

MEMORANDUM

TO: Steam Electric Rulemaking Record

FROM: Deborah Nagle, Director, Office of Science and Technology
Robert K. Wood, Director, Engineering and Analysis Division, Office of Science and Technology

DATE: August 31, 2020

SUBJECT: Error in Cost Estimates for Flue Gas Desulfurization (FGD) Treatment at Plant Scherer;
Steam Electric Effluent Guidelines Reconsideration

To support the 2020 Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category Reconsideration Final Rule (2020 Final Rule), EPA estimated the incremental cost and pollutant loading changes it projected would occur as a result of compliance with the 2020 Final Rule, compared to those that it projected would have occurred if the 2015 Final Steam Electric Power Generating Effluent Guidelines (2015 Final Rule) had been fully implemented (the baseline scenario). While conducting final reviews of the technical documents supporting the 2020 Final Rule, EPA identified an error in the treatment technology assumptions made for FGD treatment at one plant—Plant Scherer.¹ This error resulted in under-estimate of approximately \$322,000 in annual cost savings that is expected to be provided by the 2020 Final Rule when compared to the 2015 rule baseline.

The purpose of this memorandum is to document the error for the rulemaking record and memorialize that this error has no effect on the Agency's decisions for the 2020 Final Rule.

Overview

When calculating costs for effluent limitation guideline (ELG) rulemakings, EPA uses information in the rulemaking record to estimate the least cost technology option for each affected plant to comply with the ELG rule. Once the least cost technology is identified for each plant, the Agency uses the cost to install the technology and its ongoing operations and maintenance (O&M) expenses, to estimate the cost to comply with the ELG rule. See Chapter 3 of the *Regulatory Impact Analysis for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category* (RIA), EPA-821-R-20-004. Similarly, the treatment capability of the least cost technology is used to estimate changes in pollutant loadings that would occur as a result of complying with the final ELG rule. See Section 6 of the *Supplemental Technical Development Document for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category* (Supplemental TDD), EPA-821-R-20-001.

EPA used this framework to estimate the incremental changes in annual compliance costs between the 2015 Final Rule and the 2020 Final Rule. EPA first established the “treatment in place”—the technology and its associated costs currently operating to treat the wastewater at each affected plant. See Section 5 of the Supplemental TDD. EPA then estimated the “least-cost technology” for each affected plant to comply with both the 2015 and 2020 Final rules. These estimates were based on the equipment

¹ Plant Scherer is jointly owned by Oglethorpe Power and Southern Company.

upgrades and ongoing O&M that would be necessary at each plant to reach compliance with each rule, considering the plant's current treatment in place. EPA then subtracted from each estimate the current cost of the treatment in place since the expenses to operate that system would no longer be incurred by the plant.

Once the annualized costs were estimated for the 2015 Final Rule and the 2020 Final Rule, EPA calculated the difference in the estimated annual costs to comply with each rule to determine the incremental change in costs. EPA estimated the incremental change in pollutant loadings the same way—estimate pollutant loads from the least cost technology installed at each affected plant for both the 2015 Final Rule and the 2020 Final Rule, and then calculate the difference.²

Since 2010, EPA has been collecting and updating plant-specific information, including the current treatment in place at facilities affected by the Steam Electric ELG regulations. Treatment in place information is typically provided by the plant owner or operator, and in some cases, EPA has visited the plant and observed the treatment equipment in operation.

In developing the costs for the baseline analysis, EPA did not identify any FGD treatment technology capable of achieving the 2015 Final Rule effluent limits at a lower cost than high residence time biological treatment with chemical pretreatment (CP+HRTR). In other words, the rulemaking record estimates that CP+HRTR is the least cost technology for all affected facilities to comply with the 2015 Final Rule, except for plants that had installed or identified that they would install thermal technology to treat their FGD wastewater. Therefore, as a general rule, EPA assigned CP+HRTR to all facilities to estimate the cost to comply with the 2015 Final Rule.³ The treatment capability of CP+HRTR was then used to estimate pollutant loadings that would result from implementation of the 2015 Final Rule.

Plant Scherer

For Plant Scherer, EPA made two errors in its assumptions about the FGD treatment technologies that may be used by the plant. These errors resulted in incorrect cost estimates for this plant in the database EPA used to model the impacts of the final rule. EPA recalculated the estimated costs for this plant to understand the significance of the errors and generated this memorandum for the record to ensure transparency. The corrections, described in detail below, result in an additional annual estimated cost savings of the final rule of approximately \$322,000 and do not affect EPA's selection of the BAT for the 2020 Final Rule. Given that these errors do not affect EPA's analysis of the CWA section 304(b) statutory factors or the Agency's conclusions with respect to BAT for the 2020 Final Rule, the cost estimates presented in the final rule preamble and supporting documents have not been updated to reflect these corrections.

² Pollutant load estimates are based on a plant's flow and the concentration of the pollutant(s) expected in the wastestream and are not informed by or dependent upon the treatment in place at the plant. See Section 6 of the Supplemental TDD.

³ EPA received information for four facilities that thermal treatment technology had been installed or would be installed to comply with the 2015 Final Rule. For these facilities, thermal technology was used instead of CP+HRTR to estimate the cost to comply with the 2015 Final Rule. The baseline scenario technology in the proposed reconsideration rule for three of these facilities was thermal technology and EPA did not receive any public comments suggesting the baseline scenario for these facilities should be modified for the final rule. EPA received a public comment from the fourth facility that it had installed thermal and this facility's baseline scenario technology was changed to thermal for the final rule.

Error #1 - Treatment in Place Assumption. For the 2020 Final Rule cost estimate, EPA incorrectly assumed that a portion of the current “treatment in place” to treat half of the FGD wastewater volume at Plant Scherer is a membrane system. At proposal, EPA correctly identified Plant Scherer’s treatment in place as surface impoundments. For the final rule, EPA inappropriately modified the information on Plant Scherer’s current treatment in place to include a 50 gallon per minute (gpm) membrane system. As discussed further below, Plant Scherer anticipates starting a pilot study of a 50 gpm membrane treatment system in September 2020 and has no plans at this time to install a membrane treatment system full-scale to treat FGD wastewater. The treatment in place and operating at Plant Scherer to treat all of its FGD wastewater is currently surface impoundments. See Notes from Call with Southern Company – Plant Scherer (April 16 Call Notes), DCN SE08619, Letter to EPA regarding Georgia Power’s VSEP Pilot at Plant Scherer and Status of Membrane/Paste Encapsulation Preliminary Research (April 30 Letter), DCN SE08619A1, and Meeting with Southern Company and Georgia Power Company Final Notes (August 14 Meeting Notes), DCN SE09075.

Error #2 – Baseline Treatment Assumption. To determine costs to comply with the 2015 Rule, EPA incorrectly assumed that Plant Scherer would install chemical pretreatment and an additional 50 gpm membrane technology (to supplement the 50 gpm pilot membrane system that EPA incorrectly assumed was the current treatment in place). This assumption was also inconsistent with information in EPA’s rulemaking record related to Plant Scherer. See April 16 Call Notes, April 30 Letter, August 14 Meeting Notes, and Plant Scherer Flue Gas Desulfurization Wastewater Treatment in Place Memorandum (July 31 Memo), DCN SE08634A1.

To evaluate the significance of these two errors, EPA re-estimated the potential costs with the following assumptions for Plant Scherer:

- Treatment in place as surface impoundments;
- Baseline scenario technology to comply with 2015 Final Rule as CP+HRTR; and
- Technology to comply with 2020 Final Rule as membrane treatment (as a VIP participant).⁴

With these correct assumptions, the estimated annualized cost savings for Plant Scherer to comply with the 2020 Final Rule, compared to the cost to comply with the 2015 Final Rule, is approximately \$322,000. These errors resulted in an underestimate of treatment cost savings associated with the 2020 Final Rule of approximately \$322,000.⁵ Because EPA used the same treatment in place and baseline scenario costs for all regulatory options analyzed as part of the 2020 Final Rule, the error is propagated consistently throughout those analyses.

EPA evaluated the significance of this error and has determined that changing the treatment in place and baseline scenario costs for Plant Scherer would result in very small changes to costs of the rule for the industry as a whole, would not change EPA’s conclusion that the 2020 Final Rule is economically achievable for the industry as a whole, and would therefore have no bearing on EPA’s selection of Best

⁴ EPA’s analyses supporting the proposed rule assumed Plant Scherer would participate in the VIP, based on the least cost methodology described above. EPA’s cost modeling for the final rule also show the VIP as the least cost option for Plant Scherer.

⁵ With the errors described above, the estimated cost savings of the 2020 Final Rule for Plant Scherer was \$0.

Available Technology Economically Achievable (BAT) for the 2020 Final Rule. With the errors corrected, the 2020 Final Rule would result in an additional approximately \$322,000 in cost savings.

Treatment Technology at Plant Scherer

As described in Section 5 of the Supplemental TDD,⁶ when generating the current treatment in place and estimated baseline scenario costs and loadings to support the 2020 Final Rule, EPA started by using the modeled outcomes of the 2015 Final Rule and augmented model inputs with more current data when available. In its analyses supporting the 2015 Final Rule, EPA estimated that the treatment in place at Plant Scherer is surface impoundments and that CP+HRTR would be the least cost FGD treatment technology to comply with the 2015 Final Rule. See Supplemental Costs and Loadings Documentation Memorandum, EPA-HQ-OW-2009-0819-5681. On June 22, 2019, prior to publication of the proposed reconsideration rule, EPA received an email from a technology vendor who claimed that a permanent membrane treatment system had been installed at Plant Scherer to treat the plant's FGD wastewater. See New Logic: Implementation Timing Information, EPA-HQ-OW-2009-0819-8179. EPA did not, based on this email, modify the treatment in place or the baseline scenario technology assumptions for Plant Scherer and maintained in the proposed rule analyses that treatment in place is surface impoundments and CP+HRTR would be the least cost FGD treatment technology for Plant Scherer to comply with the 2015 Final Rule. See Generating Unit-Level Regulatory Option Costs and Loads Memorandum, EPA-HQ-OW-2009-0819-8220. The proposed reconsideration rule published in the Federal Register on November 11, 2019 (84 FR 64620).⁷

In finalizing the reconsideration rule, EPA updated the industry profile of all facilities anticipated to be affected by the 2020 rule based on any information EPA had been made aware of, including treatment in place and baseline scenario technology assumptions, including for Plant Scherer. EPA modified the treatment in place and the baseline scenario technology for Plant Scherer only for the purposes of estimating costs.⁸ The modified treatment in place and baseline scenario technology assumptions used in the cost analysis are inconsistent with information in the rulemaking record. These changes also created an inconsistency with the assumptions used to estimate pollutant loadings. Because EPA used the same incorrect treatment in place and baseline scenario technology assumptions for all regulatory

⁶ *Supplemental Technical Development Document for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category*, Document No. EPA-821-R-20-001

⁷ Southern Company submitted public comments to the proposed reconsideration rulemaking docket. These comments agreed with EPA that membrane technology is not BAT but disagreed that membranes could be considered "technologically available and economically achievable" by 2028, the VIP compliance deadline in the proposal. Southern Company's public comments characterize membrane treatment as an "emerging technology" and stated that, "significant additional research is needed to establish membrane technologies as an effective and economical means to treat FGD wastewater for the entire industry" and that EPA's proposal significantly underestimated the cost of membranes. See EPA-HQ-OW-2009-0819-8457.

⁸ EPA modified the baseline scenario technology for one other plant after proposal. At proposal, EPA assumed that this other plant would install CP+HRTR for compliance with the 2015 Final Rule. After proposal, EPA found documentation that this other plant was planning on installing a thermal treatment system for compliance with the 2015 Final Rule. EPA updated the baseline and treatment in place assumptions in its model for the 2020 Final Rule. With the exception of Plant Scherer and this one other facility, all other baseline scenario technology assumptions remained unchanged from the proposal to the 2020 Final Rule.

options analyzed as part of the 2020 Final Rule, the error is propagated by the same amount throughout those analyses.⁹

The effect of this error is that the Supplemental TDD and the RIA for the 2020 final rule present estimated costs to industry that include identical costs for Plant Scherer to comply with both the 2015 final rule (baseline) and all regulatory options considered for the 2020 Rule. In other words, there is a zero cost difference for Plant Scherer from baseline for all options considered. Correcting this error results in an increased cost savings associated with the 2020 Final Rule of approximately \$322,000 per year.

Record Information Concerning FGD Treatment Technology at Plant Scherer

In addition to Southern Company's public comments, the information in the record for the reconsideration rulemaking demonstrates that EPA should have maintained the assumptions from proposal for treatment in place as surface impoundments and CP+HRTR as the baseline scenario technology for Plant Scherer, consistent with EPA's least cost methodology approach in ELG rulemakings.

As noted above and discussed further below, surface impoundments should have been used as the treatment in place assumption because the membrane equipment at Plant Scherer is for a long-term pilot study that will also evaluate the feasibility of biological treatment for FGD wastewater at Plant Scherer. The pilot membrane system at Plant Scherer has not commenced operation and is not intended as a permanent installation. As also noted, CP+HRTR should have been used for the baseline analysis because EPA estimated at proposal that it would be the least-cost technology for all facilities to comply with the 2015 Final Rule (except as noted above for plants that have or are planning to install thermal technology to comply with the 2015 rule), including Plant Scherer, and EPA did not receive any information after proposal that would change that conclusion.

To verify information provided in the membrane vendor's June 22, 2019 email, on April 16, 2020, EPA participated in a teleconference with representatives from Southern Company. See April 16 Plant Scherer Meeting Notes. The purpose of the call was for EPA to learn about the plant's FGD wastewater treatment technology, including the membrane technology referenced in the June 22, 2019 email.

During the April 16, 2020 call, Southern Company representatives explained to EPA that a 25 gpm membrane treatment system had been used for a pilot study at its Water Research Center (located at a different plant) and was moved to Plant Scherer in December 2019 in preparation for another pilot study. Southern Company purchased another 25 gpm membrane system for the long-term pilot study at Plant Scherer. As described in EPA's meeting notes from the April 16, 2020 call,

Southern stated that this system is not a permanent installation but instead a long-term pilot study. In August 2020, Southern plans to initiate testing to determine the membrane chemical cleaning requirements and long-term membrane performance. Southern also indicated solidification testing on larger volumes of brine will be part of the long-term study. Prior to

⁹ Although the cost error is propagated throughout the regulatory option cost estimate analyses, EPA used the correct baseline scenario technology (CP+HRTR) for its pollutant loading estimates. The analyses supporting the 2020 Final Rule correctly estimate incremental changes in pollutant loadings from the 2015 Final Rule to the 2020 Final Rule.

moving the VSEP equipment to Scherer, Southern constructed a new building to house the VSEP equipment with hard-wired electricity and piping connections to the plant.

EPA's meeting notes from that call also reflect Southern Company's view that, "Additional significant research is needed to determine if membrane filtration along with paste encapsulation is feasible and economically achievable at Scherer." See April 16 Plant Scherer Meeting Notes. Finally, EPA's meeting notes state that Southern Company is also planning to conduct a pilot study to evaluate the effectiveness of a biological treatment technology with chemical pretreatment for its FGD wastewater.

On April 30, 2020 EPA received a letter from Georgia Power confirming the information relayed during the April 16, 2020 call that the membrane system at Plant Scherer will be used for a long-term pilot study. The letter also clarified that,

The VSEP [membrane] pilot is being conducted to determine whether a combination of pretreatment steps, water balance management, the VSEP technology, and some form of paste encapsulation is a feasible option for Plant Scherer. To be considered as a candidate technology, each of the steps of the treatment process will need to be studied and will need to demonstrate not only sufficient treatment but also reliability and resiliency with acceptable operational and maintenance requirements, all at a reasonable cost.

The letter reaffirms that two pilot studies—the membrane system and the biological technology with chemical pretreatment—will each run for a full year and that additional research may be necessary at the conclusion of these pilots to determine if either technology is feasible at Plant Scherer. See April 30 Letter. The April 30, 2020 letter further states that the membrane pilot study had been "projected to start in July 2020, but the start date is dependent on completion of on-going design and operation changes of the FGD water management system, such as increasing the overall water storage capacity within the system to allow for additional wet-weather capacity and increased cycling of the FGD wastewater."¹⁰

On April 7, 2020 EPA changed the treatment in place and baseline scenario technology assumptions for Plant Scherer in its modeling assumptions from surface impoundments and CP+HRTR, respectively, to membrane technology. Although EPA received additional information from the company in the April 16, 2020 teleconference and in the April 30, 2020 letter, the modified assumptions were not updated to reflect the new information received from the company. The model runs to support the 2020 Final Rule included the incorrect assumptions for treatment in place and baseline scenario technology costs.

Several months after the teleconference and receiving the written correspondence from Southern Company, and following the change in the model assumptions for Plant Scherer, EPA's technical consultant generated a memorandum to the record explaining the Agency's apparent rationale for selecting membrane treatment for Plant Scherer's baseline scenario technology. See July 31 Memo. The July 31, 2020 memo states, "EPA assumes that because Southern has already purchased from New Logic a treatment system capable of meeting BAT limitations and treating up to 50 gpm of FGD wastewater, the company would make use of this system rather than purchasing a replacement system." This

¹⁰ Southern Company submitted two follow up letters to EPA on May 25, 2020 and June 14, 2020, both referencing the April 16, 2020 phone call and reaffirming the pilot-nature of the membrane installation at Plant Scherer and that membrane technology had not been demonstrated to be feasible at any of the company's steam electric generating units.

rationale fails to acknowledge that half the membrane investment was not made for Plant Scherer—the first 25 gpm system had been purchased to run a pilot study at a different plant and was later moved to Plant Scherer for another pilot study. This rationale fails to acknowledge that Plant Scherer was also planning a pilot study to evaluate biological treatment and the memo does not explain why EPA assumed Plant Scherer would expand the membrane pilot and not the biological treatment pilot. Finally, and perhaps most important, the memo does not cite to any data to support the statement that the New Logic membrane system can achieve the BAT effluent limits for FGD wastewater in the 2015 rule.

Follow Up Factual Inquiry

On August 4, 2020 EPA's rulemaking team identified that the cost assumptions and pollutant loading calculations for Plant Scherer were not aligned. Given that the rulemaking record contains facts contrary to the treatment in place and baseline cost assumptions for Plant Scherer, EPA determined that additional follow up and factual inquiry with the plant owner was necessary to understand the appropriate treatment in place and baseline scenario technology assumptions for Plant Scherer.

On August 14, 2020 EPA participated in a teleconference with executives from Southern Company and Georgia Power. See August 14 Plant Scherer Meeting Notes.

The company's representatives reiterated the facts presented in the April 30, 2020 letter and reflected in EPA's notes from the April 16, 2020 call: the company has not concluded that membrane treatment technology is feasible or economically achievable at Plant Scherer. The company provided additional useful information, including:

- The company is planning a concurrent long-term pilot study of both membrane and biological treatment with physical chemical pretreatment (CP+bio); the purpose is to compare how the two technologies perform side by side with the same waste water over the course of a year of continuous operations.
- The long-term pilot study was scheduled to begin in July 2020, but plant operation changes that are necessary to support the pilot have not been completed; some delays occurred due to the COVID-19 pandemic; the pilot study has not yet begun and the company now expects operation of the membrane to begin in September 2020 and operation of CP+bio to begin between September and November 2020.
- Prior to bringing the pilot equipment to Plant Scherer, it operated at Plant Bowen; operation at Plant Bowen was bench scale on a slip stream that would not reflect operations at Plant Scherer.
- The membrane system at Plant Scherer is constructed as a research project; there is no redundancy to the system so it could not be used for normal operations; the quality and robustness of the valves, pumps, and other components is not sufficient to withstand normal operations; if the company chose to install a full-scale membrane system to treat FGD wastewater at Plant Scherer, the majority of the pilot equipment would be replaced with upgraded equipment.
- If the company had to choose an FGD treatment technology to comply with the 2015 Final Rule, it would not be membranes because there is significant additional research to be conducted before it would consider membranes a viable option for regulatory compliance at Plant Scherer.
- In 2019, the company filed with its Public Service Commission an Integrated Planning Report (IRP) stating that the company was planning to install CP+bio to comply with the 2015 Steam

Electric ELG rule; the company's IRP is publicly available and could have been used by EPA to predict how the company would comply with the ELG rule.

- Although EPA assumed Plant Scherer would choose the VIP membrane limitations as the compliance option for the proposal rule, Plant Scherer stated during the phone call that the company does not plan to participate in the Voluntary Incentive Program (VIP) (as proposed) because the company expects the proposed nitrate/nitrite limits are too low to achieve with a membrane at Plant Scherer because the plant's wastewater is high in nitrates.¹¹

Conclusions

In EPA's analyses supporting the 2020 Final Rule, surface impoundments should have been used as the treatment in place assumption and CP+LRTR should have been used as the baseline scenario technology for Plant Scherer.

For the purpose of evaluating the impact of this error on the overall economic achievability of the final rule, the Agency re-ran cost estimates for Plant Scherer with the appropriate assumptions. These cost estimates are included as an attachment to this memorandum. With the appropriate assumptions, the 2020 Final Rule would result in a cost savings for Plant Scherer, and an increase in overall cost savings for the 2020 Final Rule, of \$322,000 per year.

This minor miscalculation of projected cost savings of the 2020 Final Rule does not affect the Agency's determination that the rule is economically achievable for the industry as a whole and the overall impact on the industry cost savings estimates developed by EPA is negligible. Indeed, with the errors corrected, the rule results in greater cost savings for the industry as a whole.

Neither the costs, nor the pollutant loading estimates prepared by EPA, for the purpose of evaluating various regulatory options, are designed to reflect changes to an industry with exact precision. *See BP Exploration & Oil, Inc. v. EPA*, 66 F.3d 784, 800 (6th Cir. 1995) ("The CWA does not require a precise calculation of BAT and NSPS costs.") (quoting *NRDC, Inc. v. EPA*, 863 F.2d 1420, 1426 (9th Cir. 1988)); *Chem. Mfrs. Ass'n v. EPA*, 870 F.2d 177, 237-38 (5th Cir. 1989) ("The Act requires the EPA to 'take into account' the costs of BAT; it does not require a precise calculation. The EPA 'need make only a reasonable cost estimate in setting BAT'; it is sufficient if the EPA develops 'a rough idea of the costs the industry would incur.'") (internal quotations and citations omitted); *see also Texas Oil & Gas Ass'n v. EPA*, 161 F.3d 923, 936 (5th Cir. 1998) (EPA's effluent reduction estimates were performed "only to satisfy the CWA's unrelated requirement that the EPA 'identify' in its regulations the degree of effluent reduction attainable through the application of BAT . . . As such, even serious flaws in the effluent reduction estimates could not provide grounds for remanding the zero discharge limit.") (citing 33 U.S.C. § 1314(b)(2)(A)).

Additionally, the incorrect assumptions for treatment in place and baseline scenario treatment costs

¹¹ EPA notes that the nitrate/nitrite limits in the final rule are higher and may be more achievable for Plant Scherer than the limits in the proposal. As described in footnote 4, EPA's cost modeling shows that membranes would be the least cost option for Plant Scherer to comply with the 2020 Final Rule, and this assumption is included in the documents supporting the final rule. However, the difference in estimated costs for Plant Scherer to comply with the 2020 Final Rule using a membrane system compared to a CP+LRTR are small and if the plant chose to install CP+LRTR instead of participating in the VIP, it would not affect EPA's conclusion that the 2020 Final Rule is economically achievable for the industry as a whole.

have a minor effect and were applied to all of the regulatory options evaluated when developing the 2020 Final Rule, therefore, EPA would not have made different decisions in selecting the regulatory outcomes reflected in this rule.

Attachments:

1. Plant Scherer Flue Gas Desulfurization Wastewater Treatment in Place Memorandum (July 31, 2020)
2. Addendum to the July 31, 2020 Plant Scherer Flue Gas Desulfurization Wastewater Treatment in Place Memorandum
3. Example Cost Scenarios Scherer