BURNS McDONNELL

Kyger Creek Generating Station

Initial Certification Statement to Discharge Bottom Ash Transport Water

OVEC IKEC
Ohio Valley Electric Corporation / Indiana-Kentucky Electric Corporation

Ohio Valley Electric Corporation

Kyger Creek Generating Station

Project No. 126371

Revision 0
December 2022

Kyger Creek Generating Station

Initial Certification Statement to Discharge Bottom Ash Transport Water

Prepared for

Ohio Valley Electric Corporation
Kyger Creek Generating Station

Project No. 126371
Cheshire, Ohio

Revision 0
December 2022

Prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

INDEX AND CERTIFICATION

Ohio Valley Electric Corporation
Kyger Creek Generating Station

Initial Certification Statement to Discharge Bottom Ash Transport Water

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Certification

I hereby certify, as a Professional Engineer in the State of Ohio, that the information in this document was assembled under my direct personal charge. This report is not intended or represented to be suitable for reuse by Ohio Valley Electric Corporation or others without specific verification or adaptation by the Engineer. I hereby certify that this initial certification was prepared for the Ohio Valley Electric Corporation Kyger Creek Generating Station in accordance with standard engineering practices and based on my knowledge, information, and belief, the content of this Certification when developed in May 2021 is true and meets the requirements of 40 CFR § 423.19(c). I hereby certify that I am familiar with the ELG regulation requirements and Ohio Valley Electric Corporation's Kyger Creek Generating Station.

STATE OF OHIO
ZACHARY BAHR
PE 85998
REGISTERED
PROFESSIONAL ENGINEER

Dec 20 2022 9:46 AM

Zachary Bahr

Zachary Bahr, P.E.
(Ohio License No. PE 85998)

Date: 12/20/2022

Owner's Certification of Compliance - 40 CFR 122.22

Pursuant to 40 CFR 122.22, I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

On behalf of Ohio Valley Electric Corporation:

J. Michael Brown

J. Michael Brown
(Printed Name)

ES + H Director
(Title)

12/20/2022
(Date)

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
BAT	Best Available Technology Economically Achievable
BATW	Bottom Ash Transport Water
BMcD	Burns & McDonnell
BSHS	Boiler Slag Handling System
CCR	Coal Combustion Residual
CFR	Code of Federal Regulations
ELG Rule	Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category
EPA	U.S. Environmental Protection Agency
FGD	Flue Gas Desulfurization
gpm	gallons per minute
HDPE	High density polyethylene
Kyger Creek	Kyger Creek Generating Station
LSI	Langelier Scaling Index
L-SI	Larson-Skold Index
LVWTS	Low Volume Wastewater Treatment System
OVEC	Ohio Valley Electric Corporation
PRB	Powder River Basin
PSI	Puckorius Scaling Index
RSI	Ryznar Scaling Index
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

1.0 EXECUTIVE SUMMARY

On November 3, 2015, the U.S. Environmental Protection Agency (EPA) issued the federal Steam Electric Power Generating Effluent Limit Guidelines and Standards (ELG); see 80 FR 67838. The 2015 rule addressed discharges from flue gas desulfurization (FGD) wastewater, fly ash transport water, bottom ash transport water (BATW), flue gas mercury control wastewater, gasification wastewater, combustion residual leachate, and non-chemical metal cleaning wastes.

The 2015 rule was reconsidered by EPA, with updates finalized on October 13, 2020 (see 85 FR 64650), that became effective on December 14, 2020. The final rule revised the limitations and standards for two of the waste streams addressed in the 2015 rule: BATW and FGD wastewater. For BATW, the final rule establishes Best Available Technology Economically Achievable (BAT) as a high recycle rate system with a site-specific volumetric purge (defined in the final rule as BA purge water). The purge rate cannot exceed a 30-day rolling average of ten percent of the BATW system's primary active wetted volume, with the purge volume and associated effluent limitations are to be established by the permitting authority. EPA recognizes that some plants may need to improve their equipment, process controls, and/or operations to consistently meet the limitations included in this final rule; however, this is consistent with the Clean Water Act, which requires that BAT discharge limitations and standards reflect the best available technology economically achievable.

This document serves as the initial certification statement required by 40 CFR § 423.19(c). On behalf of Ohio Valley Electric Corporation (OVEC), this initial certification seeks to discharge BA transport water pursuant to 40 CFR § 423.13(k)(2)(i) at the Kyger Creek Generating Station (Kyger Creek), located in Gallia County, Ohio. As required by the ELG Rule, this plan includes the following:

A. A statement that the professional engineer is a licensed professional engineer (refer to Index & Certification page).
B. A statement that the professional engineer is familiar with the regulation requirements (refer to Index & Certification page).
C. A statement that the professional engineer is familiar with the facility (refer to Index & Certification page).
D. The primary active wetted bottom ash system volume in 40 CFR § 423.11(aa) (refer to Table 2-1).
E. Material assumptions, information, and calculations used by the certifying professional engineer to determine the primary active wetted bottom ash system volume (refer to Appendix A).

F. A list of all potential discharges under 40 CFR § 423.13(k)(2)(i)(A)(1) through (4), the expected volume of each discharge, and the expected frequency of each discharge (refer to Table 2-2).

G. Material assumptions, information, and calculations used by the certifying professional engineer to determine the expected volume and frequency of each discharge, including a narrative discussion of why such water cannot be managed within the system and must be discharged (refer to Table 2-2).

H. A list of all wastewater treatment systems at the facility currently, or otherwise required by a date certain under this section (refer to Table 2-5).

I. A narrative discussion of each treatment system including the system type, design capacity, and current or expected operation (refer to Table 2-5).

The Kyger Creek Station is a five unit, 1,086-megawatt coal-fired facility that burns a blend of eastern and Powder River Basin coal. Kyger Creek's existing once-thru bottom ash sluicing system is being replaced with a new BATW high recycle system, which will utilize wet sluicing to transport bottom ash to a remote settling and surge tank system to dewater the bottom ash. The system cannot be operated as a closed loop without significant corrosion that will result in damage to plant equipment that, in turn, will result in maintenance challenges that impact operational efficiency and reliability. As a result, an engineering determination has been made that the system should be operated as a high recycle rate system with pH/alkalinity adjustment and the allowable purge to alleviate these concerns.

OVEC will be directing over half of the excess water collected in the BATW system to the wet scrubber system; however, the scrubber system is an essential air pollution control system necessary for the plant to meet its obligations under the facilities Title V Operating permit. Specifically, the scrubber must be operated to meet not-to-exceed SO_2 emission limit in the facility permit to maintain compliance with the 2010 SO_2 National Ambient Air Quality Standard. In addition, the facility must meet not-to-exceed Mercury emission limits and other emission limits needed to demonstrate compliance with USEPA's Mercury and Air Toxics Standards Rule. As a result, the ash transport water reused in the scrubber needs to be managed in a holistic manner to ensure that the volume and chemistry of the ash transport water does not compromise the effectiveness of the scrubber to meet its primary/intended purpose as an air pollution control system. For example, constituents like aluminum and fluoride in the bottom ash water can cause fouling of the lime / limestone used in the FGD system which in turn can impact SO_2 removal rates and scrubber efficiency.

OVEC will seek to maximize water reuse in the scrubber system; however, OVEC expects periods of operation that will limit reuse of this water and the allowable purge will be required to maintain consistent operation of the BATW system. For these reasons, **OVEC is requesting to purge up to ten percent of the** primary active wetted bottom ash system volume **(up to a 30-day rolling average of 229,200 gallons per day) to maintain system water chemistry and water balance as allowed under 40 CFR § 423.13(k)(2)(i).**

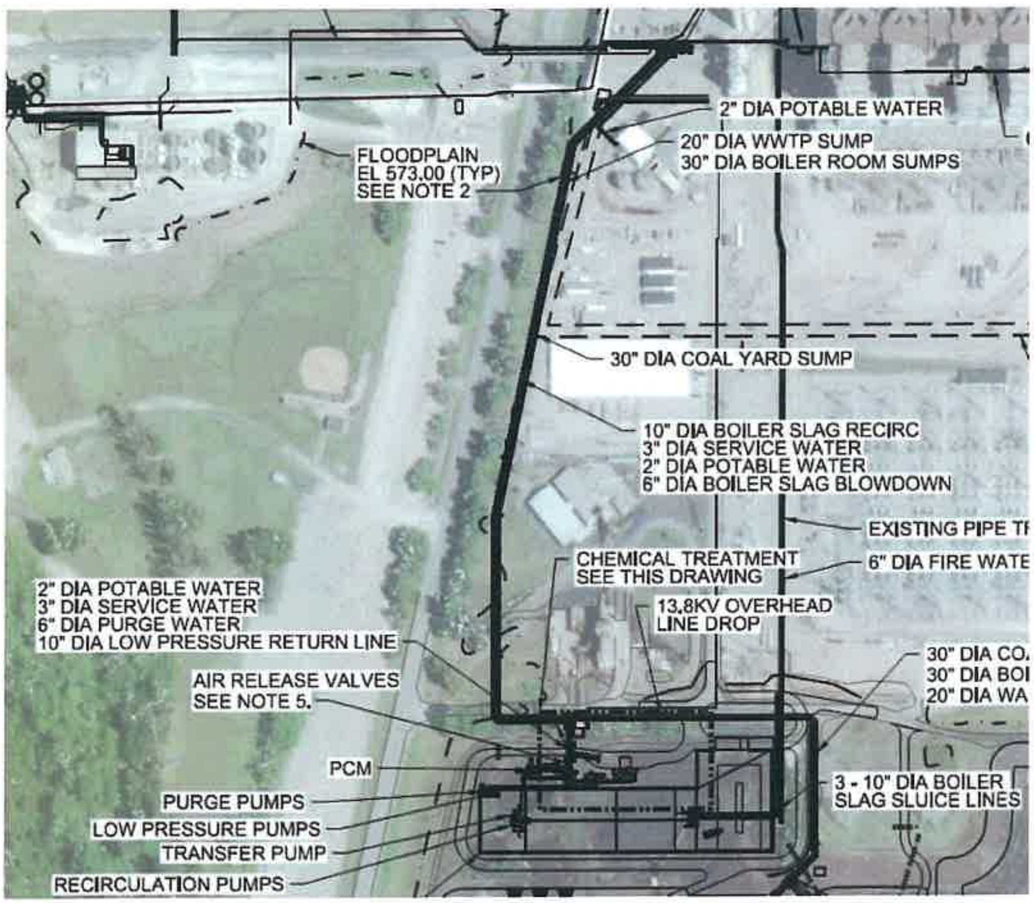
2.0 HIGH RECYCLE SYSTEM DESCRIPTION

As required by 40 CFR § 423.19(c)(3)(D) through (I), the following is a description of the existing bottom ash system at Kyger Creek, including the assumptions, information, and calculations used by the certifying professional engineer to determine the primary active wetted bottom ash system volume and the expected volume and frequency of each discharge. This section also includes a description of the wastewater treatment systems at Kyger Creek.

2.1 Bottom Ash System Description

After combustion, ash/boiler slag that accumulates in the bottom of the boiler is captured in the slag hoppers located directly beneath the boiler. Boiler slag is then crushed into small pieces by the clinker grinders and sluiced by jet pumps to a system of remote settling and surge tanks. A site plan showing major components of the bottom ash system can be found below in Figure 2-1.

Figure 2-1: Kyger Creek Generating Station Plan Drawing



The boiler slag is then dewatered, mechanically loaded into trucks, and transported offsite for beneficial use or to the site CCR landfill for disposal. Transport water from the dewatering process overflows from the settling tank to the recycle tank and is then pumped back to the sluice pumps for re-use. Major equipment for Kyger Creek's Boiler Slag Handling System (BSHS) consists of five boiler hoppers, two settling tanks (one in operation while the other is emptied of its collected bottom ash), and one surge/recycle tank. The sluice supply piping and the water return piping has been included in the system calculation as well, while the miscellaneous interconnecting piping throughout the system and most of the inactive settling tank (except the portion that always retains water) have been excluded.

A summary of pertinent system data is provided in Table 2-1. A site water balance diagram can be found in Appendix A.

Table 2-1: Kyger Creek's Primary Active Wetted Volume Summary

Description	Qty	Unit	Length (LF)	Size (in)	Component Volume (Cu. ft)	Total Component Volume (Gal)	Cumulative System Volume (Gal)
Equipment							
Boiler Slag Hopper	5	Each	See Appendix A		4,816	180,133	180,133
Settling Tank (Active)	1	Each	See Appendix A		144,598	1,081,596	1,261,729
Settling Tank (Inactive Heel)	1	Each	See Appendix A		27,036	202,229	1,463,958
Recycle/Surge Tank	1	Each	See Appendix A		104,810	783,979	2,247,937
Piping							
Basalt-Lined Sluice Piping	1	Each	6,587	10	3,504	26,207	2,274,144
Carbon Steel Recirculation Piping	1	Each	198	3	10	76	2,274,220
Carbon Steel Recirculation Piping	1	Each	143	4	13	95	2,274,315
Carbon Steel Recirculation Piping	1	Each	2,640	6	530	3,961	2,278,276
Carbon Steel Recirculation Piping	1	Each	23	8	8	60	2,278,336
Carbon Steel Recirculation Piping	1	Each	623	10	341	2,553	2,280,888
HDPE Recirculation Piping	1	Each	1,463	12	846	6,325	2,287,213
Carbon Steel Recirculation Piping	1	Each	850	12	668	4,995	2,292,208
					Total Nominal Volume		**2,292,000**
					10% gallons/day		229,200
					10% gallons/hour		9,550
					10% gallons/min		159

2.2 List of All Potential Discharges under 40 CFR § 423.13(k)(2)(i)(A)(1) – (4)

Table 2-2 summarizes the discharges from the bottom ash system at Kyger Creek:

Table 2-2: Kyger Creek's Purge Discharges

Discharge Stream	Flow/Volume	Description	Frequency
(A)(1) Stormwater	>150,000 gal	Precipitation-related inflows generated from storm events exceeding a 10-year storm event of 24-hour or longer duration (e.g., 30-day storm event) and cannot be managed by installed spares, redundancies, maintenance tanks, and other secondary bottom ash system equipment	Following significant storm events. The system was designed to manage a 10-year/24-hour storm event equivalent to 3.6" of rainfall, or 150,000 gallons. Anything surpassing this amount will be purged from the system to maintain water balance.
(A)(2) Process Waste Streams	≤159 gpm	Regular inflows from waste streams other than bottom ash transport water that exceed the ability of the bottom ash system to accept recycled water	Additional hopper quench water is introduced to the BSHS during normal sluice operation and comingled within the BA transport water. An average of 318 gpm of excess water will be forwarded to the FGD system as allowed by scrubber operations; however, the requested 159 gpm purge rate could be intermittently required to maintain the high recycle rate system water balance during upset conditions or operational issues.
(A)(3) Water Chemistry Purge	≤159 gpm	To maintain system water chemistry where installed equipment at the facility is unable to manage pH, corrosive substances, substances or conditions causing scaling, or fine particulates to below levels which impact system operation or maintenance	Water within the BSHS has corrosive tendencies based on acidic conditions. The requested 159 gpm purge rate could be intermittently required to maintain the high recycle rate system chemistry issues to reduce scaling/corrosive tendencies or the increased cycling of total dissolved solids. The requested purge for discharge stream (A)(3) will improve water chemistry, but pH adjustment will likely be needed to prevent corrosion since additional purge is not allowed under the final rule.

Discharge Stream	Flow/Volume	Description	Frequency
(A)(4) Maintenance Flows	36,000 gal per unit during outage	To conduct maintenance not otherwise included in (A) (1), (2), or (3) of this table and not exempted from the definition of transport water in § 423.11(p), and when water volumes cannot be managed by installed spares, redundancies, maintenance tanks, and other secondary bottom ash system equipment	Some air heater wash wastewater remains in the ash hopper after the wash process and will be sluiced to the bottom ash system after the conclusion of the air heater wash. This volume is approximately 36,000 gallons per wash event; however, the flow listed under (A)(2) will be reduced during these outage conditions so additional purge should not be required.

2.3 High Recycle Rate Bottom Ash Chemistry Considerations

After the conversion to a high recycle rate system, it is expected that future BSHS water quality will cycle up to an equilibrium concentration, where the additional mass of constituents introduced per sluice is equal to the mass exiting the BSHS through the reuse in the FGD system and the purge flows. Since the existing system is not currently operating as a closed-loop configuration, it is difficult to reliably predict the corrosiveness or scaling potential in the high recycle rate configuration. We anticipate that once the system is operating in a high recycle rate configuration, there will be an increase in total dissolved solids (TDS), total suspended solids (TSS), conductivity, aluminum, calcium, iron, silica, sodium, sulfates, and other constituents from the bottom ash.

In an open-loop bottom ash sluicing system, ash is sluiced to a bottom ash pond where the ash settles out to be dewatered and capped or dredged and removed at a future date. Overflow from the bottom ash pond is typically discharged and fresh makeup water is used for subsequent sluice cycles. As ash is removed from a bottom ash system, water adheres to the ash particles via surface tension, and then drains through the ash pile. Excess water is captured in drains and returned to the system, but a substantial portion of the water that has adhered to the ash evaporates or remains entrained within the ash, rather than being returned to the system. This portion of water lost from the bottom ash system is referred to as dragout. Some water is also lost from the system due to evaporation.

Several scaling indices can be used to model the scaling and corrosive properties of the water. These are the Puckorius Scaling Index (PSI), The Ryznar Scaling Index (RSI), the Langelier Scaling Index (LSI), and the Larson-Skold Index (L-SI). The PSI, RSI, and LSI all use alkalinity, hardness, temperature, and pH to estimate calcium scale and corrosivity, comparing the pH of the system to the equilibrium pH and the pH of saturation. The L-SI looks at the concentrations of carbonate, bicarbonate, sulfate, and chloride to estimate the tendency for sulfate and chloride to interfere with scale formation and to support corrosion due to sulfate and chloride chemistry. The target ranges for these indices are shown in Table 2-3.

Table 2-3: Key to Scaling Indexes

	PSI	RSI	LSI	L-SI
Extreme Corrosion	>9.0	>9.0	<-2	>4.0
Moderate Corrosion	>7.5 - 9.0	>7.5 - 9.0	-2.0 - -0.5	1.2 - 4.0
Slight Corrosion	>7.0 - 7.5	>7.0 - 7.5	>-0.5 - 0.0	0.8 - <1.2
In range	>6.0 - 7.0	>6.0 - 7.0	>0.0 - 0.5	<0.8
Slight Scaling	5.0 - 6.0	5.0 - 6.0	>0.5 - 2.0	
Heavy Scaling	<5.0	<5.0	>2.0	

Burns & McDonnell prepared a model of the bottom ash system to predict future conditions under a variety of operating scenarios. We used typical system criteria from other design projects like hydraulic residence time, cycles of concentration, evaporation rate, and bottom ash moisture content to develop this model.

The model was then used to calculate the scaling and corrosion indices and show the potential for scale formation or corrosion. It should be noted that this model was based on limited sample data from the existing open-loop configuration and that it is difficult to simulate the expected chemistry after the system conversion. Table 2-4 below provides a summary of these results for the potential operating scenarios.

Table 2-4: Estimated Scaling Indexes

Index	10% Purge - High Recycle Rate	Optimize Indexes* - High Recycle Rate
Makeup, gpm	477	477
Flow to FGD, gpm	318	318
Purge Flow, gpm	159	159
Dragout and/or Evaporation, gpm	44	44
Purge %	10.0%	10.0%
Puckorius SI	8.55	7.00
Ryznar SI	8.38	6.99
Langelier SI	(0.44)	0.51
Larson-Skold I	1.32	0.54

* pH and alkalinity control are included

The 10% Purge column predicts the values assuming an intermittent bottom ash purge in a high recycle rate bottom ash system with the indices showing that the bottom ash sluice water is slightly to moderately corrosive even with an assumed intermittent purge flow to the LVWW system. The flow rates listed are average flow rates based on the primary active wetted volume but note the instantaneous flow rates could be less/more based on actual system operation. The Optimize Indexes column predicts the values again with an intermittent bottom ash purge in a high recycle rate bottom ash system but with the addition of pH and alkalinity control. The indices show that pH and alkalinity control may be needed in addition to the intermittent bottom ash purge to bring the indices to within the target ranges to minimize corrosion. Best management practices, such as optimized operational tactics around the bottom ash system, will be maintained to reduce the potential requirement of the purge volume. The purge flow is expected to only be utilized because of an upset in operation conditions for water balance purposes or to reduce the corrosive/scaling issues as mentioned above.

2.4 Wastewater Treatment Systems at Kyger Creek

Table 2-5 summarizes the water treatment systems at Kyger Creek.

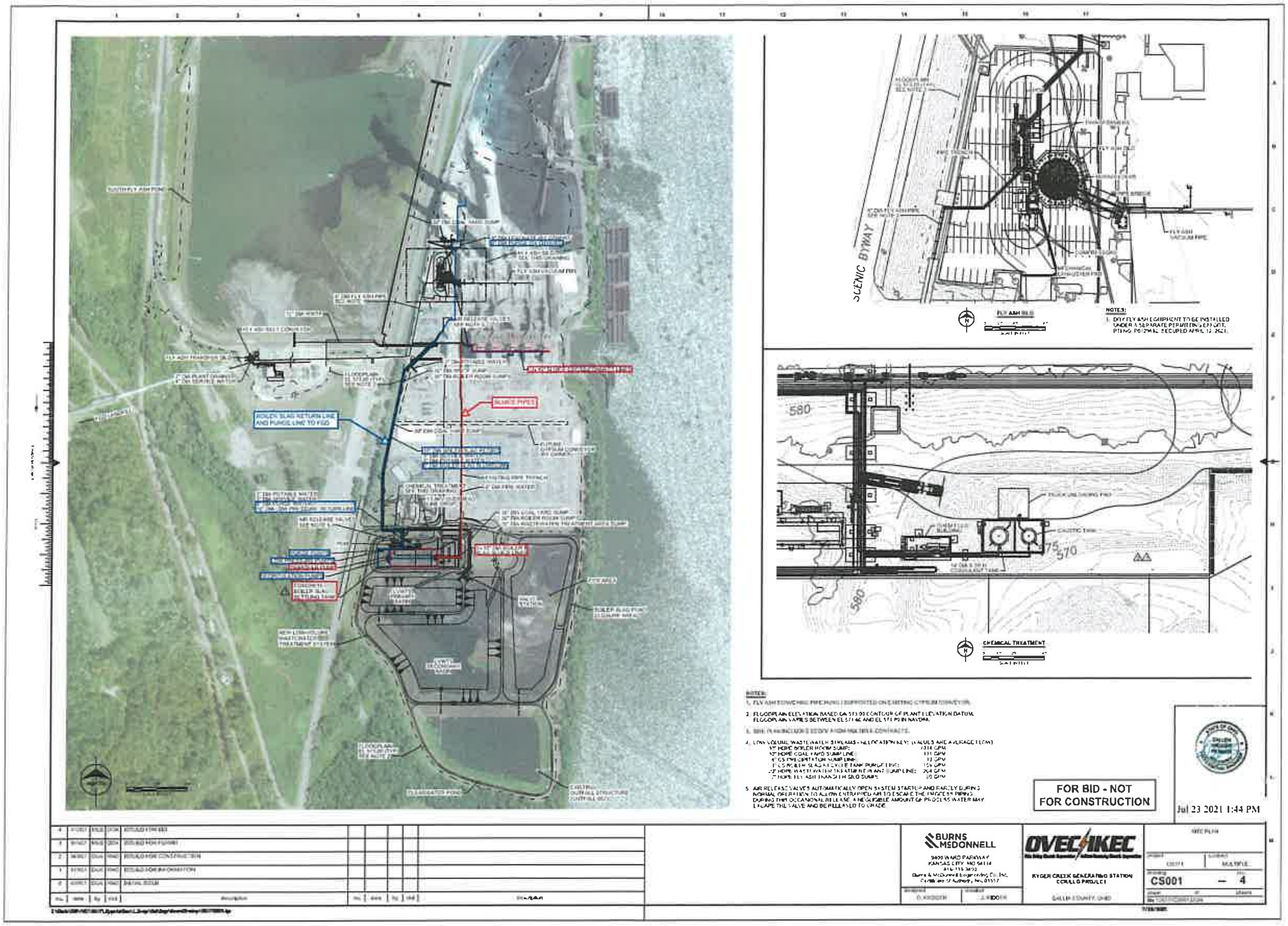
Table 2-5: Kyger Creek Wastewater Treatment Systems

System Type	Design Capacity	Current Operation	Expected Operation
FGD Wastewater Treatment System	291 gpm	Physical/chemical treatment pH adjustment, coagulant, organosulfide, clarification, and solids handling. Discharged via NPDES Outfall 602 to the Fly Ash Pond.	The current FGD wastewater treatment system will discharge treated effluent to the new low volume wastewater treatment system (LVWTS). A secondary treatment system is being piloted for additional constituent removal to comply with the final ELG rule.
Sanitary Wastewater Treatment System	8 gpm	Aerobic treatment and discharge through NPDES Outfall 601 to the Coal Yard Sump	Continued discharge to the Coal Yard Sump but in lieu of discharging to the Fly Ash Pond, the Coal Yard Sump will be discharged to the new LVWTS (settling pond).

System Type	Design Capacity	Current Operation	Expected Operation
Low Volume Wastewater	10,630 gpm	Settling via Fly Ash Pond	All streams re-routed to new LVWTS where some streams will be treated with coagulant or pH adjustment before final settling within the new lined settling pond.
Coal Pile Runoff	1,643 gpm (10-year storm)	Settling via Fly Ash Pond	Coal pile runoff discharge re-routed to the LVWTS for settling via the Coal Yard Sump.

The Kyger Creek facility operates a wet FGD scrubber, equipped with a physical/chemical wastewater treatment system that discharges through NPDES Outfall 602 to the new LVWTS. Sanitary wastewater is discharged via NPDES Outfall 601, through the Coal Yard Sump and will ultimately discharge through the new LVWTS. Low volume wastewaters, which include, but are not limited to, coal pile runoff, boiler blowdown, boiler hopper quench water, bottom ash purge wastewaters, contact storm water runoff, and other miscellaneous power plant low volume wastewaters, will be managed through the LVWTS. The addition of coagulant and/or polymer may be needed for some specific low volume waste streams to promote settling within the LVWTS prior to discharging the wastewaters through a NPDES-permitted outfall. The water balance for Kyger Creek is included in Appendix A. No other wastewater treatment systems are in use at the facility.

APPENDIX A – BOTTOM ASH EQUIPMENT SYSTEM VOLUMES AND WATER BALANCE


BOILER SLAG RETURN LINE AND PURGE LINE TO FGD
SLUICE PIPES
SCENIC BYWAY
FLY ASH SILO
CHEMICAL TREATMENT
NOTES:
FOR BID - NOT FOR CONSTRUCTION
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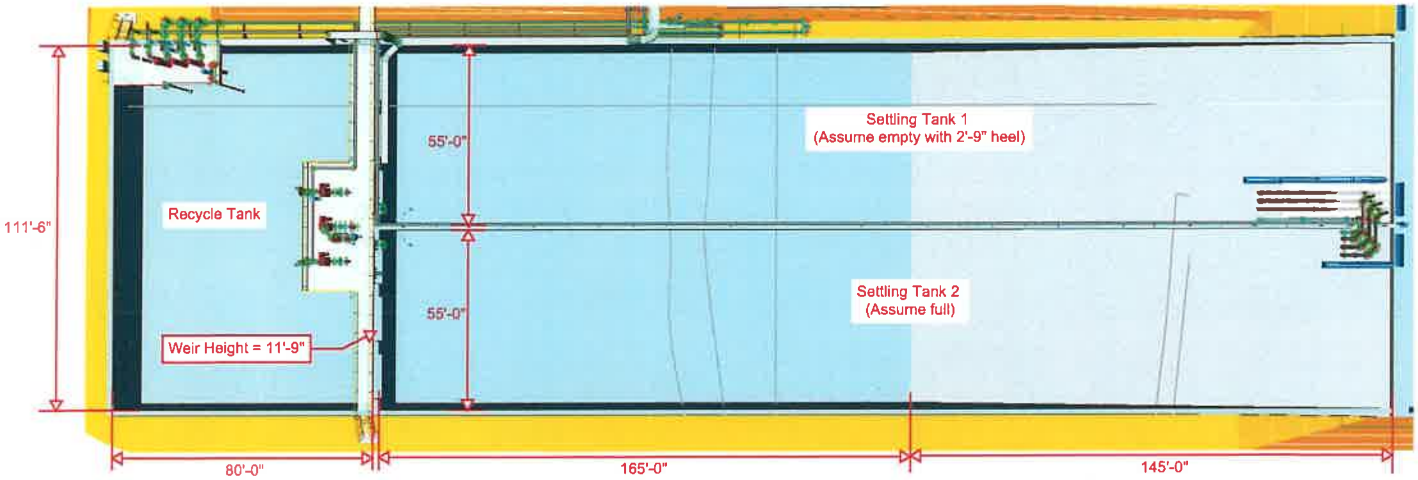
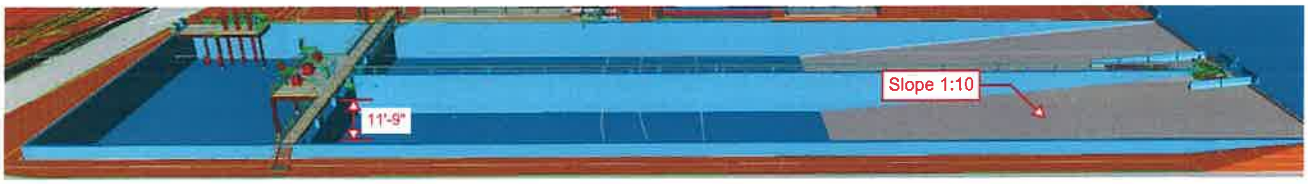
BURNS McDONNELL
OVEC IKEC
CS001
4

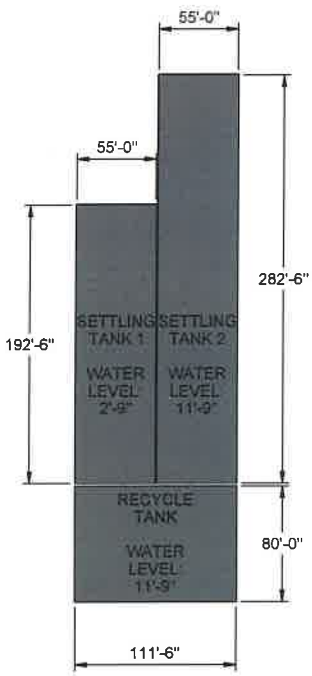
Kyger Creek
Settling & Recycle Tank Dimensions

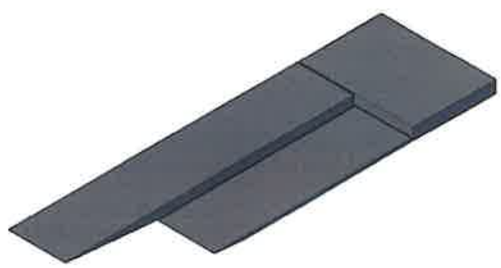




VOLUMES:

SETTLING TANK 1	27,035.98 FT^3
SETTLING TANK 2	144,598.44 FT^3
RECYCLE TANK	104810.00 FT^3





date 05/05/21	**KYGER CREEK**	project 126371
designed K. MATTHEWS	SETTLING AND RECYCLE TANK VOLUME	contract -
		SKM0001

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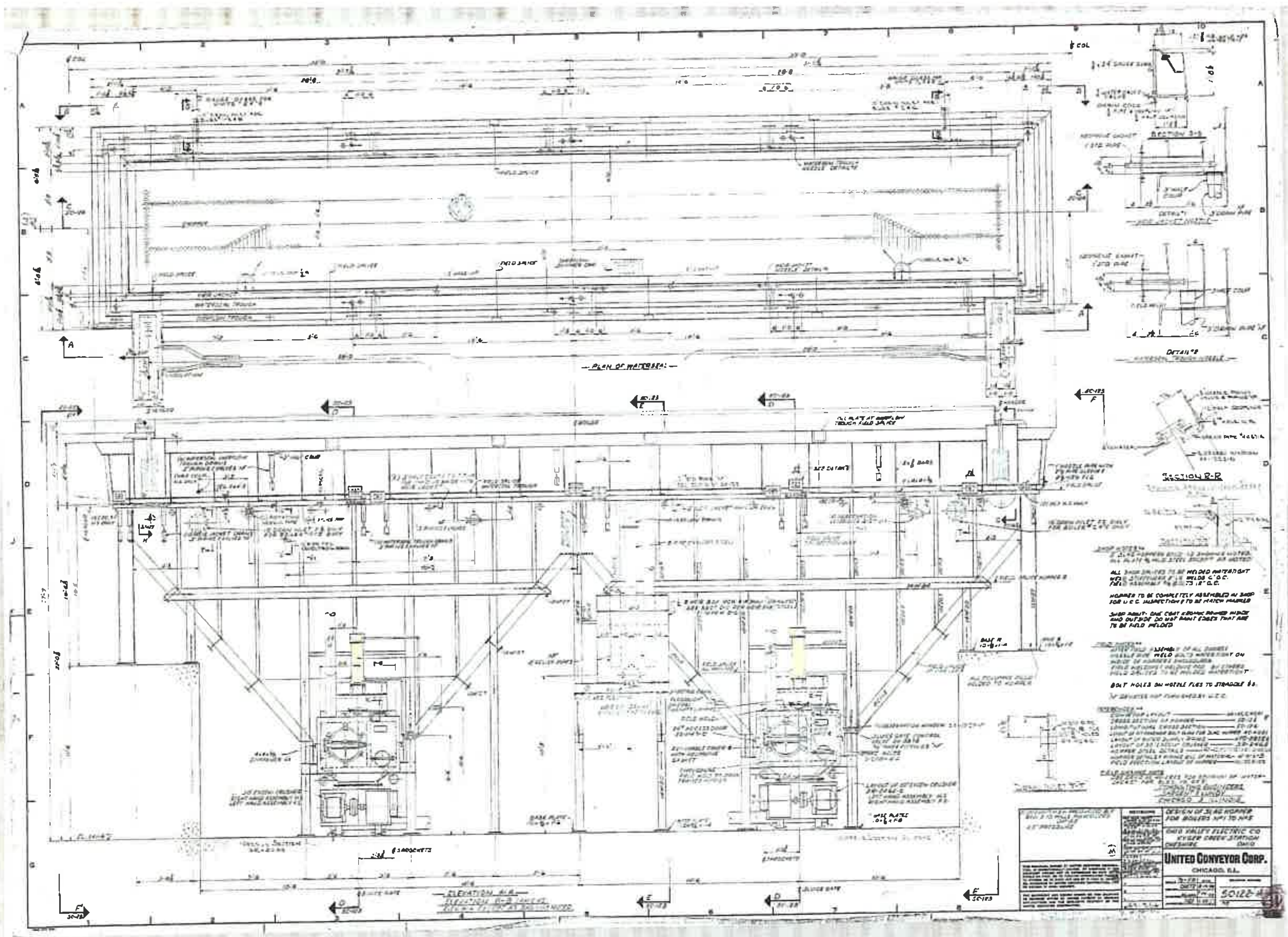
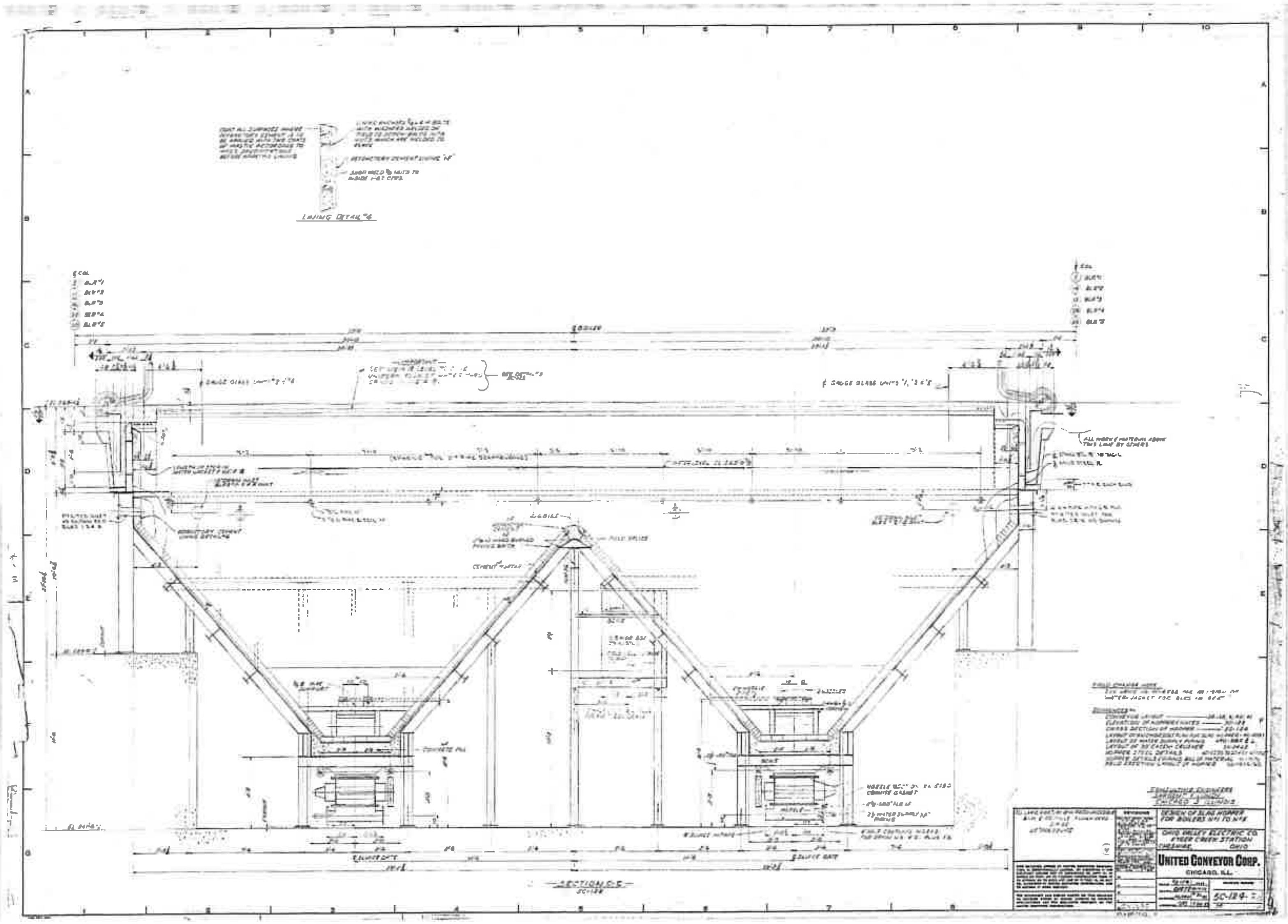
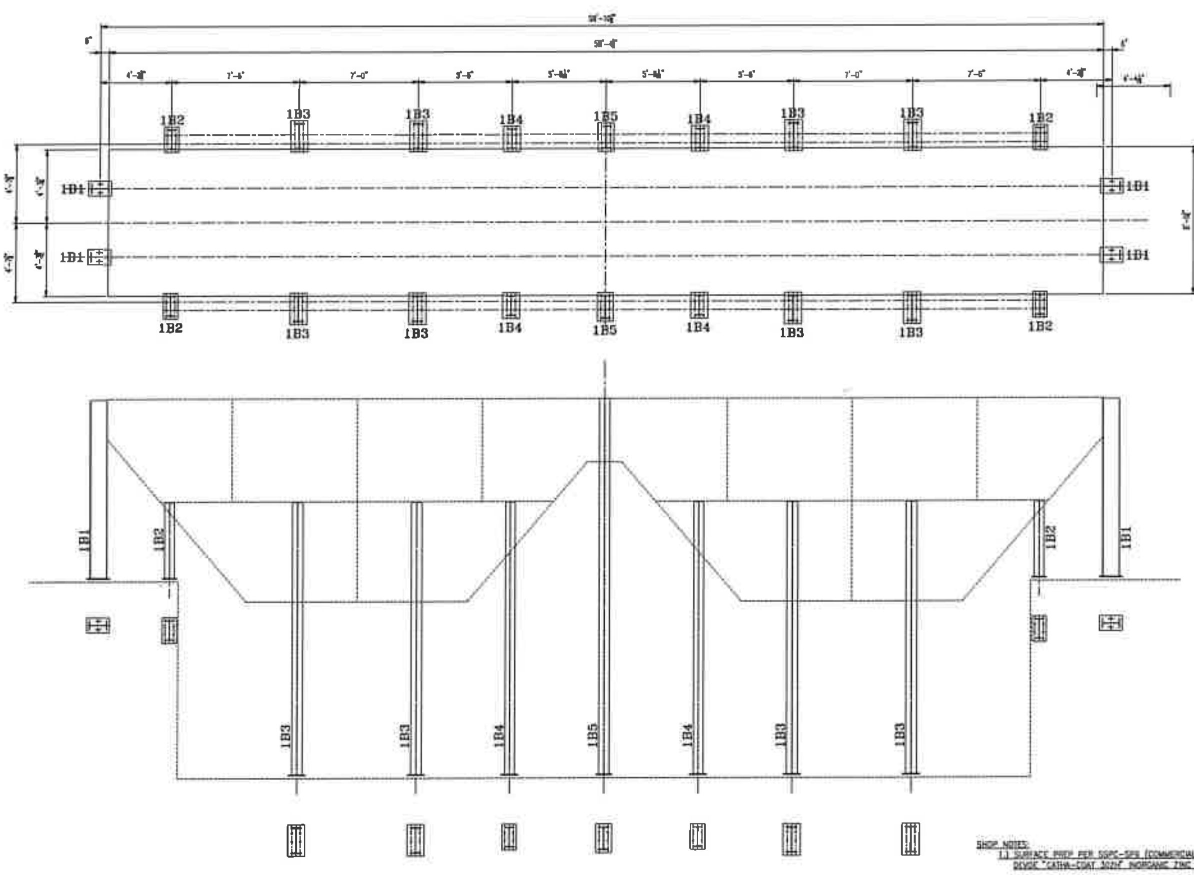

PLAN OF WATERSEAL
SECTION B-B
ELEVATION A-A
UNITED CONVEYOR CORP.
CHICAGO, ILL.
OHIO VALLEY ELECTRIC CO
KYGER CREEK STATION
CHESHIRE OHIO


LINING DETAIL "6
BOILER
SECTION C-C
DESIGN OF SLAG HOPPER
FOR BOILERS NO1 TO NO5
OHIO VALLEY ELECTRIC CO.
KYGER CREEK STATION
CHESHIRE, OHIO
UNITED CONVEYOR CORP.
CHICAGO, ILL.
SC-124

E5-11863-CA



530920

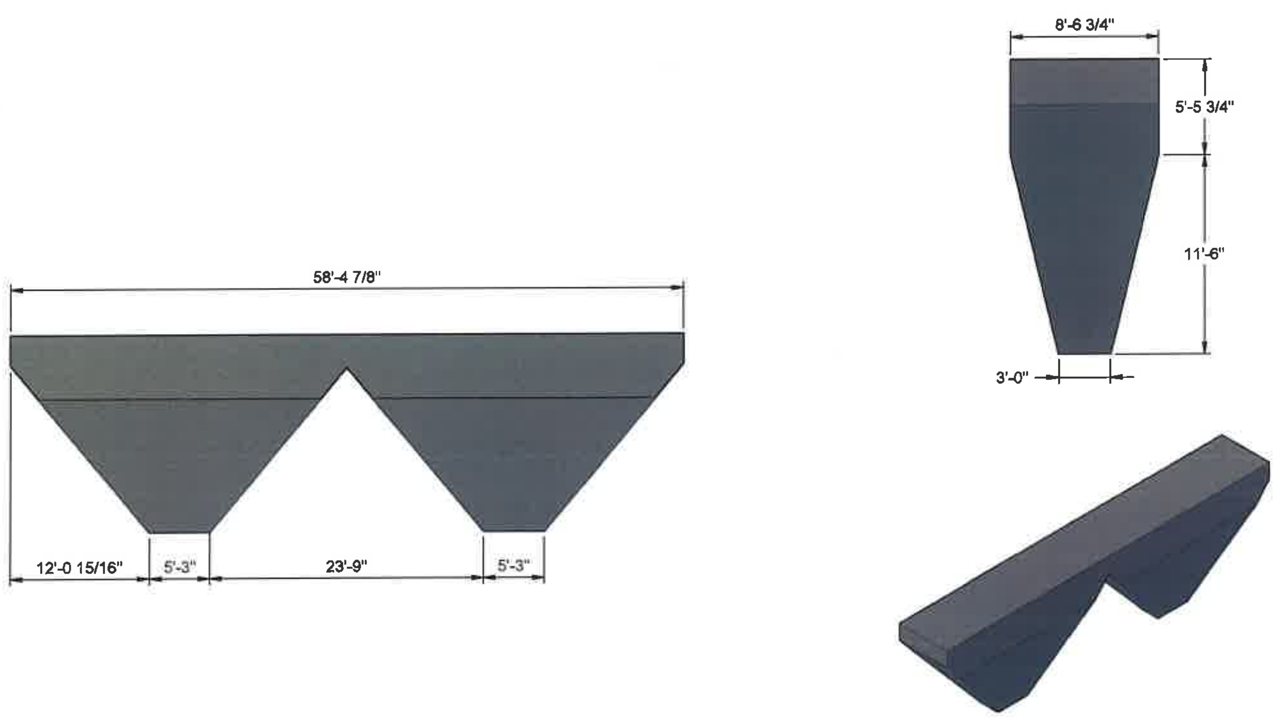
SHOP NOTES:
1.) SURFACE PREP PER SSPC-SP6 (COMMERCIAL BLAST) AND APPLY ONE PRIMER COAT DEVOE "CATHA-COAT 302H" INORGANIC ZINC PRIMER, 2-4 MILS DFT.

DELIVERY ON SITE BY: 4-6-2018

P.O. No. 23048025

DRAWN	D. Yates
DATE	3-5-88
CHECKED	
REV.	RELEASED FOR APPROVAL — 3-6-88
	CLINCH RIVER Corporation, PRINCETON, WV 24740
TITLE	UNIT #5 ASH HOPPER SUPPORT BEAMS
	CUSTOMER LAYOUT
FOR	OHIO VALLEY ELECTRIC COMPANY
	KYGER CREEK PLANT
SHEET	1 OF
SCALE	3/8in = 1ft
DWG. NO.	E5-11863-CA
REV.	1

HOPPER:
VOLUME: 4,816.38 FT^3



BURNS McDONNELL date 05/07/21 designed K. MATTHEWS	KYGER CREEK HOPPER VOLUME	project 126371 contract - SKM0002

CREATE AMAZING.

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