BURNS McDONNELL

CASE STUDY

Combined Experience Contributes to Innovative Fish-Handling Solution

After years of development of Section 316(b) regulations under the Clean Water Act, the time had come to select and implement compliance options. At Nearman Creek Power Station, an uncommon approach was customized to achieve compliance while minimizing complications.

Challenge

The Nearman Creek Power Station is a 268-MW coal-fired generation facility in Kansas City, Kansas, and along the Missouri River. The plant uses river water for cooling and is subject to regulation under Section 316(b) of the Clean Water Act, which seeks to reduce the impingement and entrainment of fish and other aquatic organisms at cooling water intake structures.

Compliance measures under the regulations were in development for more than 15 years, and seven options came out of that process under the final rule. Having multiple options allows the subjects of the regulations to choose the most feasible and cost-effective technology. It was time for facilities subject to the regulations to select and implement their preferred options.

Project Stats

Client
Kansas City Board of Public Utilities

Location
Kansas City, Kansas

4
MODIFIED TRAVELING SCREENS

32+
DROP, IN FEET, FROM TROUGH TO LOWEST EXPECTED RIVER LEVEL

2
YEARS OF MONITORING FOR OPTIMIZATION STUDY

The Nearman Creek facility needed to address two obstacles to maintain 316(b) compliance — the fluctuating river level and available space within the intake structure. To handle fluctuating river levels, the intake structure is built with the operating deck located two stories above the ground. Room inside the intake structure is limited. Any solution would need to be able to safely return fish to the water whether the river is running high or low. Construction would also need to be outside the intake house. Additionally, it would need to include a system bypass for diverting fish to a holding facility for study.

The Kansas City Board of Public Utilities (BPU), which owns the facility, also hoped to minimize major permitting challenges as related to the overall schedule. This included minimizing impacts to the adjacent flood plain and significant consultations and considerations to minimize impacts to protected species. Successful completion of the project would depend on a blend of environmental knowledge and innovative engineering work. In addition, the project required a two-year fish study to evaluate system effectiveness and ease of use, minimize study-induced variables, and allow for operational changes.

Solution

BPU has enlisted Burns & McDonnell for several years to provide engineering and environmental support as needed while it implements the optimization study for Section 316(b) compliance efforts at its generation facility. As part of that broader program, we were asked to evaluate the compliance technology options for Nearman Creek.

Intake structures are unique, so each solution must evaluate and accommodate local needs. We collaborated with the client and determined a modified traveling screen with fish return trough offered the optimal potential solution at the plant.

We applied multidisciplinary talents to designing the fish return system, combining engineering experience with biologists who understand the affected species and their anticipated survival. To avoid expanding the plant's footprint and complicating permitting for the project, the design included suspending the return trough off of the existing cooling water intake structure. Suspending the large superstructure eliminated the need for a new foundation for a separate structure.

Permitting with the U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, and U.S. Coast Guard was streamlined by avoidance of flood plain disturbance, no extension beyond the existing facility over the river, no construction in the river, and consideration given to protected species.

There were existing exit points in the building that needed to be used and limited space inside the intake building. Creative, innovative thinking helped resolve challenges like these, as well as the complex matter of designing the trough that would return fish to the river, given the height of the intake. Calculating and designing the slope of the trough and the height of the drops to safely return fish to river level required significant effort. The sloped trough included drops of up to 4 feet along the trough and a final drop of up to 32 feet during low-level river conditions. The trough design needed to account for water flow at the upstream side and retaining sufficient water level in the trough to safely transport the fish and other organisms.

Construction was successfully completed in last summer 2019. Subsequently, Burns & McDonnell designed and implemented a two-year impingement optimization study of the system. Training, oversight and quality control was provided by our biologists. The study measured and analyzed impingement survival over different operating conditions, including fish spray and removal pressure, fish trough flow, and screen rotation speed.

The optimization study had relatively little precedent to inform its design, especially given challenges like the height of the intake and fluctuating river levels. A temporary sampling system was developed to collect fish and shellfish from the modified traveling screens using a series of diversions, troughs, piping, valving and tanks to assess latent mortality.

Results

We assisted BPU with awarding contracts, installation and plant modifications, controls packages design and bid packages. Once the modified traveling screens and fish return system were installed, we designed the sample study system and trailer, trained BPU staff and completed reporting for the study. Dominant species included in the study were freshwater drum and gizzard shad. Other species common to the Missouri River were sampled with a total survival rate of 95.2% initial survival and 90.1% latent survival after 24 hours of holding time. No significant determinations of effect on fish survival were made from operational modes. The modified traveling screens and fish return installed and operated at Nearman Creek are in compliance with the impingement mortality standard under option five of the final rule and approved by all oversight agencies.

The modified traveling screens and fish return system that was implemented at the Nearman Creek Power Station have few examples across the country for comparison. We pioneered this approach, which was a first for a coal-fired generation facility in its Environmental Protection Agency region on the Missouri River and highly customized to the facility. This project should pave the way for future comparable implementations of this compliance option at other power plants by providing an example of successful execution.

About Burns & McDonnell

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