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Attn: Docket ID EPA-HQ-OW-2009-0819

RE: Comments of The Southern Company on Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category; Proposed Rule; 88 FR 18824 (Mar. 29, 2023).

Mr. Richard Benware,

The Southern Company respectfully submits the following comments in response to the U.S. Environmental Protection Agency's (EPA) March 29, 2023 Federal Register notice seeking public input on EPA's proposed rulemaking to revise the effluent limitations guidelines and standards (ELGs) for the steam electric power generating point source category. These comments are submitted on behalf of The Southern Company and its subsidiaries, Alabama Power Company, Georgia Power Company, Mississippi Power Company, Southern Nuclear Company and Southern Power Company.

The Southern Company appreciates the opportunity to comment on this proposed rulemaking. In our comments, we present ways in which EPA can finalize a rulemaking in a way that helps to ensure the delivery of clean, safe, reliable and affordable energy to customers. Where possible, we provide real examples of our operating experience to illustrate the benefits of any suggested modifications.

We look forward to engaging constructively with EPA on this important rulemaking. If you have any questions about these comments or need additional information, please do not hesitate to contact me or Donna Hill at 205-257-5234 or dbhill@southernco.com.

Sincerely,

Jeffrey A. Burleson




# Comments of The Southern Company on Environmental Protection Agency Proposed Rule; Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category

**88 Fed. Reg. 18,824 (Mar. 29, 2023)**
**Docket ID No. EPA-HQ-OW-2009-0819**

**May 30, 2023**

**EXECUTIVE SUMMARY**

The Southern Company[1] (Southern or the Company) is committed to building the future of energy for the advancement of our customers and communities. Through industry-leading innovation and a commitment to a net zero future, we are delivering the customized sustainable and resilient energy solutions our customers and communities require to help drive growth and prosperity. Our uncompromising values put the needs of those we serve at the center of everything we do. With these values in mind, we are focused on transitioning our generating fleet to net zero greenhouse gas emissions and making the necessary related investments in our transmission and distribution grids, while maintaining reliability and affordability for our customers.

The Southern Company system's compliance plan for the 2020 ELG Reconsideration Rule[2] (2020 Rule) reflects our continued commitment to comply with all environmental rules and regulations, to responsibly transition our system's generating fleet, and to continue to research and develop emerging wastewater treatment technologies. The 2020 Rule, and the associated compliance options, are now key components to facilitate the orderly fleet transition for both replacement generation resources as well as necessary transmission project completion. However, in the midst of the energy transformation that is underway at Southern, the U.S. Environmental Protection Agency's (EPA's or the Agency's) recently proposed

[1] The Southern Company is a holding company that conducts its business through its subsidiaries, accordingly, unless the context otherwise requires, references in this letter to The Southern Company's operations, such as generating activities, refer to those operations conducted through its subsidiaries.

[2] 85 Fed. Reg. 64,650 (Oct. 13, 2020).

Supplemental ELG Rule[3] ("the proposal" or "the 2023 Rulemaking") threatens to disrupt the orderly fleet transition by increasing risks to reliability while burdening customers with undue costs. EPA has heavily underestimated both the costs and necessary timeframes for complying with this proposed rule, which will result in a tremendous cost burden to customers and negative impacts to our ability to provide clean, safe, reliable, and affordable energy to customers.

The impacts of this proposed rule are apparent when considering the cascading and unaccounted for impacts to Georgia Power's Plant Bowen. Plant Bowen, located in Cartersville, Georgia serves as a key dispatchable reliability asset for the Metro Atlanta and North Georgia load center. EPA's proposed Best Available Technology Economically Achievable (BAT) (membrane filtration) for flue gas desulfurization (FGD) wastewater treatment has not been adequately demonstrated as suitable for all plants and raises significant feasibility concerns for Plant Bowen due to site-specific characteristics. Notwithstanding those concerns, not only would installation of membrane filtration at Plant Bowen increase the capital costs of the ELG compliance strategy by hundreds of millions of dollars and eliminate the environmentally friendly beneficial use of operational fly ash at the site, but EPA's basis for how facilities would meet the zero liquid discharge (ZLD) requirement could also result in unacceptable consequences for operations, such as the forced operation of the plant just to prevent discharge of treated permeate.

Further, the 2029 compliance deadline does not allow for sufficient time to complete necessary transmission and replacement generation to consider alternatives to installation of controls. Whereas Georgia Power has anticipated the eventual retirement of Plant Bowen by the end of 2035, Plant Bowen remains critical to

[3] Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, 88 Fed. Reg. 18,824 (Mar. 29, 2023).

maintaining electric service in north Georgia during the time that both replacement generation and new transmission projects are being completed. Through the state regulatory framework in Georgia, the Public Service Commission (PSC or the Commission) governs generation resource decisions and approves the transmission plans to ensure the utility can meet its obligation to serve its customers. Georgia Power is required under Georgia law and PSC regulation to complete comprehensive and long-term integrated resource planning every three years. This thorough and fully litigated process ensures decisions are made in the best interest of customers but necessarily takes time. A compliance deadline of 2029 does not allow for the appropriate time to complete these necessary projects, and the proposed rule does not offer the appropriate flexibility to alleviate the disparate costs to aging units and accommodate the time necessary to replace generation.

These impacts are not limited to Plant Bowen. Alabama's Plant Miller has already proceeded with the installation of EPA's 2020 Rule BAT and has been named by EPA in this rulemaking as an "early adopter" of the 2020 Rule. Yet, the early adopter subcategory allows plants like Miller with the option to retire earlier than anticipated, as opposed to recognizing the environmental benefits of having operated a more stringent FGD wastewater treatment plant and allowing the plant to both maximize the environmental benefits of EPA's recently established BAT and allow for adequate time to recover costs of these investments and properly evaluate the impacts of other potentially significant power sector rulemakings before abandoning the biological treatment system for EPA's newly proposed membrane technology. This membrane technology is significantly more expensive than EPA has estimated, and EPA has not fully evaluated the extent of non-water quality impacts, including the elimination of beneficial fly ash use to the local concrete market and the resulting negative impacts on economic development and infrastructure projects dependent on this resource.

In addition to EPA's revisions to effluent limitations for both bottom ash transport water (BATW) and FGD wastewater, EPA is also proposing to establish new effluent limits for both legacy wastewater (LWW) and combustion residual leachate (CRL). EPA has solicited comments for a multitude of compliance options for these waste streams, some of which are unnecessarily complicated and do not reflect current practices that are already in place to treat these waste streams. The Southern Company's electric operating companies are currently dewatering ash ponds across the system under state regulatory oversight with treatment that is protective of state water quality standards. These treatment system configurations are very site-specific and are integral to an efficient and protective closure process. We are concerned that finalizing the rule as proposed could negatively impact the progress of ash pond closures being conducted to comply with aggressive timelines under the coal combustion residuals (CCR) Rule[4] (CCR Rule).

While the Company is committed to installation and operation of wastewater treatment under the ELG Rule, the realities of cost and reliability concerns in serving our customers cannot be ignored. We encourage EPA to finalize a Supplemental ELG Rule that can protect the environment, promote resiliency and reliability of the electric power system, and help to alleviate a significant cost burden to customers. In these comments, The Southern Company provides detailed review and recommendations to EPA regarding the following issues:

**EPA's failure to pause implementation of the 2020 Rule has created important reliance interests that need to be protected:**

- EPA's failure to pause implementation of the 2020 Rule has created important reliance interests that need to be protected. EPA should acknowledge the consequences to customers of requiring

[4] 80 Fed. Reg. 21,301 (Apr. 17, 2015).

continued compliance with its recently finalized 2020 Rule while it simultaneously proceeded with its revision to more costly compliance options that render certain 2020 compliance investments obsolete. To address these interests more adequately, EPA must either reject its newly proposed BAT for FGD wastewater or finalize a rule with appropriate time to comply with the new BAT and flexibilities for aging units to either comply with the new BAT, retire or repower under an appropriate timeframe.

**EPA's proposed BAT for FGD wastewater:**

- As EPA correctly concluded in 2015 and 2020 and as has been confirmed by The Southern Company wastewater treatment experience and research results provided to EPA, membrane filtration is still not the BAT and ZLD is not a realistic effluent limit for FGD wastewater across the industry.
- As was done in both 2015 and 2020, we urge EPA to again reject membrane filtration and paste encapsulation as industry BAT for FGD wastewater. EPA has not adequately demonstrated that the newly proposed BAT is feasible beyond a limited number of plants and has not adequately considered specific data and information submitted previously to the Agency explaining why the technology is not suitable at every plant. Furthermore, EPA's proposed BAT for FGD wastewater imposes substantial and significantly underestimated new costs to customers and renders costly investments made in EPA's 2020 Rule as obsolete in as little as four years after they will have been installed. Additionally, EPA has not adequately considered the significant non-water quality impacts associated with the proposed BAT, particularly the negative consequence of eliminating

beneficial use of operational fly ash at both Alabama Power's Plant Miller and Georgia Power's Plant Bowen.

**Compliance timeframes**:

- If EPA finalizes the proposed BAT despite the concerns outlined above, we urge EPA to extend the late applicability date to December 31, 2032, to account for the additional time needed for site-specific planning requirements and/or research and development of the emerging technology. Requiring compliance by no later than December 31, 2029, would prematurely obsolete the biological treatment systems installed to comply with the 2020 Rule and increase cost impacts to customers by shortening the useful life of the equipment. Furthermore, EPA should maximize the environmental benefits associated with these investments by extending the date to comply with any new BAT.

**Retirement and repowering subcategories**:

- Existing Permanent Cessation of Coal Combustion (PCCC) by 2028 Subcategory: EPA should maintain the existing PCCC by 2028 subcategory without modification. As mentioned, the 2020 Rule PCCC by 2028 subcategory is now a key component of our planning process to transition the fleet and modifications to this subcategory, such as any new or more stringent requirements, could disrupt the orderly fleet transition.
- *New* PCCC by 2035 Subcategory: If EPA finalizes the proposed BAT despite the aforementioned concerns, EPA should create a new PCCC by 2035 subcategory that allows facilities the option to continue operating under the 2020 Rule BAT and opt to either comply with the new BAT by December 31, 2032, or retire by December 31, 2035. This subcategory would allow facilities that are nearing retirement the appropriate timing and opportunity to alleviate unnecessary cost burdens

to customers and ensure continued reliable and resilient delivery of energy while replacement generation and associated transmission is completed.

- Early Adopter Subcategory: If EPA finalizes the proposed BAT, EPA should make key modifications to the early adopter subcategory to ensure an equitable treatment of those that do and should qualify as early adopters.
    - First, EPA should modify the subcategory criteria cutoff date and expand the definition of early adopter to include those facilities that have made financial commitments to compliance with the 2020 Rule.
    - Second, EPA should not require that early adopters retire by December 31, 2032, but should instead allow early adopters to comply with the new BAT by December 31, 2032, or retire by December 31, 2035.

**Legacy Wastewater and Combustion Residual Leachate**:

- Legacy Wastewater (LWW): EPA has proposed several changes to LWW requirements in the proposal, including subdividing LWW into new categories, new definitions, and requiring different management requirements for the new categories. While we support best professional judgment (BPJ) limits for LWW, we also urge caution with any revision to the LWW requirements or the imposition of permitting constraints that could impose unnecessarily costly or stringent requirements or that could complicate, delay, or derail ongoing dewatering and closure activities required by the CCR Rule.
- Combustion Residual Leachate (CRL): Southern does not object to the proposed BAT limits for arsenic and mercury for this waste stream but believes EPA must constrain the scope of regulated CRL to that which is collected from engineered leachate collection systems and then discharged via surface outfalls from active landfills at active generating plants. Subjecting numerous

unidentified and uncharacterized sources of water to an improper regulatory definition completely unbalances any underlying determinations or assumptions of cost-effectiveness. This rulemaking should not establish effluent limits or permitting requirements for functional equivalent discharges of CRL because unlined landfills and surface impoundments are not point sources.

In assessing the potential impacts of the proposed Supplemental ELG Rule, Southern Company's focus is on managing the transition of our generation fleet in a way that protects both the environment and the best interests of our customers. We believe the suggestions provided herein are critical to maintaining clean, safe, reliable, and affordable energy for the communities we serve as we transition to a net-zero future.

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# I. INTRODUCTION

## A. The Southern Company is committed to an orderly fleet transition.

The Southern Company is committed to reducing our greenhouse gas (GHG) emissions to provide our customers and communities with a clean energy future. Southern has set an interim goal to reduce direct system-wide GHG emissions by 50% by 2030 (from 2007 levels) and a long–term goal of net zero emissions by 2050. To reach our net zero by 2050 GHG goal, Southern is focused on transitioning our generating fleet and making the necessary related investments in our transmission and distribution grids, while maintaining reliability and affordability for our customers.

Southern continues to reduce the number of generating units in our coal fleet, lowering emissions, and retiring uneconomic resources. When considering the retirements and conversions that have already been implemented by our electric operating companies, as well as expected future retirements or conversions that have been filed with state environmental and/or regulatory agencies, we currently expect to have just six coal units[5] remaining in our generating fleet with a nameplate capacity of less than 3,000 MWs by the end of 2035. The addition or retirement of generation resources, transmission capacity, and expansion plans for load growth are closely related, and our electric operating companies must consider these elements together in their comprehensive planning processes within their respective state regulatory constructs.

[5] Miller Units 1-4 and Scherer Units 1-2.

### B. The 2020 ELG Reconsideration Rule provided robust wastewater treatment while facilitating orderly fleet transition to net zero greenhouse gas emissions.

Sound environmental policies play a critical role, not only in protecting our environment, but also in maintaining a resilient and reliable electric power system. The EPA and the Department of Energy (DOE) recently issued the Joint Memorandum on Interagency Communication and Consultation on Electrical Reliability, which stated, "With the sound application of existing authorities and policy tools, the EPA and DOE can continue to support the reliability of the electric power system."[6] The Southern Company agrees that there are solutions EPA can implement through environmental rules that can protect the environment, promote resiliency and reliability of the electric power system, and help to alleviate a significant cost burden to customers.

As an example, the 2020 Rule, and the associated compliance options, are key components to facilitate the orderly fleet transition for both replacement generation resources and necessary transmission project completion. In 2020 and 2021, the Company's planning processes were used to evaluate the 2020 Rule and, as a result of that evaluation, we determined that the rule would impact most of the coal-fired generating units across The Southern Company system. Notices of Planned Participation (NOPPs) were filed with state environmental agencies in October 2021 indicating our intent to repower two coal units with natural gas

[6] DOE & EPA, Joint Memorandum on Interagency Communication & Consultation on Electric Reliability, at 2 (Mar. 9, 2023).

and retire 10 coal-fired generating units on or before December 31, 2028, in accordance with the 2020 Rule's PCCC by 2028 subcategory.[7]

In addition to the retirements and repowering, two units at Georgia Power's Plant Scherer opted into the Voluntary Incentives Program (VIP) option for FGD wastewater[8] and Alabama Power's Plant Miller and Georgia Power's Plant Bowen planned to install the 2020 Rule's BAT for FGD wastewater - chemical precipitation followed by biological treatment. Alabama Power's Plant Miller has installed and is currently operating the 2020 BAT, with an NPDES permit applicability date of December 31, 2023. Georgia Power's Plant Bowen NPDES permit requires compliance with the 2020 Rule's generally applicable limits; and the facility is on schedule and expects to achieve compliance no later than December 31, 2025.

### C. The 2023 proposed rule fails to consider the time and cost commitments companies made based on the prior ELGs.

The Southern Company system's compliance with the 2020 Rule reflects our continued commitment to comply with all environmental rules and regulations, to responsibly transition our system's generating fleet to net zero GHG emissions, and to research and develop emerging wastewater treatment technologies. If finalized as proposed, the 2023 proposed rule will be the third iteration of effluent limitations guidelines for the steam electric industry sector promulgated in less than ten years. During the prior two rulemakings,

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[7] Formal requests for retirement or natural-gas repowering related to these plants were also filed with state utility regulators and approvals have already been received to reduce the total number of coal-fired generating units to 10. In prior filings, Georgia Power requested to retire Plant Bowen Units 1&2 by 2028 and expects these requests to be considered in future regulatory proceedings.

[8] Given extensive research efforts, unique low flow rates, low chlorides, and total dissolved solids, and an associated viable permeate recovery rate, Georgia Power was able to file a NOPP for the VIP at Plant Scherer Units 1-2. This submittal was made prospectively (which was necessary due to the deadlines for submitting NOPPs), as studies are ongoing with regards to brine management and disposal.

EPA acknowledged the significant cost and resource burden required to investigate, design, construct, and optimize the massive and complex wastewater treatment systems necessary for compliance with the ELGs and took steps to mitigate unnecessary costs to facilities and customers that could be incurred during the rulemaking process. By contrast, in this third rulemaking process, EPA has continued to require facilities to comply with the 2020 Rule, even though the Agency has known since 2021 that it would promulgate more stringent limits that will apply to these same facilities within a short timeframe. EPA's failure to pause compliance timeframes for the 2020 Rule during the pendency of this rulemaking unfairly prejudices our good faith efforts to implement and comply with the regulatory options presented by EPA less than three years ago in the 2020 Rule.

### D. EPA can and should finalize solutions that embrace evidence-based decision making, implement robust and proven wastewater treatment, and avoid unnecessary disruption to orderly fleet transition.

We encourage EPA to implement environmental rules that can protect the environment, promote resiliency and reliability of the electric power system, and help to alleviate a significant cost burden to customers. As discussed in detail in our comments, we strongly encourage EPA to consider the following actions when finalizing the 2023 proposed rule:

- **BAT for FGD Wastewater:** As EPA correctly concluded in 2015 and 2020, and as our recent engagement with EPA[9] and detailed comments here will illustrate, membrane filtration is still not the BAT and ZLD is not a realistic effluent limit for FGD wastewater across the industry. EPA should

[9] *See* Letter from Donna Hill, Southern Company Services, Inc. to Robert K. Wood, Director, Office of Water, Engineering & Analysis Division (Apr. 1, 2022).

acknowledge the overwhelming evidence against establishing membrane filtration as BAT for FGD wastewater in the steam electric category and once again reject membrane filtration as BAT for the industry.

- **Fleet Transition:** We strongly support the continued availability of both the PCCC by 2028 subcategory and the VIP option as they were finalized in the 2020 Rule to minimize any potential disruption to our cost-effective, orderly fleet transition planning and execution and to minimize any further disparate cost impacts.
- **Compliance Timeframes:** If EPA finalizes the proposed BAT for FGD wastewater, EPA should also finalize compliance implementation schedules that are harmonized with other power sector rulemakings and establish subcategories to alleviate the disparate costs on coal units nearing retirement, thus promoting both resiliency and reliability. Specifically, our comments present solutions for EPA to consider for harmonizing the compliance timeframes in this rulemaking with those recently proposed in the greenhouse gas rulemaking. Our comments also suggest changes to EPA's proposed "early adopter" subcategory and request the establishment of additional subcategories.
- **Legacy Wastewater (LWW):** As a general matter, the Company urges caution with any revision to the LWW requirements that could complicate, delay, or derail ongoing dewatering and closure activities required by the CCR Rule. We support a BPJ permitting approach that takes existing treatment practices and site-specific factors into appropriate consideration without defaulting to the most stringent treatment technology available on site. EPA should not subcategorize LWW separated by time or define surface impoundment wastewaters based on the location of the water above the CCR solids.
- **Combustion Residual Leachate (CRL):** The Company does not object to EPA's proposed BAT selection (chemical precipitation) for CRL. However, EPA should constrain the scope of regulated CRL to that which is collected from engineered leachate collection systems and then discharged via surface water outfalls from active landfills at active generating plants. This rulemaking should not

establish effluent limits or permitting requirements for functional equivalent discharges of CRL for an array of reasons, but most importantly because unlined landfills and surface impoundments are not point sources. More stringent technologies are not cost-effective and pose significant operating, maintenance, and economic burdens to an operating plant, especially after a plant's retirement.

We appreciate the EPA's consideration of these comments, and we look forward to constructive engagement moving forward.

## II. EPA'S DECISION TO CONTINUE COMPLIANCE WITH THE 2020 RECONSIDERATION RULE DURING THIS RULEMAKING PROCESS CREATED IMPORTANT RELIANCE INTERESTS THAT NEED TO BE PROTECTED.

EPA first established ELGs for the steam electric industry in 1974, 1977, and 1982. Then, 35 years later, EPA promulgated comprehensive and significant revisions to the then-existing ELGs to reflect technology changes in the industry sector over the three prior decades (2015 Rule)[10], as well as widespread implementation of air pollution controls under the Clean Air Act (CAA). Litigation followed the 2015 Rule, with some effluent limits being vacated by the Fifth Circuit Court of Appeals[11] and others being reconsidered by EPA.[12] EPA twice postponed compliance deadlines for other portions of the 2015 Rule,

[10] 80 Fed. Reg. 67,838 (Nov. 3, 2015) ("2015 Rule").

[11] *Sw. Elec. Power Co. v. EPA*, 920 F.3d 999 (5th Cir. 2019).

[12] 85 Fed. Reg. 64,650 (Oct. 13, 2020).

first during the pendency of the Fifth Circuit litigation and again while the Agency evaluated whether to reconsider some portions of the 2015 Rule.[13]

In October 2020, EPA's updated effluent limits for two waste streams (BATW and FGD wastewater) became effective.[14] Three months after the 2020 Rule went into effect, EPA announced it would be reconsidering every agency action taken by the prior administration. In July 2021, EPA announced that it was initiating a rulemaking to "strengthen" the effluent limits promulgated in the 2020 Rule.[15] At the same time, EPA announced that it would not be pausing the effectiveness of the 2015 or 2020 Rules or the associated 2023 and 2025 compliance deadlines.[16] In other words, EPA clearly communicated that facilities were to continue complying with the 2020 Rule while EPA promulgated a new "more stringent" rule that EPA indicated would be based on membrane treatment technology.

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[13] *See* 82 Fed. Reg. 19,005, 19,005 ("Apr. 25, 2017) ("In light of the capital expenditures that facilities incurring costs under the Rule will need to undertake in order to meet the compliance deadlines for the new, more stringent limitations and standards in the Rule. . . the Agency finds that justice requires it to postpone the compliance dates of the Rule that have not yet passed, pending judicial review."); *see also* 82 Fed. Reg. 43,494, 43,496 (Sept. 18, 2018) ("This will prevent the potentially needless expenditure of resources during a rulemaking that may ultimately change the 2015 Rule in these respects.").

[14] 85 Fed. Reg. 64,650 (Oct. 13, 2020) ("2020 Rule").

[15] EPA, EPA Announces Intent to Bolster Limits on Water Pollution from Power Plants (July 26, 2021), *available at* https://www.epa.gov/newsreleases/epa-announces-intent-bolster-limits-water-pollution-power-plants#:~:text=EPA%20Announces%20Intent%20to%20Bolster%20Limits%20on%20Water%20Pollution%20from%20Power%20Plants,-July%2026%2C%202021&text=WASHINGTON%20%E2%80%93%20Today%2C%20the%20U.S.%20Environmental,use%20steam%20to%20generate%20electricity.; *see also* 86 Fed. Reg. 41,801, 41,802 (Aug. 3, 2021) ("While the Agency undertakes this new rulemaking, facilities will continue to be subject to the requirements of the 2015 Rule, as amended by the 2020 Rule, which are currently effective. As a result, the pollutant reductions accomplished by the existing Rules will occur while the Agency engages in rulemaking to consider more stringent requirements.").

[16] EPA, *supra* note 15 ("While the agency pursues this new rulemaking process to strengthen water pollution requirements for coal power plants, the current regulations will be implemented and enforced.").

As discussed in more detail below, EPA's current proposal *significantly* changes many aspects of the 2020 Rule. Because EPA never paused or delayed implementation of the 2020 Rule, EPA's actions created important reliance interests for industry that need to be meaningfully addressed, and protected, as part of the 2023 Rulemaking.[17]

### A. EPA should have paused or delayed implementation of the 2020 Rule, but did not, thereby creating reliance interests that need to be protected now.

When EPA first announced in 2021 that it was planning to make the ELG rule more stringent than the 2020 Rule, it should have paused or delayed the then-applicable compliance dates to prevent significant and unnecessary expenditures. Instead, EPA chose to continue requiring compliance with the 2020 Rule. As a result, many facilities made significant investments in biological treatment systems that will now be rendered obsolete through the 2023 Rulemaking. To avoid this outcome, EPA's final rule should include specific additional flexibilities that reflect the good faith efforts that have been undertaken to comply with the 2015 and 2020 Rules, and at a minimum, consider the costs associated with these continued efforts to comply with the rules in the Agency's BAT analysis.

#### 1. EPA needs to consider reliance interests.

As a matter of both good public policy and procedural protections of the Administrative Procedures Act, EPA must consider how proposed rule revisions will affect the regulated community. For the 2023 Rulemaking, this means EPA must consider the impact to facilities that have already made—or are in the

[17] *See Dep't of Homeland Sec. v. Regents of the Univ. of California*, 140 S. Ct. 1891, 1915 (2020) (the agency "*was* required to assess whether there were reliance interests, determine whether they were significant, and weigh any such interests against competing policy concerns." (emphasis in original)).

process of making—significant capital investments to comply with the 2020 Rule. In the preamble, EPA mentions the word "reliance" only three times and substantively only in a footnote where EPA states:

> EPA also recognizes that, while it may change policies based upon a reasoned explanation, where a prior policy has engendered serious reliance interests, those interests must be taken into account. FCC v. Fox Television Stations, Inc., 556 U.S. at 515 (citation omitted). EPA has taken reliance interests into account in this rulemaking, as is clear from EPA's proposal in Section VII.C.4 of this preamble, below, to create a new subcategory for early adopters who relied on certain of EPA's past determinations. EPA also notes that no NPDES permittee has certainty of its limitations beyond its 5-year NPDES permit term, as reissued permits must incorporate any newly promulgated technology-based limitations as well as potentially more stringent limitations necessary to achieve water quality standards. See 40 CFR 122.44(a) & (d).[18] 88 FR 18839, fn. 23.

With this footnote, EPA seems to concede that it only narrowly considered reliance interests, and only those asserted by facilities that qualify for the proposed category for early adopters (those that can demonstrate compliance with either the 2015 or 2020 Rule by March 29, 2023). However, EPA readily admits that only 15 out of the 69 to 93 potentially affected facilities would be eligible for its proposed subcategory.[19] For all other affected facilities, EPA does not appear to have considered reliance interests at all.

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[18] 88 Fed. Reg. at 18,839 n.23.

[19] 88 Fed. Reg. at 18,833, 18,859, Table VII.

Instead, EPA downplays those interests on grounds that the other affected facilities are subject to NPDES permits that are subject to reissuance proceedings every five years. However, in reality, NPDES permits are routinely subject to administrative extensions that can last for years due to changing regulatory landscapes, program staffing shortages, and other complications. EPA's statement also ignores the fact that it typically takes decades for the Agency to revisit and promulgate updated effluent limitations guidelines for a point source category (as evidenced by the 33 years between the 1982 and 2015 final rules). Even ignoring these practicalities, EPA still must consider the effect of proposed changes on permittees. Indeed, this is why the NPDES permit program includes a provision for compliance schedules to enable permittees to take the steps necessary to come into compliance with newly imposed limits or conditions.[20]

**2. NPDES permittees, including The Southern Company facilities, have significant reliance interests.**

The Southern Company system's facilities subject to the steam electric ELGs have accrued significant reliance interests based on EPA's ongoing directive to comply with the 2020 Rule. NPDES permittees, including Georgia Power's Plant Bowen, which have not yet *achieved* compliance with the FGD wastewater effluent limits in the 2020 Rule, nonetheless have permit conditions that require compliance by a date certain (no later than December 31, 2025, for FGD wastewater). To do so, it must install a biological treatment system and begin optimization by the beginning of 2025. In addition, many permittees also face interim milestone deadlines as their facilities approach the 2023 and 2025 deadlines. To stay on track to meet these deadlines, permittees must make significant investments of resources, including for research, development, planning, design, contracting, procurement, construction and in many cases complex and

[20] *See* 40 C.F.R. § 122.47.

protracted state utility regulatory approval. Even facilities that do not yet have permit conditions reflecting the 2020 Rule still may have made binding commitments to meet the rule limits and deadlines through submittals to regulatory agencies, including the required NOPPs.

In the 2023 Rulemaking, EPA appears to have made little effort to investigate costs incurred by those facilities who are on track to – but have not yet achieved – compliance with the 2020 Rule.[21] Given that a final rule will likely not be issued until mid-2024 at the earliest, the inescapable reality is that many permittees who are still in the process of implementing their compliance plans will have no choice but to fully comply with the 2020 Rule *and then also* comply with EPA's new final rule within just another four years (at the most). EPA's final rule should avoid this outcome to achieve the Agency's objectives and ensure that the rule is durable.

### B. EPA should address ongoing 2020 compliance obligations.

In addition to the reliance interests described above, EPA needs to consider a number of other important aspects of the compliance challenges imposed on the industry sector, including the Agency's decision not to pause or delay implementation of the 2020 Rule during its lengthy supplemental rulemaking.

#### 1. EPA needs to explain its rationale for not delaying compliance pending the outcome of this rulemaking.

As explained above, when EPA twice delayed compliance dates for the 2015 Rule, the Agency noted the significant capital and operation and maintenance costs that go into complying with an ELG. The Agency

[21] *See, e.g.*, 88 Fed. Reg. at 18,859 (comparing "early adopters" under the proposal with the rest of the affected facilities that EPA claims "have avoided incurring any cost for as long as possible . . . .").

further found that postponing compliance "will prevent the potentially needless expenditure of resources" because the applicable effluent limits may change as a result of the Agency's rulemaking.[22] EPA should have done the same here due to the significant (and potentially misdirected or unnecessary) costs that affected facilities will incur if they are required to first comply with the 2015 and 2020 Rules and then also comply with new, more stringent requirements based on entirely different and unproven technology underpinnings.

In July 2021, EPA announced it would be revising the steam electric ELG to be "more stringent," likely based on membrane technology, but required facilities to continue investing in, designing, and building biological treatment to meet the requirements of the 2020 Rule. The explanation in EPA's press release was that "the agency's approach will secure progress made by the 2015 and 2020 Rules while the Agency undertakes a new rulemaking to consider more stringent requirements."[23]

In the 2023 Rulemaking, EPA reiterates the requirement that facilities build biological treatment to achieve compliance with the 2020 Rules, while simultaneously proposing that membrane-based ZLD systems must be installed by no later than December 31, 2029. EPA's proposal touts the water quality improvements that will result from building biological treatment during the rulemaking process,[24] but does not acknowledge the costs associated with installing two different treatment systems within a few years' time, as it did in 2017 and 2018, and instead attempts to recast its previous rationale for delaying compliance. EPA now claims that its previous decisions to delay compliance deadlines "made sense at the time because EPA had

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[22] *See* 82 Fed. Reg. at 43,494 (Sept. 18, 2018); *see also* 82 Fed. Reg. at 19,005.

[23] EPA, *supra* note 15.

[24] Importantly, EPA does not seem to grasp that many systems will largely be only in the procurement and construction phase of the project during this ongoing rulemaking process.

received new information in petitions suggesting that the 2015 Rule limitations could not be met with the 2015 BAT technology basis."[25] The proposal makes no mention of EPA's prior conclusions regarding significant costs and potentially needless expenditures.

We urge EPA to acknowledge that its previous rationale for delaying compliance was driven by the significant costs facilities and customers would incur and apply that same rationale here.

**2. EPA needs to acknowledge the reality of its decision to not pause or delay implementation of the 2020 Rule.**

As explained in detail above, EPA has been clear since July 2021 that it would not pause or delay applicability of the 2020 Rule while it undertook this new rulemaking. The proposal is similarly clear that "permittees must meet applicable permit limitations as soon as possible."[26] Moreover, in the proposal, EPA reaffirms that permitting authorities must include the 2020 limits in new or modified permits and affected facilities must comply as soon as possible.[27] EPA instructs state permitting authorities that they should not establish 2020 Rule compliance deadlines that are "anything other than as soon as possible for the selected technology"[28] and asserts that "anything but steadfast implementation of the current 2020 rule limitations at this time is not warranted."[29] We urge EPA to revisit this stance. By way of example, on December 1, 2021, Georgia Power's Plant Bowen's NPDES permit was reissued with enforceable conditions requiring

[25] 88 Fed. Reg. at 18,886.

[26] *Id.*

[27] *Id.*

[28] *Id.*

[29] *Id.*

the facility to comply with the 2020 FGD wastewater limits by no later than December 31, 2025. Thereafter, Plant Bowen initiated a design, engineering and construction effort to comply with the 2020 Rule at a significant cost and has already incurred approximately $50 million to date. Depending on when a final rule is issued, Plant Bowen's current compliance costs will continue to be incurred by an additional $30-40 million, which will represent nearly all installation and capital costs of the system. Unfortunately, this reality is at odds with EPA's claim that most facilities that have not already complied with the 2020 Rule "have avoided incurring any cost."[30]

If the rule is finalized, as proposed, in 2024, Plant Bowen will have to make the difficult choice of either: 1) abandoning on-going efforts to comply with the 2020 Rule (including the nearly $110 million in investment it will have made toward 2020 Rule compliance) and seek a permit modification to immediately begin planning to construct a membrane-based ZLD system by December 31, 2029; or 2) complete installation and optimization of the biological treatment technology by December 31, 2025 as required by its NPDES permit; immediately initiate the planning, financing, and design process for another major facility modification with a proposed deadline of December 31, 2029; and operate the biological treatment system for only a few years before being decommissioned and replaced with a membrane treatment system required to be operational in 2029. EPA has not adequately considered the very real cost consequence of the proposed rule to utility customers.

Although it is true that facilities could have selected the VIP option under the 2020 Rule, which would also require membrane technology, this was not a realistic option for many facilities based on site-specific factors. EPA may state that the Agency repeatedly communicated that membranes would be BAT (long

[30] *Id*. at 18,859.

before EPA's rulemaking would be completed) so there is no unfair surprise to the regulated community. If that is the Agency's position, it should say so, and it should explain how an informal statement should be taken with the same regard as a final rule and how such a statement is not predetermining the outcome of a rulemaking. Unless remedied in the final rulemaking, this set of circumstances created by EPA will result in hundreds of millions of dollars in stranded costs to customers that facilities like Plant Bowen will incur as a result of EPA's decision to require compliance with the 2020 Rule while knowing it will establish new, far more stringent limits in a few short years. Moreover, as noted above, regulated electric utilities cannot make compliance decisions based on non-binding communications from its regulators separate from actual rule requirements.

### 3. EPA needs to consider disparate costs associated with its proposal.

Any facility that achieves compliance with the 2020 Rule FGD wastewater effluent limits will suffer disparate costs, with those achieving compliance in 2023 and beyond the most impacted. As EPA explains, "amortization periods shorter than eight years may lead to disparate costs."[31] EPA even provides an example that, where an applicant provides site-relevant information that its FGD wastewater biological treatment system can achieve compliance with the 2020 Rule by 2023, "it would not be appropriate" to establish a compliance date any later, even considering the ongoing rulemaking.[32] Using EPA's example, the facility that achieves compliance with the 2020 Rule in 2023 will still be subject to the next iteration of the rule (anticipated in 2024) which is expected to require compliance no later than December 31, 2029.

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[31] *Id.* EPA's eight-year amortization period is short-sighted. It ignores that these treatment technologies typically have a life-span of 20+years and that the premature abandonment of them also leads to disparate costs—both for utilities (especially those that do not engage in cost recovery) and, more importantly, for ratepayers that will be forced to prematurely incur the additional costs associated with installation of the new treatment system(s).

[32] *Id.* at 18,886.

This facility would have only a six-year amortization on its 2020 Rule compliance investment and thus would experience disparate costs.

EPA's only explanation is that it is prioritizing "progress toward eliminating discharges" and asserts this approach "is consistent with the Clean Water Act's (CWA's) structure of progressively more stringent limitations pushing technological advances over time."[33] EPA's explanation fails to reflect the likely large number of facilities that will suffer disparate costs based on the foregoing scenario. EPA also fails to explain why its proposed "early adopter" subcategory would only apply to facilities that are already in compliance by the time the proposal is published but would not apply to facilities that achieve compliance soon thereafter. EPA's disparate cost analysis applies equally to both groups of facilities, but the subcategory only applies to those who already achieved compliance.

Finally, EPA's cost estimate for its proposed rule assumes a baseline in which all affected facilities have already complied with the 2020 Rule, the cost of the proposal is added to that baseline, and the difference is the incremental additional cost to comply with the proposed rule. EPA's analysis is incomplete for many reasons but, most importantly, EPA's cost estimate amortizes the 2020 compliance costs over 20 years.[34] This does not present the true cost of mandating compliance with the 2020 Rule as soon as possible, and then mandating compliance with a new rule six or fewer years later. If EPA truly expects affected facilities to comply with the 2020 Rule, and then comply with new final requirements in 2024, it should properly apply an amortization of four to six years for those costs, not 20 years.

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[33] *Id.*

[34] *Id.* at 18,863.

## III. EPA HAS NOT DEMONSTRATED THAT MEMBRANE FILTRATION-BASED ZLD TREATMENT IS BAT FOR FGD WASTEWATER

As EPA recognized in both the 2015 and 2020 Rules, membranes are neither technically nor economically available on a nationwide basis for treatment of FGD wastewater; and that fact has not changed over the past three years. The Southern Company has consistently communicated this fact in multiple communications[35] to EPA before the 2019 proposed ELG Reconsideration Rule (2019 proposal),[36] and as recently as April 1, 2022.[37] Even so, we recognized in 2019 that EPA left the door open for further analysis of membranes due to its suggestion that membranes could *become* BAT by the year 2028. In response, we stated in comments:

> Southern Company agrees membrane filtration is not BAT for FGD wastewater. However, we do not agree that this technology will be available in 2028 and think it is imprudent to make that determination almost nine years in advance. EPA's proposed prediction is not supported. Southern Company believes significant research is left to be done and that demonstration of this technology at commercial scale is needed prior to determining it will

[35] *See, e.g.*, Letter from Susan Comensky, Vice President-Environmental Affairs, Alabama Power Company to Robert K. Wood, Director, Office of Water, Engineering & Analysis Division (Mar. 1, 2018); *see also* Letter from Susan Comensky, Vice President-Environmental Affairs, Alabama Power Company to Robert K. Wood, Director, Office of Water, Engineering & Analysis Division (Mar. 29, 2018); *see also* Letter from Susan Comensky, Vice President, Environmental Affairs, Alabama Power Company and from Mark Berry, Vice President, Environmental & Natural Resources, Georgia Power Company to Robert K. Wood, Director, Office of Water, Engineering & Analysis Division (Aug. 3, 2018).

[36] 84 Fed. Reg. 64,620 (Nov. 22, 2019).

[37] *See* Letter from Donna Hill, Southern Company Services, Inc., *supra* note 9.

> be technically feasible. Even if it is feasible, it may never be available nationwide due to site-specific constraints.[38]

Based on our operating experience, the Company maintains that the most suitable use of membrane filtration has been established –as the basis for the 2020 Rule's VIP option. An accurate, robust, and complete BAT analysis would demonstrate that membranes are not BAT, not only because of the very site-specific applicability of the technology, but also because of overall costs, disparate costs, the age of equipment involved, process changes required, and the significant non-water quality impacts that will result from implementing membrane treatment technology for FGD wastewater industry wide. EPA has also failed to explain how the CWA statutory factors informed the Agency's decision that biological treatment is not BAT, especially given the Agency's conclusion less than three years ago that biological treatment was BAT. We discuss these considerations in more detail below.

### A. EPA failed to consider statutory factors in rejecting biological treatment as BAT.

The CWA requires EPA to consider specific statutory factors in making BAT determinations. Less than three years ago, EPA finalized a rule establishing BAT based on biological treatment. In the 2019 proposal and the 2020 Rule, EPA considered the statutory factors in selecting BAT *and also* in rejecting other

[38] Comment Letter from Jeffrey A. Burleson, Senior Vice President, Environmental and System Planning, Southern Company to Richard Benware, EPA, at 21 (Jan. 21, 2020) (Docket ID. No. EPA-HQ-OW-2009-0819-8457).

technologies as not BAT.[39] In the 2015 Rule, EPA also considered the statutory factors in rejecting technologies as not BAT.[40]

Now in 2023, as the Agency proposes to make a significant change in an ELG that is less than three years old, EPA only analyzes the statutory factors related to its selection of membrane-based ZLD as BAT. EPA does not consider or analyze any explicit statutory factors in its rejection of biological treatment as BAT. EPA's only explanation for rejecting biological treatment is that biological treatment captures fewer pollutants than the Agency's preferred option, membrane-based ZLD.[41] This analysis is insufficient to justify EPA's approach. Particularly given the history of the steam electric rule described above and the extremely short timeframe within which EPA has changed its mind on BAT, the Agency owes the public and the regulated community a full and complete analysis of why it is rejecting biological treatment, including analyzing the required statutory factors, not just an asymmetrical endorsement of its selected BAT.

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[39] *See, e.g*., 84 Fed. Reg. at 64,632 ("LRTR is less costly than HRTR. Compared to the baseline of the 2015 rule, LRTR is estimated to save approximately $72 million per year in after-tax costs to industry. LRTR requires fewer process changes than HRTR. Compared to HRTR, LRTR installations are less complex and require fewer modifications to a facility's footprint."); *see also* 85 Fed. Reg. 64,650, 64,669 (Oct. 13, 2020) ("As authorized by section 304(b) of the CWA, which requires EPA to consider costs, as well as the discretion that the statute gives EPA to weigh the statutory factors, the Agency finds that, for this final rule, thermal technologies are not BAT due to the unreasonably high costs to industry. Given the high costs associated with thermal technology, and the fact that the steam electric power generating industry continues to face costs associated with several other rules, in addition to this rule, EPA is not establishing BAT limitations for FGD wastewater based on thermal technologies." (internal citaton omitted)).

[40] *See e.g.*, 80 Fed. Reg. at 67,852 ("The annual cost to the industry of limitations based on evaporation would be more than 2 and 1/2 times the cost to industry estimated for the final rule (after tax) (approximately $570 million more expensive than the final rule, on an annual basis, after tax). Given the high costs associated with the technology, and the fact that the steam electric industry is facing costs associated with several other rules in addition to this rule, EPA decided not to establish BAT limitations for FGD wastewater based on evaporation for all steam electric power plants.").

[41] 88 Fed. Reg. at 18,843-44.

This is especially true given the significant reliance interests implicated by the proposal and the numerous facilities and units that continue, at the Agency's insistence, working toward compliance with the 2020 rule and installation of biological treatment.

Although EPA has discretion in how it weighs the statutory factors, EPA's consideration of those factors is mandatory.[42] The statutory factors are particularly important in this rulemaking, as many affected facilities will have recently installed new technology to comply with the 2020 Rule. This fact informs the "age of equipment" factor and should weigh against EPA requiring those facilities to replace recently installed biological treatment technology with new membrane-based ZLD technology. This fact also informs the "cost of achieving effluent reductions" factor because replacing biological treatment with new membrane technology is extremely costly (when properly estimated and amortized). EPA must weigh these against the other factors in its determination that membrane-based ZLD is BAT less than three years after EPA determined that biological treatment was BAT. It is not sufficient for EPA to rely solely on pollutant reduction estimates; EPA must consider the statutory factors in its BAT decision.

At a minimum, if EPA no longer believes it is required to consider the statutory factors in its selection of BAT, or in its decision not to select a technology as BAT, it must say so, provide a rationale, and explain why it changed its position from the 2015 and 2020 Rules.

### B. EPA should consider all relevant data and information.

The Southern Company has voluntarily provided significant information and data to support the regulatory development process. The most recent of which included an April 2022 submittal of FGD wastewater data

[42] *See* 33 U.S.C. § 1314(b)(2)(B) (EPA "shall take into account" the enumerated factors and any other factors that EPA deems appropriate).

for Plant Bowen. This submittal included a more detailed 2019 study and report for a 50 gallons per minute (gpm) Vibratory Shear Enhanced Processing (VSEP) membrane system at Plant Bowen. We are concerned that EPA cites only to a 2014 report, *Performance Evaluation of a Vibratory Shear Enhanced Processing Membrane System for FGD Wastewater Treatment*, conducted at the Water Research Center at Plant Bowen in 2014 as a supporting justification for their revised BAT determination. We provide the following reasons why this 2014 report on VSEP membrane performance should not be used as a basis for supporting a membrane-based BAT determination:

- The total run time of the pilot system was only 16 days and, as such, the long-term maintenance issues with this type of system, such as degradation from fouling/scaling and overall deterioration, could not be tested.
- The size of the system tested was 0.5 gpm, which is too small to identify or evaluate potential operational challenges, such as chemical usage requirements and membrane cleaning frequencies/redundancy needs.
- The operational conditions for the study period do not reflect the current reality of the wastewater matrix that will be encountered at Plant Bowen. The feedwater Total Dissolved Solids (TDS) concentration was only 12,000 to 16,000 mg/L, whereas the plant has since cycled up scrubber operations and now experiences TDS concentrations of approximately 25,000 to 35,000 mg/L.

By only citing the 2014 study and potentially omitting consideration of the 2019 study, EPA may be ignoring the most relevant and recent data and information. The 2019 study and associated reports submitted to EPA more thoroughly document that EPA has improperly evaluated the performance of these types of systems and that the overpredicted permeate recovery rates (with associated concentration management costs) are flawed. In fact, in our experience, EPA's confidence on the performance of these systems is not matched by the vendors, whom will not or are extremely hesitant to offer performance guarantees to prospective buyers.

### C. EPA significantly underestimated costs of compliance associated with membrane filtration-based ZLD.

EPA must consider the costs associated with the proposed BAT, and EPA's calculated incremental costs of compliance for membranes – both capital and operation and maintenance (O&M) - are significantly underestimated. Below, we present several examples to illustrate the significant underestimation of EPA's calculated costs to comply with the new BAT for FGD wastewater:

1) Industry compliance cost estimates conducted by the Electric Power Research Institute (EPRI).
2) Site-specific cost estimates to comply at Alabama Power's Plant Miller and Georgia Power's Plant Bowen.
3) EPA's omission of costs for certain generating units that plan to operate beyond 2028.

#### 1. EPA has significantly underestimated the total cost to the industry to implement BAT for the proposed rule.

EPA has significantly underestimated the total costs to the industry to implement the BAT for the proposed rule (Regulatory Option 3) based on chemical precipitation, membrane filtration, and brine encapsulation. EPRI's capital cost estimate is 9 times higher than EPA's capital cost estimate for the same list of 22 plants that plan to discharge FGD wastewater after 2032. Notably, EPRI's "O&M cost estimate is 43 times higher than EPA's O&M cost estimate for the same list of plants."[43] "In evaluating the total annualized costs, EPRI's estimate of the industry cost is 27 times higher than EPA's estimate."[44] "[A] significant reason for

[43] Elec. Power Research Inst. Comments on Proposed Effluent Limitations Guidelines Rule, at 33 (May 26, 2023) ("EPRI Comments").

[44] *Id*. at 33.

the O&M cost difference appears to be largely attributed to EPA's approach in underestimating brine management requirements and associated costs."[45]

A comparison of EPRI and EPA industry-wide cost estimates to convert from chemical precipitation and biological treatment to chemical precipitation, membrane filtration, and brine encapsulation is provided in Table 1 below.[46]

Table 1. Comparison of EPRI and EPA industry-wide cost estimates to convert from chemical precipitation and biological treatment to chemical precipitation, membrane filtration, and brine encapsulation.

| Source of Industry Cost[1] | Capital Cost ($M) | Annual O&M Cost ($M/yr) | Total Annualized Cost ($M/yr)[2] | Ratio EPRI/EPA Capital Cost | Ratio EPRI/EPA O&M Cost | Ratio EPRI/EPA Total Annual Cost |
|---|---|---|---|---|---|---|
| **EPRI** | 5,410 | 2,783 | 3,292 | 9 | 43 | 27 |
| **EPA** | 613 | 65 | 122 | | | |

$M/yr = million dollars per year (2021 dollars)

1. Includes 22 plants that are assumed to operate past 2032 and therefore required to comply with regulatory option 3 BAT: chemical precipitation, membrane filtration, with brine encapsulation. EPA cost shown in the summation of costs for 22 plants as presented in FGD Wastewater Proposed Rule Cost Database, DCN SE10416.
2. Total annualized cost which is a sum of the annualized cost of capital (assumes 7% interest rate and 20-year life) and the annual O&M cost.

EPRI's comments on the proposed rule provide a detailed analysis of how EPA has significantly underestimated BAT costs for membrane filtration for FGD wastewater treatment.[47] EPA should reevaluate its cost estimates based on EPRI's cost methodology, which is explained in detail using flow

[45] *Id*. at 35.

[46] *Id*. at 33, Table 2-1.

[47] *See id.* at 32-60.

charts and mass balance calculations. At a minimum, EPA should acknowledge the EPRI comments and correct EPA's own cost estimates or explain why it believes that EPRI's estimates are erroneous.

### 2. EPA significantly underestimated the cost to comply at Plants Miller and Bowen.

#### a. Alabama Power's Plant Miller

Alabama Power Company initiated an independent[48] pre-screening cost and feasibility study for the implementation of membrane filtration treatment based on the VIP option in the 2020 Rule, which sets BAT limits on the discharge of the permeate from a membrane filtration system with pretreatment (see Appendix A). The study included the same general scope that EPA claims to have included in its cost of compliance estimates, including purchased equipment, delivery, installation, site preparation, buildings, engineering and supervision, construction, contractor fees, operation and maintenance costs, energy usage, chemical costs, and brine sludge transport and disposal. The study did not include the total costs already spent to install the existing chemical precipitation system ($149 million) followed by biological treatment system ($122 million) currently operating at Alabama Power's Plant Miller,[49] and so the study's cost estimates can be viewed as the incremental additional costs to comply with membrane filtration. Importantly, the recent study also did not contemplate a scenario in which permeate could not be discharged,

[48] Third-party water treatment company.

[49] A comprehensive breakdown of this cost information is included in the information Southern Company Services submitted to EPA on April 1, 2022, in response to EPA's December 2021 Voluntary Request, *James H. Miller (ICR ID 01493) Phys-Chem-Bio FGD Wastewater Treatment. See* Letter from Donna Hill, Southern Company Services, Inc., *supra* note 9.

as was ultimately proposed. Failing to account for ZLD means that the cost estimates in Appendix A are artificially low.

Our site-specific evaluation for all four units at Plant Miller produced a capital cost to install membranes plus pretreatment of approximately $279 million, with an annual O&M cost of approximately $10.3 million. Again, this does not include ZLD. This is compared to EPA's estimated capital and annual O&M cost estimates for all four Miller units to fully comply with the proposed rule are $18.7 million and $0.529 million, respectively.[50] These represent significant underestimates by EPA of the incremental costs to comply with EPA's new proposed BAT that should be taken into consideration.

### b. Georgia Power's Plant Bowen

For Plant Bowen, Georgia Power initiated an independent[51] pre-screening cost and feasibility study for the implementation of membrane filtration treatment based on the VIP option in the 2020 Rule, which sets BAT limits on the discharge of the permeate from a membrane filtration system (see Appendix B). The study included the same general scope that EPA claims to have included in its cost of compliance estimates, including purchased equipment, delivery, installation, site preparation, buildings, engineering and supervision, construction, contractor fees, operation and maintenance costs, energy usage, chemical costs, and brine sludge transport and disposal. The study did not include the costs already spent to install the existing chemical precipitation treatment system currently operating at Plant Bowen. The study also did

[50] In the proposed rule and supporting documents, EPA assumed under Option 3 that Plant Miller would be considered an "early adopter," thus avoiding any additional capital expenditures if it were to retire by December 31, 2032. Plant Miller only avoids costs under the proposed rule if it retires by 2032; The Southern Company has not made any commitments for Plant Miller to retire, and certainly not by 2032. EPA's costs for Plant Miller to comply with ZLD requirements are found under Option 4, which does not include an "early adopter" subcategory.

[51] Third-party water treatment company.

not evaluate or provide estimated costs for a ZLD scenario in which permeate cannot be discharged, as was ultimately proposed under the VIP option in the 2020 Rule. Not accounting for ZLD means that the cost estimates in Appendix B are artificially low.

The site-specific evaluation for Plant Bowen produced a capital cost to install membrane filtration plus pretreatment of approximately $580 million. This does not include cost for a ZLD system, which would likely include additional storage tanks, pumps, and piping to reuse the permeate/distillate as make-up water to the boiler or FGD. EPA has estimated a Plant Bowen capital cost of $90 million for membrane treatment.[52] The EPA analysis therefore represents a significant underestimation of capital compliance costs of $490 million (540%). EPA has also significantly underestimated the associated annual O&M costs ($5.3 million/year), which are not provided herein, but have been provided by EPRI in comments.[53]

EPA has assumed reduced FGD wastewater treatment costs if the system only serves two units as opposed to the currently operating four units. However, Plant Bowen FGD wastewater treatment costs do not change with a potential retirement of two units, because, when considering the water balance across the plant, the peak volume of water to be treated remains approximately the same. When units are operating, they both consume water through evaporative losses and produce wastewater. The design basis for the FGD wastewater treatment at Plant Bowen reflects a common system for all units and any potential retirements do not reduce the overall plant-wide volumes under peak conditions.

Though EPA may not be obligated to adopt the cost estimates provided in Appendix A and B, it cannot simply disregard them. Instead, EPA must consider these cost estimates, explain why the cost estimates it

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[52] Eastern Research Group, Inc., FGD Wastewater Proposed Rule Cost Database (Feb. 28, 2023) (DCN SE10416) (Doc. ID No. EPA-HQ-OW-2009-0819-9955).

[53] EPRI Comments, *supra* note 43, at 53-54.

generated are reasonable in light of competing cost estimates that are orders of magnitude higher, and consider how the range of cost estimates in the rulemaking record inform the agency's analysis of the statutory factors. Importantly, the proposed rule fails to consider the impacts of EPA's flawed economic analyses on customers.

### 3. EPA's cost estimates fail to include some generating units that will continue to operate beyond 2028.

In EPA's compilation of generating unit-level costs and loadings estimates by regulatory option for the 2023 proposed rule,[54] EPA assigned zero ($0) costs for FGD wastewater treatment at Plant Bowen Units 3-4 but reduced the facility's pollutant loadings to zero (0) to comply with Regulatory Option 3 (proposed rule) and Option 4, which would require ZLD for FGD wastewater. Also, EPA lists the treatment in place for Bowen Units 3-4 as "ZLD" for Options 3 and 4. By contrast, EPA's FGD Wastewater Costs Database[55] correctly assigns partial chemical precipitation as treatment in place for Bowen Units 3-4 and includes estimated costs for membrane filtration; however, it is not clear that EPA included these costs in its total industry cost for the proposed rule (as well as Option 4). In addition, EPA includes Plant Bowen on its list of plants discharging FGD wastewater beyond 2028[56] and calculates fly ash (FA) generated and availability for Plant Bowen for purposes of encapsulating the brine.[57] While Plant Bowen filed a NOPP for the PCCC

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[54] *See* Memorandum from U.S. EPA, Generating Unit-Level Costs and Loadings Estimates by Regulatory Option for the 2023 Proposed Rule – DCN SE10381 (Feb. 28, 2023) (Docket ID No. EPA-HQ-OW-2009-0819-9686).

[55] Eastern Research Group, Inc., FGD Wastewater Proposed Rule Cost Database, *supra* note 52.

[56] Memorandum from U.S. EPA, Flue Gas Desulfurization Flow Methodology for Compliance Costs and Pollutant Loadings – DCN SE10287, at 3, Table 1 (Sept. 12, 2022) (Docket ID No. EPA-HQ-OW-2009-0819-9379).

[57] *See* Memorandum from U.S. EPA, Steam Electric Supplemental Proposed Rule: Fly Ash Availability – DCN SE10242 (Feb. 27, 2023) (Docket ID No. EPA-HQ-OW-2009-0819-9685).

by 2028 subcategory under the 2020 Rule for Units 1-2,[58] Plant Bowen has not done so for Units 3-4. EPA appears to have mistakenly removed all units from the list of plants that plan to operate beyond 2028. Regarding Plant Miller, EPA has also assumed that Miller Units 1-4 will retire on December 31, 2032, because Plant Miller qualifies for the "early adopter" subcategory. However, Miller Units 1-4 have no planned retirement date. If EPA did not include Plant Bowen Units 3-4 and Plant Miller Units 1-4 costs for FGD wastewater treatment (ZLD) in its total industry costs for this rulemaking, then it should do so.

### D. EPA has not adequately addressed significant non-water quality impacts associated with membrane filtration-based ZLD.

In the 2020 Rule, EPA concluded in part that membranes are not BAT because of the significant non-water quality impacts. In the proposed rule, EPA has not demonstrated that these non-water quality impacts have been resolved, but rather raises more questions about the practical viability of membrane treatment plus ZLD. As EPA knows, membranes alone are not a compliance technology but instead are a volume-reduction process that needs to be coupled with additional wastewater treatment technology, as well as processes and equipment for managing the brine concentrate. Managing these concentrate streams poses significant technical and economic challenges that EPA identified in the 2020 Rule, which are still under evaluation, and that EPA has not effectively resolved or addressed in the 2023 proposed rule.

#### 1. Paste encapsulation eliminates beneficial use.

Less than three years ago, EPA stated in its 2020 Rule:

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[58] Southern Company, Third Quarter 2021 Earnings Conference Call, at Slide 15 (Nov. 4, 2021) (Docket ID No. EPA-HQ-OW-2009-0819-9231).

> EPA also rejects membranes as the technology basis for BAT for all existing plants because it could discourage more valuable forms of beneficial reuse of FA (such as replacing Portland cement in concrete), causing more FA to be disposed of as waste.[59]

The impact to beneficial use remains a significant problem for membrane filtration and paste encapsulation. Beneficial use of fly ash provides significant environmental and economic benefits which could be largely lost with industry-wide implementation of membrane technology. Beneficial use of fly ash results in reduction of land needed for disposal, reduction in the need to mine and process virgin materials and provides a local source of raw material for the production of durable products like concrete. Installing membrane filtration and utilizing paste encapsulation as a waste disposal method for the resulting brine, as the proposal envisions, would mean that fly ash that would otherwise have been beneficially used is instead consumed in the brine encapsulation process and landfilled, indefinitely. EPA fails to acknowledge or adequately consider these significant losses in the proposed rule.

Presently, the beneficial use market in the Company's footprint is approximately twice the amount of fly ash produced. As such, the Company currently markets approximately 95% of its generated fly ash. Removing ash availability from the local market will increase the carbon footprint resulting from the use of Portland cement and will create a lower value life cycle of infrastructure as the concrete would be less durable and would need to be replaced sooner than if it were produced with fly ash.

To further illustrate the site-specific impacts of this proposal, the membrane filtration feasibility evaluation at Alabama Power's Plant Miller concluded that the brine management solution would consume all available fly ash produced at the site, eliminating 100% of the beneficial use of fly ash at a site that currently

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[59] 85 Fed. Reg. at 64,666.

sells all available produced fly ash to the concrete industry, producing approximately $8.5M in revenue and significant avoided costs each year that flows to utility customers. Rather than providing the local economy and environment a valuable raw ingredient for concrete production, Plant Miller would instead become an on-site producer of a concrete-like waste material with no productive benefit to the community or the economy. This concrete would have to be disposed of in a landfill. EPA assumes there is available on-site permitted and constructed landfill capacity when, in fact, there is none. Plant Miller, for example, does not have an on-site landfill. Constructing a new landfill would come at a significant cost and could require acquisition of nearby properties or blasting and clearing of surrounding topography to achieve a suitable landfill location if there is available space at all.

This site-specific impact on beneficial use is not unique to Plant Miller. Georgia Power's Plant Bowen currently sells over 90% of its fly ash. While the ash sales generate approximately $5 million in associated annual revenue, this practice avoids significant handling and disposal costs for operational ash, resulting in an economic benefit to customers. In addition to the lost revenue from eliminating fly ash sales, it is expected that Plant Bowen would need to build additional landfill capacity to accommodate the new brine mixture or resort to off-site disposal at substantially increased costs.

In addition to the site-specific impacts, EPA's conclusion that the industry would retain enough available fly ash to supply the beneficial use market is not practical. There is no nationwide distribution system for fly ash beneficial use. EPA understood this in 2020 when it explained the very site-specific nature of fly ash availability to the local market, which remains valid now:

> But, while these assumptions are appropriate for nationwide cost estimates which are needed to demonstrate economic achievability for the industry as a whole, this does not necessarily mean that these assumptions should be used for analyzing the non-water quality environmental impacts associated with the resultant brine from membrane use, and in

> particular, estimating what plants are likely to do with this by-product in relation to available FA.[60]

Whether sufficient fly ash is present on site or available in the local market is a site-specific question. There is still no national depot or distribution system of fly ash to which users come for supply. Furthermore, EPA itself has recently further reinforced the idea of a limited potential future supply of available ash for beneficial use. In its recent Legacy CCR Surface Impoundments proposal[61], EPA states that "[o]lder, closed impoundments or other CCR storage areas are less likely to have CCR material of a known and reliable composition," thus limiting their potential value for future beneficial use.[62] Therefore, any assertion that CCR from storage sites could be used to fill the market supply is contradicted by EPA's recent statement regarding the future value of such CCR for beneficial use.

It is evident that EPA has not adequately addressed the significant non-water quality impact of its preferred brine management solution. Once the supply of fly ash from plants like Miller and Bowen is removed from the local market, it will not likely be replaced, and a highly valuable local resource will instead reside, as waste, in a landfill. EPA has not explained how it assessed local or site-specific impacts from the loss of fly ash for beneficial use in its non-water quality impacts analysis but should do so.

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[60] *Id*.

[61] 88 Fed. Reg. 31,982 (May 18, 2023).

[62] *Id*. at 32,029.

**2. The regulatory classification of a paste encapsulation mixture under the federal CCR Rule is unclear.**

Since 2019, EPA has actively advanced amendments to the CCR Rule, some of which could impact whether membrane filtration with brine encapsulation is legally, technically, or economically feasible. It is not clear whether brine encapsulation, such as paste encapsulation or ash conditioning will be considered a beneficial use of the CCR. EPA states in the 2020 Rule: "While EPA considers FA use for waste solidification and stabilization as beneficial use, the CCR waste being solidified or stabilized must still be disposed of in accordance with 40 CFR 257."[63] Beneficially used CCR should not on the one hand be exempt from federal CCR regulation by definition, and on the other, be fully subjected to requirements in 40 C.F.R. Part 257. EPA should leave regulation and disposal of fly ash to the current and any future requirements of 40 C.F.R. Part 257 and not overcomplicate long-term facility CCR compliance by upsetting established on-site ash handling practices. We encourage EPA to simply avoid these unnecessary future conflicts with the CCR Rule and reject membrane filtration as BAT for FGD wastewater.

**3. Crystallization and deep well injection (DWI) technologies alternatives to paste encapsulation are not solutions for facilities that do not have enough available fly ash.**

In the proposed rule, EPA evaluated alternatives "for handling the resulting brine that do not involve FA and thus would have no impact on the beneficial use of FA in other settings."[64] EPA evaluated two alternatives to paste encapsulation – deep well injection (DWI) and crystallization to a salt for disposal.

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[63] 85 Fed. Reg. at 64,666 n.50.

[64] 88 Fed. Reg. at 18,842.

EPA proposes to find that both crystallization and DWI have acceptable non-water quality environmental impacts[65] and that, while the costs are higher, they would be economically achievable.[66]

With respect to DWI, it is not available to every facility. As EPA knows, the ability to inject wastewater into a deep well is dependent upon both the site geology and the ability to permit an injection well in that facility's state. For example, Class I UIC wells (also known as DWI) are currently prohibited by regulation in the State of Alabama.[67] While there is no prohibition on Class I UIC wells in the State of Georgia, there have been none permitted to date.

EPA's other alternative, crystallization, is a high-energy evaporative process that requires heat from either the operating unit or some external source to concentrate the brine to a salt. The industry's limited experience with using this technology for FGD wastewater has been problematic. EPRI evaluated five existing ZLD wastewater treatment systems at Redhawk, Navajo, Iatan, Mayo, and Merrimack Generating Stations. The findings from these case studies and site interviews demonstrate that crystallizer systems are complex and challenging to operate. Common challenges for a crystallizer system include scaling and line plugging, system foaming, flow obstructions, salt dewatering, energy transfer impedance, and chemical and mechanical cleaning.[68]

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[65] *See* Memorandum from U.S. EPA, Methodology for Estimating Non-water Quality Environmental Impacts for the Proposed Steam Electric ELGs – DCN SE10244 (Feb. 27, 2023) (Docket ID No. EPA-HQ-OW-2009-0819-9691).

[66] *See* Memorandum from U.S. EPA, Alternative Brine Management Methodology – DCN SE10243 (Jan. 5, 2023) (Docket ID No. EPA-HQ-OW-2009-0819-9680).

[67] *See* Ala. Admin. Code r. 335-6-8-.05(1)(f).

[68] Electric Power Research Institute, Thermal Water/Wastewater Treatment Systems Chemistry Guidelines, 2020 Technical Report, 3002018776, at 7-1 (Sept. 2020).

EPA states that none of the facilities that currently generate brine as part of a ZLD system elects to encapsulate and dispose of that brine.[69] "Rather, these facilities send the concentrated brine to a crystallizer, and these resulting salt crystals can then be disposed of without the use of [fly ash]."[70] There are only a few facilities in the U.S. that have installed crystallization as a component of their FGD wastewater treatment system to generate a salt from the brine concentrate. These facilities have had significant scaling and corrosion problems with the crystallizer, and in some cases have abandoned it in favor of different treatment systems. For example, the Iatan Generating Station in Weston, Missouri initially installed two vapor compressor evaporators for treating FGD wastewater, but experienced so many operational problems since its commissioning that the facility abandoned the system and installed a Spray Dryer Evaporator (SDE) based on site-specific conditions.[71]

The other facility that has experienced significant scaling and corrosion issues with its FGD wastewater treatment system is Granite Shore's Merrimack Power Station in Bow, New Hampshire. Merrimack Station installed one brine concentrator and a two-stage multiple-effect crystallizer in 2011 to treat FGD wastewater. The system experiences significant scaling and corrosion issues even though it employs softening as a pretreatment step to remove suspended solids and scaling compounds.[72] The system, to this day, cannot operate without a small liquor purge to keep its crystallizer chemistry in balance, to manage

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[69] 88 Fed. Reg. at 18,842 n.49 ("While these systems are thermal systems rather than membrane systems, the brine generated would not differ substantially in its ultimate characteristics.").

[70] *Id*. at 18,842.

[71] Electric Power Research Institute, Thermal Water/Wastewater Treatment Systems Chemistry Guidelines, *supra* note 68, at 6-5 through 6-6.

[72] *See* Comments of Public Service Company of New Hampshire on EPA's Revised Draft of National Pollutant Discharge Elimination System Permit No. NH 0001465 for Merrimack Station (Aug. 18, 2014), *available at* https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/ar/AR-1215.pdf.

the critical levels of the highly soluble salts, and to keep them within the process design envelope and avoid boiling point rise. The brine and purge have reportedly been trucked offsite to a POTW.[73] The crystallizer also reportedly does not operate most of the time due to continuous operational problems.[74]

In addition, we are not aware that EPA has cited any evidence to suggest that salts produced from crystallization will be physically and chemically stable for handling and long-term disposal. Available evidence strongly suggests that salts produced from the evaporation of FGD wastewater can be highly hygroscopic and can create a liquid upon atmospheric exposure that could potentially be included in the leachate discharge from the landfill.[75] Hygroscopic salts wreak havoc on equipment and could pose environmental and structural risk to landfills, especially if those salts migrate to the leachate collection system. In this situation, pumps and other appurtenances would need replacement to avoid corrosive failure and associated compliance risks. In the proposed rule, EPA cites one plant in China that takes its brine down to salts and then sells them for industrial use as opposed to disposal in a landfill.[76] We are unaware of any established or readily available domestic market for these salts. In sum, there are significant practical uncertainties regarding the handling and disposal of any salts produced from FGD wastewater.

Not only are crystallizers problematic from a practical standpoint, but they are also expensive and additive to the costs of membranes. Specifically, since Plant Miller sells all its operational fly ash for beneficial use

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[73] *See id.*; *see also* Region 1, Responses to Comments Public Review of Merrimack Station NPDES Permit No. NH0001465, Ch. VIII, at VIII-6, VIII-20 through VIII-22, *available at* https://www3.epa.gov/region1/npdes/merrimackstation/pdfs/final/merrimack-final-rtc-ch-8.pdf.

[74] Comments of Public Service Company of New Hampshire, *supra* note 72, at 80 n.46.

[75] *See* Electric Power Research Institute, Considerations for Concentrate Management from Wastewater Volume Reduction Technologies, 3002024773 (Jan. 2023).

[76] 88 Fed. Reg. 60 at 18,843.

in the concrete market, EPA proposes the facility could use crystallization of the brine as an alternative to paste encapsulation. EPA's cost estimates for a crystallizer at Plant Miller 1-4 are $61.5 million capital and $1.9 million annual O&M costs. For Plant Bowen, which also uses nearly all (90%) of its operational fly ash for beneficial use, EPA's cost estimates for a crystallizer are $120.3 million capital and $5.4 million annual O&M costs.[77] For Plant Bowen, the crystallizer cost would be in addition to the cost of a membrane system, which based solely on EPA's own cost estimates (which we know are low), would be a total of $210.3 million in capital costs. The same is true for Plant Miller. It is not clear whether EPA has taken these additional costs into account, since fly ash is already used for other purposes at Plants Miller and Bowen.

The significant non-water quality impacts of eliminating beneficial use of operational fly ash, coupled with the significant uncertainties of the two alternative technologies EPA identifies that would allow continued beneficial use of fly ash, supports EPA's conclusion in the 2020 Rule that membrane filtration is not BAT for FGD wastewater.

### E. EPA ignores practical limitations of achieving ZLD.

EPA's proposal to set membrane treatment as BAT is further complicated by the requirement that such systems achieve ZLD. EPA arbitrarily makes this assertion by assuming that the treated permeate can simply be used for either FGD or boiler make-up without any technical challenge and at a reasonable cost. This assumption may be accurate for some facilities, but in the case of Plant Bowen and Plant Miller, there is a significant additional cost to install infrastructure to support this type of process. Significant engineering, piping, pumps, and potentially even water storage would be necessary to accomplish a closed loop system. In the case of Plant Bowen (and likely many other similar plants), it is also incorrect to assume

[77] Eastern Research Group, Inc., FGD Wastewater Proposed Rule Cost Database, *supra* note 52.

that only FGD wastewater requires treatment when units are dispatched. NPDES discharges from power plants are not limited to process wastewater but instead include industrial stormwater that is also sometimes managed through the wastewater treatment systems. This ensures that stormwater that contacts exposed materials is more thoroughly controlled prior to discharge. However, this results in water entering the wastewater treatment system even when there is no makeup water demand for treated FGD wastewater, and therefore, no operational water consumption processes to achieve ZLD. This problem is even greater at sites that have gypsum landfills/ponds for dewatering. In the case of Georgia Power's Plant Scherer, this results in the greatest FGD wastewater flow occurring when the site receives high rainfall, but all units are offline. Plant Bowen has mechanical gypsum dewatering, but also has the same challenges with the FGD water balance. A comprehensive evaluation of the water balances necessary to achieve ZLD has yet to occur, but it is possible that generating units may need to dispatch solely for purposes of water consumption to achieve the ZLD requirement in this proposal. In fact, Mississippi Power's Plant Daniel has had to dispatch units due to a build-up of water in the pond at the gypsum storage facility due to heavy rains and low dispatch of the units.

## IV. COMPLIANCE TIMING AND SUBCATEGORIES

The Southern Company supports regulations that facilitate the continued delivery of clean, safe, reliable and affordable energy to customers. The Company's planning process provides customers with reliable and affordable electric service from a diverse portfolio of demand-side and supply-side resources. This portfolio – comprised of demand response, energy efficiency, nuclear, natural gas, oil, coal, hydro, solar, wind, landfill gas, and biomass generation – maximizes value for customers in a wide variety of future economic and regulatory scenarios.

The Company considers retirement options for generating units as a part of the overall resource strategy. If environmental controls are mandated for a unit, then the economic value of the unit, including future operating costs, changes. The Company must then consider through thorough economic and planning evaluations whether it is in the best interest of customers to install the required control technology or to retire the unit and replace it with another resource. Accordingly, any compliance deadlines set by the proposed Supplemental ELG rule and other environmental rulemakings must consider the costs associated with any new rulemaking as well as the process and timing requirements of state regulatory processes, especially the integrated resource planning processes for the retail electric operating companies governed by the state PSCs.

As proposed, the FGD wastewater treatment requirements, compliance applicability date, and "early adopter" subcategory pose significant challenges to the Company's traditional electric operating companies. As explained in more detail below, we urge EPA to create additional flexibilities to alleviate the disparate costs associated with procuring and optimizing new biological treatment technology by 2025, and then immediately procuring and optimizing new membrane treatment technology and prematurely retiring the new biological system by 2029. We also urge EPA to evaluate any subcategories finalized under this rule with the subcategories in the CAA Section 111 rulemakings addressing GHG emissions from new and existing sources.

In this section, we present the following proposals in more detail for EPA's consideration:

- EPA should modify the FGD wastewater "no later than" applicability date to avoid disparate costs and avoid premature retirement of new treatment equipment.
- EPA should retain the existing PCCC by 2028 subcategory and create a new PCCC by 2035 subcategory.
- EPA should make modifications to the early adopter subcategory; and

- EPA should align compliance timing and subcategory options with other impactful proposed environmental rules.

### A. EPA should modify the FGD wastewater "no later than" applicability date to avoid disparate costs and avoid premature retirement of new treatment equipment.

Should EPA finalize membrane filtration based ZLD as BAT, then EPA should extend the "no later than" applicability date for all facilities until December 31, 2032. EPA should allow operation of the 2020 BAT for at least eight years to allow cost recovery for investments in 2020 Rule compliance, after which a facility can opt to either retire, repower, or continue operating with the new BAT. Reducing the useful life of a new biological treatment system to only four years places an acute cost recovery burden on customers and is a waste of resources. Modifying the "no later than" applicability date would allow continued operation of units that are, or may become, necessary for reliability due to load growth or other market changes; and it would allow facilities to evaluate the impacts of a multitude of relevant factors, including additional environmental rulemakings, affecting their continued operation and continue to operate by implementing the new BAT if they determine it to be the most cost-effective option. Therefore, EPA should extend the "no later than" applicability date for all facilities until December 31, 2032.

### B. EPA should retain the existing PCCC by 2028 subcategory and create a new PCCC by 2035 subcategory.

#### 1. EPA should retain existing PCCC by 2028 subcategory, as finalized in 2020.

EPA solicits comment on the proposal to retain the PCCC by 2028 subcategory. We agree that the existing PCCC by 2028 subcategory continues to be warranted and we urge EPA to not retroactively impose any

new requirements on facilities that have opted into this subcategory. The Southern Company's traditional electric operating companies submitted NOPPs for a combined total of 12 units stating their intent to retire or repower using alternative fuel by December 31, 2028. Of these 12, 10 units have received regulatory approval to retire or repower by 2028. Georgia Power requested to retire Plant Bowen Units 1&2 by 2028; however, in consideration of the reliability needs of customers in North Georgia, the Georgia PSC deferred a decision on the retirement of Plant Bowen Units 1&2 until the Georgia Power's next regularly scheduled Integrated Resource Plan (IRP) in 2025. EPA also requests comment on whether a more stringent technology already existing on site should be required for FGD wastewater at facilities in the PCCC subcategory. The imposition of any additional requirements to these facilities only adds corresponding disparate costs. Additionally, because some existing treatment systems may be utilized for treatment of ash pond dewatering activities, it is imperative that EPA not impose any complications or delays to the timely dewatering and closure of ash ponds, which are already under prescriptive closure deadlines under 40 C.F.R. § 257.102(f), with extremely limited extension options. We suggest that avoiding this unintended consequence would best support EPA's stated goal of harmonization with the CCR Rule.

**2. EPA should establish a new PCCC subcategory allowing units the option to comply with the generally applicable limitations by the "no later than" applicability date in the facility's permit or retire or repower by December 31, 2035.**

EPA should finalize a new subcategory that would allow facilities the option to comply with the 2020 BAT no later than December 31, 2025, and, by a certain date, opt to either comply with the new membrane filtration BAT for FGD wastewater no later than the finalized applicability date or opt to retire or repower no later than December 31, 2035. In the proposed rule, EPA reaffirms its support for the PCCC by 2028 subcategory: "EPA established this subcategory in the 2020 rule based on the statutory factors of cost (the

cost burden on these facilities is greater because they have less time to recoup investments); the age of the equipment and plants involved (the remaining useful life of the plants and their pollutant control equipment is shorter than for typical plants); potential non-water quality environmental impacts, including energy requirements (early retirement of these plants could affect energy supply); and harmonization with the CCR Rule alternative closure provisions."[78] This subcategory approach is supported largely by the same factors EPA relied upon for the PCCC by 2028 subcategory and is necessary for the same reasons outlined in our discussion regarding modifications to the early adopter subcategory.

In the following sections, we present additional factors for EPA to consider in finalizing a new PCCC subcategory that most appropriately addresses the timing associated with the planning, regulatory approval and implementation of any necessary replacement generation for generation units impacted by this proposed rulemaking. Based on factors presented below, we urge EPA to establish a new PCCC subcategory allowing retirement or repowering by December 31, 2035.

### a. A retirement subcategory should appropriately consider the planning and regulatory approval process.

As an illustration of the critical timing considerations of state regulatory processes, Georgia Power is required to complete extensive planning analyses as a vertically integrated utility regulated by the PSC under O.C.G.A. § 46-2-20(a). The PSC oversees and must approve of planning and resource decisions to ensure Georgia Power can meet its obligation to serve its customers, including ensuring the Company maintains sufficient capacity to serve during periods of peak energy demands. Georgia Power is required under PSC regulations to act prudently in its investment and compliance decisions. Those decisions are

[78] 88 Fed. Reg. at 18,857; *see also* 40 C.F.R. §§ 257.71(d), 257.103.

reviewed as part of statutorily required, triennial IRP proceedings, subject to Commission review and approval, which comprehensively evaluate Georgia Power's plans for the next 20 years. The IRP process allows interested members of the public the right to participate in multiple ways, including engaging in the thorough review of the Company's plans by intervening in the case or providing comments during a public hearing.

Decisions on how best to meet the needs of customers are not relegated to a singular analysis. Georgia law acknowledges this by requiring a planning process that is truly integrated and recognizes the supply-side dynamics of forecasted needs, transmission, environmental compliance, and generation. The development of the IRP is a complex process requiring coordination from across the Company that takes significant time to complete. As a part of the three-year planning cycle, planning for and preparing the IRP takes a year or more, the IRP and any associated rate case proceedings take another year, and implementation of the Commission decisions is the focus of the following year and beyond. Through the IRP process, the Company ultimately submits to the Commission its long-term plan to meet the needs of customers by providing reliable, cost-effective electricity while also complying with a range of environmental laws.

Given this regulatory framework, Georgia Power must carefully evaluate the implications for operations, reliability, and the impacts on customers through the IRP process while considering environmental compliance strategy decisions to control or retire and replace generating resources. By way of example, Georgia Power is procedurally required to submit to its PSC an IRP at least every three years that details its long-term plans for its energy resources to meet customer energy demands. To modify its generation portfolio, Georgia Power must follow Commission rules and, for large resources, would be required to issue a request for proposals (RFPs), evaluate RFP bids, and apply for certification of the new resource(s) with the PSC. To receive approval of a certification request, the utility must ensure prudency of the RFP process, which necessitates a thorough and equitable evaluation. Georgia Power typically requires between 19 and

30 months before resources are certified or activities associated with building a new resource are initiated. Up to six months of additional time may also be required prior to the certification filing depending on the level of activity at the Commission and whether certification requests will be included as part of an upcoming triennial IRP filing. Of special note is the fact that the state law prohibits an electric utility from commencing construction until a certificate is obtained from the PSC. With the robust regulatory process that is required by law, any decision to retire a generating unit necessarily follows a multi-year evaluation to ensure that customers' best interests are fully considered. EPA must consider these state regulatory process requirements in setting any guidelines around timelines for unit retirement commitments.

### b. A retirement subcategory should appropriately consider the timing required for replacement generation and transmission.

In the Southern Company's January 2020 comments to EPA[79], Southern provided support for a timeframe of *at least* 8 years for a utility to obtain necessary regulatory approvals to retire coal units and complete the construction of new generation. This timeline was largely based on a historical example illustrating the approval and construction of three new gas-fired units at Georgia Power's Plant McDonough. In these comments, we also noted the following key issues that may also affect the actual timing that may be required to replace generation: 1) transmission constraints are an important and critical component for new or retiring generation, and that significant transmission upgrades may be needed to support reliable operations and resiliency of the system, depending on the location of the generation; and 2) these updates may require long lead-time planning, land acquisition, design, and construction efforts in order to support the new generation or accommodate future retirements.

[79] Comment Letter from Jeffrey A. Burleson, Senior Vice President, Environmental and System Planning, Southern Company, *supra* note 38, at 49-53.

In the case of Georgia Power, because this rulemaking more specifically impacts the potential economic viability of Georgia Power's Plant Bowen, more current and site-specific impacts must be considered. Plant Bowen presents a different scenario than Plant McDonough in that the existing generating capacity of Plant Bowen represents the largest single facility that will have been retired to date. Due to its location and size, to replace the generation capacity of Plant Bowen, both very significant new transmission development and generation replacement are required. Georgia Power currently anticipates that the necessary transmission projects and additional generation to replace Plant Bowen while maintaining reliability could require timelines through the end of 2035, including completion of the robust regulatory approval process and associated RFP and certification process. While certain extensive transmission projects are already underway to allow for the eventual retirement of Plant Bowen, the acceleration of the timeline required to meet the 2029 compliance deadline is not possible. With numerous individual transmission projects required, planning for the timing of construction and outages is critical to maintain reliability for customers throughout the process. Even if critical factors such as supply chain, labor and transmission and generation outage planning needs are ignored, the acceleration of the timeline would require even more extensive transmission work than currently planned, almost doubling the cost (from about half a billion dollars to about one billion dollars). And yet, doubling the cost still does not make the timeline achievable when all factors are appropriately considered. Until the completion of this transmission work, Plant Bowen remains critical to maintaining electric service reliability in Georgia.

Further, procuring and/or building replacement generation to prepare for the eventual retirement of over 3,000 megawatts of capacity at Plant Bowen has critical timing considerations. Currently, Georgia Power is in the process of deploying generation capacity through power purchase agreements (PPAs) of about 2,300 megawatts to prepare for currently approved plant retirements (which does not include Plant Bowen) through 2028. Planning for the 2019 IRP, which included the proposed RFP process, began before 2018, the proposed RFP process was approved by the Commission in the 2019 IRP, selected resources from the

RFP process were approved during the 2022 IRP, and the resources are anticipated to begin serving customers between 2024 and 2028. Thus, full deployment of these resources, which are all existing resources with no new construction required, will take at least 10 years from start to finish. Meanwhile, additional coal plant retirements beyond those already approved through 2028 will only increase the complexities of market supply and demand for electricity and are expected to further challenge and prolong these timeframes.

Taking all of these relevant factors into consideration, the end of 2035 is the earliest feasible and responsible date to consider for the retirement of Plant Bowen in order to maintain reliability and resiliency of the electric grid in north Georgia and affordability for customers. If EPA finalizes the proposed BAT, EPA should finalize a new subcategory that allows plants such as Plant Bowen the time necessary to construct replacement generation and transmission necessary to accommodate its retirement without the addition of disparate costs to customers that would be imposed by the proposed new BAT for FGD wastewater. This new subcategory must consider the multi-year planning and evaluation process before unit retirements can be approved, as well as the complex planning and coordination necessary prior to construction of transmission and replacement generation for coal plants that are expected to remain after 2028. In the case of Plant Bowen, this subcategory should allow the plant to continue operating the 2020 BAT, and by a certain date no earlier than December 31, 2028, to align with the constructive state regulatory processes required by law, commit to either install the newly required BAT by December 31, 2032, or commit to retire or repower by December 31, 2035. This option mirrors the successful PCCC by 2028 subcategory and ensures resource decisions can be made in the best interest of customers.

### C. EPA should make modifications to the early adopter subcategory.

EPA has proposed a new subcategory for plants that have achieved compliance either with the 2015 or 2020 rule limitations on FGD wastewater and BA transport water by the publication of this proposed rule, and

which elect to retire no later than December 31, 2032. As a condition of being eligible for this subcategory, EPA proposes that permitting authorities include the BAT limitations in these sources' permits after December 31, 2032. EPA reasons that such a subcategory is warranted on the basis of cost (disparate costs to facilities with these units), age (both the age of the new pollution treatment technology and the remaining useful life of the plant), non-water quality environmental impacts (air pollution), and other factors the Administrator deems appropriate (impacts to early adopters who relied on the identification of biological treatment as BAT for FGD wastewater in the 2015 and 2020 Rules). EPA also reasons that utilities that have "avoided incurring any cost for as long as possible" may be better poised to adjust to this proposed rule.

As proposed, the "early adopter" subcategory inadequately assesses the entirety of effort and investments made toward compliance with the 2015 and 2020 rules across the industry, as well as the projected retirement horizons of those assumed to be "early adopters;" and therefore produces an unfair and unequitable outcome for both those that are included as early adopters but have no plans to retire by 2032 as well as those who are excluded from the subcategory even though they may have already converted to dry ash handling systems and/or made substantial and irreversible financial commitments to comply with the 2020 BAT for BATW and FGD wastewater (which could also include the early operation of a physical chemical treatment system).

In our comments, we have presented site-specific cost estimates for Plants Miller and Bowen, illustrating that the projected costs to comply with the newly proposed BAT are far greater than EPA has estimated. Further, EPA's limited review of projected retirement horizons has likely excluded retirement commitments that extend beyond the December 31, 2032, date, by only a few years. Expanding this review to include units that may retire by the end of 2035 would both alleviate disparate costs to a wider population of aging units and weigh in favor of EPA's consideration of non-water quality environmental impacts, such as

reduced air emissions. Finally, the other factors EPA relies upon (impacts to early adopters who relied on the identification of biological treatment as BAT for FGD wastewater in the 2015 and 2020 Rules) unfairly penalizes facilities that also fully complied with the law and made decisions in the best interests of customers.

Accordingly, we present solutions for EPA to consider in finalizing the early adopter subcategory to produce fair and equitable outcomes while maximizing the environmental benefits of complying with the 2015, 2020 and this Supplemental ELG rulemaking.

**1. EPA should revise the "cut-off" date or qualification date to include facilities that have entered into a contract with a vendor to install technologies to comply with the 2020 Rule BAT.**

EPA's proposed eligibility "cut-off" date or qualification date for this subcategory should be changed. EPA requested comments on this issue. EPA's proposed March 29, 2023, qualification date creates fair notice and equitable concerns. EPA never previously identified the March 29, 2023, date as one from which regulatory consequences would flow. The first notice anyone may have had of this date and its significance was disclosed in the pre-publication version of the proposed rule, released by EPA on March 8, 2023. However, that pre-publication version was also internally inconsistent, referring to the Federal Register date of the proposed rule in certain instances, while referring to a date after publication of the final ELG rule in other instances. Accordingly, the industry had no opportunity to conform its conduct to this new legal standard. Many facilities are currently in the process of contracting for and constructing a biological treatment system to comply with the 2020 Rule. The only fair and just approach would be to extend the eligibility date to one that's after the effective date of a final rule. Only then will a party considering whether to opt-in to this subcategory have the ability to conform its conduct and also have full knowledge of its legal obligations and options to make a fully informed compliance decision.

**2. The early adopter subcategory eligibility should not be limited to only those that have completed installation and demonstrated compliance with the 2020 Rule requirements.**

The early adopter subcategory eligibility should not be limited to only those that have completed installation and demonstrated compliance with the 2020 Rule requirements. It is enough that companies and facilities have made sizeable (and sometimes irreversible) commitments to install a treatment system to comply with the 2020 Rule. EPA has recognized in 2015, 2020, and in this proposed rule that the installation of these complex treatment systems is a multi-year process. Despite this, the Agency is proposing to establish an eligibility criterion that ignores the fact that many companies and facilities may have spent millions of dollars to achieve compliance with the 2020 Rule but may be one or two years away from achieving compliance; while other facilities may have executed a contract with a vendor for the installation of a 2020 ELG rule-compliant treatment system but may not be able to meaningfully amend or void that contract.

For example, the proposed qualification date for the early adopter subcategory will prevent Plant Bowen from qualifying for the subcategory. Plant Bowen has entered a contract with a vendor for the installation of a biological treatment system and has already incurred more than $50 million to pursue, plan, finance, and design how it will comply with the 2020 Rule, because its NPDES permit requires the new biological treatment system to be in service to meet the 2020 Rule limits by December 31, 2025. Depending on when a final rule is issued, Plant Bowen's current compliance costs will likely increase another $30-40 million.

A reasonable and workable subcategory needs to provide relief to permittees that initiated actions to comply with the 2020 Rule. Stated simply, the early adopter subcategory needs to provide relief not only for those facilities that have completed the installation and optimization process to achieve compliance, but also for those that have taken meaningful steps toward complying with 2020 Rule. To address these concerns, the only fair and just approach would be to revise the eligibility criteria and include units that have already

contracted for but not yet installed biological treatment to comply with the 2020 Rule, *i.e.*, entered into a contract by the signature date of the final rule.

### 3. EPA should not require retirement for early adopters.

As mentioned previously, the proposed early adopter subcategory unfairly treats even those that would qualify by requiring retirement. This requirement is largely unexplained by EPA (which makes it arbitrary and capricious) and misses the point on why the "early adopter" subcategory is necessary and equitable. The subcategory is warranted because: (1) of the reliance interests of early adopters (as explained herein); (2) these units should not be forced to abandon these new treatment technologies after only a few years (when their useful life is well-established as 20+ years); and (3) customers should not be immediately subjected to additional (or even overlapping) rate increases because of EPA's changing regulatory positions. EPA's proposal also fails to adequately take into consideration the environmental benefits already experienced at such facilities by installing and operating the 2020 BAT earlier than December 31, 2025 (Plant Miller), installing and operating a physical chemical treatment system as progress toward compliance with the 2020 BAT (Plant Bowen), and/or converting to dry bottom ash handling systems well in advance of this proposed rulemaking (Plants Miller and Bowen). Requiring retirement to qualify for this subcategory seems punitive. As opposed to penalizing these facilities with an early retirement option that is neither feasible nor coordinated with simultaneously proposed environmental rulemakings, EPA should simply remove the requirement for early adopters to commit to retirement and should instead allow early adopters to either retire or continue operating under the new BAT no later than December 31, 2032.

**4. If EPA's early adopter subcategory requires a retirement commitment, then EPA should allow early adopters to either comply with new generally applicable limits by December 31, 2032, or commit to retire by December 31, 2035.**

While we believe EPA should not require retirement for early adopters, if EPA ultimately decides to finalize an early adopter subcategory that requires a retirement commitment, then EPA should: 1) as discussed above, require compliance with the new generally applicable limits no later than December 31, 2032, and 2) extend the retirement date from December 31, 2032 to December 31, 2035. As discussed previously, EPA's review of facilities that may soon retire fell short of including a potentially substantial number of units that may elect to retire no later than the end of 2035, including Plant Bowen. EPA cited retirement plans made by utilities beyond December 31, 2032, but, without full explanation, excluded these units as early adopters by establishing a retirement date that is not achievable. In doing so, EPA has set up a potential outcome that not only fails to capture the full scope of non-water quality benefits that could be associated with an expanded subcategory (e.g., reduced air emissions), but also results in an untenable situation for units that: 1) should qualify as early adopters based on progress toward 2015 and 2020 Rule compliance, and 2) would experience disparate costs and potential reliability concerns due to the age of the units and associated timelines for completing necessary generation replacement and transmission infrastructure upgrades. In our preceding sections, we presented a scenario for Georgia Power's Plant Bowen that strongly supports both the need for such a retirement subcategory and an associated date to retire by December 31, 2035. We recommend that the timing of a retirement commitment under the early adopter subcategory should mirror that which we have recommended for a new PCCC by 2035 subcategory.

### D. EPA should align compliance timing and subcategory options with other impactful proposed environmental rules.

As a general matter, whether through establishment of an early adopter subcategory or with stand-alone subcategories that allow flexibilities in compliance timing and associated requirements, EPA should take steps to ensure harmonization with other impactful environmental rules, including, but not limited to, CAA Section 111 rulemakings. Given the substantially underestimated costs of the proposed new BAT in this rulemaking and the proposed expedited timeframe to achieve compliance, utilities should have the appropriate time to evaluate the impact of multiple rulemakings on the generation fleet and make decisions that are protective of the environment and in the best interests of customers. Extending the time to comply with any new proposed BAT until at least December 31, 2032, and extending the date by which units must commit to retire to December 31, 2035, under any new retirement subcategory best achieves this outcome.

## V. LEGACY WASTEWATER (LWW)

In spring of 2016, The Southern Company announced that operating companies would stop sending coal ash to unlined ponds by spring of 2019, except for one facility. By spring of 2019, the Company's operating companies fulfilled this commitment through an aggressive ash and wastewater management program. By the end of 2020, all the Company's operating companies had completely discontinued sending both CCR and non-CCR waste streams to our ash ponds – ahead of EPA's April 11, 2021, deadline. Twenty-one units across six sites (Plants Barry, Bowen, Gaston, Miller, Scherer, and Wansley) converted to dry/closed loop ash handling (even as early as August 2018) and the water treatment functionality of the ash ponds was replaced at 12 sites, comprising a $2.6 billion program.

EPA has proposed several changes to LWW requirements in the proposal, including subdividing LWW into new categories, new definitions, and requiring different management requirements for the new

categories. As a general matter, Southern urges caution with any revision to the LWW requirements that could complicate, delay, or derail ongoing dewatering and closure activities required by the CCR Rule.

### A. EPA should not subdivide LWW.

EPA is proposing in this rule to segregate LWW into two main categories of separately regulated discharges, which would each be subject to separate case-by-case technology-based effluent limitations established by the permitting authority. These two main categories are described as follows:

1) Wastewater continuously or intermittently generated and discharged to a pond after the issuance of the first permit implementing the 2015 or 2020 Rule but before the compliance date specified in the permit (the "as soon as possible" date required by the rule), and

2) Wastewater that was discharged to the pond previously and will be discharged when the pond is dewatered for closure.

The Southern Company believes these proposed definitional changes to be unnecessary. While there is value in acknowledging the current status of waste streams in the context of how the CCR and ELG Rules have impacted the on-site management and treatment of these waste streams, as proposed, EPA's subdivision of LWW is problematic. The proposed subdivision allows for a scenario where a wastewater may have been sent to the pond after permit issuance but before its late applicability date in the permit. The definition becomes retroactive in a manner that is impossible to achieve. If a facility were to discharge wastewater continuously or intermittently to a pond after the issuance of a permit, then this wastewater would not be separable, physically, or otherwise, from wastewater that was discharged to that same pond prior to the issuance of the permit. In this scenario, there is no significant difference in composition between the two categories of LWW. The only difference is when the LWW was generated. If separated by time, both categories of LWW with similar composition will be treated to meet the existing ELGs and any water

quality-based effluent limits in the NPDES permit prior to discharge. Therefore, EPA does not need to propose separate subcategories of LWW separated by time or propose that the permit writer conduct a separate ELG BAT determination on each category to set BPJ limits. This is unnecessary, creates confusion, and adds an extra burden to the permit writer.

### B. If EPA chooses to subdivide LWW, then EPA should do so based on the following temporal marker: the later date of either when a pond stopped receiving these waste streams (i.e., the "cease receipt" date of CCR and non-CCR wastes for unlined ponds) or the issuance of the first permit implementing the 2015 or 2020 Rule.

If EPA does subdivide LWW into different categories, then EPA could instead consider establishing a more practical temporal marker to subdivide these waste streams: the later date of either when the pond stopped receiving these waste streams (i.e., the "cease receipt" date of CCR and non-CCR wastes for unlined ponds) or the issuance of the first permit implementing the 2015 or 2020 Rule either renewal or modification. In this scenario, there would be no instance where the subdivided wastewater would have already been sent to the pond, and a facility that stopped sending wastewater to ponds earlier than the issuance of the NPDES permit would not be subject to these requirements any earlier than the date of issuance of the first permit implementing the 2015 or 2020 Rule.

Even if EPA can establish a practical subdivision, there may be little practical effect for any LWW other than FGD wastewater, as it is likely that facilities would have implemented the 2015 BAT for fly ash transport water (FATW) prior to, or at latest, concurrent with, the date that they stopped sending LWW to the pond. Presuming EPA issues a final rule in 2024, many facilities would be well underway toward installation and testing of the 2020 BAT to meet the applicability date established in the permit, no later

than December 31, 2025. At Plants Bowen and Miller, both FATW and BATW are already meeting the 2020 BAT, and FGD wastewater is being treated by either chemical precipitation (Plant Bowen) or the 2020 BAT (Plant Miller). Even in the case where FGD wastewater were re-rerouted from an unlined CCR impoundment to a lined settling pond, the effluent would still be discharged through an NPDES permitted outfall and subject to meeting existing ELGs and state water quality standards. Therefore, there is no reason to separate this waste stream as a subdivision of LWW for purposes of this rulemaking since EPA's objective of achieving a more effective treatment for FGD wastewater until the 2020 BAT applicability date is likely already occurring in many cases.

### C. EPA should not subcategorize LWW that was discharged to the pond previously and will be discharged when the pond is dewatered for closure.

EPA is proposing to further subcategorize the second major proposed category of LWW: that which was discharged to the pond previously and will be discharged when the pond is dewatered for closure. This is effectively the wastewater that remains in the pond after the pond has ceased receipt of both CCR and non-CCR wastes. This wastewater may exist above the settled CCR solids within the pond or as interstitial water surrounding the settled CCR solids. EPA's proposed subdivision of this category is as follows:

- Surface impoundment (SI) decant wastewater: surficial water located above the CCR solids (hereafter referred to as ''surface impoundment (SI) decant wastewater''), or the layer of a closing surface impoundment's wastewater that is located from the water surface down to the level sufficiently above any coal combustion residuals that, when drained, does not resuspend the coal combustion residuals; and

- Surface impoundment (SI) dewatering wastewater: Pore water in the saturated CCR layer at levels beyond that needed for conditioning, or the layer of a closing surface impoundment's wastewater

that is located below surface impoundment decant water due to its contact with either stationary or resuspended coal combustion residuals.

Since the beginning of dewatering efforts, our facilities have recognized and addressed the potential differences in pollutant levels associated with progressive dewatering. This is evident from the dewatering data the Company voluntarily provided to EPA in April 2022. In practice, a single technology can be used to treat both types of surface impoundment wastewaters with modifications to the treatment process (*e.g.,* addition of chemicals to remove pollutants) to protect receiving stream water quality. Therefore, we suggest that this specific subcategorization is unnecessary and irrelevant for purposes of establishing effluent limits for dewatering wastewater. If there is water removed from an impoundment during closure through dewatering, then it should be referred to collectively as "dewatering wastewater."

Importantly, EPA's definition of this LWW refers to wastewater within an impoundment that is in the process of being closed (i.e., "a closing surface impoundment"). We support EPA's decision to limit this definition to wastewater that is removed from within the impoundment to facilitate closure. We question, however the intent of EPA's description of surface impoundment dewatering wastewater in the preamble as that which is present "in the saturated CCR at levels beyond that needed for conditioning." For purposes of this ELG rulemaking, knowing whether a wastewater is present "at levels beyond that needed for conditioning" serves no purpose.

As stated above, EPA should not further subcategorize LWW that was discharged to the pond previously and will be discharged when the pond is dewatered for closure. Our experience and information/data provided to EPA has shown that this subcategorization is not necessary.[80] However, should EPA ultimately

[80] Letter from Donna Hill, Southern Company Services, Inc., *supra* note 9.

choose to define these two subcategories, then EPA should remove any reference regarding the degree to which the wastewater is present "in the saturated CCR at levels beyond that needed for conditioning."

### D. EPA should not establish more stringent LWW treatment requirements that hinder pond closure.

As described above, the Company's operating companies have moved aggressively to replace surface impoundments as wastewater treatment units, rerouting LWWs to robust treatment systems that protects receiving water quality and facilitates pond closure activities. EPA is correct in its stated uncertainty as to whether more stringent systems (chemical precipitation, biological treatment, membrane filtration, thermal evaporation, spray dryer evaporation) could be used nationwide "without disrupting some plants' already commenced (and contracted for) closure process, thereby possibly jeopardizing the ability of those plants to meet their closure deadlines under the CCR Rule."[81] We agree that EPA should avoid establishing requirements (either through more stringent technologies or through permitting constraints) that would interfere with the closure progress or become a linchpin of the pond closure schedule. To account for this, EPA could specifically instruct permit writers to take into consideration in their BPJ analyses a facility's current dewatering treatment system, dewatering status, and CCR closure timeline, and establish effluent limitations accordingly. It is imperative that, given the already stringent deadlines for completing closure, these activities proceed expeditiously and without delays associated with the imposition of an unnecessarily stringent technology, even if it is perceived as readily available at the site.

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[81] 88 Fed. Reg. at 18,853.

## VI. COMBUSTION RESIDUAL LEACHATE (CRL)

EPA has maintained the definition for CRL from the original 2015 rulemaking, which defines CRL as "liquid, including any suspended or dissolved constituents in the liquid, which has percolated through or drained from waste or other materials placed in a landfill, or that passes through the containment structure (e.g., bottom, dikes, berms) of a surface impoundment."[82] EPA is proposing chemical precipitation as the technology basis for establishing BAT limitations to control pollutants discharged in CRL. EPA proposes that this technology is available, is economically achievable, and has acceptable non-water quality environmental impacts. Specifically, the proposed BAT basis consists of chemical precipitation/coprecipitation employing the combination of hydroxide precipitation, iron coprecipitation, and sulfide precipitation. The Company does not object to the proposed BAT limits for arsenic and mercury for this waste stream but believes EPA should constrain the scope of regulated CRL to that which is collected from engineered leachate collection systems and then discharged via surface outfalls from active landfills at active generating plants. Subjecting numerous unidentified and uncharacterized sources of water to an improper regulatory definition completely unbalances any underlying determinations or assumptions of cost-effectiveness. In particular, this rulemaking should not establish effluent limits or permitting requirements for functional equivalent discharges of CRL because unlined landfills and surface impoundments are not point sources.

[82] 80 Fed. Reg. 67,838, 67,847 (Nov. 3, 2015).

### A. EPA's proposed BAT limits for functional equivalent discharges of CRL represents a regulatory overreach and should not be finalized.

As part of the proposal, EPA has included new guidance to implement the U.S. Supreme Court's decision in *County of Maui*.[83] The proposed guidance is presented as having limited applicability, but it actually represents a significant regulatory overreach. Notably, in 2020, EPA published for comment a proposed standalone guidance document that would help inform how to broadly incorporate *County of Maui* into existing NPDES permit programs. EPA finalized that guidance in January 2021, only to rescind it several months later. Now, years later, EPA proposes new *County of Maui* guidance but has tucked it into a larger, industry-specific rulemaking. As described below, the substance of EPA's proposed *County of Maui* guidance is flawed, as is the Agency's decision to propose it, for the first time, as part of this industry specific ELG rulemaking.

#### 1. Unlined landfills and surface impoundments are not point sources.

In *County of Maui*, the existence of a "point source" was both a necessary predicate and *undisputed* (there, wastewater was injected directly into groundwater through an engineered underground injection control system). However, unlined landfills and surface impoundments are *not* point sources. In the only cases directly on point, both the Fourth Circuit and Sixth Circuit Court of Appeals rejected all arguments to the contrary.

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[83] *Cty. of Maui v. Haw. Wildlife Fund*, 140 S. Ct. 1462 (2020).

In the Fourth Circuit case, *Sierra Club v. Virginia Electric & Power Company*,[84] Sierra Club argued that seepage of CRL from an unlined landfill and settling ponds at the Chesapeake Energy Center in Virginia constituted unpermitted point source discharges under the CWA. But the court disagreed, ruling that they did not function as conveyances and thus did not meet the statutory definition of point source. The court went on to explain that in regulating discharges of pollutants from point sources, Congress clearly intended to target the measurable discharge of pollutants.

> When a source works affirmatively to *convey* a pollutant, the concentration of the pollutant and the rate at which it is discharged by that conveyance *can be measured*. But when the alleged discharge is diffuse and not the product of a discrete conveyance, that task is virtually impossible.[85]

The court concluded that the scenario presented by the unlined landfill and settling ponds at Chesapeake Energy Center "indicates circumstances that are incompatible with the effluent limitation scheme that lies at the heart of the Clean Water Act."[86]

In *Ky. Waterways Alliance. v. Kentucky Utilities Company*, the Sixth Circuit reached the identical conclusion in a case involving two coal ash ponds at the E.W. Brown Generating Station in Kentucky.

> Here [plaintiffs] contend that the coal ash ponds are point sources. We doubt the correctness of that position. A point source, by definition, is a "conveyance." 33 U.S.C. § 1362(14). Coal ash ponds are not conveyances – they do not "take or carry [pollutants] from one place to another." . . . In fact, ash ponds are quite the opposite; they are designed to *store* coal ash in place.[87]

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[84] 903 F.3d 403 (4th Cir. 2018).

[85] *Id*. at 411 (emphasis in original).

[86] *Id*.

[87] 905 F.3d 925, 934 n.8 (6th Cir. 2018), *abrogated by Cty. of Maui, Hawaii v. Hawaii Wildlife Fund*, 140 S. Ct. 1462 (2020) (internal citations omitted) (emphasis in original).

EPA fails to reconcile or even acknowledge the existence of these controlling cases in its proposal. Instead, EPA purports to dodge the point source requirement altogether: "EPA, through this action, is not addressing the definition of any terms in the CWA (such as 'point source' or 'discharge of a pollutant') that governs when a discharge is subject to NPDES permitting requirements . . . ."[88] EPA's position is untenable and any attempt to regulate CRL through groundwater from unlined landfills and surface impoundments must be rejected.

**2. EPA has not yet taken the steps necessary to implement *County of Maui*.**

Even assuming, for the sake of argument, that a point source exists, EPA's proposal would still be inappropriate. In the three years since the Supreme Court issued *County of Maui*, EPA has not yet taken the required regulatory steps necessary to bring functional equivalent discharges into the NPDES permit program. First, EPA has not amended the NPDES regulations at 40 C.F.R. Part 122 to implement *County of Maui*, either in terms of the scope of the NPDES permit requirements in § 122.1(b) or the application requirements in § 122.21 *et seq*. Second, EPA has not revised the required application forms to encompass the types of data and information needed to determine the existence of, and develop the limitations and conditions applicable to, functional equivalent discharges. Indeed, across EPA's complete set of forms and instructions for the entire universe of regulated NPDES discharges, there is not a single reference to functional equivalent discharges.[89] Third, EPA has not issued any guidance that interprets or applies

[88] 88 Fed. Reg. at 18,850.

[89] *See* EPA, National Pollutant Discharge Elimination System (NPDES), NPDES Application Forms, *available at* https://www.epa.gov/npdes/npdes-application-forms (last visited May 28, 2023).

*County of Maui* or, for that matter, instructs delegated states on how to do so.[90] In the absence of any of these necessary predicate actions, EPA's recommendations in the preamble for applicants to submit extensive "supplemental information" on potential CRL in groundwater, and thereafter to provide annual CRL monitoring reports, are wholly unsupported and inappropriate.

EPA claims that much of the supplemental data and information to be submitted with applications and included in annual reports is already available and thus "the incremental burden to facilities should be minimal,"[91] but this is not accurate. The recommended technical information extends far beyond what is required under EPA's CCR Rules. For example, EPA's CCR Rules do not require any of the information required to apply the Supreme Court's *County of Maui* factors (as proposed here), including travel time, pathway(s), or chemical fate and transport, as part of routine operational compliance. Moreover, EPA's CCR Rules only require characterization of the nature and extent of groundwater impacts for units that are subject to corrective action (i.e., those exceeding groundwater protection standards for Appendix IV constituents by statistically significant levels and for which an alternative source such as natural variability has not been identified). Therefore, the supplemental data and information EPA identifies for inclusion with applications is, in fact, not readily available.

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[90] In January 2021, EPA issued a guidance document interpreting and applying *County of Maui*. But in September 2021, EPA rescinded the guidance. We note that EPA apparently just submitted a proposed *Maui* implementation rule to OMB for review (https://www.reginfo.gov/public/jsp/EO/eoDashboard.myjsp [reginfo.gov]). However, the scope and details of the proposal have not yet been shared publicly so we have no basis to evaluate whether the approach here is consistent with the approach there. In addition, it would be procedurally improper for EPA to advance any particular *Maui* implementation approach through industry-specific ELGs without first proposing, taking comment on, and then finalizing its overall Maui implementation rulemaking.

[91] 88 Fed. Reg. at 18,889.

### 3. CRL ceases to be a waste stream—by definition—when it exits a unit.

As noted above, EPA proposes to maintain the 2015 definition of CRL, which is leachate that exits a CCR landfill or surface impoundment. CRL clearly is not the same as groundwater, which EPA defines as "water that is found in the saturated part of the ground underneath the land surface."[92] If CRL exits a unit and ends up in groundwater, then it necessarily becomes impacted groundwater.

EPA seems to assume that CRL retains some independent identity even after it mixes with groundwater, but this defies logic and lacks any limiting principles, the most obvious of which would be both spatial and temporal. In other words, CRL ceases to exist as a unique waste stream subject to the ELG program (or the CWA for that matter) once it exits a unit (e.g., through migration into groundwater). Similarly, CRL can no longer be considered CRL when it mixes with other media before, during or after the closure process. Otherwise, CRL-impacted groundwater could be subject to BAT limits (and EPA's presumptive pump-and-treat technology) long after a unit closes or at substantial distance from the unit. This proposal does not contemplate these definitional and practical limitations.

### 4. CRL in groundwater is governed by RCRA, not the CWA.

EPA's approach to CRL in groundwater also conflicts with – and threatens to undermine – EPA's comprehensive regulation of groundwater quality at CCR units through the CCR regulatory program under RCRA. In fact, EPA's proposal is fundamentally inconsistent with RCRA. In 2015, EPA adopted the first national regulations governing CCR as RCRA solid waste.[93] These regulations impose location restrictions,

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[92] 88 Fed. Reg. at 18,895 (Appendix A to the Preamble: Definitions, Acronyms and Abbreviations Used in this Preamble).

[93] *See* 80 Fed. Reg. 21,301 (Apr. 17, 2015).

design and operating criteria, groundwater monitoring and corrective action requirements, and closure and post-closure care requirements for regulated CCR units, including landfills and surface impoundments, as well as extensive recordkeeping, notification and public posting requirements, all of which are designed to meet the RCRA protectiveness standard of "no reasonable probability of adverse effects."[94] With respect to groundwater monitoring and corrective action, in particular, EPA's CCR Rules require compliance with groundwater protection standards and require remedial measures whenever Appendix IV constituents are detected in groundwater at statistically significant levels above those standards.[95] EPA's proposed BAT limits for CRL in groundwater bear no relation to these CCR groundwater protection standards, and EPA's presumed pump-and-treat approach[96] (assuming the groundwater is pumped for purposes of corrective action) circumvents the more comprehensive corrective action process required by the CCR rules. Furthermore, establishing effluent limits for groundwater impacted by CCR units could unnecessarily complicate or prolong corrective action under the federal CCR Rule at the site. Should EPA establish effluent limits for groundwater impacted by CRL, then EPA would introduce unnecessary uncertainty to the remedy selection process.

More fundamentally, EPA's proposed ELGs for CRL in groundwater threaten to disrupt the foundation of the RCRA CCR program. Congress defined "solid waste" in the statute to exclude point sources subject to

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[94] 42 U.S.C. § 6944(a).

[95] *See* 40 C.F.R. §§ 257.95 – 257.98.

[96] Included in the record for EPA's proposed supplemental ELGs is a memorandum dated March 2, 2023, entitled, "Evaluation of Potential CRL in Groundwater – DCN SE10250." The memo provides EPA's estimates for the maximum amount of groundwater potentially impacted by CRL and the rate at which groundwater would need to be pumped and treated to meet the proposed BAT limits. *See* Memorandum from U.S. EPA, Evaluation of Potential CRL in Groundwater – DCN SE10250 (Mar. 2, 2023) (Docket ID No. EPA-HQ-OW-2009-0819-9678). It is clear from this memo that EPA assumes pump-and-treat systems will be required to meet those limits.

NPDES permits under the CWA.[97] If EPA determines that CRL in groundwater is subject to ELGs implemented through NPDES permits, then CRL in groundwater will no longer be considered solid waste subject to RCRA, or more specifically, to the comprehensive CCR regulatory program (including groundwater corrective action). Congress could not possibly have intended for EPA to usurp its legislative prerogative in this manner.

Finally, in its brief and incomplete discussion of the CCR regulatory program,[98] EPA fails to meaningfully address significant pending CCR rulemakings and litigation over recent CCR determinations, all of which will affect the scope and applicability of the proposed ELGs. These include:

1. Legacy CCR surface impoundment rule (proposal published in the Federal Register on May 18, 2023);
2. Inactive landfill rule (this proposal has been consolidated with the legacy surface impoundment rulemaking identified above and further expanded to include other "non-containerized accumulations of CCR" including historical solid waste management units such as CCR landfills and surface impoundments that closed under then-existing law prior to the effective date of EPA's 2015 CCR Rule);[99]
3. Federal permit program rule (final expected in July 2023);
4. Part B, Part 2 rule (TBD);
5. Part A and B decisions and DC Circuit litigation (Pending).

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[97] *See* 42 U.S.C. § 6903(27).

[98] *See* 88 Fed. Reg. at 18,831.

[99] EPA's May 18, 2023, proposal would significantly expand the universe of regulated units subject to the CCR Rule but just as in this rulemaking, EPA wholly fails to address the ELG consequences. In fact, quite to the contrary, EPA says in the May 18 preamble that "there is no longer a need to coordinate with the ELG compliance deadlines." 88 Fed. Reg. at 31,996. This statement is demonstrably false insofar as the newly regulated CCR units – including legacy CCR surface impoundments and inactive CCR landfills – may generate CRL subject to the proposed BAT limits, even though they will be subject to nearly immediate closure requirements.

EPA cannot possibly impose BAT limits on CRL-impacted groundwater from unlined landfills and surface impoundments without fully understanding – or explaining to the public – the scope of the potentially regulated universe (which will not be determined, at the earliest, until items 1 and 2 above are proposed and finalized). Nor can EPA draw rational conclusions about how its proposed ELGs will affect units that are in the closure process – or the timing of closure – without fully understanding the outcome of items 3, 4, and 5 above. This is particularly problematic since the CCR Rules impose prescriptive closure deadlines with limited extension opportunities, all of which are directly implicated by EPA's newly proposed BAT limits and pump-and-treat requirements for CRL in groundwater. For all these reasons, EPA should withdraw its proposal to regulate CRL in groundwater. Doing so would be entirely consistent with EPA's approach to the landfill point source category in 2000.

### B. EPA should not establish BAT or set effluent limits for CRL based upon the characteristics and treatment methods for FGD wastewater.

EPA solicits comment on whether it should establish BAT and set effluent limits for CRL based upon the characteristics and treatment methods for FGD wastewater. There are two key reasons why EPA should not pursue such an approach: 1) the two waste streams exhibit key differences that warrant different treatment; and 2) these two waste streams occur in entirely different settings, and for much different durations, relative to the life expectancy of the power plant itself.

Ultimately, both FGD wastewater and CRL result from combustion of coal. Therefore, there will be some similarities in the chemical composition of the waste streams. However, there are key differences in the waste stream chemical makeup that would allow a more cost-effective solution for CRL than is required for FGD wastewater. From a chemical standpoint, CRL is typically a much lower TDS waste stream than FGD wastewater with much lower concentrations of constituents that could necessitate different levels of treatment, such as selenium or nitrate. CRL typically contains selenium and nitrate at levels orders of magnitude lower than FGD wastewater, specifically making biological treatment a poor solution for CRL

compared to FGD wastewater. Unlike FGD wastewater, the production of CRL will long outlive the production of electricity at the plant. This fact should lead EPA toward considering more cost-effective options to effectively treat CRL. For at least these reasons, EPA should view the supporting basis for FGD wastewater limits and CRL limits as separate and distinct and should collect additional data as necessary to establish an appropriate BAT for CRL.

### C. EPA should not pursue more stringent technology than chemical precipitation and should avoid establishing ZLD limits for CRL.

EPA should not pursue the use of more stringent technology such as biological or thermal systems for the treatment of CRL. As discussed, CRL should be viewed as separate and distinct from waste streams produced only during the operating life of the power plant itself, such as FGD wastewater. CRL is different in that the waste stream will be produced long into the future beyond the plant's active life of producing electricity. Biological and thermal systems pose significant operating, maintenance, and economic burdens to an operating plant, and even more so after a plant's retirement. Similarly, spray dryer evaporator (SDE) systems, which evaporate water by a heat source (typically from a slipstream of hot flue gas) are known to create hygroscopic salts from power plant waste streams that can quickly become a liquid under atmospheric conditions.

EPA is soliciting comment on whether ZLD limits should apply to CRL, and, if so, whether they should be based upon membrane filtration. As stated previously, we strongly encourage EPA to study and consider CRL as a separate waste stream from FGD wastewater and not simply transfer limitations from FGD wastewater to CRL. As a practical matter, we are not aware that EPA's technical administrative record would support such an approach. Additionally, achieving ZLD for a waste stream with a long-anticipated duration is an energy-intensive proposition. The energy required to maintain a ZLD of CRL will have to come from somewhere, even after a plant has ceased generating electricity. Landfills don't always exist

near the plant infrastructure. In some cases, landfills are located in relatively remote areas, which may be miles away from the plant operations. Given these settings, we encourage EPA to instead seek effective treatment systems with lower energy requirements and allow owners to reduce the leachate generated over time through appropriate landfill water management practices.

### D. EPA should not set CRL limits for closed landfills or landfills at retired facilities.

CRL discharges from retired facilities or from landfills capped and closed prior to or within five years after promulgation of the rule should be exempt from further regulation and remain subject to the limits currently applied. Research shows that closed landfills have reduced CRL flows due to less rainfall that percolates through or drains from the materials placed in the landfill.[100] As the CRL flows decrease from closed landfills over time, the pollutant loadings decrease significantly. Likewise, in EPA's TDD for the proposed 2015 Rule, EPA provides the average CRL generation from active landfills is 65,500 gpd/plant, whereas the average CRL generation at retired landfills is 5,959 gpd/plant, less than 10% of active landfills.[101]

Annual CRL pollutant loadings for a closed landfill are provided in Table 2. Using EPA's flow rate for retired landfills and EPA's untreated CRL water quality data,[102] the pollutant loading per year for a closed

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[100] Electric Power Research Institute, Coal Combustion Residuals Leachate Management: Characterization of Leachate Quality and Evaluation of Leachate Minimization and Management Methods, 2015 Technical Report, 3002006283, at 3-4 (Dec. 2015).

[101] EPA, Technical Development Document for the Proposed Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, EPA-821-R-13-002, at 6-13, Table 6-8 (Apr. 2013), (DCN SE01964) (EPA Docket ID No. EPA-HQ-OW-2009-0819-2257).

[102] EPA, Technical Development Document for the Proposed Supplemental Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, EPA-821-R-23-005, at 61, Table 17 (Feb. 2023) (DCN SE10372) (Docket ID No. EPA-HQ-OW-2009-0819-9950).

landfill is 56,333 lbs/year and using EPA's toxicity weighting factors,[103] the loading per plant would be 38 TWPE/year or toxic-weighed pounds per equivalent/year. These numbers are significantly different with EPA's estimate of approximately 980,000 lbs/year at each operating plant.[104] EPA states that the pollutant loadings were calculated as the sum of TDS and TSS. Most of the TDS constituents discharged from CRL include sulfate, chloride, calcium, and sodium, which are not considered toxic and have not been assigned toxic weighing factors by EPA. Therefore, the lower flows and smaller quantity of pollutant loadings in CRL at closed landfills does not justify substantial capital cost investments for chemical precipitation.

In addition, when developing ELGs, the CWA requires EPA to consider the age of facilities involved and the cost of achieving effluent reduction. The costs of achieving the proposed BAT limits for CRL discharges at *retired* facilities would be much higher than compliance costs at *operating* facilities. EPA's cost estimates for CRL BAT (chemical precipitation), assuming an average flow rate of 63 gallons per minute (gpm), is $11.2 million capital, $0.65 million annual O&M, and $1.7 million annualized cost.[105] At a retired facility, the cost of power, labor, and residuals management and disposal is expected to be higher due to additional costs to bring power to the facility where no power is being generated onsite, the cost of a wastewater treatment operator who will work exclusively on the treatment system, and higher transportation and disposal costs for residuals management.[106]

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[103] EPA, Regulatory Impact Analysis for the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category, EPA-821-R-15-004, at Appendix F (Sept. 2015) (DCN SE07620) (Docket ID No. EPA-HQ-OW-2009-0819-7549).

[104] EPA, 2023 Technical Development Document, *supra* note 102, at 63, Table 20 (baseline 67,700,000 lbs/year divided by 69 plants).

[105] EPA assumed 7% interest rate and 20-year life for annualized cost.

[106] EPRI Comments, *supra* note 43, at 69.

**Table 2. CRL Pollutant Loadings from Closed Landfills**

| Pollutant | Toxic Weighted Factor | Untreated CRL[1] | Pollutant Loading[2] | |
|---|---|---|---|---|
| | | Average Conc. (µg/L) | lbs/year | TWPE/yr |
| Total Suspended Solids | | 35,800 | 649 | |
| Total Dissolved Solids | | 3,500,000 | 63,435 | |
| Priority Pollutants | | | | |
| Antimony | 0.01225 | 3.75 | 0.1 | 0.0 |
| Arsenic | 4.04133 | 38.4 | 0.7 | 2.8 |
| Cadmium | 23.11680 | 10.1 | 0.2 | 4.2 |
| Chromium | 0.07570 | 2,120 | 38.0 | 3.0 |
| Copper | 0.63482 | 7.58 | 0.1 | 0.1 |
| Mercury | 117.11802 | 1.06 | 0.0 | 2.3 |
| Nickel | 0.10891 | 46.5 | 0.8 | 0.1 |
| Selenium | 1.12134 | 111 | 2.0 | 2.0 |
| Thallium | 1.02706 | 1.16 | 0.0 | 0.0 |
| Zinc | 0.04689 | 211 | 4.0 | 0 |
| Non-conventional Pollutants | | | | |
| Aluminum | 0.06469 | 2,990 | 54 | 4.0 |
| Barium | 0.00199 | 53.2 | 1.0 | 0.0 |
| Boron | 0.00834 | 22,400 | 406 | 3.0 |
| Calcium | 0.00003 | 408,000 | 7,395 | 0 |
| Chloride | 0.00002 | 413,000 | 7,485 | 0 |
| Cobalt | 0.11429 | 38.6 | 0.7 | 0.1 |
| Iron | 0.00560 | 37,100 | 672 | 4.0 |
| Magnesium | 0.00087 | 118,000 | 2,139 | 2.0 |
| Manganese | 0.07043 | 2,720 | 49 | 3.0 |
| Molybdenum | 0.20144 | 1,380 | 25 | 5.0 |
| Sodium | 0.00001 | 308,000 | 5,582 | 0 |
| Sulfate | 0.00001 | 1,790,000 | 32,442 | 0 |
| Vanadium | 0.03500 | 1,910 | 35 | 1.0 |
| | | | | |
| TOTAL (TSS and TDS Only) | | | **64,084** | **N/A** |
| TOTAL (all except TSS and TDS) | | | **56,333** | **38.0** |

[1] Untreated CRL water quality obtained from Table 17 of 2023 TDD.

[2] Annual pollutant loading calculated using pollutant concentration and retired CRL daily flow obtained from Table 6-8 of the 2013 TDD multiplied by 365 days.

But EPA has not considered these costs. Therefore, in recognition of the age of the facilities and the cost of chemical precipitation, EPA should exclude retired facilities from the new CRL BAT limits or develop a new proposal that adequately assesses the potential regulatory impact on retired facilities.

### E. EPA should update its population of landfills that collect and discharge CRL and the total industry costs to comply with the proposed CRL limits based on chemical precipitation.

EPA has underestimated the number of landfills that collect and discharge CRL and the total industry costs to treat CRL with chemical precipitation technology to meet proposed mercury and arsenic limits. Table 12, *Estimated Cost of Implementation for Combustion Residual Leachate by Regulatory Option (in Millions of Pre-tax 2021 Dollars)*, in the 2023 TDD[107] includes 69 facilities that EPA has identified as the population of landfills containing CCRs that collect and discharge CRL to surface waters or POTWs. Also, Table 10 in EPA's memorandum, *Generating Unit-Level Costs and Loadings Estimates by Regulatory Option for the 2023 Proposed Rule (SE10381)*, provides costs for chemical precipitation treatment of CRL for 69 facilities. Later in its analysis, EPA found 65 additional facilities that have constructed new landfills since 2015 using data from utilities' "CCR Rule Compliance Data and Information" websites[108] but apparently did not include these facilities in their industry cost estimates. EPA needs to include these additional 65 landfills in its overall costs to the industry. The addition of these 65 facilities to EPA's cost estimates is more than likely to double the costs of CRL treatment to the industry. EPA needs to add these

[107] EPA, 2023 Technical Development Document, *supra* note 102, at 52, Table 12.

[108] Memorandum from U.S. EPA, Evaluation of Potential CRL in Groundwater, *supra* note 96.

costs into its total industry costs and rerun all its models to account for these additional costs, including the missing costs identified for FGD wastewater Option 3 compliance.

## VII. CONCLUSION

Southern Company is committed to building the future of energy for the advancement of our customers and communities. We are focused on transitioning our generating fleet to net zero greenhouse gas emissions and making the necessary related investments in our transmission and distribution grids, while maintaining reliability and affordability for our customers. EPA's recently proposed Supplemental ELG Rule threatens to disrupt the orderly fleet transition by increasing risks to reliability while burdening customers with undue costs. While The Southern Company is committed compliance with environmental laws, the realities of cost and reliability concerns in serving our customers cannot be ignored. We encourage EPA to finalize a Supplemental ELG Rule that can protect the environment, promote resiliency and reliability of the electric power system, and help to alleviate a significant cost burden to customers. We look forward to engaging constructively with EPA on this and future rulemakings.

# APPENDIX A

## Alabama Power Company - Plant Miller Membrane Cost Study

## First Page – Total Project Cost

## WesTech Budgetary Study Report

**Miller ELG - Screening**

**DI□ISI□□ □□ □ □R□ □D□□ □**

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| **Engineering** | □ | □R | | □□ | □□ | □ | □□ | □□□□□□□□□□ | □□ | □□□□□□□□□□ |
| CECEN285 - Design & Technical Services - Detailed Engineering | 0 | HR | | $0 | $0 | 0 | $0 | $2,679,017 | $0 | $2,679,017 |
| CECEN291 - Outsourced Detailed Engineering | 0 | HR | | $0 | $0 | 0 | $0 | $13,000,000 | $0 | $13,000,000 |
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| COCIN150 - T&PS - Construction Management | 0 | HR | | $0 | $0 | 0 | $0 | $3,827,167 | $0 | $3,827,167 |
| COCIN151 - Temporary Construction | 0 | HR | | $0 | $0 | 0 | $0 | $2,296,300 | $0 | $2,296,300 |
| COCPK001 - Underground Investigations / Site Work | | | 11,898 | $494,608 | $0 | 0 | $0 | $0 | $0 | $494,608 |
| COCPK006 - Mechanical | | | 0 | $58,003,045 | $76,223,647 | 0 | $0 | $0 | $0 | $134,226,692 |
| COCPK012 - Demolition | | | 199,209 | $9,434,339 | $0 | 0 | $478,170 | $0 | $0 | $9,912,510 |
| COCPK030 - Contractor Indirects | | | 0 | $5,430,748 | $5,335,655 | 0 | $0 | $0 | $0 | $10,766,403 |
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| TSSUC750 - Start-up and Commissioning | 0 | HR | 0 | $0 | $0 | 0 | $0 | $1,530,867 | $0 | $1,530,867 |
| TSSUC752 - Outsourced Start-Up and Commissioning | 0 | HR | 0 | $0 | $0 | 0 | $0 | $5,860,000 | $0 | $5,860,000 |
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| CPCOC301 - E&S | | | | $2,443,052 | $2,716,005 | | $15,924 | $972,167 | $0 | $6,147,147 |
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| CPCOC304 - Escalation | | | | $1,453,777 | $1,616,202 | | $9,476 | $578,504 | $0 | $3,657,958 |
| CPCOC305 - Contingency | | | | $14,672,548 | $16,311,860 | | $95,634 | $5,838,670 | $0 | $36,918,713 |
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| CPCOC300 - AFUDC/IDC | | | | $15,101,617 | $16,788,867 | | $98,431 | $6,009,410 | $0 | $37,998,325 |
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| | |
|---|---|
| Temporary Bio Rental (2.5 years from 2019 proposal) | $ 3,160,000 |
| ECO Materials contract buyout | 6,600,000 |
| Total | $279,075,708 |



# Alabama Power

# Plant Miller VIP – Budgetary Study

**Location**

Alabama Power James H. Miller
Generating Station
4250 Porter Rd. Quinton, AL 35130

**Contact**

Dallas Torgersen
dtorgersen@westech-inc.com
801.290.1921

**Owner**

Southern Company

**Representative**

Lawson Craig
Lawson@pureprocess.co
265.260.3967

WesTech®

Project Number: 24877
Wednesday, February 22, 2023

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# Technical Proposal

## Design Basis

The objective of this document is to provide Southern Company Services with a conceptual design and budgetary level cost estimate of certain deliverables associated with converting Alabama Power Company's existing flue gas desulfurization (FGD) wastewater treatment system at Plant Miller to comply with revised discharge limits for the treatment of FGD wastewater expected in EPA's forthcoming Effluent Limitations Guideline (ELG) Supplemental Rule. Alabama Power previously installed "chemical precipitation + low hydraulic residence time biological treatment" at Plant Miller for the treatment of FGD wastewater. The treatment system is designed to comply with EPA's 2015 and 2020 ELGs.

This document assumes EPA's new FGD wastewater discharge limits will be identical to the Voluntary Incentives Program (VIP) limits included in the agency's 2020 ELG rule and delineates a cost estimate for certain elements necessary for the installation of membrane filtration technologies (i.e., the "Process Island Costs").

### Reference Standards & Codes

- ANSI/ASME American Society of Mechanical Engineers B31.1 Power Piping Code
- American Institute of Steel Construction (AISC) specification for the Design, Fabrication and Erection of Structural Steel for Buildings
- AWS - American Welding Society: D1.1 - "Structural Welding Code - Steel".
- American Iron and Steel Institute (AISI) specification for the Design of Light Gauge Cold-Formed Steel Structural Members
- NEMA - National Electrical Manufacturers Association: MG 1 - "Motors and Generators".
- American Concrete Institute (ACI) Building Code requirements for reinforced Concrete ACI 318-63
- AISC Manual of Steel construction
- ASME B16.5 Pipe Flanges and Flanged Fittings
- ASME B30-2 Overhead and Gantry Cranes
- Underwriters Laboratories (UL): 10B - "Standard for Safety Fire Tests of Door Assemblies".
- NEC National Electric Code
- NFPA - National Fire Protection Association:
  - 70 - "National Electrical Code".
  - 80 - "Standard for Fire Doors and Fire Windows".
  - 101 – "Life Safety Code".

- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA): 29 CFR, Title 29 - "Occupational Safety and Health Standards".

### Governing codes for project location:

- 2006 International Building Code with Georgia amendments.
- Including and not limited to verifying and designing for the Seismic Site Class in accordance with IBC Section 1615.
- NFPA 101 – "Life Safety Code for Buildings".
- OSHA - Occupational Safety and Health Administration.

## WesTech General Specifications

- D-11 DESIGN FUNCTIONAL TAGS AND DESCRIPTIONS
- FIELD LINING SPECIFICATION
- PAINT COLOR GUIDANCE
- PAVEMENT STRUCTURES
- PREFERRED VENDOR LIST
- M_2_09 MECHANICAL INSULATION

## WesTech Electrical Specifications

### BGE Drawings

- BGE1001
- BGE1003
- BGE1004
- BGE1005
- BGE1006
- BGE1007
- BGE1008
- BGE1011

### Electrical Standards

- E-1-02 Raceway Naming
- E-1-03 Raceway Design Standard
- E-1-04 Circuit Naming

- E-1-05 Plant Circuitry
- E-1-06 Cable and Cable Bus
- E-1-07 Transformers
- E-1-08 Direct Current Distribution Systems Standard
- E-1-09 Fuses
- E-1-10 Lighting and Receptacles
- E-1-11 Grounding Standard
- E-1-13 Hazardous Classified Locations
- E-2-03 Cable Code Definition
- E-2-04 Electrical Mark Numbers
- E-2-10 Arc Flash Mitigation (1)

### Installation Standards

- Standard_Spec_SECTION_260000_Gen_Req
- Standard_Spec_SECTION_260526_grounding_system
- Standard_Spec_SECTION_260533_conduit
- Standard_Spec_SECTION_261213_outdoor_xfrmers
- Standard_Spec_SECTION_262716_boxes
- Standard_Spec_SECTION_265000_lighting_fixtures
- Standard_Spec_SECTION_266010_motors
- Standard_Spec_SECTIONS_2605xx_electrical_cables

### Other Specifications

- Cable Specification
- G95797 LV MCC Detailed Spec
- G95797 LV MCC General Spec
- Heat Tracing Specification

## Process Design

Below is a table of the influent water process design criteria provided as part of the request for quotation. This process stream will discharge from the Plant's existing FGD wastewater physical/chemical (phys/chem) treatment system and feed the new Membrane Treatment System (MTS).

**Table 1. Influent Design Criteria Values**

| Influent Design Criteria (to MTS) | | | | |
|---|---|---|---|---|
| **Parameter** | **Units** | **Normal (Cycled Down, Typ. Values, 50% Flow)** | **Design Case 1 (Cycled Down, Max. Values, 100% Flow)** | **Design Case 2 (Cycled Up, Max. Values, 100% Flow)** |
| Flow, total leaving Phys/Chem | gpm | 304 | 608 | 608 |
| Flow, portion feeding VSEP | gpm | 304 | 608 | 150 |
| Total Dissolved Solids (TDS) | mg/L | 8,000 | 10,000 | 35,000 |
| pH | S.U. | 6.7 | 5.5 – 8.5 | 5.5 – 8.5 |
| Total Suspended Solids (TSS) | mg/L | 6.4 | 50 | 50 |
| Oil & Grease | mg/L | <1 | <1 | <1 |
| As, total | µg/L | 2.5 | 5 | 12 |
| Hg, total | ng/L | 2,500* | 10,000** | 15,000*** |
| Nitrates/Nitrites | mg/L as N | 20 | 30 | 75 |
| Se, total | µg/L | 500 | 1,000 | 2,000 |
| Chloride | mg/L | 3,000 | 3,000 | 15,000 |
| Bromide | mg/L | 30 | 30 | 240 |
| Calcium, total | mg/L as CaCO3 | 1,000 | 1,500 | 3,000 |
| Magnesium, total | mg/L as CaCO3 | 1,500 | 1,500 | 5,000 |
| Temperature | Deg F | 50 - 120 | 50 - 120 | 50 - 120 |

**Notes:**
* Typical cycled down range for total mercury ranges from 200 to 3,000 ng/L
** Cycled down operation can range up to 6,500 ng/L with occasional, isolated spikes up to 10,000 ng/L.
*** Typical cycled up range is 5,000 to 9,000 ng/L with occasional isolated spikes up to 15,000 ng/L

The treatment system proposed herein is designed in accordance with the Design Case 1 constituent levels and maximum flowrate (608 gpm). This design case reflects conditions observed when all the FGD scrubber systems are cycled down and all treated effluent is discharged to the river. All brine generated is encapsulated, with no water returning to the FGD scrubbers as make-up water.

The performance of the proposed system has been evaluated at the Design Case 2, which reflects maximum cycled up values. This scenario reflects the recycling of the majority of treated effluent from the existing physical/chemical system back to the FGD scrubbers as makeup water. The remaining water is sent to the membrane system (150 gpm). All effluent from the membrane system is discharged to the river and all brine generated in the evaporators is encapsulated. Please refer to Item A – VSEP Membranes and Spiral Reverse Osmosis (RO) Membrane Systems for detailed equipment design information.

The following table outlines effluent performance criteria for the Membrane Treatment System discharges.

**Table 2. Membrane System Effluent Values (Permeate and Distillate Stream)**

| Membrane System Effluents (Permeate and Distillate Stream) | | | |
|---|---|---|---|
| **Parameter** | **Units** | **Maximum for any 1 Day** | **Maximum Rolling 30 Day Average** |
| Total Dissolved Solids (TDS) | mg/L | 306 | 149 |
| pH | S.U. | 6 - 9 | 6 - 9 |
| As, total | µg/L | 5 | NA |
| Hg, total | ng/L | 23 | 10 |
| Nitrates/Nitrites | mg/L as N | 2 | 1.2 |
| Se, total | µg/L | 10 | NA |
| Bromide | mg/L | 0.2 | NA |

Note that these effluent limits are assumed from the 2020 ELG VIP for reference only and do not constitute a process guarantee. WesTech can provide a formal process guarantee upon request.

### Assumptions

- The existing physical / chemical treatment will remain in service as pre-treatment ahead of the new Membrane Treatment System.
- The existing Biological Treatment System (BTS) may be decommissioned and removed.
- The existing Biological Treatment System ultrafiltration (UF) clean-in-place (CIP) system will not be removed if further analysis reveals this existing equipment can be reused in the new system.
- Unless otherwise stated, all subsystems and modular components will be provided as manufacturer's standard and will not follow any additional custom specifications.

## Plant Design

**Table 3. List of Major Equipment Vendors**

| Major Equipment Vendors | |
|---|---|
| **Type** | **Vendor** |
| Vibrating Membranes (VSEP) | New Logic Research |
| Spiral RO Membranes | New Logic Research |
| Thermal Evaporator (AVARA) | Purestream |
| Solidification Equipment | Jamieson Equipment Company |
| Process Pumps | Grundfos, or Equal |
| Chemical Metering Pumps | Grundfos, or Equal |
| PLC | Allen Bradley or Equal |
| Butterfly Valves | Bray or Equal |
| Ball Valves | Flow-Tek or Equal |
| Analytical Instrumentation | Endress+Hauser or Equal |
| Pressure Instrumentation | Endress+Hauser or Equal |
| Flow Instrumentation | Endress+Hauser or Equal |
| Level Instrumentation | Endress+Hauser or Equal |

*Final vendor selections may differ based on detailed engineering. WesTech may utilize an 'or equal' if needed.

### Sparing Philosophy

In general, WesTech will provide equipment with 2 x 50% sparing. Equipment not in 2 x 50% trains will at minimum treat 100% of design flow with expected equipment under routine cleaning (CIP), and will treat a minimum of 50% of design flow in all cases.

### Pumps

- ASME B73 or pump manufacturer standards will be considered, as applicable.

## Piping

**Table 4. Plant Miller Piping Summary Design Basis**

| Piping Summary | |
|---|---|
| **Service** | **Pipe Material** |
| Process, Above Ground, Inside | HDPE |
| Process, Above Ground, Outside | HDPE |
| Process, Underground, | HDPE |
| Process, Underground, Treated, Outfall | HDPE |
| Process, Underground, Treated, Outfall | HDPE |
| Process, Above Ground, Skidded Materials | 2205 |
| Process, Above Ground, Inside, MTS Boundary Limits | 2205 |
| Chemical, Hydrogen Peroxide | Tube: PVDF |
| Chemical, Ferric Chloride | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Hydroxide | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sulfuric Acid | Tube: PVDF |
| Chemical, Organosulfide | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Ferric Sulfate | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Sulfate | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Bisulfite | Tube: Polypropylene (CPVC on Skid) |
| Polymer, <= 1/2-in. | Tube: Polypropylene (CPVC on Skid) |
| Polymer, > 1/2-in. | Tube: Polypropylene (CPVC on Skid) |
| Service Water | CS |
| Air, Service, >= 1/2-in. | 304SS |
| Air, Instrument, >= 1/2-in. | 304SS |
| Air, Instrument, < 1/2-in. (Pressure Regulated) | Tube: 304SS (SwageLok) |
| Potable Water, Above Ground, Inside, < 2-in | Copper |
| Potable Water, Underground | HDPE |
| Fire Water, Inside, Sprinkler | CS |
| Sewer | HDPE |

### Battery Limits

The following tie points have been identified and will be specified with generalized (not to exceed) conditions for the purposes of developing engineering. The purchaser will be responsible for providing not to exceed values where indicated in the table below. Final tie point conditions will be identified in the Tie Point List which will be provided by WesTech with a 30% engineering package.

**Table 5. Plant Miller Battery Limit Tie Points**

| Tie Points | | | | | | |
|---|---|---|---|---|---|---|
| **#** | **Tie-Point** | **Max Flow (GPM)** | **Max Pressure (ft H2O)** | **Location** | **Grade Elevation (ft)** | **Connection Type** |
| 1 | Inlet to Influent Pump Skid | 608 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 2 | Final Effluent to Existing pipeline to FGD Effluent Tank | 520 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 3 | AVARA Brine Final Effluent | 23.1 | TBD | TBD | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 4 | Service Water | 21 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 5 | Sumps | | | | | |
| | Note 1: Effluent from any drain lines from the proposed system to the two (2) existing sumps on the BTS pad are to serve as a project boundary. WesTech has not included any sumps within this study. | | | | | |
| 6 | Compressed Air | | | | | |
| | Note 1: At BTS Pad. VSEP requirements are 66 CFM. | | | | | |
| 7 | Electrical | | | Note 1 | | |
| | Note 1: WT will determine location on field wiring plans (preliminary) with an engineering package after execution of the contract.<br>Other: WT will supply a 480V 3PH 60 HZ distribution panel for all loads inside the battery limits of the WWTS. Purchaser will be responsible for powering this panel based on not to exceed loads that will be provided on the single line diagram with an engineering package after execution of contract. | | | | | |
| 8 | Communication | | | Note 1 | | |
| | Note 1: WT will determine location on field wiring plans (preliminary) with an engineering package after execution of the contract<br>Other: Tie points will be at WT supplied PLC. Purchaser will be responsible for communication cable with any systems outside of 10’ of WesTech’s treatment boundary. | | | | | |

## Site Information

**Table 6. Plant Miller Site Specific Information**

| | | | |
|---|---|---|---|
| **Operating Company** | Alabama Power Company | | |
| **Plant** | Plant J.H. Miller | | |
| **Units** | 1-4 | | |
| **Street Address** | 4250 Porter Road | | |
| **City** | Quinton | | |
| **County** | Jefferson | | |
| **State** | Alabama | | |
| **Zip Code** | 35130-9471 | | |
| **Coordinates** | Longitude: | 87.06038º West | |
| | Latitude: | 33.63420º North | |
| **Grade Elevation** | 306'-0" ASL | | |
| **Railroad Access** | Yes (Burlington Northern and Norfolk Southern) | | |
| **Barge Access** | No | | |
| | **Minimum** | **Typical** | **Maximum** |
| **Ambient Temperature (ºF)** | -10 | 75 | 107 |
| **Indoor Temperature (ºF)** | 45 | 90 | 110 |
| **Ambient Relative Humidity (%)** | 30 | 60 | 100 |
| **Barometric Pressure (psia)** | | 14.535 | |
| **Average Monthly Rainfall (in)** | | 4.67 | |
| **Max. Daily Rainfall (25yr/24hr, in)** | | | 7.11 |
| **Max. Single Rainfall Event (10yr/2hr, in)** | | | 3 |

## Scope Split

**Table 7. Plant Miller Project Execution Scope Matrix**

| Scope Matrix | | | | |
|---|---|---|---|---|
| **Work Category** | **Functional Design/Input** | **Detailed Design** | **Supply** | **Install/ Perform** |
| Equipment Supply | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Earthwork | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Concrete | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Interconnecting Piping (plant)* | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Interconnecting piping (to plant)** | Owner | Owner | Owner | Owner |
| Interconnecting Wiring* | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Interconnecting Wiring (to plant)** | Owner | Owner | Owner | Owner |
| Main Power Distribution | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Transformer | WesTech | Owner | Owner | Owner |
| MCC | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| PLC | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Temporary Structures | WesTech | WesTech | 3rd Party Construction Contractor | 3rd Party Construction Contractor |
| Permitting | WesTech | WesTech | Owner | Owner |

*Within boundary limits of the plant

**Outside boundary limits of the plant (See Battery Limits)

## Process Flow Diagram

CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH

PFD 3
STAGE 3 RO CONCENTRATE

MULTI MEDIA FILTER EFFLUENT

TP 1

INFLUENT PUMP SKID

C1

STAGE 1 LOW PRESSURE VSEP FEED TANK

C2 C3

STAGE 1A-1G VSEP FEED PUMP AND BOOSTER PUMP SKID X 7

C4 C5

8 MEMBRANES PER SKID

F P C

STAGE 1A-1G LOW PRESSURE VSEP MEMBRANES SKID X 7

NOTE 2

NEW LOGIC STAGE 1 PACKAGE

STAGE 3 SPIRAL RO FEED TANK

STAGE 2 HIGH PRESSURE VSEP FEED TANK

*NOTES:*

1. FOLLOW THE LISTED WESTECH REFERENCE DOCUMENTS EXCEPT AS NOTED ON THIS DRAWING
2. IF CHLORIDE CORROSION BECOMES A CONCERN STAGE 1 MAY USE TWO FEED PUMPS INSTEAD OF TWO BOOSTER PUMPS AND TWO FEED PUMPS.

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| ---- | ---- |
| ENGINEER: | WESTECH ENGINEERING, LLC |
| ---- | SALT LAKE CITY |
| ---- | ---- |
| CONTRACTOR: | WESTECH ENGINEERING, LLC |
| ---- | SALT LAKE CITY, UTAH |
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TITLE **PROCESS FLOW DIAGRAM**
STAGE 1

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CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH

PFD 1
STAGE 1 LOW PRESSURE VSEP CONCENTRATE

STAGE 2 HIGH PRESSURE VSEP
FEED TANK

C2

STAGE 2A-1D VSEP FEED PUMP AND
BOOSTER PUMP SKID X 4

C4 C5

4 MEMBRANES PER SKID

F P C

STAGE 2A-2D HIGH PRESSURE
VSEP MEMBRANES SKID X 4

STAGE 3 SPIRAL RO FEED TANK

CONCENTRATE STORAGE TANK

NEW LOGIC STAGE 2 PACKAGE

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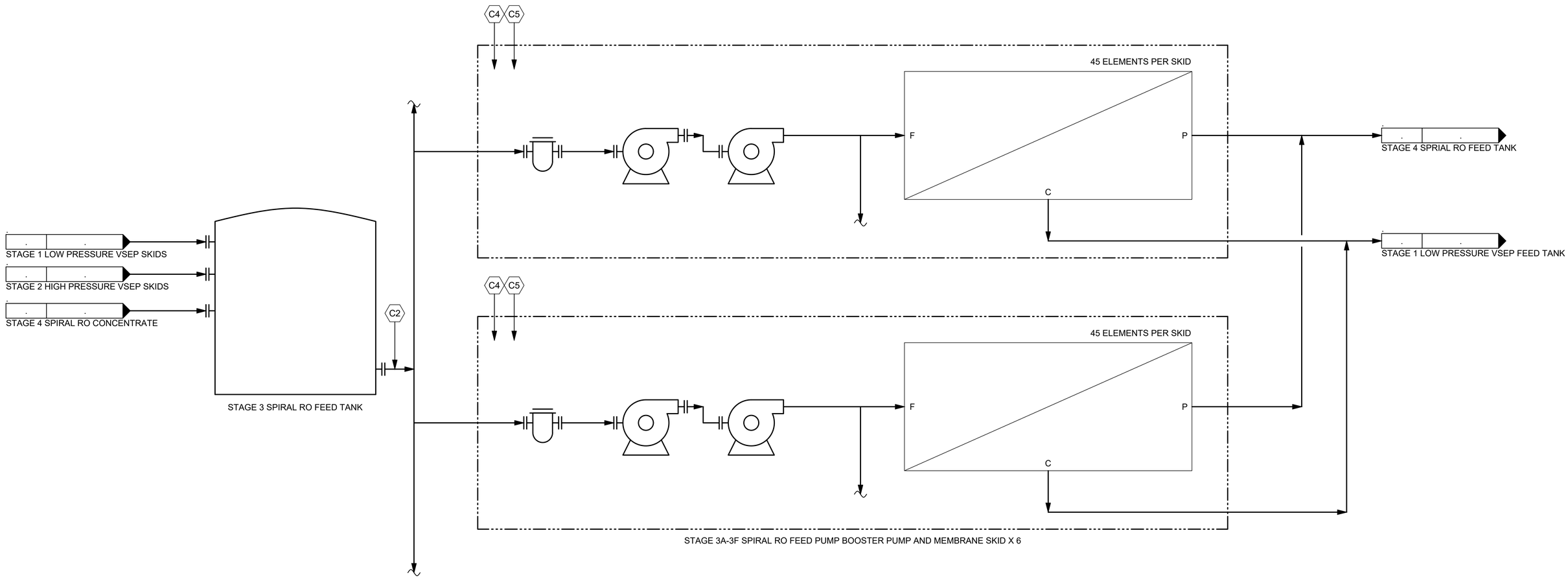
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STAGE 2

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CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH




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TITLE **PROCESS FLOW DIAGRAM**
STAGE 3

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CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH

STAGE 3 SPIRAL RO PERMEATE

STAGE 5 SPIRAL RO CONCENTRATE

STAGE 4 SPIRAL RO FEED TANK

C4 C5

45 ELEMENTS PER SKID

F

P

C

STAGE 5 SPIRAL RO FEED TANK

STAGE 3 SPIRAL RO FEED TANK

STAGE 4A-4F SPIRAL RO FEED PUMP BOOSTER PUMP AND MEMBRANE SKID X 6

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---- SALT LAKE CITY
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STAGE 4

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CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH

AVARA DISTALLATE

STAGE 4 SPIRAL RO PERMEATE

STAGE 5 SPIRAL RO FEED TANK

C4 C5

45 ELEMENTS PER SKID

F

P

C

C4 C5

45 ELEMENTS PER SKID

F

P

C

STAGE 5A-5F SPIRAL RO FEED PUMP BOOSTER PUMP AND MEMBRANE SKID X 6

PERMEATE FORWARDING STORAGE TANK

PERMEATE FORWARDING PUMP SKID

TP 2

3

FGD EFFLUENT TANK

STAGE 4 SPIRAL RO FEED TANK

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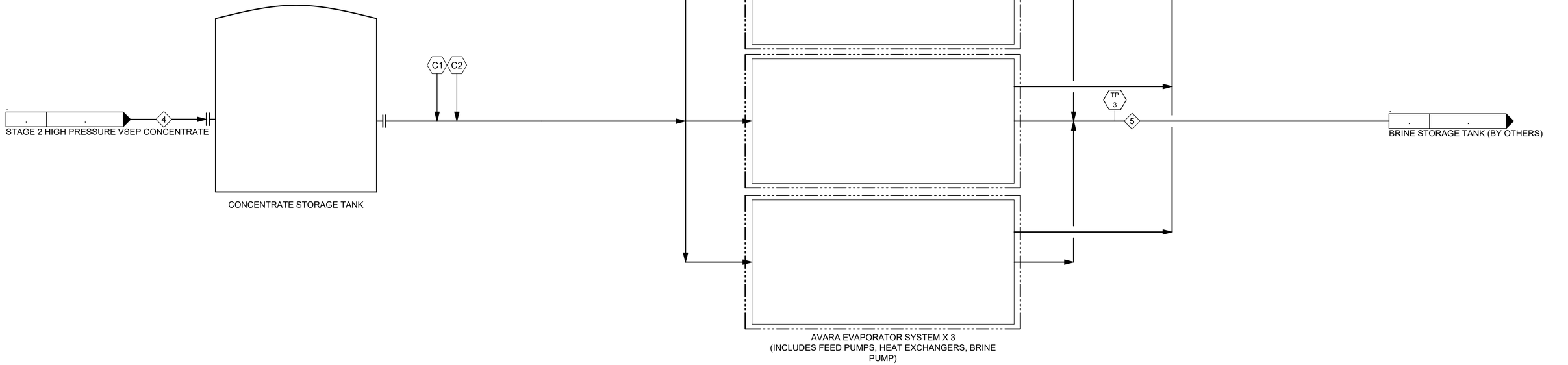
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STAGE 5

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CHEMICAL LEGEND:
C1 - ACID
C2 - ANTISCALANT
C3 - BISULFITE
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C5 - CIP HIGH PH




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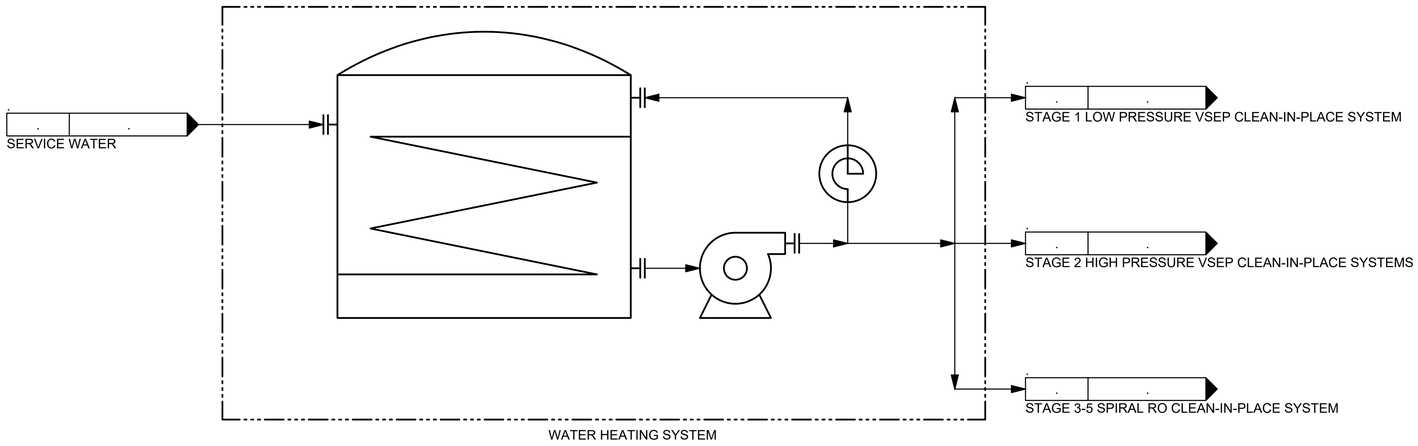
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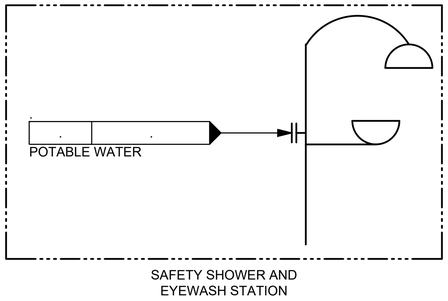
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AVARA EVAPORATION SYSTEMS

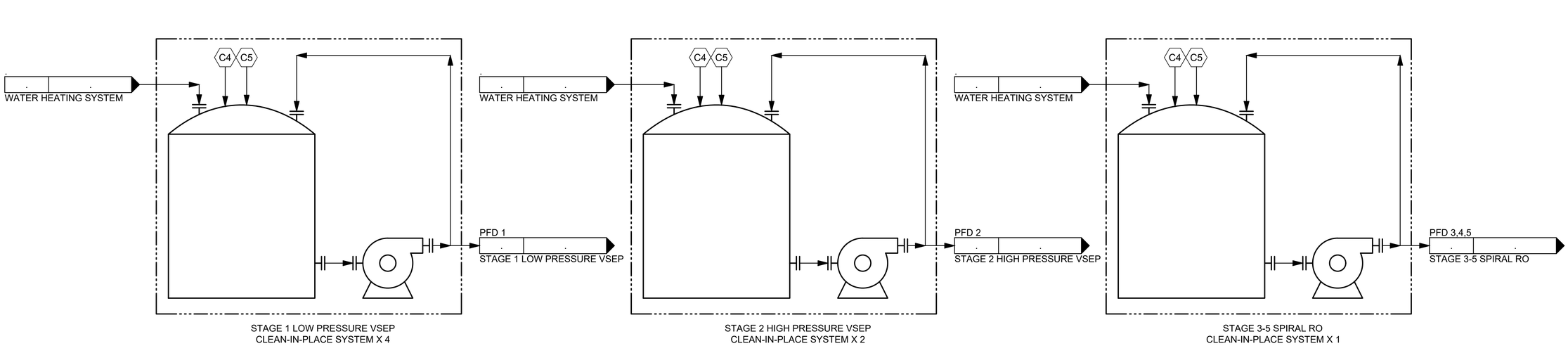
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CHEMICAL LEGEND:
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C2 - ANTISCALANT
C3 - BISULFITE
C4 - CIP LOW PH
C5 - CIP HIGH PH




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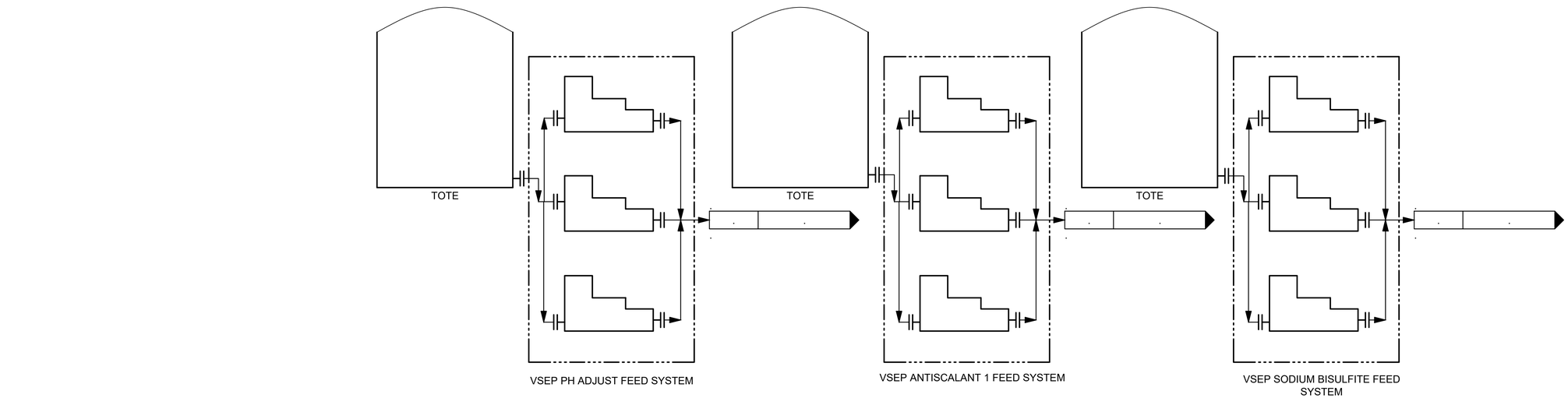
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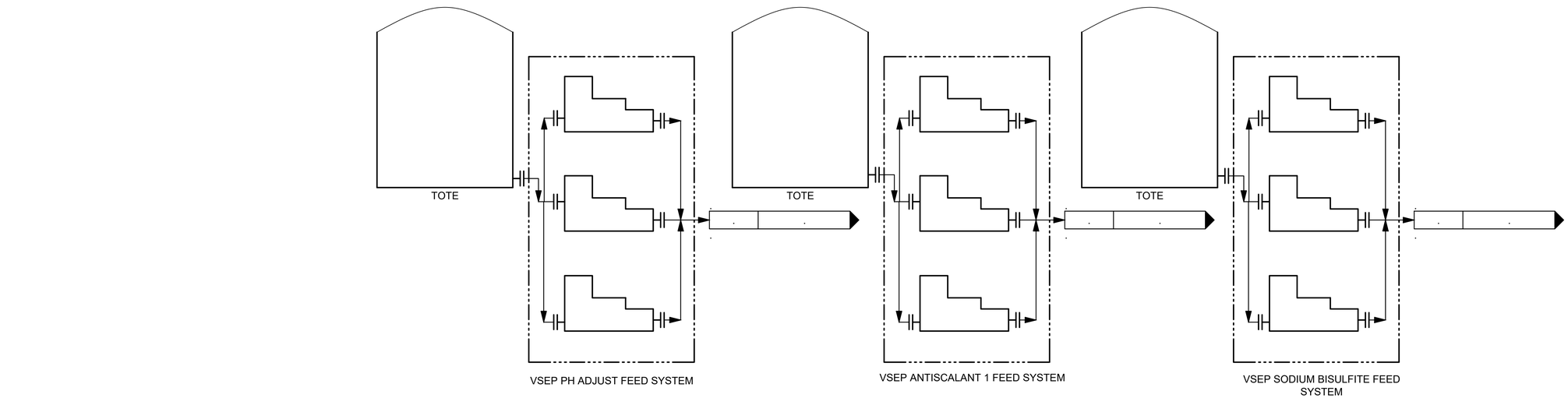
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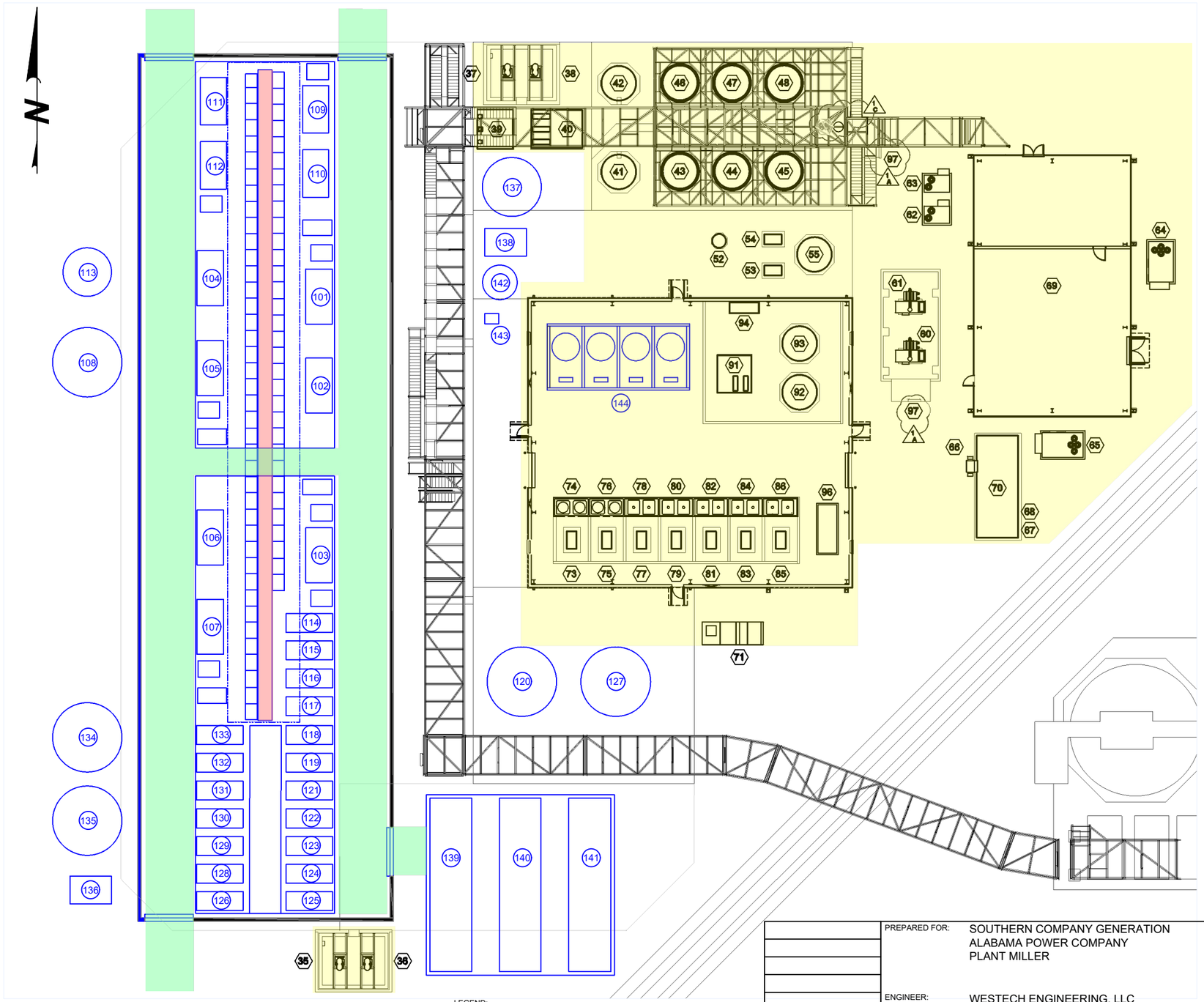
TITLE **PROCESS FLOW DIAGRAM**
CIP CHEMICAL SYSTEMS

| CLIENT DOCUMENT NUMBER | | | |
|---|---|---|---|
| **24877A-PR-PFD-01** | | | |
| DESIGNER | CHECKER | APPROVER | DATE |
| ---- | ---- | ---- | ---- |

| JOB NUMBER | DOCUMENT NUMBER | SHEET | REV |
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| 24877A | **XXX** | 9 OF 9 | **A** |

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## Site Plan




| NEW EQUIPMENT LIST | |
|---|---|
| ID NUMBER | DESCRIPTION |
| 101 | STAGE 1A VSEP |
| 102 | STAGE 1B VSEP |
| 103 | STAGE 1C VSEP |
| 104 | STAGE 1D VSEP |
| 105 | STAGE 1E VSEP |
| 106 | STAGE 1F VSEP |
| 1077 | STAGE 1G VSEP |
| 108 | STAGE 1 VSEP FEED TANK |
| 109 | STAGE 2A VSEP |
| 110 | STAGE 2B VSEP |
| 111 | STAGE 2C VSEP |
| 112 | STAGE 2D VSEP |
| 113 | STAGE 2 VSEP FEED TANK |
| 114 | STAGE 3A VSEP |
| 115 | STAGE 3B VSEP |
| 116 | STAGE 3C VSEP |
| 117 | STAGE 3D VSEP |
| 118 | STAGE 3E VSEP |
| 119 | STAGE 3F VSEP |
| 120 | STAGE 3 VSEP FEED TANK |
| 121 | STAGE 4A VSEP |
| 122 | STAGE 4B VSEP |
| 123 | STAGE 4C VSEP |
| 124 | STAGE 4D VSEP |
| 125 | STAGE 4E VSEP |
| 126 | STAGE 4F VSEP |
| 127 | STAGE 4 VSEP FEED TANK |
| 128 | STAGE 5A VSEP |
| 129 | STAGE 5B VSEP |
| 130 | STAGE 5C VSEP |
| 131 | STAGE 5D VSEP |
| 132 | STAGE 5E VSEP |
| 133 | STAGE 5G VSEP |
| 134 | STAGE 5 VSEP FEED TANK |
| 135 | PERMEATE FORWARDING STORAGE TANK |
| 136 | PERMEATE FORWARDING PUMP |
| 137 | CONCENTRATE STORAGE TANK |
| 138 | CONCENTRATE FORWARDING PUMP |
| 139 | AVARA SYSTEM A |
| 140 | AVARA SYSTEM B |
| 141 | AVARA SYSTEM C |
| 142 | HOT WATER TANK |
| 143 | HOT WATER FORWARDING PUMP |
| 144 | CHEMICAL SYSTEM AREA |

| REV | REVISION DESCRIPTION | ECN | DESIGNER | APPROVER | DATE |
|---|---|---|---|---|---|
| A | FOR INFORMATION ONLY | - | HA76 | SO74 | 2023-02-01 |

REFERENCE DOCUMENTS

PREPARED FOR: SOUTHERN COMPANY GENERATION
ALABAMA POWER COMPANY
PLANT MILLER

ENGINEER: WESTECH ENGINEERING, LLC
SALT LAKE CITY, UTAH

CONTRACTOR:

PO/CONTRACT NUMBER: 1179664

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TITLE **PLANT MILLER UNITS 1-4**
OVEALL SITE LAYOUT
PLAN VIEW

CLIENT DOCUMENT NUMBER

| DESIGNER | CHECKER | APPROVER | DATE |
|---|---|---|---|
| HA76 | BA123 | SO74 | 2023-02-01 |

| JOB NUMBER | DOCUMENT NUMBER | SHEET | REV |
|---|---|---|---|
| 24877A | | 11 OF 11 | 1 |

# Process Description

## Membrane Treatment System

### Stage 1 VSEP Feed Tank

The influent for the system goes into the Stage 1 VSEP Feed Tank. The Stage 1 VSEP Feed Tank is fed by the existing Multimedia Filter effluent. The Tank also receives flow from the concentrate of the Stage 3 Reverse Osmosis (RO) membrane. Acid is added to the Stage 1 Tank for any necessary pH adjustment. Anti-scalant and bisulfite are dosed in the header to prevent scaling and reduce chlorine respectively.

The Stage 1 Low Pressure VSEPs pull from the Stage 1 VSEP Feed Tank. To prevent cavitation of the VSEP Feed Pumps, a Booster Pump on the feed line starts when both low pressure VSEP membranes are active.

### Stage 1 Low Pressure VSEP

The Low Pressure VSEP Membranes use membrane filtration to separate suspended and dissolved solids. They employ a unique vibrating filter pack that produces a high shear rate on the membrane surface which inhibits membrane surface fouling and induces greater filtrate flow rates during the filtration process.

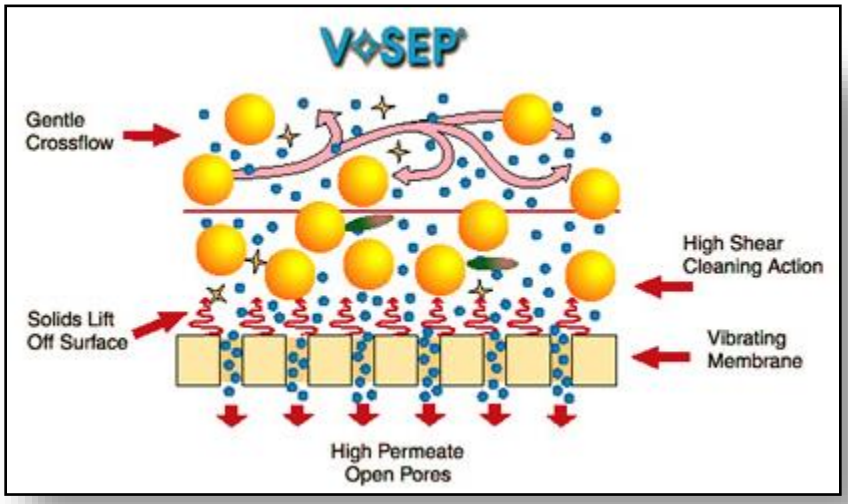



**Figure 1. New Logic Vibratory Shear Enhanced Processing Membrane leaf element tangential vibration process. Courtesy of https://www.vsep.com/technology/**

The Stage 1 Low Pressure VSEPs discharge two streams: permeate (filtrate or product) and concentrate (brine or retentate). The VSEP concentrate is sent to the Stage 2 High Pressure VSEP Feed Tank. The permeate is sent to the Stage 3 Spiral RO Feed Tank.

The membranes will need to be cleaned occasionally to remove accumulated foulants or scaling. There are two modes of cleaning, flush and CIP. Flush is a lower pressure single pass step where heated RO permeate is sent to the system for removal of foulants and/or scaling. CIP is a lower pressure recirculation step where heated RO permeate mixed with cleaning chemicals is sent to the system for removal of more stubborn foulants.

### Stage 2 High Pressure VSEP Feed Tank

The Stage 2 High Pressure VSEP Feed Tank receives flow from the Low Pressure VSEP membranes concentrate. This Tank is the feed tank to the Stage 2 High Pressure VSEP membranes for further volume reduction. Antiscalant is dosed after the Feed Tank to prevent scaling.

### Stage 2 High Pressure VSEP

The High Pressure VSEP membranes use membrane filtration to separate suspended and dissolved solids. They employ a unique vibrating filter pack that produces a high shear rate on the membrane surface which inhibits membrane surface fouling and induces greater filtrate flow rates during the filtration process. Stage 2 membranes operate at a higher pressure than Stage 1 due to the higher dissolved solids loading in the brine feed that must be rejected at the membrane surfaces.

The Stage 2 High Pressure VSEPs discharge two streams: permeate (filtrate or product) and concentrate (brine or retentate). The Stage 2 High Pressure VSEP concentrate is sent to the Concentrate Storage Tank. The permeate is sent to the Stage 3 Spiral RO Feed Tank.

The membranes will need to be cleaned occasionally to remove accumulated foulants or scaling. There are two modes of cleaning, flush and CIP. Flush is a lower pressure single pass step where heated RO permeate is sent to the system for removal of foulants and/or scaling. CIP is a lower pressure recirculation step where heated RO permeate mixed with cleaning chemicals is sent to the system for removal of more stubborn foulants.

### Stage 3 Spiral RO Feed Tank

The Stage 3 Spiral RO Feed Tank receives flow from the Stage 1 Low Pressure VSEP permeate, Stage 2 High Pressure VSEP permeate, and Stage 4 Spiral RO concentrate. This tank is the feed tank to the Stage 3 Spiral RO membranes for further polishing.

### Stage 3 Spiral RO

The Stage 3 Spiral RO is the first stage of polishing after the VSEP membranes. There are 3 stages of RO (Stages 3, 4, and 5) total. The last stage is required to lower the mercury concentration to the required effluent quality. The same principles of operation apply to this membrane as the Stage 1 Low Pressure VSEP membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Stage 4 Spiral RO Feed Tank. The concentrate is recycled back to the Stage 1 Low Pressure VSEP Feed Tank for additional processing. The Stage 3 Spiral RO is cleaned in a similar manner to the Stage 1 and 2 VSEP membranes.

### Stage 4 Spiral RO Feed Tank

The Stage 4 Spiral RO Feed Tank receives flow from the Stage 3 Spiral RO permeate, and Stage 5 Spiral RO concentrate. This tank is the feed tank to the Stage 4 Spiral RO membranes.

### Stage 4 Spiral RO

The Stage 4 Spiral RO is the second stage of polishing after the VSEP membranes. The same principles of operation apply to this membrane as the Stage 3 Spiral RO membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Stage 5 Spiral RO Feed Tank. The concentrate is recycled back to the Stage 3 Spiral RO Feed Tank for additional processing. The Stage 4 Spiral RO is cleaned in a similar manner to the previous system membranes.

### Stage 5 Spiral RO Feed Tank

The Stage 5 Spiral RO Feed Tank receives flow from the Stage 4 Spiral RO permeate. This tank is the feed tank to the Stage 5 Spiral RO membranes.

### Stage 5 Spiral RO

The Stage 5 Spiral RO is the third and final stage of polishing after the VSEP membranes. The same principles of operation apply to this membrane as the previous spiral RO membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Permeate Forwarding Storage Tank. This permeate water will meet the effluent limits assumed from the 2020 ELG VIP. The concentrate is recycled back to the Stage 4 Spiral RO Feed Tank for additional processing. The Stage 5 Spiral RO is cleaned in a similar manner to the previous system membranes.

### Permeate Forwarding Storage Tank

The Permeate Forwarding Storage Tank will receive flow from the Stage 5 Spiral RO membranes and the AVARA distillate. The Permeate Forwarding Storage Tank supplies the Permeate Forwarding Pump Skid that sends water to the FGD Effluent Tank located in the existing Phys/Chem Treatment Area. Contents of the FGD Effluent Tank are pumped to the river for final discharge.

### Concentrate Storage Tank

The Concentrate Storage Tank will receive the concentrate flow from the Stage 2 High Pressure VSEP membranes. It will feed the AVARA system.

### Thermal Evaporator (AVARA)

There will be 3 Thermal Evaporators in parallel in this process. The thermal evaporators will be AVARA systems. AVARAs use advanced vapor recompression technology for thermal evaporation and to concentrate a brine stream. AVARA systems are fully automated and come as a fully skidded solution.

The Thermal Evaporators will operate as 3x33%. The AVARAs will be fed by the Concentrate Storage Tank. The brine of the 3 AVARAs will go to the Brine Storage Tank while the distillate will be fed to the permeate forwarding tank.

The Thermal Evaporator is used to concentrate brine from the High Pressure VSEP membranes to the point just before saturation. It is expected that the concentration of TDS could reach up to 262,000 ppm.

The Thermal Evaporators will heat the feed concentrate to the point of boiling. Water is pumped through a 500-mesh self-cleaning filter and split into two streams. One stream is sent through the distilled heat-exchanger while the other is sent through the brine heat exchanger. The streams recombine and are sent to the core tank section of the AVARA.



**Figure 2. AVARA Advanced Vapor Recompression Process Schematic – Heat Exchange. Courtesy of www.purestream.com/project-2**

In the core tank section, water is boiled to create a saturated vapor. Vapor is compressed to between 3 and 7.5 PSI with a blower. The compressed vapor is then forced through dimpled plates. As the vapor moves through the plates, it condenses. The condensed and distilled water is then pumped through the feed heat exchangers and out of the system as effluent to the Permeate Forwarding Storage Tank.

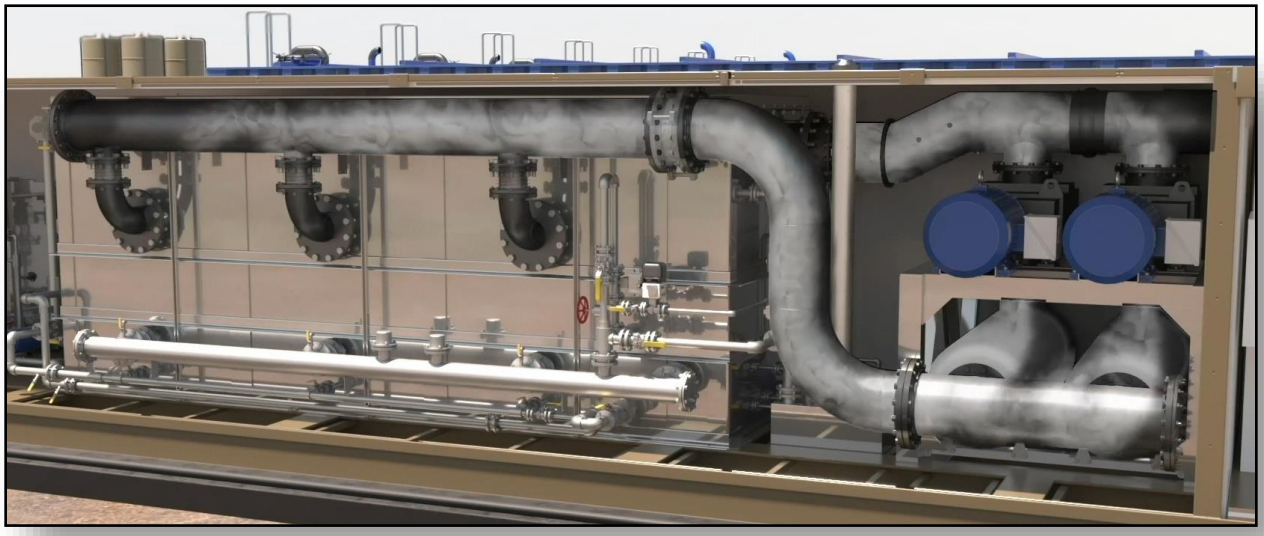


**Figure 3. AVARA Advanced Vapor Recompression Process Schematic – Vaporization. Courtesy of www.purestream.com/project-2**

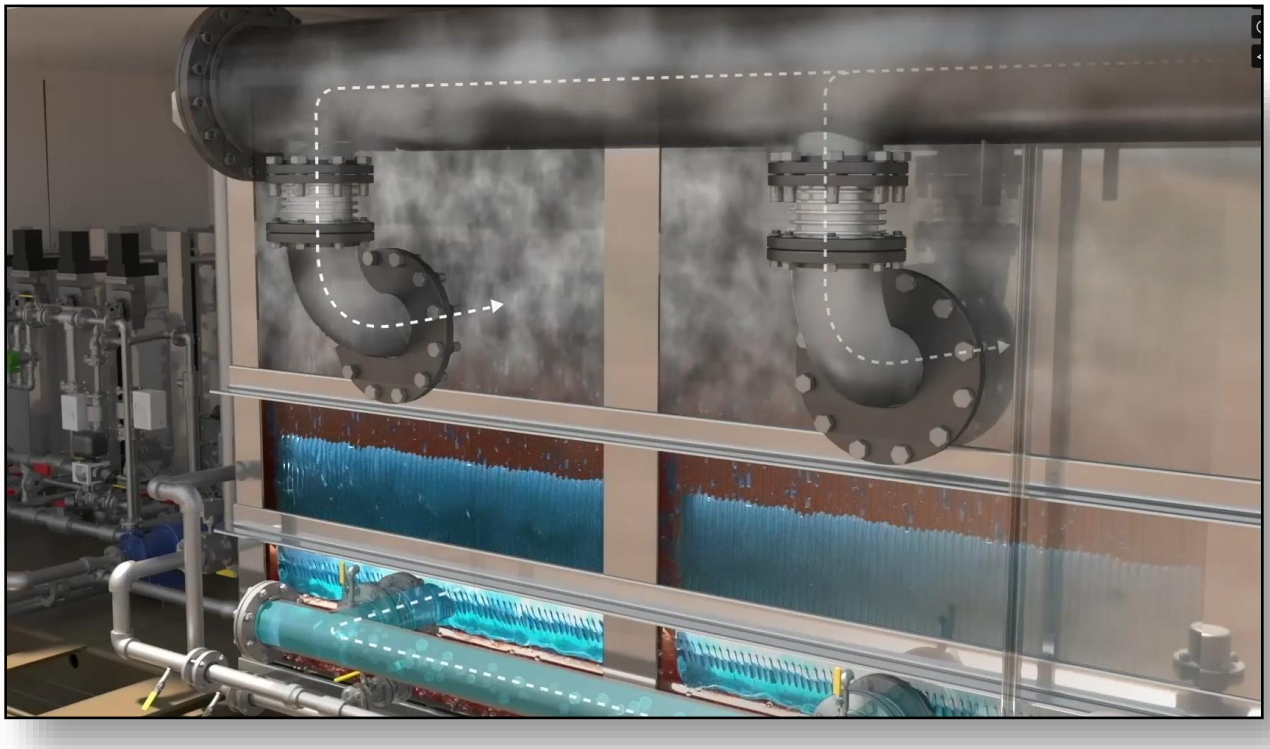


**Figure 4. AVARA Advanced Vapor Recompression Process Schematic – Condensation. Courtesy of [www.purestream.com/project-2](www.purestream.com/project-2)**

Operators watch the pressures within the AVARA. Changes in pressure can change production rate and temperature making it a key process condition. Operators can adjust relief valves, heater temperature, blower speed, and the heat exchanger by-pass valve to optimize system pressures.

With much of the feed water evaporated, condensed, and discharged, the brine left in the AVARA will continue to recirculate through the heat exchanger. Once it is concentrated to near saturation, it is pumped out of the system. A control valve will control brine discharge flowrate and will be set to maintain the desired brine concentration. Brine will be sent to the Brine Storage tank and then processed through the Solidification Batch Plant.

### Brine Solidification Batch Plant

The solidification plant will collect, store, and meter dry solidification materials and brine for loading into a cement mixer. These solidification materials are Flyash, Lime, and standard concrete conditioning additives. Flyash with small amounts of lime will be used as the primary solidification material. If Flyash is not readily available Cement and lime can be used as an alternative. These materials will be stored in silos above a weigh hopper. These materials will be metered into the weigh hopper at a known quantity. This hopper will feed the dry material into cement trucks followed by brine for mixing. The solidification plant will be designed for fugitive dust control. The cement truck will transport the mixed material for disposal. The solidified brine mixture will pass both the paint filter test and the Toxicity Leaching Characteristic Procedure prior to being landfilled in an off-site facility.

## Equipment List

**Table 8. Plant Miller Budgetary Study Major Equipment List**

| Major Equipment List | | | |
|---|---|---|---|
| **Item** | **Description** | **Materials** | **Size** |
| Influent Pump Skid | Centrifugal | SS | 1 Skid<br>2 x 100% pumps per skid<br>@ 20 psi<br>610 gpm total<br>10 HP each |
| Stage 1 VSEP Feed Tank | Flat Bottom Tank<br>(Knock Down)<br>No Roof | FRP | 1 x 100%<br>50,000 gal<br>20'D x 25'H |
| Stage 1A – 1G VSEP Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | 7 Skids<br>4 x 25% pumps per skid<br>@ 450 PSI<br>608 gpm total<br>200 HP each |
| Stage 1A – 1G Low Pressure VSEP Membranes | Vibrating disc membrane filters | Varies | 7 Skids<br>8 Modules per Skid<br><br>54 of 56 Modules (84")<br>(2 spare/future)<br>792 gpm total<br>8 x 20 HP Vibration Motors<br>~5650 lb |
| Stage 2 High Pressure VSEP Feed Tank | Cylindrical closed top tank | HDPE | 1 x 100%<br>12,000 gal<br>12'D x 16' – 7.75"H |
| Stage 2A – 2D High Pressure VSEP Feed Pumps | Positive displacement | SS | 4 skids<br>4 x 25% pumps per skid<br>@ 750 PSI<br>200 gpm total<br>30 HP each |
| Stage 2A – 2D Membranes High Pressure VSEP Membranes | Vibrating disc membrane filters | Varies | 4 Skids<br>4 Modules per Skid<br><br>16 of 16 Modules (17")<br>(0 spare/future)<br><br>200 gpm total<br>6 x 20 HP Vibration Motors<br>~5650 lb |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 3 Spiral RO Feed Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>50,000 gal<br>20'D x 25'H |
| Stage 3A – 3F Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (6x)<br>2 pumps per skid @ 300 PSI<br>840 gpm total<br>100 HP each |
| Stage 3A – 3F Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 6 Skids<br><br>45 Elements per skid (270 Total)<br>(0 spare/future)<br><br>840 gpm total<br><br>~12,000lb |
| Stage 4 Spiral RO Feed Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>45,000 gal<br>20'D x 22' – 6"H |
| Stage 4A – 4F Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (6x)<br>2 pumps per skid @ 200 PSI<br>745 gpm total<br>60 HP each |
| Stage 4A – 4F Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 6 Skids<br><br>45 Elements per skid (270 Total)<br>(0 spare/future)<br><br>745 gpm total<br>~12,000 lb |
| Stage 5 Spiral RO Feed Tank | Steel Bottom Tank (Knock Down)<br><br>A36 Construction, No Roof | FRP | 1 x 100%<br>35,000 gal<br>20'D x 18' – 6"H |
| Stage 5A – 5F Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (6x)<br>2 pumps per skid @ 200 PSI<br>610 gpm total, 50 HP each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 5A – 5F Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 6 Skids<br><br>45 Elements per skid (270 Total)<br>(0 spare/future)<br><br>610 gpm total<br><br>~12,000 lb |
| Permeate Forwarding Storage Tank | Steel Bottom Tank (Knock Down)<br><br>A36 Construction, No Roof | FRP | 1 x 100%<br>30,000 gal<br>20'D x 18' – 6"H |
| Permeate Forwarding Pumps | Vertical Multi-Stage Centrifugal | SS | 2 x 100% @ 60 PSI<br>610 gpm<br>15 HP |
| Concentrate Storage Tank | Flat Bottom Tank (Knock Down) | FRP Tank | 1 x 100%<br>30,000 gal<br>17'D x 28'H<br><br>Θ = 5.3 hr @ max flow<br>Θ = 16 hr @ 1 AVARA off-line |
| | Includes Top Mounted Mixer and Mixer Bridge (supports to grade) | Carbon steel for mixer bridge (Painted) | 7.5HP mixer |
| Evaporator Feed Pump | Horizontal Centrifugal | SS | 3 x 33% @ 60PSI<br>90 gpm total, 30 gpm each<br>1.5 HP each |
| Evaporator Booster Pumps | Horizontal Centrifugal | SS | 6 x 33% @ 43PSI<br>90 gpm total, 30 gpm each<br>5 HP each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Evaporators | AVARA Advanced Vapor Recompression System | Varies | 3 x 33%<br>90 gpm total, 30 gpm each<br><br>12'W x 50'L x 10'H each<br>20.5 GPM Brine Flow<br><br>*Power Requirements:*<br>480V/3 Ph/ 600 Amp Breaker x (6) 3600 Amp Total<br><br>MVR Vapor Blowers A/B:<br>200 HP<br><br>Core Heaters<br>6 x 40 kW |
| Distillate Discharge Pump(s) | Horizontal Centrifugal | SS | 3 x 33%<br>*25 gpm @ 45 psi, 5 HP*<br>(68.54 gpm total) |
| Concentrate (Brine) Recycle/Discharge Pump(s) | Horizontal Centrifugal | SS | 3 x 33%<br>*10 gpm @ 60 psi, 5 HP*<br>(23.1 gpm total) |
| Stage 1 Low Pressure VSEP Clean-in-Place System | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 4 Systems<br><br>1 x 100% pumps each @ 250 PSI<br>60 gpm 20HP |
| | pH Sensor<br>Level Sensor | HDPE Tank/Piping | 260-gal HDPE Tank<br>3'D x 6' – 4"H<br><br>~2010 lb each |
| Stage 2 High Pressure VSEP Clean-in-Place Systems | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 2 Systems<br><br>1 x 100% pumps each @ 250 PSI<br>60 gpm 20HP |
| | pH Sensor<br><br>Level Sensor | HDPE Tank/Piping | 200-gal HDPE Tank each<br>3'Dx 4' – 6"H<br>~2010 lb each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 3-5 Spiral RO Clean-in-Place System | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 1 Systems<br><br>1 x 100% pumps each @ 185 PSI<br>60 gpm 20HP |
| | pH Sensor<br><br>Level Sensor | HDPE Tank/Piping | 200-gal HDPE Tank each<br>3'D x 4'– 6"H<br><br>~2010 lb each |
| Water Heating System | | Varies | 400 HP max<br><br>Tank – 6,100 gal<br>10'D x 12' – 8"H |
| Brine Storage Tank(s) | Closed Top Cylindrical Tank with Mixing | HDPE<br><br>316 SS Wetted Mixer End* | 3 x 33%<br>20.5 gpm<br>24 hours of storage<br><br>12,000 gal ea. |

*Mixer material selection may change depending on the results of future pilot results.

**Table 9. Chemical Feed Systems and Tankage Equipment List**

| Chemical Feed Systems & Tankage | | | |
|---|---|---|---|
| **Item** | **Description** | **Materials** | **Size** |
| VSEP Antiscalant 1 Feed System | Tote Fed<br><br>100% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| VSEP pH Adjust Feed System | Tote Fed<br><br>Sulfuric Acid<br>93% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1.2 gph<br>0.5 HP each |
| VSEP Sodium Bisulfite Feed System | Tote Fed<br><br>40% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>2 gph<br>0.5 HP each |
| VSEP Antiscalant 2 System | Tote Fed<br><br>100% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| Spiral RO Antiscalant 2 System | Tote Fed | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| Stage 1 Low Pressure VSEP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 4 x 100% Metering pumps<br>1 HP each |
| Stage 1 Low Pressure VSEP CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 4 x 100% Metering pumps<br>1 HP each |
| Stage 2 High Pressure VSEP CIP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 2 x 100% Metering pumps<br>1 HP each |
| Stage 2 High Pressure VSEP CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 2 x 100% Metering pumps<br>1 HP each |
| Stage 3-5 Spiral RO CIP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 1 x 100% Metering pumps<br>1 HP each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 3-5 Spiral RO CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 1 x 100% Metering pumps<br>1 HP each |
| NLR 404 Storage Tank | Cylindrical Closed Top Chemical Storage Tank | HDPE | 1 x 100%<br>4000 gal |
| NLR 505 Storage Tank | Cylindrical Closed Top Chemical Storage Tank | HDPE | 1 x 100%<br>4000 gal |
| AVARA Acid Feed System | Tote Fed | | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>1 HP each |
| AVARA Antiscalant Feed System | Tote Fed | | 2 x 100% Metering pumps (plus shelf spare) pumps<br>1 gph<br>0.5 HP each |

# Level 1 Schedule

[Attached separately until final draft]

## Major Equipment Lead Times

**Table 10. Major Equipment Lead Times**

| Major Equipment Lead Times | |
|---|---|
| **Equipment (Vendor)** | **Lead Time** |
| Membranes (New Logic Research) | 24 months |
| Evaporators (Purestream - AVARA) | 10 months |
| Solidification Batch Plant (Jamieson) | 30 weeks |

# VSEP & AVARA Equipment Descriptions

## Item A – VSEP Membranes and Spiral RO Membrane Systems

**Table 11. New Logic VSEP and Spiral RO Membrane System Design Overview**

| System Design Overview | |
|---|---|
| **Parameter** | **Value** |
| Influent Flow Rate | 608 gpm |
| Estimated Average Filtrate Rate Performance[1] | 16 gfd |
| Estimated System Filtrate Recovery | 85% |
| Design Basis[2] | 25°C, 450 psi – LP VSEP, 750 psi HP VSEP |
| Stage 1 LP VSEP Recovery | ~75% |
| Stage 1 LP VSEP Design Flux | 16 gfd |
| Stage 2 HP VSEP Recovery | ~55% |
| Stage 2 HP VSEP Design Flux | 12 gfd |
| Stage 3 SRO Recovery | ~78% |
| Stage 4 SRO Recovery | ~82% |
| Stage 5 SRO Recovery | ~85% |
| Stage 3 – 5 SRO SRO Design Flux | 10 gfd |

1. Estimated average performance at 10,000 mg/L TDS.
2. See Basis of Design and Equipment List for Stage specific pressure requirements

### Design Assumptions:

#### Design Case 1:

The VSEP Stage 1 modules are designed for a total flow rate of 792 gpm. This includes 608 gpm of phys/chem effluent at a TDS concentration of 10,000 mg/L and 184 gpm of recycled reject from the Stage 3 Spiral RO Membranes. A membrane efficiency factor of 130% is applied to the design flux to reflect the decrease in membrane throughput over time. The operating flux is expected to decline to 100% of the design flux after three years of operation.

Membrane cleaning frequency is estimated on a per day basis at roughly 8% of an operational day. It is important to note that this is not the actual cleaning/maintenance frequency and is an estimated average value.

The third stage of the spiral RO is required due to the high influent mercury levels of 10,000 to 15,000 ng/L. The Second Stage Spiral RO can achieve approximately 30 ng/L, and the additional third stage is needed to achieve the required effluent value of 10 ng/L.

#### Design Case 2:

Design Case 2 assumes a majority of phys/chem effluent is recycled back to the FGD scrubbers as makeup water. The remaining water is sent to the membrane treatment system (150 gpm, 35,000 pm

TDS, 15,000 ng/L Hg, total). This flow may be routed directly to the Stage 2 HP VSEP membranes for treatment and achieve identical effluent values with Design Case 1 feeding the Stage 1 LP VESP membranes. Stage 2 HP VSEP permeate is sent through the Spiral RO Membrane stages with reject from those stages recycled back to the Stage 2 HP VSEP influent.

## VSEP Stage 1 Low Pressure Membranes Specifications:

### Filter Pack:

| | |
|---|---|
| Membrane: | RO |
| Allowable Process Temperature: | 5°C - 60°C |
| Allowable Feed Slurry pH Range: | 2 - 12 |
| O-ring and Seal Material: | EPDM |
| Filter Pack Housing: | Glass impregnated epoxy resin (FRP) |
| Wetted Steel Trays: | 304 Stainless Steel |
| Wetted Plastic End Plates: | Polypropylene |

### Vibration System:

| | |
|---|---|
| Vibration Drive Motor: | Baldor CM4106T 460VAC, 3phase, 20HP, 3525 RPM |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Max. Vibration Amplitude: | 3/4 inch (peak to peak measured at the Filter Pack) |
| Frequency Range: | 49.0 Hz to 55.0 Hz (Approximate) |
| Maximum Decibels: | <85 |
| Bearing RPM: | 2800 to 3100 |
| Bearing Oil: | Sullube ~750 ml Compressor Oil |
| Bearing O-rings: | 2-263 & 2-270 Buna |

### Pump Specifications:

| | |
|---|---|
| Feed Pump Type: | Grundfos 316SS Vertical Multi-stage Centrifugal |
| Feed Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Chemical Metering Pump: | Bran+Luebbe MD 200S 19111 007 |
| Metering Pump Motor: | Baldor 3/4HP TEFC 120/220V, 1phase, 15A, 60/50Hz |

### Pre-Screen Basket Strainer:

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made Alloy 2507 |
| Basket Strainer: | 60 Mesh 316 SS (Considered consumable) |
| Capacity: | 220 GPM (50m3/hr) |
| Elastomers (Seals): | EPDM |

### Operating Site Conditions:

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sunlight & rain. |
| Ambient Temperature: | 5° - 37°C |
| Storage Temperature: | 2° - 70°C (Protect Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating VFD |

### Piping:

| | |
|---|---|
| Maximum Pressure: | 550 psi (3,800 kPa) |

| | |
|---|---|
| Feed/Concentrate Pressure Piping: | Schedule 80 Super Duplex 2507 |
| Permeate Piping: | Schedule 40 316 SS |
| Special VSEP Concentrate Pipe: | 1-1/4” OD Alloy 20 Stainless Steel .065 wall |
| Flexible Hoses: | Neoprene Lined Reinforced Flex Hose |
| Pipe Clamps: | Victaulic Zero-Flex Style 07 EPDM |
| Pneumatic Air Supply: | 90lb Instrument Grade Air (3/8" connection) |
| Airline Tubing Fittings: | Hylok 316 SS |
| Piping Drain Fittings: | Hylok 2507 Duplex |
| Feed/Conc On/Off Valves: | Flotite Alloy 2507 3-piece ball valve |
| Permeate On/Off Valves: | Flotite 316 SS 3-piece ball valve |
| Flow Control Valves: | Flotite Alloy 2507 V-port ball valve |
| Permeate Check Valves: | 316 SS Swing check |
| Pneumatic Actuators: | Habonim Compact, Spring Return |
| Feed/Concentrate Pipe Terminations: | 150 lb Alloy 2507 Flange |
| Permeate Pipe Terminations: | 150 lb 316 SS Flange |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

**Clean in Place (CIP):**

| | |
|---|---|
| CIP Pump Type: | Grundfos 316 SS Vertical Multi-Stage Centrifugal |
| CIP Pump Motor: | Grundfos ML 3500 rpm TEFC 460 VAC 3-phase |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Clean in Place Tank: | 260 Gallon Cross Linked Polypropylene |
| pH Meter: | GF Signet 3-2726-00, 3-2750-1, 3-9900-1 |
| Level Sensor: | IFM Efector PN-2298 |

**Electrical Specifications:**

| | |
|---|---|
| Controls Voltage: | 220/120VAC, 1phase, 15A, 50/60Hz |
| Enclosures: | Hoffman NEMA 4 Powdercoat Finish 48x30x10, 24x30x8 |
| Switches, Relays, & Contactors: | Allen Bradley 220/110 Volt |
| Programmable Controller: | AB ControlLogix 1769 |
| Operator Display: | AB Versa View 5400 |
| IO Link Masters and Hubs: | IFM Efector AL1122 |
| Feed/Conc Pressure Sensors: | IFM Efector PN-2292 (with 2507ss seals) |
| Permeate Pressure Sensors: | IFM Efector PN-2292 316ss |
| Conc Mag Flow Tube and Transmitter: | Rosemount (or equal) (with Hastelloy electrodes/flanges) |
| Perm Mag Flow Tube and Transmitter: | IFM Efector SM2000 316ss |
| Bag Filter DP Sensors: | Efector PN-2294 (with 2507ss seals) |
| Temperature Sensor: | IFM Efector TN-2511, (with 2507ss thermowell) |
| Conductivity Meter: | Rosemount or equal (PEEK, Hastelloy, EPDM) |
| pH Meter: | Rosemount or equal (PEEK, glass, Hastelloy, EPDM) |
| Solenoid Valve: | Festo Manifold Gang Mounted Dual 3/2 24 VDC, IO Link |
| CIP Communication: | IFM Efector IO Link Masters over Ethernet |
| VFD Communication: | Ethernet Com Card (Ethernet Switch) |
| DCS Communication | Ethernet OPC Server (option for Modbus) |

## VSEP Stage 2 High Pressure Membranes Specifications:

### Filter Pack:

| | |
|---|---|
| Membrane: | RO |
| Allowable Process Temperature: | 5° - 60°C |
| Max Process Pressure: | 1000 psi (7000 kPa) |
| Allowable Feed Slurry pH Range: | 2 - 12 |
| O-ring and Seal Material: | EPDM (option for Viton) |
| Filter Pack Housing: | Glass impregnated epoxy resin (FRP) |
| Wetted Steel Trays: | 316 Stainless Steel |
| Wetted Plastic End Plates: | Polypropylene |

### Vibration System:

| | |
|---|---|
| Vibration Drive Motor: | Baldor 380-480VAC, 3phase, 20HP, 3525 RPM Motor |
| Speed Controller: | Danfoss 20HP 380-480VAC, NEMA 4 (or Equal) Max. |
| Vibration Amplitude: | 3/4 inch (peak to peak measured at the Filter Pack) |
| Frequency Range: | 43.0 Hz to 55.0 Hz (Approximate) |
| Maximum Decibels: | <85 |
| Bearing RPM: | 2800 to 3100 |
| Bearing Oil: | Sullube ~750 ml Compressor Oil |
| Bearing O-rings: | 2-263 & 2-270 Buna |

### Pump Specifications:

| | |
|---|---|
| Feed Pump Type: | Hydracell Hastelloy, Horizontal Teflon Diaphragm |
| Feed Pump Motor: | Baldor 380-480VAC, 3phase, 30HP, 1200 RPM |
| Booster Transfer Pump Type: | NOTE Supplied by Customer at Feed Tank (24 ft NPSH) |
| Motor Speed Controller: | Danfoss 380-480VAC, NEMA 4 (or Equal) |
| Chemical Metering Pump: | Bran+Luebbe Diaphragm pump with manual stroke |
| Metering Pump Motor: | Baldor 3/4HP TEFC 120/220V, 1phase, 15A, 60/50Hz |
| Dosing Solenoid Pump: | Chemtech Series 100 |

### Pre-Screen Basket Strainer:

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made 2507 Alloy Shell |
| Basket Strainer: | 100 Mesh 316 SS (Considered Consumable) |
| Capacity: | 120 GPM, 4.6 sq ft |
| Elastomer Seals: | EPDM (option for Viton) |

### Operating Site Conditions:

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sunlight & rain. |
| Ambient Temperature: | 5° - 37°C |
| Storage Temperature: | 2° - 70°C (Protect Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating VFD |

### Piping:

| | |
|---|---|
| Maximum Pressure: | 900 psi |
| Feed/Concentrate Pressure Piping: | Schedule 80 Super Duplex 2507 |

| | |
|---|---|
| Permeate Piping: | Schedule 40 316 SS |
| Special VSEP Concentrate Pipe: | 1-1/4” OD Alloy 20 Stainless Steel .065 wall |
| Flexible Hoses: | Neoprene Lined Reinforced Weatherhead Flex Hose |
| Pipe Clamps: | Victaulic Zero-Flex Style 07 EPDM |
| Pneumatic Air Supply: | 90lb Instrument Grade Air (3/8" connection) |
| Airline Tubing Fittings | Hylok 316 SS |
| Piping Drain Fittings | Hylok 2507 Duplex |
| Feed/Conc On/Off Valves | Flotite Alloy 2507 3-piece ball valve |
| Permeate On/Off Valves | Flotite 316 SS 3-piece ball valve |
| Flow Control Valves | Flotite Alloy 2507 V-port ball valve |
| Permeate Check Valves | 316 SS Swing check |
| Pneumatic Actuators | Habonim Compact, Spring Return |
| Feed/Concentrate Pipe Terminations | 150 lb Alloy 2507 Flange |
| Permeate Pipe Terminations | 150 lb 316 SS Flange |
| Flange Gaskets | 150 lb Garlock Blue Guard |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

**CIP:**

| | |
|---|---|
| CIP Pump Type: | Grundfos 316SS Vertical Multi-stage Centrifugal |
| CIP Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | AC Tech 380-480VAC, NEMA 4 (or Equal) |
| Clean in Place Tank: | 200 Gallon Sloped Cross Linked Polypropylene |
| pH Meter: | GF Signet 3-2726-00, 3-2750-1, 3-9900-1 |
| Level Sensors: | IFM Efector PN-2298 |

**Electrical:**

| | |
|---|---|
| Controls Voltage: | 120/220VAC, 1phase, 15A, 50/60Hz |
| Enclosures: | Hoffman NEMA 4 Powdercoat Finish |
| Wireway Gutters: | Hoffman NEMA 4 Powdercoat Finish |
| Switches, Relays, & Contactors: | Allen Bradley 120/220 Volt |
| Remote Access: | Ewon Cosy 131 |
| Programmable Controller: | AB Compact Logix 1769 |
| Operator Display: | AB Versa View 5400 |
| IO Link Masters and Hubs: | IFM Efector AL1122 |
| Feed/Conc Pressure Sensors | IFM Efector PN-2292 (with 2507ss seals) |
| Permeate Pressure Sensors | IFM Efector PN-2292 316ss |
| Conc Mag Flow Tube and Transmitter | Rosemount (or equal) (with Hastelloy electrodes/flanges) |
| Perm Mag Flow Tube and Transmitter | IFM Efector SM2000 316ss |
| Bag Filter DP Sensors | Efector PN-2294 (with 2507ss seals) |
| Temperature Sensor | IFM Efector TN-2511, (with 2507ss thermowell) |
| Conductivity Meter | Rosemount or equal (PEEK, Hastelloy, EPDM) |
| pH Meter | Rosemount or equal (PEEK, glass, Hastelloy, EPDM) |
| Solenoid Valves: | Festo Manifold Gang Mounted Dual 3/2 24 VDC, IO Link |
| CIP Communication: | IFM Efector IO Link Masters over Ethernet |
| VFD Communication: | Ethernet Com Card (Ethernet Switch) |
| DCS Communication: | Ethernet OPC Server (option for Modbus) |

## Spiral RO Stages 3 – 5 Membranes (S-18000) Specifications

### Filter Pack:

| | |
|---|---|
| Membrane: | RO (depends on application and pilot testing) |
| Membrane Surface Area: | 18000sf (1672m2) (45ea 8”Dia x 40”L) |
| Maximum Operating Temperature: | 120˚F (49˚C) (Options for up to 80˚C) |
| Allowable Feed Slurry pH Range: | 2 - 11 |
| O-ring Material: | Ethylene Propylene |
| Filter Pack Housing: | Polyurethane Coated, Filament Wound, Epoxy |
| FRP Wetted Ports: | 316L Stainless Steel |
| Wetted Plastic End Plates: | PVC Thermoplastic |

### Piping:

| | |
|---|---|
| Maximum Pressure: | 550 psi (Options for up to 1200 |
| psi) Pressure Piping: | 316L Stainless Steel Schedule 80 |
| Atmospheric Piping: | 316L Stainless Steel Schedule 40 |
| Pipe Clamps: | Zero-Flex Victaulic Style 07 |
| EPDM On/Off Valves: | 316 SS 3-piece ball valve |
| Flow Control Valves: | 316 SS V-port ball valve |
| Check Valves: | 316 SS swing check valve |
| Pneumatic Actuators: | Habonim Compact, Spring Return |
| Positioners: | BLX Linear Quarter Turn I/P |
| Skid Pipe Terminations: | 150 lb 316 SS Raised Face Flange |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

### Pump Specifications:

| | |
|---|---|
| Feed Pump Type: | Grundfos 316SS Vertical Multi-stage |
| Centrifugal Feed Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | Danfoss 380-480VAC, NEMA 4 (or Equal) |

### Pre-Screen Basket Strainer:

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made 316 SS |
| Basket Strainer: | 100 Mesh 316SS (Optional Felt Bag Filter) |
| Capacity: | 120 GPM, 4.6 sq ft |
| Elastomer Seals: | EPDM (option for Viton) |

### Operating Site Conditions:

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sun & rain. |
| Ambient Temperature: | 5 - 37°C |
| Storage Temperature: | 2 - 70°C (Project Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating |

### Electrical Specifications:

The membrane (VSEP) system is typically provided with a PLC/HMI control panel which also controls the spiral RO system. This control panel is mounted on the Clean in Place (CIP) Skid that is also shared for both membrane types.

| | |
|---|---|
| Controls Voltage: | 120/220VAC, 1phase, 15A,5 0/60Hz |

| | |
|---|---|
| Programmable Controller Type: | None (Control signals from CIP PLC) |
| Touch Screen Display Type: | None (Set Point change at CIP HMI) |
| Enclosures: | *Hoffman* NEMA 4 Powdercoat Finish 20x16x8 |
| Switches, Relays, & Contactors: | Allen Bradley 120/220 Volt |
| IO Link Masters and Hubs: | IFM Efector AL1122 |
| Pressure Sensors: | IFM Efector PN-2292 |
| Mag Flow Tube and Transmitter: | IFM Efector SM2000, SM8000 |
| Bag Filter DP Sensors: | IFM Efector PN-2294 |
| Temperature Sensor: | IFM Efector TN-2511, UT0028 |
| Conductivity Meter: | IFM Efector LDL-100 |
| Solenoid Valves: | Festo Manifold Gang Mounted Dual 3/2 24 VDC, IO Link |
| VSEP and CIP Communication: | IO Link |
| VFD Communication: | Ethernet Com Card |
| DCS Communication: | Ethernet OPC Server (option for Modbus) |

## Item B – AVARA: Advanced Vapor Recompression System

**Table 12. Advanced Vapor Recompression System (AVARA) System Design Overview**

| System Design Overview | |
|---|---|
| **Parameter** | **Value** |
| Total Influent Flow Rate | 89 gpm |
| Total Estimated Evaporation | 65.9 gpm |
| Total Estimated Brine | 23.1 gpm |
| Feed TDS | 68,211 ppm |
| Target Brine TDS | 262,000 ppm |
| Nominal Operating Electricity | 4,140 kW |
| Required Electricity | 480V / 3 Phase / 4140 Service Amps |

AVARA features patented submerged core technology. Feed water is pumped into a tank and heated with immersion heaters. As steam is generated, compressors force the steam back into the submerged heat exchanger (core) where the steam recondenses into a clean distillate. The AVARA is capable of concentrating the residual brine in the tank up to 300,000 ppm TDS before being discharged from the system for disposal or beneficial use. AVARA can significantly reduce the amount of wastewater requiring disposal while providing a distilled water byproduct.

### AVARA Specifications

**Table 13. AVARA System Design Specifications (per Treatment Unit)**

| AVARA System Specifications (per Treatment Unit) | |
|---|---|
| **Parameter** | **Value** |
| Skid Dimension | 12’ W x 50’ L x 10’ H |
| Skid Shipping Weight | 100,000 lbs |
| Weather Enclosed | Yes |
| Fuel Type | Electricity: Grid or Genset |
| Line Power | 3 Phase – 480V; 800 Service Amps; 500 Running Amps |
| Generated Power | Min. 450kW Genset (prime rated) |
| Volume Capacities | Mid-range to high TDS feed |
| Discharge TDS | Up to 300,000+ PPM TDS |
| Inlet Water Pressure | 5’ Head Pressure |
| Set-up Time | 24 Hours |
| Remote Monitoring | Yes |

## Maintenance Requirements

**Table 14. AVARA Operations and Maintenance Requirements Summary**

**AVARA O&M Requirements**

| AVARA Unit | Total Feed Flow (gpm)* | Energy Usage (kW) | Service Amps | Energy Costs** | Estimated Maintenance & Replacement Costs | Chemical Cleaner | Total System Cost |
|---|---|---|---|---|---|---|---|
| Unit 1 | 29.7 | 565 | 1380 | $9.70 | $4.60 | $4.00 | $18.30 |
| Unit 2 | 29.7 | 565 | 1380 | $9.70 | $4.60 | $4.00 | $18.30 |
| Unit 3 | 29.7 | 565 | 1380 | $9.70 | $4.60 | $4.00 | $18.30 |
| Totals | 89 | 1695 | 4140 | $29.10 | $13.80 | $12.00 | $54.90 |

*Includes all recycling flows
**Energy Costs assumed at $0.10/kW-hr. Operational Day assumed at 22hrs/day.
***Costs given as $/1000gal of feed to equipment item

***Table 15. Membrane Operations and Maintenance Requirements Summary***

**Membrane O&M Requirements**

| Stage | Total Feed Flow (gpm)* | Estimated Time between Cleanings | Energy Consumption / Usage | Energy Costs** | Estimated Membrane Life/Module Replacement Cost / Cost | Chemical Cleaner Usage (gal per day)/ Cost | Total System Cost |
|---|---|---|---|---|---|---|---|
| Stage 1 LP VSEP Membranes | 791.6 | 2880 min | 677 hp / 505 kW | $0.97 | 3 yr / $84,000 ea. / $3.63 | 54 / $0.85 | $5.45 |
| Stage 2 HP VSEP Membranes | 198.0 | 2000 min | 230 hp / 172 kW | $1.32 | 2 yr / $90,000 ea. / $6.92 | 23 / $1.45 | $9.69 |
| Stage 3 Spiral RO Membranes | 836.6 | 50000 min | 172 hp / 129 kW | $0.23 | 5 yr / $1,400 ea. / $0.23 | 20 / $0.27 | $0.73 |
| Stage 4 Spiral RO Membranes | 744.6 | 50000 min | 102 hp / 76 kW | $0.16 | 5 yr / $1,400 ea. / $0.24 | 10 / $0.14 | $0.54 |
| Stage 5 Spiral RO Membranes | 610.6 | 50000 min | 84 hp / 62 kW | $0.16 | 5 yr / $1,400 ea. / $0.25 | 8 / $0.15 | $0.56 |
| Totals | - | - | - | $2.84 | $11.27 | $2.86 | $16.97 |

*Includes all recycling flows
**Energy Costs assumed at $0.10/kW-hr. Operational Day assumed at 22hrs/day.
***Costs given as $/1000gal of feed to equipment item

### O&M Labor

It is assumed that the AVARA systems will require 24 hours per day for managing all three units simultaneously. This would require one (1) person managing the three units 24-7 on a per shift basis. The VSEP membranes are estimated to require one (1) full time employee for treatment and maintenance operations on a 24-7 basis. An additional three (3) employees would be required for maintenance of the entire treatment system on a 20 hour per week basis.

# Solidification Equipment Descriptions

## Item A – Standley Batch Systems, Inc.

**Table 16. Encapsulation Standley Batch Systems Fly Ash Silo Overview**

| Item No. | Description |
|---|---|
| 1A | Flyash Silo (1850 cuft) |
| 1B | Flyash Silo (1850 cuft) |
| 2A | Flyash Silo (1850 cuft) |
| 2B | Flyash Silo (1850 cuft) |
| 3A | Flyash Silo (1850 cuft) |
| 3B | Flyash Silo (1850 cuft) |
| 3C | Lime Silo (1600 cuft) |
| 4 | HyControl Silo Safety (7 Silo) |
| 5 | Screw Conveyors (2) |
| 6 | Weigh Batcher |
| 7 | Water Tank and Weigh Batcher |
| 8 | Drive Thru Structure |
| 9 | Collecting Hopper |
| 10 | Valve Bank Enclosure |
| 11 | Starter Enclosure |

## Item B – C&W DusTech

**Table 17. C&W DusTech System Overview**

| Item No. | Description |
|---|---|
| 12 | Dust Collector w/ Explosion Protection |
| 13 | Flap Valve Package |
| 14 | Drive Up Truck Dust Shroud |
| 15 | Ductwork Package (Shroud) |
| 16 | Ductwork Package (Silos) |
| 17 | Weigh Batcher Dust Collector |
| 18 | Mounting Flange-Weigh Batcher |

## Item C – Command Alkon

**Table 18. Command Alkon System Overview**

| Item No. | Description |
|---|---|
| 19 | Freight |
| 20 | Water Scale |
| 21 | Command Batch CP Control |
| 22 | Continuous Bin Levels |
| 23 | Installation |
| 24 | Travel |
| 25 | Project Management |
| 26 | Airfare |
| 27 | Expenses |

## Item D – BinMaster Inventory Management

**Table 19. BinMaster Inventory Management Overview**

| Item No. | Description |
|---|---|
| 28 | Continuous Measurement System (7 silo) |
| 29 | Mounting Plates (7) |
| 30 | Bin Disc Interface |
| 31 | Data Cable |
| 32 | On-site Startup |

## Item E – Solidification Site Work and Installation

**Table 20. Solidification Site Work and Installation Services Overview**

| Item No. | Description |
|---|---|
| 33 | Foundations, Ramps, Dust Collector Pads, Piers, Curbs |
| 34 | Installation and Erection |

# Engineering & Design Services

## Scope of Services

Deliverables developed during the engineering and design phase will serve as the basis of design for the project. The following engineering tasks and deliverables are included in this bid:

- Design Criteria
- Process Flow Diagram
- Process & Instrumentation Diagrams
- Mass Balance
- Hydraulic Profile
- Equipment Descriptions (GA drawings & Datasheets)
- Control Narrative
- Equipment Layout
- 3D Plant Modeling
- Site Civil Design
- HVAC Design
- Design & Construction Schedule

### Process Flow Diagram (PFD)

WesTech offers a wide range of treatment equipment that can be implemented in multiple process configurations and we will refine the approach with input from the finalized Design Criteria.

The PFD will identify the major pieces of equipment, their position in the process and the main control loops operating the process. They will indicate the main process streams and utility lines.

**Deliverable:**

- Process Flow Diagram

### Process & Instrumentation Diagrams (P&IDs)

After the Process Flow Diagram is finalized, WesTech will develop preliminary P&IDs for the process. The P&IDs will portray the components needed to run, monitor, control specific processes and will depict their relationship with each other. P&IDs will show equipment, piping that connects the equipment, instrumentation, and valves. The information compiled in the P&ID will provide the blueprint for the system and set the scope of the final project, define the process parameters and the level of controls. The P&IDs and supporting documentation are the most important document when establishing the details of the project.

P&IDs will be generated following ISA S5.1 and the owner's specifications. P&IDs typically include, but are not limited to the following information:

- Equipment names, tag and design conditions
- Relief valve location, tag numbers, sizes and pressure. Relief valve interlocks

- Venting, draining, maintenance, shutdown and start-up requirements are indicated
- Type of manual valves are identified, specialty piping items are tagged, and piping notes are added
- Control valves size, fail position, tags, and interlocks
- Vessel nozzles, details, and levels
- Process and utility lines
- Line sizes, line numbers, pipe specifications and product designation are indicated
- All instrumentation is shown with alarm and switch set points
- Instrument signals to control system are detailed
- Scope of supply, system boundaries

**Deliverable:**

- P&IDs based on finalized PFD

## Mass Balance

WesTech will perform mass balance calculations based on the finalized Design Criteria and PFD. Mass balance values will be used as inputs for specific equipment sizing.

**Deliverable:**

- Mass Balance calculations based on finalized PFD

## Equipment Descriptions (General Arrangement Drawings & Datasheets)

WesTech will provide detailed equipment descriptions including General Arrangement (GA) drawings, equipment datasheets, and other lists as required.

**Deliverables:**

- Equipment datasheets
- GA drawings

## Hydraulic Profile

WesTech will perform hydraulic calculations for the treatment system within the specified boundaries given in the Battery Limits Table of the Design Basis.

**Deliverables:**

- Hydraulic profile drawing

## HAZOP Assistance

WesTech will provide personnel for one (1) trip up to five (5) working days to participate in a hazard and operability study (HAZOP) workshop that will be conducted by others. Our process and controls engineers will assist in identifying and evaluating potential risks to personnel or equipment and operability issues.

## Control Narrative

WesTech process engineers will provide control narratives in paragraph form describing functionality of each unit process. Descriptions will include an overall description of the piece of equipment and how it is operated via pumps, blowers, valves, instruments, control logic, etc. Descriptions will also outline interactions between individual unit processes. The control narrative will provide the basis for PLC logic programming.

## Equipment Layout

As the equipment manufacturer, WesTech is intimately familiar with the plant site layout requirements needed to produce a functional site plan. Our in-house former mechanical piping contractors are experts at laying out piping networks to connect all the plant components. We use 3D modeling software to further increase our accuracy with interconnecting piping and civil structures.

**Deliverable:**

- Equipment layout drawings in native AutoCAD

## 3D Plant Modeling

- Equipment and interconnecting piping model
- Provided in native AutoCAD Plant 3D
- Periodic updates viewable in NavisWorks

**Deliverables:**

- 50% Model Review Workshop
- 90% Model Review Workshop

## Site Civil Design

- Site survey & topography
- Geotechnical investigation
- Finish grading plan design
- Storm drainage design
- Access road design
- Footing and foundation design

## HVAC Design

- Area classification identifications
- Heat load calculations
- Ventilation fan and louver sizing
- Unit heater equipment selection, and location drawings
- Make-up air unit sizing and ducting design drawings

- Mechanical cooling unit equipment selection and location drawings

## Design & Construction Schedule

WesTech will develop a detailed design and construction schedule that will be used by the team to ensure resources are properly allocated and to identify critical path items. The schedule will be a detailed Gantt chart using the latest Primavera P6 software to outline design, construction and start-up milestones.

**Deliverable:**

- Initial detailed design & construction Gantt chart schedule

# Commercial Proposal

Proposal Name: Plant Miller Budgetary Study
Proposal Number: 24877
Tuesday, February 07, 2023

## 1. Bidder's Contact Information

| | |
|---|---|
| Company Name | WesTech Engineering LLC |
| Primary Contact Name | Dallas Torgersen |
| Phone | 801.265.1000 |
| Email | DTorgersen@westech-inc.com |
| Address: Number/Street | 3665 S West Temple |
| Address: City, State, Zip | Salt Lake City, UT 84115 |

## 2. Budget Pricing

Currency: US Dollars

Scope of Supply

| | | |
|---|---|---|
| A | Engineering | $13,000,000.00 |
| B | Procurement (Includes MCC and PDC Building) | $71,660,000.00 |
| C | Freight | $710,000.00 |
| D | Construction | $56,500,000.00 |
| E | Commissioning & Start-up | $5,860,000.00 |
| F | Solidification: | |
| F.1 | Solidification Equipment | $3,853,647.00 |
| F.2 | Solidification Site Work and Installation | $1,503,045.00 |
| Process Island Cost | | $153,086,692.00 |
| | Taxes (sales, use, VAT, IVA, IGV, duties, import fees, etc.) | Not Included |

Prices are valid for a period not to exceed 30 days from date of proposal.

## 3. Additional Field Service

| | |
|---|---|
| Daily Rate (Applicable Only to Field Service Not Included in Scope) | $1,450 |

Pricing does not include field service unless noted in scope of supply, but is available at the daily rate plus expenses. The greater of a two week notice or visa procurement time is required prior to departure date. Our field service policy can be provided upon request for more details.

## 4. Schedule

Please refer to Level 1 Schedule Section

## 5. Freight

| | | |
|---|---|---|
| Domestic | | FOB Shipping Point - Prepaid and Added (FSP-PPA) |
| **From** | **Final Destination** | **Number of Trucks or Containers** |
| WesTech Shops | Quinton, AL | Approximately TBD |

The Process Island Cost provided includes only the costs associated with WesTech's discrete scope of work, as outlined in this budgetary study. A "Total Project Cost" estimate (including but not limited to such costs as decommissioning of Plant Miller's biological treatment system, project management, insurance, etc.) will likely be generated by Alabama Power Company and/or Southern Company Services and would represent the comprehensive dollar figure associated with the installation of the new treatment system at Plant Miller.

# Clarifications and Exceptions

This report is provided as a non-binding budgetary study. The scope included does not reflect WesTech's intended scope of work if this project were to be actualized.

## General Clarifications

**Terms & Conditions:** Changes to any terms and conditions, including but not limited to submittal and shipment days, payment terms, and escalation clause shall be negotiated at order placement, otherwise the proposal terms and conditions contained herein shall apply.

**Paint:** If your equipment has paint included in the price, please take note to the following. Primer paints are designed to provide only a minimal protection from the time of application (usually for a period not to exceed 30 days). Therefore, it is imperative that the finish coat be applied within 30 days of shipment on all shop primed surfaces. Without the protection of the final coatings, primer degradation may occur after this period, which in turn may require renewed surface preparation and coating. If it is impractical or impossible to coat primed surfaces within the suggested time frame, WesTech strongly recommends the supply of bare metal, with surface preparation and coating performed in the field. All field surface preparation, field paint, touch-up, and repair to shop painted surfaces are not by WesTech.

**Escalation:** If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

**USA Tariffs and Current Trade Laws:** All prices are based on current USA and North America tariffs and trade laws/agreements at time of bid. Any changes in costs due to USA Tariffs and trade laws/ agreements will be passed through to the purchaser at cost.

## One-Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period is either, one calendar year immediately following start-up, or eighteen (18) months from when WesTech sent its ready-to-ship notification to the purchaser, whichever expires sooner. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear or consumables. This warranty is not transferable.
This warranty shall be void and shall not apply where the equipment or any part thereof.

(a) has been dismantled, modified, repaired or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or
(b) has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or
(c) has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or
(d) has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third-party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for

normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

# Terms & Conditions

Terms and Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech Engineering LLC The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

**1. SPECIFICATIONS:** WesTech Engineering LLC is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

**2. ITEMS INCLUDED:** This proposal includes only the equipment specified herein and does not include erection, installation, accessories, nor associated materials such as controls, piping, etc., unless specifically listed.

**3. PARTIES TO CONTRACT:** WesTech Engineering LLC is not a party to or bound by the terms of any contract between WesTech Engineering LLC's customer and any other party. WesTech Engineering LLC's undertakings are limited to those defined in the contract between WesTech Engineering LLC and its direct customers.

**4. PRICE AND DELIVERY:** All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise. Unless otherwise stated, all prices are F.O.B. WesTech Engineering LLC or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B. job site or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech Engineering LLC of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech Engineering LLC shall constitute acceptance by Purchaser, relieving WesTech Engineering LLC of any liability for shipping damages or shortages.

**5. PAYMENTS:** All invoices are net 30 days. Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when WesTech Engineering LLC is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner.

**6. PAYMENT TERMS:** Credit is subject to acceptance by WesTech Engineering LLC's Credit Department. If the financial condition of the Purchaser at any time is such as to give WesTech Engineering LLC, in its judgment, doubt concerning the Purchaser's ability to pay, WesTech Engineering LLC may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the WesTech Engineering LLC until such payment has been received.

**7. ESCALATION:** If shipment is, for any reason, deferred by the Purchaser beyond the normal shipment date, or if material price increases are greater than 5% from proposal date to material procurement date, stated prices set forth herein are subject to escalation. The escalation shall be based upon increases in labor and material and other costs to WesTech Engineering LLC that occur in the time period between quotation and shipment by WesTech Engineering LLC Purchaser agrees to this potential escalation regardless of contradicting terms in the contract, except when an agreed upon escalation adder is included in the price.

**(a)** The total quoted revised price is based upon changes in the indices published by the United States Department of Labor, Bureau of Labor Statistics. Labor will be related to the Average Hourly Earnings indices found in the Employment and Earnings publication. Material will be related to the Metal and Metal Products Indices published in Wholesale Prices and Prices Indices.

**(b)** Price revision for items furnished to, and not manufactured by WesTech Engineering LLC, which exceed the above escalation calculation, will be passed along by WesTech Engineering LLC to Purchaser based upon the actual increase in price to WesTech Engineering LLC for the period from the date of quotation to the date of shipment by WesTech Engineering LLC Any item that is so revised will be excluded from the index escalation calculations set forth in subparagraph (a) above.

**8. APPROVAL:** If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech Engineering LLC supplying any equipment shall be such complete approval.

**9. INSTALLATION SUPERVISION:** Prices quoted for equipment do not include installation supervision. WesTech Engineering LLC recommends and will, upon request, make available, at WesTech Engineering LLC's then current rate, an experienced installation supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment, if not installed by WesTech Engineering LLC or installed in accordance with WesTech Engineering LLC's instructions, and inspected and accepted in writing by WesTech Engineering LLC, rests entirely with Purchaser; and any work performed by WesTech Engineering LLC personnel in making adjustment or changes must be paid for at WesTech Engineering LLC's then current per diem rates plus living and traveling expenses.

WesTech Engineering LLC will supply the safety devices described in this proposal or shown in WesTech Engineering LLC's drawings furnished as part of this order but excepting these, WesTech Engineering LLC shall not be required to supply or install any safety devices whether required by law or otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech Engineering LLC from any claims or losses arising due to alleged or

actual insufficiency or inadequacy of the safety devices offered or supplied hereunder, whether specified by WesTech Engineering LLC or Purchaser, and from any damage resulting from the use of the equipment supplied hereunder.

**10. ACCEPTANCE OF PRODUCTS:** Products will be deemed accepted without any claim by Purchaser unless written notice of non-acceptance is received by WesTech Engineering LLC within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech Engineering LLC unless it is accompanied by all freight bills for said shipment, with Purchaser's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

**11. TAXES:** Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price, shall be for Purchaser's account.

**12. TITLE:** The equipment specified herein, and any replacements or substitutes therefore shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech Engineering LLC until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech Engineering LLC's title and interest in and to such equipment; and upon Purchaser's default, WesTech Engineering LLC may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech Engineering LLC may suffer from any cause.

**13. INSURANCE:** From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech Engineering LLC's benefit, adequate insurance including, but not limited to, builders risk insurance on the equipment against any loss of any nature whatsoever.

**14. SHIPMENTS:** Any shipment of delivery dates recited represent WesTech Engineering LLC's best estimate but no liability, direct or indirect, is assumed by WesTech Engineering LLC for failure to ship or deliver on such dates.

WesTech Engineering LLC shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof. If Purchaser defaults in any payment when due hereunder, WesTech Engineering LLC may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech Engineering LLC that the equipment is ready for shipment; and thereafter any storage or other charge WesTech Engineering LLC incurs on account of the equipment shall be for the Purchaser's account.

If delivery is specified at a point other than WesTech Engineering LLC or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech Engineering LLC's reasonable control and occurring at a location other than WesTech Engineering LLC or its supplier's shipping points, WesTech Engineering LLC assumes no liability in delivery delay. If Purchaser refuses such delivery, WesTech Engineering LLC may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

**15. WARRANTY:** WESTECH ENGINEERING LLC WARRANTS EQUIPMENT IT SUPPLIES ONLY IN ACCORDANCE WITH THE WARRANTY EXPRESSED IN THE ATTACHED COPY OF "WESTECH WARRANTY" AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS WHICH IS MADE A PART HEREOF. SUCH WARRANTY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESSED, IMPLIED OR STATUTORY, WESTECH ENGINEERING LLC SHALL NOT BE LIABLE ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR ANY REASON WHATSOEVER.

**16. PATENTS:** WesTech Engineering LLC agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech Engineering LLC is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech Engineering LLC needed information, assistance, and authority to enable WesTech Engineering LLC so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech Engineering LLC shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech Engineering LLC will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech Engineering LLC's request. The foregoing states the entire liability of WesTech Engineering LLC, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech Engineering LLC assumes no responsibility for process patent infringement.

**17. SURFACE PREPARATION AND PAINTING:** If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech Engineering LLC will not be responsible for the condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment. WesTech Engineering LLC assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism installation.

Motors, gear motors, and other components not manufactured by WesTech Engineering LLC will be painted with that manufacturer's standard paint system. It is WesTech Engineering LLC's intention to ship major steel components as soon as fabricated, often before drive, motors, and other

manufactured components. Unless Purchaser can ensure that shop primed steel shall be field painted within thirty (30) days after arrival at the job site, WesTech Engineering LLC encourages the Purchaser to order these components without primer.

WesTech Engineering LLC's prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, WesTech Engineering LLC requests that Purchaser's order advise of the paint selection. WesTech Engineering LLC will then either adjust the price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

**18. CANCELLATION, SUSPENSION, OR DELAY:** After acceptance by WesTech Engineering LLC, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech Engineering LLC to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech Engineering LLC's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

**19. FORCE MAJEURE:** Neither party hereto shall be liable to the other for default or delay in delivery caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, act of government, pandemic, delay of carriers, failure of normal sources of supply, complete or partial shutdown of plant by reason of inability to attain sufficient raw materials or power, and/or other similar contingency beyond the reasonable control of the respective parties. The time for delivery specified herein shall be extended during the continuance of such conditions, or any other cause beyond such party's reasonable control.

**20. RETURN OF PRODUCTS:** No products may be returned to WesTech Engineering LLC without WesTech Engineering LLC's prior written permission. Said permission may be withheld by WesTech Engineering LLC at its sole discretion.

**21. BACKCHARGES:** WesTech Engineering LLC will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech Engineering LLC-furnished materials unless such back charge has been authorized in advance in writing by a WesTech Engineering LLC employee, by a WesTech Engineering LLC purchase order, or work requisition signed by WesTech Engineering LLC

**22. INDEMNIFICATION:** Purchaser agrees to indemnify WesTech Engineering LLC from all costs incurred, including but not limited to court costs and reasonable attorney fees, from enforcing any provisions of this contract, including but not limited to breach of contract or costs incurred in collecting monies owed on this contract.

**23. ENTIRE AGREEMENT:** This proposal expresses the entire agreement between the parties hereto superseding any prior understandings, and is not subject to modification except by a writing signed by an authorized officer of each party.

**24. MOTORS AND MOTOR DRIVES:** In order to avoid shipment delays of WesTech Engineering LLC equipment, the motor drives may be sent directly to the job site for installation by the equipment installer. Minor fit-up may be required.

**25. EXTENDED STORAGE:** Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

**26. LIABILITY:** Professional liability insurance, including but not limited to, errors and omissions insurance, is not included. In any event, liability for errors and omissions shall be limited to the lesser of $100,000USD or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech Engineering LLC against which a claim is sought.

**27. ARBITRATION NEGOTIATION:** Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction.

WESTECH

3665 SOUTH WEST TEMPLE

Salt Lake City, Utah 84115
(801) 265-1000

| | | REV | BY | CHECKED | REASON | DATE |
|---|---|---|---|---|---|---|
| CLIENT: | PLANT MILLER | | | | | |
| PROJECT TITLE: | FGD WASTEWATER VSEP TREATMENT CONVERSION | A | SW17 | SO74 | Initial Submittal | 2/7/2023 |
| PROJECT NO.: | 24877 | B | SO74 | SW17 | Includes Southern Company's MB | 2/24/2023 |
| DOCUMENT NAME: | 24877-Mass Balance | C | SO74 | SW17 | Update Mass Flow Column 9 | 2/28/2023 |
| DOCUMENT NUMBER: | - | | | | | |

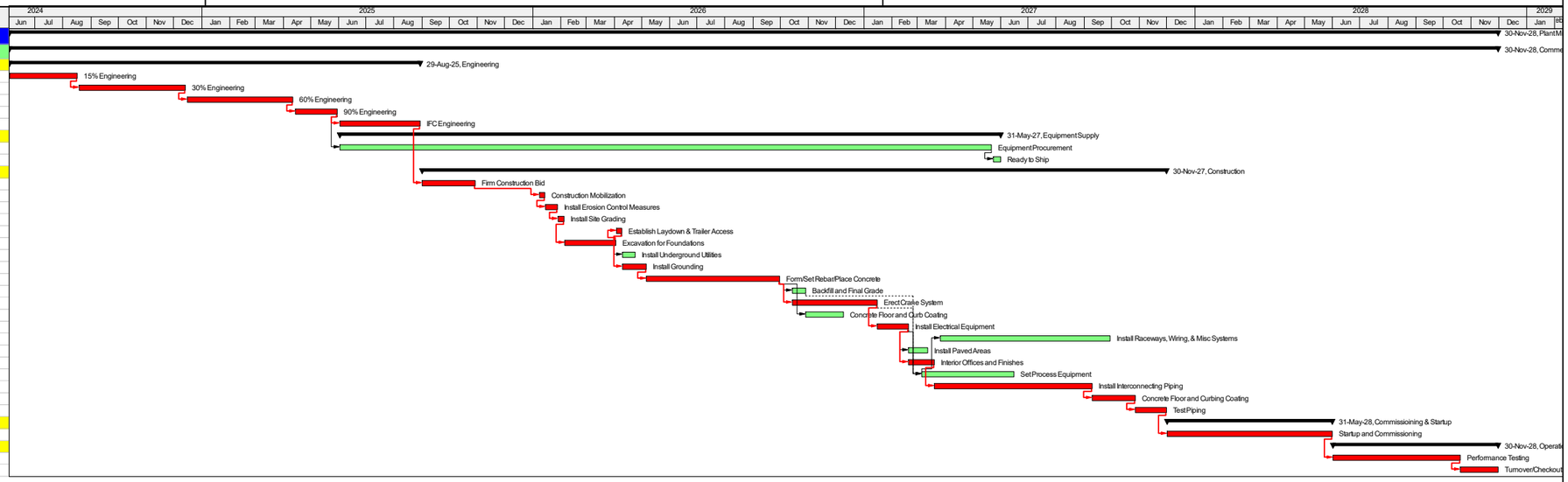
| *Stream ID* | 1. INFLUENT FROM PHYS/CHEM SYSTEM | 2. VSEP SYSTEM INFLUENT (INCLUDES RO REJECT RECIRC) | 3. VSEP SYSTEM EFFLUENT | 4. VSEP SYSTEM REJECT | 5. AVARA CONCENTRATE | 6. AVARA DISTILLATE | 7. FLYASH TO SOLIDIFICATION PROCESS (BY OTHERS) | 8. LIME TO SOLIDIFICATION PROCESS (BY OTHERS) | 9. TOTAL SOLIDIFICATION MIX (18% BRINE, 77% FLYASH, and 5% LIME) (BY OTHERS) |
|---|---|---|---|---|---|---|---|---|---|
| **Design (Max) Flow Rate, Continuous (GPM)** | 608.0 | 792.0 | 519.0 | 89.0 | 23.1 | 65.9 | 163 (1307.6 cuft/hr) | 6.2 (50 cuft/hr) | 192.5 (1543.9 cuft/hr) |
| **Design (Max) Mass Flow Rate, Continuous (lbs/hr)** | | | | | | | 58843 lbs/hr | 3821 lbs/hr | 76419 lbs/hr |
| **Maximum TDS (mg/L)** | 10000.0 | 9019.5 | 2.3 | 68211.9 | 263366.4 | ~10 | | | |
| | | | | | | | | | |
| **Solids SG** | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 2.40 | 0.72 | 3.34 | - |
| **Liquid SG** | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | - | 1.0 | - |
| **pH** | 5.5-8.5 | 5-8 | 5-8 | 6-8 | 6-8 | 6-8 | - | - | - |
| **Intermittent Flow Rate *NOTE 1** | | | | | | | | | |
| **NOTES** | 1. If the intermittent flowrate is greater than the Design (Max) flow, this is the flow the system will be designed to. | | | | | | | | |

Southern Company - Plant Miller Pre-Feasibility Study

Plant Miller Pilot Schedule

WesTech Document Name: Project Schedule
WesTech Document Number: 24877-SCH01
Version: As of 14-Feb-23 / 17:08

| Activity ID | Activity Name | Original Duration | Remaining Duration | Start | Finish |
|---|---|---|---|---|---|
| **Plant Miller Pre-Feasibility Study** | | 1174 | 1174 | 03-Jun-24 | 30-Nov-28 |
| **Commercial Project** | | 1174 | 1174 | 03-Jun-24 | 30-Nov-28 |
| **Engineering** | | 325 | 325 | 03-Jun-24 | 29-Aug-25 |
| A1000 | 15% Engineering | 55 | 55 | 03-Jun-24 | 16-Aug-24 |
| A1010 | 30% Engineering | 85 | 85 | 19-Aug-24 | 13-Dec-24 |
| A1020 | 60% Engineering | 85 | 85 | 16-Dec-24 | 11-Apr-25 |
| A1030 | 90% Engineering | 35 | 35 | 14-Apr-25 | 30-May-25 |
| A1050 | IFC Engineering | 65 | 65 | 02-Jun-25 | 29-Aug-25 |
| **Equipment Supply** | | 521 | 521 | 02-Jun-25 | 31-May-27 |
| A1110 | Equipment Procurement | 515 | 515 | 02-Jun-25 | 21-May-27 |
| A1115 | Ready to Ship | 6 | 6 | 24-May-27 | 31-May-27 |
| **Construction** | | 587 | 587 | 01-Sep-25 | 30-Nov-27 |
| A1040 | Firm Construction Bid | 43 | 43 | 01-Sep-25 | 29-Oct-25 |
| A1130 | Construction Mobilization | 5 | 5 | 08-Jan-26 | 14-Jan-26 |
| A1140 | Install Erosion Control Measures | 10 | 10 | 15-Jan-26 | 28-Jan-26 |
| A1150 | Install Site Grading | 5 | 5 | 29-Jan-26 | 04-Feb-26 |
| A1160 | Establish Laydown & Trailer Access | 5 | 5 | 03-Apr-26 | 09-Apr-26 |
| A1170 | Excavation for Foundations | 41 | 41 | 05-Feb-26 | 02-Apr-26 |
| A1180 | Install Underground Utilities | 10 | 10 | 10-Apr-26 | 23-Apr-26 |
| A1190 | Install Grounding | 19 | 19 | 10-Apr-26 | 06-May-26 |
| A1200 | Form/Set Rebar/Place Concrete | 105 | 105 | 06-May-26 | 30-Sep-26 |
| A1210 | Backfill and Final Grade | 10 | 10 | 14-Oct-26 | 28-Oct-26 |
| A1220 | Erect Crane System | 67 | 67 | 14-Oct-26 | 15-Jan-27 |
| A1230 | Concrete Floor and Curb Coating | 30 | 30 | 28-Oct-26 | 09-Dec-26 |
| A1240 | Install Electrical Equipment | 25 | 25 | 15-Jan-27 | 19-Feb-27 |
| A1250 | Install Raceways, Wiring, & Misc Systems | 133 | 133 | 26-Mar-27 | 29-Sep-27 |
| A1260 | Install Paved Areas | 15 | 15 | 19-Feb-27 | 12-Mar-27 |
| A1270 | Interior Offices and Finishes | 20 | 20 | 19-Feb-27 | 19-Mar-27 |
| A1280 | Set Process Equipment | 72 | 72 | 05-Mar-27 | 15-Jun-27 |
| A1290 | Install Interconnecting Piping | 124 | 124 | 19-Mar-27 | 09-Sep-27 |
| A1300 | Concrete Floor and Curbing Coating | 34 | 34 | 09-Sep-27 | 27-Oct-27 |
| A1310 | Test Piping | 24 | 24 | 27-Oct-27 | 30-Nov-27 |
| **Commissioining & Startup** | | 130 | 130 | 01-Dec-27 | 31-May-28 |
| A1120 | Startup and Commissioning | 130 | 130 | 01-Dec-27 | 31-May-28 |
| **Operations Optimization** | | 130 | 130 | 01-Jun-28 | 30-Nov-28 |
| A1400 | Performance Testing | 100 | 100 | 01-Jun-28 | 19-Oct-28 |
| A1410 | Turnover/Checkout | 30 | 30 | 19-Oct-28 | 30-Nov-28 |




Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summary



TASK filter: All Activities

© Oracle Corporation

**APPENDIX B**

**Georgia Power Company - Plant Bowen Membrane Cost Study**

**First Page – Total Project Cost**

**WesTech Budgetary Study Report**

**□□-□□□ □□□en ELG - Screening**

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **Engineering** | □ | □R | | □□ | □□ | □ | □□ | □□□□□□□□□□ | □□ | □□□□□□□□□□ |
| CECEN285 - Design & Technical Services - Detailed Engineering | 0 | HR | | $0 | $0 | 0 | $0 | $5,706,278 | $0 | $5,706,278 |
| CECEN291 - Outsourced Detailed Engineering | 0 | HR | | $0 | $0 | 0 | $0 | $16,500,000 | $0 | $16,500,000 |
| | | | | | | | | | | |
| | | | | | | | | | | |
| **C□n□□r□c□□n** | □ | □R | □□□□□□ | □□□□□□□□□□ | □□□□□□□□□□□□ | □ | □□□□□□□□□□ | □□□□□□□□□□ | □□□□□□□□□□ | □□□□□□□□□□□□ |
| COCIN150 - T&PS - Construction Management | 0 | HR | | $0 | $0 | 0 | $0 | $8,151,826 | $0 | $8,151,826 |
| COCIN151 - Temporary Construction | 0 | HR | | $0 | $0 | 0 | $0 | $0 | $4,891,095 | $4,891,095 |
| COCPK006 - Mechanical | | | 17,500 | $1,077,315 | $187,539,681 | 0 | $94,956,035 | $0 | $0 | $283,573,031 |
| COCPK020 - Switchyard, Distribution & Transmission | | | 0 | $0 | $0 | 0 | $20,000,000 | $0 | $0 | $20,000,000 |
| COCPK029 - Scaffolding | | | 0 | $129,278 | $0 | 0 | $0 | $0 | $0 | $129,278 |
| COCPK030 - Contractor Indirects | | | 0 | $788,564 | $13,182,488 | 0 | $0 | $0 | $0 | $13,971,052 |
| | | | | | | | | | | |
| **S□□r□□□** | □ | □R | □ | □□ | □□ | □ | □□ | □□□□□□□□□□ | □□ | □□□□□□□□□□□□ |
| TSSUC750 - Start-up and Commissioning | 0 | HR | 0 | $0 | $0 | 0 | $0 | $3,260,730 | $0 | $3,260,730 |
| TSSUC752 - Outsourced Start-Up and Commissioning | 0 | HR | 0 | $0 | $0 | 0 | $0 | $6,000,000 | $0 | $6,000,000 |
| | | | | | | | | | | |
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| **□□ner** | □ | □R | □ | □□□□□□□ | □□□□□□□□□□ | □ | □□□□□□□□□□ | □□□□□□□□□□ | □□□□□□□□□ | □□□□□□□□□□□ |
| CPCOC301 - E&S | | | | $68,627 | $6,904,209 | | $3,954,125 | $1,362,763 | $168,238 | $12,457,962 |
| | | | | | | | | | | |
| **E□c□l□□i□n □nd C□n□ingenc□** | | | | □□□□□□□□ | □□□□□□□□□□ | □ | □□□□□□□□□□ | □□□□□□□□□□ | □□□□□□□□□ | □□□□□□□□□□□ |
| CPCOC304 - Escalation | | | | $118,830 | $11,954,815 | | $6,846,668 | $2,359,659 | $291,309 | $21,571,280 |
| CPCOC305 - Contingency | | | | $598,547 | $60,216,651 | | $34,486,811 | $11,885,650 | $1,467,329 | $108,654,987 |
| | | | | | | | | | | |
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| **□□□DC** | | | | □□□□□□□□ | □□□□□□□□□□ | □ | □□□□□□□□□□ | □□□□□□□□□□ | □□□□□□□□□ | □□□□□□□□□□□ |
| CPCOC300 - AFUDC/IDC | | | | $431,820 | $43,443,066 | | $24,880,374 | $8,574,856 | $1,058,598 | $78,388,713 |
| | | | | | | | | | | |
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# Georgia Power

# Plant Bowen Budgetary Study

**Euharlee, GA**

**Owner**

Southern Company

Carson Brown
SCS T&PS Environmental Solutions
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WESTECH®

Project Number: 24926 rev 1
Thursday, May 25, 2023

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# Technical Proposal

## Design Basis

The objective of this document is to provide Southern Company Services with a conceptual design and budgetary level cost estimate of the deliverables associated with potentially converting Georgia Power Company Plant Bowen flue gas desulfurization (FGD) wastewater treatment system to utilize membrane technology, considering the 2020 ELG Rule's Voluntary Incentives Program (VIP) compliance option and the 2023 Proposed ELG Rule.

### Reference Standards & Codes

- ANSI/ASME American Society of Mechanical Engineers B31.1 Power Piping Code
- American Institute of Steel Construction (AISC) specification for the Design, Fabrication and Erection of Structural Steel for Buildings
- AWS - American Welding Society: D1.1 - "Structural Welding Code - Steel".
- American Iron and Steel Institute (AISI) specification for the Design of Light Gauge Cold-Formed Steel Structural Members
- NEMA - National Electrical Manufacturers Association: MG 1 - "Motors and Generators".
- American Concrete Institute (ACI) Building Code requirements for reinforced Concrete ACI 318-63
- AISC Manual of Steel Construction
- ASME B16.5 Pipe Flanges and Flanged Fittings
- ASME B30-2 Overhead and Gantry Cranes
- Underwriters Laboratories (UL): 10B - "Standard for Safety Fire Tests of Door Assemblies".

#### NEC National Electric CodeNFPA

- 70 - "National Electrical Code".

#### National Fire Protection Association:

- 80 - "Standard for Fire Doors and Fire Windows".
- 101 – "Life Safety Code".
- U.S. Department of Labor, Occupational Safety and Health Administration (OSHA): 29 CFR, Title 29 - "Occupational Safety and Health Standards".

#### Governing codes for project location:

- 2006 International Building Code with Georgia amendments.
- Including and not limited to verifying and designing for the Seismic Site Class in accordance with IBC Section 1615.

- NFPA 101 – “Life Safety Code for Buildings”.
- OSHA - Occupational Safety and Health Administration.

## WesTech General Specifications

- D-11 DESIGN FUNCTIONAL TAGS AND DESCRIPTIONS
- FIELD LINING SPECIFICATION
- PAINT COLOR GUIDANCE
- Pavement Structures
- Preferred vendor list
- M_2_09 MECHANICAL INSULATION

## WesTech Electrical Specifications

### BGE Drawings

- BGE1001
- BGE1003
- BGE1004
- BGE1005
- BGE1006
- BGE1007
- BGE1008
- BGE1011

### Electrical Standards

- E-1-02 Raceway Naming
- E-1-03 Raceway Design Standard
- E-1-04 Circuit Naming
- E-1-05 Plant Circuitry
- E-1-06 Cable and Cable Bus
- E-1-07 Transformers
- E-1-08 Direct Current Distribution Systems Standard
- E-1-09 Fuses
- E-1-10 Lighting and Receptacles
- E-1-11 Grounding Standard

- E-1-13 Hazardous Classified Locations
- E-2-03 Cable Code Definition
- E-2-04 Electrical Mark Numbers
- E-2-10 Arc Flash Mitigation (1)

### Installation Standards

- Standard_Spec_SECTION_260000_Gen_Req
- Standard_Spec_SECTION_260526_grounding_system
- Standard_Spec_SECTION_260533_conduit
- Standard_Spec_SECTION_261213_outdoor_xfrmers
- Standard_Spec_SECTION_262716_boxes
- Standard_Spec_SECTION_265000_lighting_fixtures
- Standard_Spec_SECTION_266010_motors
- Standard_Spec_SECTIONS_2605xx_electrical_cables

### Other Specifications

- Cable Specification
- G95797 LV MCC Detailed Spec
- G95797 LV MCC General Spec
- Heat Tracing Specification

## Process Design

Below is a table of the influent water process design criteria provided as part of the request for quote that will discharge from the Plant's existing FGD wastewater physical/chemical treatment system and feed the new Membrane Treatment System (MTS).

**Table 1. Influent Design Criteria Values**

| Parameter | Units | Normal (Cycled Down, Typ. Values, 100% Flow) | Design Case 1 (Cycled Down, Max. Values, 100% Flow) |
|---|---|---|---|
| Flow, total leaving Phys/Chem | gpm | 750 | 1,500 |
| Total Dissolved Solids (TDS) | mg/L | 15,000-30,000* | 8,000-14,000* |
| pH | S.U. | 6.7-7.5 | 6.7-7.5 |
| Total Suspended Solids (TSS) | mg/L | <10 | <10 |
| Oil & Grease | mg/L | <1 | <1 |
| As, total | µg/L | 5 | 5 |
| Hg, total | ng/L | 2,500** | 2,500 |
| Nitrates/Nitrites | mg/L as N | 33 | 22 |
| Se, total | µg/L | 50-500 | 150-1,000 |
| Chloride | mg/L | <14,000 | <8,000 |
| Bromide | mg/L | 40 | 30 |
| Calcium, total | mg/L as CaCO3 | <10,600 | <6,500 |
| Magnesium, total | mg/L as CaCO3 | <1,075 | <660 |
| Temperature | Deg F | 50 - 120 | 50 - 120 |

**Notes:**

** - Typical cycled down range is 200 to 2,500 ppt.

* - Recommended level of softening required to meet target

The treatment system proposed herein is designed in accordance with the Design Case 1 constituent levels and maximum flowrate (1,500 gpm). This design case reflects conditions observed when all the FGD scrubber systems are cycled down and all treated effluent is discharged to the river in the case of 2020 ELG VIP Option, or reused within the plant in the case of 2023 Proposed ELG Rules. All brine generated is encapsulated.

The following table outlines effluent performance criteria from the Membrane Treatment System.

**Table 2. VSEP System Effluent**

**(Combined Permeate and Distillate Stream)**

| Parameter | Units | Maximum for any 1 Day | Maximum Rolling 30 Day Average |
|---|---|---|---|
| Total Dissolved Solids (TDS) | mg/L | 306 | 149 |
| pH | S.U. | 6 - 9 | 6 - 9 |
| Total Suspended Solids (TSS) | mg/L | | |
| Oil & Grease | mg/L | | |
| As, total | µg/L | 5 | NA |
| Hg, total | ng/L | 23 | 10 |
| Nitrates/Nitrites | mg/L as N | 2 | 1.2 |
| Se, total | µg/L | 10 | NA |
| Chloride | mg/L | | |
| Bromide | mg/L | 0.2 | NA |

Please note, these effluent limits are assumed from the 2020 ELG VIP for reference only and do not constitute a process guarantee. WesTech can provide a formal process guarantee upon request.

In the event 2023 Proposed ELG Rules are adopted, zero discharge limits require the reuse of permeate and distillate on site.

### Assumptions

- The existing physical / chemical treatment will remain in service as pre-treatment ahead of the new Membrane Treatment System.
- Modifications will be made to the physical / chemical treatment train to improve performance of the clarifier and allow for metals removal and softening to precipitate hardness.
- Unless otherwise stated, all subsystems and modular components will be provided as manufacturer's standard and will not follow any additional custom specifications.

## Plant Design

**Table 3. List of Major Equipment Vendors**

| Major Equipment Vendors | |
|---|---|
| **Type** | **Vendor** |
| Vibrating Membranes (VSEP) | New Logic |
| Spiral RO Membranes | New Logic |
| Thermal Evaporator (AVARA) | Purestream |
| Process Pumps | Grundfos, or Equal |
| Chemical Metering Pumps | Grundfos, or Equal |
| Silos/Slakers | Chemco, or Equal |
| PLC | Allen Bradley or Equal |
| Butterfly Valves | Bray or Equal |
| Ball Valves | Flow-Tek or Equal |
| Analytical Instrumentation | Endress+Hauser or Equal |
| Pressure Instrumentation | Endress+Hauser or Equal |
| Flow Instrumentation | Endress+Hauser or Equal |
| Level Instrumentation | Endress+Hauser or Equal |

*Final vendor selections may differ based on detailed engineering. WesTech may utilize an 'or equal' if needed.

### Sparing Philosophy

In general, WesTech will provide equipment with 2 x 50% sparing. Equipment not in 2 x 50% trains will at minimum treat 100% of design flow with expected equipment under routine cleaning (CIP), and will treat a minimum of 50% of design flow in all cases.

### Pumps

- ASME B73 or pump manufacturer standards will be considered, as applicable.

## Piping

**Table 4. Plant Bowen Piping Summary Design Basis**

| Piping Summary | |
|---|---|
| **Service** | **Pipe Material** |
| Process, Above Ground, Inside | HDPE |
| Process, Above Ground, Outside | HDPE |
| Process, Underground, | HDPE |
| Process, Underground, Treated, Outfall | HDPE |
| Process, Underground, Treated, Outfall | HDPE |
| Process, Above Ground, Skidded Materials | 2205 |
| Process, Above Ground, Inside, MTS Boundary Limits | 2205 |
| Chemical, Hydrogen Peroxide | Tube: PVDF |
| Chemical, Ferric Chloride | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Hydroxide | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sulfuric Acid | Tube: PVDF |
| Chemical, Organosulfide | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Ferric Sulfate | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Sulfate | Tube: Polypropylene (CPVC on Skid) |
| Chemical, Sodium Bisulfite | Tube: Polypropylene (CPVC on Skid) |
| Polymer, <= 1/2-in. | Tube: Polypropylene (CPVC on Skid) |
| Polymer, > 1/2-in. | Tube: Polypropylene (CPVC on Skid) |
| Service Water | CS |
| Air, Service, >= 1/2-in. | 304SS |
| Air, Instrument, >= 1/2-in. | 304SS |
| Air, Instrument, < 1/2-in. (Pressure Regulated) | Tube: 304SS (SwageLok) |
| Potable Water, Above Ground, Inside, < 2-in | Copper |
| Potable Water, Underground | HDPE |
| Fire Water, Inside, Sprinkler | CS |
| Sewer | HDPE |

### Battery Limits

The following tie points have been identified and will be specified with generalized (not to exceed) conditions for the purposes of developing engineering. The purchaser will be responsible for providing not to exceed values where indicated in the table below. Final tie point conditions will be identified in the Tie Point List which will be provided by WesTech with a 30% engineering package.

**Table 5. Plant Bowen Battery Limit Tie Points**

| Tie Points | | | | | | |
|---|---|---|---|---|---|---|
| **#** | **Tie-Point** | **Max Flow (GPM)** | **Max Pressure (ft H2O)** | **Location** | **Grade Elevation (ft)** | **Connection Type** |
| 1 | Inlet to Influent Pump Skid | 1500 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 2 | Final Effluent to Existing pipeline to FGD Effluent Tank | 1033 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 3 | AVARA Brine Final Effluent | 84 | TBD | TBD | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 4 | Service Water | 21 | TBD | BTS Pad | TBD | FF, ANSI 150 |
| | Note 1: Connection within 10’ of the WWTS boundary | | | | | |
| 5 | Sumps | | | | | |
| 6 | Compressed Air | | | | | |
| | Note 1: At BTS Pad. VSEP requirements are 66 CFM. | | | | | |
| 7 | Electrical | | | Note 1 | | |
| | Note 1: WT will determine location on field wiring plans (preliminary) with an engineering package after execution of the contract.<br>Other: WT will supply a 480V 3PH 60 HZ distribution panel for all loads inside the battery limits of the WWTS. Purchaser will be responsible for powering this panel based on not to exceed loads that will be provided on the single line diagram with an engineering package after execution of contract. | | | | | |
| 8 | Communication | | | Note 1 | | |
| | Note 1: WT will determine location on field wiring plans (preliminary) with an engineering package after execution of the contract<br>Other: Tie points will be at WT supplied PLC. Purchaser will be responsible for communication cable with any systems outside of 10’ of WesTech’s treatment boundary. | | | | | |

## Site Information

**Table 6. Plant Bowen Site Specific Information**

| | | | |
|---|---|---|---|
| **Operating Company** | Georgia Power Company | | |
| **Plant** | Plant Bowen | | |
| **Units** | 1-4 | | |
| **Street Address** | 317 Covered Bridge Road | | |
| **City** | Euharlee | | |
| **County** | Bartow | | |
| **State** | Georgia | | |
| **Zip Code** | 30120 | | |
| **Grade Elevation** | 306’-0” ASL | | |
| **Railroad Access** | Yes (CSX) | | |
| **Barge Access** | No | | |
| | **Minimum** | **Typical** | **Maximum** |
| **Ambient Temperature (°F)** | -10 | 75 | 107 |
| **Indoor Temperature (°F)** | 45 | 90 | 110 |
| **Ambient Relative Humidity (%)** | 30 | 60 | 100 |
| **Barometric Pressure (psia)** | | 14.535 | |
| **Average Monthly Rainfall (in)** | | 4.67 | |
| **Max. Daily Rainfall (25yr/24hr, in)** | | | 7.11 |
| **Max. Single Rainfall Event (10yr/2hr, in)** | | | 3 |

## Scope Split

**Table 7. Plant Bowen Project Execution Scope Matrix**

| Scope Matrix | | | | |
|---|---|---|---|---|
| **Work Category** | **Functional Design/Input** | **Detailed Design** | **Supply** | **Install/ Perform** |
| Equipment Supply | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Earthwork | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Concrete | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Interconnecting Piping (plant)* | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Interconnecting piping (to plant)** | Owner | Owner | Owner | Owner |
| Interconnecting Wiring* | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Interconnecting Wiring (to plant)** | Owner | Owner | Owner | Owner |
| Main Power Distribution | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Transformer | WesTech | Owner | Owner | Owner |
| MCC | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| PLC | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Temporary Structures | WesTech | WesTech | WesTech | 3rd Party Construction Contractor |
| Permitting | WesTech | WesTech | Owner | Owner |

*Within boundary limits of the plant

**Outside boundary limits of the plant (See Battery Limits)

## Process Flow Diagram

[Attached separately until final draft]

## Site Plan

[Attached separately until final draft]

# Process Description

## Physical / Chemical Treatment (Existing)

### Softening to Lower TDS

Precipitation of solids by caustic and soda ash softening lowers the hardness and therefore Total Dissolved Solids (TDS) will be lowered as well. Dosage of caustic and soda ash will be in reaction tanks upstream of the clarifier. Metals precipitation can be improved by the addition of organosulfide. The clarifier is followed by continuous backwash sand filters. pH adjustment with acid takes place in the Stage 1 VSEP Feed Tank which also serves as an attenuation tank.

## Membrane Treatment System

### Stage 1 VSEP Feed Tank

The influent for the system goes into the Stage 1 VSEP Feed Tank. The Stage 1 VSEP Feed Tank is fed by the multimedia filter effluent. The tank also receives flow from the concentrate of the Stage 3 Reverse Osmosis (RO) membrane. Acid is added to the Stage 1 tank for any necessary pH adjustment. Antiscalant and bisulfite are dosed in the header to prevent scaling and reduce chlorine respectively.

The Stage 1 Low Pressure VSEPs pull from the Stage 1 VSEP Feed Tank. To prevent cavitation of the VSEP feed pumps, a booster pump on the feed line starts when both low pressure VSEP membranes are active.

### Stage 1 Low Pressure VSEP

The Low Pressure VSEP Membranes use membrane filtration to achieve liquid/solid separation. They employ a unique vibrating filter pack that produces a high shear rate on the membrane surface which inhibits membrane surface fouling and induces greater filtrate flow rates during the filtration process.

The Stage 1 Low Pressure VSEPs discharge two streams: permeate (filtrate or product) and concentrate (brine or retentate). The VSEP concentrate is sent to the Stage 2 High Pressure VSEP Feed Tank. The permeate is sent to the Stage 3 Spiral RO Feed Tank.

The membranes will need to be cleaned occasionally to remove accumulated foulants or scaling. There are two modes of cleaning, flush and CIP. Flush is a lower pressure single pass step where heated RO permeate is sent to the system for removal of foulants and/or scaling. CIP is a lower pressure recirculation step where heated RO permeate mixed with cleaning chemicals is sent to the system for removal of more stubborn foulants.

### Stage 2 High Pressure VSEP Feed Tank

The Stage 2 High Pressure VSEP Feed Tank receives flow from the Low Pressure VSEP membranes concentrate. This tank is the feed tank to the Stage 2 High Pressure VSEP membranes for further volume reduction. Antiscalant is dosed after the Feed Tank to prevent scaling.

### Stage 2 High Pressure VSEP

The High Pressure VSEP membranes use membrane filtration to achieve liquid/solid separation. They employ a unique vibrating filter pack that produces a high shear rate on the membrane surface which inhibits membrane surface fouling and induces greater filtrate flow rates during the filtration process.

Stage 2 membranes operate at a higher pressure than Stage 1 due to the higher dissolved solids loading in the brine feed that must be rejected at the membrane surfaces.

The Stage 2 High Pressure VSEPs discharge two streams: permeate (filtrate or product) and concentrate (brine or retentate). The Stage 2 High Pressure VSEP concentrate is sent to the Concentrate Storage Tank. The permeate is sent to the Stage 3 Spiral RO Feed Tank.

The membranes will need to be cleaned occasionally to remove accumulated foulants or scaling. There are two modes of cleaning, flush and CIP. Flush is a lower pressure single pass step where heated RO permeate is sent to the system for removal of foulants and/or scaling. CIP is a lower pressure recirculation step where heated RO permeate mixed with cleaning chemicals is sent to the system for removal of more stubborn foulants.

### Stage 3 Spiral RO Feed Tank

The Stage 3 Spiral RO Feed Tank receives flow from the Stage 1 Low Pressure VSEP permeate, Stage 2 High Pressure VSEP permeate, and Stage 4 Spiral RO concentrate. This tank is the feed tank to the Stage 3 Spiral RO membranes for further polishing.

### Stage 3 Spiral RO

The Stage 3 Spiral RO is the first stage of polishing after the VSEP membranes. There are 3 stages of RO (stage 3,4, and 5) total. The last stage is required to lower the mercury concentration to the required effluent quality. The same principles of operation apply to this membrane as the Stage 1 Low Pressure VSEP membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Stage 4 Spiral RO Feed Tank. The concentrate is recycled back to the Stage 1 Low Pressure VSEP Feed Tank for additional processing. The Stage 3 Spiral RO is cleaned in a similar manner to the Stage 1 and 2 VSEP membranes.

### Stage 4 Spiral RO Feed Tank

The Stage 4 Spiral RO Feed Tank receives flow from the Stage 3 Spiral RO permeate, and Stage 5 Spiral RO concentrate. This tank is the feed tank to the Stage 4 Spiral RO membranes.

### Stage 4 Spiral RO

The Stage 4 Spiral RO is the second stage of polishing after the VSEP membranes. The same principles of operation apply to this membrane as the Stage 3 Spiral RO membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Stage 5 Spiral RO Feed Tank. The concentrate is recycled back to the Stage 3 Spiral RO Feed Tank for additional processing. The Stage 4 Spiral RO is cleaned in a similar manner to the previous system membranes.

### Stage 5 Spiral RO Feed Tank

The Stage 5 Spiral RO Feed Tank receives flow from the Stage 4 Spiral RO permeate. This tank is the feed tank to the Stage 5 Spiral RO membranes.

### Stage 5 Spiral RO

The Stage 5 Spiral RO is the third and final stage of polishing after the VSEP membranes. The same principles of operation apply to this membrane as the previous spiral RO membranes. The feed stream is separated into 2 discharge streams: permeate and concentrate. The permeate is sent to the Permeate Forwarding Storage Tank. This permeate water will meet the effluent limits assumed from the 2020 ELG

VIP. The concentrate is recycled back to the Stage 4 Spiral RO Feed Tank for additional processing. The Stage 5 Spiral RO is cleaned in a similar manner to the previous system membranes.

### Concentrate Storage Tank

The Concentrate Storage Tank will receive the concentrate flow from the Stage 2 High Pressure VSEP membranes. It will feed the AVARA system.

### Thermal Evaporator (AVARA)

Parallel thermal evaporators will be used to reach the appropriate flow rate. The thermal evaporators will be AVARA systems. AVARAs use advanced vapor recompression technology for thermal evaporation and to concentrate a brine stream. AVARA systems are fully automated and come as a fully skidded solution.

The AVARAs will be fed by the Concentrate Storage Tank. The brine from the AVARAs will go to the Brine Storage Tank while the distillate will be fed to the permeate forwarding tank.

The Thermal Evaporator is used to concentrate brine from the High Pressure VSEP membranes to the point just before saturation. It is expected that the concentration of TDS could reach up to 250,000 ppm.

The Thermal Evaporators will heat the feed concentrate to the point of boiling. Water is pumped through a 500 mesh self-cleaning filter and split into two streams. One stream is sent through the distilled heat-exchanger while the other is sent through the brine heat exchanger. The streams recombine and are sent to the core tank section of the AVARA.

In the core tank section, water is boiled to create a saturated vapor. Vapor is compressed to between 3 and 7.5 PSI with a blower. The compressed vapor is then forced through dimpled plates. As the vapor moves through the plates, it condenses. The condensed and distilled water is then pumped through the feed heat exchangers and out of the system as effluent to the Permeate Forwarding Storage Tank.

Operators watch the pressures within the AVARA. Changes in pressure can change production rate and temperature making it a key process condition. Operators can adjust relief valves, heater temperature, blower speed, and the heat exchanger by-pass valve to optimize system pressures.

With much of the feed water evaporated, condensed, and discharged, the brine left in the AVARA will continue to recirculate through the heat exchanger. Once it is concentrated to a point just before saturation, it is pumped out of the system. A control valve will control brine discharge flowrate and will be set to maintain the desired brine concentration. Brine will be sent to the Brine Storage tank where it will then be processed through the Solidification Batch Plant.

### Permeate Forwarding Storage Tank

The Permeate Forwarding Storage Tank will receive flow from the Stage 5 Spiral RO membranes and the AVARA distillate. The Permeate Forwarding Storage Tank supplies the Permeate Forwarding Pump Skid that sends water to the FGD Effluent Tank located in the existing Phys/Chem Treatment Area.

## Solidification Plant

The solidification plant will work to collect and meter dry solidification materials and brine for loading into a cement mixer. These solidification materials are Flyash, Lime, and standard concrete conditioning additives. Flyash with small amounts of lime will be used as the primary solidification material. If Flyash is not readily available, Cement and lime can be used as an alternative. These materials will be stored in silos above a weigh hopper. These materials will be metered into the weigh hopper at a known quantity. This hopper will feed the dry material into cement trucks followed by brine for mixing. The solidification plant will be designed for fugitive dust control. The cement truck will transport the mixed material for disposal. The solidified brine mixture will pass both the paint filter test and the Toxicity Leaching Characteristic Procedure prior to being landfilled in an on-site facility.

## Equipment List

**Table 8. Plant Bowen Budgetary Study Major Equipment List**

### Major Equipment List

| Item | Description | Materials | Size |
|---|---|---|---|
| Reaction Tanks | Cylindrical open top, flat bottom tank, shop built, with mixer | FRP tank, rubber lined carbon steel mixer | 3 Tanks<br>15,000 gal<br>12'D x 20' |
| Flocculating Clarifier Mechanisms | Curved rake blades on posts, paddle wheel type flocculator in existing feedwell, dual shaft drive 83,500 ft-lbs with 10 ton lift | Rubber lined carbon steel with some FRP components | Modifications to 3 existing clarifiers<br>38'D x 18' |
| Caustic Storage / Feed System | Cylindrical closed top tank | HDPE | 1 x 100%<br>12,000 gal<br>12'D x 16' – 7.75"H |
| Soda Ash Silo | Heavy Soda Ash Cone Bottom Sloped Roof | Carbon steel | 2 x 50%<br>14'D x 78' storage height |
| Influent Pump Skid | Centrifugal | SS | 1 Skid<br>2 x 100% pumps per skid<br>@ 20 psi<br>1500 gpm<br>10 HP each |
| Stage 1 VSEP Feed Tank | Open top cylindrical tank (existing)<br><br>Mixer (new) | FRP<br><br>Rubber lined steel | 1 x 100%<br>174,000 gal<br>30'D x 34'H |
| Stage 1 VSEP Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | 7 Skids<br>4 x 25% pumps per skid<br>@ 450 Total PSI<br>1500 gpm total<br>200 HP each |
| Stage 1 Low Pressure VSEP Membranes | Vibrating disc membrane filters | Varies | 7 Skids<br>8 Modules per Skid<br><br>52 of 56 Modules (84")<br>(4 spare/future)<br><br>1,867 gpm total<br>8 x 20 HP Vibration Motors |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 2 High Pressure VSEP Feed Tank | Cylindrical closed top tank | FRP | 1 x 100%<br>55,000 gal<br>18'D x 30'H |
| Stage 2 High Pressure VSEP Feed Pumps | Positive displacement | SS | 16 skids<br>4 x 25% pumps per skid<br>@ 750 Total PSI<br>933 gpm total<br>200 HP each |
| Stage 2 Membranes High Pressure VSEP Membranes | Vibrating disc membrane filters | Varies | 16 Skids<br>4 Modules per Skid<br><br>61 of 64 Modules (17")<br>(3 spare/future)<br><br>933 gpm total<br>4 x 20 HP Vibration |
| Stage 3 Spiral RO Feed Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>100,000 gal<br>25'D x 30'H |
| Stage 3 Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (12x)<br>2 pumps per skid @ 300 PSI<br>1667 gpm total<br>50 HP each |
| Stage 3 Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 12 Skids<br><br>45 Elements per skid<br><br>1667 gpm total |
| Stage 4 Spiral RO Feed Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>100,000 gal<br>25'D x 30'H |
| Stage 4 Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (10x)<br>2 pumps per skid @ 200 PSI<br>1483 gpm total<br>40 HP each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 4 Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 10 Skids<br><br>45 Elements per skid<br><br>1483 gpm total |
| Stage 5 Spiral RO Feed Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>100,000 gal<br>25'D x 30'H |
| Stage 5 Spiral RO Feed & Booster Pumps | Vertical Multi-Stage Centrifugal | SS | On Spiral RO Skid (8x)<br>2 pumps per skid @ 200 PSI<br>1216 gpm total<br>40 HP each |
| Stage 5 Spiral RO Membranes | S-18000 Spiral System<br><br>Spiral-wound membrane filters<br><br>Pre-Screen Basket Strainers Included | Varies | 8 Skids<br><br>45 Elements per skid<br><br>1216 gpm total |
| Permeate Forwarding Storage Tank | Flat Bottom Tank (Knock Down)<br><br>No Roof | FRP | 1 x 100%<br>68,000 gal<br>20'D x 30'H |
| Permeate Forwarding Pumps | Vertical Multi-Stage Centrifugal | SS | 2 x 100% @ 60 PSI<br>1033 gpm<br>75 HP |
| Evaporator Feed Pump | Horizontal Centrifugal | SS | 3x50% @ 60PSI<br>234 gpm each<br>20 HP each |
| Evaporator Booster Pumps | Horizontal Centrifugal | SS | 28 @ 43PSI<br>30 gpm each<br>5 HP each |
| Concentrate Storage Tank | Flat Bottom Tank (Knock Down) | FRP | 1 x 100%<br>150,000 gal<br>30'D x 30'H |
| Mixer | Hydrofoil Mixer | Rubber lined steel | 25 HP |

| Item | Description | Materials | Size |
|---|---|---|---|
| Evaporators | AVARA Advanced Vapor Recompression System | Varies | 14<br>30 gpm each<br><br>12'W x 50'L x 10'H each<br>84 GPM Brine Flow total<br><br>*Power Requirements:*<br>480V/3 Ph/ 600 Amp Breaker x (6) 3600 Amp Total<br><br>MVR Vapor Blowers A/B:<br>200 HP<br><br>Core Heaters<br>6 x 40 kW |
| Distillate Discharge Pump(s) | Horizontal Centrifugal | SS | 14<br>*25 gpm @ 45 psi, 5 HP* |
| Concentrate (Brine) Recycle/Discharge Pump(s) | Horizontal Centrifugal | SS | 14<br>*10 gpm @ 60 psi, 5 HP* |
| Stage 1 Low Pressure VSEP Clean-in-Place System | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 4 Systems<br><br>1 x 100% pumps each @ 250 PSI<br>60 gpm 20HP |
| | pH Sensor<br><br>Level Sensor | HDPE Tank/Piping | 260-gal HDPE Tank<br>3'D x 6' – 4"H<br><br>~2010 lb each |
| Stage 2 High Pressure VSEP Clean-in-Place Systems | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 2 Systems<br><br>1 x 100% pumps each @ 250 PSI<br>60 gpm 20HP |
| | pH Sensor<br><br>Level Sensor | HDPE Tank/Piping | 200-gal HDPE Tank each<br>3'Dx 4' – 6"H<br>~2010 lb each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 3-5 Spiral RO Clean-in-Place System | Vertical Multi-Stage Centrifugal Pump | 316 SS Pump | QTY – 1 Systems<br><br>1 x 100% pumps each @ 185 PSI<br>60 gpm 20HP |
| | pH Sensor | HDPE Tank/Piping | 200-gal HDPE Tank each<br>3'D x 4'– 6"H |
| | Level Sensor | | ~2010 lb each |
| Water Heating System | | Varies | 400 HP max<br><br>Tank – 6,100 gal<br>10'D x 12' – 8"H |

**Table 9. Chemical Feed Systems and Tankage Equipment List**

## Chemical Feed Systems & Tankage

| Item | Description | Materials | Size |
|---|---|---|---|
| Organosulfide | Tote Fed | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph |
| Soda Ash | Silo | Carbon Steel | 274 gpm |
| Caustic | Cylindrical Closed Top Chemical Storage Tank | HDPE | 3.4 gpm<br>9500 gal |
| Hydrochloric Acid | Tote Fed | | 0.6 gpm |
| VSEP AntiScalant 1 Feed System | Tote Fed<br>100% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| VSEP pH Adjust Feed System | Tote Fed<br>Sulfuric Acid 93% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1.2 gph<br>0.5 HP each |
| VSEP Sodium Bisulfite Feed System | Tote Fed<br>40% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>2 gph<br>0.5 HP each |
| VSEP Antiscalant 2 System | Tote Fed<br>100% Active | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| Spiral RO Antiscalant 2 System | Tote Fed | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>0.5 HP each |
| Biocide Feed System | Tote Fed | HDPE Skid, Sch 80 PVC Plumbing | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>1 HP each |
| Stage 1 Low Pressure VSEP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 4 x 100% Metering pumps<br>1 HP each |
| Stage 1 Low Pressure VSEP CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 4 x 100% Metering pumps<br>1 HP each |

| Item | Description | Materials | Size |
|---|---|---|---|
| Stage 2 High Pressure VSEP CIP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 2 x 100% Metering pumps<br>1 HP each |
| Stage 2 High Pressure VSEP CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 2 x 100% Metering pumps<br>1 HP each |
| Stage 3-5 Spiral RO CIP Low pH Membrane Cleaner (NLR 404) Feed System | See NLR 404 Storage Tank | Varies | 1 x 100% Metering pumps<br>1 HP each |
| Stage 3-5 Spiral RO CIP High pH Membrane Cleaner (NLR 505) Feed System | See NLR 505 Storage Tank | Varies | 1 x 100% Metering pumps<br>1 HP each |
| NLR 404 Storage Tank | Cylindrical Closed Top Chemical Storage Tank | HDPE | 1 x 100%<br>4000 gal |
| NLR 505 Storage Tank | Cylindrical Closed Top Chemical Storage Tank | HDPE | 1 x 100%<br>4000 gal |
| AVARA Acid Feed System | Tote Fed | | 2 x 100% Metering pumps (plus shelf spare)<br>1 gph<br>1 HP each |
| AVARA Antiscalant Feed System | Tote Fed | | 2 x 100% Metering pumps (plus shelf spare) pumps<br>1 gph<br>0.5 HP each |

# Level 1 Schedule

[Attached separately until final draft]

## Major Equipment Lead Times

**Table 10. Major Equipment Lead Times**

| Major Equipment Lead Times | |
|---|---|
| **Vendor (Equipment)** | **Lead Time** |
| New Logic (Membranes) | 24 months |
| AVARA (Evaporators) | 16 months |
| Batch Plant (By Others) | 30 weeks |

# VSEP & AVARA Equipment Descriptions

## Item A – VSEP Membranes and Spiral RO Membrane Systems

**Table 11. New Logic VSEP and Spiral RO Membrane System Design Overview**

| System Design Overview | |
|---|---|
| **Parameter** | **Value** |
| Influent Flow Rate | 1500 gpm |
| Estimated System Filtrate Recovery | ~69% |
| Stage 1 LP VSEP Recovery | ~50% |
| Stage 2 HP VSEP Recovery | ~50% |
| Stage 3 SRO Recovery | ~78% |
| Stage 4 SRO Recovery | ~82% |
| Stage 5 SRO Recovery | ~85% |

### Design Assumptions:

#### Design Case 1:

The VSEP Stage 1 modules are designed for a total flow rate of 1867 gpm. This includes 1500 gpm of phys/chem effluent and 367 gpm of recycled reject from the Stage 3 Spiral RO Membranes and an influent TDS value of 10,000 mg/L. A membrane efficiency factor of 130% is applied to the design flux to reflect the change in membrane throughput over time. This factor would correlate to 100% throughput effectiveness in year three of operation.

Redundancy and cleaning frequency is estimated on a per day basis at roughly 8% of an operational day. It is important to note that this is not the actual cleaning/maintenance frequency and is an average assumed value.

### VSEP Stage 1 Low Pressure Membranes Specifications

#### Filter Pack:

| | |
|---|---|
| Membrane: | RO |
| Allowable Process Temperature: | 5°C-60°C |
| Allowable Feed Slurry pH Range: | 2-12 |
| O-ring and Seal Material: | EPDM |
| Filter Pack Housing: | Glass impregnated epoxy resin (FRP) |
| Wetted Steel Trays: | 304 Stainless Steel |
| Wetted Plastic End Plates: | Polypropylene |

#### Vibration System:

| | |
|---|---|
| Vibration Drive Motor: | Baldor CM4106T 460VAC, 3phase, 20HP, 3525 RPM |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Max. Vibration Amplitude: | 3/4 inch (peak to peak measured at the Filter Pack) |
| Frequency Range: | 49.0 Hz to 55.0 Hz (Approximate) |

| | |
|---|---|
| Maximum Decibels: | <85 |
| Bearing RPM: | 2800 to 3100 |
| Bearing Oil: | Sullube ~750 ml Compressor Oil |
| Bearing O-rings: | 2-263 & 2-270 Buna |

**Pump Specifications:**

| | |
|---|---|
| Feed Pump Type: | Grundfos 316SS Vertical Multi-stage Centrifugal |
| Feed Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Chemical Metering Pump: | Bran+Luebbe |
| Metering Pump Motor: | Baldor 3/4HP TEFC 120/220V, 1phase, 15A, 60/50Hz |

**Pre-Screen Basket Strainer:**

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made 316 SS |
| Basket Strainer: | 100 Mesh 316 SS (Considered consumable) |
| Capacity: | 120 GPM |
| Elastomers (Seals): | EPDM |

**Operating Site Conditions:**

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sunlight & rain. |
| Ambient Temperature: | 5º - 37°C |
| Storage Temperature: | 2º - 70°C (Protect Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating VFD |

**Piping:**

| | |
|---|---|
| High Pressure Piping: | Schedule 80 316 SS |
| Low Pressure Piping: | Schedule 40 316 SS |
| Special VSEP Concentrate Pipe: | 1-1/4” OD 904L Stainless Steel Tubing .065 wall |
| Flexible Hoses: | SBR/NBR Lined Reinforced Flex Hose |
| Pipe Clamps: | Zero-Flex Victaulic Style 07 EPDM |
| On/Off Valves: | 316 SS 3-piece ball valve |
| Manual Valves: | 316 SS 3-piece ball valve |
| Flow Control Valves: | 316 SS V-port ball valve |
| Check Valves: | 316 SS swing check valve |
| Pneumatic Actuators: | Alpha Compact 4, Spring Return |
| Positioners: | BLX Linear Quarter Turn I/P |
| Skid Pipe Terminations: | 150 lb 316 SS Raised Face Flange |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

**Clean in Place (CIP):**

| | |
|---|---|
| CIP Pump Type: | Grundfos 316 SS Vertical Multi-Stage Centrifugal |
| CIP Pump Motor: | Grundfos ML 3500 rpm TEFC 460 VAC 3-phase |
| Motor Speed Controller: | Danfoss 380-480 VAC NEMA 4 (or equal) |
| Clean in Place Tank: | 200 Gallon Cross Linked Polypropylene |
| pH Meter: | GF Signet 3-2726-00, 3-2750-1, 3-9900-1 |
| Level Sensor: | IFM Efector PN-2298 |

### Electrical Specifications:

| | |
|---|---|
| Controls Voltage: | 220/120VAC, 1phase, 15A, 50/60Hz |
| Enclosures: | Hoffman NEMA 4 Powdercoat Finish |
| Switches, Relays, & Contactors: | Allen Bradley 220/110 Volt |
| Programmable Controller: | AB ControlLogix 1756 |
| Operator Display: | AB Industrial Computer |
| Pressure Sensors: | IFM Efector PN-2292 |
| Mag Flow Tube and Transmitter: | IFM Efector SM2004, SM0540 |
| Bag Filter DP Sensors: | IFM Efector PN-2294 |
| Temperature Sensor: | IFM Efector TN-2511, UT0028 |
| Conductivity Meter: | GF Signet 3-2850-52-42/41 |
| Solenoid Valves: | Festo Manifold Gang Mounted Dual 3/2 24 VDC |
| CIP Communication: | Festo Ethernet Flex IO |
| VFD Communication: | Ethernet Com Card |
| DCS Communication: | Ethernet OPC Server (option for Modbus) |

## VSEP Stage 2 High Pressure Membranes Specifications

### Filter Pack:

| | |
|---|---|
| Membrane: | RO |
| Allowable Process Temperature: | 5º-60ºC |
| Max Process Pressure: | 1000 psi (7000 kPa) |
| Allowable Feed Slurry pH Range: | 2-12 |
| O-ring and Seal Material: | EPDM (option for Viton) |
| Filter Pack Housing: | Glass impregnated epoxy resin (FRP) |
| Wetted Steel Trays: | 316 Stainless Steel |
| Wetted Plastic End Plates: | Polypropylene |

### Vibration System:

| | |
|---|---|
| Vibration Drive Motor: | Baldor 380-480VAC, 3phase, 20HP, 3525 RPM Motor |
| Speed Controller: | Danfoss 20HP 380-480VAC, NEMA 4 (or Equal) Max. |
| Vibration Amplitude: | 3/4 inch (peak to peak measured at the Filter Pack) |
| Frequency Range: | 43.0 Hz to 55.0 Hz (Approximate) |
| Maximum Decibels: | <85 |
| Bearing RPM: | 2800 to 3100 |
| Bearing Oil: | Sullube ~750 ml Compressor Oil |
| Bearing O-rings: | 2-263 & 2-270 Buna |

### Pump Specifications:

| | |
|---|---|
| Feed Pump Type: | Hydracell Hastelloy, Horizontal Teflon Diaphragm |
| Feed Pump Motor: | Baldor 380-480VAC, 3phase, 30HP, 1200 RPM |
| Booster Transfer Pump Type: | NOTE Supplied by Customer at Feed Tank (24 ft NPSH) |
| Motor Speed Controller: | Danfoss 380-480VAC, NEMA 4 (or Equal) |
| Chemical Metering Pump: | Bran+Luebbe Diaphragm pump with manual stroke |
| Metering Pump Motor: | Baldor 3/4HP TEFC 120/220V, 1phase, 15A, 60/50Hz |
| Dosing Solenoid Pump: | Chemtech Series 100 |

**Pre-Screen Basket Strainer:**

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made 2507 Alloy Shell |
| Basket Strainer: | 100 Mesh 316 SS (Considered Consumable) |
| Capacity: | 120 GPM, 4.6 sq ft |
| Elastomer Seals: | EPDM (option for Viton) |

**Operating Site Conditions:**

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sunlight & rain. |
| Ambient Temperature: | 5º - 37°C |
| Storage Temperature: | 2º - 70°C (Protect Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating VFD |

**Piping:**

| | |
|---|---|
| Maximum Pressure: | 900 psi |
| Feed/Concentrate Pressure Piping: | Schedule 80 Super Duplex 2507 |
| Permeate Piping: | Schedule 40 316 SS |
| Special VSEP Concentrate Pipe: | 1-1/4” OD Alloy 20 Stainless Steel .065 wall |
| Flexible Hoses: | Neoprene Lined Reinforced Weatherhead Flex Hose |
| Pipe Clamps: | Victaulic Zero-Flex Style 07 EPDM |
| Pneumatic Air Supply: | 90lb Instrument Grade Air (3/8" connection) |
| Airline Tubing Fittings | Hylok 316 SS |
| Piping Drain Fittings | Hylok 2507 Duplex |
| Feed/Conc On/Off Valves | Flotite Alloy 2507 3-piece ball valve |
| Permeate On/Off Valves | Flotite 316 SS 3-piece ball valve |
| Flow Control Valves | Flotite Alloy 2507 V-port ball valve |
| Permeate Check Valves | 316 SS Swing check |
| Pneumatic Actuators | Habonim Compact, Spring Return |
| Feed/Concentrate Pipe Terminations | 150 lb Alloy 2507 Flange |
| Permeate Pipe Terminations | 150 lb 316 SS Flange |
| Flange Gaskets | 150 lb Garlock Blue Guard |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

**CIP:**

| | |
|---|---|
| CIP Pump Type: | Grundfos 316SS Vertical Multi-stage Centrifugal |
| CIP Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | AC Tech 380-480VAC, NEMA 4 (or Equal) |
| Clean in Place Tank: | 200 Gallon Sloped Cross Linked Polypropylene |
| pH Meter: | GF Signet 3-2726-00, 3-2750-1, 3-9900-1 |
| Level Sensors: | IFM Efector PN-2298 |

**Electrical:**

| | |
|---|---|
| Controls Voltage: | 120/220VAC, 1phase, 15A, 50/60Hz |
| Enclosures: | Hoffman NEMA 4 Powdercoat Finish |
| Wireway Gutters: | Hoffman NEMA 4 Powdercoat Finish |
| Switches, Relays, & Contactors: | Allen Bradley 120/220 Volt |
| Remote Access: | Ewon Cosy 131 |
| Programmable Controller: | AB Compact Logix 1769 |

| | |
|---|---|
| Operator Display: | AB Versa View 5400 |
| IO Link Masters and Hubs: | IFM Efector AL1122 |
| Feed/Conc Pressure Sensors | IFM Efector PN-2292 (with 2507ss seals) |
| Permeate Pressure Sensors | IFM Efector PN-2292 316ss |
| Conc Mag Flow Tube and Transmitter | Rosemount (or equal) (with Hastelloy electrodes/flanges) |
| Perm Mag Flow Tube and Transmitter | IFM Efector SM2000 316ss |
| Bag Filter DP Sensors | Efector PN-2294 (with 2507ss seals) |
| Temperature Sensor | IFM Efector TN-2511, (with 2507ss thermowell) |
| Conductivity Meter | Rosemount or equal (PEEK, Hastelloy, EPDM) |
| pH Meter | Rosemount or equal (PEEK, glass, Hastelloy, EPDM) |
| Solenoid Valves: | Festo Manifold Gang Mounted Dual 3/2 24 VDC, IO Link |
| CIP Communication: | IFM Efector IO Link Masters over Ethernet |
| VFD Communication: | Ethernet Com Card (Ethernet Switch) |
| DCS Communication: | Ethernet OPC Server (option for Modbus) |

## Spiral RO Stages 3 – 5 Membranes (S-18000) Specifications

### Filter Pack:

| | |
|---|---|
| Membrane: | RO (depends on application and pilot testing) |
| Membrane Surface Area: | 18000sf (1672m2) (45ea 8”Dia x 40”L) |
| Maximum Operating Temperature: | 120 $^{O}$F (49ºC) (Options for up to 80ºC) |
| Allowable Feed Slurry pH Range: | 2-11 |
| O-ring Material: | Ethylene Propylene |
| Filter Pack Housing: | Polyurethane Coated, Filament Wound, Epoxy |
| FRP Wetted Ports: | 316L Stainless Steel |
| Wetted Plastic End Plates: | PVC Thermoplastic |

### Piping:

| | |
|---|---|
| Maximum Pressure: | 550 psi (Options for up to 1200 |
| psi) Pressure Piping: | 316L Stainless Steel Schedule 80 |
| Atmospheric Piping: | 316L Stainless Steel Schedule 40 |
| Pipe Clamps: | Zero-Flex Victaulic Style 07 |
| EPDM On/Off Valves: | 316 SS 3-piece ball valve |
| Flow Control Valves: | 316 SS V-port ball valve |
| Check Valves: | 316 SS swing check valve |
| Pneumatic Actuators: | Habonim Compact, Spring Return |
| Positioners: | BLX Linear Quarter Turn I/P |
| Skid Pipe Terminations: | 150 lb 316 SS Raised Face Flange |
| Flange Gaskets: | 150 lb Garlock Blue Guard |

### Pump Specifications:

| | |
|---|---|
| Feed Pump Type: | Grundfos 316SS Vertical Multi-stage |
| Centrifugal Feed Pump Motor: | Grundfos ML 3500 rpm TEFC 460VAC, 3phase |
| Motor Speed Controller: | Danfoss 380-480VAC, NEMA 4 (or Equal) |

### Pre-Screen Basket Strainer:

| | |
|---|---|
| Filter Housing Type: | NLR Custom Made 316 SS |
| Basket Strainer: | 100 Messh 316SS (Optional Felt Bag Filter) |
| Capacity: | 120 GPM, 4.6 sq ft |
| Elastomer Seals: | EPDM (option for Viton) |

### Operating Site Conditions:

| | |
|---|---|
| Equipment Rating: | NEMA 4, Indoor/Outdoor protect from sun & rain. |
| Ambient Temperature: | 5 - 37°C |
| Storage Temperature: | 2 - 70°C (Project Filter Pack from Freezing) |
| Max Relative Humidity: | <95%, non-condensing |
| Elevation: | 3300 ft maximum without derating |

### Electrical Specifications:

(Note typically this is provided with a VSEP system, and the PLC/HMI is split with the spiral system. The controls are mounted on CIP 'Clean in Place' Skid that is also shared)

| | |
|---|---|
| Controls Voltage: | 120/220VAC, 1phase, 15A,5 0/60Hz |
| Programmable Controller Type: | None (Control signals from CIP PLC) |
| Touch Screen Display Type: | None (Set Point change at CIP HMI) |
| Enclosures: | *Hoffman* NEMA 4 Powdercoat Finish 20x16x8 |
| Switches, Relays, & Contactors: | Allen Bradley 120/220 Volt |
| IO Link Masters and Hubs: | IFM Efector AL1122 |
| Pressure Sensors: | IFM Efector PN-2292 |
| Mag Flow Tube and Transmitter: | IFM Efector SM2000, SM8000 |
| Bag Filter DP Sensors: | IFM Efector PN-2294 |
| Temperature Sensor: | IFM Efector TN-2511, UT0028 |
| Conductivity Meter: | IFM Efector LDL-100 |
| Solenoid Valves: | Festo Manifold Gang Mounted Dual 3/2 24 VDC, IO Link |
| VSEP and CIP Communication: | IO Link |
| VFD Communication: | Ethernet Com Card |
| DCS Communication: | Ethernet OPC Server (option for Modbus) |

## Item B – AVARA: Advanced Vapor Recompression System

**Table 12. Advanced Vapor Recompression System (AVARA) System Design Overview**

**System Design Overview**

| Parameter | Value |
|---|---|
| Total Influent Flow Rate | 467 gpm |
| Total Estimated Evaporation | 383 gpm |
| Total Estimated Brine | 84 gpm |
| Feed TDS | 45,000 ppm |
| Target Brine TDS | 250,000 ppm |
| Nominal Operating Electricity | 7910 kW |
| Required Electricity | 480V / 3 Phase / 60 hz |

AVARA features patented submerged core technology. Feed water is pumped into a tank and heated with immersion heaters. As steam is generated, compressors force the steam back into the submerged heat exchanger (core) where the steam recondenses into a clean distillate. The AVARA is capable of concentrating the residual brine in the tank up to 300,000 ppm TDS before being discharged from the system for disposal or beneficial use. AVARA can significantly reduce the amount of wastewater requiring disposal while providing a distilled water byproduct.

## AVARA Specifications

**Table 13. AVARA System Design Specifications (per Treatment Unit)**

| AVARA System Specifications (per Treatment Unit) | |
|---|---|
| **Parameter** | **Value** |
| Skid Dimension | 12’ W x 50’ L x 10’ H |
| Skid Shipping Weight | 100,000 lbs |
| Weather Enclosed | Yes |
| Fuel Type | Electricity: Grid or Genset |
| Line Power | 3 Phase – 480V; 800 Service Amps; 500 Running Amps |
| Generated Power | Min. 450kW Genset (prime rated) |
| Volume Capacities | Mid-range to high TDS feed |
| Discharge TDS | Up to 300,000+ PPM TDS |
| Inlet Water Pressure | 5’ Head Pressure |
| Set-up Time | 24 Hours |
| Remote Monitoring | Yes |

# Solidification Equipment Descriptions

## Item A – Standley Batch Systems, Inc.

**Table 14. Encapsulation Standley Batch Systems Fly Ash Silo Overview**

| Item No. | Description |
|---|---|
| 1A | Flyash Silo (1850 cuft) |
| 1B | Flyash Silo (1850 cuft) |
| 2A | Flyash Silo (1850 cuft) |
| 2B | Flyash Silo (1850 cuft) |
| 3A | Flyash Silo (1850 cuft) |
| 3B | Flyash Silo (1850 cuft) |
| 3C | Lime Silo (1600 cuft) |
| 4 | HyControl Silo Safety (7 Silo) |
| 5 | Screw Conveyors (2) |
| 6 | Weigh Batcher |
| 7 | Water Tank and Weigh Batcher |
| 8 | Drive Thru Structure |
| 9 | Collecting Hopper |
| 10 | Valve Bank Enclosure |
| 11 | Starter Enclosure |

## Item B – C&W DusTech

**Table 15. C&W DusTech System Overview**

| Item No. | Description |
|---|---|
| 12 | Dust Collector w/ Explosion Protection |
| 13 | Flap Valve Package |
| 14 | Drive Up Truck Dust Shroud |
| 15 | Ductwork Package (Shroud) |
| 16 | Ductwork Package (Silos) |
| 17 | Weigh Batcher Dust Collector |
| 18 | Mounting Flange-Weigh Batcher |

## Item C – Command Alkon

**Table 16. Command Alkon System Overview**

| Item No. | Description |
|---|---|
| 19 | Freight |
| 20 | Water Scale |
| 21 | Command Batch CP Control |
| 22 | Continuous Bin Levels |
| 23 | Installation |
| 24 | Travel |
| 25 | Project Management |
| 26 | Airfare |
| 27 | Expenses |

## Item D – BinMaster Inventory Management

**Table 17. BinMaster Inventory Management Overview**

| Item No. | Description |
|---|---|
| 28 | Continuous Measurement System (7 silo) |
| 29 | Mounting Plates (7) |
| 30 | Bin Disc Interface |
| 31 | Data Cable |
| 32 | On-site Startup |

## Item E – Solidification Site Work and Installation

**Table 18. Solidification Site Work and Installation Services Overview**

| Item No. | Description |
|---|---|
| 33 | Foundations, Ramps, Dust Collector Pads, Piers, Curbs |
| 34 | Installation and Erection |

# Engineering & Design Services

## Scope of Services

Deliverables developed during the engineering and design phase will serve as the basis of design for the project. The following engineering tasks and deliverables are included in this bid:

- Design Criteria
- Process Flow Diagram
- Process & Instrumentation Diagrams
- Mass Balance
- Hydraulic Profile
- Equipment Descriptions (GA drawings & Datasheets)
- Control Narrative
- Equipment Layout
- 3D Plant Modeling
- Site Civil Design
- HVAC Design
- Design & Construction Schedule

### Process Flow Diagram (PFD)

WesTech offers a wide range of treatment equipment that can be implemented in multiple process configurations and we will refine the approach with input from the finalized Design Criteria.

The PFD will identify the major pieces of equipment, their position in the process and the main control loops operating the process. They will indicate the main process streams and utility lines.

**Deliverable:**

- Process Flow Diagram

### Process & Instrumentation Diagrams (P&IDs)

After the Process Flow Diagram is finalized, WesTech will develop preliminary P&IDs for the process. The P&IDs will portray the components needed to run, monitor, control specific processes and will depict their relationship with each other. P&IDs will show equipment, piping that connects the equipment, instrumentation, and valves. The information compiled in the P&ID will provide the blueprint for the system and set the scope of the final project, define the process parameters and the level of controls. The P&IDs and supporting documentation are the most important document when establishing the details of the project.

P&IDs will be generated following ISA S5.1 and the owner's specifications. P&IDs typically include, but are not limited to the following information:

- Equipment names, tag and design conditions
- Relief valve location, tag numbers, sizes and pressure. Relief valve interlocks
- Venting, draining, maintenance, shutdown and start-up requirements are indicated
- Type of manual valves are identified, specialty piping items are tagged, and piping notes are added

- Control valves size, fail position, tags, and interlocks
- Vessel nozzles, details, and levels
- Process and utility lines
- Line sizes, line numbers, pipe specifications and product designation are indicated
- All instrumentation is shown with alarm and switch set points
- Instrument signals to control system are detailed
- Scope of supply, system boundaries

**Deliverable:**

- P&IDs based on finalized PFD

### Mass Balance

WesTech will perform mass balance calculations based on the finalized Design Criteria and PFD. Mass balance values will be used as inputs for specific equipment sizing.

**Deliverable:**

- Mass Balance calculations based on finalized PFD

### Equipment Descriptions (General Arrangement Drawings & Datasheets)

WesTech will provide detailed equipment descriptions including General Arrangement (GA) drawings, equipment datasheets, and other lists as required.

**Deliverables:**

- Equipment datasheets
- GA drawings

### Hydraulic Profile

WesTech will perform hydraulic calculations for the treatment system within the specified boundaries given in the Battery Limits Table of the Design Basis.

**Deliverables:**

- Hydraulic profile drawing

### HAZOP Assistance

WesTech will provide personnel for one (1) trip up to five (5) working days to participate in a hazard and operability study (HAZOP) workshop that will be conducted by others. Our process and controls engineers will assist in identifying and evaluating potential risks to personnel or equipment and operability issues.

### Control Narrative

WesTech process engineers will provide control narratives in paragraph form describing functionality of each unit process. Descriptions will include an overall description of the piece of equipment and how it is operated via pumps, blowers, valves, instruments, control logic, etc. Descriptions will also outline interactions between individual unit processes. The control narrative will provide the basis for PLC logic programming.

## Equipment Layout

As the equipment manufacturer, WesTech is intimately familiar with the plant site layout requirements needed to produce a functional site plan. Our in-house former mechanical piping contractors are experts at laying out piping networks to connect all the plant components. We use 3D modeling software to further increase our accuracy with interconnecting piping and civil structures.

**Deliverable:**

- Equipment layout drawings in native AutoCAD

## 3D Plant Modeling

- Equipment and interconnecting piping model
- Provided in native AutoCAD Plant 3D
- Periodic updates viewable in NavisWorks

**Deliverables:**

- 50% Model Review Workshop
- 90% Model Review Workshop

## Site Civil Design

- Site survey & topography
- Geotechnical investigation
- Finish grading plan design
- Storm drainage design
- Access road design
- Footing and foundation design

## HVAC Design

- Area classification identifications
- Heat load calculations
- Ventilation fan and louver sizing
- Unit heater equipment selection, and location drawings
- Make-up air unit sizing and ducting design drawings
- Mechanical cooling unit equipment selection and location drawings

## Design & Construction Schedule

WesTech will develop a detailed design and construction schedule that will be used by the team to ensure resources are properly allocated and to identify critical path items. The schedule will be a detailed Gantt chart using the latest Primavera P6 software to outline design, construction and start-up milestones.

**Deliverable:**

- Initial detailed design & construction Gantt chart schedule

# Clarifications and Exceptions

This report is provided as a non-binding budgetary study. The scope included does not reflect WesTech's intended scope of work if this project were to be actualized.

## General Clarifications

**Terms & Conditions:** Changes to any terms and conditions, including but not limited to submittal and shipment days, payment terms, and escalation clause shall be negotiated at order placement, otherwise the proposal terms and conditions contained herein shall apply.

**Paint:** If your equipment has paint included in the price, please take note to the following. Primer paints are designed to provide only a minimal protection from the time of application (usually for a period not to exceed 30 days). Therefore, it is imperative that the finish coat be applied within 30 days of shipment on all shop primed surfaces. Without the protection of the final coatings, primer degradation may occur after this period, which in turn may require renewed surface preparation and coating. If it is impractical or impossible to coat primed surfaces within the suggested time frame, WesTech strongly recommends the supply of bare metal, with surface preparation and coating performed in the field. All field surface preparation, field paint, touch-up, and repair to shop painted surfaces are not by WesTech.

**Escalation:** If between the proposal date and actual procurement and through no fault of the Seller, the relevant cost of labor, material, freight, tariffs, and other Seller costs combined relating to the contract, increase by greater than 2.5% of the overall contract price, then the contract price shall be subject to escalation and increased. Such increase shall be verified by documentation and the amount of contract price escalation shall be calculated as either the actual increased cost to the Seller or, if agreed by the Parties, the equivalent increase of a relevant industry recognized third-party index, and in both cases without any additional profit or margin being added.

**USA Tariffs and Current Trade Laws:** All prices are based on current USA and North America tariffs and trade laws/agreements at time of bid. Any changes in costs due to USA Tariffs and trade laws/ agreements will be passed through to the purchaser at cost.

# Commercial Proposal

Proposal Name: Plant Bowen Budgetary Study
Proposal Number: 24926A
Thursday, May 25, 2023

## 1. Bidder's Contact Information

| | |
|---|---|
| Company Name | WesTech Engineering LLC |
| Primary Contact Name | Dallas Torgersen |
| Phone | 801.265.1000 |
| Email | DTorgersen@westech-inc.com |
| Address: Number/Street | 3665 S West Temple |
| Address: City, State, Zip | Salt Lake City, UT 84115 |

## 2. Budget Pricing

Currency: US Dollars

Scope of Supply

| | | |
|---|---|---|
| A | Engineering | $16,500,000 |
| B | Procurement | $156,000,000 |
| C | Freight | $1,200,000 |
| D | Construction | $83,500,000 |
| E | Commissioning & Start-up | $6,000,000 |
| F | Solidification Equipment | $29,428,000 |
| G | Solidification Site Work and Installation | $11,956,000 |
| **Process Island Cost** | | **$304,584,000** |
| | Taxes (sales, use, VAT, IVA, IGV, duties, import fees, etc.) | Not Included |

Prices are valid for a period not to exceed 30 days from date of proposal.

Additional Field Service

| | |
|---|---|
| Daily Rate (Applicable Only to Field Service Not Included in Scope) | $1,450 |

Pricing does not include field service unless noted in scope of supply, but is available at the daily rate plus expenses. The greater of a two week notice or visa procurement time is required prior to departure date. Our field service policy can be provided upon request for more details.

## 4. Schedule

Please refer to Level 1 Schedule Section

## 5. Freight

| | | |
|---|---|---|
| Domestic | | FOB Shipping Point - Prepaid and Added (FSP-PPA) |
| **From** | **Final Destination** | **Number of Trucks or Containers** |
| WesTech Shops | Euharlee, GA | TBD |

The Process Island Cost provided includes only the costs associated with WesTech's discrete scope of work, as outlined in this budgetary study. A "Total Project Cost" estimate (including but not limited to such costs as work by the plant, project management, insurance, etc.) will likely be generated by Georgia Power Company and/or Southern Company Services and would represent the comprehensive dollar figure associated with the installation of the new treatment system at Plant Bowen.

## One-Year Warranty

WesTech is meeting a global need for clean water through technology treatment solutions. We are proud that the equipment and systems we design, build, maintain, and operate are making the world a better place and creating a more sustainable environment for future generations.

Equipment manufactured or sold by WesTech Engineering, LLC, once paid for in full, is backed by the following warranty:

Subject to the terms below, WesTech warrants all new equipment manufactured or sold by WesTech Engineering, LLC to be unencumbered and free from defects in material and workmanship, and WesTech will replace or repair, F.O.B. its factories or other location it chooses, any part or parts returned to WesTech which WesTech's examination and analysis determine have failed within the warranty period because of defects in material and workmanship. The warranty period is either, one calendar year immediately following start-up, or eighteen (18) months from when WesTech sent its ready-to-ship notification to the purchaser, whichever expires sooner. All repair or replacement parts qualifying under this warranty shall be free of charge. Purchaser will provide timely written notice to WesTech of any defects it believes should be repaired or replaced under this warranty. WesTech will reject as untimely any warranty defect claim that purchaser submits more than thirty (30) days after the possible warranty defect first occurred. Unless specifically stated otherwise, this warranty does not cover normal wear or consumables. This warranty is not transferable.
This warranty shall be void and shall not apply where the equipment or any part thereof

(a) has been dismantled, modified, repaired or connected to other equipment, outside of a WesTech factory, or without WesTech's written approval, or

(b) has not been installed in complete adherence to all WesTech's or parts manufacturer's requirements, recommendations, and procedures, or

(c) has been subject to misuse, abuse, neglect, or accident, or has not at all times been operated and maintained in strict compliance with all of WesTech's requirements and recommendations therefor, including, but not limited to, the relevant WesTech Operations & Maintenance Manual and any other of WesTech's specified guidelines & procedures, or

(d) has been subject to force majeure events; use of chemicals not approved in writing by WesTech; electrical surges; overloading; significant power, water or feed supply fluctuations; or non-compliance with agreed feedwater or chemical volumes, specifications or procedures.

In any case where a part or component of equipment under this warranty is or may be faulty and the component or part is also covered under the warranty of a third party then the purchaser shall provide reasonable assistance to first pursue a claim under the third-party warranty before making a claim under this warranty from WesTech. WesTech Engineering, LLC gives no warranty with respect to parts, accessories, or components purchased other than through WesTech. The warranties which apply to such items are those offered by the respective manufacturers.

This warranty is expressly given by WesTech and accepted by purchaser in lieu of all other warranties whether written, oral, express, implied, statutory or otherwise, including without limitation, warranties of merchantability and fitness for particular purpose. WesTech neither accepts nor authorizes any other

person to assume for it any other liability with respect to its equipment. WesTech shall not be liable for normal wear and tear, corrosion, or any contingent, incidental, or consequential damage or expense due to partial or complete inoperability of its equipment for any reason whatsoever. The purchaser's exclusive and only remedy for breach of this warranty shall be the repair and or replacement of the defective part or parts within a reasonable time of WesTech's accepting the validity of a warranty claim made by the purchaser.

# Terms & Conditions

Terms and Conditions appearing in any order based on this proposal which are inconsistent herewith shall not be binding on WesTech Engineering LLC The sale and purchase of equipment described herein shall be governed exclusively by the foregoing proposal and the following provisions:

**1. SPECIFICATIONS:** WesTech Engineering LLC is furnishing its standard equipment as outlined in the proposal and as will be covered by final approved drawings. The equipment may not be in strict compliance with the Engineer's/Owner's plans, specifications, or addenda as there may be deviations. The equipment will, however, meet the general intention of the mechanical specifications of these documents.

**2. ITEMS INCLUDED:** This proposal includes only the equipment specified herein and does not include erection, installation, accessories, nor associated materials such as controls, piping, etc., unless specifically listed.

**3. PARTIES TO CONTRACT:** WesTech Engineering LLC is not a party to or bound by the terms of any contract between WesTech Engineering LLC's customer and any other party. WesTech Engineering LLC's undertakings are limited to those defined in the contract between WesTech Engineering LLC and its direct customers.

**4. PRICE AND DELIVERY:** All selling prices quoted are subject to change without notice after 30 days from the date of this proposal unless specified otherwise. Unless otherwise stated, all prices are F.O.B. WesTech Engineering LLC or its supplier's shipping points. All claims for damage, delay or shortage arising from such equipment shall be made by Purchaser directly against the carrier. When shipments are quoted F.O.B. job site or other designation, Purchaser shall inspect the equipment shipped, notifying WesTech Engineering LLC of any damage or shortage within forty-eight hours of receipt, and failure to so notify WesTech Engineering LLC shall constitute acceptance by Purchaser, relieving WesTech Engineering LLC of any liability for shipping damages or shortages.

**5. PAYMENTS:** All invoices are net 30 days. Delinquencies are subject to a 1.5 percent service charge per month or the maximum permitted by law, whichever is less on all past due accounts. Pro rata payments are due as shipments are made. If shipments are delayed by the Purchaser, invoices shall be sent on the date when WesTech Engineering LLC is prepared to make shipment and payment shall become due under standard invoicing terms. If the work to be performed hereunder is delayed by the Purchaser, payments shall be based on the purchase price and percentage of completion. Products held for the Purchaser shall be at the risk and expense of the Purchaser. Unless specifically stated otherwise, prices quoted are for equipment only. These terms are independent of and not contingent upon the time and manner in which the Purchaser receives payment from the owner.

**6. PAYMENT TERMS:** Credit is subject to acceptance by WesTech Engineering LLC's Credit Department. If the financial condition of the Purchaser at any time is such as to give WesTech Engineering LLC, in its judgment, doubt concerning the Purchaser's ability to pay, WesTech Engineering LLC may require full or partial payment in advance or may suspend any further deliveries or continuance of the work to be performed by the WesTech Engineering LLC until such payment has been received.

**7. ESCALATION:** If shipment is, for any reason, deferred by the Purchaser beyond the normal shipment date, or if material price increases are greater than 5% from proposal date to material procurement date, stated prices set forth herein are subject to escalation. The escalation shall be based upon increases in labor and material and other costs to WesTech Engineering LLC that occur in the time period between quotation and shipment by WesTech Engineering LLC Purchaser agrees to this potential escalation regardless of contradicting terms in the contract, except when an agreed upon escalation adder is included in the price.

**(a)** The total quoted revised price is based upon changes in the indices published by the United States Department of Labor, Bureau of Labor Statistics. Labor will be related to the Average Hourly Earnings indices found in the Employment and Earnings publication. Material will be related to the Metal and Metal Products Indices published in Wholesale Prices and Prices Indices.

**(b)** Price revision for items furnished to, and not manufactured by WesTech Engineering LLC, which exceed the above escalation calculation, will be passed along by WesTech Engineering LLC to Purchaser based upon the actual increase in price to WesTech Engineering LLC for the period from the date of quotation to the date of shipment by WesTech Engineering LLC Any item that is so revised will be excluded from the index escalation calculations set forth in subparagraph (a) above.

**8. APPROVAL:** If approval of equipment submittals by Purchaser or others is required, a condition precedent to WesTech Engineering LLC supplying any equipment shall be such complete approval.

**9. INSTALLATION SUPERVISION:** Prices quoted for equipment do not include installation supervision. WesTech Engineering LLC recommends and will, upon request, make available, at WesTech Engineering LLC's then current rate, an experienced installation supervisor to act as the Purchaser's employee and agent to supervise installation of the equipment. Purchaser shall at its sole expense furnish all necessary labor equipment, and materials needed for installation.

Responsibility for proper operation of equipment, if not installed by WesTech Engineering LLC or installed in accordance with WesTech Engineering LLC's instructions, and inspected and accepted in writing by WesTech Engineering LLC, rests entirely with Purchaser; and any work performed by WesTech Engineering LLC personnel in making adjustment or changes must be paid for at WesTech Engineering LLC's then current per diem rates plus living and traveling expenses.

WesTech Engineering LLC will supply the safety devices described in this proposal or shown in WesTech Engineering LLC's drawings furnished as part of this order but excepting these, WesTech Engineering LLC shall not be required to supply or install any safety devices whether required by law or otherwise. The Purchaser hereby agrees to indemnify and hold harmless WesTech Engineering LLC from any claims or losses arising due to alleged or

actual insufficiency or inadequacy of the safety devices offered or supplied hereunder, whether specified by WesTech Engineering LLC or Purchaser, and from any damage resulting from the use of the equipment supplied hereunder.

**10. ACCEPTANCE OF PRODUCTS:** Products will be deemed accepted without any claim by Purchaser unless written notice of non-acceptance is received by WesTech Engineering LLC within 30 days of delivery if shipped F.O.B. point of shipment, or 48 hours of delivery if shipped F.O.B. point of destination. Such written notice shall not be considered received by WesTech Engineering LLC unless it is accompanied by all freight bills for said shipment, with Purchaser's notations as to damages, shortages and conditions of equipment, containers, and seals. Non-accepted products are subject to the return policy stated below.

**11. TAXES:** Any federal, state, or local sales, use or other taxes applicable to this transaction, unless specifically included in the price, shall be for Purchaser's account.

**12. TITLE:** The equipment specified herein, and any replacements or substitutes therefore shall, regardless of the manner in which affixed to or used in connection with realty, remain the sole and personal property of WesTech Engineering LLC until the full purchase price has been paid. Purchaser agrees to do all things necessary to protect and maintain WesTech Engineering LLC's title and interest in and to such equipment; and upon Purchaser's default, WesTech Engineering LLC may retain as liquidated damages any and all partial payments made and shall be free to enter the premises where such equipment is located and remove the same as its property without prejudice to any further claims on account of damages or loss which WesTech Engineering LLC may suffer from any cause.

**13. INSURANCE:** From date of shipment until the invoice is paid in full, Purchaser agrees to provide and maintain at its expense, but for WesTech Engineering LLC's benefit, adequate insurance including, but not limited to, builders risk insurance on the equipment against any loss of any nature whatsoever.

**14. SHIPMENTS:** Any shipment of delivery dates recited represent WesTech Engineering LLC's best estimate but no liability, direct or indirect, is assumed by WesTech Engineering LLC for failure to ship or deliver on such dates.

WesTech Engineering LLC shall have the right to make partial shipments; and invoices covering the same shall be due and payable by Purchaser in accordance with the payment terms thereof. If Purchaser defaults in any payment when due hereunder, WesTech Engineering LLC may, without incurring any liability therefore to Purchaser or Purchaser's customers, declare all payments immediately due and payable with maximum legal interest thereon from due date of said payment, and at its option, stop all further work and shipments until all past due payments have been made, and/or require that any further deliveries be paid for prior to shipment.

If Purchaser requests postponements of shipments, the purchase price shall be due and payable upon notice from WesTech Engineering LLC that the equipment is ready for shipment; and thereafter any storage or other charge WesTech Engineering LLC incurs on account of the equipment shall be for the Purchaser's account.

If delivery is specified at a point other than WesTech Engineering LLC or its supplier's shipping points, and delivery is postponed or prevented by strike, accident, embargo, or other cause beyond WesTech Engineering LLC's reasonable control and occurring at a location other than WesTech Engineering LLC or its supplier's shipping points, WesTech Engineering LLC assumes no liability in delivery delay. If Purchaser refuses such delivery, WesTech Engineering LLC may store the equipment at Purchaser's expense. For all purposes of this agreement such tender of delivery or storage shall constitute delivery.

**15. WARRANTY:** WESTECH ENGINEERING LLC WARRANTS EQUIPMENT IT SUPPLIES ONLY IN ACCORDANCE WITH THE WARRANTY EXPRESSED IN THE ATTACHED COPY OF "WESTECH WARRANTY" AGAINST DEFECTS IN WORKMANSHIP AND MATERIALS WHICH IS MADE A PART HEREOF. SUCH WARRANTY IN LIEU OF ALL OTHER WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE, WHETHER WRITTEN, ORAL, EXPRESSED, IMPLIED OR STATUTORY, WESTECH ENGINEERING LLC SHALL NOT BE LIABLE ANY CONTINGENT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES FOR ANY REASON WHATSOEVER.

**16. PATENTS:** WesTech Engineering LLC agrees that it will, at its own expense, defend all suits or proceedings instituted against Purchaser and pay any award of damages assessed against it in such suits or proceedings, so far as the same are based on any claim that the said equipment or any part thereof constitutes an infringement of any apparatus patent of the United States issued at the date of this Agreement, provided WesTech Engineering LLC is given prompt notice in writing of the institution or threatened institution of any suit or proceeding and is given full control of the defense, settlement, or compromise of any such action; and Purchaser agrees to give WesTech Engineering LLC needed information, assistance, and authority to enable WesTech Engineering LLC so to do. In the event said equipment is held or conceded to infringe such a patent, WesTech Engineering LLC shall have the right at its sole option and expense to a) modify the equipment to be non-infringing, b) obtain for Purchaser the license to continue using said equipment, or c) accept return of the equipment and refund to the Purchaser the purchase price thereof less a reasonable charge for the use thereof. WesTech Engineering LLC will reimburse Purchaser for actual out-of-pocket expenses, exclusive of legal fees, incurred in preparing such information and rendering such assistance at WesTech Engineering LLC's request. The foregoing states the entire liability of WesTech Engineering LLC, with respect to patent infringement; and except as otherwise agreed to in writing, WesTech Engineering LLC assumes no responsibility for process patent infringement.

**17. SURFACE PREPARATION AND PAINTING:** If furnished, shop primer paint is intended to serve only as minimal protective finish. WesTech Engineering LLC will not be responsible for the condition of primed or finish painted surfaces after equipment leaves its shops. Purchasers are invited to inspect paint in shops for proper preparation and application prior to shipment. WesTech Engineering LLC assumes no responsibility for field surface preparation or touch-up of shipping damage to paint. Painting of fasteners and other touch-up to painted surfaces will be by Purchaser's painting contractor after mechanism installation.

Motors, gear motors, and other components not manufactured by WesTech Engineering LLC will be painted with that manufacturer's standard paint system. It is WesTech Engineering LLC's intention to ship major steel components as soon as fabricated, often before drive, motors, and other

manufactured components. Unless Purchaser can ensure that shop primed steel shall be field painted within thirty (30) days after arrival at the job site, WesTech Engineering LLC encourages the Purchaser to order these components without primer.

WesTech Engineering LLC's prices are based on paints and surface preparations as outlined in the main body of this proposal. In the event that an alternate paint system is selected, WesTech Engineering LLC requests that Purchaser's order advise of the paint selection. WesTech Engineering LLC will then either adjust the price as may be necessary to comply or ship the material unpainted if compliance is not possible due to application problems or environmental controls.

**18. CANCELLATION, SUSPENSION, OR DELAY:** After acceptance by WesTech Engineering LLC, this proposal, or Purchaser's order based on this proposal, shall be a firm agreement and is not subject to cancellation, suspension, or delay except upon payment by Purchaser of appropriate charges which shall include all costs incurred by WesTech Engineering LLC to date of cancellation, suspension, or delay plus a reasonable profit. Additionally, all charges related to storage and/or resumption of work, at WesTech Engineering LLC's plant or elsewhere, shall be for Purchaser's sole account; and all risks incidental to storage shall be assumed by Purchaser.

**19. FORCE MAJEURE:** Neither party hereto shall be liable to the other for default or delay in delivery caused by extreme weather or other act of God, strike or other labor shortage or disturbance, fire, accident, war or civil disturbance, act of government, pandemic, delay of carriers, failure of normal sources of supply, complete or partial shutdown of plant by reason of inability to attain sufficient raw materials or power, and/or other similar contingency beyond the reasonable control of the respective parties. The time for delivery specified herein shall be extended during the continuance of such conditions, or any other cause beyond such party's reasonable control.

**20. RETURN OF PRODUCTS:** No products may be returned to WesTech Engineering LLC without WesTech Engineering LLC's prior written permission. Said permission may be withheld by WesTech Engineering LLC at its sole discretion.

**21. BACKCHARGES:** WesTech Engineering LLC will not approve or accept backcharges for labor, materials, or other costs incurred by Purchaser or others in modification, adjustment, service, or repair of WesTech Engineering LLC-furnished materials unless such back charge has been authorized in advance in writing by a WesTech Engineering LLC employee, by a WesTech Engineering LLC purchase order, or work requisition signed by WesTech Engineering LLC

**22. INDEMNIFICATION:** Purchaser agrees to indemnify WesTech Engineering LLC from all costs incurred, including but not limited to court costs and reasonable attorney fees, from enforcing any provisions of this contract, including but not limited to breach of contract or costs incurred in collecting monies owed on this contract.

**23. ENTIRE AGREEMENT:** This proposal expresses the entire agreement between the parties hereto superseding any prior understandings, and is not subject to modification except by a writing signed by an authorized officer of each party.

**24. MOTORS AND MOTOR DRIVES:** In order to avoid shipment delays of WesTech Engineering LLC equipment, the motor drives may be sent directly to the job site for installation by the equipment installer. Minor fit-up may be required.

**25. EXTENDED STORAGE:** Extended storage instructions will be part of information provided to shipment. If equipment installation and start-up is delayed more than 30 days, the provisions of the storage instructions must be followed to keep WARRANTY in force.

**26. LIABILITY:** Professional liability insurance, including but not limited to, errors and omissions insurance, is not included. In any event, liability for errors and omissions shall be limited to the lesser of $100,000USD or the value of the particular piece of equipment (not the value of the entire order) supplied by WesTech Engineering LLC against which a claim is sought.

**27. ARBITRATION NEGOTIATION:** Any controversy or claim arising out of or relating to the performance of any contract resulting from this proposal or contract issued, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator(s) may be entered to any court having jurisdiction.