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In an effort to develop new technologies with lower maintenance costs, Stantec is currently monitoring entrainment and impingement at this Marine Life Exclusionary Device, which restricts fish eggs and larvae within an estuary in Taunton, MA. Photo Courtesy: Stantec

A New and Improved 316(b)

The Impact of the EPA's Final Rule on the Power Generation Industry

BY TIM MISER, ASSOCIATE EDITOR

Last May, the Environmental Protection Agency (EPA) finalized standards for Section 316(b) of the Clean Water Act (CWA). The rule makes good on a settlement the EPA reached with environmental groups to mandate measures that would protect fish and other aquatic wildlife which are impacted by cooling water intake structures (CWIS) utilized by power plants to normalize operating temperatures within their facilities. After a decades-long legal battle, power plant owners are now moving forward with plans to comply with the new regulations.

The rule is intended to mitigate injuries sustained by aquatic life forms that become caught in the strong currents created by power plants when they intake huge volumes of water to cool their facilities. In a process called *impingement*, these currents can pin small, sick, or otherwise weak fish against a CWIS, preventing the fish from swimming away to calmer waters. In a related process called ***entrainment***, smaller aquatic organisms (including fish eggs and larvae) can be swept by the current through a CWIS and into the cooling system itself. Because of the heat, pressure, mechanical, and chemical stresses incumbent in a power plant's cooling system, the EPA presumes mortality in all life that is entrained by a CWIS, unless site-specific studies can demonstrate otherwise.

To combat these problems, the EPA has worked to develop a system of regulations that will protect aquatic

life, while also affording power plant operators the flexibility they require to meet environmental mandates within the contexts of their particular circumstances. Earlier iterations of the rule were more prescriptive in nature, and many in the industry are relieved that the EPA has elected in this final revision to give operators and directors greater latitude in the application and enforcement of the standards, allowing for solutions which do not represent a short-sighted, one-size-fits-all approach, but which can be customized to site-specific constraints.

Tim Woodrow, industry team leader for Hydrolox, is satisfied with the final revision of the rule. "We're much happier today than we were a year ago because we actually have a rule," he says. "This part of the CWA has been under debate for many, many years, and now the EPA has finally delivered a clean mandate. The industry has long wanted a rule that is site-specific. Previous drafts of the rule were one-size-fits-all. Now we have a rule that responds to a particular plant with a specific set of circumstances, and that's a good thing."

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Douglas Dixon, technical executive and program manager for the fish protection research program at the Electric Power Research Institute (EPRI), is similarly pleased that the EPA has chosen to preserve site-specific flexibility in the final 316(b) rule. "Research on the 1973 CWA repeatedly indicates that the process of mitigating entrainment and impingement is a site-specific issue," Dixon says. "This new rule acknowledges the site-specific nature of impingement and entrainment problems, as well as the site-specific nature of the solutions to those problems, depending on the best professional judgment of public directors."

Nearly all natural gas-fired power plants built in the last 30 years, and more than 75 percent of coal-fired plants built in that same time frame, utilize closed-cycle cooling systems to moderate the heat that is created by the power generation process. Closed-cycle cooling systems need intake only enough water to replace that which is lost to evaporation by exposure to ambient conditions in cooling towers. As a result, they are safer for fish because they are not as water-intensive, and so create less current at the CWIS.

According to data published by the Union of Concerned Scientists, however, about 43 percent of the country's total portfolio of thermoelectric generators use once-through cooling systems, a method in which the entire volume of cooling water must be continually replenished and replaced, since the water is effectively "discarded" by the facility after it has served its purpose. It is these power plants that are targeted by the new rule.

The new regulations apply to existing facilities, and to new production units installed at those facilities. The EPA estimates that this amounts to approximately 544 power plants, all of which meet the rule's criteria of withdrawing water totaling at least two million gallons per day (MGD).

About 40 percent of these power plants have already implemented solutions to comply with the new rule. "In the Northeast, and to a lesser extent in the Upper Midwest, larger power facilities have already been pushed into compliance with the rule," says Nathan Henderson, principle and Section 316(b) practice leader for Stantec, a consulting firm that conducts onsite studies to help power plant operators assess the best technologies and strategies for their needs. "The technologies that these regions have required power plants to retrofit mean that many issues have already been addressed, especially where impingement is concerned."

Henderson concedes, however, that "there are still many plants that know little, if anything, about the rule." For these facilities, the path to compliance requires plant operators to choose from seven regulatory options, each of which is designed to represent the best technology available (BTA) to mitigate fish mortality as a result of impingement at a specific site.

These options include:

1. Operating a closed-cycle recirculating system as defined by the rule
2. Operating a CWIS that has a maximum design through-screen velocity of 0.5 feet per second
3. Operating a CWIS that has a maximum actual through-screen velocity of 0.5 feet per second
4. Operating an existing offshore velocity cap that is a minimum of 800 feet offshore and has bar screens or otherwise excludes marine mammals, sea turtles, and other large aquatic organisms
5. Operating a modified traveling screen system such as a modified Ristroph screen with a fish handling/return system, dual flow screens with smooth mesh, or rotary screens with fish returns or vacuum returns which the director determines is the BTA for impingement reduction
6. Operating any combination of technologies, management practices, and operational measures that the director determines represent the BTA for impingement reduction

7. Achieving a 12-month performance standard of no greater than 24 percent mortality including latent mortality for all non-fragile species

Plants which withdraw more than 125 MGD must satisfy greater compliance burdens by conducting "studies to help their permitting authority determine whether and what site-specific controls, if any, would be required to reduce the number of aquatic organisms entrained by cooling water systems. This decision process would include public input," says the EPA. Dixon explains that these larger plants can still select from among the seven regulatory options for compliance, but only after their state-level EPA director has made an initial ruling regarding entrainment. "Their impingement decisions, then, are necessarily dependent on the entrainment ruling they receive from their director," he says.

After weighing their options, Woodrow expects most plants will find the easiest path to compliance to be BTA option five (BTA-5). "This is the option that mandates that power plants must install traveling fish screens in such a way as to best protect aquatic wildlife," he says.

"Over the years, various screen technologies have been developed to protect aquatic life from CWIS," says Dixon. "Flat-paneled or cylindrical wedge-wired screens can help to protect fish on a site-specific basis. There have also been significant innovations in traveling water screens to protect against both impingement and entrainment. Traditional traveling water screens were modified by Ristroph to include woven mesh that minimizes screen abrasion on fish," he says. "These screens can also utilize buckets to collect fish, and low-pressure washes to gently wash the fish from the screens. There have also been some really new innovative screens which have come along in the last 10 years or so that offer significant fish-protection benefits. One of these innovations is the Bilfinger Rotary Screen; another is the Hydrolox molded polymer screen, which is very light weight. And Beaudrey offers vacuum screens that move fish through a fish return system."

"Not one solution is better than another; so much depends on the specifics of a given site," Dixon continues. "The hydraulics of a site will often dictate which solutions can and cannot be used. The debris load at a given site must also be taken into consideration. The existing configurations of civil structures at a site can effect what solutions are best adapted to a particular scenario. One popular option for EPA compliance requires power plants to conduct site optimization studies at their facilities in order to learn how best to tweak screen performance such that it achieves maximum fish survival. Variables tested include screen rotation rates; strength of pressure washes; water volume, depth, and velocity of fish return systems; and other incremental tweaks designed to improve performance. These parameters are then written into the plant's permit, and may differ considerably from facility to facility."

"There are any number of companies that manufacture fish-friendly traveling water screens that will help plants comply with 316(b) BTA-5," Woodrow notes. "All currently manufactured fish screens are now approved by the EPA for compliance. But this is not the entire story. Of paramount importance is the costs a plant must incur to operate a screen. Currently, power plants operate their screens two to three times a day, about 20 minutes at a time, for a total of about an hour a day. Even with this reduced usage, they are still spending from $20,000 to $50,000 a year to keep the screens operating. Under the new rule, any time a plant turns on its water circulation pumps, it must also rotate its screens. In order to comply with the rule, then, these plants must now operate their screens 24/7, and this has many plant operators worried about costs."

"Hydrolox screens were designed from the very beginning to run around the clock, with attention to minimizing the total cost of ownership", Woodrow says. "The total cost of a screen is not entirely accounted for by its upfront capital expenditure. Operational and maintenance costs must also be added into this equation. Traditional screens are driven by large side chains which represent a large maintenance burden. Hydrolox has eliminated this chain altogether. Instead, we make our entire screen mesh operate as a drive chain, using small sprockets to engage the underside of the screen mesh every two inches. This distributes the load pressures, moving them from the edges to the entirety of the screen, and eliminates torsional forces due to differing rates of chain elongation. An entirely maintenance-free screen is mechanically impossible, but this screen comes as close as you can."

Improvements notwithstanding, the final 316(b) rule does have some shortcomings, and there remains progress to be made in both the substance and the implementation of the rule.

"One of the big gaps that remains in the rule is its ability to address the components of the endangered species act," says Henderson. "There is now a memorandum of agreement between the EPA, the Fish and Wildlife Service, and the National Oceanic and Atmospheric Association's (NOAA) National Marine Fisheries Service (NMFS) that all 316(b) permit applications will be reviewed relative to the Endangered Species Act. This means that a facility that doesn't have much of an issue with impingement or entrainment, but which does have any kind of endangered species (not just fish), will have greater issues meeting the requirements of 316(b). We're recommending that

Hydrolox traveling water screens like the one in operation at Xcel Energy's Wilmarth Station, Mankato, Minnesota have very low associated O&M costs. Photo Courtesy: Hydrolox

some of our clients conduct sampling programs for endangered species, even if they don't have to, simply to disprove the presence of endangered species."

"There also isn't much guidance to help facilities develop their own schedules toward compliance," Henderson continues. "The regulatory agencies need to develop a plan to help facilities determine their next steps. Too many facilities don't know what to do next, so they are simply doing nothing, and this can be a bad idea. Permit holders are required to understand everything that changes with their permits. Facilities that choose to turn a blind eye to the issue will not absolve themselves from the requirement to meet mandates and requirements, especially in the eyes of the EPA and other regulatory agencies."

Dixon also sees room for improvement. "There's still a lot of work to be done," he says. "For example, it's proven very difficult to protect what the EPA calls 'fragile species' of fish. There are currently 14 species on this list including anchovy and threadgill shad, and the EPA has made provisions whereby additional fish can be added to the list on a site-specific basis. Fragile species are fish that are not amenable to any type of handling, whether by humans, nets, or screens. Merely touching these fish can remove scales. They have weak musculature, and they begin to break down and die very quickly. Many fragile fish are what people call 'trash' fish. They are forage fish with very high reproductive rates. As such, they are quite common, and population impacts on them are generally minimal. Some states, however, consider fragile fish to be highly important in the food chain and, therefore, in need of protection. Fragile species are still in need of considerable research." pe

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