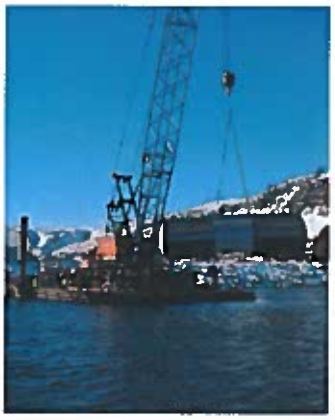
WATER-ENERGY NEXUS



Understanding the Proposed §316(b) Rule for Cooling Water Intake Structures at Existing Facilities

October 2012

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Mr. Burnett specializes in regulatory compliance for cooling water intake and discharge systems regulated under the Clean Water Act §316(a) and (b). During his 16-year tenure, he has played a key role in the development of Comprehensive Demonstration Studies and managed dozens of projects involving biological studies, siting and design of cooling water intakes. He has worked with the Equivalent Recruit Model, Empirical Transport Model, Empirical Impingement Model and RAMAS population modeling software in the assessment of potential impacts on fish populations.

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HDR

OVERVIEW

In April 2011, the U.S. Environmental Protection Agency (EPA) published a draft revision of the Clean Water Act §316(b) Phase II rule and is committed through a settlement agreement with environmental groups to issue a final version by June 27, 2013. The proposed rule intends to regulate existing facilities equipped with once-through cooling water systems and has wide-sweeping implications for the energy and manufacturing industries. Because the rule applies to both manufacturing and power facilities, it would supersede the suspended Phase II rule and certain portions of the previously promulgated Phase III rule. EPA is currently reviewing public comments on the draft.

Section 316(b) was enacted under the 1972 Clean Water Act, which also introduced the National Pollutant Discharge Elimination System (NPDES) permit program (Figure 1). Facilities with NPDES or SPDES permits (most states have permitting programs approved by EPA) are subject to §316(b), which requires that the location, design, construction and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impacts.

This summary discusses the proposed revised rule and intake technologies that are expected to receive industry attention in the coming years and what facility owners and operators should be doing now in anticipation of the final rule.

SCOPE AND IMPACT

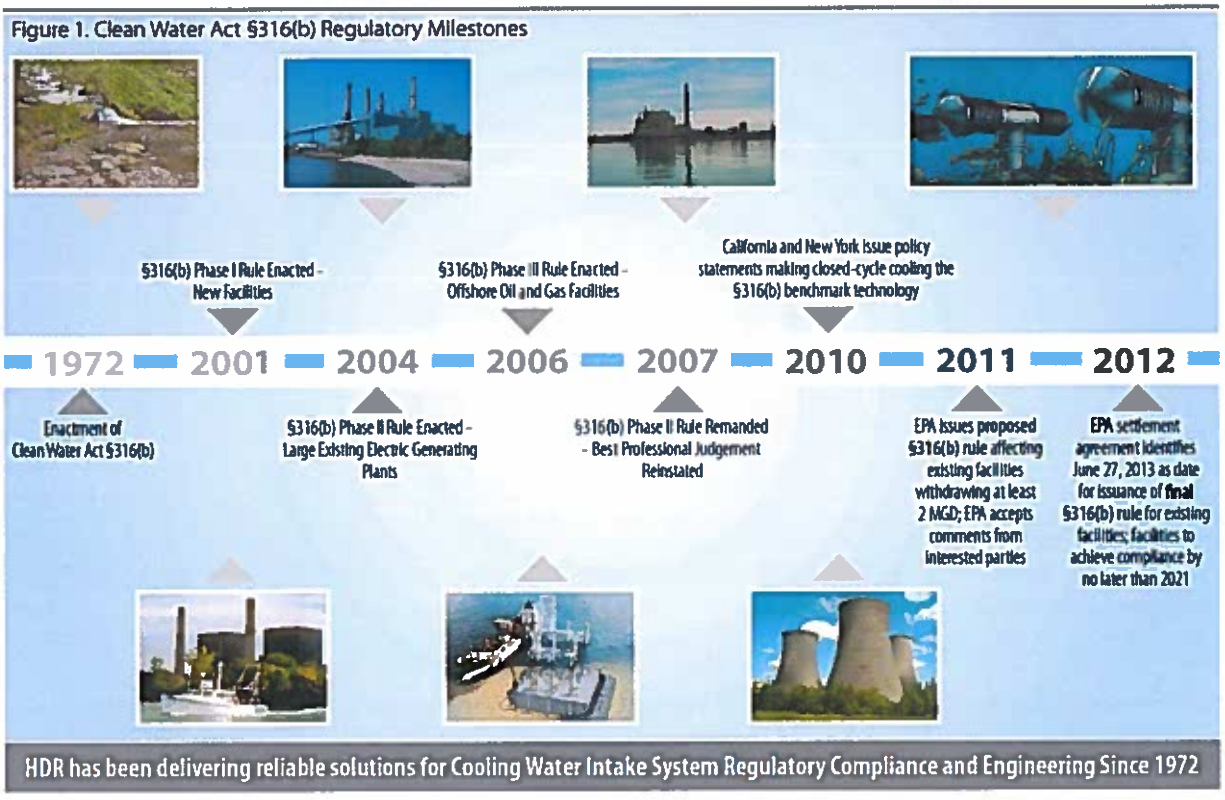
Entrainment and Impingement

Cooling water intakes can cause adverse environmental impacts by drawing early life-stage fish and shellfish into cooling water systems, where the organisms might be harmed by heat, pressure, mechanical stress or chemicals used to clean the cooling system. This process is referred to as entrainment. Larger organisms may be harmed when they are trapped against screens at the opening of an intake structure. This process is referred to as impingement.

Provisions for Existing Facilities

The proposed rule, which was published in the Federal Register on April 20, 2011, applies to existing power plants

Figure 1. Clean Water Act §316(b) Regulatory Milestones



and industrial and manufacturing facilities that withdraw at least 2 million gallons per day of cooling water and use at least 25 percent of that water exclusively for cooling purposes. EPA estimates that roughly 1,260 facilities meet this threshold, 670 of them power plants.

Under the revised rule, EPA proposed two potential compliance approaches that facilities can adopt to minimize impingement mortality:

1. Install modified traveling screens equipped with fish buckets, a low-pressure wash and a fish handling and return system, or
2. Reduce through-screen velocity to 0.5 feet per second or less.

If the first option is chosen, the facility operator must monitor for impingement mortality and demonstrate that the annual average and monthly maximum mortality of impinged fish does not exceed 12 and 31 percent, respectively. This approach differs from the performance standards approach contained in the suspended Phase II rule, which required 80 to 95 percent reductions in impingement mortality relative to a baseline condition. Under the proposed rule there is no need to establish a baseline against which impingement reductions can be measured.

If the second option is chosen, the facility must verify that through-screen velocities meet the rule requirements. To the extent this is accomplished, the regulation assumes that the reduced through-screen velocity will allow fish to safely swim away from the screens and result in negligible potential impingement impacts.

In addition to meeting one of the two impingement mortality compliance options, facilities that are located on tidal or marine waters and not equipped with passive screens will be required to implement a seasonal barrier net in order to protect shellfish from impingement.

With respect to entrainment, the proposed rule requires that the permitting authority maximize entrainment protections. Facilities that withdraw large amounts of water, at least 125 million gallons per day, are to conduct studies to help their permitting authority determine what site-specific controls, if any, would be required to reduce entrainment mortality.

Potential Compliance Technologies

There are typically tens of technology types and hundreds of technology and operational measure combinations that facilities can consider as cost-effective solutions for protecting fish at cooling water intakes. However, with consideration of the proposed rule requirements, and the restrictive two-track impingement compliance option, the pool of potential technologies for which a facility may be given credit has been reduced. The following are summaries of some technologies expected to gain the most attention should the rule be finalized as currently written.

Modified traveling screens

If modified traveling screens (photo 1) are selected for compliance, the proposed rule requires that the annual average and monthly maximum mortality of impinged fish not exceed 12 and 31 percent, respectively. If this technology is paired with fine-mesh screens, the number of organisms entrained can be reduced. However, the excluded organisms become impinged on the screens and only those that survive impingement will actually contribute to the reduction in entrainment losses.Variants on the traveling screen that may also warrant consideration include dual flow screens that can reduce through-screen velocities, and drum screens and Geiger screens that can reduce screen carry over.

Photo 1. Modified traveling screen.

Photo 2. Fixed panel screen used during a dewatered intake project.

Fixed panel screens

Fixed panel screens (photo 2) with sufficient screen surface area to achieve a through-screen velocity equal to or less than 0.5 feet per second can be used to satisfy the reduced intake velocity requirement. Retrofitting fixed panel screens at most facilities involves significant and costly

modifications to the cooling water intake. Fixed screens with smaller mesh sizes may also be used to reduce entrainment.

Wedgewire screens

Wedgewire screens (photo 3) are considered one of the more promising technologies available for reducing both impingement and entrainment. They have a "v" or wedge-shaped cross-section wire welded to a framing system that forms a slotted screen. The screen configuration needs to be developed with consideration of the specific life stages to be protected. Design features may include narrow slot sizes, through-slot velocities low enough to minimize potential impingement of life stages with underdeveloped swimming ability, and placement and orientation of the screen assembly that will result in sufficient "sweeping" velocities in the source water body (or through engineered velocities) to carry excluded organisms safely away from the screen. This technology would achieve impingement compliance by reducing through-slot velocities to 0.5 feet per second or less and potentially provide entrainment protection by using narrow slot wedgewire. Recent studies have indicated that in addition to physically excluding some entrainable size organisms, narrow slot sizes may increase screen avoidance by motile early life stages.

Barrier net system

Barrier nets are constructed of wide-mesh fabric panels and configured to completely surround the cooling water intake structure. Their mesh sizes typically are relatively large (3/8 inch) and they have had the most success in locations where seasonal migrations create high impingement events. This technology would achieve impingement compliance by reducing through-net velocities to less than 0.5 feet per second, but would not generally protect against entrainment.

Photo 3. Modified traveling screen.

Aquatic filter barriers

Aquatic filter barriers, such as the Gunderboom Marine Life Exclusion System (photo 4), are water-permeable barriers that reduce both impingement and entrainment by completely surrounding the intake structure and preventing organisms from entering. A curtain formed by two layers of treated fabric is either suspended by flotation billets and anchored in place or integrated into existing shoreline intake structures. This technology would achieve impingement compliance by reducing through-fabric velocities to less than 0.5 feet per second and provide substantial entrainment reductions to the extent early life stages are excluded from entering the intake.

Photo 4. Gunderbloom Marine Life Exclusion System.

Closed-cycle cooling

Closed-cycle cooling (photo 5) may have limited application as a full or partial retrofit depending on the existing configuration, repowering projects and many other factors. These are closed-cycle, recirculation systems, which typically use two to five percent of the water used in a once-through system. The closed-cycle cooling option is not recognized explicitly as a compliance option by the proposed rule; however, if 0.5 feet per second through-screen velocities are achieved as a result of the reduced water use, impingement compliance would be assured and the reduced intake flows would also reduce entrainment.

Operational measures

The list of potential operational measures to be considered for compliance is smaller than that for technologies. For example, if capacity factor reductions or unit mothballing results in through-screen velocities that are less than 0.5

feet per second, impingement compliance would be achieved and entrainment losses would be reduced. Variable speed drives, flow optimization and targeted outages may also be considered to the extent they provide impingement and entrainment protections that will be recognized by permitting authorities. Operational measures may become more important as EPA refines the proposed rule prior to promulgation of a final rule.

The extent to which a particular technology or suite of technologies and operational measures may be appropriate for a facility will depend on the permit director's objectives for entrainment reductions, as well as site-specific biological and engineering considerations. For some technologies, performance in terms of impingement and entrainment reductions can be largely driven by the robustness or fragility of specific species subject to withdrawal at the facility and the extent of debris loading and biofouling. Costs will be driven by these same site-specific factors, as well as the existing intake configuration, space availability and potentially many other factors.

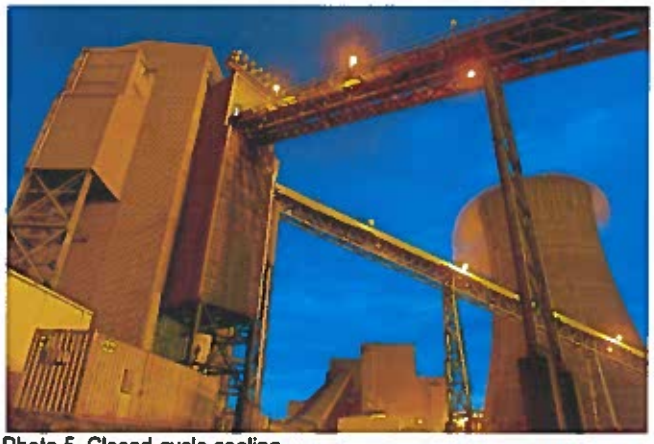


Photo 5. Closed-cycle cooling.

Schedule and Preparing for Compliance

When the final rule is promulgated, which is likely to take place within approximately 30 days from June 27, 2013, technologies to meet impingement requirements would need to be implemented as soon as possible, but within eight years (i.e., no later than 2021). Existing electrical generation facilities with a design intake flow of 50 million gallons per day or more would be on an expedited compliance schedule for certain application requirements and submittals, presumably because EPA believes these former Phase II facilities already performed certain related studies based on requirements in the 2004 version of the rule. Of particular interest to these facilities is the large number of study reports and data submittals due within six months of rule promulgation (Exhibit IX-1). All other facilities, including electrical generation facilities that withdraw between 2 and 50 million gallons per day, have a more lenient schedule of three years for these same requirements (Exhibit IX-2). Also important is the requirement that all existing facilities with actual intake flows of 125 million gallons per day and greater perform additional entrainment studies.

CONCLUSION

The proposed rule has important implications for owners and managers of impacted power plants and manufacturing facilities. It will determine what facility modifications will have to be made to intakes and operations in order to minimize losses of organisms. Available compliance strategies for impingement mortality require either costly upgrades of traveling screens to include fish protection, or reducing through-screen velocity to 0.5 feet per second or less. The latter could be achieved by expanding the intake or installing one of a number of screen or barrier options previously discussed; all of which can be very costly and in many cases not feasible. The approach owners and managers should take toward planning for compliance will depend to a large extent on their individual permitting authority's approach, given that entrainment requirements are based on the permit director's best professional judgment.

Owners and managers should be developing compliance strategies that consider the economic and operational impact of the rule's alternatives. If the final rule is challenged, the process could take years. In the meantime, compliance with the rule would be required, including timely submission of reports, and implementing studies and selected technologies to maintain compliance with NPDES and SPDES permits.

References:

EPA. 2011. National Pollutant Discharge Elimination System–Cooling Water Intake Structures at Existing Facilities and Phase I Facilities. 40 CFR Parts 122 and 135. Proposed Rules. April 20, 2011.

Exhibit IX-1: Application Requirements and Due Dates for Initial Permit Term* - Power Plants with DIF of 50 MGD or more

Application Requirement and Submittal Date	Submittal Date (all dates from rule promulgation)	Existing Facility Category: Power Plants with DIF of 50 MGD or more
	6 months	§ 122.21(r)(2) *Source water physical data* § 122.21(r) (3) *Cooling water intake structure data* § 122.21(r) (4) *Source water baseline biological characterization data* § 122.21(r) (5) *Cooling water system data* § 122.21(r) (6) *Proposed IM reduction plan* § 122.21(r) (7) *Performance studies* § 122.21(r) (8) *Operational status* AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study:(i) EM plan with peer reviewers identified*
	1 year	AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study:(ii) peer reviewed EM plan and (iii) implement EM plan*
	3.5 years	§ 122.21(r) (6) *Proposed IM reduction plan results*
	4 years	AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study: (iii) completed study*
	5 years	AIF>125 MGD and facilities with new units: § 122.21(r) (10) *Comprehensive technical feasibility and cost evaluation study* § 122.21(r) (11) *Benefits valuation study* § 122.21(r) (12) *Non-water quality and other environmental impacts study*
	*Subsequent Permit Terms After the initial submission of the §122.21(r) application studies, the owner or operator of a facility may submit a request to reduce the information required, if conditions at the facility and in the waterbody remain substantially unchanged since the previous application such that relevant previously submitted information remains representative of current source water, intake structure, cooling water system, and operating conditions. The request for reduced information requirements must be submitted to the Director at least one year prior to the expiration of its NPDES permit. The Director may accept or reject any part of the request. (See § 125.95(c)). For subsequent permit terms, information collection activities required under §122.21(r) must begin no later than eighteen months prior to permit expiration (see § 125.95(d)). For subsequent permit terms, all permit application materials are expected to be submitted to the Director with the application for permit renewal at least 6 months prior to permit expiration.	

Exhibit IX-2: Application Requirements and Due Dates for Initial Permit Term* - Other Existing Facilities with DIF > 2 MGD

Application Requirement and Submittal Date	Submittal Date (all dates from rule promulgation)	Existing Facility Category: Other Existing Facilities with DIF > 2 MGD
	3 years	§ 122.21(r)(2) *Source water physical data* § 122.21(r) (3) *Cooling water intake structure data* § 122.21(r) (4) *Source water baseline biological characterization data* § 122.21(r) (5) *Cooling water system data* § 122.21(r) (6) *Proposed IM reduction plan* § 122.21(r) (7) *Performance studies* § 122.21(r) (8) *Operational status* AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study:(i) EM plan with peer reviewers identified*
	3.5 years	AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study:(ii) peer reviewed EM plan and (iii) implement EM plan*
	6 years	§ 122.21(r) (6) *Proposed IM reduction plan results*
	6.5 year	AIF>125 MGD and facilities with new units: § 122.21(r) (9) *Entrainment characterization study: (iii) completed study*
	7.5 years	AIF>125 MGD and facilities with new units: § 122.21(r) (10) *Comprehensive technical feasibility and cost evaluation study* § 122.21(r) (11) *Benefits valuation study* § 122.21(r) (12) *Non-water quality and other environmental impacts study*
	*Subsequent Permit Terms After the initial submission of the §122.21(r) application studies, the owner or operator of a facility may submit a request to reduce the information required, if conditions at the facility and in the waterbody remain substantially unchanged since the previous application such that relevant previously submitted information remains representative of current source water, intake structure, cooling water system, and operating conditions. The request for reduced information requirements must be submitted to the Director at least one year prior to the expiration of its NPDES permit. The Director may accept or reject any part of the request. (See § 125.95(c)). For subsequent permit terms, information collection activities required under §122.21(r) must begin no later than eighteen months prior to permit expiration (see § 125.95(d)). For subsequent permit terms, all permit application materials are expected to be submitted to the Director with the application for permit renewal at least 6 months prior to permit expiration.	