Roy S. Nelson Generating Station Unit 6

Bottom Ash System Evaluation

Report SL-016282

Revision 1, For Information
December 22, 2025

S&L Project No.: 13603.006

Prepared by

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RS NELSON PLANT UNIT 6

BOTTOM ASH SYSTEM EVALUATION

ISSUE SUMMARY AND APPROVAL PAGE

This is to certify that this report has been prepared, reviewed and approved in accordance with Sargent & Lundy's Standard Operating Procedure SOP-0405, which is based on ANSI/ISO/ASSQC Q9001 Quality Management Systems.

Rev.	Purpose of Issue	Date	Sections Affected
0	Issued for Use	11/03/21	All
1	Updated for 2025 Operation	12/22/25	ES, 1, 2, and 4

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RS NELSON PLANT UNIT 6

BOTTOM ASH SYSTEM EVALUATION

CERTIFICATION PAGE

I certify that this report was prepared by me or under my supervision and that I am a registered professional engineer under the laws of the State of Louisiana.

I certify that I am familiar with the 40 CFR 423 regulation requirements and the RS Nelson Facility.

Certified By: ______________________ Date: 12/23/2025

Sean C. McHone
(P.E. No. 37552)

Seal:

RS NELSON PLANT UNIT 6

BOTTOM ASH SYSTEM EVALUATION

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Note: Drawings in the appendixes have been omitted from the LDEQ submittal package due to confidentiality limitations.

EXECUTIVE SUMMARY

The RS Nelson Generating Station Unit 6 (Nelson 6) is a 580 MW Unit, fueled by PRB coal and located in Westlake, Louisiana. Sargent & Lundy (S&L) was retained to evaluate the current status of Nelson's bottom ash system in conjunction with the requirements for discharges of bottom ash transport water (BATW) under the currently applicable Steam Electric Power Generating Effluent Limitations Guidelines and Standards (ELGs) for BATW. *See* 40 CFR §423.10 *et seq.*

S&L reviewed Nelson 6 drawings and documents to prepare a primary active wetted bottom ash system volume (referred to as the primary wetted volume or "PWV") calculation, evaluated the current system influents and effluents in a water balance, and developed a narrative description of the current wastewater treatment system. As part of this evaluation, S&L evaluated the rainfall volume that can be managed by the system and the impact of surge events on potential discharges.

The PWV of the bottom ash system was calculated at **711,059** gallons with a surge volume of **274,517** gallons.

Bottom ash purge water from the four approved categories of purge water under 40 CFR § 423.13(k)(2)(i)(A) are relevant to operation and maintenance of the Nelson 6 bottom ash system and indicate a discharge of over 10% of the PWV on a 30-day rolling average basis (see, Table 1). Accordingly, Entergy requests a purge water allowance of 10% of PWV on a 30-day rolling average for the following occurrences. First, when the system modifications to maximize recirculation are implemented, water chemistry challenges can arise requiring total suspended solids (TSS) and pH to be managed with purging to avoid impacts to system operation or maintenance. Second, Nelson 6 is located in Calcasieu Parish, Louisiana, which has above the national average precipitation. Purging storm water will support the system water balance when precipitation-related inflows are generated from storm events exceeding the 10-year storm event of 24-hour or longer duration (e.g., a 50-year, 30-day storm event). Third, the bottom ash system receives inflows (specifically, boiler blowdown) other than bottom ash transport water, which also can result in the need to discharge water from the bottom ash system. Finally, certain major maintenance events can require that the bottom ash system be partially or entirely drained.

Table 1 - The 30-Day Rolling Average Calculated Discharge Volume as a Percent of PWV

Type of Discharge Event	Current Operation
Exceeding 10-year, 24-hour (or longer duration) storm event up to a 50-year, 30-day storm event *See 40 CFR §423.13(k)(2)(i)(A)(1)*	2.4%
Discharge needs to maintain water balance due to wastewater inflows *See 40 CFR §423.13(k)(2)(i)(A)(2)*	10.6%
Discharge needs to maintain water chemistry *See 40 CFR §423.13(k)(2)(i)(A)(3)*	5.4%
Other infrequent maintenance events *See 40 CFR §423.13(k)(2)(i)(A)(4)*	4.7%
Total % of PWV of potential coincident maximum volume discharged per day	23.1%
Estimated Potential Total % of PWV Discharged	23.1%
Operational strategies may be employed to reduce the total 30-day rolling average discharge lower than the sum of the individual contributors. The requested 10% total discharge volume reflects the implementation of these strategies.	

Based upon recent flow data provided by Nelson 6 operations personnel, the facility can operate without exceeding a discharge limitation of 10% of PWV. Entergy installed a flow instrument to facilitate daily flow measurement. With the time for compliance provided by the Agency, Entergy has performed inspections and maintenance on the meter, troubleshooting erroneous values. Entergy believes the procedure and maintenance schedule in place will ensure meter accuracy moving forward. Although Table 1 indicates that Nelson 6 will discharge over 10% of PWV as a 30-day rolling average, based on the recent operating data, it is expected that Nelson 6 will be able to maintain the less than 10% of PWV as a 30-day rolling average beginning January 1st 2026 onward.

Section 5 of this evaluation includes a list and narrative description of existing wastewater treatment systems that would receive proposed flows of bottom ash purge water.

1. INTRODUCTION AND BACKGROUND

The RS Nelson Generating Station Unit 6 (Nelson 6) is a 580 MW Unit located in Westlake, Louisiana that is fueled by PRB coal. The facility has a bottom ash system that handles bottom ash transport water (BATW). In November 2015 and October 2020, EPA published and then modified the Effluent Limitations Guidelines and Standards (ELGs) for the Steam Electric Power Generating Point Source Category. Under the current ELGs, the technology basis for the best available technology economically achievable ("BAT") standard for BATW is a high-recycle rate system that recycles most bottom ash transport water. In accordance with the current ELGs, a high-recycle rate system that is subject to the BAT standard may be allowed to discharge a limited amount of bottom ash purge water consistent with 40 CFR 423.13(k)(2)(i), summarized as follows:

- The discharge of pollutants in bottom ash transport water from a properly installed, operated, and maintained bottom ash system is authorized under the following conditions:

  (1) To maintain system water balance when precipitation-related inflows are generated from storm events exceeding a 10-year storm event of 24-hour or longer duration,

  (2) To maintain system water balance when regular inflows from wastestreams other than bottom ash transport water exceed the ability of the bottom ash system to accept recycled water and segregating these other wastestreams is not feasible,

  (3) 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,

  (4) To conduct maintenance not otherwise included in the above.

- The total volume of the discharges listed above in no event shall exceed a 30-day rolling average of ten percent of the primary active wetted bottom ash system volume (referred to as the primary wetted volume or "PWV").

Based upon recent flow data provided by Nelson 6 operations personnel, the facility can operate without exceeding a discharge limitation of a 30-day rolling average of 10% of the PWV .

While certain recent records showed anomalously high discharge values, subsequent investigations by plant personnel determined that the flow instrumentation had been compromised; accordingly, those anomalous readings are not representative of actual discharges.

2. SCOPE OF EVALUATION

This initial evaluation provides certain information listed in 40 CFR 423.19(d)(3)(i) through (ix) based on the current operation of the Nelson 6 bottom ash system. The scope of this evaluation includes the following deliverables and assessments based on the Nelson 6 drawings and documents provided by Entergy:

- Calculation of the primary active wetted bottom ash system volume as defined in §423.11(aa).
- Material assumptions, information, and calculations used to determine the primary active wetted bottom ash system volume.
- A list of potential discharges identified under 40 CFR 423.13(k)(2)(i)(A)(1) through (4).
- A narrative description of the wastewater treatment system.

3. THE PRIMARY ACTIVE WETTED BOTTOM ASH SYSTEM VOLUME 40 CFR 423.19(d)(3)(iv) and 40 CFR 423.19(d)(3)(v)

S&L developed a primary wetted volume calculation including all bottom ash and ash water handling equipment, piping and trenches based on the drawings provided by Entergy. Per 40 CFR 423.11(aa), the term "primary active wetted bottom ash system volume" is defined as:

> …the maximum volumetric capacity of bottom ash transport water in all non-redundant piping (including recirculation piping) and primary bottom ash collection and recirculation loop tanks (e.g., bins, troughs, clarifiers, and hoppers) of a wet bottom ash system, excluding the volumes of surface impoundments, secondary bottom ash system equipment (e.g., installed spares, redundancies, and maintenance tanks), and non-bottom ash systems that may direct process water to the bottom ash.

Per the stated definition, the total calculated primary active wetted bottom ash system volume was determined to be **711,059** gallons. Refer to Appendix A – Bottom Ash Volume Calculation for the calculation details, including material assumptions, information, and calculations used by the certifying professional engineer to determine the primary wetted bottom volume.

The bottom ash system has not been modified since the previous revision of this evaluation in 2021 in a way which alters the PWV calculation in Appendix A.

4. ALL POTENTIAL DISCHARGES 40 CFR 423.19(d)(3)(vi) & 40 CFR 423.19(d)(3)(vii)

The Nelson 6 bottom ash system is properly installed, operated, and maintained. The system was evaluated for potential discharges listed in 40 CFR 423.13(k)(2)(i)(A)(1)–(4) and the details of the material assumptions and calculations are included within. The following discharges are expected from the system:

- Discharges to Balance Precipitation-related Flows (40 CFR 423.13(k)(2)(i)(A)(1))
  - Rainfall runoff exceeding a 10-year storm event of 24 hour or longer duration collected in the bottom ash system and cannot be managed by installed spares, redundancies, maintenance tanks, and other secondary bottom ash system equipment.
- Discharges to Balance Wastewater Inflows (40 CFR 423.13(k)(2)(i)(A)(2))
  - Boiler Blowdown
- Discharges to Maintain System Water Chemistry (40 CFR 423.13(k)(2)(i)(A)(3))
  - Water discharges to maintain bottom ash system total suspended solids (TSS) to 0.3 wt% or less; and
  - Water discharges to maintain bottom ash system pH.
- Other Discharges related to maintenance not otherwise included (40 CFR 423.13(k)(2)(i)(A)(4))
  - Discharge to drain the system in a timely manner; and
  - Other maintenance events described in Section 4.4 that cannot be managed by installed spares, redundancies, maintenance tanks, and other secondary bottom ash system equipment.

4.1. DISCHARGES TO BALANCE PRECIPITATION-RELATED INFLOWS AS DESCRIBED IN 40 CFR 423.13(k)(2)(i)(A)(1)

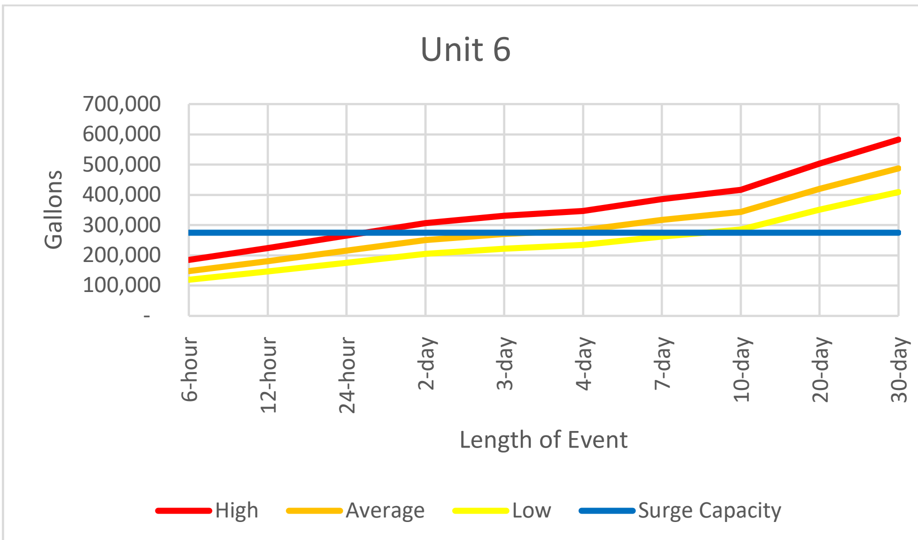
As part of this evaluation, S&L evaluated storms exceeding a 10-year, 24-storm event to determine whether such rainfall events trigger the need to discharge purge water from the bottom ash system. Refer to Appendix B – Bottom Ash System Rainfall Estimation Calculation for the calculation details, including material assumptions, information, and calculations used by the certifying professional engineer to determine the amount of purge water potentially required to maintain the bottom ash system's water balance due to precipitation-related inflows.

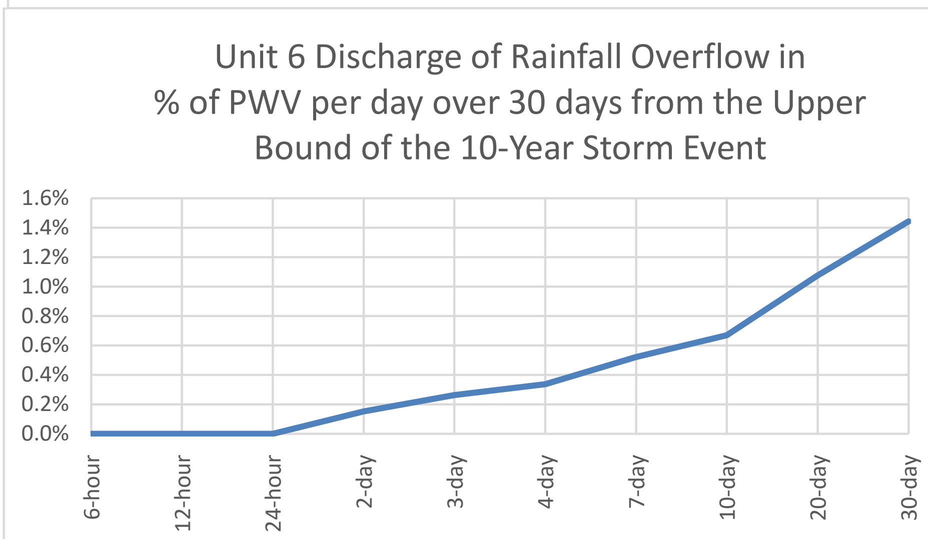
This evaluation takes into account projected surge capacity in the system during relevant events. The calculated surge capacity is 274,517 gallons. The equipment included in determination of the surge capacity of the system is identified in Appendix A – Primary Wetted Volume.

During sluicing operations, ash sluiced to the dewatering bin displaces water in the hydrobin. This displaced water passes through the settling tank and is retained in the surge tank. The maximum quantity of sluiced ash is approximately the volume of ash available in the dewatering bin. For this evaluation, it is assumed that the rainfall event occurs during the sluicing operation and the volume of ash collected within the bottom ash system will be subtracted from the available volume in the surge tank.

The calculated surge capacity volumes were plotted along with the upper and lower bounds (as well as the average) of the 90% confidence rainfall volumes from the NOAA Atlas 14 Point Precipitation Frequency Estimates for the Nelson 6 site. Charts address the 10-, 25-, and 50-year storm events with durations from 6-hours to 30-days and include volumes calculated using the areas over which rainwater is expected to drain into the bottom ash system. Additional charts were created to illustrate the expected discharge rates upper bound for each event duration as a percentage of the PWV averaged over a 30-day period. These charts indicate that Nelson 6's surge capacity will be exceeded with precipitation events of sufficient duration, and thus some volume of outflow must be permitted to account for these events.

Figure 1 - 10-Year Rainfall Summary

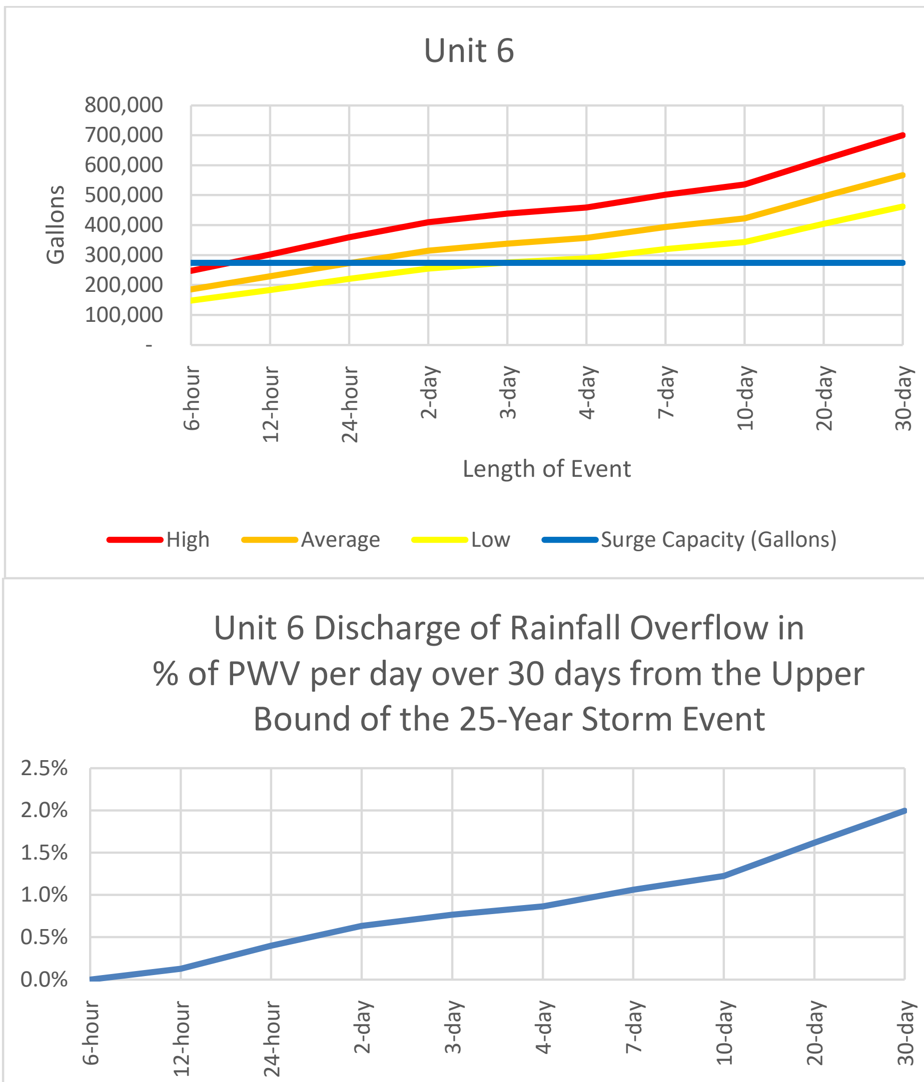




The Nelson 6 bottom ash system can manage the average 10-year, 24-hour rainfall event without purge water because system surge capacity is sufficient to contain the average level 10-year, 24-hour rainfall event (even at the 90% confidence interval).

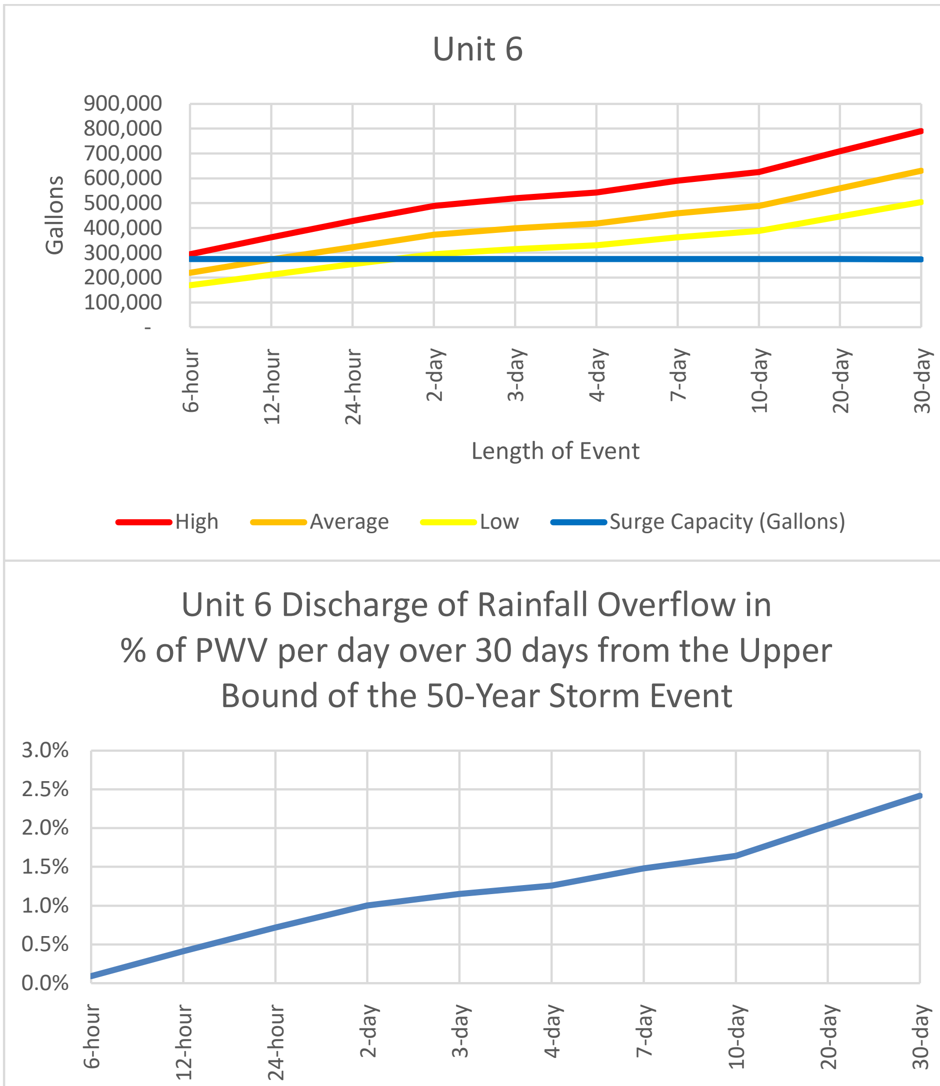
In the event of a 10-year, 30-day rainfall event, however, the high of the 90% confidence interval exceeds Unit 6 system surge capacity by up to 10,272 gallons per day, or 1.4% of the PWV averaged over a 30-day period, and therefore may require a purge water discharge.

Figure 2 - 25-year Rainfall Summary



Charts for the 25-year rainfall events are similar to those of the 10-year rainfall events shown in in Figure 1, only the magnitude of these events are greater, and thus the unit's surge capacity is overwhelmed within a shorter period of time. Within this 25-year dataset, a 30-day rainfall event could require an average daily purge water discharge of 14,209 gallons, or 2.0% of PWV, per day (i.e., 30-day rolling average) for Unit 6 to manage the influx of rainwater.

Figure 3 - 50-Year Rainfall Summary



The worst-case rainfall events included in this evaluation were the 50-year storms. Within this 50-year dataset, a 30-day rainfall event could be expected to require an average daily purge water discharge of 17,197 gallons, or 2.4% of PWV, per day (i.e., 30-day rolling average) for Unit 6 to manage the influx of rainwater.

4.2. DISCHARGES TO BALANCE WASTEWATER INFLOWS AS DESCRIBED IN 40 CFR 423.13(k)(2)(i)(A)(2)

4.2.1. Boiler Blowdown

The only current wastewater inflow to the bottom ash system, other than BATW, is boiler blowdown. Boiler blowdown is necessary to control boiler water chemistry and prevent corrosion of wetted boiler surfaces and substandard steam quality. Blowdown at Nelson 6 is delivered to the blowdown flash tank at grade in the boiler area. In the blowdown flash tank, part of the energetic blowdown flashes to steam and the remainder drops in temperature to boiling, or saturation, temperature. This blowdown flows by gravity to the Boiler Ash Hopper Sump, where it enters the bottom ash system. The estimated 30-day average flow of bottom ash purge water required to balance potential boiler blowdown input is provided in Table 2.

Refer to Appendix D – Water Balance for the calculation details, including material assumptions, information, and calculations used by the certifying professional engineer to determine the amount of purge water potentially required to maintain the bottom ash system's water balance due to inflow of boiler blowdown.

Table 2 - Estimated 30-day Average Flow of Bottom Ash Purge Water Required to Balance Potential Boiler Blowdown Input

30-days of Potential Boiler Blowdown (Gallons)	Total Potential Discharge After Accounting for Water in Ash to Landfill, Evaporation, and Surge Capacity (Gallons)	Average Potential Daily Discharge (Gallons per day)	Bottom Ash Purge Flow Required (%PWV/day)
3,278,632	2,254,819	75,161	10.6%

4.3. DISCHARGES TO MAINTAIN SYSTEM WATER CHEMISTRY AS DESCRIBED IN 40 CFR 423.13(k)(2)(i)(A)(3)

The EPA studied the behavior of coal ash particles in water ("Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling", EPA-600/7-80-067, March 1980). The report addressed the following six major areas of concern in wet ash disposal: (1) characteristics of ashes and ash pond effluents; (2) effects of ash and raw water characteristics on the pH of ash pond water; (3) methods for pH adjustment of ash pond effluents; (4) settling characteristics of both fly ash and bottom ash; (5) leaching of minerals from ashes; and (6) relationship of trace metals to pH and concentration of suspended solids in ash pond effluents. Of specific interest to Nelson 6 are the evaluations of ash pond water quality characteristics in relation to the chemical quality of the fuel burned at 12 TVA coal-fired power stations.

The primary system chemistry concern is the buildup of bottom ash fines in the recirculating transport water. Particles smaller in diameter than 75 µm are considered fines. Fines enter the bottom ash system with other, larger, particles of ash falling into the hopper and occasionally from fracturing of the larger particles of ash due to the thermal shock of entering the hopper water. The ash in the dewatering bin system removes particles above 300 µm in size based on input from a reputable dewatering bin manufacturer. A small percentage of fines (e.g., <5.0%) will exit the bottom ash system through entrainment in bottom ash purge water and ash in trucks being taken to landfill. The remaining fines will concentrate in the bottom ash water until the mass flow rate of fines into the system is equal to that exiting. In order to mitigate equipment and piping erosion and reduce maintenance impacts due to the concentration of fines within the bottom ash system, the system needs an amount of purge to maintain a concentration of 0.3% or 3000 mg/L. The estimated 30-day average flow of bottom ash purge required to mitigate for fines within the bottom ash system is provided in Table 3. Refer to Appendix C – Bottom Ash Purge Water Suspended Solids Estimate for the calculation details, including material assumptions, information, and calculations used by the certifying professional engineer to determine the amount of purge water required to maintain a fines concentration of 0.3%.

Table 3 - Estimated 30-day Average Flow of Bottom Ash Purge Water Required

Bottom Ash System	Bottom Ash Purge Flow Required (%PWV/day)
Unit 6	5.4%

Another system chemistry concern is the scaling or corrosivity of the BATW in high-recycle bottom ash systems. To estimate the pH of the high-recycle bottom ash system, S&L used the chart on EPA-600/7-80-067, pg. 17 and the Nelson 6 fuel ash quality from five fuel sources used at Nelson 6. The chart relates the ratio of ash calcium oxide and magnesium oxide concentrations to the ash sulfur trioxide concentration. Results of applying the EPA analysis to Nelson 6 are shown in Table 4.

Table 4 – Estimate of Bottom Ash System Equilibrium pH at Nelson 6

Nelson 6 Fuel Source	Fuel Ash Calcium Oxide (%)	Fuel Ash Magnesium Oxide (%)	Fuel Ash Sulfur Tri-Oxide (%)	Ratio of (CaO+MgO) to SO_3	Estimated pH
Belle Ayre Mine	26.14	5.22	10.99	2.85	~3 (acidic)
Black Thunder	20.11	4.10	8.42	2.87	~3 (acidic)
Coal Creek	19.78	3.46	9.07	2.56	~3 (acidic)
Peabody NARM 2018	23.9	6.2	10.0	3.01	~3 (acidic)
Peabody NARM 2019	24.1	6.2	10.0	3.03	~3 (acidic)

Each fuel chemistry indicates that, at equilibrium, the ash will create an acidic water chemistry. The predicted acidic chemistry of the bottom ash system will occur at system chemical equilibrium, which takes time to achieve. In order to prevent the system from reaching chemical equilibrium, the water in the system should be continuously discharged and made-up with fresh utility, service water, or rainfall collected in the system. The purge water rate for TSS discussed above will also provide more protection from constituents in the ash creating acidic water in the system than purging at a lower rate.

4.4. OTHER DISCHARGES REQUIRED TO CONDUCT MAINTENANCE NOT OTHERWISE INCLUDED AS DESCRIBED IN 40 CFR 423.13(k)(2)(i)(A)(4)

Complete drains of the bottom ash system may be periodically necessary to conduct inspections and maintenance during outages that cannot be performed while the plant is operating. In order to drain the entire bottom ash system for maintenance and maintain the 30-day rolling average per day discharge requirement, the allowable discharge must be equal to or greater than the following:

$$\frac{\%PWV}{day} = \left(TSV/PWV\right)\Big/30\ days$$

Where:
TSV: Total System Volume
PWV: Primary Wetted Volume
%PWV/day: Minimum Percentage of Primary Wetted Volume per Day (rounded up)

For example, the Nelson 6 bottom ash system has a total system volume of 985,576 gallons and a PWV of 711,059 gallons. In order to drain the system completely for a maintenance event, the %PWV/day must be greater than:

$$\frac{\%PWV}{day} = {(985{,}576/711{,}059)}\Big/{30\ days} = \frac{4.7\%PWV}{day}$$

There are several infrequent maintenance events which require draining the portions of the bottom ash system but fall short of complete discharge. Examples of such events are the following:

- Temporary drainage of individual system tanks and hoppers are likely during replacement/repair of system components, including:
    - Dewatering bin – Discharge gate, center baffle, dewatering units, etc.
    - Bottom ash hopper – refractory lining, crushers, hopper sluice gates, jetting nozzles, etc.
- Temporary drainage of the bottom ash hopper due to large clinkers of bottom ash blocking the discharge that cannot be rodded out while the unit is online.
- System cleaning / inspection during outages, including:
    - Dewatering bin / settling / surge tanks;
    - Bottom ash hopper and seal trough; and
    - Pyrite tanks.

These events require the bottom ash system to discharge less volume; therefore, the calculated volume discharge to drain the entire system will be sufficient for each of the maintenance events listed above.

4.5. TOTAL DISCHARGE SUMMARY - 40 CFR 423.19(d)(3)(vi) & 40 CFR 423.19(d)(3)(vii)

Table 1 at the beginning of this report summarizes each of the designated categories of discharge water from the bottom ash system as defined by 40 CFR 423.13(k)(2)(i)(A)(1) through (4). In some instances, the causes and the timing of these discharge events and scenarios are independent of each other. However, events can influence one another and affect the total percent discharged (e.g., rain influencing water chemistry). It is possible that operational considerations can further minimize the risk that the percent discharges associated with each scenario would function in a purely additive manner. For example, in anticipation of a maintenance event, the purge to balance water chemistry could be minimized before and after, as needed.

Discharge volumes summarized in Table 1 indicate that Nelson 6 would require 23.1% of PWV based on the potential coincident maximum volume discharged per day. Based upon flow data from May 1, 2023 through November 11, 2025 provided by Nelson 6 operations personnel, the facility has demonstrated the ability to operate without exceeding a discharge limitation of 10% of PWV. Entergy installed a flow instrument to facilitate daily flow measurement. With the time for compliance provided by the Agency, Entergy has performed inspections and maintenance on the meter, troubleshooting erroneous values. Entergy believes the procedure and maintenance schedule in place will ensure meter accuracy moving forward.

Although Table 1 indicates that Nelson 6 will discharge over 10% of PWV as a 30-day rolling average, based on the recent operating data, it is expected that Nelson 6 will be able to maintain the less than 10% of PWV as a 30-day rolling average beginning January 1st 2026 onward. Accordingly, the requested purge water allowance is 10% PWV on a 30-day rolling average.

5. NARRATIVE DESCRIPTION OF THE WASTEWATER TREATMENT SYSTEM 40 CFR 423.19(d)(3)(viii) & 40 CFR 423.19(d)(3)(ix)

Below is a list of the wastewater treatment systems Nelson Unit 6 is equipped with which do not treat BATW:

- Nelson Plant Sewage Treatment
- Metal Cleaning Waste Lagoon
- Ash Disposal Area Sewage Treatment

Nelson Unit 6 is equipped with the following wastewater treatment system which does treat BATW:

- Settling Pond

Discharged BATW at Nelson is routed to the settling pond, located to the west of Nelson 6, for additional treatment prior to being discharged via Outfall 003. The settling pond is an 11.6-acre pond consisting of three areas in a series (a grit chamber, a sediment retention chamber, and a final settling chamber) that is intended to ensure that the blend of the following current and future wastewater streams meet the discharge limitations in Nelson Station's NPDES permit:

- Bottom Ash Transport Water and Bottom Ash Purge Water
- Floor Drainage Storm Water from Oil/Water Separator

- Coal Pile Runoff
- Coal Ash Disposal Landfill Runoff
- Coal Handling Area Runoff
- Optional Routing of Cooling Tower Blowdown and Drift
- Combustion Residual Leachate
- Water associated with demolition activities
- Low volume wastewaters
- Miscellaneous non-process wastewaters including but not limited to washdown water, water used for dust suppression, and line flushing
- Previously monitored hydrostatic test water

The grit chamber is concrete-lined and is designed to retain large, fast-settling solids. It is designed to facilitate easy sediment removal by mechanical means (backhoe or dragline) without taking the pond out of service. The sediment retention chamber is designed to collect the majority of the settled solids contained in the water leaving the grit chamber. This chamber is also designed to facilitate easy sediment removal by bulldozer or front-end loader, as it requires periodic cleaning. The largest portion of the Settling Pond is the final settling chamber. The final settling chamber reduces the wastewater flow to its lowest velocity, allowing fine particles to settle out of the water prior to discharge via Outfall 003.

Given that the present overflow from the bottom ash system is routed to the Settling Pond, the system flow path is not expected to change due to future discharge of bottom ash purge water and compliance with the ELGs.

APPENDIX A – WETTED BOTTOM ASH VOLUME CALCULATION

ENTERGY LOUISIANA, LLC

NELSON 6

DOCUMENT NO. 2021-03195
WETTED BOTTOM ASH VOLUME CALCULATION

Rev. 0
October 27, 2021

Sargent & Lundy LLC

WETTED BOTTOM ASH VOLUME CALCULATION

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WETTED BOTTOM ASH VOLUME CALCULATION

1.00	**PURPOSE AND SCOPE:**				
1.01	Nelson Unit 6 is a coal fired unit located in Westlake, LA				
1.02	This calculation was performed to determine the total wetted ash volume (ash water) within the plant's ash handling systems in order to support analysis of the effluent limitation guidelines (ELG) at the station.				

Item	Description	Reference	Unit of Measure	Data Value	Input (V/UV/ EJ)
2.00	**DESIGN INPUT:**				
2.01	Pyrites Transfer Tank and Pyrite Storage Hoppers volume is determined per drawings in Attachment 8.02				V
2.02	Ash Hopper (both) volume is determined per drawings in Attachment 8.03				V
2.03	Seal Trough volume is determined per drawings in Attachment 8.03				V
2.04	Dewatering Bins volume is determined per drawings in Attachment 8.04				V
2.05	Settling Tank volume is determined per drawings in Attachment 8.05				V
2.06	Surge Tank volume is determined per drawings in Attachment 8.06				V
2.07	Bottom Ash Hopper Sump volume is determined per drawings in Attachment 8.07				V
2.08	Loadout Sump volume is determined per drawings in Attachment 8.08				V
2.09	Boiler Area trenches volume is determined per drawings in Attachment 8.09				V
2.10	Dewatering Bins Area trenches volume is determined per drawings in Attachment 8.10				V
2.11	Ash water piping volume is determined per drawings in Attachment 8.11				V
2.12	Ash water piping schedule is defined by the piping specification provided in Attachment 8.12				V

Item	Description	Reference	Unit of Measure	Data Value	
3.00	**ASSUMPTIONS:**				
3.01	The economizer hopper has been converted to a dry system and is not a part of the bottom ash handling system. Its volume was excluded from this calculation.				EJ
3.02	Redundant equipment was excluded from this calculation per 40 CFR 423.11(aa).				EJ
3.03	Bottom ash hopper sump volume was taken at high water level, 2ft from the top.				EJ
3.04	Loadout sump volume was taken at high water level of 3ft from the top, set by the sump overflow weir.				EJ
3.05	Boiler area trenches are operating at a depth of 1ft.				EJ
3.06	Dewatering bins area trenches are operating at a depth of 0.5ft.				EJ
3.07	A 0.5% pipe length margin was added to all measured piping to make up for any small bore and miscellaneous piping not directly captured by the measurements.				EJ
3.08	Wetted volume of the surge tank is its full volume minus the surge volume, with surge volume equal to the top 6ft of the tank volume.				EJ

Item	Description	Variables	Data Value	
4.00	**METHODOLOGY & ACCEPTANCE CRITERIA:**			
4.01	The methodology for performing the calculations involves the following principal steps: • Identify all equipment and piping expected to contain ash water in during normal plant operation and ash handling processes. • Determine the volume of all identified equipment and piping that is applicable per the definition from 40 CFR 423.11(aa) as follows: The term "primary active wetted bottom ash system volume" means the maximum volumetric capacity of bottom ash transport water in all non-redundant piping (including recirculation piping) and primary bottom ash collection and recirculation loop tanks (e.g., bins, troughs, clarifiers, and hoppers) of a wet bottom ash system, excluding the volumes of surface impoundments, secondary bottom ash system equipment (e.g., installed spares, redundancies, and maintenance tanks), and non-bottom ash transport systems that may direct process water to the bottom ash.			
4.02	Volume of Cylinder	V = Volume [ft^3] pi = Constant {3.14} r = Radius (ft) h = Height (ft)	$V = \pi r^2 h$	
4.03	Volume of Rectangular Shapes	V = Volume [ft^3] l = Length (ft) w = Width (ft) h = Height (ft)	$V = lwh$	
4.04	Volume of Cone	V = Volume [ft^3] pi = Constant {3.14} r = Radius (ft) h = Height (ft)	$V = \pi r^2 (\frac{h}{3})$	
4.05	Volume of Tapered Rectangular Hopper (Reference 7.04)	V = Volume [ft] h = Height (ft) X = Height between bases (ft) Y = Width of upper rectangular base (ft) x = Length of lower rectangular base (ft) y = Width of lower rectangular base (ft)	$V = \left(\frac{h}{3}\right)((X^2Y - \frac{x^2y}{X-x}))$	
4.06	Volume of Trapezoid	V = Volume [ft^3] a = Base a (ft) b = Base b (ft) h = Length between bases (ft) d = Depth (ft)	$V = \frac{a+b}{2} hd$	
4.07	Volume of Piping	V = Volume [ft^3] A = Internal Area (ft^2) per Reference 7.03 l = Pipe Length (ft)	$V = Al$	
4.08	Internal area of various size piping was taken from Cameron Hydraulic Data, Reference 7.03			
4.09	Surge volume, where applicable was determined from the drawings referenced in Items 2.01 through 2.12			V

Item	Description	Reference	Unit of Measure	Equation
5.00	**CALCULATIONS:**			
5.01	See Attachment 8.01 for wetted volume breakdown			

Item	Description	Reference	Unit of Measure	Equation	Accept (Y/N)
6.00	**RESULTS:**				
6.01	Ash Water Volume in Equipment and Trenches		gal	697,752	YES
6.02	Ash Water Volume in Piping		gal	13,307	YES
6.03	**Total Wetted Ash Volume**		**gal**	**711,059**	**YES**
6.04	Ash Water Volume in Equipment and Trenches		gal	270,890	YES
6.05	Ash Water Volume in Piping		gal	411	YES
6.06	**Surge Wetted Ash Volume**		**gal**	**271,301**	**YES**

7.00	**REFERENCES:**
7.01	Program No. 03.2.286-1.0, Microsoft Excel for Office 2003
7.02	Program No. 03.7.755-1.0, (Pipe Data Dynamic Link Library), pipedata.xla
7.03	Cameron Hydraulic Data 18th Edition

WETTED BOTTOM ASH VOLUME CALCULATION

7.04	Area of a Tapered Rectangular Hopper Formula: https://www.easycalculation.com/measurement/volume-of-rectangular-hopper.php
8.00	**ATTACHMENTS: Drawings in attachments 8.02 through 8.13 have been omitted from the LDEQ submittal package due to confidentiality limitations.**
8.01	Wetted Ash Volume Calculation Summary
8.02	Pyrites and Pyrites Transfer Tank Drawings
8.03	Bottom Ash Hopper and Seal Trough Drawings
8.04	Dewatering Bins Drawing
8.05	Settling Tank Drawing
8.06	Surge Tank Drawing
8.07	Bottom Ash Hopper Sump Drawing
8.08	Loadout Sump Drawing
8.09	Boiler Area Trenches Drawing
8.10	Ash Handling Area Trenches Drawing
8.11	Piping Isometrics
8.12	Piping Specification CL 125
8.13	Bottom Ash System PFD and P&IDs

ATTACHMENT 8.01
WETTED ASH VOLUME CALCULATION SUMMARY

WETTED ASH VOLUME SUMMARY - EQUIPMENT

Equipment	Volume (ft^3)	Wetted Qty	Spare Qty	Wetted Volume (gal)	Surge Capacity Volume (ft^3)	Surge Capacity (gal) - not part of wetted volume	Notes
Pyrites Hoppers (x3)	36	3	3	817	36	817	Wetted volume: x3 hoppers Surge capacity: x3 hoppers
Pyrites Transfer Tank	750	1	-	5,611	181	1,354	Surge capacity is additional 1.6ft
Ash Hopper (both)	7,702	2	-	115,222	386	2,887	Wetted volume is normal water level. Surge capacity assumed to be 6" to emergency overflow level from normal water level.
Seal Trough	438	1	-	3,276	-	-	
Dewatering Bins (x1)	23,497	1	1	175,758	23,497	175,758	Wetted volume: x1 bin Surge capacity: x1 bin
Settling Tank	18,901	1	-	141,379	-	-	
Surge Tank	26,607	1	-	199,020	11,781	88,122	Wetted volume: 6ft from overflow. Surge volume: top 6ft of tank up to overflow.
Bottom Ash Hopper Sump	4,177	1	-	31,244	261	1,952	Wetted volume: 2ft from top. Surge volume: up to overflow.
Loadout Sump	2,150	1	-	16,082		0	Wetted volume: 2ft from top. Surge volume: up to overflow.
Trenches							
Boiler Area	1,074	1	-	8,034	-	-	Assumed 1.0ft working water level for wetted volume.
DW Bins Area	175	1	-	1,309	-	-	Assumed 0.5ft working water level. Excludes DW bins branch.
Ash Water Volume in Equipment and Trenches	**85,508**			**697,752**			
Ash Water Surge Capacity						**270,890**	

WETTED ASH VOLUME CALCULATION - PIPING

Piping	Wetted Volume (ft^3)	Wetted Volume (gal)	Surge Volume (ft^3)	Surge Volume (gal)	Notes
01_Surge Tank to Recirc Pumps (6-M-8JR-129)	163	1,218			
02_Recirc Pumps Discharge to Boiler Area (6-M-8JR-132_1)	149	1,117			
03_Recirc Pumps Discharge to Boiler Area (6-M-8JR-132_2)	180	1,347			
04_Recirc Pumps Discharge to Boiler Area (6-M-8JR-132_3)	140	1,047			
05_Recirc. Pump Dicharge Header to Pyrites Transfer Tank (6-M-8JM-305)	2	15			
06_Header to Bottom Ash Hopper (6-M-8JR-3107)	7	52			
07_Ash Hopper Booster Pumps To Bottom Ash Hoppers Sheet 1_6-M-8JR-380	39	292			
08_Ash Hopper Booster Pumps To Bottom Ash Hoppers Sheet 2_6-M-8JR-380	7	49			
09_Seal Trough Supply_6-M-8JR-389	46	346			
10_Wall Cooling Supply Sheet 1_6-M-8JM-384	30	224			
11_Wall Cooling Supply Sheet 1_6-M-8JM-384	21	159			
12_Wall Cooling Supply Sheet 1_6-M-8JM-384	27	199			
13_Bottom Ash Piping Pumps to Dewatering Bins_06-1240C	267	1,999			
14_Bottom Ash Sump to Dewatering Bins_6-M-8JR-3132	57	426			
15_Boiler Area Sump Pump Disch. To Dewatering Bins_6-M-8JR-101	139	1,040			
16_Dewatering Bin Overflow Header to Settling Tank_6-M-8JR-118	43	322			
17_Ash Loadout Area Sump Pumps to Dewatering Bins 6A & 6B_6-M-8JR-102	47	349			
18_Recirc. Pump Dicharge Hdr. to pyrites hoppers_6-M-8JM-306	47	348			
19_Dewatering Bin 6A to ash loadout area sump header_6-M-8JR-106	33	249	33	249	
20_Dewatering Bin 6A to Overflow Header_6-M-8JR-103	22	162	22	162	
21_From Recirc. Pump Disch. Header to Bottom Ash Pumps Disch. Hdr_6-M-8JM-3127	7	53			
22_Recirculation Pump Discharge Header to Ash Loadout Area Sump_6-M-8JR-155	15	114			
23_Seal Trough Drains_6-M-8JM-392	24	178			
24_Suction Make up at bottom ash hopper Sheet 2_6-M-8JM-376	119	886			
25_Suction Make up at bottom ash hopper Sheet 2_6-M-8JM-376	37	274			
26_Wall Cooling Spray Drains_6-M-8JM-391	28	208			
Misc. Secondary Piping	85	634			5% of sum of major process piping listed
Ash Water Volume in Piping	**1,779**	**13,307**	**55**	**411**	

ATTACHMENT 8.02
PYRITES AND PYRITES TRANSFER TANK DRAWINGS

ATTACHMENT 8.03
BOTTOM ASH HOPPER AND SEAL TROUGH DRAWINGS

ATTACHMENT 8.04
DEWATERING BINS DRAWING

ATTACHMENT 8.05
SETTLING TANK DRAWING

ATTACHMENT 8.06
SURGE TANK DRAWING

ATTACHMENT 8.07
BOTTOM ASH HOPPER SUMP DRAWING

ATTACHMENT 8.08
LOADOUT SUMP DRAWING

ATTACHMENT 8.09
BOILER AREA TRENCHES DRAWING

ATTACHMENT 8.10
ASH HANDLING AREA TRENCHES DRAWING

ATTACHMENT 8.11
PIPING ISOMETRICS

ATTACHMENT 8.12
PIPING SPECIFICATION CL 125

ATTACHMENT 8.13
BOTTOM ASH SYSTEM PFD AND P&IDS

APPENDIX B – BOTTOM ASH SYSTEM RAINFALL ESTIMATION CALCULATION

Entergy Louisiana, LLC

Nelson Power Plant Unit 6

DOCUMENT NO. 2021-03526 BOTTOM ASH SYSTEM RAINFALL EVALUATION

Rev. F
October 27, 2021

Sargent & Lundy

Table of Contents

Total Pages: 7

Contents

1. PURPOSE AND SCOPE

The EPA published a new revision of the 40 CFR 423 Effluent Limitations Guidelines (ELG) on December 31, 2020. The revision allows for discharge of stormwater from the bottom ash system under certain circumstances. The purpose of this calculation is to determine rainfall/stormwater contribution into the bottom ash system through direct rainfall into uncovered equipment or onto surfaces that drain into the bottom ash system for Entergy Louisiana, LLC's Nelson Power Plant Unit 6 in Westlake, Louisiana. This information will be used to assess, in a separate calculation, the potential amount of purge water discharge in specified storm events.

2. DESIGN INPUT

2.1 Rainfall Data

As stated in 40 CFR 423 (Reference 7.1), discharges of bottom ash transport water may be authorized to maintain system water balance when precipitation-related inflows are generated from storm events exceeding a 10-year storm event of 24-hour or longer duration. Because within the preamble of the rule it specifies the 100-year event and longer does not need to be considered, this document analyzes 10-, 25-, and 50-year events, and calculates anticipated discharges. The duration presented within the Bottom Ash System Rainfall Calculation was the 24-hour event, but all durations from 6 hours to 30 days were analyzed and included in Attachments 8.3 through 8.5. The rainfall depths used were the high, low, and average depths as published by NOAA in Attachment 1. The high and low depth are estimates as the upper and lower bounds, respectively, of the 90% confidence interval. The probability that the rainfall depths will be greater than the upper bound or less than the lower bound is 5 percent, as stated by NOAA in note 1 on Attachment 8.1.

Within this calculation, the 10-year, 24-hour depth will be utilized as the rainfall depth in order to outline the process used to calculate each additional storm event. For Unit 6 at the Nelson Power Plant, the average 10-year, 24-hour rainfall depth value is 8.21 inches per NOAA Atlas 14 (Reference 7.2). The rainfall depth for the lower and upper boundaries of the 90% confidence interval for the 10-year, 24-hour storm is 6.7 inches and 10.1 inches, respectively. Rainfall depths from NOAA Atlas 14 are included as Attachment 8.1.

2.2 Drainage Areas

There are three separate drainage areas that contribute to the bottom ash system that have been considered for rainfall impact, as follows:

Area 1 is the Settling and Surge tanks, as well as the paved, at-grade runoff surrounding those tanks that is discharged into the bottom ash system.

Area 2 is both of the Dewatering Bins.

Area 3 is the stormwater runoff from the Boiler Building mat foundation that is discharged into the bottom ash system.

Each of these areas can be seen outlined and quantified on Attachment 8.2, which are applicable Nelson Power Plant drawings that were used to obtain the runoff areas. The drawings have been omitted from the LDEQ submittal package due to confidentiality limitations.

2.3 Runoff Coefficient

The runoff coefficient was calculated as 1.0 for all the areas. These values can be considered conservative values as taken from the Louisiana DOT Hydraulics Manual as shown in Reference 7.3.

3. ASSUMPTIONS

No assumptions were used in this calculation.

4. METHOLOGY AND ACCEPTANCE CRITERIA

4.1 Methology

Utilizing the existing Plant drawings as shown in Attachment 8.2, three areas were found that contributed to the bottom ash system. Area 1 is considered the Settling and Surge tanks, as well as the runoff surrounding those tanks, Area 2 is both Dewatering Bins, and Area 3 is the runoff from the Boiler Building.

Once the contributing equipment and contributing drainage area of the Plant were understood, the area was calculated as shown in Section 2.2 and Attachment 8.2. At this point the runoff volume could be calculated using the 10-year, 24-hour rainfall depth, as shown in Attachment 8.1, and the selected runoff coefficient per Reference 7.3.

The runoff coefficients for each of the areas were selected based on the surfacing and permeability. Because all of these areas are within a heavy industrial area, the runoff coefficients selected was 1.0.

4.2 Acceptance Criteria

No acceptance criteria were applicable for this calculation.

5. CALCULATION

The equation utilized to calculate the runoff volume from each area is shown below. Design inputs for this section are from Section 2.

$$Runoff\ Volume = C * d * A$$

Where:
C= Runoff Coefficient (Reference 7.3)

d= Average 10-Year, 24-Hour storm depth as shown on Attachment 8.1 and listed above in Section 2.0

A= Area for each section as shown on Attachment 8.2

5.1.1 Area 1 Runoff Volume

Area 1 consists of the subareas as shown on Attachment 8.2: the Settling Tank, the Surge Tank and the runoff from the area surrounding those two tanks. The runoff volume below is calculated in square feet and converted into gallons.

$$Runoff\ Volume = C * d * A$$

$$Runoff\ Volume = 1.0 * 8.21\ in * \frac{1\ ft}{12\ in} * (7{,}958.65\ ft^2 + 1{,}592.64\ ft^2 + 1{,}965.95\ ft^2)$$

$$Runoff\ Volume = 1.0 * 0.6841\ ft * 11{,}517.24\ ft^2$$

$$Runoff\ Volume = 7879.71 ft^3 * \frac{7.48\ gallons}{1\ ft^3}$$

$$Runoff\ Volume = 58{,}940\ gallons$$

5.1.2 Area 2 Runoff Volume

Area 2 consists of both of the Dewatering Bins as shown on Attachment 8.2. The runoff volume below is calculated in square feet and converted into gallons.

$$Runoff\ Volume = C * d * A$$

$$Runoff\ Volume = 1.0 * 8.21\ in * \frac{1\ ft}{12\ in} * (1{,}206.53\ ft^2 + 1{,}206.53\ ft^2)$$

$$Runoff\ Volume = 1.0 * 0.6841\ ft * 2{,}413.06\ ft^2$$

$$Runoff\ Volume = 1{,}650.94\ ft^3 * \frac{7.48\ gallons}{1\ ft^3}$$

$$Runoff\ Volume = 12{,}349\ gallons$$

5.1.3 Area 3 Runoff Volume

Area 3 consists of the runoff from the boiler building as shown on Attachment 8.2. The runoff volume below is calculated in square feet and converted into gallons.

$$Runoff\ Volume = C * d * A$$

$$Runoff\ Volume = 1.0 * 8.21\ in\ * \frac{1\ ft}{12\ in} * 28{,}176.70\ ft^2$$

$$Runoff\ Volume = 1.0 * 0.6841\ ft * 28{,}176.70\ ft^2$$

$$Runoff\ Volume = 18{,}583.39\ ft^3 * \frac{7.48\ gallons}{1\ ft^3}$$

$$Runoff\ Volume = 144{,}196\ gallons$$

6. CONCLUSION

The runoff volumes for each of the storm events are shown below.

6.1 10 Year-24 Hour Storm Event

The 10-year, 24-hour rainfall runoff volumes for each of the three areas are stated below. The values listed are calculated using the average and upper bounds of the 90% confidence interval for the 10-year, 24-hour storm. Because we have considered a 24-hour storm event, we reported the volumes as MGD, as well.

For Area 1, which is comprised of the Settling and the Surge Tank, as well as the surrounding area, the runoff volume for the average rainfall depth is 58,940 gallons or 0.059 MGD. The runoff volume for the upper bounds of the rainfall depth is 72,509 gallons or 0.073 MGD.

For Area 2, which is comprised of both Dewatering Bins, the runoff volume for the average rainfall depth is 12,349 gallons or 0.012 MGD. The runoff volume for the upper bounds of the rainfall depth is 15,192 gallons or 0.015 MGD.

For Area 3, which is comprised of the runoff from the Boiler Building, the runoff volume for the average rainfall depth is 144,196 gallons or 0.144 MGD. The runoff volume for the upper bounds of the rainfall depth is 177,391 gallons or 0.177 MGD.

The total runoff volume for the 10-Year, 24-Hour event from all three of the areas for the average rainfall depth is 215,485 gallons or 0.215 MGD, while the total runoff for the upper bounds of the 10-year, 24-hour event is 265,092 gallons or 0.265 MGD.

6.2 Other Storm Events

As stated above, the volumes calculated were for the 10-Year, 24-hour storm event. The same process shown within the calculation was used to calculate various durations ranging from 6 hours to 30 days for the 10-, 25- and 50-year storm events. A table outlining these volumes for 10-, 25- and 50-year storm events can be found in Attachments 8.3 through 8.5. Graphs outlining volumes for the high, low, and average depths for each of the storm durations are shown in Attachment 8.6 through 8.8 for the 10-, 25- and 50-year storm events, respectively.

7. REFERENCES

7.1 "Electronic Code of Federal Regulations." Electronic Code of Federal Regulations (ECFR), EPA, 2020.

7.2 US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service. "NOAA's National Weather Service." PF Data Server Home - HDSC/OHD/NWS/NOAA, US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service.

7.3 Hydraulics Manual. State of Louisiana Department of Transportation, 2011.

8. ATTACHMENTS

8.1 NOAA Atlas 14

8.2 Existing Nelson Plant Drawings- Drawings have been omitted from LDEQ submittal package due to confidentiality limitations (Drawing Numbers: 523-05584-09, 6-C-440-C01, A-C-770-C01)

8.3 Rainfall Volumes for 10-Year Storm Events

8.4 Rainfall Volumes for 25-Year Storm Events

8.5 Rainfall Volumes for 50-Year Storm Events

8.6 Graphs of the Rainfall Volumes for the 10-Year Storm Events

8.7 Graphs of the Rainfall Volumes for the 25-Year Storm Events

8.8 Graphs of the Rainfall Volumes for the 50-Year Storm Events

NOAA Atlas 14, Volume 9, Version 2
Latitude: 30.2721°, Longitude: -93.2982°
Elevation: 15.2 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.564** (0.454-0.712)	**0.645** (0.519-0.815)	**0.777** (0.623-0.985)	**0.886** (0.706-1.13)	**1.03** (0.796-1.36)	**1.15** (0.864-1.53)	**1.26** (0.918-1.72)	**1.37** (0.961-1.93)	**1.52** (1.02-2.20)	**1.63** (1.07-2.41)
10-min	**0.826** (0.665-1.04)	**0.945** (0.760-1.19)	**1.14** (0.912-1.44)	**1.30** (1.03-1.65)	**1.51** (1.17-1.98)	**1.68** (1.27-2.24)	**1.84** (1.34-2.52)	**2.01** (1.41-2.83)	**2.22** (1.50-3.23)	**2.38** (1.57-3.53)
15-min	**1.01** (0.811-1.27)	**1.15** (0.927-1.46)	**1.39** (1.11-1.76)	**1.58** (1.26-2.01)	**1.85** (1.42-2.42)	**2.05** (1.54-2.73)	**2.25** (1.64-3.08)	**2.45** (1.72-3.45)	**2.71** (1.83-3.94)	**2.91** (1.92-4.31)
30-min	**1.47** (1.18-1.85)	**1.69** (1.36-2.13)	**2.05** (1.65-2.60)	**2.35** (1.88-2.99)	**2.76** (2.12-3.61)	**3.06** (2.31-4.08)	**3.37** (2.46-4.61)	**3.67** (2.57-5.17)	**4.07** (2.74-5.90)	**4.36** (2.87-6.46)
60-min	**1.95** (1.57-2.46)	**2.24** (1.80-2.83)	**2.74** (2.19-3.47)	**3.17** (2.53-4.03)	**3.80** (2.94-5.03)	**4.30** (3.26-5.78)	**4.83** (3.54-6.66)	**5.39** (3.79-7.64)	**6.15** (4.17-8.99)	**6.76** (4.45-10.0)
2-hr	**2.43** (1.96-3.04)	**2.79** (2.25-3.50)	**3.42** (2.75-4.30)	**3.99** (3.20-5.04)	**4.84** (3.78-6.40)	**5.54** (4.23-7.43)	**6.29** (4.64-8.65)	**7.10** (5.04-10.0)	**8.24** (5.63-12.0)	**9.15** (6.07-13.5)
3-hr	**2.74** (2.22-3.42)	**3.14** (2.54-3.92)	**3.87** (3.12-4.85)	**4.55** (3.66-5.73)	**5.61** (4.42-7.45)	**6.52** (5.01-8.75)	**7.50** (5.57-10.3)	**8.59** (6.13-12.2)	**10.1** (6.97-14.8)	**11.4** (7.61-16.7)
6-hr	**3.32** (2.71-4.12)	**3.80** (3.10-4.72)	**4.73** (3.84-5.89)	**5.63** (4.55-7.05)	**7.08** (5.65-9.41)	**8.35** (6.47-11.2)	**9.77** (7.32-13.4)	**11.3** (8.16-16.0)	**13.6** (9.45-19.8)	**15.5** (10.4-22.6)
12-hr	**3.96** (3.24-4.88)	**4.56** (3.73-5.62)	**5.73** (4.68-7.09)	**6.88** (5.59-8.55)	**8.73** (7.00-11.5)	**10.4** (8.07-13.8)	**12.2** (9.17-16.6)	**14.2** (10.3-19.9)	**17.1** (12.0-24.7)	**19.6** (13.2-28.3)
24-hr	**4.64** (3.83-5.69)	**5.39** (4.44-6.61)	**6.82** (5.60-8.39)	**8.21** (6.70-10.1)	**10.4** (8.40-13.7)	**12.3** (9.68-16.3)	**14.5** (11.0-19.7)	**16.9** (12.3-23.5)	**20.3** (14.3-29.1)	**23.2** (15.8-33.3)
2-day	**5.37** (4.45-6.53)	**6.26** (5.18-7.62)	**7.94** (6.55-9.69)	**9.53** (7.82-11.7)	**12.0** (9.72-15.6)	**14.2** (11.2-18.6)	**16.5** (12.6-22.3)	**19.2** (14.0-26.5)	**22.9** (16.2-32.6)	**26.1** (17.8-37.2)
3-day	**5.81** (4.83-7.04)	**6.79** (5.63-8.23)	**8.59** (7.11-10.4)	**10.3** (8.47-12.6)	**12.9** (10.5-16.7)	**15.2** (12.0-19.8)	**17.6** (13.5-23.6)	**20.4** (15.0-28.0)	**24.3** (17.2-34.3)	**27.4** (18.9-39.0)
4-day	**6.15** (5.13-7.43)	**7.19** (5.98-8.69)	**9.08** (7.53-11.0)	**10.8** (8.95-13.2)	**13.6** (11.0-17.5)	**15.9** (12.6-20.7)	**18.4** (14.1-24.6)	**21.2** (15.6-29.1)	**25.2** (17.9-35.5)	**28.4** (19.6-40.3)
7-day	**7.01** (5.87-8.43)	**8.15** (6.81-9.80)	**10.2** (8.51-12.3)	**12.1** (10.0-14.7)	**15.0** (12.2-19.1)	**17.5** (13.8-22.5)	**20.1** (15.4-26.6)	**23.0** (17.0-31.3)	**27.1** (19.3-37.9)	**30.4** (21.1-42.9)
10-day	**7.83** (6.56-9.37)	**9.03** (7.56-10.8)	**11.2** (9.33-13.4)	**13.1** (10.9-15.9)	**16.1** (13.1-20.4)	**18.6** (14.8-23.8)	**21.2** (16.3-27.9)	**24.1** (17.9-32.6)	**28.2** (20.2-39.2)	**31.5** (21.9-44.2)
20-day	**10.3** (8.69-12.3)	**11.7** (9.82-13.9)	**14.0** (11.7-16.7)	**16.0** (13.4-19.2)	**18.9** (15.4-23.6)	**21.3** (17.0-27.0)	**23.8** (18.4-31.0)	**26.5** (19.7-35.4)	**30.1** (21.7-41.5)	**33.0** (23.1-46.1)
30-day	**12.4** (10.5-14.7)	**13.9** (11.8-16.5)	**16.5** (13.9-19.6)	**18.6** (15.6-22.2)	**21.6** (17.6-26.7)	**24.0** (19.2-30.1)	**26.4** (20.5-34.1)	**28.9** (21.6-38.4)	**32.3** (23.3-44.2)	**34.9** (24.6-48.6)
45-day	**15.0** (12.7-17.7)	**16.8** (14.3-19.9)	**19.8** (16.7-23.4)	**22.2** (18.7-26.4)	**25.5** (20.8-31.2)	**28.0** (22.4-34.9)	**30.5** (23.7-39.0)	**33.0** (24.7-43.5)	**36.3** (26.2-49.3)	**38.7** (27.4-53.6)
60-day	**17.2** (14.6-20.3)	**19.4** (16.4-22.8)	**22.8** (19.3-26.9)	**25.5** (21.5-30.2)	**29.2** (23.8-35.5)	**31.9** (25.5-39.6)	**34.6** (26.9-44.0)	**37.2** (27.9-48.8)	**40.6** (29.4-54.9)	**43.0** (30.5-59.5)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical

ATTACHMENT 8.2

EXISTING NELSON PLANT DRAWINGS

Nelson Power Plant			6-hour (gallons)	12-hour (gallons)	24-hour (gallons)	2-day (gallons)	3-day (gallons)	4-day (gallons)	7-day (gallons)	10-day (gallons)	20-day (gallons)	30-day (gallons)
		Average	5.63	6.88	8.21	9.53	10.3	10.8	12.1	13.1	16	18.6
		High	7.05	8.55	10.1	11.7	12.6	13.2	14.7	15.9	19.2	22.2
	Areas (Square Feet)	Low	4.55	5.59	6.7	7.82	8.47	8.95	10	10.9	13.4	15.6
Unit 6	42,107	Average	147,769	180,577	215,485	250,131	270,341	283,464	317,585	343,832	419,947	488,189
		High	185,039	224,409	265,092	307,086	330,708	346,456	385,826	417,322	503,937	582,677
		Low	119,422	146,719	175,853	205,249	222,310	234,908	262,467	286,089	351,706	409,448
	Area 1 - Surge & Settling Tank Area	Average	40,418	49,392	58,940	68,417	73,945	77,534	86,867	94,046	114,865	133,531
	11,517	High	50,613	61,381	72,509	83,995	90,456	94,764	105,532	114,147	137,838	159,376
		Low	32,665	40,131	48,100	56,140	60,807	64,253	71,791	78,252	96,200	111,994
	Area 2 - Dewatering Bin Area	Average	8,468	10,348	12,349	14,334	15,493	16,245	18,200	19,704	24,066	27,977
	2,413	High	10,604	12,860	15,192	17,598	18,952	19,855	22,111	23,916	28,880	33,392
		Low	6,844	8,408	10,078	11,762	12,740	13,462	15,041	16,395	20,155	23,465
	Area 3 - Boiler Building Area	Average	98,882	120,837	144,196	167,380	180,904	189,686	212,518	230,082	281,016	326,681
	28,177	High	123,823	150,168	177,391	205,493	221,300	231,838	258,183	279,259	337,219	389,909
		Low	79,914	98,180	117,675	137,346	148,763	157,193	175,635	191,442	235,351	273,990

Unit 6										
Duration	6-hour	12-hour	24-hour	2-day	3-day	4-day	7-day	10-day	20-day	30-day
Duration in Days	0.25	0.5	1	2	3	4	7	10	20	30
Surge Capacity (Gallons)	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**
Average Discharge/30-days (Gallons)	0	0	0	0	0	2237	6153	6931	7272	7122
High Discharge/30-days (Gallons)	0	0	0	16285	18730	17985	15901	14281	11471	10272
Low Discharge/30-day (Gallons)	0	0	0	0	0	0	0	1157	3859	4498
10% PWV (Gallons per Day)	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105
10% PWV x 30 days (Gallons)	8,532,624	4,266,312	2,133,156	1,066,578	711,052	533,289	304,737	213,316	106,658	71,105
% of PVW	0.0%	0.0%	0.00%	0.2%	0.3%	0.3%	0.5%	0.7%	1.1%	1.4%

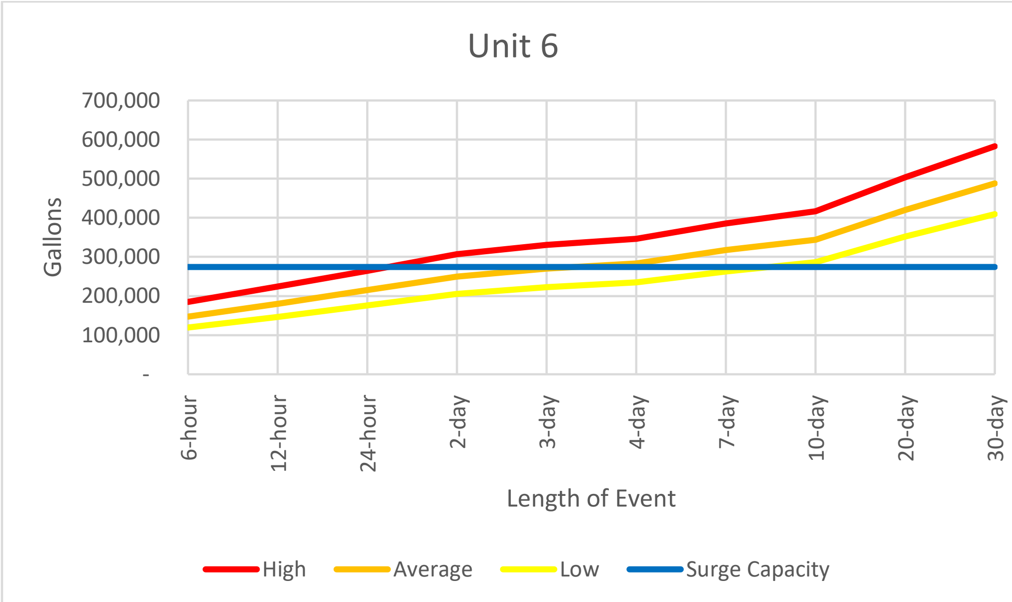
Nelson Power Plant			6-hour (gallons)	12-hour (gallons)	24-hour (gallons)	2-day (gallons)	3-day (gallons)	4-day (gallons)	7-day (gallons)	10-day (gallons)	20-day (gallons)	30-day (gallons)
		Average	7.08	8.73	10.4	12	12.9	13.6	15	16.1	18.9	21.6
		High	9.41	11.5	13.7	15.6	16.7	17.5	19.1	20.4	23.6	26.7
	Areas (Square Feet)	Low	5.65	7	8.4	9.72	10.5	11	12.2	13.1	15.4	17.6
Unit 6	42,107	Average	185,827	229,134	272,966	314,960	338,582	356,955	393,700	422,572	496,063	566,929
		High	246,981	301,837	359,580	409,448	438,320	459,317	501,312	535,433	619,422	700,787
		Low	148,294	183,727	220,472	255,118	275,590	288,714	320,210	343,832	404,199	461,942
	Area 1 - Surge & Settling Tank Area	Average	50,828	62,673	74,662	86,149	92,610	97,635	107,686	115,583	135,685	155,068
	11,517	High	67,555	82,559	98,353	111,994	119,891	125,634	137,120	146,453	169,426	191,681
		Low	40,562	50,254	60,304	69,781	75,380	78,970	87,585	94,046	110,558	126,352
	Area 2 - Dewatering Bin Area	Average	10,649	13,131	15,643	18,050	19,403	20,456	22,562	24,217	28,428	32,489
	2,413	High	14,154	17,298	20,607	23,465	25,119	26,322	28,729	30,684	35,498	40,161
		Low	8,498	10,529	12,635	14,620	15,793	16,546	18,351	19,704	23,164	26,473
	Area 3 - Boiler Building Area	Average	124,349	153,329	182,660	210,762	226,569	238,863	263,452	282,772	331,950	379,371
	28,177	High	165,272	201,980	240,620	273,990	293,310	307,361	335,462	358,295	414,498	468,945
		Low	99,234	122,944	147,533	170,717	184,417	193,198	214,274	230,082	270,478	309,117

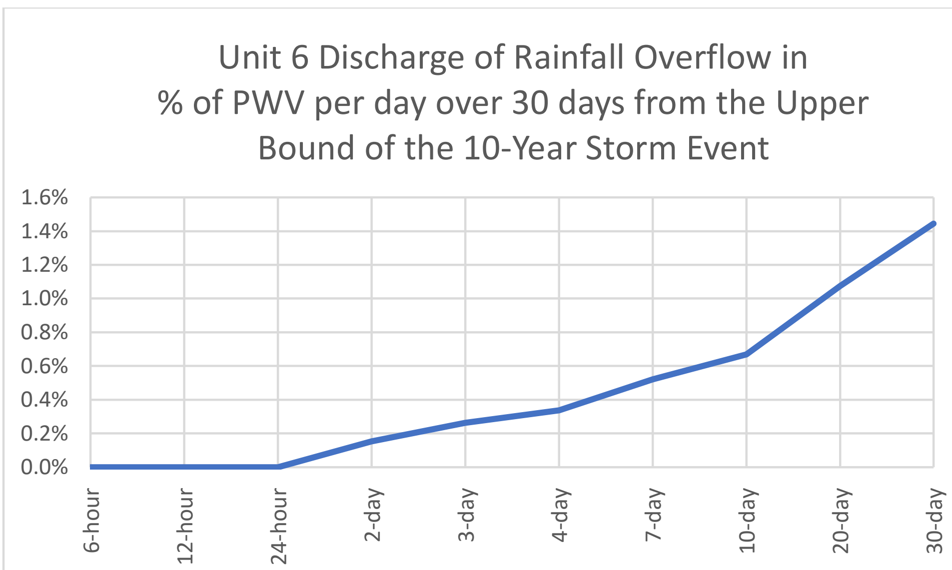
Unit 6										
Duration	6-hour	12-hour	24-hour	2-day	3-day	4-day	7-day	10-day	20-day	30-day
Duration in Days	0.25	0.5	1	2	3	4	7	10	20	30
Surge Capacity (Gallons)	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**
Average Discharge/30-days (Gallons)	-	-	-	20,221.68	21,355.13	20,609.52	17,026.21	14,805.48	11,077.28	9,747.05
High Discharge/30-days (Gallons)	-	54,640.02	85,062.74	67,465.73	54,600.94	46,200.05	32,399.27	26,091.56	17,245.25	14,208.99
Low Discharge/30-day (Gallons)	-	-	-	-	357.77	3,549.17	6,527.53	6,931.47	6,484.11	6,247.50
10% PWV (Gallons per Day)	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105
10% PWV x 30 days (Gallons)	8,532,624	4,266,312	2,133,156	1,066,578	711,052	533,289	304,737	213,316	106,658	71,105
% of PVW	0.0%	0.1%	0.40%	0.6%	0.8%	0.9%	1.1%	1.2%	1.6%	2.0%

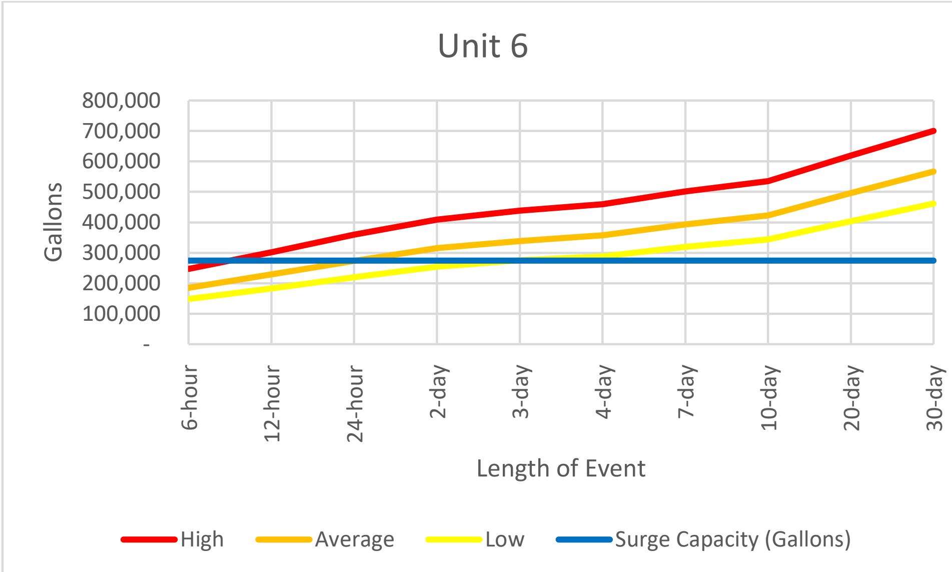
Nelson Power Plant			6-hour (gallons)	12-hour (gallons)	24-hour (gallons)	2-day (gallons)	3-day (gallons)	4-day (gallons)	7-day (gallons)	10-day (gallons)	20-day (gallons)	30-day (gallons)
			8.35	10.4	12.3	14.2	15.2	15.9	17.5	18.6	21.3	24
			11.2	13.8	16.3	18.6	19.8	20.7	22.5	23.8	27	30.1
			6.47	8.07	9.68	11.2	12	12.6	13.8	14.8	17	19.2
Unit 6	42,107	Average	219,160	272,966	322,834	372,703	398,950	417,322	459,317	488,189	559,055	629,921
		High	293,963	362,204	427,821	488,189	519,685	543,307	590,551	624,671	708,661	790,026
		Low	169,816	211,811	254,068	293,963	314,960	330,708	362,204	388,451	446,194	503,937
	Area 1 - Surge & Settling Tank Area	Average	59,945	74,662	88,303	101,943	109,122	114,147	125,634	133,531	152,914	172,298
	11,517	High	80,406	99,071	117,019	133,531	142,146	148,607	161,529	170,862	193,835	216,090
		Low	46,449	57,935	69,493	80,406	86,149	90,456	99,071	106,250	122,044	137,838
	Area 2 - Dewatering Bin Area	Average	12,560	15,643	18,501	21,359	22,863	23,916	26,322	27,977	32,038	36,099
	2,413	High	16,846	20,757	24,517	27,977	29,782	31,136	33,843	35,799	40,612	45,275
		Low	9,732	12,138	14,560	16,846	18,050	18,952	20,757	22,261	25,570	28,880
	Area 3 - Boiler Building Area	Average	146,655	182,660	216,031	249,401	266,965	279,259	307,361	326,681	374,102	421,523
	28,177	High	196,711	242,376	286,285	326,681	347,757	363,564	395,178	418,011	474,214	528,661
		Low	113,636	141,737	170,014	196,711	210,762	221,300	242,376	259,939	298,579	337,219

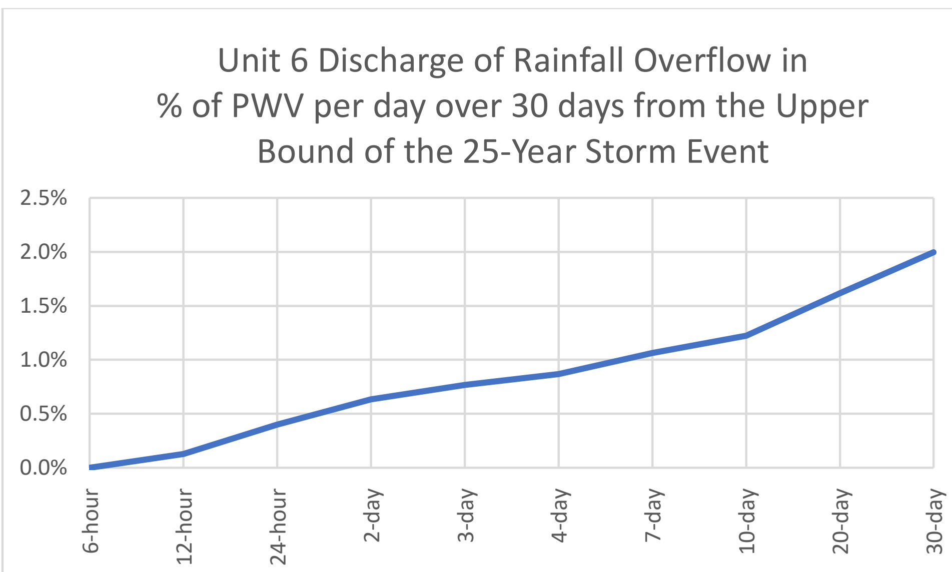
Unit 6										
Duration	6-hour	12-hour	24-hour	2-day	3-day	4-day	7-day	10-day	20-day	30-day
Duration in Days	0.25	0.5	1	2	3	4	7	10	20	30
Surge Capacity (Gallons)	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,517**	**274,106**
Average Discharge/30-days (Gallons)	-	-	48,317	49,093	41,478	35,701	26,400	21,367	14,227	11,860
High Discharge/30-days (Gallons)	77,784	175,375	153,304	106,836	81,723	67,197	45,148	35,015	21,707	17,197
Low Discharge/30-day (Gallons)	-	-	-	9,723	13,481	14,048	12,527	11,393	8,584	7,661
10% PWV (Gallons per Day)	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105	71,105
10% PWV x 30 days (Gallons)	8,532,624	4,266,312	2,133,156	1,066,578	711,052	533,289	304,737	213,316	106,658	71,105
% of PVW	0.1%	0.4%	0.72%	1.0%	1.1%	1.3%	1.5%	1.6%	2.0%	2.4%

ATTACHMENT 8.6

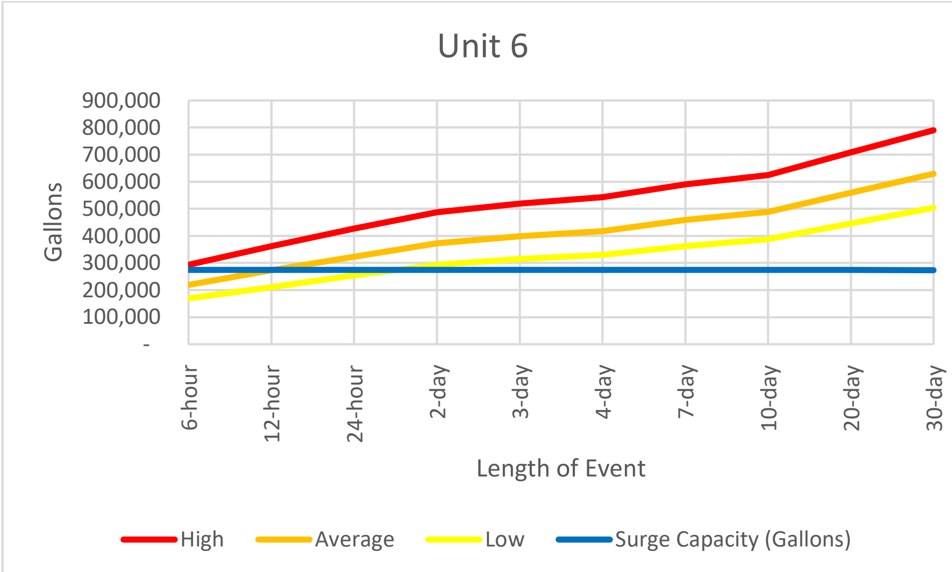


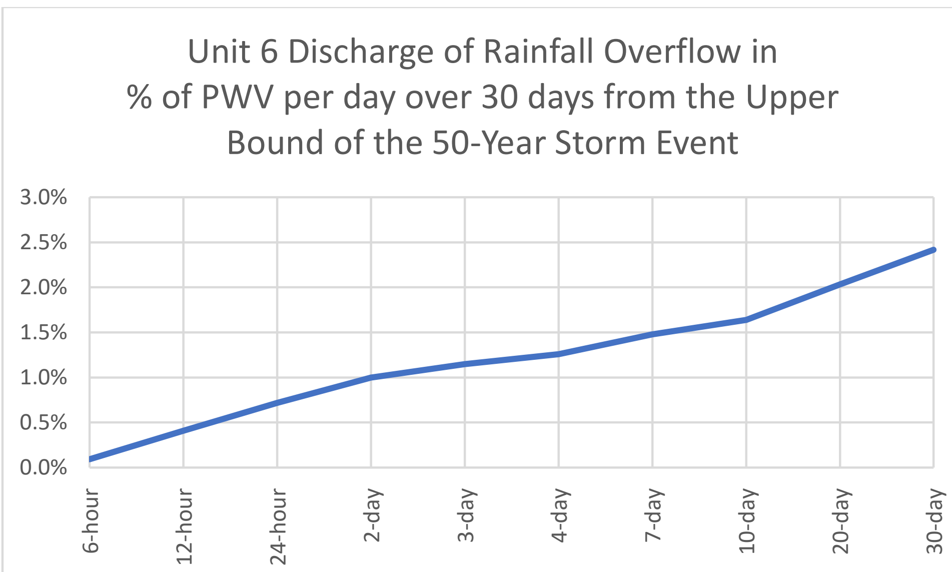



Unit 6
800,000
700,000
600,000
500,000
400,000
300,000
200,000
100,000
-
Gallons
6-hour
12-hour
24-hour
2-day
3-day
4-day
7-day
10-day
20-day
30-day
Length of Event
High
Average
Low
Surge Capacity (Gallons)


Unit 6 Discharge of Rainfall Overflow in % of PWV per day over 30 days from the Upper Bound of the 25-Year Storm Event
2.5%
2.0%
1.5%
1.0%
0.5%
0.0%
6-hour
12-hour
24-hour
2-day
3-day
4-day
7-day
10-day
20-day
30-day

ATTACHMENT 8.8





APPENDIX C – BOTTOM ASH PURGE WATER SUSPENDED SOLIDS ESTIMATE

Entergy Louisiana, LLC

Nelson 6 Generating Station, Unit 6

Document Number: 2021-04299
Bottom Ash Purge Water Suspended Solids Estimate

Rev. 0
October 26, 2021

Sargent & Lundy

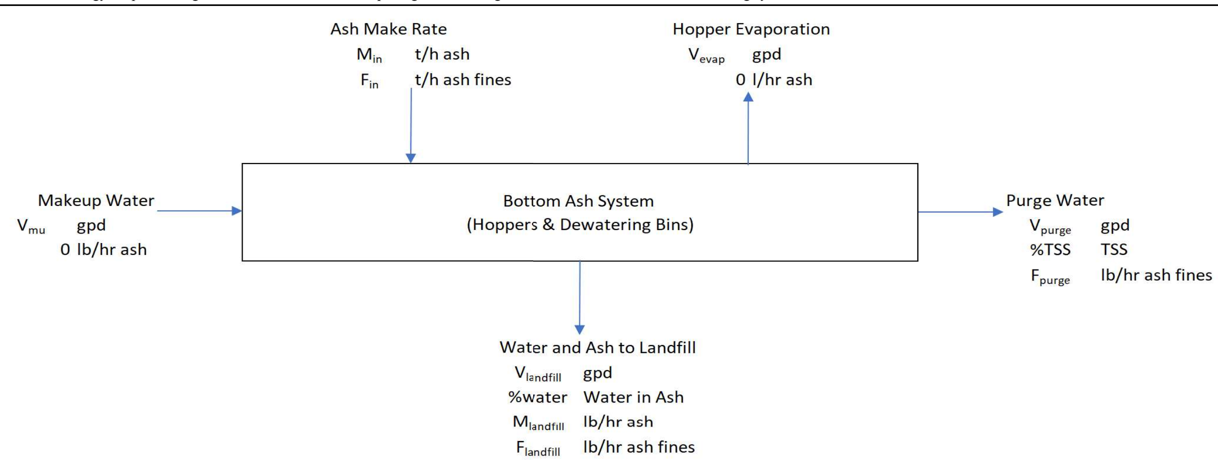
Bottom Ash Purge Water Suspended Solids Estimate

TABLE OF CONTENTS

Bottom Ash Purge Water Suspended Solids Estimate

1.00	**PURPOSE AND SCOPE:**				
1.01	The R.S. Nelson Unit 6 is a coal fired unit located in Westlake, LA				
1.02	This calculation was performed to estimate the bottom ash purge water discharge to maintain TSS concentration of 0.3% or less.				
Item	**Description**	**Reference**	**Unit of Measure**	**Data Value**	**Input (V/UV/EJ)**
2.0	**DESIGN INPUTS:**				
2.1	**Units 6**				
2.1.a	Unit 6 ash make rate, M_{in}	Bottom Ash Make Rate Design Basis, Rev. A.	t/day	258	**UV**
2.1.b	Unit 6 Primary Active Wetted Bottom Ash System Volume, V	2021-03826, Wetted Bottom Ash Transport Water Volume Estimate	gallons	711,059	**V**
2.3	**Bottom Ash Particle Size Distribution**				
2.3.a	Fraction of bottom ash particles <300 µm interpolated from EPA particle size data, %removed	EPA-600/7-80-067, Table 8, pg 38	%wt	10.3%	**UV**
2.3.b	Fraction of bottom ash particles <75 µm, %fines	EPA-600/7-80-067, Table 8, pg 38	%wt	1.8%	**UV**
Item	**Description**	**Reference**	**Unit of Measure**	**Data Value**	
3.0	**ASSUMPTIONS:**				
3.1	Particles <75µm are considered fines and only removed from the system in bottom ash purge water and water entrained in the ash in the trucks going to landfill				**EJ**
3.2	No ash is present in the makeup water, V_{mu}, and water evaporated from the hopper and dewatering bins, V_{evap}				**EJ**
3.3	Unit 6 evaporation from hopper and dewatering bins based on previous project experience prorated by unit nameplate MW, Vevap	N/A	gpd	2995	**EJ**
3.4	Percentage by weight of water entrained in ash trucked to landfill, %water	N/A	%	25%	**EJ**
3.5	All particles other than fines are completely removed in the dewatering bins				**EJ**
3.6	Dewatering bin systems will remove particles of 300 µm size and above.	Value based upon information from United Conveyor Corporation, the supplier of the system at WA Parish.	N/A	N/A	**UV**
3.7	Bottom Ash System Total Suspended Solids Concentration Limit				
3.8.a	Total Suspended Solids Concentration to trigger erosion resistant pump materials, %TSS		%wt	0.30%	**UV**

Item	**Description**	**Variables**	**Data Value**
4.0	**METHODOLOGY & ACCEPTANCE CRITERIA:**		
4.1	The methodology for performing this calculation involves completing the following mass balance for all bottom ash handling systems on site:		



4.2	This calculation is acceptable if the resultant concentration of total suspended solids, %TSS, is less than or equal to the value in 3.8.a.		

Item	**Description**	**Reference**	**Unit of Measure**	**Equation**
5.0	**CALCULATIONS:**			
5.1	Input of ash into system, M_{in}		lb/hr	$M_{in} = M_{in} \times 2000 / 24$
	Unit 6		lb/hr	21500.0
5.2	Input of fines into system, F_{in}		lb/hr	$F_{in} = M_{in} \times \%fines$
	Unit 6		lb/hr	387.0
5.3	Output of ash to landfill, $M_{landfill}$		lb/hr	$M_{landfill} = M_{in} - F_{in}$
	Unit 6		lb/hr	21113.0

Bottom Ash Purge Water Suspended Solids Estimate

5.4	Flow of water entrained in ash to landfill, $V_{landfill}$		gpd	$V_{landfill}$ = ($M_{landfill}$ x %water) x 24 / 8.338	
	Unit 6		gpd	15192.9	
5.5	Makeup water flow into system, V_{mu}		gpd	$V_{mu} = V_{purge} + V_{landfill} + V_{evap}$	
	Unit 6		gpd	56543.4	
5.6	Fines included in the water entrained in ash to landfill, $F_{landfill}$		lb/hr	$F_{landfill} = F_{in}$ x (1-%removed)	
	Unit 6		lb/hr	347.0	
5.7	Fines included in the bottom ash purge water, F_{purge}		lb/hr	$F_{purge} = F_{in} - F_{landfill}$	
	Unit 6		lb/hr	40.0	
5.8	Concentration of suspended solids in bottom ash purge water,recirculating water, and water entrained in ash to landfill, %TSS.		%	%TSS = F_{purge} / (V_{purge} / 24 x 8.338)	
	Unit 6		%	0.30%	
5.9	Bottom ash purge water flow, V_{purge}		gpd	$V_{purge} = F_{purge}$ / %TSS x 24 / 8.338	
	Unit 6		gpd	38355.3	
5.10	Average fraction of primary wetted volume discharged per day, %PVW		%	%PVW = V_{purge} / V	
	Unit 6		%	5.39%	
Item	**Description**	**Reference**	**Unit of Measure**	**Equation**	**Accept (Y/N)**
6.0	**RESULTS:**				
6.1	30-day rolling average dischage of bottom ash purge water from bottom ash system required to control fines concentration in Combined Unit 6 bottom ash system, %PWV		%PWV/day	5.39%	**YES**
7.0	**REFERENCES:**				
7.1	Program No. 03.2.435-16.0, Microsoft Excel for Office 365				
7.2	Bottom Ash Volume Calculation, 2021-03195				
7.3	EPA Report, EPA-600/7-80-067, Behavior of Coal Ash Particles in Water: Trace Metal Leaching and Ash Settling				
8.0	**ATTACHMENTS:**				
	None				

APPENDIX D – WATER BALANCE

Entergy Louisiana, LLC
Nelson 6

Bottom Ash System Water Balance

Document No. NL-MSK-WB-005
A13603.006
26-Oct-2021
Revision 0

1.0 PURPOSE AND SCOPE

The purpose of this calculation is to estimate discharge of bottom ash purge water due to regular inflows from wastestreams other than bottom ash transport water which, in total, exceed the capacity of the bottom ash system to accept in accordance with 40 CFR 423.13(k)(2)(i)(A)(2).

Flows around the following systems pertain to the scope of this water balance:

- Makeup Water Source from SRA pond
- Dewatering Bins
- Settling Tank
- Surge Tank
- Ash Loadout Area Sump
- Recirculation Pumps
- Boiler Blowdown
- Boiler Hopper Seal and Flushing Water
- Water Discharges (i.e. overflow outfall)

The flow of particular interest is the boiler blowdown. This is the only wastewater inflow to the bottom ash system. All other bottom ash system flows, including hopper seal and flushing water, are supplied by recycled transport water, from the recirculation pumps.

2.0 DESIGN INPUT

2.1 Boiler Main Steam for Blowdown Calculation

2.1a	Full load boiler main steam based on Steam Generator Flow in accordance with Thermal Performance Data for Nelson Unit 6, 551 MW maximum guaranteed case.	3,796,838	lb/hr	(Ref. 8.1)

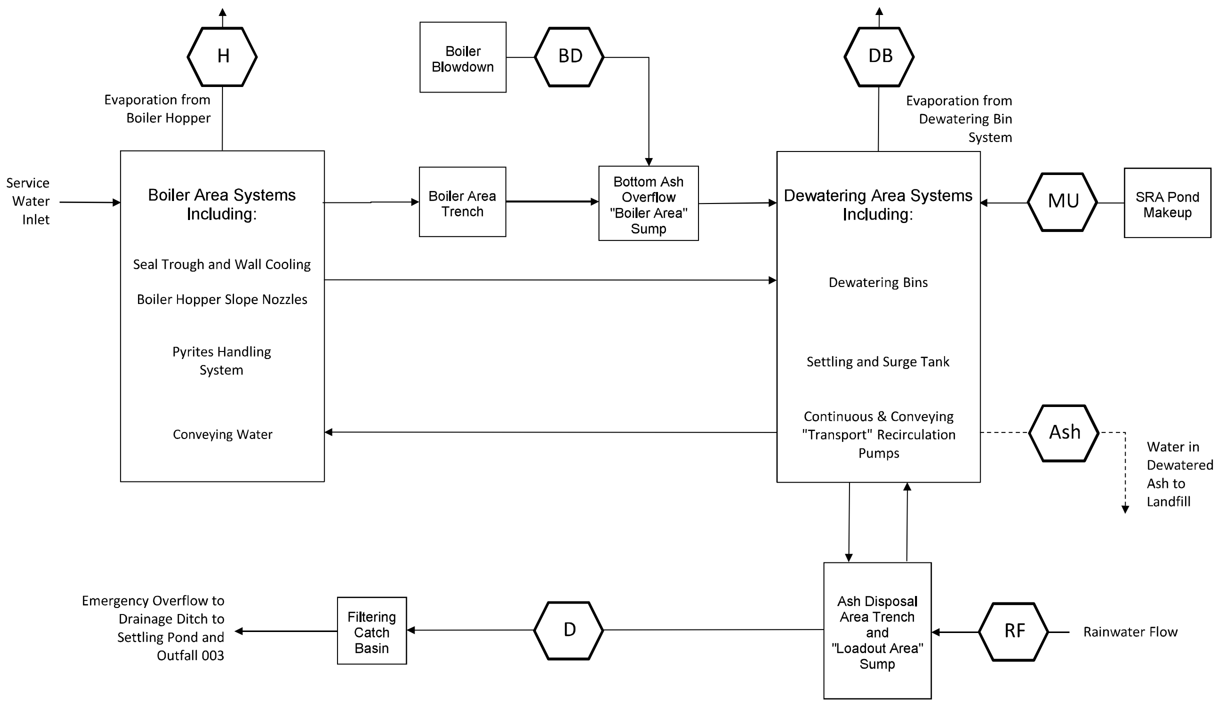
2.2 Bottom Ash System Volumes

2.2a	Bottom ash system primary wetted volume in accordance with Wetted Bottom Ash Volume Calculation, [PWV]	711,059	gallons	(Ref 8.3)
2.2b	Bottom ash system surge capacity in accordance with Wetted Bottom Ash Volume Calculation, [SC]	274,517	gallons	(Ref 8.3)

ATTACHMENT 9.1

Water Balance Diagram

Water Inputs			Water Discharges							
Boiler Blowdown, [gallons]	Rainfall, [gallons]	SRA Pond Makeup, [gallons]	Water in Ash to Landfill, [gallons]	Hopper Evaporation [gallons]	Dewatering Bin System Evaporation [gallons]	Discharge Before Surge Capacity, [gallons]	Surge Capacity, [gallons]	Hours of Discharge	Total Discharge, [gallons]	Fraction of Primary Wetted Volume per
BD	RF	MU	Ash	H	DB				D	
3,278,632	0	0	490,096	216,000	43,200	2,529,336	274,517	720	2,254,819	10.6%



Notes:

1 Boiler blowdown based on Thermal Performance Data for Nelson Unit 6, 551 MW maximum guaranteed case (Curve No. AC-227-3584).

2 Water in ash trucked to landfill is assumed based on ash 25% moisture content.

3 Hopper evaporation is assumed based on previous project experience prorated to nameplate MW.

4 Evaporation from dewatering bin system, including settling and surge tanks, is based on previous project experience.

5 Makeup from SRA pond balances discharges to maintain water balance.

6 Total discharge equals the Discharge Before Surge Capacity minus the Surge Capacity

7 Fraction of Primary Wetted Volume per Day based on Primary Wetted Volume in accordance with Wetted Bottom Ash Volume Calculation, 2021-03195, Rev 0

8 Surge Capacity in accordance with Wetted Bottom Ash Volume Calculation, 2021-03195, Rev 0

9 Service water makeup is assumed to be zero. Makeup to the bottom ash system is provided by the SRA pond.

10 Ash make rate per June 22, 2021 e-mail, from Lauren Carpenter

11 Rainfall is assumed to be zero for this water balance.

Drawing Release Record					
Rev	Date	Prepared	Reviewed	Approved	Purpose
0	26-Oct-21	M. Heermann	D. Eglar	M. Murray	For Use

Project No: A13603.006

Owner: Entergy

Engineer: Sargent & Lundy

Entergy Louisiana, LLC

Bottom Ash System Water Balance

NL-MSK-WB-005

ATTACHMENT 9.2

Summary of Water Balance Calculation

Potential Discharge from Bottom Ash System Resulting from Boiler Blowdown

Water Inputs							Water Discharges									
MW Load	Main Steam, (MS) [lb/hr]	Boiler Blowdown, (%MS), [%]	Boiler Blowdown, (BD-flow) [gpm]	Boiler Blowdown, (BD-vol) [gallons]	Rainfall, (RF-vol) [gallons]	SRA Pond Makeup, (MU-vol), [gallons]	Ash Make Rate including Pyrites, (Ash) [tons]	Water in Ash to Landfill, (Ash-vol), [gallons]	Hopper Evaporation, (H-vol), [gallons]	Dewatering Bin Evaporation, (DB-vol), [gallons]	Discharge Before Surge Capacity, [gallons]	Surge Capacity, (SC), [gallons]	Hours of Discharge	Total Discharge, (D), [gallons]	Fraction of PWV per day, [%]
From Westinghouse Thermal Kit		Assumption	Calculated	Calculated	Rainfall Estimate	Calculated	Estimate	Calculated	Assumption	Assumption	Calculated	Estimate	Assumption	Calculated	Calculated
551	3,796,838	1%	75.9	3,278,632	0	0	8172.85	490,096	216,000	43,200	2,529,336	274,517	720	2,254,819	11%

ATTACHMENT 9.3

Nelson Ash Make Rate Design Basis.xlsx

Bottom Ash Make Rate Design Basis

Table 1: Unit Make-Rate Calculation (Equipment Sizing)

Plant-Unit	Unit type	Gross Rating (MW)	Heat Rate[5] (Btu/kWh)	Btu Value[1] (Btu/lb)	Total Coal Burned (tons/hr)	Number of Coal Mills	Ash %[1]	Total Ash (tph)	Percent Fly Ash[2]	Percent Bottom Ash[2]	Fly Ash (tph)	Bottom Ash (tph)	Economizer ash[3] (tph)	Pyrites[4] (tph)
Nelson Unit 6	Pulverized Coal	551	11,340	8,985	347.71	6	7.73%	26.88	60%	40%	16.13	10.75	1.34	0.60

Notes (DI = Design Input, U = Unverified, V = Verified, J = Engineering Judgment)
1) Per June 22, 2021 e-mail, from Lauren Carpenter (DI)
2) Pulverized coal boiler has an ash distribution of 60%/40% fly ash/bottom ash per client request. (DI)
3) Per *Steam: It's Generation and Use by B&W* : economizer ash is assumed to be 5% of total ash. Economizer ash is not handled within the bottom ash system. (DI)
4) Pyrite production based on an assumed production rate of 200 lbs/hr per coal mill. (U)
5) Heat Rate is assumed to be 11,340 Btu/kWh in accordance with 2007 NETL coal plant database information. (U)