MEMORANDUM

TO: Steam Electric Rulemaking Record

FROM: Blake Fox, ERG
Ryan Novak, ERG

DATE: April 16, 2020

SUBJECT: **Notes from Site Call with Platte River Power Authority Rawhide Energy Station – DCN SE08682**

On March 27, 2020, EPA held a conference call with Platte River Power Authority (PRPA) to discuss their experience with implementing a submerged grind conveyor (SGC) system as a retrofit to the bottom ash handling system at the Rawhide Energy Station in Colorado. This conference call was conducted in place of an in-person visit to the site. See **Table 1** for a list of teleconference attendees. See Appendix A for a copy of slides Platte River Power Authority presented at the meeting.

Table 1. List of Attendees

Name	Affiliation	Contact Information
Richard Benware	EPA – Project Lead	Email: benware.richard@epa.gov Phone: 703-308-0436
Phillip Flanders	EPA – Project Engineer	Email: flanders.phillip@epa.gov Phone: 202-566-8283
Samantha Lewis	EPA – Project Engineer	Email: lewis.samantha@epa.gov Phone: 202-566-1058
Jace Staponski	PRPA – Senior Plant Mechanical Engineer	Email: staponskij@prpa.org Phone: 970-229-1770
Chris Wood	PRPA – Environmental Services Manager	Email: woodc@prpa.org Phone: 970-266-7906
Courtney Stewart	PRPA – Senior Environmental Engineer	Email: stewartc@prpa.org Phone: 970-212-7869
Ryan Novak	ERG – EPA Contractor	Email: ryan.novak@erg.com Phone: 703-633-1668
Maggie Harrington	ERG – EPA Contractor	Email: maggie.harrington@erg.com Phone: 703-633-1690
Blake Fox	ERG – EPA Contractor	Email: blake.fox@erg.com Phone: 703-633-1634

Below is a summary of the topics discussed during the meeting.

Platte River Power Authority & Rawhide Energy Station Overview

- Rawhide Energy Station is PRPA's primary owned and operated electricity generating source and has always operated as a zero-discharge facility. The plant does not have a National Pollutant Discharge Elimination System (NPDES) permit and is not subject to the effluent guidelines for the Steam Electric Power Generating Point Source Category.

- The Rawhide Energy Station operates one 278 megawatt (MW) coal-fired electric generating unit. The unit is a combustion engine and has burned powder river basin coal since it was commissioned in 1984. It produces approximately three tons per hour of bottom ash, pyrites and economizer ash at full capacity. Until the SGC retrofit, there have been no major modifications to the bottom ash handling system since construction.

- The original ash handling system consisted of hydraulically sluicing bottom ash, economizer ash, and pyrites from the boiler to a pond system and then recirculating the water back to the plant for reuse. Bottom ash, economizer ash, and pyrites were sluiced once per shift to a clay-lined bottom ash pond. Two bottom ash ponds were located on site and rotated service every 18 months. Effluent from the bottom ash ponds commingle with other treated wastewaters in a reclaim pond before being pumped back to the plant for reuse in the bottom ash system and the spray dryer absorber.

- The bottom ash and reclaim ponds did not meet Coal Combustion Residual (CCR) Rule location requirements for separation to uppermost aquifer under a conservative interpretation; therefore, PRPA evaluated dry ash handling alternatives and a new system for receiving effluent from the on-site wastewater treatment plant. PRPA wanted to have a solution in place by the end of 2018, prior to requirements in the CCR Rule. Major outages are spaced every three years, so PRPA would need to wait until 2021 if a solution was not installed during the next outage in Fall 2018.

- The site also includes 388 MW in gas generation, 30 MW in solar generation (22 MW of additional solar under construction), and 2 megawatt-hours (MWh) of battery storage under construction.

- The station is currently undergoing some operational changes in response to the COVID-19 pandemic: all engineers and administrative staff are teleworking; two teams are taking two-week cycles of working and staying at plant around the clock; all non-essential work has stopped, including most capital investments. PRPA is modifying compliance measures while implementing social distancing but does not anticipate any compliance issues during this time.

Technology Evaluation & Selection

- PRPA considered the following technologies as bottom ash handling retrofits:
  - Bottom ash pond liner retrofit.
  - Traditional under-boiler submerged chain conveyor (SCC).
  - Concrete settling basins.
  - Pneumatic ash handling system.
  - Babcock & Wilcox (B&W) under-boiler SGC.
  - Remote SCC system.

- PRPA identified the traditional under-boiler SCC and B&W under-boiler SGC systems as preferred solutions based on the elimination of bottom ash transport water and cost. PRPA cited the following reasons for rejecting the remaining bottom ash technologies.
  - Bottom ash pond liner retrofit is subject to the CCR Rule and corrective actions.
  - Concrete settling basins have concerns with water chemistry when recycled back to the spray dryer absorber and a higher operating and maintenance (O&M) cost.
  - Pneumatic ash handling system was more expensive and had increased maintenance requirements, no redundancy, and a longer outage requirements making it infeasible to install before 2021.
  - Remote SCC system would require make-up water and additional land requirements outside of the boiler house.

- See Appendix A for a detailed description of each evaluated technology and PRPA's assessment. Appendix B presents the estimated capital, O&M, auxiliary, and pond closure costs associated with each technology option. PRPA notes that the estimates included in Appendix B were developed for budgetary purposes for their specific unit and do not represent all in costs. According to PRPA, the capital cost estimates account for purchased equipment, installation, building/site prep, demolition, upfront engineering and design, project management, and training. The O&M cost estimates reflect operating labor, maintenance labor, maintenance materials, energy requirements, transport and disposal of ash, and spare parts.

- Further evaluation of the traditional under-boiler SCC alternative revealed limitations such as long lead times, long outage duration, and no redundancy; therefore, the traditional under-boiler SCC could not meet all of PRPA's requirements. The typical outage time for the Rawhide Energy Station is 6-8 weeks, but the traditional under-boiler SCC would require a 10 to 12 week outage to install.

- PRPA determined that the B&W under-boiler SGC alternative was the desirable path forward for Rawhide Energy Station because it met the CCR Rule requirements, had more flexibility and redundancy (e.g., can isolate one side for maintenance), and lower costs. The SGC system required no significant modification to the existing boiler and because the SGC conveyors are smaller than traditional SCC conveyors, the plant would be able to avoid interfering with existing equipment that would otherwise need to be relocated.

- PRPA's primary concern with the SGC technology was that B&W was having financial challenges and was at risk of going out of business. PRPA was worried that B&W would not be available for continued support of the SGC technology.

- PRPA stated that factors most influential on costs of the SGC system were the space requirements underneath the boiler and the state of the existing equipment. Capital costs were considered and favored the SGC system, but redundancy, installation time frame, and reasonable O&M costs were most important.

- The total cost of the Rawhide Energy Station retrofit was approximately $22 million, which included additional costs for settling tanks, the bottom ash bunker building, relocating or replacing fire water and service water systems, replacement of pumps, removing and converting piping, and converting the pyrite system. The estimated capital cost for the just the SGC system components and installation was approximately $6.8 million.

- PRPA considered three alternatives for rerouting the non-CCR liquid waste streams, being the plant sumps, sanitary/wastewater treatment effluent, and outage related boiler washes, from unlined impoundments:
    - Lining the existing bottom ash ponds.
    - Lining another waste impoundment handling non-CCR streams.
    - Installing a settling tank.

- PRPA selected the settling tank because it was smaller, was able to be built independently, and satisfied even the most conservative interpretations of the CCR Rule requirements.

Equipment Installation & Configuration

- The SGC retrofit at Rawhide Energy Station included installation of twin SGCs that interface with the existing ash hoppers. The SGCs rise above the ash hopper water level and exit the boiler house, transferring ash into a new bottom ash bunker. New dry flight economizer conveyors were installed to transfer economizer ash from the economizer hopper and drop it onto either SGC conveyor.

- The retrofit did not require replacement of the existing hopper or ash gate, so this equipment was reused. However, all items underneath the transfer enclosure were replaced, including four clinker grinders, knife gate valves, and the wet sluicing piping. PRPA replaced the single roll clinker grinder design with a double roll to allow them to process thicker materials. Fortunately, there was generous height between the floor and the bottom of the transfer enclosure to allow for these additional equipment. The installation was all field cut to fit the space and there was less than four inches of leftover space under the boiler following installation.

- B&W initially estimated two weeks to install the SGC system but PRPA found that it took five to six weeks. However, some of that was due to a learning curve as this was only the second SGC system installed. If done again, PRPA estimates the timeframe could shorten by one or two weeks.

- PRPA elected to build an enclosed bottom ash building, rather than a three-sided bunker, to allow a truck to collect the ash and remove it to an on-site landfill. The enclosed building also mitigated site specific concerns regarding fugitive dust and winter weather/freezing. The construction of this building was not included in the cost of the SGC.

- PRPA began planning for this retrofit soon after promulgation of the 2015 Rule and CCR Rule. The SGC system began operating in December 2018 and the settling tank for sanitary wastewater and wastewater treatment effluent was in service by June 2019.

- The total retrofit process (from planning to beginning of operation) took about four years. The technology evaluation process was long and arduous and changed course throughout the process. The timeframe from design to being 100% operational was 2.5 to 3 years.

Operation and Maintenance

- Although B&W recommended alternating operation of the two conveyors to reduce wear, PRPA typically runs them simultaneously at a reduced speed of four feet per minute to mitigate overload risk in the event of an upset (e.g., sometimes a larger ash load may drop in a small window of time). The facility has the ability to run each at a rate of eight feet per minute but does not typically need to. The generating unit only generates three tons of bottom ash per hour on average.

- In terms of operation, before the SGC installation operators pulled ash once a shift and now have shifted their responsibilities to include verification of the ash level in the truck, purging the SGC and economizer ash conveyors, and driving the truck out to the landfill and back.

- Once operational, PRPA experienced several minor operational and/or maintenance issues. The most significant of which was the over-pressurizing of the transfer enclosure which caused warping and leaking. To prevent this, the flushing sequence provided by B&W was altered. Other minor issues included the following:
    - Ongoing issue with the clinker grinder seals which are grease-filled and leak water. Though this does not cause major operational or compliance issues, it is counter to their efforts to maintain a clean boiler room. These leaks sometimes result in a build-up of economizer ash in the holding tank when transitioning from the dry to the wet conveyor. About once every three or four weeks this build-up has to be unplugged. PRPA plans to replace the clinker grinder seals during the 2021 outage.

  - Other issues encountered during the installation were specific to the facility. For example, the SGC chutes at one point froze before the bunker was built and could provide insulation from the cold weather.
  - During installation B&W conducted and relied on three dimensional scans of existing equipment for fitting equipment. Many field modifications were required to make everything work since the scans were inaccurate (e.g., moving additional piping).

- The SGC system does not require much preventative maintenance, only quarterly oil changes for gear boxes. PRPA anticipates learning more during their first inspection period on the system in Spring 2020, but that has been delayed due to the COVID-19 pandemic. Major maintenance is required every three years to replace the pin connections in the flight assembly and additional mechanical components.

Feasibility and Implementation of Other SGC Systems

- Space constraints beneath the boiler would likely preclude installation of a SGC system entirely or make a retrofit significantly more costly at other sites. PRPA stated that Rawhide Energy Station generates a small volume of ash and has more space beneath the above-ground boiler than most plants. The costs associated with replacing/demolishing equipment below the boiler and fitting the conveyor around existing equipment to exit the boiler house can be substantial. Additionally, plants needing to retrofit multiple generating units may find a remote system more economical.

- PRPA is aware of a non-coal plant in Poland that installed SGC system with stacked conveyors to provide more flexibility. PRPA indicated other utilities have consulted them about their experience with SGC systems.

- PRPA is hesitant to say that other plants would find an SGC system appropriate since some may struggle to implement it at their specific site. The Rawhide Energy Station had several factors that allowed the system to be installed successfully.

- PRPA noted their approach to compliance with the CCR Rule took a conservative approach and over-engineered to lower their risk. Additionally, PRPA was forced to be creative to meet both state and federal requirements.