NBBPVI	National Board of Boiler and Pressure Vessel Inspectors
NEC	National Electric Code
NEMA	National Electrical Manufacturer's Association
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPI	Plastic Pipe Institute
PFI	Pipe Fabrication Institute
RCRA	Resource Conservation and Recovery Act
RMA	Rubber Manufacturer's Association
SAMA	Scientific Apparatus Manufacturer's Association
SDIS	Steel Deck Institute Standards
SJIS	Steel Joint Institute Standard
SMACNA	Sheet Metal and Air conditioning Contractors National Association
SSPC	Sheet Structures Painting Council
TEMA	Tubular Exchanger Manufacturers Association
TIMA	Thermal Insulation Manufacturers Association
UBC	Uniform Building Code
UL	Underwriters Laboratories
USSG	United States Standard Gauge
40 CFR Part 60	Federal New Source Performance Standards (NSPS)

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Where WFGD Supplier's preferred design, manufacturing and installation procedures and standards differ from the Codes and Standards of the Agreement, then the adopted design basis must be at least equivalent to the designated Codes and Standards.

Adoption of alternative standards shall be subject to Buyer's prior approval. WFGD Supplier shall be consistent in their application of Codes and Standards in execution of the Work.

When requested, WFGD Supplier shall provide one English language copy of such alternative Codes and Standards for Buyer's sole use.

When required by the Codes and Standards, the Work shall be inspected by an independent competent third party. Where no requirement is specified, Buyer shall reserve the right to carry out any inspections or monitoring as necessary.

Where materials are subject to elevated temperature, pressure, or rapid rates of temperature change over time and their selection is not governed by the required Codes and Standards then the design process and the selection of materials shall be justified by WFGD Supplier and approved by Buyer.

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EXHIBIT O

OPTIONS

WFGD Supplier shall provide the options at the firm fixed pricing shown in table 1.

Table 1

Option	Price Impact in US Dollars to As Proposed	Option Validity Date Days After Effective (Award) Date
A) Delete fabrication and delivery of field erected hydrocyclone underflow tanks. This price includes fabricate and deliver to site only, and does not include the price to field erect, nor the price to internally coat those vessels. BPEI retains basic engineering only (capacity requirements & nozzle schedule, as reflected on P&ID's, and BPEI will still supply the agitators and valves and I&C as shown on the P&ID's for each vessel.	Total Deduct ($637,000) Unit 1/2 Vessel $357,000 Unit 4 Vessel $280,000	30 Days Note: Cannot be combined with Option B
B) Add field erection of the hydrocyclone underflow tanks. This price includes field erection of tanks, ladders & platforms, and installation of nozzles, agitators, valves, and I&C as shown on the P&ID's for each vessel. Price does not include internal coating or external finish painting of the vessels. Price includes full time CWI.	Add +$979,250 Unit 1/2 Vessel $548,800 Unit 4 Vessel $434,250	60 Days Note: Cannot be combined with Option A

EXHIBIT R

Rates

WFGD Supplier labor hourly rates for employees and temporary personnel performing agreed to changes in the Work shall be compensated in accordance with the Rates schedule below.

A fixed General and Administrative multiplier of [redacted] shall be applied to such Rates.

RATES:

Personnel Classification:	[redacted]
Project Manager	
Project Engineer	
Engineer	
Designer	
Project Scheduler	
Project Controller	
Field Construction Engineer	
Field Service Engineer	
Purchasing	
Document Control / Clerical	
Quality Assurance	
Expeditor	

Notes:

Rates specified are for WFGD Supplier's Fiscal Years. WFGD Supplier's Fiscal Year runs from October 1st to September 30th.

An example of how the rate for a given engineer is determined for the overall billing to LG&E is as follows:

[redacted]

Overhead costs included in the Hourly Billing Rates include, but are not limited to:

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1. Fringe and other employee benefits
2. Vacation/Holiday
3. Depreciation (furniture and fixtures, personal computers)
4. Facility Cost (utilities, telephone, maintenance, rent, taxes)
5. Human Resource (training, relocation, new hire)
6. Supervision, secretarial
7. Office supplies
8. Professional services
9. Overhead Travel
10. Other costs and expense

Additional overhead costs included in the Hourly Billing Rates related to Engineering:

1. Information Technology (Cad, Fluent, scheduling software)
2. Engineering risk
3. Professional technical support (staff, consulting)

All functional support services cost are included in the General & Administrative (G&A) Multiplier. Examples of those services are:

(a) Finance (treasury, accounting, tax)
(b) Legal, Contract administration
(c) Selling and Marketing
(d) Senior Management including holding company administrative cost
(e) Human Resources
(f) Information Systems
(g) Corporate Expenses (auditing, insurance)
(h) Research and Development (laboratory, test facility)
(i) Business Facility Administration

B. FIELD ENGINEERING SERVICE REPRESENTATIVE

1. Transportation, including air, train, bus, rental car, or taxi will be billed at cost.
2. Notwithstanding, Field Service Engineering rates do not include living expenses, telephone, or other miscellaneous costs, which are billable at $135 per day.

[redacted] by multiplying the Subcontractor receipt cost plus WFGD

D. OTHER WFGD SUPPLIER EXPENSES

Travel and Relocation. The costs of reasonable travel, relocation, lodging, meals, per diem and other travel expenses to be billed at actual cost.

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EXHIBIT S
SITE AND SITE CONDITIONS

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MSS-1 Site Data

Two (2) FGD systems are to be supplied to Mill Creek, one (1) to serve Units 1 and 2 and one (1) to serve Unit 4. Refer to the following arrangement drawings for layout information and equipment boundaries.

Mill Creek– Site Plot Plan	Dwg No. 173465-MCDS-1000, Rev. D
Mill Creek– Site Arrangement – Units 1 & 2	Dwg No. 173465-MCDS-1001, Rev. D
Mill Creek– Site Arrangement – Units 3 & 4	Dwg No. 173465-MCDS-1002, Rev. D

All four boilers fire high sulfur, western Kentucky, bituminous coal from the Illinois Basin and use natural gas for startup fuel.

Gypsum, a scrubber by-product, produced at Mill Creek is either stored in the on-site landfill or sold for use in manufacture of wall board for the home construction industry.

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The following is a summary of basic project information:

- Project Name: Mill Creek Air Compliance – WFGD EPA
- Client/Buyer: Louisville Gas & Electric Company (LG&E)
- Operator: Louisville Gas & Electric (LG&E)
- Project Site Address: 14660 Dixie Hwy., Louisville, KY 40272

Existing Facilities Data:

- Existing On Site Generation Units:
  - Unit 1 - 330 gross MW
  - Unit 2 - 330 gross MW
  - Unit 4 - 525 gross MW
- Existing Air Quality Control Equipment:
  - Unit 1 - Low NOx Burners (LNBs), Overfire Air System (OFA), Cold-side Dry Electrostatic Precipitator (ESP)
  - Unit 2 - LNBs, OFA, Cold-side Dry ESP
  - Unit 4 - LNBs, SCR, Cold-side Dry ESP
- Site Access: Site is located in Jefferson County, Louisville, Kentucky, on the east side of the Ohio River, approximately 10.5 miles southwest of the city of Louisville, near Meadowlawn with access on Lee Driveway off of Dixie Highway (US 60).
- Site Elevation 460 ft. MSL
- Fuel High Sulfur Western Kentucky Bituminous Coal from Illinois Basin, Natural Gas for startup

Additional design criteria:
Plant design is based on the criteria listed in the following table.

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 MSS-2

This table summarizes the meteorological data applicable to plant design.

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Meteorological (Ambient and Extreme) Data		
Design Parameter	**Design Value**	**Units**
Design Wind Speed	90*(C, I)	mph
Structural 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
Frost Depth (50 Year Recurrence)	32(C)	inches
Snow Load – Ground, p_g	15(I)	lb/ft^2
Snow Importance Factor, I_s	1.1(E)	
Open Structure Icing Design Conditions	0.75 inches ice thickness with 30 mph concurrent wind speed(I)	
Freeze Protection Design Conditions	-23.1°F (H) DB with 8.3 (F) mph coincident wind	
Importance Factor (Ice Loads – Ice Thickness), I_i	1.25	
Importance Factor (Ice Loads – Concurrent Wind), I_w	1.0	
Annual Barometric Pressure, adjusted to site elevation	29.49(C)	in. Hg
Design Ambient Temp (Extreme High)	105.4 DB(H)	°F
Design Ambient Temp (Extreme Low)	-23.1 DB(H)	°F
Design Annual Average Ambient Temp	56.9(B)	°F

This table summarizes Seismicity parameters applicable to plant design. Table references are to ASCE 7 as referenced by the Kentucky Building Code.

Seismicity Data	
Design Parameter	**Value**
Building Code	2007 Kentucky Building Code (IBC 2006 as specifically amended)
Seismic Importance Factors	1.25
Site Class (based on assumed soil profile)	D
Seismic Design Category (SDC) (from Table 11.6-2)	C

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MSS-2 Coal Analysis

The following table depicts Performance Fuel specification (for use in applying correction curves in the Performance Tests) and the range of properties of coals used in the Units (the WFGDs are to be designed for this entire range):

		Performance Fuel (Bituminous)	Project Fuel Range	
			Min	Max
Coal Data Sheet	Units			
Coal Source:	Coal Mine			
Date Sample Taken:	Date			
Coal Ultimate Analysis	As Received	As Received		
Carbon (C)	Wt%	61.20	42.00	76.00
Hydrogen (H)	Wt%	4.28	2.31	5.70
Oxygen (O2)	Wt%	6.89	0.84	9.50
Nitrogen (N2)	Wt%	1.27	0.13	2.14
Sulfur (S)(composition)	Wt%	3.36	0.59	5.23
Chlorine (Cl)	Wt%	0.16	0.02	0.33
Fluorine (Fl)	Wt%	-	0.01	0.02
Moisture (Water H2O)	Wt%	9.56	5.00	16.00
Ash	Wt%	12.00	5.00	30.00
	Total	100.00		
Wt. % Volatile	Wt%	33.00	26.00	50.00
Wt % Fixed Carbon	Wt%	42.00	27.00	62.00
Higher Heating Value	Btu/lb, As Recvd	11,000	9000	12800
Trace Elements - Coal - As Rec'd	Typical			
Coal Basin Name	-			
Silver	Ppm		0.00	0.00
Arsenic	Ppm	13.00	3.00	23.00
Boron	Ppm		0.00	0.00
Barium	Ppm	74.00	30.00	130.0
Beryllium	Ppm		0.00	0.00
Bromine	Ppm		0.00	0.00
Manganese	Ppm		0.00	0.00
Nickel	Ppm	20.00	10.00	50.00
Lead	Ppm	11.00	5.00	40.00
Antimony	Ppm	1.05	1.00	3.00
Selenium	Ppm	2.94	1.00	4.00
Strontium	Ppm	56.00	20.00	200.00
Cadmium	Ppm	0.65	1.00	3.00
Cobalt	Ppm		0.00	0.00
Chromium	Ppm	23.00	10.00	75.00
Copper	Ppm		0.00	0.00
Germanium	Ppm		0.00	0.00
Mercury	Ppm	0.12	0.10	3.00
Thalius	Ppm		0.00	0.00
Uranium	Ppm		0.00	0.00
Vanadium	Ppm	40	30.00	150.00
Zinc	Ppm	48.00	8.00	100.00
Fluorine	Ppm	98.00	40.00	200.00
Chlorine	Ppm	1600	200.00	3500.00
Additional Trace Elements				
Magnesium	Ppm	684.00	200.00	1500.00
Mineral Analysis from Coal				
Silica, SiO_2	Wt%	45.88	31.00	65.00
Alumina, Al_2O_3	Wt%	21.69	15.00	50.00

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Titania, TiO_2	Wt%	1.04	0.50	2.00
Iron Oxide, Fe_2O_3	Wt%	21.80	6.00	40.00
Calcium Oxide, CaO	Wt%	2.74	0.38	8.46
Magnesium Oxide, MgO	Wt%	0.91	0.50	1.50
Sodium Oxide, Na_2O	Wt%	0.48	0.20	1.68
Potassium Oxide, K_2O	Wt%	2.33	1.00	10.00
Phosphoric Pentoxide, P_2O_5	Wt%	0.26	0.08	1.20
Sulfur Trioxide, SO_3	Wt%	2.58	0.10	4.77
Strontium Oxide, SrO	Wt%	0.05	0.01	0.40
Barium Oxide, BaO	Wt%	0.07	0.01	0.30
Manganese Oxide, Mn_3O_4	Wt%	0.04	0.01	0.50
Nickel Oxide, NiO	Wt%	-	0.00	0.00
Vanadium Oxide, V_2O_5	Wt%	-	0.00	0.00
Undetermined	Wt%	0.13	0.01	0.70

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MSS-3 Flue Gas Properties (Design Basis)

Revised: 4/19/2012

Mill Creek Design Basis - Full Load 4/19/2012					
Unit Designation	Mill Creek				Reference
	Design	Min	Max	n/a	
Ultimate Coal analysis, as received					Design Fuel Analysis: Microsoft Excel file "Fuel Box TC-Ghent-MC and Brown for Bag house design project June 2011.xlsx" provided to B&V on November 2, 2011. Minimum - Maximum Ranges: Microsoft Excel file "Fuel Box TC-Ghent-MC and Brown for Bag house design project June 2011.xlsx" provided to B&V on November 2, 2011.
Carbon, %	60.00	43.68	80.00		
Hydrogen, %	4.00	2.75	5.70		
Sulfur, %	3.45	0.59	5.23		
Nitrogen, %	1.30	0.13	2.25		
Chlorine, %	0.35	0.02	0.35		
Oxygen, %	5.90	0.64	10.00		
Ash, %	14.00	5.00	30.00		
Moisture, %	11.00	4.00	16.00		
Higher Heating Value, Btu/lb	10,900	9,000	13,400		
Trace Metal Analysis, ppm					
Antimony (Sb)	1.05	1.00	3.00		
Arsenic (As)	13.00	3.00	23.00		
Barium (Ba)	74.00	30.00	130.00		
Cadmium (Cd)	0.65	0.65	3.00		
Chlorine (Cl)	3500.00	200.00	3500.00		
Chromium (Cr)	23.00	10.00	75.00		
Fluorine (F)	98.00	40.00	200.00		
Lead (Pb)	11.00	5.00	40.00		
Magnesium (Mg)	684.00	200.00	1500.00		
Mercury (Hg)	0.12	0.10	3.00		
Nickel (Ni)	20.00	10.00	50.00		
Selenium (Se)	2.94	1.00	4.00		
Strontium (Sr)	56.00	20.00	200.00		
Vanadium (V)	40.00	30.00	150.00		
Zinc (Zn)	48.00	8.00	100.00		
Ash Analysis, % by mass					
Alumina (Al2O3)	21.69	15.00	50.00		
Barium Oxide (BaO)	0.07	0.01	0.30		
Lime (CaO)	2.74	0.38	8.46		
Iron Oxide (Fe2O3)	21.80	6.00	40.00		
Magnesia (MgO)	0.91	0.50	1.50		
Manganese Oxide (Mn3O4)	0.04	0.01	0.50		
Phosphorous Pentoxide (P2O5)	0.26	0.08	1.20		
Potassium Oxide (K2O)	2.33	1.00	10.00		
Silica (SiO2)	45.88	31.00	65.00		
Sodium Oxide (Na2O)	0.48	0.20	1.68		
Strontium Oxide (SrO)	0.05	0.01	0.40		
Sulfur Trioxide (SO3)	2.58	0.10	4.77		
Titania (TiO2)	1.04	0.50	2.00		
Undetermined	0.12	0.01	0.70		

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MSS-3 Mill Creek Design Basis - Full Load 4/19/2012					
Unit Designation	Mill Creek				Reference
	1	2	1 & 2 Combined	4	
Unit Characteristics					Black & Veatch Air Quality Control Global Purchase Program - Phase II Work for Louisville Gas & Electric/Kentucky Utilities
Gross Turbine Generator Output, MW	330	330	660	525	
Boiler Efficiency, % (HHV)	85.38	85.38	85.38	86.45	
Boiler Heat Input, MBtu/hr (HHV)	3,224	3,311	6,535	5,122	
Coal Flow Rate, lb/hr	295,780	303,761	599,541	469,908	
Capacity Factor, %					
Fly Ash Portion of Total Ash, %	80.0	80.0	80.0	80.0	
Excess Air, %	20.0	20.0	20.0	20.0	
SCR System Leakage, %	——	——	——	2.0	
Air Heater Leakage, %	10.0	10.0	10.0	10.0	
ESP Leakage, %	5.0	5.0	5.0	5.0	
PJFF Leakage, %	3.00	3.00	3.00	3.00	
Scrubber Inlet Conditions					
Flue Gas Condition					
Temperature, F	362.55	362.55	362.55	356.92	
Pressure, in. w.g.	11.00	11.00	11.00	11.00	
Molecular Weight, lb/lbmol	29.51	29.51	29.51	29.50	
Flue Gas Mass Flow Rates (lb/hr)					
Oxygen, O2	249,115	255,954	505,183	423,417	
Nitrogen, N2	2,680,670	2,754,404	5,438,434	4,352,181	
Carbon Dioxide, CO2	647,162	664,626	1,311,788	1,028,153	
Sulfur Dioxide, SO2	20,388	20,938	41,326	32,391	
Chlorine, Cl	1,035	1,063	2,098	1,645	
Total Dry Flue Gas	3,598,370	3,696,986	7,296,830	5,837,786	
Moisture, H2O	180,283	185,170	365,474	287,883	
Total Wet Flue Gas	3,778,653	3,882,156	7,662,304	6,125,669	
Volumetric Flue Gas Flow Rates (acfm)					
Oxygen, O2	76,917	79,028	155,980	129,839	
Nitrogen, N2	940,580	966,451	1,907,508	1,516,616	
Carbon Dioxide, CO2	145,283	149,204	294,487	229,233	
Sulfur Dioxide, SO2	3,144	3,229	6,373	4,961	
Chlorine, Cl	144	148	292	228	
Total Dry Flue Gas	1,166,068	1,198,061	2,364,641	1,880,877	
Moisture, H2O	98,870	101,550	200,433	156,799	
Total Wet Flue Gas	1,264,939	1,299,611	2,565,074	2,037,676	
Flue Gas Composition (% wet volume)					
Oxygen, O2	6.08	6.08	6.08	6.37	
Nitrogen, N2	74.36	74.36	74.36	74.43	
Carbon Dioxide, CO2	11.49	11.48	11.48	11.25	
Sulfur Dioxide, SO2	0.25	0.25	0.25	0.24	
Chlorine, Cl	0.01	0.01	0.01	0.01	
Total Dry Flue Gas	92.18	92.19	92.19	92.30	
Moisture, H2O	7.82	7.81	7.81	7.70	
Total Wet Flue Gas	100.00	100.00	100.00	100.00	
Particulate Matter @ Scrubber Inlet					
Mass Flow Rate, lb/hr	32	33	65	51	
Concentration, lb/MBtu	0.0099	0.0100	0.0099	0.0100	
Concentration, gr/acf	0.0030	0.0030	0.0030	0.0029	
HCl @ Scrubber Inlet					Mass Flow Rate = ((Chlorine ppm in fuel analysis) / 1,000,000) x (Coal Flow Rate) x (HCl molecular weight / Cl molecular weight)
Mass Flow Rate, lb/hr	1,064	1,093	2,158	1,691	
Concentration, lb/MBtu	0.3301	0.3301	0.3301	0.3301	
SO3 @ Scrubber Inlet					Assumptions of 1% SO2 to SO3 conversion in boiler, SCR - 2% conversion (if equipped), each air heater and ESP - 25% reduction (if equipped). Effects of existing mitigations systems not included
Mass Flow Rate, lb/hr	143	147	291	683	
Concentration, lb/MBtu	0.0445	0.0445	0.0445	0.1334	
Concentration, ppmvw @ actual O2	14	14	14	41	
H2SO4 @ Scrubber Inlet					Conversion of SO3 to H2SO4 through the use of the H2SO4/SO3 molecular weight ratio
Mass Flow Rate, lb/hr	176	180	356	837	
Concentration, lb/MBtu	0.0545	0.0545	0.0545	0.1634	
Concentration, ppmvw @ actual O2	14	14	14	41	

MSS-3 Mill Creek Design Basis - Low Load 4/19/2012					
Unit Designation	Mill Creek				Reference
	Design	Min	Max	n/a	
Ultimate Coal analysis, as received					
Carbon, %	60.00	43.68	80.00		
Hydrogen, %	4.00	2.75	5.70		
Sulfur, %	3.45	0.59	5.23		
Nitrogen, %	1.30	0.13	2.25		
Chlorine, %	0.35	0.02	0.35		
Oxygen, %	5.90	0.84	10.00		
Ash, %	14.00	5.00	30.00		
Moisture, %	11.00	4.00	16.00		
Higher Heating Value, Btu/lb	10,900	9,000	13,400		
Trace Metal Analysis, ppm					
Antimony (Sb)	1.05	1.00	3.00		
Arsenic (As)	13.00	3.00	23.00		
Barium (Ba)	74.00	30.00	130.00		
Cadmium (Cd)	0.65	0.65	3.00		
Chlorine (Cl)	3500.00	200.00	3500.00		
Chromium (Cr)	23.00	10.00	75.00		
Fluorine (F)	98.00	40.00	200.00		**Design Fuel Analysis:** Microsoft Excel file "Environmental Compliance Proj quality data.xlsx" provided to B&V in May 2010.
Lead (Pb)	11.00	5.00	40.00		
Magnesium (Mg)	684.00	200.00	1500.00		**Minimum - Maximum Ranges:** LG&E/KU Fuel Box Data for Mill Creek, Ghent, Trimble County, and Brown, "*Fuel Box TC-Ghent-MC and Brown for Bag house design project June 2011.xls*"
Mercury (Hg)	0.12	0.10	3.00		
Nickel (Ni)	20.00	10.00	50.00		
Selenium (Se)	2.94	1.00	4.00		
Strontium (Sr)	56.00	20.00	200.00		
Vanadium (V)	40.00	30.00	150.00		
Zinc (Zn)	48.00	8.00	100.00		
Ash Analysis, % by mass					
Alumina (Al2O3)	21.69	15.00	50.00		
Barium Oxide (BaO)	0.07	0.01	0.30		
Lime (CaO)	2.74	0.38	8.46		
Iron Oxide (Fe2O3)	21.80	6.00	40.00		
Magnesia (MgO)	0.91	0.50	1.50		
Manganese Oxide (Mn3O4)	0.04	0.01	0.50		
Phosphorous Pentoxide (P2O5)	0.26	0.08	1.20		
Potassium Oxide (K2O)	2.33	1.00	10.00		
Silica (SiO2)	45.88	31.00	65.00		
Sodium Oxide (Na2O)	0.48	0.20	1.68		
Strontium Oxide (SrO)	0.05	0.01	0.40		
Sulfur Trioxide (SO3)	2.58	0.10	4.77		
Titania (TiO2)	1.04	0.50	2.00		
Undetermined	0.12	0.01	0.70		

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MSS-3 Mill Creek Design Basis - Low Load 4/19/2012					
Unit Designation	**Mill Creek**				
	1	**2**	**1 & 2 Combined**	**4**	**Reference**
Unit Characteristics					
Gross Turbine Generator Output, MW	83	83	83	131	
Boiler Efficiency, % (HHV)	83.34	83.60	83.34	85.19	
Boiler Heat Input, MBtu/hr (HHV)	806	828	806	1,281	
Coal Flow Rate, lb/hr	73,945	75,963	73,945	117,523	
Capacity Factor, %					
Fly Ash Portion of Total Ash, %	80.0	80.0	80.0	80.0	
Excess Air, %	95.0	95.0	95.0	95.0	
SCR System Leakage, %	——	——	——	2.0	
Air Heater Leakage, %	10.0	10.0	10.0	10.0	
ESP Leakage, %	5.0	5.0	5.0	5.0	
PJFF Leakage, %	3.0	3.0	3.0	3.0	
Scrubber Inlet Conditions					
Flue Gas Condition					
Temperature, F	318.29	312.26	318.29	271.70	
Pressure, in w g	1.71	1.71	1.71	1.71	
Molecular Weight, lb/lbmol	29.23	29.23	29.23	29.22	
Flue Gas Mass Flow Rates (lb/hr)					
Oxygen, O2	186,589	191,682	186,589	307,371	
Nitrogen, N2	1,083,268	1,112,837	1,083,268	1,757,604	
Carbon Dioxide, CO2	161,791	166,207	161,791	257,139	
Sulfur Dioxide, SO2	5,097	5,236	5,097	8,101	
Chlorine, Cl	259	266	259	411	
Total Dry Flue Gas	1,437,004	1,476,227	1,437,004	2,330,626	
Moisture, H2O	51,555	52,962	51,555	82,502	
Total Wet Flue Gas	1,488,559	1,529,190	1,488,559	2,413,128	Black & Veatch Air Quality Control Global Purchase Program - Phase II Work for Louisville Gas & Electric/Kentucky Utilities
Volumetric Flue Gas Flow Rates (acfm)					
Oxygen, O2	55,768	56,847	55,768	86,366	
Nitrogen, N2	367,933	375,048	367,933	561,217	
Carbon Dioxide, CO2	35,159	35,839	35,159	52,532	
Sulfur Dioxide, SO2	761	776	761	1,137	
Chlorine, Cl	35	36	35	52	
Total Dry Flue Gas	459,656	468,545	459,656	701,304	
Moisture, H2O	27,369	27,899	27,369	41,175	
Total Wet Flue Gas	487,025	496,444	487,025	742,480	
Flue Gas Composition (% wet volume)					
Oxygen, O2	11.45	11.45	11.45	11.63	
Nitrogen, N2	75.55	75.55	75.55	75.59	
Carbon Dioxide, CO2	7.22	7.22	7.22	7.08	
Sulfur Dioxide, SO2	0.16	0.16	0.16	0.15	
Chlorine, Cl	0.01	0.01	0.01	0.01	
Total Dry Flue Gas	94.38	94.38	94.38	94.45	
Moisture, H2O	5.62	5.62	5.62	5.55	
Total Wet Flue Gas	100.00	100.00	100.00	100.00	
Particulate Matter @ Scrubber Inlet					
Mass Flow Rate, lb/hr	8	8	8	13	
Concentration, lb/MBtu	0.0099	0.0097	0.0099	0.0101	
Concentration, gr/acf	0.0019	0.0019	0.0019	0.0020	
HCl @ Scrubber Inlet					
Mass Flow Rate, lb/hr	266	273	265	423	Mass Flow Rate = ((Chlorine ppm in fuel analysis) / 1,000,000) x (Coal Flow Rate) x (HCl molecular weight / Cl molecular weight)
Concentration, lb/MBtu	0.3301	0.3301	0.3301	0.3301	
SO3 @ Scrubber Inlet					
Mass Flow Rate, lb/hr	36	37	36	171	Assumptions of 1% SO2 to SO3 conversion in boiler, SCR - 2% conversion (if equipped), each air heater and ESP - 25% reduction (if equipped). Effects of existing mitigations systems not included
Concentration, lb/MBtu	0.0445	0.0445	0.0445	0.1334	
Concentration, ppmw @ actual O2	9	9	9	26	
H2SO4 @ Scrubber Inlet					
Mass Flow Rate, lb/hr	44	45	44	209	Conversion of SO3 to H2SO4 through the use of the H2SO4/SO3 molecular weight ratio
Concentration, lb/MBtu	0.0545	0.0545	0.0545	0.1634	
Concentration, ppmw @ actual O2	9	9	9	26	

MSS-4 Limestone Analysis
Revised: 4/19/2012

Mill Creek Limestone Properties		
Dry Basis, Percent (%) by Weight	**Nominal**	**% Guaranteed[1]**
Calcium Carbonate, $CaCO_3$	93%	90% minimum
Magnesium Carbonate, $MgCO_3$	3%	6% maximum
Silica Dioxide, SiO_2	-	3.5% maximum
Ferric Oxide, Fe_2O_3	-	1.5% maximum
Aluminum Oxide, Al_2O_3	-	4.3% maximum
Total Inerts	4%	7% maximum
Fluorides ppm	500	
Chlorides ppm	550	
Bulk Density Design Basis		
Average Density pcf	109	
Volumetric Sizing pcf	85	
Structural Loading pcf	115	
Angle of Repose degrees	30	
Surcharge Angle degrees	25	
Maximum lump size inches	1¼	

Note:
1. Specifications ("dry" basis) for limestone delivered to the site.

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MSS-5 Water Analysis

Revised: 7/20/2011 Eliminate constituents with no data

Mill Creek Anticipated Water (Clearwell Pond) Analysis Design Basis Water Analysis				
Constituent	**Clearwell Pond (Note 1)**	**Ohio River Water (Service Water)**	**Cooling Tower Unit 3**	**Cooling Tower Unit 4**
Calcium, mg/L as $CaCO_3$	141.79	119	161	183
Magnesium, mg/L as $CaCO_3$	64.46	55	73	81
Sodium, mg/L as $CaCO_3$	57.07	47.7	65.1	73.78
Potassium, mg/L as $CaCO_3$	No data	No data	No data	No data
M-alkalinity, mg/L as $CaCO_3$	113.91	98	125	145
Sulfate, mg/L as $CaCO_3$	93.58	75.9	109.2	124.8
Sulfite, mg/L as $CaCO_3$	No data	No data	No data	No data
Chloride, mg/L as $CaCO_3$	54.91	47.9	59.2	69.09
Nitrate, mg/L as $CaCO_3$	No data	No data	No data	No data
Silica, mg/L as such	5.77	5.1	6.6	6.7
pH (range)	No data	7.7	8	8.2
Specific Conductance, µS/cm	550.88	481	598	689
Temperature (range), °F	No data	No data	No data	No data
Total Suspended Solids	13.65	13	19	10
Total Phosphate, mg/l as PO_4	1.02	0.4	1.3	2.4
Aluminum, mg/L as such	No data	No data	No data	No data
Barium, mg/L as such	No data	No data	No data	No data
Boron, mg/L as such	No data	No data	No data	No data
Cadmium, mg/L as such	No data	No data	No data	No data
Chromium, mg/L as such	No data	No data	No data	No data
Copper, mg/L as such	0.17	0.14	0.28	0.13
Iron, mg/L as such	0.71	0.74	0.83	0.49
Manganese, mg/L as such	0.07	0.07	0.07	0.05
Nickel, mg/L as such	No data	No data	No data	No data
Strontium, mg/L as such	No data	No data	No data	No data
Zinc, mg/L as such	0.08	0.07	0.16	0.04

Note:
1. WFGD makeup water source is from Clearwell Pond. The ratio mixture of WFGD makeup water is Service Water: Cooling Tower Blowdown Unit 3: Cooling Tower Unit 4 = 0.57 : 0.215 : 0.215

References:
- GE Power & Water "Water Analysis Report" to LG&E, Sampled date: 04-AUG-2010.

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MSS-6 Equipment Closed Cooling Water Analysis

Revised: 8/18/2011

Mill Creek Anticipated Closed Cooling Water Analysis Design Basis Water Analysis	
Constituent	**Range[1]**
Total Hardness, mg/L as $CaCO_3$	<1 – 44
Calcium, mg/L as $CaCO_3$	0.5 – 30
Magnesium, mg/L as $CaCO_3$	<0.5 – 14
Sodium, mg/L as $CaCO_3$	29.9 – 115.5
M-alkalinity, mg/L as $CaCO_3$	25 – 111
P-alkalinity, mg/L as $CaCO_3$	0 – 22
Sulfate, mg/L as $CaCO_3$	<5.2 – 43.7
Chloride, mg/L as $CaCO_3$	0.7 – 12.7
Silica, mg/L as such	<0.5 – 2.6
pH	7.3 – 9.7
Specific Conductance at 25°C, µS/cm	110 – 221
Copper, mg/L as such	0.82 – 6.5
Iron, mg/L as such	0.71 – 3.3
Molybdenum, mg/L as such	1.3 – 4.5
Total Phosphate, mg/L as such	3.1 – 17.4

Note:

1. The ranges of values were derived from closed cycle cooling water analyses (referenced below) for Units 1, 2, 3, and 4.
2. Values were converted to as $CaCO_3$ as necessary.

References:

· GE Power & Water "Water Analysis Report" to LG&E, Sampled date: 14-DEC-2010.

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MSS-7 Site Drawings

Mill Creek– Site Plot Plan	**Dwg No. 173465-MCDS-1000, Rev. D**
Mill Creek– Site Arrangement -- Units 1 & 2	**Dwg No. 173465-MCDS-1001, Rev. D**
Mill Creek– Site Arrangement -- Units 3 & 4	**Dwg No. 173465-MCDS-1002, Rev. D**


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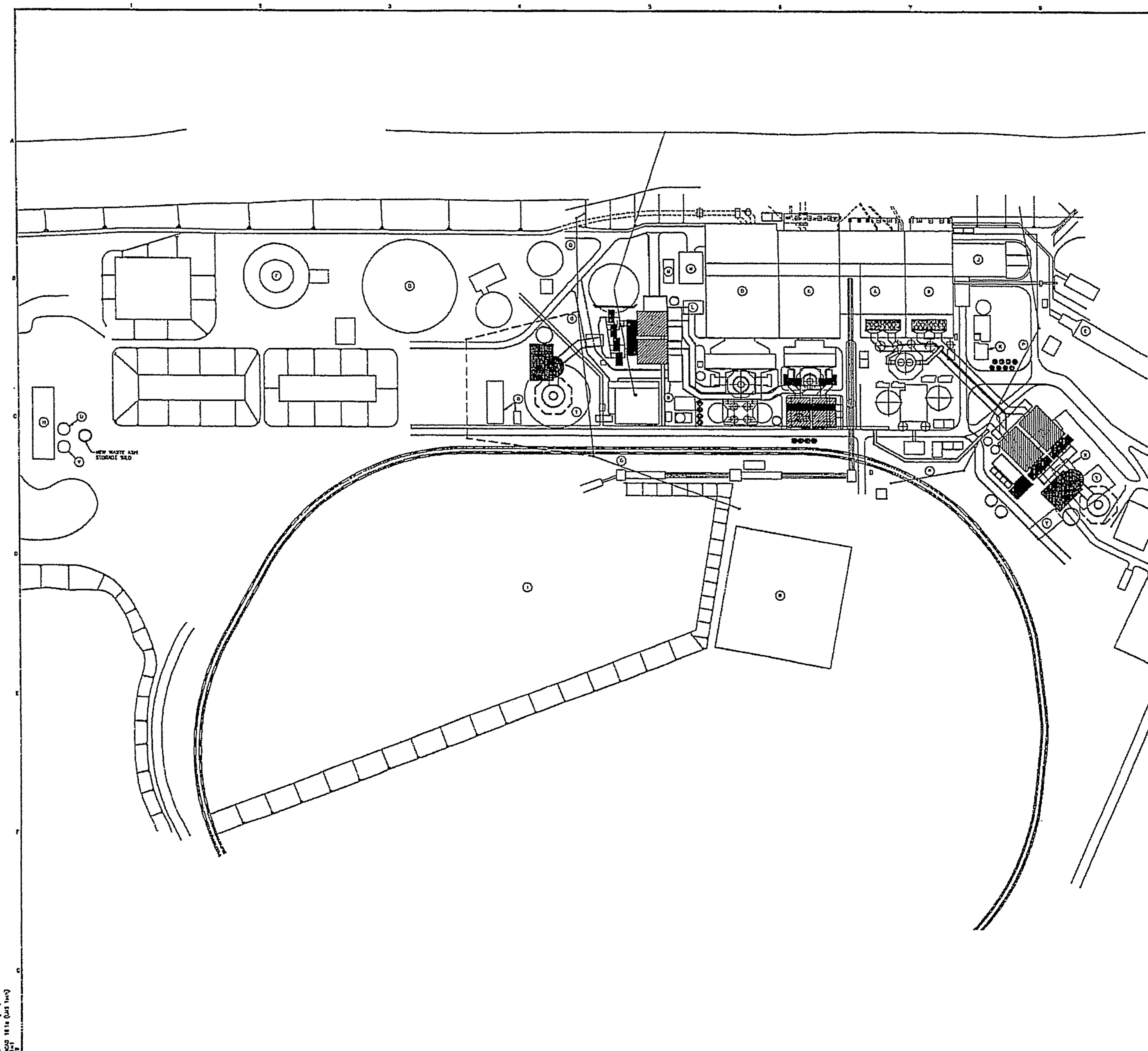


EXISTING FACILITIES LEGEND		
ID	FACILITY	
A	UNIT 1	
B	UNIT 2	
C	UNIT 3	
D	UNIT 4	
E	UNIT 2 COOLING TOWER	
F	UNIT 3 COOLING TOWER	
G	UNIT 4 COOLING TOWER	
H	DEWATERING FACILITY	
I	COAL YARD	
J	WAREHOUSE AND LOADING DOCK	
K	UNIT 1 & 2 AUX BOILER BUILDING	TO BE DEMOLISHED
L	UNIT 4 AUX BOILER BUILDING	TO BE DEMOLISHED
M	ANNEX BUILDING	
N	SAMPLE LAB	
O	AMMONIA STORAGE FACILITY	
P	UNIT 1/2 345KV OVERHEAD TRANSMISSION LINE	RELOCATE IF NECESSARY
Q	UNIT 3/4 345KV OVERHEAD TRANSMISSION LINE	TO BE ELEVATED OR RELOCATED
R	SUBSTATION	
S	UNIT 4 AQCS SWITCHGEAR BLDG	TO BE USED FOR UNIT 3
T	THICKENER BASE	TO BE DEMOLISHED
U	EAST ASH SILO	FOR SALEABLE ASH
V	WEST ASH SILO	FOR WASTE ASH
W	FITNESS & LOCKER ROOM BUILDING	TO BE RELOCATED AND DEMOLISHED
X	TRAINING BUILDING	TO BE RELOCATED AND DEMOLISHED
Y	WAREHOUSE	TO BE RELOCATED AND DEMOLISHED

NOTES:

1. SCALE IS APPROXIMATE. EXISTING SITE WAS TRACED FROM LG&E DRAWINGS 317265-S302, REV Y, AND 317273-S301, REV G.
2. REFER TO SITE ARRANGEMENT DRAWINGS MCGS-1001 AND MCGS-1002 FOR ADDITIONAL DETAIL.
3. ITEMS K (UNIT 1 AND 2 AUX BOILER BUILDING) AND ITEM L (UNIT 4 AUX BOILER BUILDING) WILL NOT BE REPLACED.
4. LOCATION OF RELOCATED FITNESS & LOCKER ROOM BUILDING, TRAINING BUILDING, AND TWO WAREHOUSES (ITEMS W, X, AND Y) TO BE DETERMINED BY LG&E/KU

LEGEND:

BY 85.3120 SUPPLIER

BY 87.8310 SUPPLIER

BY WFGD SUPPLIER

NOT TO BE USED FOR CONSTRUCTION

THE DISTRIBUTION AND USE OF THE NATIVE FORMAT CAD FILE OF THIS DRAWING IS UNCONTROLLED. THE USER SHALL VERIFY TRACEABILITY OF THIS DRAWING TO THE LATEST CONTROLLED VERSION.

NO	DATE	REVISIONS AND RECORD OF ISSUE		
D	17/AUG/11	ADDED WFGD SCOPE OF SUPPLY		
C	11/JUL/11	ADDED FUFF SCOPE OF SUPPLY		
B	24/JUN/11	ISSUED FOR CLIENT REVIEW		
A	22/JUN/11	ISSUED FOR BV-HOUSE REVIEW		

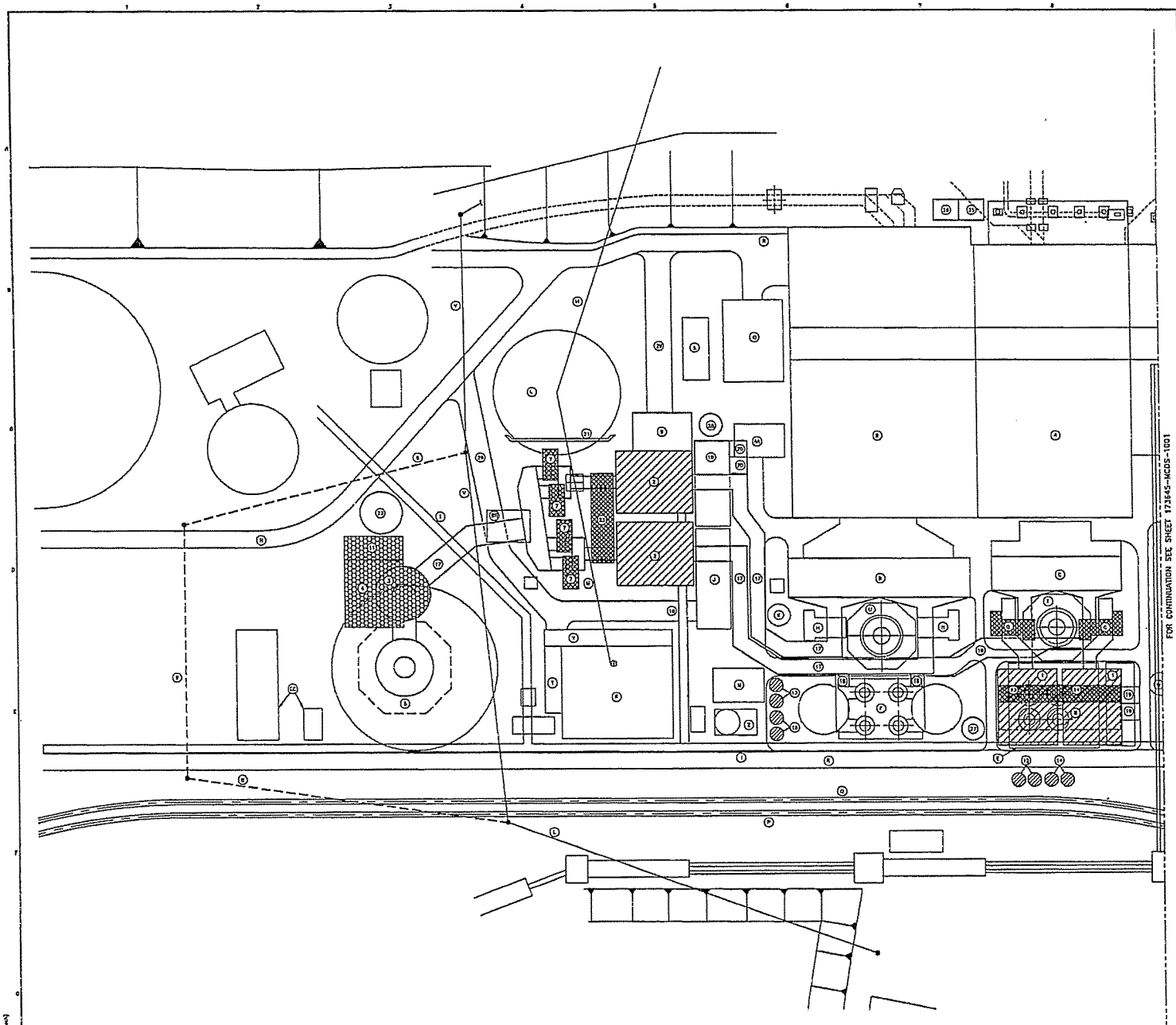
100' 50' 0 100' 200'
SCALE 1"=100'

BLACK & VEATCH CORPORATION

LG&E/KU – MILL CREEK STATION
AIR QUALITY GLOBAL PURCHASE PROGRAM

SITE PLOT PLAN

PROJECT 173465 DRAWING NUMBER MCDS-1000 REV D



EXISTING FACILITIES LEGEND		
ID	FACILITY	REMARKS
A	UNIT 3 BOILER	
B	UNIT 4 BOILER	
C	UNIT 3 ELECTROSTATIC PRECIPITATOR	
D	UNIT 4 ELECTROSTATIC PRECIPITATOR	
E	UNIT 3 WET SCRUBBER	TO BE DEMOLISHED
F	UNIT 4 WET SCRUBBER	TO BE USED FOR UNIT 3
G	UNIT 3 ID FANS	TO BE RELOCATED WITH NEW MOTORS
H	UNIT 4 ID FANS	TO BE DEMOLISHED IF REQUIRED
I	FLY ASH/REAGENT PIPERACK	
J	UNIT 4 ACCS ENTRENCHAM BUILDING	TO BE USED FOR UNIT 3
K	REAGENT PREPARATION BUILDING	
L	LIMESTONE PILE	
M	LIMESTONE CONVEYOR	
N	DESICATION AIR BUILDING	
O	ANNEX BUILDING	
P	COAL DELIVERY RAIL LOOP	
Q	OUTSIDE RAIL LOOP	
R	PLANT ROADS	RELOCATE OR ABANDON AS SHOWN
S	SAMPLE LAB	
T	UNIT 3 CHIMNEY	TO BE ABANDONED IN PLACE
U	UNIT 4 CHIMNEY	TO BE USED FOR UNIT 3
V	UNIT 3 & 4 345kV OVERHEAD TRANSMISSION LINE	TO BE ELEVATED OR RELOCATED
W	UNIT 3 FLY ASH TRANSFER TANK	FOR SELLABLE ASH
X	UNIT 4 FLY ASH TRANSFER TANK	FOR SELLABLE ASH
Y	REAGENT BUILDING ADDITIONS	
Z	UNIT 4 HYDROCYCLONE AND TRANSFER TANK	TO BE USED BY UNIT 3
AA	UNIT 4 AUX BOILER BUILDING	TO BE DEMOLISHED
BB	FLOCCULENT FEED BUILDING	TO BE DEMOLISHED
CC	AMMONIA STORAGE FACILITY	

NEW FACILITIES LEGEND		
ID	FACILITY	REMARKS
1	UNIT 3 PULSE JET FABRIC FILTER (PJFF)	
2	UNIT 4 PULSE JET FABRIC FILTER (PJFF)	
3	UNIT 4 WFGD MODULE	
4	UNIT 4 WFGD PUMP BUILDING	
5	UNIT 4 CHIMNEY	
6	RELOCATION OF OVERHEAD TRANSMISSION LINE	ALTERNATE TO ELEVATING T-LINE
7	UNIT 4 ID FANS	
8	UNIT 3 FLY ASH TRANSFER EQUIPMENT AREA	BENEATH PJFF
9	UNIT 4 FLY ASH TRANSFER EQUIPMENT AREA	
10	UNIT 4 ACC ELECTRICAL BUILDING	
11	UNIT 4 WFGD AREA ELECTRICAL BUILDING	
12	UNIT 3 SORBENT SILOS AND TRANSFER EQUIPMENT	
13	UNIT 4 SORBENT SILOS AND TRANSFER EQUIPMENT	
14	UNIT 3 PAC SILOS AND TRANSFER EQUIPMENT	
15	UNIT 4 PAC SILOS AND TRANSFER EQUIPMENT	
16	UNIT 3 EXHAUST DUCT	
17	UNIT 4 EXHAUST DUCT	
18	UNIT 4 FLY ASH PIPE RACK	
19	UNIT 3 13.8x4.16kV TRANSFORMERS	
20	UNIT 4 13.8x4.16kV TRANSFORMERS	
21	RETAINING WALL AT LIMESTONE PILE	
22	UNIT 4 UNDERFLOW TRANSFER TANK	DUPLEX OUTLOOK, USE AS DEWATER HOLDING TANK
23	FAN VARIABLE FREQUENCY DRIVE ENCLOSURE	
24	UNIT 3 ACC ELECTRICAL BUILDING	BENEATH PJFF
25	UNIT 3 ACC MAIN AUXILIARY TRANSFORMER	
26	UNIT 4 ACC MAIN AUXILIARY TRANSFORMER	
27	UNIT 3 FLY ASH TRANSFER TANK	FOR WASTE ASH
28	UNIT 4 FLY ASH TRANSFER TANK	FOR WASTE ASH
29	NEW OR RELOCATED PLANT ROADS	

NOTES:

1. SCALE IS APPROXIMATE. EXISTING SITE WAS TRACED FROM LG&E DRAWING 317795-A001, REV 14.
2. NEW DUCTWORK WILL BE TIED INTO OUTLET OF EXISTING ESP'S
3. NEW DUCTWORK DOWNSTREAM OF UNIT 3 ID FANS WILL BE ROUTED TO THE EXISTING INLET DUCTWORK AT UNIT 4 SCRUBBER. DUCTWORK DOWNSTREAM OF SCRUBBER TO CHIMNEY WILL NOT BE SIGNIFICANTLY MODIFIED AND IS NOT SHOWN FOR CLARITY.
4. AFTER UNIT 3 IS TIED IN TO UNIT 4 SCRUBBER SYSTEM, THE EXISTING UNIT 3 SCRUBBER WILL BE DEMOLISHED AND THE UNIT 3 PJFF AND NEW MOTORS AND DUCTS FOR THE EXISTING ID FAN INSTALLED. THEN THE ESP OUTLET WILL BE TIED INTO THE PJFF INLET AND THE PJFF OUTLET WILL BE TIED INTO THE ID FAN INLET.
5. SIZE OF PJFFS AND WFGD COMPONENTS TO BE CONFIRMED DURING DETAILED DESIGN.

LEGEND:

BY BECHTEL SUPPLIER

BY WFGD SUPPLIER

BY BECHTEL SUPPLIER

NOT TO BE USED FOR CONSTRUCTION

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FOR CONTINUATION SEE SHEET 173645-MCDS-1001

REV	DATE	REVISIONS AND RECORD OF ISSUE	BY	CHK	APP
D	17/AUG/11	ADDED WFGD SCOPE OF SUPPLY	PRT	JDC	KDH
C	10/JUL/11	ADDED SCOPE OF SUPPLY	PRT	JDC	KDH
B	24/JUN/11	ISSUED FOR CLIENT REVIEW	PRT	JDC	KDH
A	22/JUN/11	ISSUED FOR IN-HOUSE REVIEW	PRT	JDC	KDH

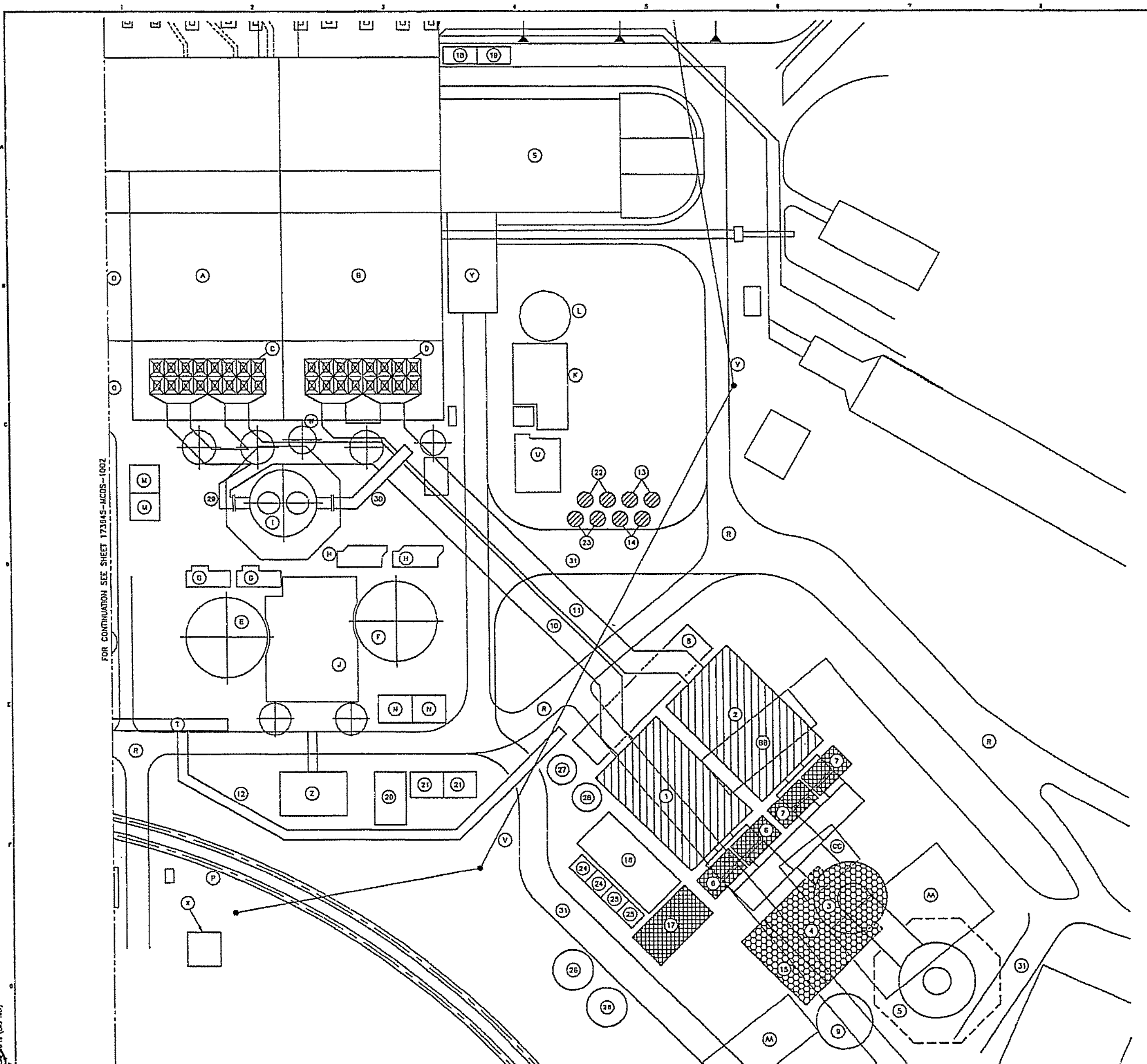
BLACK & VEATCH CORPORATION

LG&E/KU – MILL CREEK STATION
AIR QUALITY GLOBAL PURCHASE PROGRAM

SITE ARRANGEMENT
UNIT 3 AND UNIT 4

DRAWING NUMBER: 173645-MCDS-1002
REV: D

1" = 40'



EXISTING FACILITIES LEGEND		
ID	FACILITY	REMARKS
A	UNIT 1 BOILER	
B	UNIT 2 BOILER	
C	UNIT 1 ELECTROSTATIC PRECIPITATOR	
D	UNIT 2 ELECTROSTATIC PRECIPITATOR	
E	UNIT 1 WET SCRUBBER	
F	UNIT 2 WET SCRUBBER	
G	UNIT 1 BOOSTER FANS	TO BE BYPASSED
H	UNIT 2 BOOSTER FANS	TO BE BYPASSED
I	UNIT 1 & 2 COMMON CHIMNEY	
J	SORS BUILDING	
K	WATER TREATMENT BUILDING	
L	DEMINERALIZATION WATER TANK	
M	STATION RESERVE AUX TRANSFORMERS	
N	UNIT 1/UNIT 2 SCRUBBER TRANSFORMERS	
O	ADMINISTRATION BUILDING	
P	COAL DELIVERY RAIL LOOP	
Q	COAL CONVEYOR	
R	PLANT ROADS	RELOCATE OR ABANDON AS SHOWN
S	WAREHOUSE	
T	FLY ASH/REAGENT PIPERACK	
U	UNIT 1 & 2 AUX BOILER BUILDING	TO BE DEMOLISHED
V	UNIT 1 & 2 345KV OVERHEAD TRANSMISSION LINE	
W	UNIT 1 & 2 FLY ASH TRANSFER TANK	FOR SELLABLE ASH
X	14KV SUBSTATION	IN SWITCHYARD, LOCATION APPROXIMATE
Y	WAREHOUSE LOADING DOCK	
Z	UNIT 1 & 2 OXIDATION BUILDING	
AA	WAREHOUSE	TO BE RELOCATED AND DEMOLISHED
BB	FITNESS & LOCKER ROOM BUILDING	TO BE RELOCATED AND DEMOLISHED
CC	TRAINING BUILDING	TO BE RELOCATED AND DEMOLISHED

NEW FACILITIES LEGEND		
ID	FACILITY	REMARKS
1	UNIT 1 PULSE JET FABRIC FILTER (PJFF)	
2	UNIT 2 PULSE JET FABRIC FILTER (PJFF)	
3	UNIT 1/2 WFGD MODULE	
4	UNIT 1/2 WFGD PUMP BUILDING	
5	UNIT 1/2 CHIMNEY	
6	UNIT 1 ID FANS	
7	UNIT 2 ID FANS	
8	UNIT 1/2 COMMON FLY ASH TRANSFER EQUIPMENT AREA	
9	UNIT 1/2 UNDERFLOW TRANSFER TANK	DURING OUTAGES, USE AS ABSORBER HOLDING TANK
10	UNIT 1 EXHAUST DUCTWORK	
11	UNIT 2 EXHAUST DUCTWORK	
12	EXTENDED FLY ASH/REAGENT PIPERACK	
13	UNIT 1 PAC SILOS AND TRANSFER EQUIPMENT	
14	UNIT 2 PAC SILOS AND TRANSFER EQUIPMENT	
15	UNIT 1/2 WFGD AREA ELECTRICAL BUILDING	
16	UNIT 1/2 COMMON AQC ELECTRICAL BUILDING	
17	FAN VARIABLE FREQUENCY DRIVE ENCLOSURE	
18	UNIT 1 AQC MAIN AUXILIARY TRANSFORMER	
19	UNIT 2 AQC MAIN AUXILIARY TRANSFORMER	
20	AQC RESERVE SWITCHGEAR ENCLOSURE	
21	AQC RESERVE AUXILIARY TRANSFORMER	
22	UNIT 1 SORBENT SILOS AND TRANSFER EQUIPMENT	
23	UNIT 2 SORBENT SILOS AND TRANSFER EQUIPMENT	
24	UNIT 1 13.8-4.16KV TRANSFORMERS	
25	UNIT 2 13.8-4.16KV TRANSFORMERS	
26	TWC WATER TANKS	
27	UNIT 1 FLY ASH TRANSFER TANK	FOR WASTE ASH
28	UNIT 2 FLY ASH TRANSFER TANK	FOR WASTE ASH
29	UNIT 1 HTPA VENT	
30	UNIT 2 HTPA VENT	
31	NEW OR RELOCATED PLANT ROADS	

NOTES:

1. SCALE IS APPROXIMATE. EXISTING SITE WAS TRACED FROM LG&E DRAWING 317290-S301, REV U.
2. EXISTING ID FANS (INSIDE POWERBLOCK) AND BOOSTER FANS WILL BE BYPASSED WITH NEW DUCTWORK EXTENDED FROM ESP TO DOWNSTREAM AQCS.
3. SIZE OF WFGD AND PJFFS TO BE CONFIRMED DURING DETAILED DESIGN.

LEGEND:

- BY 23.3120 SUPPLIER
- BY 27.3310 SUPPLIER
- BY WFGD SUPPLIER

NOT TO BE USED FOR CONSTRUCTION

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NO	DATE	REVISIONS AND RECORD OF ISSUE
D	17/AUG/11	ADDED WFGD SCOPE OF SUPPLY
C	18/JUL/11	ADDED SCOPE OF SUPPLY
B	24/JUN/11	ISSUED FOR CLIENT REVIEW
A	22/JUN/11	ISSUED FOR IN-HOUSE REVIEW

SCALE: 1" = 30'

BLACK & VEATCH CORPORATION

LG&E/KU — MILL CREEK STATION
AIR QUALITY GLOBAL PURCHASE PROGRAM

SITE ARRANGEMENT
UNIT 1 AND UNIT 2

PROJECT / DRAWING NUMBER: 173465-MCDS-1001 REV D

EXHIBIT T
TERMINAL POINTS

The following terminal points define the terminations or the start as the case may be, of WFGD Supplier's scope. Modification to the locations of those terminal points required by Buyer shall be at no additional cost provided that the revised termination is consistent with the Tie-In point definitions below. WFGD Supplier shall include an easily accessible isolation valve at each terminal point for each piping system. Additional or other interface points may be required or available based upon approval by the Buyer.

1 Water

1.1 Service Water

WFGD island limit (single point)

1.2 Deleted

1.3 Deleted

1.4 Reclaim Water (from Clearwell Pond)

WFGD island limit (single point at WFGD Makeup Water header; single point at Mist Eliminator Tank Fill header; single point at Emergency Quench Water header)

1.5 Deleted

1.6 Equipment Cooling Water Supply and Return

WFGD island limit (single point)

2 Electric Power Distribution

The electrical power distribution system will be designed and provided by the Buyer's Engineer. WFGD Supplier shall coordinate with Buyer's Engineer to provide adequate area in his WFGD System layout for 4KV switchgear, 480V power centers/switchgear, 480V motor control centers, UPS systems, LV distribution systems, lighting and aux transformers. Buyer will wire to each electrical device (motor, instrument, etc.) provided by the WFGD Supplier.

The WFGD Supplier shall provide termination equipment, such as terminal strips, lugs, bolts, etc. for the connection of the Buyer's power, control, grounding, instrumentation, and communication cables. The following interfaces shall be provided for the termination of the Buyer's cables:

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- Skid mounted junction boxes, for equipment located on skids, to serve as interface points for external field wiring.
- Junction boxes or terminal boxes on equipment
- Motor terminal boxes
- Buswork, such as grounding buses.

3 Waste Water

3.1 Waste Water – Process Effluent

WFGD island limit (single point at the discharge of the hydrocyclone overflow tank for process purge,)

3.2 Equipment Drains

At each equipment drain

4 Roadways

N/A

5 Limestone Slurry Feed

WFGD island limit (single point)

6 Flue Gas

Inlet to absorber module inlet transition duct; outlet of absorber module.

7 Gypsum Slurry Bleed (Underflow Transfer)

WFGD island limit (single point at the discharge of the underflow tank discharge pumps to the existing (common) dewatering facility.)

8 Stack Drains

WFGD Supplier will provide a single flange at the external absorber wall for a stack drain pipe.

9 Downspouts

WFGD Supplier will provide a tie-in at the Buyer furnished underground drain pipe system.

10 Concrete Wall

N/A

11 Stairs, Ladders, and Access Platforms

Stairs, ladders, and access platforms supplied by WFGD supplier and mounted on absorber will interface with Buyer's stair towers.

12 Controls

All PLC or microprocessor-based control packages shall be capable of remote control and monitoring from the Buyer's Honeywell DCS. If the control package includes 20 or more I/O points, the interface with the DCS shall be through Ethernet communications with all alarm, control and monitoring parameters controllable and retrievable through the interface.

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EXHIBIT U

TRAINING

WFGD Supplier will develop and implement a Job Site-based comprehensive training program for Buyer's experienced operating and maintenance (O&M) personnel to understand the overall integrated operation and maintenance of the SCR System. O&M personnel will be required to pass the training course prior to operating or maintaining the SCR System.

The training program will consist of Job Site classroom training and instruction for Owners' O&M personnel, followed by on-the-job training through Commercial Operation. The level of detail and pace of this training program will be based on the assumption that Owners' personnel being trained have some knowledge and experience with power plants and power plant components and require only orientation to the specific operational requirements of the new Equipment.

Training for Equipment provided in the Mill Creek WFGD Contract will be provided by the WFGD supplier. The EPC Contract shall provide training for the balance of plant Equipment. Training shall be coordinated and scheduled in conjunction with the EPC Supplier's training to provide an overall comprehensive training program for the WFGD system.

Within 6 months after Full Notice To Proceed (FNTP), Contractor will prepare and submit the training program and preliminary schedule to Owners for review. It is expected that classroom training will begin approximately 8 weeks before and complete no later than the start of the Tie-In Outage of the WFGD systems, and Owners should ensure the availability of all nominated personnel requiring training at that time.

Classroom Training

WFGD Supplier's training materials will be based on system descriptions, each containing an operations section with a basic description of systems and equipment operations. WFGD Supplier's training materials will also provide a basic description of several modes of integrated plant operations. The level of detail provided in these materials will address any detailed step-by-step sequence action required by the operators. An alarm response section will address those alarms for which the appropriate operator response may not be obvious.

Lesson Plan Outline

The student's lesson text will incorporate the following elements:

- Course Objectives – what the student is required to learn
- System Overview – what the system does and how it works
- Major Component Description – functional description
- Flow Path and Controls – major flow paths, instrumentation, protective devices, controls, and interlocks

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- Principles of Operation
- Startup, Normal Operation, Shutdown, and Infrequent operation procedures
- Alarm Responses
- Support Systems – systems needed for operations
- Hazards and Safety Features
- Routine Maintenance
- Emergency Procedures
- Figures and Tables (as required)

WFGD Supplier trainers will present those portions of the classroom training that are prepared by WFGD Supplier (approximately 50 percent of the training). The remainder of the classroom training will be presented by the original equipment manufacturers (OEMs), major equipment and system vendors, or subcontractors. WFGD Supplier will arrange for, schedule, and coordinate the classroom training presented by OEMs/subcontractors.

The classroom training provided by the vendors/subcontractors will cover the following equipment and systems:

- WFGD System
- Oxidation Air Blower System
- Mechanical Equipment
- Electrical Equipment
- Distributed Control System
- Auxiliary Systems

Student Evaluations

Up-to-date records reflecting each student's progress, including test results and attendance, will be submitted to Owners upon completion of each training course for review and evaluation.

Materials

WFGD Supplier will provide training materials, manuals, slides, films, and other instructional material as may be necessary for training.

Training aids, such as films, slides, computer presentations, computer-simulated process interactive videos, and software packages/materials, along with supplies necessary to support, maintain, and successfully supplement the training program, will be furnished and then turned over to Owners at completion.

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Facilities

Training will be conducted at the Mill Creek Site or other mutually agreed-on-site location.

On-The-Job Training

The Owner considers on-the-job training an essential part of an overall training program. During the commissioning phase, Owners O&M staff will work closely with the WFGD Supplier's Startup team and the OEM technical advisors. This will give the O&M staff an opportunity to convert knowledge gained in the classroom to practical experience in the plant by assisting with hands-on activities such as preoperational system valve lineups. In addition, the WFGD Supplier will involve Owners operations personnel during the development of the operating procedures and allow active participation in writing detailed sequences of actions required for basic integrated operations, such as cold start to full load, hot restart, normal shutdown, and response to plant abnormal conditions.

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EXHIBIT V

OPERATING AND MAINTENANCE MANUALS

1.0 Operating and Maintenance Manuals Submittal Instructions

1. In addition to electronic Submittals specified in Exhibit X, Equipment instruction books and operating manuals prepared by the each equipment supplier and the WFGD Supplier shall include the following:
   a. Index and tabs.
   b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers.
   c. Matrix of all regularly scheduled maintenance requirements.
   d. Applicable drawings.
   e. Warranties and guarantees.
   f. Name and address of nearest manufacturer-authorized service facility.
   g. All additional data specified.
2. Information listed above shall be bound into hard-back binders. Four manuals are required, two in heavy duty Bok-Hinge Split Prong or McBee Swing Hinge post type binders and two in standard binders. Sheet size shall be 8-1/2" x 11". Binder color shall be black. Capacity shall be a minimum of 1-1/2 inches, but sufficient to contain and use sheets with ease.
   a. Provide the following accessories:
      i. Label holder.
      ii. Business card holder.
      iii. Sheetlifters.
      iv. Horizontal pockets.
   b. The following information shall be imprinted, inserted, or affixed by label on the binder front cover: See Appendix 01330-C for details.
      i. Owner's name.
      ii. Owner's facility or plant name.
      iii. Equipment item name.
      iv. Volume number (if applicable).
      v. Contract number.
      vi. Manufacturer's name and address.
   c. The following information shall be imprinted, inserted, or affixed by label on the binder spine:
      i. Equipment item name.
      ii. Owner's name and Owner's facility or plant name.
      iii. Manufacturer's name.
      iv. Contract number.
      v. Volume number (if applicable).
   d. Submit mockup of cover and spine for Owner's review.

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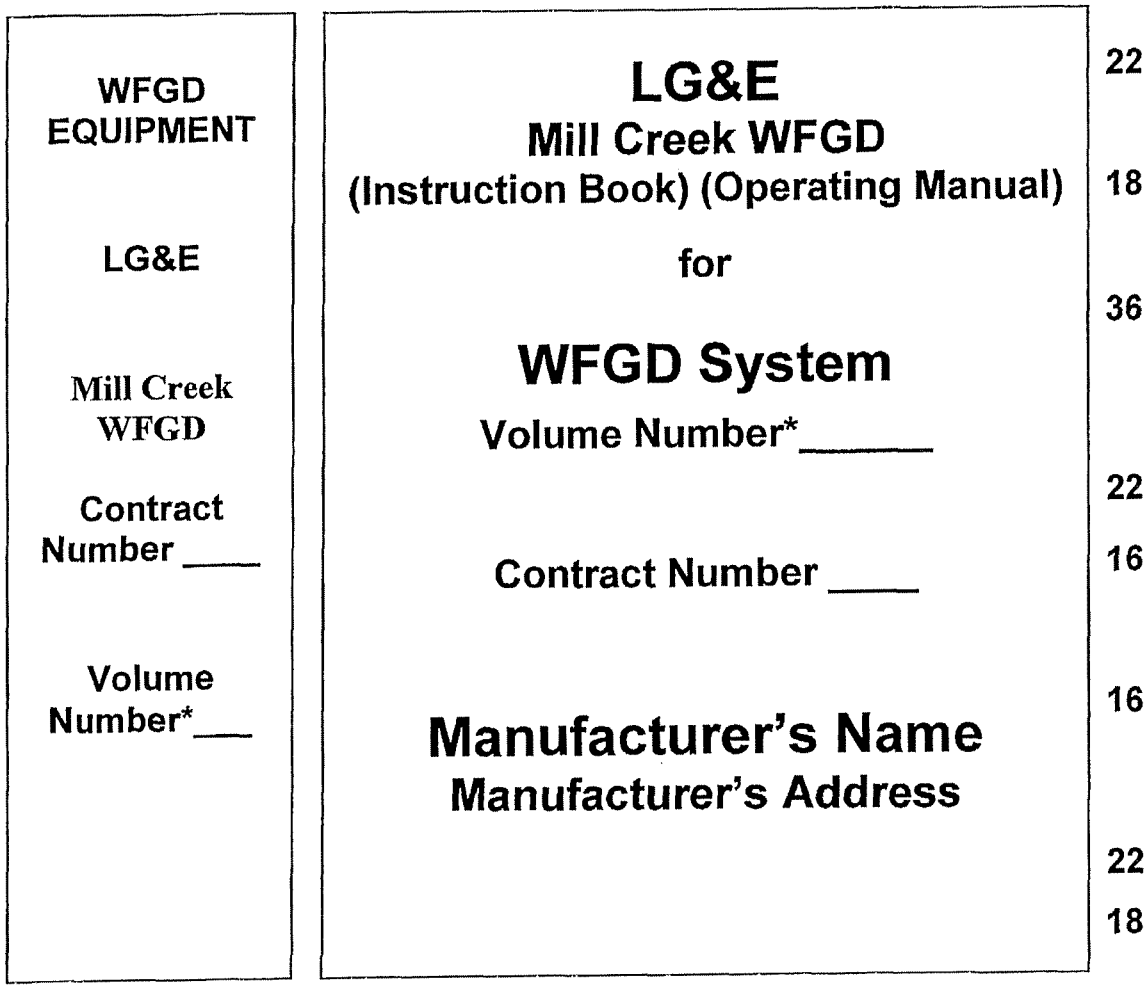
2.0 Typical Instruction Book or Operating Manual Cover and Spine Layout



(Spine) **(Cover)**

NOTES:

1. Choose either "Instruction Book" or "Operating Manual."
2. All lettering shall be a block style font, imprinting color to contract with binder color specified.
3. Cover lettering shall be point sizes indicated in column to right of cover illustration.
4. Spine letter shall be 14-point minimum.
5. *Volume number required only if instructions are contained in more than one volume.

BPEI Note 01/13/12: BPEI accepts Exhibit V as written. Also, for reference, please see attached "Typical" Table of Contents, reflective of a similar effort on a recent LG&E WFGD System.

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EXHIBIT W

WORK BREAKDOWN STRUCTURE

WFGD Supplier shall provide units of property total cost (inclusive of an appropriate allocation of directs and indirects) for Equipment and Materials (the items in this list may be based from the equipment list, motor list, valve list, instrument list, erection quantities or other appropriate technical documents) valued at over twenty-five thousand dollars ($25,000). The sum cost of the items unitized must match the Agreement Price or the total project cost as modified by the Change Order process. The items unitized shall be apportioned per the unit of property categories provided herein Exhibit W.

UNIT OF PROPERTY DESCRIPTION
WFGD Absorber
WFGD Agitators
WFGD Bleed Pumps
WFGD Buildings
WFGD Cranes and Hoists
WFGD Electrical
WFGD Expansion Joints
WFGD Hydrocyclones
WFGD I&C
WFGD Inlet Duct 15'Concrete
WFGD Mist Eliminator Panels
WFGD Model Study
WFGD Outlet Turret & Elbow
WFGD Oxidation Air Blowers
WFGD Pipe,Valves and Hangars
WFGD Recycle Pumps
WFGD Tanks

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EXHIBIT X

Submittals, Reviews, and Hold Points

TABLE OF CONTENTS

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1.0 Submittals

1.01 SUMMARY:

A. This Section includes definitions, descriptions, transmittal, and review of submittals.

B. Related Work Specified Elsewhere:

1. Project meetings, schedules, and reports: Exhibit M of the Agreement.

1.02 GENERAL INFORMATION:

A. Definitions:

1. Select shop drawings (meaning equipment and fabrication requirements for construction, inclusive of arrangement, sub drawings etc. provided inclusive of field requirements for Owner use regarding future operations and maintenance), product data, and Samples are Technical Submittals prepared by Contractor, Subcontractor, manufacturer, or other Persons and submitted by Contractor to Owner as a basis for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties, as specified in each Division of the Specifications.
   a. Shop drawings include custom prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
   b. Product data includes standard printed information on materials, products, and systems; not custom prepared for this Work, other than the designation of selections from available choices.
   c. Samples include both fabricated and un-fabricated physical examples of materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or where indicated for more detailed testing and analysis. Mockups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample Submittals.
2. Informational submittals are those technical reports, administrative submittals, certificates and guarantees not defined as shop drawings, product data, or samples.
   a. Technical reports include laboratory reports, tests, technical procedures, technical records, and Contractor's design analysis.
   b. Administrative submittals are those nontechnical submittals required by the Agreement or deemed necessary for administrative records. These submittals include maintenance agreements, bonds, project photographs, physical work records, statements of applicability, copies of industry standards, project record data, schedules, security/protection/safety data, and similar type submittals.
   c. Certificates and guarantees are those submittals on Equipment and Materials where a written certificate or guarantee from the manufacturer or Contractor is called for in the Technical Specifications.
3. Refer to ARTICLES 1.03 and 1.04 of this Part for detailed lists of submittals and specific requirements.

B. Quality Requirements:

1. Submittals such as drawings and data submitted shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings such as reproducibles shall be useable for further reproduction to yield legible hard copy.
2. Documents submitted that do not conform to the specified requirements shall be subject to rejection by Owner, and upon request, Contractor shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's or its

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Subcontractors' failure to initially satisfy the legibility quality requirements will not relieve Contractor or its Subcontractors from meeting the required schedule for submittals.

C. Language and Dimensions:
   1. All words and dimensional units shall be in the English language.
   2. Metric dimensional unit equivalents may be stated in addition to English units. However, English units of measurement shall prevail.
   3. All words shall be in the English language.

D. Submittal Completeness:
   1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.
   2. Where standard drawings are furnished which cover a number of variations of the general class of equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations which do not apply to the submittal. The use of "highlighting markers" will not be an acceptable means of annotating submittals. Such annotation shall also include proper identification of the submittal permanently attached to the drawing.
   3. Reproduction or copies of Agreement drawings or portions thereof will not be accepted as complete fabrication or erection drawings, but will be acceptable when used by Contractor as a drawing upon which to indicate information on erection or to identify detail drawing references. Whenever the Agreement drawings are revised to show additional Contractor's information, the title block shall be replaced with Contractor's title block, and the professional seal shall be removed from the drawing.

E. Form of Submittals:
   1. Submittals and other project documents shall be transmitted in electronic format as specified.
      a. Electronic format shall include Microsoft Office formats, Adobe *PDF format, Primavera, or AutoCAD.
      b. Selected submittals may be provided in paper ("hardcopy") copies with advance approval of Owner, and using procedures specified herein.
      c. Equipment instruction books and operating manuals shall be provided in paper copies in addition to specified electronic format.
   2. Electronic Format using Owner's Document Management System (DMS):
      a. Scanned submittals and documents are not acceptable. Transmit submittal and project documents in:
         (1) Adobe *PDF files created directly from native electronic format, or
         (2) Owner approved equal.
         (3) Electronic Submittals in .TIF format are permitted only with specific Owner approval.
      b. Each drawing shall be submitted with an electronic file name that is equivalent to the drawing number, and any resubmitted drawing shall use the same file name as the original file name each time. No spaces or periods (except in the file extension) are allowed in the file name.
      c. Contractor submittals shall be accompanied with a completed transmittal letter. Submittals that are not accompanied with an approved transmittal letter will not be accepted and will be returned to Contractor.
      d. All Contractor transmittal letters submitted to Owner shall be in the form supplied and shall contain as a minimum the following information:
         (1) Contractor's Name.
         (2) Project number.
         (3) Agreement number.

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(4) Filename.
(5) Description of the information contained in the specific submittal.
(6) Revision number.
(7) Submittal type.
(8) Date of submittal.

e. Nonconforming submittals are subject to rejection.

3. Owner's review comments will be provided electronically in Adobe *PDF format.
4. Digital delivery media for transmittal of electronic documents and submittals shall be through Owner's DMS in accordance with the procedures specified herein, as addressed below. See Section 5.0 below for more details.

1.03 TECHNICAL SUBMITTALS:

A. Items shall include but not be limited to, the following:
1. Manufacturer's specifications.
2. Catalogs, or parts thereof, of manufactured equipment.
3. Shop fabrication and erection drawings.
4. General outline drawings of equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates.
5. Detailed equipment installation drawings, showing foundation details, anchor bolt sizes and locations, base plate sizes, location of Owner's connections, grounding pads and all clearances required for erection, operation, and disassembly for maintenance.
6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams, and one-line diagrams.
7. Bills of material and spare parts list.
8. Instruction books and operating manuals.
9. Material lists or schedules.
10. Performance tests on equipment by manufacturers.
11. Samples and color charts.
12. All drawings, catalogs, or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary:
a. To determine that Equipment and Materials conform to the design concept and comply with intent of the Agreement.
b. For proper erection, installation, operation, and maintenance of Equipment and Materials which will be reviewed for general content but not for basic details.
c. To determine what supports, anchorages, structural details, connections, and services are required for Equipment and Materials, and effects on contiguous or related structures, Equipment and Materials.

B. Schedule of Submittals:
1. Prepare a schedule for submission of all Submittals specified or necessary for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed for proper installation, operation, or maintenance. Submit the schedule with the Work progress schedule. Schedule submission of all submittals to permit review, fabrication, and delivery in time so as to not cause delay in the Work of Owner or its Subcontractors or any other Person as described herein.
2. In establishing schedule for submittals, allow 20 days in Owner's office for reviewing original submittals and 15 days in Owner's office for reviewing re-submittals.
3. Submittals requiring revisions shall be resubmitted within 15 days after receipt of Owner's review notations.
4. The schedule shall indicate anticipated dates of original submission for each item and shall be based upon at least one resubmission of each item.

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5. Schedule all submittals (shop drawings, product data, and samples), not listed in Section 2 below, required prior to fabrication or manufacture for submission as necessary to meet Agreement delivery requirements.
6. Resubmit submittals the number of times required to be approved. However, any need for re-submittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining approval of submittals, will not be grounds for extension of the schedule.

C. Transmittal of Submittals:
1. All submittals (shop drawings, product data, and samples) for Equipment and Materials furnished by Contractor, Subcontractors, manufacturers, and other Persons shall be submitted to Owner thru the Contractor.
   a. Reports and letters shall be 8.5"x11" unless containing drawings requiring 11"x17" for legibility.
   b. Shop drawings shall be D size and submitted in a rolled fashion unless otherwise agreed by Owner during the Work.
2. Transmit all Submittals to Owner as follows:
   a. Mark each Submittal by project name and number, Agreement title and number, and applicable Technical Specification Section and Article numbers. Include in the letter of transmittal the drawing number and title, sheet number (if applicable), revision letter, and electronic file name (if applicable). Unidentifiable submittals will be returned for proper identification.
   b. Check and approve submittals of Subcontractors, other Persons, and manufacturers prior to transmitting. Contractor's submission shall constitute a representation to Owner that Contractor approves submittals and has determined and verified all design criteria, quantities, dimensions, materials, catalog numbers, compliance with Codes and Standards, and similar data, and Contractor assumes full responsibility for doing so; and Contractor has coordinated each submittal with requirements of the Work and the Agreement.
   c. At the time of each submission, call to attention in the letter of transmittal any deviations from requirements of the Agreement.
   d. Make all modifications noted or indicated and return the required number of revised submittals until approved. Direct specific attention in writing, or on revised submittals, to changes other than the modifications called for by on previous submittals. Previously approved submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the submittal and resubmit for review.
   e. Following completion of the Work and prior to final payment, furnish record documents and approved samples and shop drawings necessary to indicate "as constructed" conditions, including field modifications, in the number of copies specified. Furnish additional copies for insertion in equipment instruction books and operating manuals as required. All such copies shall be clearly marked "PROJECT RECORD."
      (1) Submit a final record copy of the master field drawing list which shall indicate the final revision status of each drawing on the list.
      (2) Accompany submittal with transmittal letter containing date, contract number and title, Contractor's name, address and telephone number, number and title of each record document and signature of Contractor's authorized representative.
3. Quantity Requirements:
   a. Except as otherwise specified, transmit all shop drawings in the following quantities for Owner's use. Additional copies shall also be provided to the Owner as required by the Owner:
      (1) Initial Submittal:
         (a) Electronic - One copy to Owner.

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(b) Paper – Two copies to Owner

(2) Re-submittals:
(a) Electronic - One copy to Owner.
(b) Paper – Two copies to Owner.

(3) Submittal for final distribution:
(a) Paper - Two copies to Owner.
(b) Electronic - One copy to Owner.

(4) As-constructed documents:
(a) Paper - Four copies to Owner.
(b) Electronic - One copy to Owner.

b. Transmit Submittals of product data as follows:
(1) Initial Submittal:
(a) Electronic - One copy to Owner.
(2) Re-submittals:
(a) Electronic - One copy to Owner.
(3) Submittal for final distribution:
(a) Electronic - One copy to Owner.

c. Transmit Submittals of material samples, color charts, and similar items as follows:
(1) Initial Submittal - One to Owner.
(2) Re-submittal - One to Owner.
(3) Upon approval, no sample(s) will be returned to Contractor.

d. Transmit submittals of equipment instruction books and operating manuals as follows:
(1) Initial Submittal:
(a) Electronic - One copy to Owner.
(2) Re-submittals:
(a) Electronic - One copy to Owner.
(3) Submittal for Final Distribution - Six paper copies and one electronic copy to Owner.

e. When all submittals have been updated to "as-constructed" conditions, transmit to Owner in electronic format.

f. Contractor and Owner may copy and use for internal operations and staff training purposes any and all document submittals required by this Agreement and approved for final distribution, whether or not such documents are copyrighted, at no additional cost to Contractor or Owner.

D. Owner's Review:
1. Owner may review submittals for indications of Work or material deficiencies.
2. Owner will respond to the Contractor on submittals which indicate there may be a Work or material deficiency.
3. Contractor shall respond promptly to Owner's comments.
4. Owner's review of shop drawings, product data, or samples will not relieve Contractor of responsibility for any deviation from requirements of the Agreement unless Contractor has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Contractor from responsibility for errors or omissions in submittals.

E. Instruction Books and Operating Manuals:
1. In addition to electronic submittals specified above, equipment instruction books and operating manuals prepared by the each equipment supplier and the Contractor shall include the following:
a. Index and tabs.

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b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers.
c. Matrix of all regularly scheduled maintenance requirements.
d. Applicable drawings.
e. Warranties and guarantees.
f. Name and address of nearest manufacturer-authorized service facility.
g. All additional data specified.

2. Information listed above shall be bound into hard-back binders. Four manuals are required, two equivalent to heavy duty Bok-Hinge Split Prong or McBee Swing Hinge post type binders and two in standard binders. Sheet size shall be 8-1/2" x 11". Binder color shall be black. Capacity shall be a minimum of 1-1/2 inches, but sufficient to contain and use sheets with ease.
   a. Provide the following accessories:
      (1) Label holder.
      (2) Business card holder.
      (3) Sheetlifters.
      (4) Horizontal pockets.
   b. The following information shall be imprinted, inserted, or affixed by label on the binder front cover: See Exhibit V for details.
      (1) Owner's name.
      (2) Owner's facility or plant name.
      (3) Equipment item name.
      (4) Volume number (if applicable).
      (5) Agreement number.
      (6) Manufacturer's name and address.
   c. The following information shall be imprinted, inserted, or affixed by label on the binder spine:
      (1) Equipment item name.
      (2) Owner's name and Owner's facility or plant name.
      (3) Manufacturer's name.
      (4) Agreement number.
      (5) Volume number (if applicable).
   d. Submit mockup of cover and spine for Owner's review.

F. Samples:
   1. Office samples shall be of sufficient size and quantity to clearly illustrate the following:
      a. Functional characteristics of the product, with integrally related parts and attachment devices.
      b. Full range of color, texture, and pattern.
      c. Material, manufacturer, pertinent catalog number, and intended use.

1.04 INFORMATIONAL SUBMITTALS:

A. Informational submittals are comprised of technical reports, administrative submittals, and guarantees which relate to the Work, but do not require Owner approval prior to proceeding with the Work. Informational submittals include but are not limited to:
   1. Test reports.
   2. Certification on materials:
      a. Steel mill tests.
   3. Shipping and/or packing lists.
   4. Job progress schedules.
   5. Equipment and Materials delivery schedules.
   6. Warranties and guarantees.

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B. Transmittal of Informational Submittals:
   1. All informational submittals furnished by Contractor, Subcontractors, manufacturers, and other Persons shall be submitted to Owner unless otherwise specified.
      a. Identify each informational submittal by project name and number, Agreement title and number, and the Technical Specification Section and Article numbers marked thereon or in the letter of transmittal. Unidentifiable submittals will be returned for proper identification.
      b. At the time of each submission, call to the attention of Owner in the letter of transmittal any deviations from the requirements of the Agreement.
   2. Quantity Requirements:
      a. Technical reports and administrative submittals except as otherwise specified:
         (1) Electronic: One to Owner.
   3. Test Reports:
      a. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports as follows:
         (1) Owner: One copy.
         (2) Contractor: One copy.

C. Owner's Review:
   1. Owner may review informational submittals for indications of Work or material deficiencies.
   2. Owner will respond to the Contractor on those informational submittals which indicate Work or material deficiency.
   3. Contractors shall respond promptly to any identified deficiencies.

2.0 Submittal Schedule

A. Commercial

Submittals, Review and Hold Points

Effective Date: 5/1/2012

Estimated First Shipment Date:
Project Delivery Date:

The list is not all-inclusive. There are more requirements for Supplier to "provide notice," to "advise," to "update," to "inform," etc., or to "submit" should a condition precedent occur. These have not been included in the list. It will however remain Supplier's responsibility to comply with the submittal requirements whether or not the submittal is actually included on the following:

Item No.	Reference Document	Submittals Item	Submittal Dates					Bidder Complies Yes/No
			Calendar		Event	Due Date	LD's apply ?	
1	0	Commercial						
2	0	Certificate of Insurance	0	At	Effective Date	5/1/2012		Y
3	0	Intl' Transportation Insurance Certificate		With/ 45 Days Prior	Shipping Documents/ Shipment			Y
4	0	Acknowledge Acceptance and Return of Contract	30	After	Receipt of Contract			Y
5	0	Performance Bond	30	After	Effective Date	5/31/2012		Y

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6	0	Letter of Credit	30	After	Effective Date	5/31/2012		Y
7	0	Notice of any Cancellation, Termination or Material Changes of Insurance Policies	30	Before	Cancellation or Change			
8	0	Project Organizational Chart, Including key personnel resumes		Through out	Project duration			Y
9	0	Installation & Commissioning Spare Parts List	120	Before	Startup			Y
10	0	Recommended Two-Year Operational Spare Parts List	120	Before	Startup			Y
11	0	Catalog Data Sheets with Dimensions						
12	0	Standard Training Classes						
13	0	Training Agenda, Schedule, Outline and Materials	60	Before	Training			Y
14	0	Preliminary Work Progress Schedule	60	After	Effective Date	6/30/2012		Y
15	0	Work Progress Schedule	30	After/ Monthly	Effective Date/ Thereafter	5/31/2012		Y
16	0	Manufacturer Field Staffing Plan, including Names and Durations of Visits	30	Before	Arrival to Site			Y
17	0	Progress Reports	30	After/ Monthly	Effective Date/ Thereafter	5/31/2012		Y
18	0	Detailed Drawing Submittal Schedule	30	After/ Monthly	Effective Date/ As Modified	5/31/2012		Y
19	0	Partial Lien Waiver		With	Invoice			Y
20	0	Quality Assurance/Quality Control Manuals, unless of file with Buyer's QA/AC Dept.	120	After	Effective Date	8/29/2012		Y
21	0	Preliminary Instruction Books	120	Before	Contract Delivery			Y
22	0	Preliminary O & M Manuals	120	Before	Contract Delivery			Y
23	0	Final Instruction Books	30	Before	Contract Delivery			Y
24	0	Final O & M Manuals	30	Before	Contract Delivery			Y
25	0	MBE/WBE Reporting						
26	0	Accruals						
27	0	Factory Acceptance Test Procedures	60	Before	Test			Y
28	0	Copies of Certified Test and Inspection Reports	30	After	Test			Y
29	0	Transportation/Shipping Plan	60	Before	First Shipment			Y
30	0	Notice of Shipment	14	Before	Shipment			Y
31	0	Packing Lists	3	Before	Shipment			Y
32	0	List of all accessory equipment to be shipped loose to Jobsite	30	Before	Shipment of Equipment			Y
33	0	Shipment Bill of Materials		With	Each Shipment			Y

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34	0	Unloading and Handling Requirements and Procedures	60	Before/ With	Shipment/ Each Shipment			Y
35	0	Description and details of preservation and protection systems and recommended storage procedures	30	Before	Shipment of Equipment			Y
36	0	Lubrication list and initial fill requirements	15	Before	Shipment of Equipment			Y
37	0	Material Safety Data Sheets	30	Before/ With	Notice of Shipment/ Each Shipment			Y
38	0	Design Data		Before	Final Payment			Y
39	0	Final Bill of Materials		Before	Final Payment			Y
40	0	Final Lien Waiver		With	Final Invoice			Y
41	0	Final As-Constructed Documentation		Before	Final Payment			Y
42	0	Exhibit W	90	After	Effective Date	7/30/2012		Y

B. Technical WFGD

43	**0**	**Technical Scope and System Performance Requirements**						
44	0	Preliminary Electrical Load list	90	After	Effective Date	7/30/2012	No	Y
45	0	Final Electrical Load List	300	After	Effective Date	2/25/2013	Yes	Y
46	0	Schematic/Wiring Diagrams	360	After	Effective Date	4/26/2013	Yes	Y
47	0	Instrument Location Diagrams showing locations of instrument taps	240	After	Effective Date	12/27/2012	No	Y
48	0	Preliminary DCS Logic Diagrams	270	After	Effective Date	1/26/2013	No	Y
49	0	Final DCS Logic Diagrams	360	After	Effective Date	4/26/2013	Yes	Y
50	0	Preliminary DCS Graphics	180	After	Effective Date	10/28/2012	No	Y
51	0	Final DCS Graphics	360	After	Effective Date	4/26/2013	Yes	Y
52	0	Preliminary DCS I/O List	90	After	Effective Date	7/30/2012	No	Y
53	0	Final DCS I/O List	300	After	Effective Date	2/25/2013	Yes	Y
54	0	Preliminary Instrument List	90	After	Effective Date	7/30/2012	No	Y
55	0	Final Instrument List with setpoints	300	After	Effective Date	2/25/2013	Yes	Y

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58		3D Composite Drawing of ductwork and WFGD shipped components	90	After	Effective Date	7/30/2012		Y
59		Utility(air, steam, water) consumptions list	240	After	Effective Date	12/27/2012		Y
60	**5120**	**Structural Steel**						
61	5120	Structural Steel Material Certification			Upon request		No	Y
62	0	Information on the allowable forces and moments on connections	180	After	Effective Date	10/28/2012		Y
63	5120	High Strength Bolts Material Certification			Upon request		No	Y
64	5120	Direct Tension Indicators Material Certification			Upon request		No	
65	5120	Structural Steel Fabrication and Erection Drawings	60	After	Receipt of IFC Drawings		No	Y
82	**11220**	**Agitators**						
83	11220	Agitator drawings and component weights	180	After	Effective Date	10/28/2012	No	Y
84	11220	Agitator mounting detail drawing	180	After	Effective Date	10/28/2012	No	Y
85	**11502**	**Wet Limestone Flue Gas Desulfurization System**						
86	11502	Detailed outline drawings of WFGD system equipment	180	After	Effective Date	10/28/2012	Yes	Y
87	11502	Schematic drawings and data regarding the WFGD system	210	After	Effective Date	11/27/2012	Yes	Y
88	**11502**	**All drawings required for plant layout:**						
89	11502	General Arrangement drawings required for plant layout other than those associated with reagent preparation and byproduct dewatering. These drawings shall indicate all major equipment locations and give information such as piping corridors equipment space requirements, access requirements, and all pertinent information required for location of platforms. (Preliminary)	90	After	Effective Date	7/30/2012	Yes	Y
90	11502	General Arrangement drawings required for plant layout of the reagent preparation and byproduct dewatering. These drawings shall indicate all major equipment locations and give information such as piping corridors, equipment space requirements, access requirements, and all pertinent information required for location of platforms. (Preliminary)	90	After	Effective Date	7/30/2012	Yes	
91	11502	3D AutoCAD model of major components	90	After	Effective Date	7/30/2012	No	Y
92	11502	Equipment/motor outline drawings, including all ground floor-mounted equipment (including dimensions, weights, and anchorage requirements)	210	After	Effective Date	11/27/2012	No	

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95	11502	All drawings required for foundation design. These drawings shall indicate all foundation interface information including: embedments plan size, locations, and thickness; anchor bolt sizes, locations, and materials (i.e., A36, A307, etc.); floor drain locations, sizes, and expected flow rates, and loads divided into separate load cases, i.e. dead, live, snow, wind, and seismic with magnitudes and directions clearly noted.	180	After	Effective Date	10/28/2012		Y
96	11502	Preliminary WFGD system (not to exceed loads)	45	After	Effective Date	6/15/2012	Yes	Y
98	11502	Final and certified WFGD system (loads and embedments)	90	After	Effective Date	7/30/2012	Yes	Y
99	11502	Final and certified tanks, reagent preparation and byproduct dewatering (loads and embedments)	150	After	Effective Date	9/28/2012	Yes	Y
101	**11502**	**Hanger list**						
102	11502	Preliminary hanger list	240	After	Effective Date	12/27/2012	No	Y
103	11502	Final hanger list	285	After	Effective Date	2/10/2013	No	Y
104	**11502**	**Piping support drawing submittal**						
105	11502	Preliminary piping support drawing submittal	240	After	Effective Date	12/27/2012	No	Y
106	11502	Final piping support drawing submittal	285	After	Effective Date	2/10/2013	No	Y
111	**11502**	**Preliminary piping and instrument diagrams.**						
112	11502	Preliminary piping and instrument diagrams including pipe termination information, piping materials, and freeze protection requirements.	90	After	Effective Date	7/30/2012	Yes	Y
113	11502	Preliminary piping routing (AR piping)	180	After	Effective Date	10/28/2012	Yes	Y
114	**11502**	**Final piping and instrument diagrams.**			Effective Date	5/1/2012		
115	11502	Final piping and instrument diagrams excluding reagent preparation/dewatering.	270	After	Effective Date	1/26/2013	Yes	Y
116	11502	Final piping and instrument diagrams for reagent preparation/dewatering.	270	After	Effective Date	1/26/2013	Yes	
117	11502	Final piping routing (AR piping)	270	After	Effective Date	1/26/2013	Yes	Y
120	11502	Electronic I/O List	300	After	Effective Date	2/25/2013	Yes	Y
121		Preliminary Logic Diagrams	270	After	Effective Date	1/26/2013	No	Y
122		Final Logic Diagrams	360	After	Effective Date	4/26/2013	Yes	Y
145	**11502**	**Valve operator data, including the following:**						
146	11502	Operator wiring diagrams	210	After	Effective Date	11/27/2012	No	
147	11502	Operator sizing calculations	210	After	Effective Date	11/27/2012	No	
148	11502	Makeup, Service, cooling water requirements.	60	After	Effective Date	6/30/2012		

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149	11502	Preliminary NTE listing of makeup and service water requirements including flows, pressures and temperatures. Complete listing of equipment cooling water requirements including flow rates, pressure drops, and temperature rises or heat loads.	60	After	Effective Date	6/30/2012	No	Y
150	11502	Final listing of makeup and service water requirements including flows, pressures and temperatures. Final complete listing of equipment cooling water requirements including flow rates, pressure drops, and temperature rises or heat loads.	300	After	Effective Date	2/25/2013	No	Y
151	11502	Drawings showing all air and water piping interconnections.	180	After	Effective Date	10/28/2012	No	Y
152	**11502**	**Station and instrument airflow and pressure requirements.**						
153	11502	NTE station and instrument airflow and pressure requirements (total)	180	After	Effective Date	10/28/2012	No	
154	11502	Final station and instrument airflow and pressure requirements (total)	240	After	Effective Date	12/27/2012	No	
155	**11502**	**Accessory equipment & instrument list.**						
156	11502	Complete accessory equipment & instrument list, excluding reagent preparation and byproduct dewatering, including instrument ranges and recommended set points	120	After	Effective Date	8/29/2012	No	Y
158	11502	Complete listing of valves	120	After	Effective Date	8/29/2012	No	Y
159	11502	Programmable Logic Control System (PLC) Wiring diagrams showing termination information, I/O card arrangements, etc.	180	After	Effective Date	10/28/2012	No	
160	11502	Complete startup/shutdown procedures, I/O list, and System Requirement Specification for all equipment furnished by the Supplier that will be controlled by the Programmable Logic Control System (PLC)	180	After	Effective Date	10/28/2012	No	
162	**11502**	**Listing of all electrical equipment and control system cabinets requiring electrical service.**						
163	11502	Preliminary listing of all electrical equipment and control system equipment requiring electrical service with required kW, kVA, full load amperes, locked-rotor amperes, and voltage and phases (including all motors, heaters, and motor operators)	120	After	Effective Date	8/29/2012	No	Y
164	11502	Certified listing of all electrical equipment and control system equipment requiring electrical service with required kW, kVA, full load amperes, locked-rotor amperes, and voltage and phases (including all motors, heaters, and motor operators)	300	After	Effective Date	2/25/2013	No	Y
165	11502	Detail of procedure for grouting all equipment to bases, including the type of grout and requirements for placement	180	After	Effective Date	10/28/2012	No	Y
166	11502	Superimposed medium voltage motor and driven equipment speed-torque curves at minimum, rated, and maximum voltage range	240	After	Effective Date	12/27/2012	No	Y
167	11502	Superimposed thermal limit and time-current curves for medium voltage motors at minimum, rated, and maximum voltage range	240	After	Effective Date	12/27/2012	No	Y
168	11502	Instrument Calibration Data Sheets	7	After	Shipment		No	Y

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169	11502	Detailed description of proposed model test and model test procedures	60	Before	Start of model construction		No	Y
170	11502	Final model test report	30	After	Completion of model test		No	Y
171	11502	Tank mixer calculations pertaining to sizing of components	60	After	Notice of Award		No	Y
172	11502	Data reports for all code stamped shop fabricated tanks, if applicable.	30	After	Completion of inspection		No	
173	11502	Leak test reports for all shop fabricated tanks not receiving ASME code stamp	30	After	Completion of test		No	Y
174	11502	Lubrication list, and initial fill requirements	15	Before	Shipment of Equipment		No	Y
175	11502	Valve installation instructions for use by the installing Contractor	60	Before	Shipment of Equipment		No	Y
177	**13204**	**Shop Fabricated Tanks**						
178	13204	Domestic Documentation for shipments whereby, Supplier is responsible for required documentation. These may include, but not limited to the following: a. Commercial Invoice (C.I.) b. Packing List c. Bill of Lading d. Multimodal Transport Document e. Inland Waterway Document f. Railway Consignment Note g. Road Consignment Note	48 Hrs	After	Delivery of Shipment		No	Y
179	13204	Equipment Handling, Storage, and Installation Requirements at Site Prior to Placing Equipment in Service		With	Instruction Manual		No	Y
180	13204	Data reports for ASME code stamped tanks	15	After	Test or Inspection		No	
181	13204	Pressure and leak test reports	15	After	Test		No	Y
182	13204	For all shop applied coatings and linings, a letter of certification from a representative of the coating manufacturer shall be submitted to the Purchaser, verifying that all interior coatings have been applied in strict accordance with the instructions and recommendations of the coating manufacturer and that the overall coating systems meet the coating manufacturer's standards	30	Before	Start of Welding		No	
183	13204	Factory Acceptance Test Procedure Including Acceptance Criteria	90	Before	Test		No	Y
184	13204	Foundation requirements: Loads listed separately for each support (dead, hydro, wind, seismic, etc.) showing magnitude and direction for each load at each support; Baseplate footprint.	150	After	Effective Date	9/28/2012	Yes	Y
185	13204	Anchorage requirements including bolt sizes, materials, and locations	150	After	Effective Date	9/28/2012	No	Y
186	13204	Nozzle locations, schedule, and size	90	After	Effective Date	7/30/2012	Yes	Y
187	13204	Diagram of allowable forces and moments on piping connections	90	After	Effective Date	7/30/2012	No	Y

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188	13204	Detailed general arrangement drawing for all equipment furnished including horizontal and vertical center-of-gravity.	15	After	Effective Date	5/16/2012	Yes	Y
189	13204	Coating and surface preparation specification	150	After	Effective Date	9/28/2012	No	Y
190	0	Hydrostatic Testing Procedure	90	Before	Test			Y
238	**15062**	**Pipe Supports Designed by Supplier**						
239	15062	Design conference	90	After	Effective Date	7/30/2012	No	Y
240	15062	Shop drawing submittal	28	After	Receipt of hanger list (if applicable)		No	Y
241	**15221**	**Fabricated Steel Pipe**						
242	15221	Copies of Certified Test and Inspection Reports including material test reports	21	After	Test/Inspection		No	
243	15221	Factory Acceptance Test Procedure Including Acceptance Criteria	90	Before	Test		No	
244	15221	Pipe wall thickness calculations in accordance with the applicable code for pipe wall thickness sized by the Supplier (Pipe Bends)	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
245	15221	Manufacturer's data for piping material and piping accessories	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
246	15221	Documentation that integrally reinforced forged branch outlet fittings have been designed in accordance with the applicable code	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
247	15221	Bending equipment and procedures used for all pipe bends, including calculations to document compliance with Code required minimum wall thickness resulting from bending and post bending heat treatment procedures	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
248	15221	Bending results documentation showing records of actual wall thicknesses	15	After	Completion of Bend		No	
249	15221	ASME pipe data report forms	30	After	Fabrication Completion		Yes	
250	15221	Erection lug sizing calculations in accordance with the applicable codes.	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	

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251	15221	Drawings of each finished machined wye type fitting, safety relief valve vesselet and LOL type fitting	30	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
252	15221	Special piping details including butt weld end preparations, special connections such as performance test connections, and other details	14	After	Receipt of "Released For Fabrication" Piping Isometrics		No	
253	15221	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
254	15221	Hydrostatic Testing Procedure	60	Before	Start of Fabrication		No	
255	15221	Pipe root side purging procedure	60	Before	Start of Fabrication		No	
256	**15224**	**Large Diameter FRP Pipe**						
257	15224	Certified details of pipe fittings, flanges, and specials, including dimensions and weights	330	After	Effective Date	3/27/2013	No	Y
258	15224	A certified laying arrangement showing each section of pipe or specialty giving section identification, dimensions, location of manholes, physical properties, and standard and restrained joint locations	330	After	Effective Date	3/27/2013	No	Y
259	15224	Certified joint details, including restraining joint design drawings	330	After	Effective Date	3/27/2013	No	Y
260	15224	Certified details of internal stiffeners, reinforcing, and supports required for concrete encased piping	330	After	Effective Date	3/27/2013	No	Y
261	15224	Calculations and drawing documenting code application of branch reinforcement	330	After	Effective Date	3/27/2013	No	Y
262	15224	Recommendations for the design and location of pipe supports	210	After	Effective Date	11/27/2012	No	Y
263	15224	Data supporting the qualification of the design strain values and the associated test basis	210	After	Effective Date	11/27/2012	No	Y
264	15224	Design basis tests performed, including documentation of test specimens and coupons used	60	Before	Start of Fabrication		No	Y
265	15224	Calculations providing criteria for pipe design, including proof of design certified test data from previous tests and a complete description of the scope of all previous proof of design tests conducted, including hydrostatic design basis tests	30	Before	Start of Fabrication		No	Y
266	15224	Description of the recommended anti-flotation anchoring and certified details of provisions for attachment of anchors to pipe	210	After	Effective Date	11/27/2012	No	Y
267	15224	Recommendations, including case history documentation of experience, for elastomeric gaskets suitable for application	210	After	Effective Date	11/27/2012	No	Y
268	15224	Bills of material to allow Purchaser to procure all necessary bolting, elastomeric gaskets, and other materials necessary for the installation of piping system	240	After	Effective Date	12/27/2012	No	Y
269	15224	Drawings indicating proposed shipping lengths of each piece	30	Before	Start of Fabrication		No	Y

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270	15224	Fabrication procedures for the following processes: filament winding, standard and restrained joint; fabrication; inspection and repair; verification of material composition; material control; and machine and equipment calibration	30	Before	Start of Fabrication		No	Y
271	15224	Adhesive and curing agent storage, handling, and curing procedure	30	Before	Start of Fabrication		No	Y
272	15224	Joiners' and inspectors' qualifications and certificates	30	Before	Start of Fabrication		No	Y
273		Hydrostatic Testing Procedure	90	Before	Test			
274	**15225**	**General Service Pipe**						
275	15225	Factory Acceptance Test Procedure Including Acceptance Criteria	90	Before	Test		Yes	
276	15225	A laying arrangement listing each section of pipe or specialty giving dimensions, physical properties, and joint locations	210	After	Effective Date	11/27/2012	No	
277	15225	Details of pipe fittings, attachments, joints, and specials, including dimensions and weights	240	After	Effective Date	12/27/2012	No	
278	15225	Diagram of allowable forces and moments on piping connections	240	After	Effective Date	12/27/2012	No	
279	15225	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
280	**15227**	**Slurry Pumps**						
281	15227	Pump characteristic curves	60	After	Effective Date	6/30/2012	No	Y
282	15227	Detailed outline drawing of each pump, including materials of construction	90	After	Effective Date	7/30/2012	No	Y
283	15227	Detailed pump and motor assembly drawings showing overall dimensions, foundation requirement, and total weights	90	After	Effective Date	7/30/2012	No	Y
284	15227	Details of shaft seals and bearings	90	After	Effective Date	7/30/2012	No	Y
285	15227	Soleplate and baseplate and motor support drawings	90	After	Effective Date	7/30/2012	No	Y
286	15227	Coupling drawings	120	After	Effective Date	8/29/2012	No	Y
288	**15228**	**General Service Horizontal Pumps**						
289	15228	Pump characteristic curves	120	After	Effective Date	8/29/2012	No	Y
290	15228	Detailed outline drawing of each pump including materials of construction	150	After	Effective Date	9/28/2012	No	Y
291	15228	Detailed pump and motor assembly drawings showing overall dimensions, foundation requirement, and total weights	150	After	Effective Date	9/28/2012	No	Y
292	15228	Details of shaft seals and bearings	150	After	Effective Date	9/28/2012		Y
293	15228	Baseplate and motor support drawings	150	After	Effective Date	9/28/2012	No	Y
300	**15243**	**Piping Expansion Joints - Rubber**						
301	15243	Certified drawings showing dimensions, weights, and materials of construction	30	Before	Start of Fabrication		No	Y
302	15243	Calculations documenting the size and quantity of control units	30	Before	Start of Fabrication		No	Y

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309	**15261**	**Steel Valves 2-1/2 Inches (65 mm) and Larger**						
310	15261	Documentation of body casting repairs, including post-weld heat treatment records and re-examination records		Upon	Shipment of Equipment		No	
311	15261	Radiograph reports in accordance with ANSI B16.34		Upon	Shipment of Equipment		No	
312	15261	Requirements for disassembly of valves for preheat, welding, and PWHT, including critical temperature thresholds for any points on the valve body/actuator		Upon	Shipment of Equipment		Yes	
313	15261	ANSI Pressure Class Ratings for all Valves in accordance with ASME B16.34	30	After	Formal Issue of Valve List.		Yes	
314	15261	Wiring and elementary diagrams showing all external power/control/instrumentation connections.	300	After	Effective Date	2/25/2013	Yes	
315	15261	Dimensional drawings including overall dimensions, detailing all power, control and instrumentation junction box sizes and locations and maximum power, control and instrumentation cable termination requirements. Also provide ground lug size and location, if specified or furnished.	270	After	Effective Date	1/26/2013	Yes	
316	15261	Valve and accessory outline with overall dimensions, weights (including operators and accessories), direction of flow, and butt weld end details	30	After	Formal Issue of Valve List.		Yes	
317	15261	Calculations establishing valve motor operator torque requirements. Data shall be calculated and submitted by Valve Manufacturer	60	After	Formal issue of valve list		No	
318	15261	Motor and actuator information sheets with actuator rating, running times, rated voltage, running load (hp), running amps, starting amps, and installed amps, include whether valve is torque seated or position seated. Data shall be calculated and submitted by Actuator Manufacturer	60	After	Formal Issue of valve list		No	
319	15261	Limit switches, solenoid valves, positioners, position transmitter data including make, model, electrical ratings, and physical arrangements. (Vendor only needs to submit once if components don't change from one valve to the next.)	30	After	First applicable valve packet		No	
320	15261	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
321	15261	Valve pneumatic tubing diagrams		With	Instruction Manual		No	
322	15261	Factory Valve and Accessory Outline Drawings With all Accessory Equipment Shown. Drawings should include overall dimensions, operator removal clearance, end-to-end dimensions, and direction of flow.		With	Instruction Manual			
323	15261	Sectional drawing showing materials and internal construction		With	Instruction Manual		No	
324	**15263**	**General Service Valves (Furnished with Equipment)**						
325	15263	Documentation of body casting repairs, including post-weld heat treatment records and re-examination records		Upon	Shipment of Equipment		No	
326	15263	Radiograph reports in accordance with ANSI B16.34		Upon	Shipment of Equipment		No	

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327	15263	Requirements for disassembly of valves for preheat, welding, and PWHT, including critical temperature thresholds for any points on the valve body/actuator		Upon	Shipment of Equipment		Yes	
328	15263	ANSI Pressure Class Ratings for all Valves in accordance with ASME B16.34	30	After	Formal Issue of Valve List.		Yes	
329	15263	Wiring and elementary diagrams showing all external power/control/instrumentation connections.	300	After	Effective Date	2/25/2013	Yes	
330	15263	Dimensional drawings including overall dimensions, detailing all power, control and instrumentation junction box sizes and locations and maximum power, control and instrumentation cable termination requirements. Also provide ground lug size and location, if specified or furnished.	270	After	Effective Date	1/26/2013	Yes	
331	15263	Valve and accessory outline with overall dimensions, weights (including operators and accessories), direction of flow, and butt weld end details	30	After	Formal Issue of Valve List.		Yes	
332	15263	Calculations establishing valve motor operator torque requirements. Data shall be calculated and submitted by Valve Manufacturer	60	After	Formal Issue of valve list		No	
333	15263	Motor and actuator information sheets with actuator rating, running times, rated voltage, running load (hp), running amps, starting amps, and installed amps, include whether valve is torque seated or position seated. Data shall be calculated and submitted by Actuator Manufacturer	60	After	Formal Issue of valve list		No	
334	15263	Limit switches, solenoid valves, positioners, position transmitter data including make, model, electrical ratings, and physical arrangements. (Vendor only needs to submit once if components don't change from one valve to the next.)	30	After	First applicable valve packet		No	
335	15263	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
336	15263	Valve pneumatic tubing diagrams		With	Instruction Manual		No	
337	15263	Sectional drawing showing materials and internal construction		With	Instruction Manual		No	
338	**15265**	**Rubber Seated Butterfly Valves**						
339	15265	Documentation of body casting repairs, including post-weld heat treatment records and re-examination records		Upon	Shipment of Equipment		No	
340	15265	Radiograph reports in accordance with ANSI B16.34		Upon	Shipment of Equipment		Yes	
341	15265	ANSI Pressure Class Ratings for all Valves in accordance with ASME B16.34	30	After	Formal Issue of Valve List.		Yes	
342	15265	Wiring and elementary diagrams showing all external power/control/instrumentation connections.	300	After	Effective Date	2/25/2013	Yes	
343	15265	Dimensional drawings including overall dimensions, detailing all power, control and instrumentation junction box sizes and locations and maximum power, control and instrumentation cable termination requirements. Also provide ground lug size and location, if specified or furnished.	270	After	Effective Date	1/26/2013	Yes	

344	15265	Valve and accessory outline with overall dimensions, weights (including operators and accessories), direction of flow, orientation of disks and shafts, direction of rotation, location of operator, and operator removal clearances	270	After	Effective Date	1/26/2013	Yes	
345	15265	Calculations establishing valve motor operator torque requirements. Data shall be calculated and submitted by Valve Manufacturer	270	After	Effective Date	1/26/2013	No	
346	15265	Motor and actuator information sheets with actuator rating, running times, rated voltage, running load (hp), running amps, starting amps, and installed amps, include whether valve is torque seated or position seated. Data shall be calculated and submitted by Actuator Manufacturer	300	After	Effective Date	2/25/2013	No	
347	15265	Limit switches, solenoid valves, positioners, position transmitter data including make, model, electrical ratings, and physical arrangements. (Vendor only needs to submit once if components don't change from one valve to the next.)	300	After	Effective Date	2/25/2013	No	
348	15265	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
349	15265	Valve pneumatic tubing diagrams		With	Instruction Manual		No	
350	15265	Factory Valve and Accessory Outline Drawings With all Accessory Equipment Shown. Drawings should include overall dimensions, operator removal clearance, end-to-end dimensions, and direction of flow.		With	Instruction Manual			
351	15265	Sectional drawing showing materials and internal construction		With	Instruction Manual		No	
352	**15266**	**Metal Seated Butterfly Valves**						
353	15266	Certified correct dimensional data for each size and type of valve	270	After	Effective Date	1/26/2013	Yes	
354	15266	Cross-sectional assembly views of the valves indicating materials used for each component	270	After	Effective Date	1/26/2013	No	
355	15266	Outline drawings of the valves showing dimensions, weight, and center of gravity for each assembled valve, operator, and accessory	270	After	Effective Date	1/26/2013	No	
356	15266	Wiring and elementary diagrams showing all external power/control/instrumentation connections.	300	After	Effective Date	2/25/2013	No	
357	15266	Limit switches, solenoid valves, positioners, position transmitter data including make, model, electrical ratings, and physical arrangements. (Vendor only needs to submit once if components don't change from one valve to the next.)	300	After	Effective Date	2/25/2013	No	
358	**15268**	**Control Valves**						
359	15268	Documentation of body casting repairs, including post-weld heat treatment records and re-examination records		Upon	Shipment of Equipment		No	
360	15268	Radiograph reports in accordance with ANSI B16.34		Upon	Shipment of Equipment		No	
361	15268	Requirements for disassembly of valves for preheat, welding, and PWHT, including critical temperature thresholds for any points on the valve body/actuator		Upon	Shipment of Equipment		No	
362	15268	Shell pressure test and seat leakage test reports (for tests required by ASME B16.34 and ANSI/FCI 70-2)	7	After	Test		Yes	

363	15268	ANSI Pressure Class Ratings for all Valves in accordance with ASME B16.34	30	After	Formal Issue of Valve List.		Yes	
364	15268	Wiring and elementary diagrams showing all external control/instrumentation connections.	300	After	Effective Date	2/25/2013	Yes	
365	15268	Dimensional drawings including overall dimensions, detailing all power, control and instrumentation junction box sizes and locations and maximum power, control and instrumentation cable termination requirements. Also provide ground lug size and location, if specified or furnished.	270	After	Effective Date	1/26/2013	No	
367	15268	Manufacturer's Specification and Design Data Sheets, Including Scope Description		With	Bid		No	
368	15268	Valve/Actuator Assembly Outline Drawings, Including Dimensions (End-to-End, Removal), Weight, Direction of Flow, and Weld End Details (Included with Valve Packet)	270	After	Effective Date	1/26/2013	No	
369	15268	Price Summary		With	Bid		No	
372	15268	Chemical Cleaning Cover, and/or Flush Kits, Piping Connections Drawings, Including Overall Dimensions and Weights	90	After	Respective Valve Order		No	
373	15268	Limit switches, solenoid valves, positioners, position transmitter data including make, model, electrical ratings, and physical arrangements. (Vendor only needs to submit once if components don't change from one valve to the next.)	30	After	First applicable valve packet		No	
374	15268	Coating and surface preparation specification	60	After	Effective Date	6/30/2012	No	
375	15268	Valve pneumatic tubing diagrams		With	Instruction Manual		No	
376	15268	Factory Valve and Accessory Outline Drawings (Consistent with Supplier Type I Drawings) With all Accessory Equipment Shown. Drawings should include overall dimensions, operator removal clearance, end-to-end dimensions, and direction of flow.		With	Instruction Manual		No	
377	15268	Sectional drawing showing materials and internal construction		With	Instruction Manual		No	
378	**15269**	**Automatic Recirculation Control (ARC) Valves**			.			
379	15269	Outline drawings showing end-to-end dimensions, end preparation details, and center of gravity location for each assembled valve and operator	180	After	Effective Date	10/28/2012	No	
380	15269	Certified performance curves showing switch point and bypass flow characteristics	270	After	Effective Date	1/26/2013	No	
381	15269	Cross-sectional assembly drawings indicating construction materials for each part	180	After	Effective Date	10/28/2012	No	
382	15269	Requirements for disassembly of valves for preheat, welding, and PWHT, including critical temperature thresholds for any points on the valve body/actuator		Upon	Shipment of Equipment		No	
383	**15271**	**Safety and Relief Valves**			.			
384	15271	Documentation of body casting repairs, including post-weld heat treatment records and re-examination records		Upon	Shipment of Equipment		No	
385	15271	Radiograph reports in accordance with ANSI B16.34		Upon	Shipment of Equipment		No	

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386	15271	Requirements for disassembly of valves for preheat, welding, and PWHT, including critical temperature thresholds for any points on the valve body/actuator		Upon	Shipment of Equipment		No	
387	15271	Shell pressure test and seat leakage test reports (for tests required by ASME B16.34 and ANSI/FCI 70-2)	7	After	Test		Yes	
388	15271	ANSI Pressure Class Ratings for all Valves in accordance with ASME B16.34	30	After	Formal Issue of Valve List		Yes	
389	15271	Valve and accessory outline with overall dimensions and weights (including accessories),	270	After	Effective Date	1/26/2013	No	
390	15271	Valve specification sheet including operating conditions, set pressure, fluid conditions, and orifice and valve selection	30	After	Formal Issue of Valve List		No	
391	15271	Coating and surface preparation specification	60	Before	Start of Fabrication		No	
392	15271	Valve pneumatic tubing diagrams		With	Instruction Manual		No	
393	15271	Factory Valve and Accessory Outline Drawings With all Accessory Equipment Shown. Drawings should include overall dimensions and end-to-end dimensions.		With	Instruction Manual		No	
394	15271	Sectional drawing showing materials and internal construction		With	Instruction Manual		No	
517	**15941**	**Insulation and Lagging**						
518	15941	Drawings detailing types and thicknesses of insulation for pipelines, auxiliary equipment items, and flatwork areas	300	After	Effective Date	2/25/2013	No	
519	15941	Installation details for insulation and lagging supports for each flatwork area or equipment	300	After	Effective Date	2/25/2013	No	
520	15941	Installation details including fastening of insulation and lagging to supports, flashing methods, convection barriers, lagging closures, and provisions for expansion and contraction	300	After	Effective Date	2/25/2013	No	
521	15941	Installation details specific to sidewalls; roofs; hoppers and hopper crotch areas; hopper poke holes and instrument and test port connections; dampers; fans; and penetrations for breeching, ductwork, support steel, etc.	300	After	Effective Date	2/25/2013	No	
522	15941	Fabrication details for field fabricated pipe elbow jacketing, and access door and manhole insulated covers	300	After	Effective Date	2/25/2013	No	
523	15941	Storage and handling requirements for insulation and lagging materials to be erected by others	30	Before	Delivery of Materials		No	
524	**16051**	**Electrical Design and Equipment**						
525	16051	Certified design data and performance curves	30	Before	Shipment		Yes	
526	16051	Arrangement and fabrication/ erection drawings	60	Before	Delivery of Materials		Yes	
527	16051	Detailed set of drawings to include arrangement drawings, interconnection drawings, schematics, nameplate schedule and bill of materials	60	Before	Delivery of Materials		No	
528	16051	Final set of above drawings in addition to interconnection wiring diagrams	21	Before	Delivery of Materials		No	
538	**16410**	**Junction Boxes**						
539	16410	Manufacturer's catalog sheets for junction boxes and all devices mounted in the junction boxes	60	Before	Delivery of Materials		No	

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540	16410	Terminal block layout and terminal numbering.	60	Before	Delivery of Materials		No	
541	**16430**	**Disconnect Switches**						
542	16430	Manufacturer's catalog sheets showing equipment data including fuse manufacturer's name and model number along with fuse curves when fusible disconnects are furnished.	30	Before	Delivery of Materials		No	
560	**17053**	**Subsystem - Programmable Logic Control System**						
561	17053	Notice of Factory Inspection or Tests	30	Before	Inspection and Testing		No	
562	17053	PLC power, communications, and grounding wiring diagrams	60	Before	Delivery of Materials		No	
575	17053	Operator interface system operation and maintenance instruction manuals			At equipment shipment		No	
576	17053	Final PLC program printouts and electronic file of PLC program			At equipment shipment		No	
577	**17151**	**Vibration Monitoring Equipment**						
578	17151	Bill of Material, Including Quantity, Description, and Part Number	240	After	Effective Date	12/27/2012	No	Y
579	17151	Wiring and elementary diagrams showing all external control/instrumentation/power connections.	240	After	Effective Date	12/27/2012	No	Y
580	17151	Wiring and elementary diagrams showing all external control/instrumentation/power connections.	240	After	Effective Date	12/27/2012	No	Y
581	17151	Detailed Job Specific System hardware Layout Drawings (Internal Cabinet Layout Drawings for all cabinets)	240	After	Effective Date	12/27/2012	No	Y
582	17151	Detailed Job Specific Equipment Dimension Drawings (Drawings to include: Overall dimensions; door locations, swings and threshold elevations; All power, control and instrumentation junction box sizes and arrangements).	240	After	Effective Date	12/27/2012	No	Y
583	17151	Detailed Job Specific Power and Grounding Wiring Diagrams (Drawings to include : Maximum power, control and instrumentation cable size termination requirements; Ground lug size and location)	240	After	Effective Date	12/27/2012	No	Y
584	17151	Detailed Job Specific DCS to Vibration Monitoring Communications Drawings (Drawings to include: communications connection location/connector type and prefab communications cable configuration requirements,)	240	After	Effective Date	12/27/2012	No	Y
585	17151	Equipment Storage Requirements.	90	Before	Shipment of Equipment		No	Y
586	**17205**	**Local Instrument Racks and Enclosures**						
587	17205	Preliminary electrical load list	60	After	Effective Date	6/30/2012	Yes	
588	17205	Air requirements	60	After	Effective Date	6/30/2012	No	
589	17205	Foundation design data, including equipment operating loads, anchor bolt sizes and locations, and equipment base sizes	120	After	Effective Date	8/29/2012	No	
590	17205	Equipment outline, layout, and arrangement drawings	120	After	Effective Date	8/29/2012	No	

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591	17205	Piping details	120	After	Effective Date	8/29/2012	No	
592	17205	Final electrical load list	210	After	Effective Date	11/27/2012	No	
593	17205	Point-to-point internal physical wiring diagrams	240	After	Effective Date	12/27/2012	No	
594	17205	Wiring diagrams (field wiring)	240	After	Effective Date	12/27/2012	No	
595	**17220**	**Instrument Enclosures**						
596	17220	Air requirements (for each enclosure)	10	After	Instrument List		No	
597	17220	Piping details (for each enclosure)	30	After	Instrument List		No	
598	17220	Final electrical load list (for each enclosure)	45	After	Instrument List		No	
599	17220	Point-to-point internal physical wiring diagrams (for each enclosure)	45	After	Instrument List		No	
600	17220	Instrument data sheets (ISA type)	90	After	Instrument List		No	
601	17220	Dimensional drawings (for each enclosure) including: Detailed general arrangement drawings for all equipment; Weight; Overall dimensions; Door locations, swings, and threshold elevations; All power, control, and instrumentation junction box sizes and location	60	After	Instrument List		No	
602	17220	Anchorage requirements including bolt sizes, materials (i.e., A36, A307, etc.) and locations.	60	After	Instrument List		No	
603	17220	Drawings and data on accessory equipment including valves, fittings, terminal blocks, convenience receptacles, and other components.	30	After	Instrument List		No	
604	17220	Factory acceptance test procedure including acceptance criteria.	90	Before	Test		No	
605	17220	Notice of factory inspection or tests	30	Before	Inspection or Testing		No	
606	17220	Copies of certified inspection or test reports.	15	After	Inspection or Test		No	
607	17220	Copies of all applicable service bulletins, application guides, installation updates or other similar documentation for the devices being furnished (or certification that no such documents apply to product being supplied).	30	After	IFC Drawing		No	
608	**17300**	**Instrumentation**						
609	17300	Outline drawing showing all dimensions including process connection sizes, tag number/description and model/serial number.	30	After	IFC Drawing		No	Y
610	17300	Terminal block layout and terminal nomenclature if applicable.	30	After	IFC Drawing		No	Y
611	17300	Flow element calculation sheet showing beta ratio and differential pressure drop/loss if applicable.	30	After	IFC Drawing		No	Y
612	17300	Flow element overall and component dimension/material drawing if applicable.	30	After	IFC Drawing		No	Y
613	17300	Calibration Certification/Report if applicable.	14	After	Test/Inspection		Yes	Y
619	**E635**	**Medium Voltage Induction Motors**						

620	E635	Motor dimensional drawings	180	After	Effective Date	10/28/2012	No	Y
621	E635	Motor nameplate data	180	After	Effective Date	10/28/2012	Yes	Y
622	E635	Preliminary Motor Data Sheets	90	After	Effective Date	7/30/2012	No	Y
623	E635	Completed Motor Data Sheets	240	After	Effective Date	12/27/2012	No	Y
624	E635	Superimposed medium voltage motor and driven equipment speed-torque curves at minimum, rated, and maximum voltage range	180	After	Effective Date	10/28/2012	No	Y
625	E635	Superimposed thermal limit and time-current curves for medium voltage motors at minimum, rated, and maximum voltage range	180	After	Effective Date	10/28/2012	No	Y
626	E635	Power factor versus percent load curves for medium voltage motors	180	After	Effective Date	10/28/2012	No	Y
627	E635	Wiring diagrams	300	After	Effective Date	2/25/2013	No	Y
628	E635	Bearing disassembly and reassembly drawings			With Instruction Manuals		No	Y
629	E635	Medium voltage motor rotor removal clearance drawings	300	After	Effective Date	2/25/2013	No	Y
630	E640	Low Voltage Induction Motors	180	After	Effective Date	10/28/2012		Y
631	E640	Motor dimensional drawings	180	After	Effective Date	10/28/2012	No	Y
632	E640	Motor nameplate data	180	After	Effective Date	10/28/2012	No	Y
633	E642	Single-Phase Induction Motors	180	After	Effective Date	10/28/2012		Y
634	E642	Motor nameplate data	180	After	Effective Date	10/28/2012	No	Y
635	E642	Motor dimensional drawings	180	After	Effective Date	10/28/2012	No	Y
636	E645	Electric Actuators	180	After	Effective Date	10/28/2012		Y
637	E645	Actuator outline diagrams	180	After	Effective Date	10/28/2012	No	Y
638	E645	Wiring diagrams	210	After	Effective Date	11/27/2012	Yes	Y
639	**K100**	**Instrumentation**						
640	K100	Instrument factory calibration sheets		Upon	Shipment of Instruments		Yes	Y
641	K100	Flow element calculation data sheets showing beta ratio, dP, flow	360	After	Effective Date	4/26/2013	Yes	Y
642	K100	ISA-format datasheets for all Instruments	360	After	Effective Date	4/26/2013	Yes	Y
643	**Q001**	**ISO:9001:2000 Quality System Requirements**						
644	Q001	Quality Manual, controlled copy	90	After	Effective Date	7/30/2012		Y

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645	Q001	Certification Letter or Certificate of Authorization (copy), if certified by a registered agency, e.g., ASME Certificate of Authorization, ISO Certificate	90	After	Effective Date	7/30/2012		Y
646	Q001	Sub-supplier listing	10	Before	Issue of Sub-supplier Purchase Order			Y
647	Q001	Inspection and test plan	90	After	Effective Date	7/30/2012		Y
648	Q001	Notification of inspection/test (for B&V hold/witness points)	14	Before	Test/Inspection			Y
649	Q1XX							
650	Q1XX	Welding Procedure Specifications (WPS) with applicable Procedure Qualification Records (PQR)	30	Before	Start of Fabrication			Y
665	**Q1XX**	**Welding of Duplex Stainless Steel, Super Duplex Stainless Steel, and Alloy C-276 for Flue Gas Desulfurization**						
666	Q1XX	Written plan for training of production welders of duplex stainless steel, super duplex stainless steel, and Alloy C-276	30	Before	Start of Fabrication		No	Y
667	Q1XX	Detailed Pickling Procedure (when required)	30	Before	Start of Fabrication		No	
668	**Q301**	**Manufacturer's Standard Coating**						
669	Q301	Shop drawings that identify shop-applied coating systems	30	Before	Start of Fabrication		No	
670	Q301	Manufacturer's product data sheets	30	After	Release to Proceed		No	
671	**Q302**	**Purchaser Specified Exterior Shop Coating**						
672	Q302	Manufacturer's product data sheets	30	After	Release to Proceed		No	
673	Q302	Manufacturer's color cards	30	After	Release to Proceed		No	
674	Q302	Manufacturer's surface preparation and coating application procedures. Include manufacturer's construction standards and recommended practices for surface contamination testing, crack and joint treatment, edge treatment, coating penetration and termination.	30	After	Release to Proceed		No	
675	Q302	Manufacturer's certification of the coating applicator	30	After	Release to Proceed		No	
676	Q302	Applicator's experience record	30	After	Release to Proceed		No	
677	Q302	Manufacturer's approval of surface condition prior to coating application	10	After	Release to Proceed		No	
678	Q302	Applicator's inspection and test reports	7	After	Test/Inspection		No	
679	Q302	Manufacturer's field representative inspection and test report	7	After	Test/Inspection		No	
680	**Q303**	**Interior Coatings and Linings**						
681	Q303	Manufacturer's product data sheets	30	After	Release to Proceed		No	

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682	Q303	Applicator's blast media data sheets	30	After	Release to Proceed		No	
683	Q303	Manufacturer's surface preparation and coating application procedures. Include manufacturer's construction standards and recommended practices for surface contamination testing, crack and joint treatment, edge treatment, coating penetration and termination.	30	After	Release to Proceed		No	
684	Q303	Manufacturer's certification of the coating applicator	30	After	Release to Proceed		No	
685	Q303	Applicator's experience record	30	After	Release to Proceed		No	
686	Q303	Applicator's approval of manufacturer's surface preparation and coating application procedures	30	After	Release to Proceed		No	
687	Q303	Manufacturer's approval of surface condition prior to coating application	10	After	Release to Proceed		No	
688	Q303	Applicator's inspection and test reports	7	After	Test/Inspection		No	
689	Q303	Manufacturer's field representative inspection and test report	7	After	Test/Inspection		No	
690	**Q305**	**Rubber Lining**						
691	Q305	Manufacturer's product data sheets	30	After	Release to Proceed		No	
692	Q305	Manufacturer's surface preparation and coating application procedures. Include manufacturer's construction standards and recommended practices for surface contamination testing, crack and joint treatment, edge treatment, coating penetration and termination.	30	After	Release to Proceed		No	
693	Q305	Manufacturer's certification of the coating applicator	30	After	Release to Proceed		No	
694	Q305	Applicator's experience record	30	After	Release to Proceed		No	
695	Q305	Applicator's inspection and test reports	7	After	Test/Inspection		No	

3.0 Review

Per Exhibit Section 1.1.03B.2 above.

4.0 Hold Points

The following list of activities shall be treated as Hold Points:

A. Shipment of Ductwork
B. Flow Model Review
C. Equipment Factory Acceptance Test Prior To Shipment

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D Backfill Placement Compaction Testing
E. Rebar Placement
F. Concrete Placement
G. Insulation Placement over Ductwork (Weld Inspections)
H. Paint Primer and Final Coat
I Bearing Pile Blow Count
J. Structural Steel Connection Final Bolt Up
K. Embedded Grounding and Conduits (Prior to Concrete Pour)
L. Electrical Devices (Transformers, Switchgear, MCC, Controls) Prior to Energization

5.0 Owner Electronic Submittal Specifications

LG&E / KU Specifications for Electronic Submittal of Vendor Documentation

1. Introduction

1.1. The purpose of this document is to set forth the minimum standards for submittal of vendor documentation for equipment or package system purchases. This document would typically be provided to Equipment Suppliers.

1.2. LG&E / KU Generation utilizes Oracle IPM as a repository that provides secure storage, backup and recovery for all electronic files, document images, and various record types that are not likely to change. Examples: Vendor drawings, instruction manuals, correspondence, and all other vendor documentation. Drawing and document numbers are assigned by the supplier.

1.3. Documents from sub-vendors shall be included and provided in a similar fashion to those of the primary vendor.

1.4. Project records are to be submitted to the LG&E / KU project manager per this specification and shall include a formal transmittal.

1.5. Final documentation shall include the most recent revisions and up to date information, as-built or as-delivered modifications to be submitted within 30 days of project completion.

1.6. This document sets forth the basic guidelines for electronic drawing/document submittal. Since technology is constantly evolving, file formats and application versions listed in this document are subject to mutually agreeable change.

2. Oracle IPM (formerly Stellent IBPM) – Vendor Drawings and other documents

2.1. This specification provides minimum requirements on how documents shall be provided electronically to LG&E / KU.

2.2. Unless otherwise specified in the contract or purchase order, final documentation, drawings, specifications, and manuals are to be submitted in electronic format on CD or DVD.

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2.3. In addition, electronic submissions may be requested via e-mail, and hard copies may be required.

2.4. Letter/Legal size documents are to be submitted in Microsoft Word or Adobe *PDF format.

2.5. Drawings created by CAD software shall be submitted in AutoCAD DWG format or *PDF images. Non-CAD drawings shall be submitted in TIFF or *PDF formats.

2.6. Each drawing submitted in CAD, *PDF, and TIFF format shall have a unique filename unless the drawing is only intended to be submitted as a page in a larger document or manual.

2.7. Photographs, aerial photos or maps etc. shall be submitted in JPG format.

2.8. If the number of records being submitted exceeds 20 records, an index (as it applies per type of record being submitted) shall be provided for each vendor or sub-vendor drawing and other documentation for storage into Oracle IPM. Drawings are to be indexed individually. Other documentation, such as project files, can be batched by the Document Type and indexed as a group. The index shall be submitted electronically in Excel or Access format which includes, as a minimum, the information contained in TABLE 1 at the end of the Specification.

3. Oracle IPM - Technical Library Manuals and Reports

3.1. Technical manuals, parts catalogs and equipment specifications originating from an equipment manufacturer or distributor shall be submitted in *PDF format.

3.2. Power Plant system manuals which contain a compilation of customized technical specs or equipment manuals from various sources must be provided in a sectional format with a detailed table of contents. System manuals may be submitted in a bound hardcopy or *PDF format. Hard copies shall be submitted with duplicate *PDF files. The *PDF shall closely mimic the sectional hardcopy style with a table of contents referencing each section. If the entire manual is greater than 200 pages, then each section must be provided as a separate *PDF file.

3.3. Technical and Regulatory Reports including Outage Reports must be submitted in *PDF format, rendered from the original document when possible, otherwise PDF's containing scanned images of the report(s) are acceptable. Desktop services may be able to provide you with the necessary *PDF print driver required to output compound *PDF document from your software application.

3.4. All manuals and reports will be provided to LG&E / KU by filling out spreadsheets provided by LG&E / KU following the format laid out in TABLE 2 at the end of the Specification.

***PDF Format:** *All PDF documents submitted must be PDF/A-1a or PDF/A-1b compliant. See ISO Spec 19005-1:2005 Document Management - Electronic document file format for long term preservation - Part 1 Reference: http://en.wikipedia.org/wiki/PDF/A*

TABLE 1 – Typical Information for Oracle IPM Data Submission

Field Name	Character Limit	Examples
Document ID#	20	*Louisville Order #, Contract #, PO #, Spec ID #, Photo #, or Plant ID #*
Initiative #	16	*LG&E / KU Project #*
Supplier	40	Manufacturer
Supplier Document ID	30	Manufacturing Drawing #
AE Name	40	
AE Drawing #	30	
Type of Equipment Description	90	Drawing or Record Title, Description
Plant/Location	20	
Unit	20	MC4 or TC2 or COM for common systems
Comments	50	Additional information pertaining to document
Record Type	10	Record Types: PD – for Drawings and PF – for other documentation. If PF applies then Document Type must also be supplied. Files are to be batched and labeled by Document Type.
Record Source	20	Vendor
Document Type	20	Contracts, specifications, financial, proposal/bids, correspondence, manuals, pictures and miscellaneous.
Record Description	50	Specific type of record for example : Structural Calculations Report
Volume #	10	With leading 0's (001, 010 or 999)
System	50	
Equipment #	50	EID #, Serial #, Shop Order #
Date	10	MM/DD/YYYY (Format consistency important)

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TABLE 2 – Typical information for Technical Library Manuals and Reports

Data Entry Instructions			
Field Name	**Description / Comments**	**Type / Length**	**Values / Examples**
Media Label	The name of the media the document is contained on. Please make sure to uniquely identify each media volume delivered, use black permanent marker to label media.	Char / 20	Project Name – IOM-001
File Path	Enter the relative path of the file being indexed without drive a letter. (Path relative to the root of the source media, CD/DVD etc..)	Char / 50	\dir1\dir2\filename.pdf
Record Type	Manual for all IOM Manuals, sections or chapters contained in a manual. Report for all inspection or reports on specific plant equipment and or systems that are not specifically incorporated with an IOM Manual.	Picklist	MANUAL, REPORT
Document Id	Order #, PO #, Contract #, Spec Id	Char / 20	Louisville Order #, Contract #, PO #
Project No	LG&E or KU designated project number	Char / 16	LG&E / KU Project Number
Plant	Standard 2 Character Plant ID	Picklist	TC, MC, GH, CR, PR, BR, etc..
Unit	Standard 2 digit Unit Id, 00 designates entire plant facility	Picklist	00, 01, 02, 03, etc..
System	System name from Maximo	Picklist	FUEL OIL EQUIPMENT, COAL CONVEYOR
Sub-System	Sub-system name from Maximo	Picklist	ALARM MISC INST. AND CONTROL
Manual / Report Title	Manual / Report Title is repeated for each section / chapter for all entries contained in a particular manual or report. Including tables of contents, sections/chapters appendixes and attachments	Char / 50	COAL CONVEYOR
Volume	Volume Id of Manual or Report	Numeric / 3	1, 2, 3 etc
Set (Volume Set)	Volume set Id of Manual or Report	Numeric / 3	1, 2, 3 etc
Manufacturer / Supplier	Name of manufacturer or supplier of equipment	Char / 30	General Electric
Revision Date	Document revision date or Report of report	Char / 10	MM/DD/YYYY or MM/YYYY
Section / Chapter Id	Please use the following conventions for section enumeration: TOC Table of Contents, 00 Entire Manual or Report contained in a single file. Letters and/or numbers can be used. Examples: (1 = Section 1), (1.1 = Section 1 Sub-section 1), (1.1.1, 1.1.a and 1.1.1a) are all valid. Make sure that all Id's are in the proper sequential order for each Manual or Report.	Char / 10	Sequential enumeration of Section / Chapter
Section / Chapter Description	Detailed description of Section or Chapter	Char / 150	Section / Chapter level description
Comments	Data entry comments (not filed)	Char / 150	Misc. comments

LG&E / KU Specifications for Electronic Submittal of Engineered Drawings

1. Introduction

1.1. The purpose of this document is to set forth the minimum standards for submittal of engineered drawings for all outside engineered systems or plant improvements. This document would typically be provided to Architects and Engineering firms.

1.2. LG&E / KU Generation utilizes the Drawing Management System (DMS) which works with AutoCAD and CAD viewing software to create, edit, view, and manage CAD drawings. DMS houses *drawings only* that are likely to require updating and editing. Examples include: most A/E generated drawings such as electrical schematics, wiring diagrams, P&ID, steel, concrete and piping plans/details, and general arrangement drawings. Drawing numbers are normally assigned by LG&E / KU.

1.3. Engineered drawings are to be submitted to the LG&E / KU project manager per these specifications and are to include a formal transmittal.

1.4. Final documentation shall include the most recent revisions and up to date information, as-built or as-delivered modifications to be submitted within 30 days of project completion.

This document sets forth the basic guidelines for electronic drawing/document submittal. Since technology is constantly evolving, file formats and application versions listed in this document are subject to mutually agreeable change.

2. Drawing Management System - CAD drawings

2.1. General

2.1.1. This specification provides minimum requirements on how CAD drawings shall be provided to the Owner.

2.1.2. There are no defined CAD standards that the Owner requires the A/E to follow. It is up to the Contractor to use their standards as long as it complies with the other requirements of this document.

2.1.3. Once the final copy is released to the Owner, the Owner will become the proprietor of the electronic drawing. The Owner will take full responsibility for all future modifications and subsequent liability thereof.

2.1.4. Unless otherwise specified in the contract or purchase order, only the final copy of the drawing shall be provided to the Owner for electronic storage. The final copy shall include all as-built or as-delivered modifications.

2.1.5. All new CAD drawings shall be vector based unless a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal.

2.1.6. Unless otherwise specified in the contract or purchase order existing plant prints requiring modification shall be redlined and submitted electronically in color TIFF/JPG or *PDF format as a sketch (SK) drawing. The drawing number shall include the letters SK and the existing plant drawing number. An SK drawing can be used to identify a drawing

to be voided. LG&E/KU will be responsible for incorporating these changes into the existing drawing. Black and white TIFF or *PDF redlined drawings may be submitted if redlined hard copies are also provided if a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal.

2.1.7. The Owner shall provide to the Contractor an AutoCAD version of all LG&E / KU drawing title blocks as required. The Owner shall also provide hard copy, TIFF or *PDF images of existing plant drawings for redlining unless otherwise outlined in the contract.

2.1.8. The Owner reserves the right to request sample AutoCAD drawings to test our ability to access and properly view the drawing information within our applications.

2.1.9. Upon project completion final paper copies of as-built drawings shall be provided to the project manager or designee unless a copy of a waiver to this requirement for the specific drawing(s) is provided with the transmittal. The number of paper drawing sets required shall be outlined in the contract.

***PDF Format:** *All PDF documents submitted must be PDF/A-1a or PDF/A-1b compliant. See ISO Spec 19005-1:2005 Document Management - Electronic document file format for long term preservation - Part 1 Reference: http://en.wikipedia.org/wiki/PDF/A*

2.2. **Vector Based CAD Drawings**

2.2.1. Drawings shall be drawn in AutoCAD 2008 version or later but must be saved and turned over to the owner in AutoCAD 2007 file format.

2.2.2. When using other CAD applications and performing conversions to AutoCAD the vendor shall ensure that drawing attributes, block names, line types, line weights, font styles, dimension styles, etc. are properly converted. Ultimately the converted file, when plotted, should look identical to the version created in the native CAD format. The Owner may request electronic copies of converted files to review the conversion quality from native format to AutoCAD.

2.2.3. The drawings shall be bordered by a title block/drawing sheet provided by the owner. Drawing sizes A thru E are available by request.

2.2.3.1. The drawing sheet shall be inserted as a block retaining all of the title block attributes and layers. **Do not explode or modify the title block or change the title block name, layer names, or modify the attribute tag names in the Owner supplied title block.**

2.2.3.2. The drawing sheet shall be inserted at the 0,0 coordinate in layout 1 paper space view such that the lower left hand corner of the sheet is at 0,0.

2.2.3.3. The title block attributes shall be filled out. See Table 1 for typical title block attributes and Figure 1 for a sample title block. Other LG&E / KU title blocks may be used depending on plant locations and drawing size.

2.2.3.4. The Contractor shall provide their company name in the Originally Designed by attribute in the title block. In addition, they may insert their own title block, company logo, and/or PE stamp to the immediate left of the Owner's title block **as a separate AutoCAD block**. This information shall not stand taller than the Owner's title block. See Figure 1.

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2.2.4. All non-dimensioned drawings shall be drawn at a 1 to 1 scale. These drawings may include electrical schematics, wiring, and connection diagrams, mechanical flow diagrams, and logic diagrams.

2.2.5. The Contractor will provide the Owner an estimated range of drawing numbers for each of the major disciplines (Arch, Civil, Structural, Mech, Elect) and by plant unit or common. The Owner will provide a range of Unit-specific LG&E / KU drawing numbers to the Contractor as required based on this information.

2.2.6. Drawing numbers shall use the following format:

GH3-E-12345-4321 or GH3-SK-E-12345-4321

Where-

***GH3** is the 3 or 4 digit plant and unit number (0=common)*
***SK** used only if identifying a redlined existing plant drawing*
***E** is the engineering discipline (E-Electrical, C-Civil, M-Mechanical, A-Architectural, S-Structural)*
***12345** is the 5-digit next available drawing number based on location AND discipline. Field must have the leading zeros padded to (5) digits such that drawing "432" would appear as "00432"*
***4321** is an optional Contractor-assigned 4-digit alphanumeric describing a specific page or sheet number of the drawing. This field is optional but if used it shall be padded to (4) characters.*

2.2.7. The Contractor may include their own drawing number in their title block (if included) but all internal and external drawing references shall utilize the Owner's assigned drawing number.

2.2.8. LG&E / KU drawing number revisions shall start with the letter "A" and proceed through the alphabet skipping the letters "I" and "O". Numbers are not to be used for LG&E / KU revisions unless used for preliminary drawings for review not for final submittal.

2.3. Raster (or hybrid) Based CAD Drawings

2.3.1. Where required, hybrid CAD techniques may be employed to modify existing plant drawings. Do not use AutoCAD's *WIPEOUT* command to mask raster images. The raster images shall be modified using raster editing software such as Raster Design 2008 as provided by Autodesk.

2.3.2. Raster images shall be provided in a GP4 (CALs Group 4, Type 1) format. Other formats may be acceptable upon review with the LG&E / KU.

2.3.3. A sample drawing (containing as a minimum both a DWG and a GP4 file) shall be provided to test LG&E / KU's ability to access the hybrid drawing information.

2.3.4. All raster images shall be scanned at a minimum 200 DPI resolution. Higher resolutions shall be used if the drawing detail or quality warrants it.

2.3.5. Scanning shall be by the Contractor or by the Owner as outlined in the specific contract. The original raster title block shall be removed. The standard Owner's title block will be inserted as per paragraph 2.2.3.2. the scanned image shall be visible in a viewport.

2.3.6. If specified in the contract vectorization of raster or hybrid drawings may be required prior to final submission. Contractor and Owner will agree upon drawings to be vectorized.

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2.3.7. ALL OTHER ITEMS IN SECTION 2.2 APPLY.

2.4. **CAD Drawing Submittal**

2.4.1. Final AutoCAD drawings and raster images (in the case of Hybrid drawings) shall be submitted to Owner on CD or DVD. The file names shall match the LG&E / KU drawing numbers

2.4.2. Back-up TIFF or *PDF images of the drawings as produced from the native CAD application shall be provided on the CD. TIFF or *PDF images shall include the signed PE stamp if applicable.

2.4.3. Drawings may be created using x-references and/or links to other drawings but when the final drawing is submitted to Owner, all external references shall be permanently bound into the drawing such that there is only one DWG file per drawing. Likewise if there are multiple insertions of raster images (in the case of Hybrid drawings) they shall be merged into a single raster image file with the same name as the DWG file except using the file extension of one of the approved raster formats.

2.4.4. Each drawing shall be submitted under a different file name. For example if three drawings are created using three different paper space views of the same model space, it shall be duplicated three times and only the view representative of the individual drawing shall be saved in the final file as layout 1 in paper space. Any extraneous drawing entities in model space not pertaining to the drawing shall be deleted.

2.4.5. Standard AutoCAD text fonts should be used. If any non-standard AutoCAD fonts, textures, dimension styles, plot styles, etc. are used within the drawing, a copy shall be provided when the drawings are submitted to Owner.

2.4.6. If drawings are created with line weights based on Color Tables, the proper CTB file shall also be provided to the Owner. CTB filenames are to be unique and should include the vendor's initials and a date.

2.4.7. Non-standard support files submitted according to 2.4.5 and 2.4.6. shall be given unique filenames containing originating company's name or initials.

2.4.8. If drawings are created based on layer/level dependent line weights, a listing of those settings shall be provided to the Owner. (NOTE: Line weights based on CTB tables is preferred).

2.4.9. The Contractor shall keep a backup copy of all electronic data provided to Owner for a minimum of 1 year from the date sent to Owner.

2.4.10. All drawings and media provided to Owner shall be fully manifested. If 20 or more drawings are to be submitted an index shall be provided electronically in Excel or Access format which includes, as a minimum, the information contained in TABLE 1 at the end of the Specification.

TABLE 1 – Typical Drawing Attribute Information for DMS Submission

Field Name	Character Limit	Examples
Project	8	*As agreed upon in the contract*
Drawing Number	20	*As agreed upon in the contract*
Alternate Drawing Number	20	Vendor's internal drawing number (optional)
Revision	1	A or B or C... (skipping I and O)
Original creation date	8	12/01/00
Latest revision date	8	12/31/00
Title	96	
Location	4	MC4 or TC1 or GH0 (0=common systems)
Engineering Discipline	1	E=electrical, C=civil, M=mechanical, A=architectural, S=structural
Drawing Type	Any	wiring, schematic, flow, logic, site plan, foundation, piping, details, steel, etc.
Drawing size	1	D or E, etc.
Scale	Any	¼"=1', none, as noted, etc.
CAD Filename	Any	File name shall match the LG&E/KU drawing number and shall not contain any spaces.
Release Reason	Any	Construction, Approval, Reference, etc

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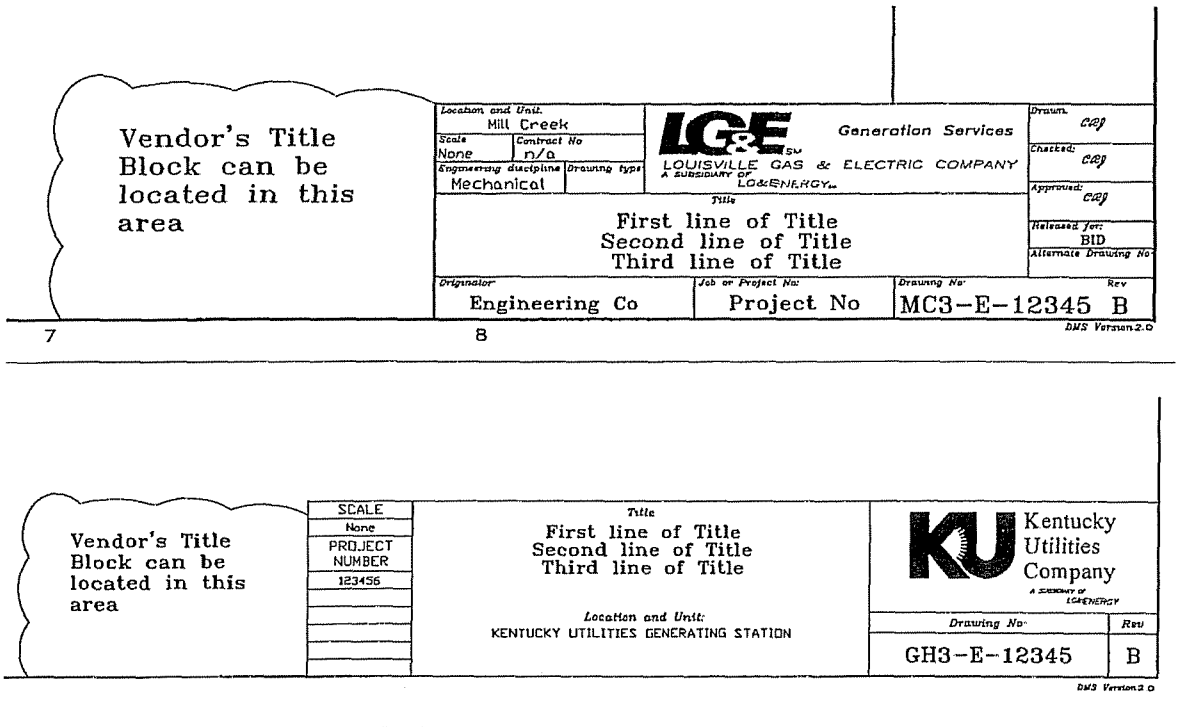

Figure 1

Sample Title Block

(other versions and formats are available)

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EXHIBIT Y

COMPONENT EXTENDED WARRANTY

Component	Warranty Period
Mist Eliminator Note: terms of Subcontractor's warranty which was provided to Buyer shall apply once the applicable Warranty Period under this Agreement expires.	Fifteen Years from Commercial Operation
ITT Knife Gate Discharge Valves	Forty Eight Months from Commercial Operation

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EXHIBIT Z

BACKCHARGES

Category of labor applicable to Contractor	$/hour 2012		$/hour 2013		$/hour 2014		$/hour 2015	
	ST	OT	ST	OT	ST	OT	ST	OT
Contractor's Office based staff:	225.00	225.00	236.25	236.25	248.06	248.06	260.47	260.47
Engineering Project Manager	147.00	147.00	154.35	154.35	162.07	162.07	170.17	170.17
Engineering – Onshore	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Engineering – Offshore	117.00	117.00	122.85	122.85	128.99	128.99	135.44	135.44
Procurement	125.00	125.00	131.25	131.25	137.81	137.81	144.70	144.70
Project Controls (cost, planning and scheduling)								
Contractor's Site based staff:								
Construction Site Manager	192.50	192.50	202.13	202.13	212.23	212.23	222.84	222.84
Field Engineers	172.00	172.00	180.60	180.60	189.63	189.63	199.11	199.11
Superintendents	144.87	144.87	152.11	152.11	159.72	159.72	167.71	167.71
Project Controls (cost, planning and scheduling)	126.02	126.02	132.32	132.32	138.94	138.94	145.88	145.88
Field Procurement and Subcontracts	99.23	99.23	104.19	104.19	109.40	109.40	114.87	114.87
Craft Labor:								
Group I - structural steel welding and erection, pipe welding, and boiler tube welding	67.25	100.32	70.61	105.34	74.14	110.60	77.85	116.13
Group II - carpenters, rebar iron workers, cement masons and operating engineers	60.64	90.46	63.67	94.98	66.86	99.73	70.20	104.72
Group III - millwrights, electricians, boiler makers (no welding), pipe fitters (no welding) and startup support	65.05	94.82	68.30	99.56	71.72	104.54	75.30	109.77
Group IV – laborers	39.41	58.76	41.38	61.70	43.45	64.78	45.62	68.02

Notes

1. The above rates shall be fully inclusive of all costs, charges, benefits and taxes related thereto including, but not limited to; Workers' Compensation insurance, site establishment costs, overheads, administration, statutory deductions, head office charges, bonus and incentive payments, protective clothing, tools and equipment with a value of less than $1,500, holiday pay, traveling expenses, subsistence, special site conditions, etc.

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2. Overtime rates include only those costs from item 1 above that apply to overtime hours.

3. Construction equipment rental rates are not included above and will be invoiced separately on a T&M basis.

4. No more than five percent escalation each year thereafter through Warranty Period.

5. Rates shown are "not-to-exceed." Should lower rates be obtained from Contractor(s), those lower rates will apply and this document will be revised accordingly.

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LOUISVILLE GAS AND ELECTRIC COMPANY

FINANCIAL EXHIBIT
(807 KAR 5:001 SEC. 6)

March 31, 2012

(1) Amount and kinds of stock authorized.

75,000,000 shares of Common Stock, without par value
1,720,000 shares of Preferred Stock at $25.00 par value – authorized, but unissued
6,750,000 shares of Preferred Stock, without par value – authorized, but unissued

(2) Amount and kinds of stock issued and outstanding.

Common Stock:
21,294,223 shares issued and outstanding, without par value, recorded at $424,334,535.

(3) Terms of preference of preferred stock whether cumulative or participating, or on dividends or assets or otherwise.

None

(4) Brief description of each mortgage on property of applicant, giving date of execution, name of mortgagor, name of mortgagee, or trustee, amount of indebtedness authorized to be secured thereby, and the amount of indebtedness actually secured, together with any sinking fund provisions.

Date of Execution: As of October 1, 2010 (Supplemental Indentures were executed on October 15, 2010 and November 1, 2010.)
Mortgagor: Louisville Gas and Electric Company
Trustee: The Bank of New York Mellon
Amount of Authorized Debt: One quintillion dollars
Amount of Debt Secured: $1,109,304,000
Sinking Fund Provisions: None
Pledged Assets: Substantially all assets of Louisville Gas and Electric Company located in Kentucky

(5) Amount of bonds authorized, and amount issued, giving the name of the public utility which issued the same, describing each class separately, and giving date of issue, face value, rate of interest, date of maturity and how secured, together with an amount of interest paid thereon during the last 12-month period.

Secured by first mortgage lien on substantially all assets in Kentucky.

Louisville Gas and Electric Company

Date of Issue	Date of Maturity	Rate of Interest	Principal Amount Authorized	Principal Amount Outstanding at March 31, 2012	Interest Expense Year Ended March 31, 2012
Pollution Control Bonds					
05/19/00	05/01/27	Variable	$ 25,000,000	$ 25,000,000	$ 967,353
08/09/00	08/01/30	Variable	83,335,000	83,335,000	126,253
09/11/01	09/01/27	Variable	10,104,000	10,104,000	15,745
03/06/02	09/01/26	Variable	22,500,000	22,500,000	115,397
03/06/02	09/01/26	Variable	27,500,000	27,500,000	230,492
03/22/02	11/01/27	Variable	35,000,000	35,000,000	85,100
03/22/02	11/01/27	Variable	35,000,000	35,000,000	79,892
10/23/02	10/01/32	Variable	41,665,000	41,665,000	230,854
11/20/03	10/01/33	1.900%	128,000,000	128,000,000 *	2,427,003
04/13/05	02/01/35	5.750%	40,000,000	40,000,000	2,300,000
04/26/07	06/01/33	5.625%	31,000,000	31,000,000	1,743,750
04/26/07	06/01/33	1.900%	35,200,000	35,200,000 *	667,426
04/26/07	06/01/33	4.600%	60,000,000	60,000,000	2,760,000
Interest Rate Swaps					7,842,219
			$ 574,304,000	$ 574,304,000	$ 19,591,484
First Mortgage Bonds					
11/16/10	11/15/15	1.625%	$ 250,000,000	$ 250,000,000	$ 4,062,500
11/16/10	11/15/40	5.125%	285,000,000	285,000,000	14,606,250
			$ 535,000,000	$ 535,000,000	$ 18,668,750

* On January 13, 2011, Louisville Gas and Electric (LG&E) remarketed the Louisville/Jefferson County Metro Government 2003 Series A and 2007 Series B bonds. In connection with the remarketing, each bond series was converted to a mode wherein the interest rate was fixed for an intermediate term but not the full term of the bond. The 2003 Series A bonds bore interest at the rate of 1.900% until April 2012 and the 2007 Series B bonds will bear interest at the rate of 1.900% until June 2012. On April 2, 2012,

the 2003 Series A bond was remarketed wherein the interest rate is fixed for an intermediate term but not the full term of the bond at the rate of 1.650%. On June 1, 2012, the 2007 Series B bonds will be remarketed wherein the interest rate will be fixed for an intermediate term but not the full term of the bond at the rate of 1.600%. At the end of the intermediate terms, the Company must remarket the bonds or buy them back.

(6) Each note outstanding, giving date of issue, amount, date of maturity, rate of interest, in whose favor, together with amount of interest paid thereon during the last 12-month period.

There are no notes outstanding as of March 31, 2012.

(7) Other indebtedness, giving same by classes and describing security, if any, with a brief statement of the devolution or assumption of any portion of such indebtedness upon or by person or corporation if the original liability has been transferred, together with amount of interest paid thereon during the last fiscal year.

None, other than current and accrued liabilities.

(8) Rate and amount of dividends paid during the five previous fiscal years, and the amount of capital stock on which dividends were paid each year. (1)

Dividends on Common Stock, without par value (not based on rate per share)

2007	$ 65,000,000
2008	40,000,000
2009	80,000,000
2010	55,000,000
2011	83,250,000

(1) On November 1, 2010, PPL Corporation completed its acquisition of E.ON U.S LLC., the Company's parent. Upon completion of the acquisition, E.ON U.S. LLC was renamed LG&E and KU Energy LLC. The 21,294,223 shares are currently owned by LG&E and KU Energy LLC. From May 1998 to October 31, 2010, the 21,294,223 shares were all owned by E.ON U.S. LLC (formerly LG&E Energy LLC) and all dividends declared by LG&E's Board of Directors were paid to E.ON U.S. LLC. Subsequent to October 31, 2010, all dividends declared by LG&E's Board of Directors were paid to LG&E and KU Energy LLC. During the 1st quarter of 2012, LG&E declared and paid a dividend on common stock of $15,000,000.

Dividends on 5% Cumulative Preferred Stock, $25 par value

The amount of dividends declared and paid on the 860,287 shares of 5% Cumulative Preferred Stock, $25 par value, in the year 2007 was $316,636. All shares were redeemed on April 16, 2007.

Dividends on $5.875 Cumulative Preferred Stock, without par value

The preferred stock had a sinking fund requirement sufficient to retire a minimum of 12,500 shares on July 15 of each year commencing with July 15, 2003, and the remaining 187,500 shares on July 15, 2008 at $100 per share. The Company redeemed 12,500 shares in accordance with these provisions annually on July 15, 2003 through July 15, 2006. The 200,000 remaining shares were redeemed April 16, 2007.

Annual dividends and interest on preferred stock, without par value for the previous five fiscal years were:

2007	$ 345,972
2008	0
2009	0
2010	0
2011	0

Dividends on Auction Rate Cumulative Preferred Stock, without par value

Declared Date	Payment Date	Rate Per Share	Amount
March 2007	04/13/07	1.25000	$625,000
			$625,000

Dividend is based on 500,000 shares for all periods. All shares were redeemed on April 16, 2007.

(9) Detailed Income Statement, Balance Sheet and Statement of Retained Earnings

Monthly Financial and Operating Reports are filed each month with the Kentucky Public Service Commission. Attached are detailed Statements of Income, Balance Sheets and Retained Earnings for the Company for the period ending March 31, 2012.

Louisville Gas and Electric Company
Balance Sheet as of March 31, 2012

Assets

Utility Plant		
Utility Plant at Original Cost	$	4,933,705,788.03
Less: Reserves for Depreciation and Amortization		2,144,260,445.77
Total		2,789,445,342.26
Investments		
Ohio Valley Electric Corporation		594,286.00
Nonutility Property - Less Reserve		11,879.20
Special Funds		26,812,546.91
Total		27,418,712.11
Current and Accrued Assets		
Cash		37,944,606.65
Special Deposits		-
Temporary Cash Investments		16,338,854.02
Accounts Receivable - Less Reserve		121,482,082.46
Accounts Receivable from Associated Companies		20,097,723.37
Materials and Supplies - At Average Cost		
Fuel		66,393,015.44
Plant Materials and Operating Supplies		30,964,056.64
Stores Expense		5,553,099.47
Gas Stored Underground		20,184,889.10
Emission Allowances		17,221.12
Prepayments		4,804,662.67
Miscellaneous Current and Accrued Assets		693.97
Total		323,780,904.91
Deferred Debits and Other		
Unamortized Debt Expense		12,916,551.41
Unamortized Loss on Bonds		20,682,089.39
Accumulated Deferred Income Taxes		22,116,906.94
Deferred Regulatory Assets		388,800,142.12
Other Deferred Debits		1,804,929.40
Total		446,320,619.26
Total Assets	$	3,586,965,578.54

Liabilities and Proprietary Capital

Proprietary Capital		
Common Stock	$	425,170,424.09
Less: Common Stock Expense		835,888.64
Paid-In Capital		83,581,499.00
Other Comprehensive Income		-
Retained Earnings		879,118,652.63
Total Proprietary Capital		1,387,034,687.08
Pollution Control Bonds - Net of Reacquired Bonds		574,304,000.00
First Mortgage Bonds		531,401,507.42
LT Notes Payable to Associated Companies		-
Total Long-Term Debt		1,105,705,507.42
Total Capitalization		2,492,740,194.50
Current and Accrued Liabilities		
ST Notes Payable to Associated Companies		-
Notes Payable		-
Accounts Payable		92,234,601.80
Accounts Payable to Associated Companies		15,938,027.00
Customer Deposits		22,435,650.26
Taxes Accrued		17,874,000.30
Dividends Declared		-
Interest Accrued		12,083,404.23
Miscellaneous Current and Accrued Liabilities		28,854,345.46
Total		189,420,029.05
Deferred Credits and Other		
Accumulated Deferred Income Taxes		515,319,247.11
Investment Tax Credit		42,048,774.66
Regulatory Liabilities		58,003,499.13
Customer Advances for Construction		7,329,863.59
Asset Retirement Obligations		59,331,864.27
Other Deferred Credits		8,148,016.44
Miscellaneous Long-Term Liabilities		53,954,916.00
Accum Provision for Postretirement Benefits		160,669,173.79
Total		904,805,354.99
Total Liabilities and Stockholders' Equity	$	3,586,965,578.54

Louisville Gas and Electric Company
Statement of Income
March 31, 2012

	Year Ended 3/31/2012
Electric Operating Revenues	$ 1,047,904,225.60
Gas Operating Revenues	275,941,947.28
Total Operating Revenues	1,323,846,172.88
Fuel for Electric Generation	364,417,722.66
Power Purchased	69,067,179.05
Gas Supply Expenses	134,952,881.75
Other Operation Expenses	236,431,977.22
Maintenance	124,285,221.46
Depreciation	143,365,535.89
Amortization Expense	8,381,255.24
Regulatory Credits	(5,963,064.74)
Taxes	
Federal Income	3,749,740.75
State Income	6,333,346.98
Deferred Federal Income - Net	53,700,477.69
Deferred State Income - Net	2,517,313.82
Property and Other	28,493,239.65
Amortization of Investment Tax Credit	(2,794,366.47)
Loss (Gain) from Disposition of Allowances	(693.97)
Accretion Expense	2,711,211.78
Total Operating Expenses	1,169,648,978.76
Net Operating Income	154,197,194.12
Other Income Less Deductions	343,093.48
Income Before Interest Charges	154,540,287.60
Interest on Long-Term Debt	38,260,233.51
Amortization of Debt Expense - Net	3,275,104.95
Other Interest Expenses	2,724,996.26
Total Interest Charges	44,260,334.72
Net Income	$ 110,279,952.88

Louisville Gas and Electric Company
Analysis of Retained Earnings
March 31, 2012

	Year Ended 3/31/12
Balance at Beginning of Period	$ 849,838,699.75
Add:	
Net Income for Period	110,279,952.88
Deduct:	
Common Dividends	
Common Stock Without Par Value	81,000,000.00
Balance at End of Period	$ 879,118,652.63

SECRETARY'S CERTIFICATE

I, Gerald A. Reynolds, do hereby certify that I am the duly qualified and acting General Counsel, Chief Compliance Officer and Corporate Secretary of Louisville Gas and Electric Company, a Kentucky corporation, (the "Company"), and that as such officer, I have access to all original records of the Company and that I am authorized to make certified copies of Company records on its behalf. I further hereby certify that the attached resolutions are a true and correct copy of the resolutions of the Company adopted by unanimous written consent effective as of June 5, 2012, and that the same have not been altered, amended or repealed.

IN WITNESS WHEREOF, I have executed this Certificate this 5th day of June 2012.

Gerald A. Reynolds
General Counsel, Chief Compliance Officer
And Corporate Secretary

ACTION OF THE BOARD OF DIRECTORS
OF
LOUISVILLE GAS AND ELECTRIC COMPANY
TAKEN BY WRITTEN CONSENT
IN LIEU OF A SPECIAL MEETING

June 5, 2012

ISSUANCE OF FIRST MORTGAGE BONDS

WHEREAS, the Board of Directors of the Company (the "Board") has determined that it is desirable and in the best interests of the Company to issue up to $350,000,000 aggregate principal amount of long-term debt in the form of first mortgage bonds for the purposes of providing funds for anticipated capital expenditures, operational or financial needs and other general corporate purposes.

NOW, THEREFORE, BE IT RESOLVED, by the Board as follows:

The Offering

(a) That the Board authorizes and approves the issuance and sale by the Company from time to time, in one or more series, and in any combination, of up to $350,000,000 aggregate principal amount of long-term debt in the form of first mortgage bonds (any of such bonds, the "Debt Securities" in one or more underwritten public offerings, negotiated sales, or private placement transactions (such offerings, sales and transactions collectively referred to herein as the "Offering"), the net proceeds of such Debt Securities to be used for general corporate purposes, including construction and other capital expenditures, operational funding requirements, and repayment, refunding or refinancing of short- or long-term debt at maturity or otherwise.

(b) That the Company be, and it hereby is, authorized to issue and offer for sale the Debt Securities through or to one or more underwriters, selling or placement agents, or other purchasers pursuant to an underwriting, purchase or similar agreement, on and subject to such terms and conditions as may be approved by the Authorized Officers (as defined below), provided that the interest rate on such Debt Securities shall not exceed 6-6.5% per annum.

Debt Securities or First Mortgage Bonds

(c) That the Chief Executive Officer, President, Chief Financial Officer, Chief Administrative Officer, General Counsel, Chief Compliance Officer and Corporate Secretary, any Vice, President, the Treasurer, and the Controller of the Company (each, an "Authorized Officer" and, collectively, the "Authorized Officers") are, and each of them hereby is, authorized by and on behalf of the Company, to negotiate, enter into, execute and deliver one or more supplemental indentures, company orders and/or officer's certificates (the "Supplemental Indentures") pursuant to the Company's Indenture dated October 1, 2010 to The Bank of New York Mellon, as trustee (such Indenture, as heretofore supplemented and as to be further supplemented and amended by any such instrument the "Indenture") relating to the creation and issuance of, and establishing the designation, form, characteristics and terms of the Debt Securities, in such form or forms and having such terms as the Authorized Officers executing the same shall approve, and to perform all of the agreements and obligations of the Company under the Supplemental Indentures and Indenture and to consummate the transactions contemplated thereby; and that each Authorized Officer be, and hereby is, authorized to execute and deliver such other agreements, certificates and documents and to take such other actions in connection with the execution and delivery of any Supplemental Indenture or other instrument pursuant to the Indenture as such Authorized Officers deem necessary, advisable or appropriate; with such changes therein, additions thereto or omissions therefrom, as any Authorized Officer executing, acknowledging or delivering the same shall approve, such Authorized Officer's execution, acknowledgement and/or delivery thereof to be conclusive evidence of such approval.

(d) That the Authorized Officers are, and each of them hereby is, authorized, empowered and directed, in the name and on behalf of the Company, to execute, acknowledge and deliver new securities representing the Debt Securities in substantially such form and containing such terms and conditions as such Authorized Officer shall approve, with such changes therein, additions thereto or omissions therefrom as such Authorized Officer executing, acknowledging or delivering the same shall approve, such Authorized Officer's execution, acknowledgement and delivery thereof to be conclusive evidence of such approval.

(e) That the Authorized Officers are, and each of them hereby is, authorized, empowered and directed to fix and approve the terms and conditions on which the Debt Securities are to be issued and authenticated and the final terms of the Supplemental Indentures or any other instrument pursuant to the Indenture, including, without limitation, the rights of the holders thereof, the interest rate or rates, the maturity date or dates, the sinking fund, redemption or repurchase provisions and prices, the purchase price or prices, the offering date and terms and all other matters relating thereto, and to take all such other actions as any Authorized Officer deems necessary, advisable or appropriate to consummate the transactions contemplated by the Supplemental Indentures.

(f) That a facsimile of the corporate seal of the Company may be imprinted on the Supplemental Indentures and/or Debt Securities, which facsimile is hereby acknowledged to be the corporate seal of the Company for the purposes of sealing the Debt Securities.

(g) That the Authorized Officers are, and each of them hereby is, authorized to execute and deliver on behalf of the Company, in the event that all or a portion of the Debt Securities

bear a fixed or variable rate of interest: (i) one or more interest rate lock or swap agreements or similar agreements with one or more underwriters, banks or other financial institutions or other counter-parties, including affiliated entities, providing for the hedging of the interest rates on such securities, and (ii) any other agreement, document or instrument that may be necessary or appropriate in connection with any such transaction.

Paying Agent and Security Registrar

(h) That The Bank of New York Mellon is hereby appointed to act as the initial paying agent and security registrar for the Debt Securities described herein in accordance with the provisions of the Indenture; provided that any Authorized Officer may take all actions necessary or desirable, on behalf of the Company, to provide for any additional or different paying agent or security registrar for any Debt Securities, if such Authorized Officer deems such provision to be desirable, such officer's determination to be conclusively evidenced by his execution of documentation effecting such appointment or change.

Offering Documents

(i) That, in connection with the issuance and sale of the Debt Securities, the Authorized Officers are, and each of them hereby is, authorized, empowered and directed, in the name and on behalf of the Company to: (i) prepare, or cause to be prepared, one or more prospectuses, offering memoranda or other appropriate disclosure documents (including all exhibits, annexes and other documents relating thereto) in connection with such issuance and sale of the Debt Securities, including any supplement(s) or amendment(s) thereto (the "Offering Memorandum"); (ii) execute, as such Authorized Officers or Authorized Officer deem(s) necessary, advisable or appropriate, any and all, agreements, documents and instruments in connection with such issuance and sale; and (iii) take all such other actions as such Authorized Officers or Authorized Officer deem(s) necessary, advisable or appropriate in order to effect the issuance and sale of the Debt Securities, such Authorized Officer's authority and determination to execute such documents and instruments and to take such actions being conclusively evidenced by such execution or action, as the case may be.

Authorization of Underwriting, Purchase or Similar Agreements

(j) That the Authorized Officers are, and each of them hereby is, authorized and directed, for and on behalf of the Company, to fix and approve the terms of an underwriting, purchase or similar agreement relating to the issuance and sale of the Debt Securities to one or more underwriters, selling or placement agents or other purchasers thereof (the "Purchase Agreement") to be entered into by and among the Company and such underwriters, agents or purchasers as may agree to become parties thereto, and the Authorized Officers be, and each of them hereby is, authorized to execute and deliver the same, in such form or with such changes therein, additions thereto or omissions therefrom as such Authorized Officers may approve, such execution and delivery by any such Authorized Officer to be conclusive evidence of such authorization and approval.

(k) That the Authorized Officers are, and each of them hereby is, authorized to execute and file such instruments, make all such payments, and do such other acts and things as, in the opinion of any Authorized Officer, may be necessary or desirable in order to comply

with the rules and regulations promulgated under the Securities Act of 1933, as amended; and to qualify the Company or any Debt Securities under the securities or "Blue Sky" laws of such states of the United States and other jurisdictions as may be necessary or desirable, and to take further necessary action for said purposes.

Regulatory Approval

(l) That the Authorized Officers of the Company are, and each of them hereby is, authorized and empowered to execute and file, or cause to be filed, on behalf of the Company, such applications, petitions or notices (including amendments or supplements thereto) with the Public Service Commission of the Commonwealth of Kentucky and any other federal, state, or local commission, court, agency or body having jurisdiction as may be required to obtain any approvals, consents, orders or rulings as such officers or counsel for the Company may deem to be necessary or desirable in connection with the transactions contemplated hereby, as may be required by law or as may be deemed to be proper or appropriate in their judgment or in the judgment of counsel for the Company in connection with the foregoing.

General

(m) That the Authorized Officers of the Company are, and each of them is, hereby authorized and empowered, in the name and behalf of the Company, to execute and deliver such agreements and other documents relating to electronic deposit and delivery, cash management, information services and such other matters as they shall deem necessary or desirable to otherwise facilitate the offering, issuance, sale and delivery of the Debt Securities and receive and apply the proceeds therefrom.

(n) That the officers of the Company are, and each of them hereby is, authorized in the name and on behalf of the Company and under its corporate seal or otherwise, to take or cause to be taken all such further actions and to execute and deliver or cause to be executed and delivered all such further instruments, agreements, certificates and other documents in connection with the Offering as such persons may deem necessary, advisable or appropriate in connection with the transactions contemplated thereby and hereby, and to incur all such fees and expenses as shall be necessary, advisable or appropriate in their judgment in order to carry into effect the purpose and intent of any and all of the foregoing resolutions.

(o) That any acts of the officers of this Company, which acts would have been authorized by the foregoing resolutions except that such acts were taken prior to the adoption of such resolutions, are hereby severally ratified, confirmed, approved and adopted as acts in the name of and on behalf of this Company.

(p) That the Authorized Officers are, and each of them hereby is, authorized and directed to take any and all further action to see that the intent of the above resolutions is carried forth.

This unanimous written consent may be executed in two or more counterparts, all of which taken together shall be deemed one and the same instrument.

ACTION OF THE BOARD OF DIRECTORS
OF
LOUISVILLE GAS AND ELECTRIC COMPANY
TAKEN BY WRITTEN CONSENT
IN LIEU OF A SPECIAL MEETING

June 5, 2012

EXPANSION OF REVOLVING CREDIT FACILITIES

WHEREAS, the Company is borrower under a $400 million Revolving Credit Agreement, dated as of November 1, 2010, among the Company, the Lenders party thereto and Wells Fargo Bank, National Association, as administrative agent, as amended (the "Existing Credit Agreement"), which currently is scheduled to expire in October 2016, subject to the ability to expand the facility by up to $100 million at the Company's request, and subject to the consent of the lenders; and

WHEREAS, the Company desires to increase the amount of borrowings available under its revolving credit facilities to a total aggregate amount of up to $500 million, through modification of the Existing Credit Agreement or by entering into additional revolving credit facilities having similar terms, such expansions or alternative facilities having a combined aggregate principal amount not to exceed $100 million (collectively, the "Revolving Credit Facilities"); and

WHEREAS, the Board has determined that it is in the Company's best interests to amend or modify, as appropriate, the Existing Credit Agreement or negotiate and enter into additional revolving credit agreements, as appropriate, so as to effect the Revolving Credit Facilities; and

NOW, THEREFORE, BE IT RESOLVED, by the Board as follows:

Credit Agreements or Amendments

(a) That the Chief Executive Officer, President, Chief Financial Officer, the Chief Administrative Officer, the General Counsel, Chief Compliance Officer and Corporate Secretary, any Vice President, the Treasurer, and the Controller of the Company (each, an "Authorized Officer" and, collectively, the "Authorized Officers") be, and each of them hereby is, authorized by and on behalf of the Company, authorized and empowered to negotiate, execute and enter into, on behalf of the Company, such forms of amended, modified, replacement or new promissory notes or credit agreements, whether relating to the Existing Credit Agreement or to new credit arrangements, with existing or new banks and financial institutions, that such Authorized Officer deems necessary or desirable to

document and effect the Revolving Credit Facilities, together with such other agreements, instruments, notices, certificates and documents, on such terms and conditions as the officer executing such documents deems appropriate, with such officer's execution of a definitive agreement to conclusively evidence such officer's approval and the approval of this Board of Directors.

(b) That the Authorized Officers be, and each of them hereby is, authorized by and on behalf of the Company to: (i) request advances (including issuance of letters of credit) under the Revolving Credit Facilities; (ii) delegate to any other officers or employees of the Company, either acting individually or jointly, authority to request advances (including issuances of letters of credit) under the Revolving Credit Facilities; and (iii) execute and deliver any other agreements and documents and take any and all other action as contemplated by the Revolving Credit Facilities or as such officer may deem necessary or desirable in connection with the making of advances (including issuances of letters of credit) on account of the Company pursuant to the Revolving Credit Facilities.

(c) That the Authorized Officers be, and each of them hereby is, authorized and directed to cause the preparation of, to approve, or consent to, and execute and deliver the necessary documents, instruments, agreements or certificates necessary to enter into the Revolving Credit Facilities.

General

(d) That the Authorized Officers of the Company be, and each of them hereby is, authorized and empowered to execute and file, or cause to be filed, on behalf of the Company, such applications, petitions or notices (including amendments or supplements thereto) with the Public Service Commission of the Commonwealth of Kentucky, the State Corporation Commission of the Commonwealth of Virginia, the Tennessee Regulatory Authority and any other federal, state, or local commission, court, agency or body having jurisdiction as may be required to obtain any approvals, consents, orders or rulings as such officers or counsel for the Company may deem to be necessary or desirable in connection with the transactions contemplated hereby, as may be required by law or as may be deemed to be proper or appropriate in their judgment or in the judgment of counsel for the Company in connection with the foregoing.

(e) That any and all actions heretofore taken by the Authorized Officers within the terms of the foregoing resolutions, including any actions taken in connection with applications to the Public Service Commission of the Commonwealth of Kentucky or any other federal, state, or local commission, court, agency or body having jurisdiction as required to obtain any approvals, consents, orders or rulings as such officers or counsel for the Company deemed to be necessary or desirable in connection with the transactions contemplated hereby, be and the same are hereby in all respects approved, ratified and confirmed.

This unanimous written consent may be executed in two or more counterparts, all of which taken together shall be deemed one and the same instrument.