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Cooling Water Intake Structures: Summary of the EPA Rule

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Summary

Thermoelectric generating plants and manufacturing facilities withdraw large volumes of water for production and, especially, to absorb heat from their industrial processes. Water withdrawals by power producers and manufacturers represent more than one-half of water withdrawn daily for various uses in the United States. Although water withdrawal is a necessity for these facilities, it also presents special problems for aquatic resources. In particular, the process of drawing surface water into the plant through cooling water intake structures (CWIS) can simultaneously pull in fish, shellfish, and tiny organisms, injuring or killing them. Congress enacted Section 316(b) of the Clean Water Act (CWA) specifically to address CWIS.

Regulatory efforts by the Environmental Protection Agency (EPA) to implement Section 316(b) have a long and complicated history over more than 35 years, including legal challenges at every step by industry groups and environmental advocates. Currently most new facilities are regulated under a rule issued in 2001, while a rule for existing facilities was challenged and remanded to EPA for revisions. In response, in 2011 EPA proposed national requirements affecting approximately 1,150 existing electric power plants and manufacturing facilities. Even before release, the proposed regulations were highly controversial among stakeholders and some Members of Congress. The issue for Congress has been whether a stringent and costly environmental mandate could jeopardize reliability of electricity supply in the United States. Many in industry feared, while environmental groups hoped, that EPA would require installation of technology called closed-cycle cooling that most effectively minimizes the adverse environmental impacts of CWIS, but also is the most costly technology option.

The EPA proposal declined to mandate closed-cycle cooling universally and instead favored a less costly, more flexible regulatory option. EPA's recommended approach in the 2011 proposal would essentially codify current CWIS permitting procedures for existing facilities, which are based on site-specific determinations and have been in place administratively for some time because of legal challenges to previous rules. EPA acknowledges that closed-cycle systems reduce the adverse effects of CWIS to a greater extent than other technologies, but in the proposed rule it rejected closed-cycle cooling as a uniform requirement to minimize entrainment at existing facilities. The agency based that conclusion on four factors: additional energy needed by electricity and manufacturing facilities to operate cooling equipment (i.e., energy penalty), additional air pollutants that would be emitted because fossil-fueled facilities would need to burn more fuel as compensation for the energy penalty, land availability concerns in some locations, and limited remaining useful life of some facilities that would not justify retrofit costs.

Not surprisingly, stakeholder groups viewed the proposal differently. Environmental groups endorsed the parts of the rule that would establish nationally uniform requirements, but criticized those allowing for site-specific determinations. Industry groups urged EPA to provide greater flexibility that would be more cost-effective. State permitting authorities were divided on modifying the rule to be more flexible. The final rule was delayed several times, largely due to EPA's consultation with federal wildlife services on potential impact of the rule on threatened and endangered species. The final rule was published in the *Federal Register* on August 15, 2014, with an October 14 effective date. EPA again declined to mandate closed-cycle cooling as a uniform requirement and provided several compliance options that are more flexible and less costly than the 2011 proposal. EPA estimates the annual compliance costs of the final rule to be $275 million and the annualized benefits to be $33 million. Projected costs do not reflect any site-specific requirements that permitting authorities may establish.

Stakeholder groups differ in evaluating the final rule, and their views diverge from those on the 2011 proposal. Environmental groups, who had advocated that EPA include closed-cycle cooling as a uniform requirement at existing facilities, said that they were extremely disappointed with the final rule, and they have already filed several challenges to it in federal court. The petroleum industry also has filed a legal challenge, as did representatives of the electric power industry, even though the latter indicated overall approval of the final rule. Some Members of Congress have criticized the final rule's cost as a threat to affordability and reliability of the nation's electricity supply.

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Introduction

Thermoelectric generating plants and many manufacturing facilities withdraw large volumes of water for use in production and, especially, to absorb waste heat from their industrial processes. Water withdrawals by electric generating plants, used primarily for cooling, are the largest category by sector in the United States—201 billion gallons per day (BGD)—while water withdrawals by industrial facilities, used both for production and cooling, are 18 BGD. Together, water withdrawals by manufacturers and electricity generators represent more than one-half of the 410 billion gallons of water withdrawn daily for various uses in the United States.[1]

Withdrawing water from streams, rivers, lakes, and coastal waters is a necessity for most electricity generating and manufacturing facilities, but facilities that require water for cooling also present special problems for aquatic resources. For example, the direct release of heated water after circulation through a power plant or manufacturing facility can harm aquatic life in a stream or lake. And the process of drawing surface water into the plant or facility can simultaneously pull fish, shellfish, and tiny organisms into the plant, generally killing them. In recognition of such impacts, Congress included Section 316 in the 1972 Federal Water Pollution Control Act (the law is commonly known as the Clean Water Act, or CWA)[2] specifically to address the potential problems of heat discharges[3] and cooling water intake structures.

Cooling water intake structures (CWIS) can cause two types of adverse environmental impacts. First, impingement occurs when fish, invertebrates, and other aquatic life are trapped on equipment such as screens at the entrance to the CWIS. The force of the intake water traps the organisms against the screen, and they are unable to escape. Second, entrainment occurs when small aquatic organisms, eggs, and larvae pass through the intake screening system and are drawn into the cooling mechanism, travel through the cooling system pumps and tubes, and then are discharged back into the source water. Impingement and entrainment injure or kill large numbers of aquatic organisms at all life stages. In turn, reducing impingement and entrainment mortality rates is likely to increase the number of fish, shellfish, and other aquatic organisms in affected waters. Effects of these manmade stressors on local biota may contribute to or compound the local impact of CWIS impingement and entrainment mortality. CWA Section 316(b) authorizes regulation of CWIS in order to protect such organisms from being harmed or killed.

The Environmental Protection Agency (EPA) has been engaged in regulatory efforts to implement Section 316(b) for more than 35 years. In March 2011, EPA proposed national requirements to be implemented through CWA discharge permits to minimize adverse environmental impact of cooling water intake structures at existing electricity generating and manufacturing facilities. Even before release, the proposed regulations were highly controversial among stakeholders and some Members of Congress. The issue for Congress has been whether a stringent and costly environmental mandate could jeopardize reliability of electricity supply in the United States. Many industry stakeholders feared, while environmental groups hoped, that EPA would require

[1] Joan F. Kenny, Nancy L. Barber, and Susan S. Hutson et al., *Estimated Use of Water in the United States in 2005*, U.S. Department of the Interior, U.S. Geological Survey, Circular 1344, 2009.

[2] 33 U.S.C. 1251 et seq.

[3] Regulation of thermal discharges, under CWA Section 316(a), is not part of the regulatory proposal discussed in this report. Regulations to implement this provision are found at 40 CFR 125.70. See Section X-D-7 of the final rule for discussion of thermal discharge impacts of cooling water systems.

installation of technology called closed-cycle cooling[4] that most effectively minimizes impingement and entrainment, but also would be the most costly technology option.[5] However, as discussed in this report, the EPA proposal declined to mandate closed-cycle cooling universally and instead proposed a less costly, more flexible regulatory option. EPA's recommended option would require uniform impingement mortality standards at all affected facilities and case-by-case determination of entrainment controls for all facilities.[6] Based on its review of public comments and additional data, in June 2012, the agency announced that it was considering certain changes to the impingement standards in the proposed rule (see "Impingement" below). Under the original court-ordered schedule, EPA was to issue a final rule on July 27, 2012. EPA did not meet that deadline, which was extended six times before EPA announced the final rule on May 19, 2014. Delays reportedly resulted from time needed to assess possible changes to the proposal and consultation with federal wildlife services for an Endangered Species Act (ESA) review of the rule. In the remainder of this report, provisions of the final rule are highlighted in text boxes that are titled "Final Rule."

Background

The primary goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."[7] To further this goal, the act prohibits the "discharge of any pollutant by any person" unless a statutory exception applies; the primary exception is procurement of a CWA permit.[8] Under the law, EPA or an authorized state agency can issue a permit for the discharge of any pollutant provided that the discharge complies with the conditions of the CWA.[9] The act requires technology-based solutions to minimize adverse environmental impacts of pollutant discharges, and Sections 301 and 306 require EPA to develop technology-based effluent limitation guidelines for existing sources and performance standards for new sources, respectively, that are used as the basis for restrictions specified in discharge permits.[10]

[4] Throughout this report, the terms "closed-cycle," "recirculating," and "cooling tower" will be used interchangeably. The term "closed-loop cooling" also is commonly used.

[5] The North American Electric Reliability Corporation (NERC), in an October 2010 report, concluded that implementation of four EPA rules, including a 316(b) rule, could result in a loss of up to 19% of fossil-fuel-fired steam capacity in the United States by 2018, with the potential for "significantly deteriorating future … system reliability." However, NERC incorrectly assumed that EPA would mandate closed-cycle cooling for all power plants and on that basis concluded that the 316(b) rule would be the most costly of the rules that it analyzed. North American Electric Reliability Corporation*, 2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations*, October 2010, http://www.nerc.com/files/EPA_Scenario_Final.pdf.

[6] U.S. Environmental Protection Agency, "National Pollutant Discharge Elimination System—Cooling Water Intake Structures at Existing Facilities and Phase 1 Facilities," 76 *Federal Register* 22,174-22,228, April 20, 2011. Hereinafter, CWIS Proposal.

[7] CWA Section 101(a) (33 U.S.C. 1251(a)).

[8] CWA Section 301 (33 U.S.C. 1311) and CWA Section 402 (33 U.S.C. 1342).

[9] CWA Section 402. The CWA vests permitting authority with EPA, but allows the agency to authorize qualified states to do so in lieu of EPA. Currently, 46 states have been authorized to issue CWA permits, and EPA is the permitting authority in other states (i.e., Idaho, Massachusetts, New Hampshire, and New Mexico), the District of Columbia, and all U.S. Territories except the Virgin Islands.

[10] CWA Section 301, and CWA Section 306 (33 U.S.C. 1316).

Section 316, the provision concerned with thermal discharges and cooling water intake structures, cross-references both Sections 301 and 306.[11] Section 316(b) provides in full—

> Any standard established pursuant to section 301 or section 306 of this Act and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

EPA's efforts to implement Section 316(b) have a long and complicated history, including legal challenges at every step by industry groups and environmental advocates (for details, see the **Appendix**). In summary, however, CWIS regulation involves three rulemaking phases. These regulatory requirements are applied to individual facilities through discharge permits issued by EPA or an authorized state agency.

- Phase I, issued in 2001, covers CWIS at new facilities,
- Phase II, issued in 2004, covers large existing electric generating plants, and
- Phase III, issued in 2006, covers certain existing facilities (manufacturing facilities and small electric generating plants) and new offshore and coastal oil and gas extraction facilities.

EPA's March 2011 proposal stemmed from legal challenges to the Phase II rule (including a Supreme Court ruling in 2009) and the Phase III rule.[12] Eventually, EPA determined that the most efficient regulatory approach would be to consolidate the regulations for existing facilities in a single proposal. In November 2010, EPA signed a settlement agreement with environmental group plaintiffs regarding rulemaking dates for establishing CWIS technology-based standards for existing facilities. EPA agreed to propose standards by March 14, 2011, and to take final action by July 27, 2012. EPA proposed the regulations on March 28, 2011. As noted above, EPA and environmental litigants agreed to several extensions of the initial deadline for a final rule, which EPA announced on May 19, 2014. It was published in the *Federal Register* on August 15, 2014, with an effective date of October 14, 2014.[13]

Cooling Water System Technology

Most power generators and manufacturing facilities use various types of water-based systems to cool power production processes[14] or manufacturing equipment.[15] On average, existing power

[11] 33 U.S.C. 1326.

[12] The 2011 regulatory proposal did not address the Phase III rule for new offshore and coastal oil and gas facilities. However, the proposal did address one provision of the Phase I rule, which is discussed below (see "Phase I Restoration Measures").

[13] Environmental Protection Agency, "National Pollutant Discharge Elimination System—Final Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities and Amend Requirements at Phase I Facilities; Final Rule," 79 *Federal Register* 48,300-49,439, August 15, 2014. Hereinafter, CWIS Final Rule.

[14] According to the Department of Energy—

> At nuclear and fossil-fuel power plants, electricity is produced by heating purified water to create high-pressure steam. The steam is expanded in turbines, which drive the generators that produce electricity. After leaving the turbines, the steam passes through a condenser that has multiple tubes and a large surface area. A large volume of cool water circulates through the tubes, absorbing heat from the steam. As the steam cools and condenses, the temperature of the cooling water rises.

U.S. Department of Energy, Office of Fossil Energy, *Energy Penalty Analysis of Possible Cooling Water Intake*
(continued...)

generators use 85% of withdrawn water for cooling, while manufacturing facilities on average use 52% of withdrawn water for cooling.[16] As defined in the proposed and final rule, "cooling water" is water used for equipment cooling, evaporative cooling tower makeup, and dilution of waste heat.[17] Most facilities use either once-through cooling or recirculating cooling (also known as closed-loop or closed-cycle). The basic designs are illustrated in **Figure 1**.

Once-through cooling refers to cooling systems in which untreated water is withdrawn from a source, circulated through heat exchangers, and then returned to a surface-water body. Large amounts of water—typically in the range of tens of millions to billions of gallons per day—are needed for once-through cooling. The vast majority of it is returned to the stream or lake, but at higher temperatures. The discharged water also may contain chemicals or pollutants from the cooling process. Once-through systems are used by the majority of electric generating units (63%) and about one-half of manufacturers (47%) subject to EPA's rule.

Recirculating, or closed-cycle, cooling systems receive their cooling water from and return it to a cooling tower and basin, cooling pond, or cooling lakes. Closed-cycle cooling systems allow facilities to transfer waste heat to the environment using much less water, relative to once-through cooling systems. In a closed-cycle system, water is withdrawn from a source, circulated through heat exchangers, cooled using ponds or towers, and then recirculated. Some water is removed from the recirculating system as a blowdown stream to control the buildup of suspended and dissolved solids. Amounts of water that are lost to evaporation, blowdown, and leakage are replaced with new withdrawal, usually from surface water bodies. Closed-cycle systems are used by 27% of electric generating units and 20% of manufacturers subject to the final rule. There also are combination systems, facilities with multiple cooling water systems that use both once-through and closed-cycle cooling; combination systems account for another 9% of electric generators and 22% of manufacturers subject to the final rule.[18]

There are two main types of closed-cycle recirculating systems. Both reduce the quantity of water that must be withdrawn, compared with once-through cooling systems. In a wet cooling tower system, water that has absorbed waste heat transfers that heat through evaporation into the surrounding air and recirculates the water to continue the cooling process. In dry cooling tower systems, waste heat is transferred completely through convection and radiation, rather than evaporation. Dry cooling towers are much larger and therefore more expensive—reportedly 5 to 10 times more expensive—than wet cooling towers. Because dry cooling towers virtually eliminate the need for cooling water withdrawals, they have been used as part of newly

(...continued)

Structure Requirements on Existing Coal-Fired Power Plants, October 2002, p. 13.

[15] Manufacturers withdraw water both for on-site power production (like electric utilities) and for process water that is used directly in an industrial process (e.g., water used as raw material in a product). Process water is more typically associated with manufacturers than electric plants.

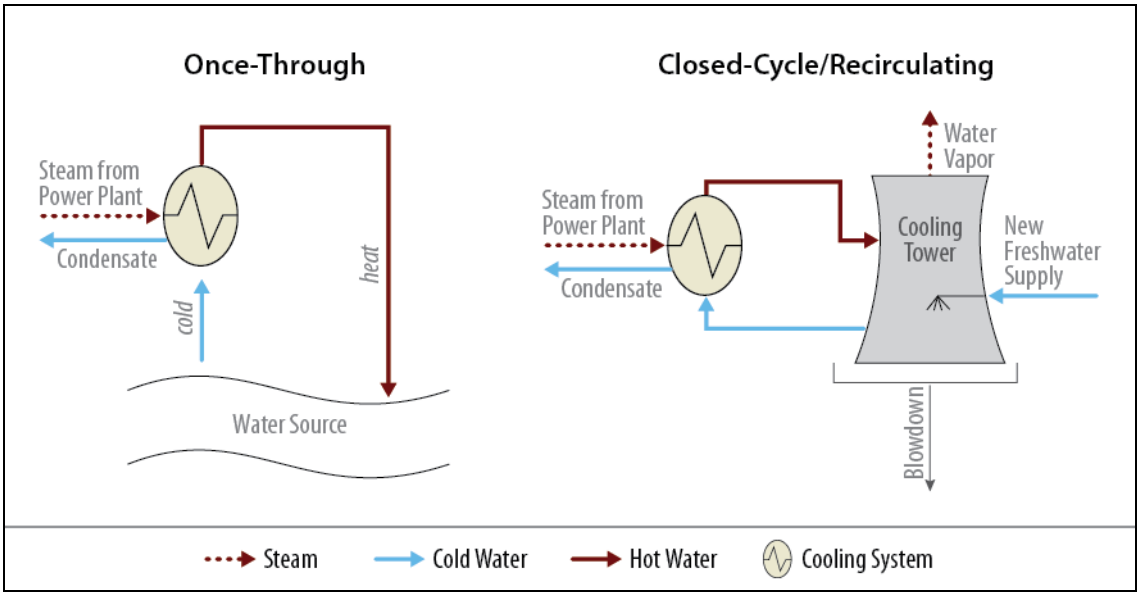
[16] CWIS Proposal p. 22,217.

[17] Cooling water is further subcategorized into either water that does not come into contact with any industrial materials, equipment or processes (non-contact cooling water) or water that comes in direct contact with hot equipment or heated materials and often requires treatment to remove pollutants such as metals before it may be discharged (contact cooling water).

[18] U.S. Environmental Protection Agency, *Economic and Benefits Analysis for Final Section 316(b) Existing Facilities Rule*, EPA 821-R-14-001, May 2014, pp. 1-2 – 1-4. Hereinafter, Economic Analysis. In some cases, the closed-cycle system uses cooling ponds, rather than cooling towers. The focus of the rule is cooling towers as an alternative to once-through cooling systems.

constructed cooling systems at smaller electric generating units and in areas with limited water supplies, such as the arid southwest of the United States.[19]

Figure 1. Once-Through and Closed-Cycle Wet Cooling System Designs



Source: Prepared by CRS, from North American Electric Reliability Corporation, "2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations," October 2010, p. 46.

Regardless of the plant design, a facility with a once-through cooling system will always withdraw more water, but evaporate (that is, consume, or remove water from the immediate environment) less water than a closed-cycle system. There are other types of tradeoffs between the two systems. Closed-cycle systems are more expensive to construct and operate. Once-through systems minimize evaporative losses and make facilities more energy efficient, because large amounts of power are not needed to operate cooling towers and condensers. However, their use is potentially limited during low-flow conditions, such as drought.[20] Also, because they withdraw large quantities of water, once-through systems will have greater potential impacts on aquatic life.

Technology for Impingement and/or Entrainment Control

Section 316(b) requires EPA to establish standards for CWIS that reflect the "best technology available [BTA] for minimizing adverse environmental impact." Because the two main adverse effects of CWIS are impingement and entrainment (I&E), EPA's regulatory proposal encompassed the best technology to minimize both of those effects. There are two basic approaches to reducing I&E.

[19] CWIS Proposal, pp. 22,199-22,200. Some power plants use hybrid closed-cycle systems with both wet and dry closed-cycle elements.

[20] Water dependence is a risk for hydroelectric and thermoelectric generation. During low-flow or high-heat events, water intakes and high water temperatures may harm or limit thermoelectric cooling. For discussion, see CRS Report R43199, *Energy-Water Nexus: The Energy Sector's Water Use*, by (name redacted).

> The first approach is flow reduction, where the facility installs technology or operates in a manner to reduce or eliminate the quantity of water being withdrawn.…The second way to reduce I&E is to install technologies or operate in a manner that either a) gently excludes organisms or b) collects and returns organisms without harm [back to the source water].[21]

EPA identified a number of technologies that can minimize impingement and/or entrainment mortality associated with CWIS, as described in the following text box.

Technology to Minimize Impingement and/or Entrainment Mortality

- The potential for impingement and entrainment is greatly minimized by using closed-cycle cooling systems, which withdraw less water than once-through systems.
- Flow reduction is commonly used to reduce impingement and entrainment. One approach to flow reduction is limiting the velocity of intake water to 0.5 feet per second or less to allow fish to swim away and escape the intake current.
- Screens are installed in front of water intakes and work by collecting or "impinging" fish and shellfish on the screen. They generally are either traveling screens, which rotate up and out of the water where debris and impinged organisms are removed from the screen surface by a high pressure spray wash, or cylindrical wedgewire screens, which act passively to block passage. The size of the screen mesh is an important consideration, because entrainment typically decreases as mesh size decreases. EPA believes that traveling screens are used by a large majority of electric generators (93%) and manufacturers (73%) that have CWIS.
- Barrier nets prevent impingement by fully encircling the intake area of water withdrawal to prevent fish and shellfish from coming in contact with intake structures and screens. Typically they have large mesh sizes that are designed to prevent impingement, but with no reduction in entrainment. Barrier nets are more effective than traveling screens to minimize shellfish impingement, because many types of shellfish grab hold of the traveling screen surface and are not removed by high pressure spray wash.
- Aquatic filter barriers are similar to barrier nets but are made of water-permeable fabric panels with small pores. Because they present a physical barrier to large and very small organisms, they can reduce both impingement and entrainment.
- Changing the water intake location from nearshore to far offshore areas that are less biologically productive can reduce impingement and entrainment. Most offshore intakes are fitted with a velocity cap, thus converting the direction of flow from vertical to horizontal, which triggers a physiological avoidance response in fish that reduces impingement. Re-location may be possible for facilities located on coasts but is not possible on many rivers and streams.
- In some cases, it may be possible to restrict a facility's operation so that water intake does not occur during spawning or other periods when large numbers of aquatic organisms are present near intake structures.

Source: CWIS Proposal, pp. 22,200-22,202.

Since promulgation of the Phase I CWIS rule in December 2001, *new* power plants and manufacturing facilities have been built in compliance with the rule's requirement for closed-cycle cooling or equivalent alternative.

For *existing* facilities, in the absence of nationwide regulations issued by EPA (because of legal challenges to the Phase II and III rules), permitting authorities make BTA determinations for CWIS on a case-by-case basis, using the permit writer's best professional judgment (BPJ).[22] In a few states, permitting authorities have proposed or are requiring installation of closed-cycle cooling systems at existing facilities. For example, New York regulators proposed a policy in

[21] Ibid., p. 22,198.

[22] When national standards do not exist or do not apply, permit writers use BPJ to determine applicable requirements for individual facilities.

2010 to establish closed-cycle cooling or its equivalent as BTA for existing facilities, and they have used the draft policy as the basis for imposing strict cooling water requirements at the Indian Point Units 2 and 3 nuclear power facilities in the state.[23] Similarly, California regulators adopted a policy in 2010 intended to require power plants that use marine or estuarine waters as a source of cooling water to replace once-through cooling systems with closed-cycle systems.[24] At least two other states—Delaware and New Jersey—have proposed to issue permits for existing power plants that would require closed-cycle cooling systems in order to reduce cooling water use and protect aquatic organisms.[25]

The Rule: Proposed and Final

Facilities Covered by the Final Rule

From a biological perspective, the effect of intake structures on impingement and entrainment is identical whether a CWIS is associated with a power plant or a manufacturing facility. Thus, the regulatory requirements in both the proposed and final rule would apply identically to all covered facilities. In total, the final rule would apply to approximately 1,065 facilities. It does not differentiate requirements for existing power producers and existing manufacturing facilities.

The universe of manufacturers affected by the final rule is 521 facilities; 509 of these are in six primary manufacturing industries (aluminum manufacturing, chemical manufacturing, food manufacturing, pulp and paper manufacturing, petroleum refining—accounting for the largest share of manufacturers, 11% of the regulated total—and steel manufacturing). The remaining 12 facilities are in other manufacturing categories (e.g., mining). Small entities (with fewer than 500 employees) that own regulated facilities comprise 16% of the affected manufacturing facilities; the aluminum manufacturing sector had the largest percentage of small manufacturing entities.[26]

The universe of steam electric generators that would be affected by the final rule is 544 facilities. Together, these facilities comprise approximately 9% of all U.S. steam electric generating facilities and nearly 46% of the U.S. electric power sector capacity. Five percent of the plants are large (with more than 2,500 megawatts (MW) of generation capacity), while 59% generate less than 1,000 MW of electricity. Regionally, 22% of the affected power plants are located in the Upper Midwest/Mid-Atlantic states, and 32% are located in the Southeast and Florida.[27]

EPA's 2011 proposal described four regulatory options. All would apply to power producers and manufacturers that withdraw over 2 million gallons per day (MGD) of water, at least 25% of which is used for cooling purposes. While nearly all water withdrawn by electricity generators is for cooling, manufacturers withdraw water for multiple purposes that include cooling and various direct industrial processes (e.g., water needed as a raw material or used as an ingredient in

[23] For information, see http://www.dec.ny.gov/animals/32847.html.

[24] For information, see http://www.swrcb.ca.gov/board_decisions/adopted_orders/resolutions/2010/rs2010_0020.pdf.

[25] See http://www.dnrec.delaware.gov/News/Pages/DNREC_to_require_95_percent_cooling_water_reduction_for_Indian_River_power_plant_permit.aspx, and http://www.state.nj.us/dep/newsrel/2010/10_0001.htm.

[26] Economic Analysis, p. 10-11.

[27] Ibid., p. 2A-15.

intermediate products). EPA believes that a significant amount of reduction, reuse, and recycling of water has already occurred in most manufacturing processes, in part due to other existing CWA requirements.

According to EPA, the 2 MGD/25% thresholds would potentially cover 99.7% of water withdrawals by existing utilities and other industrial sources. The proposed thresholds would cover approximately 70% of manufacturers and 87% of power-generating facilities.[28]

Final Rule: Coverage

Like the proposal, the final rule applies to cooling water intake structures that have the design capacity to withdraw amounts of water greater than 2 MGD from waters of the United States and at least 25% of the water actually withdrawn is used exclusively for cooling purposes. The difference in numbers of facilities subject to the rule between the proposal and final rule (1,150 vs. 1,065) resulted from a change in how EPA accounts for baseline closures, that is, facilities expected to close as a result of the rule.

The final rule also applies to existing offshore oil and gas facilities, existing offshore seafood processing facilities, and existing LNG terminals (i.e., facilities that were covered by the withdrawn Phase III rule). EPA did not identify uniformly applicable and available technology to minimize impingement mortality and entrainment at these facilities. Thus, permitting authorities will continue to make permitting decisions based on case-by-case determination.

Regulatory Options—the Proposed and Final Rule

In developing the 2011 proposed rule, EPA evaluated four regulatory options to minimize impingement mortality and entrainment mortality by CWIS at existing facilities, which are summarized in **Table 1**. Each had varying costs and environmental benefits. Three of them (Options 1, 2, and 3) would have required the same impingement mortality standards (uniform impingement standards—modified traveling screens[29]—for all existing facilities), but they differed with respect to the approach to controlling entrainment mortality (differences primarily related to requiring closed-cycle cooling for some or all facilities, or using case-by-case permitting determinations). Option 4 would have allowed permitting authorities to establish both impingement and mortality controls on a case-by-case basis for facilities with water-intake flow between 2 MGD and 50 MGD and would require uniform controls for larger facilities. The agency's identified preference at the time of proposal was Option 1, requiring uniform impingement mortality standards everywhere (i.e., modified traveling screens) and case-by-case determination of entrainment mortality controls for all facilities.

[28] CWIS Final Rule, p. 48,306.

[29] A modified traveling screen is a traveling water screen that incorporates measures to protect fish and shellfish. Examples include modified Ristroph screens with a fish handling and return system, dual flow screens with smooth mesh, and rotary screens with fish returns or vacuum returns.

Table 1. CWIS Regulatory Options: Proposed and Final Rule

(All proposed options and the final rule would apply to facilities withdrawing over 2 million gallons per day (MGD) of water and using at least 25% of withdrawn water for cooling purposes)

	Impingement Mortality Controls for Existing Facilities	Entrainment Mortality Controls for Existing Facilities	New Units at Existing Facilities
Option 1	Uniform controls[a] everywhere	Case-by-case determination everywhere	Closed-cycle cooling[b]
Option 2	Uniform controls everywhere	Closed-cycle cooling for facilities with DIF[c] > 125 MGD; case-by-case determination for smaller facilities	Closed-cycle cooling[b]
Option 3	Uniform controls everywhere	Closed-cycle cooling everywhere	Closed-cycle cooling[b]
Option 4	Uniform controls for facilities with DIF > 50 MGD; case-by-case determination for smaller facilities	Closed-cycle cooling for facilities with DIF > 50 MGD; case-by-case determination for smaller facilities	Closed-cycle cooling[b]
Final Rule	Final rule identifies 7 alternatives for impingement mortality control	Case-by-case determination everywhere	Closed-cycle cooling[b]

Source: Compiled by CRS from CWIS Proposal, including Exhibit X-1, p. 22,262, and Final Rule.

a. Under the proposed rule, BTA for impingement would be modified traveling screens. EPA also would allow facilities to comply by reducing through-screen intake velocity to 0.5 ft/sec or less where available or feasible at the facility.

b. EPA alternatively would allow facilities to comply by reducing entrainment mortality to the equivalent of 90% of reductions achieved by closed-cycle cooling.

c. DIF = Design Intake Flow.

Final Rule: Selected Regulatory Option

The proposed rule evaluated four regulatory options with differing degrees of stringency. However, in developing the final rule, EPA focused on two of the four—Option 2 and Option 4. EPA decided to not evaluate Option 3 as part of the final rule because that option was, in many ways, the same as requiring closed-cycle cooling at all existing facilities, which the agency determined was infeasible as BTA. The final rule is closest but not identical to proposed Option 1 (which was EPA's preferred option at proposal) by requiring case-by-case determination of entrainment mortality controls for all facilities. Regarding impingement mortality controls, it differs from all of the 2011 proposed options. As EPA describes in the final rule, modified traveling screens are defined as BTA, but the final rule allows one of seven compliance alternatives, one of which is traveling screens. The seven alternatives for impingement mortality control, described further below, give permitting authorities wide flexibility to select controls and will essentially lead to case-by-case determinations for both impingement mitigation and entrainment requirements, not a single national BTA standard or uniform controls everywhere.

Impingement

For control of impingement mortality at existing facilities, in the 2011 proposal EPA evaluated several possible technologies (see "Technology for Impingement and/or Entrainment Control") and, from them, concluded for the proposed rule that the best technology available is modified traveling screens with a fish handling and return system, plus barrier nets for intake systems

located on ocean or estuarine tidal waters. Based on its assessment of best performing technology, EPA proposed to set a numeric performance standard limiting fish impingement mortality to no more than 12% on an annual average and 31% on a monthly average.

Under the proposal, the owner or operator of a facility would be able to choose one of two options to comply with standards based on this BTA technology. Under the first, a numeric fish impingement limitation, the owner or operator would have to sample to measure fish mortality directly to show it will meet specified mortality performance standards and could use any appropriate technology to meet the standard. Under the second option, a velocity limitation, a facility could meet the standards by demonstrating that the through-screen design velocity does not exceed 0.5 feet per second, or by demonstrating that the actual average intake velocity does not exceed 0.5 feet per second. As shown in **Table 1**, three of the regulatory options considered by EPA in the proposal, including the agency's preferred Option 1, would have required these performance standards at all covered facilities.[30] Option 4 would have required these technologies at facilities with water-intake flow of more than 50 MGD, while requirements for facilities with intake flow between 2 MGD and 50 MGD would be determined case-by-case by permitting authorities.

This part of the proposal generated significant comment and criticism from industry and some states. These commenters urged EPA to adopt more flexible approaches, including more site-specific approaches and allowing for once-through cooling systems, rather than the stringent nationwide standard for impingement contained in the proposed rule. Industry groups contend that, when it comes to intake structures and their impacts on biological organisms, it is difficult to fashion a one-size-fits-all standard, given the variability of plants' technology and surroundings in terms of stream flow, temperature, and aquatic life characteristics. In discussions with EPA, some industry groups proposed that EPA develop a database of pre-approved BTAs. The facility owner and state would then be responsible for justifying why pre-approved BTA would be infeasible at a particular site and for ranking alternative technology, based on cost-benefit analysis and effectiveness of control. Some states, too, said that a more flexible rule would allow states to prioritize implementation of the new rule. A group of state water officials expressed concern that the proposed numeric limits were not uniformly achievable, and they recommended that the rule allow permitting authorities to set impingement mortality rates on a site-specific basis. Environmental advocacy groups, on the other hand, endorsed the uniform approach in this part of EPA's proposal.

Based on public comments and additional data, in June 2012, the agency announced in a Notice of Data Availability (NODA) that it was considering certain changes to the impingement standards.[31] After publication of the proposed rule, EPA had reviewed data from 80 studies documenting fish impingement, and in the NODA the agency indicated that it was considering several alternatives to the uniform requirements originally proposed. The possible revisions would tailor the rule's requirements to site-specific circumstances, while providing regulated entities with greater flexibility in complying with the rule, according to EPA. For example, the agency was considering adopting an approach that would allow establishing impingement

[30] EPA estimated that half of all manufacturers and more than three-fourths of all electric generators may already meet some or all of the proposed requirements for reducing impingement mortality under Option 1. CWIS Proposal, p. 22,248.

[31] U.S. Environmental Protection Agency, "National Pollutant Discharge Elimination System—Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities; Notice of Data Availability Related to Impingement Mortality Control Requirements," 77 *Federal Register* 34,315-34,326, June 11, 2012.

controls on a site-specific basis, either generally or limited to circumstances in which a facility demonstrates that the national controls are not feasible. Further, EPA was considering changes to the intake velocity compliance alternative, such as how to measure or calculate volumetric flow. The agency received data showing that some facilities have very low impingement rates, and it was also considering allowing permitting authorities to make a site-specific determination that the facility is already employing BTA.

Final Rule: Impingement Mortality Controls

The CWIS proposed rule would have required all covered facilities to meet a national performance standard limiting fish impingement mortality to no more than 12% on an annual average and 31% on a monthly average. Under the proposed rule, a covered facility would meet this standard either by measuring fish mortality directly and using any appropriate technology to minimize impingement, or the facility could meet the performance standard by using technology that meets specific through-screen intake velocity limits.

The final rule modifies the proposed rule significantly. It omits the proposed uniform numeric performance standard and bases the BTA standard for impingement mortality on performance of well-operated modified traveling screens with a fish handling and return system. Under the final rule, facilities can achieve compliance with this standard by utilizing one of seven alternatives, only one of which includes a numeric performance standard. Three of the alternatives are pre-approved technologies: (1) a closed-cycle recirculating system; (2) a cooling water intake structure that has a design maximum through-screen intake velocity capacity of 0.5 feet per second; or (3) an existing offshore velocity cap. Use of these technologies will require facilities to provide no demonstration or only a minimal demonstration that the flow reduction and control measures are functioning as envisioned. Once installed, the pre-approved technologies would obviate the need for further regulatory conditions, such as periodic monitoring, which EPA estimates will reduce the monitoring and reporting costs of the rule by approximately $20 million annually.

Three additional options offer a "streamlined" approach to compliance. All are based on a technology or suite of technologies and practices with more variable performance than the pre-approved technologies: (4) a cooling water intake structure that has an actual maximum through-screen intake velocity capacity of 0.5 feet per second; (5) modified traveling screens whose demonstrated performance represents the best technology available for impingement reduction at the site; or (6) a system or combination of technologies or operational measures, such as flow reductions, seasonal operation, unit closures, and behavioral deterrent systems. Facilities using the streamlined alternatives must submit several different types of site-specific studies to permitting authorities and must conduct periodic compliance monitoring.

The seventh alternative is to demonstrate compliance with a numeric performance standard—no more than 24% mortality over a 12-month period—through any technology; under this alternative, biological monitoring is to be conducted monthly. EPA expects that, save for future technologies or innovations, few facilities will use this option.

Entrainment

According to EPA, BTA impingement control alone would reduce CWIS-related mortality at existing facilities by up to 31%. The agency's analysis determined that some existing facilities may be able to do more to reduce mortality by also controlling entrainment. As described previously, wet cooling towers reduce both impingement mortality and entrainment mortality. However, in developing the 2011 proposed rule, EPA could not identify cooling towers or any other single technology as BTA for entrainment mortality control at all existing facilities nationwide.

As shown in **Table 1**, in the 2011 proposal, EPA evaluated four entrainment mitigation options ranging from case-by-case determinations by permitting authorities for all covered facilities (Option 1, the agency's preference at proposal) to closed-cycle cooling for all covered facilities (Option 3). Options 2 and 4 combined closed-cycle cooling for some facilities, based on a threshold of water-intake flow, and case-by-case permitting for facilities below the threshold. Options 1, 2, and 4 would have required permitting authorities to conduct a resource-intensive site-specific analysis of candidate BTA technologies for entrainment control for some or all

covered facilities. This would involve analysis of the localized benefits of entrainment reductions along with the costs of controls. The agency acknowledged that the outcome of the analysis might be a determination that no other technologies beyond impingement controls are feasible and/or justified by their costs.

EPA concluded that closed-cycle cooling reduces impingement and entrainment mortality to a greater extent than other technologies. However, the agency determined that closed-cycle cooling is not the "best technology available" for the regulatory proposal because it is not available nationally and has significant non-water quality impacts. Thus, in the proposed rule, the agency rejected closed-cycle cooling as the uniform basis for national entrainment controls at existing facilities. This conclusion was based on four factors.[32]

- There may be adverse consequences to the reliability of energy delivery on the local level from installing cooling towers. Retrofitting existing once-through cooling systems reduces output from the power plant due to additional equipment (pumps and fans) that must be run to operate the cooling system. This is referred to as energy penalty. Retrofitting also is likely to involve extended downtime. During such periods, some geographic regions could experience electricity reliability problems, because existing transmission systems would not be able to transfer sufficient electricity to ensure reliability. Further, if required to retrofit, some operators will elect to close, or retire, existing facilities. The loss of efficiency and generating capacity means that less electricity is available to meet demand.
- Fossil-fueled facilities would need to burn additional fuel to compensate for the energy required to operate cooling towers, thus emitting additional pollutants, including nitrogen oxides, sulfur dioxide, mercury, and especially additional particulate matter formation associated with plume drifts. It may be difficult to obtain air permits for cooling towers at existing facilities located in nonattainment areas because of the need to identify emission offsets.
- Land availability concerns might limit the feasibility of installing cooling towers on a site-specific basis. This may affect 25% of facilities covered by the proposal, according to EPA.
- Under some circumstances, remaining useful life of a particular facility may not justify the cost of installing closed-cycle cooling.

Considering all four factors together, EPA concluded that closed-cycle cooling is not practically feasible in a number of circumstances, thus it was not possible to uniformly require that technology at existing facilities nationwide. However, the case-by-case evaluations contemplated under the preferred regulatory option would result in site-specific determinations of BTA that could justify closed-cycle cooling or other technologies, or it could result in requiring no additional controls for entrainment mortality.

Industry groups and some states endorsed the flexibility provided in this part of the proposal to not establish a blanket requirement that closed-cycle cooling be installed at all existing facilities, while environmental advocacy groups and some states were critical of it. Environmental groups said that the case-by-case approach would ensure continuation of the current inadequate

[32] CWIS Proposal, pp. 22,208-22,210.

permitting process, because most state permitting agencies lack sufficient financial and technical resources to address cooling water impacts in the absence of national categorical requirements. Similarly, several individual states, such as Kansas and Minnesota, said that EPA's approach would require state permitting authorities to undertake a level of effort and site-specific analysis with every permit action to justify why a specific technology is chosen for a given facility that would result in excessive resource and cost implications.

Final Rule: Entrainment

The final rule adopts EPA's policy position in the proposal calling for entrainment control decisions to be made on a case-by-case basis by permitting authorities. The agency's reasoning for not requiring closed-cycle cooling at all facilities—even though it is the most effective technology—is based on factors also cited in the 2011 proposal: limited land availability and geographical constraints; increased air emissions of various pollutants because of the additional fuel needed to operate closed-cycle systems (especially emissions of particular matter, which are associated with increased adverse human health effects); and remaining useful plant life at some facilities does not justify the expense of installing closed-cycle cooling. For these reasons, EPA believes that closed-cycle cooling is not available to at least 25% of all existing facilities. Site-specific decisions by the permitting authority could lead to entrainment requirements based on variable speed pumps, water reuse, fine mesh screens, a closed-cycle cooling system, or some combination of technologies that constitutes BTA for the individual site. Under this approach, there likely will be additional entrainment controls for some facilities and none for others.

Under the final rule, any facility with actual intake flows in excess of 125 MGD must provide an entrainment study with its permit application. The 125 MGD administrative threshold will capture 90% of actual CWIS flows—those facilities with the highest likelihood of causing adverse aquatic impacts—but will apply to 30% of existing facilities.

New Units at Existing Facilities

The proposal also included provisions that would apply to newly installed units built at existing facilities. The proposal was the same under all four regulatory options—that is, impingement mortality requirements the same as those for existing facilities, and entrainment mortality reductions by installation of closed-cycle cooling systems, which EPA determined is the best performing technology. The latter is essentially the same requirement that applies to new facilities under the Phase I CWIS rule. EPA's rationale is similar, explaining that it is generally more feasible and cost-effective to install closed-cycle systems at brand new facilities (Phase I) and newly built units that increase operational capacity at an existing facility than it is to retrofit the same technology at existing facilities. In contrast to retrofits, new units can have their CWIS optimized for cooling towers, reducing the size of the cooling towers, increasing their efficiency, and reducing energy requirements. As with the current Phase I rule, a facility could demonstrate compliance with this portion of the rule by establishing reductions in entrainment mortality for the new unit that are 90% of the reductions that would be achieved by closed-cycle cooling.

Final Rule: New Units at Existing Facilities

The final rule adopts EPA's approach in the 2011 proposal. A covered facility must reduce actual intake flow at a new facility, at a minimum, to a level commensurate with that attainable with a closed-cycle recirculating system. As an alternative, the facility must demonstrate entrainment mortality reductions equivalent to 90% or greater of reduction achieved by a closed-cycle cooling system. A new unit means a newly built, stand-alone unit at an existing facility whose construction begins after the effective date of the rule.

Threatened and Endangered Species Concerns

The purpose of the CWIS rule is to minimize harm to aquatic species that may be impinged or entrained by cooling water intake structures. The proposed rule did not include specific provisions to protect threatened and endangered (T&E) species over other aquatic species

potentially affected by CWIS, but EPA concluded that minimizing impingement and entrainment of all aquatic organisms will promote and enhance protection of T&E species. EPA's evaluation of the benefits of the proposed rule (see "Estimated Benefits") noted that mortality of T&E species resulting from I&E may either lengthen the species' recovery time, or hasten the demise of the species. For this reason, EPA said, the population-level and social values of T&E losses are likely to be disproportionately higher than the absolute number of losses that occur. In material supporting the proposed rule, EPA identified 88 federally listed aquatic T&E species potentially affected by I&E mortality, because of geographic location, with 43 freshwater mussel species having the highest vulnerability. Nationally, 36% of T&E species that were assessed have vulnerable life history stages that overlap with the location of CWIS facilities. Other vulnerable species include species of sea turtles, anadromous fish, and other T&E freshwater fish.

Final Rule: Protection of T&E Species

Under Section 7 of the Endangered Species Act (ESA), federal agencies must ensure that any action authorized, funded, or carried out by the agency "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction of adverse modification of habitat." In the case of any federal agency action subject to the ESA that may affect listed species or critical habitat, the federal agency must consult with other agencies with responsibilities under ESA, principally the Fish and Wildlife Service (FWS) and the National Marine Fisheries Service (NMFS), jointly referred to as the Services. EPA began ESA consultation with these agencies in mid-2012, a process that ended up being responsible for delays in promulgating the final CWIS rule.

As a result of the consultation, the final rule includes a number of provisions specifically designed to address incidental take of federally listed T&E species and to ensure that the rule meets the requirements of Section 7. It requires a facility in its permit application to identify all federally listed T&E species and designated critical habitat that are or may be present in the area in the vicinity of the CWIS. In addition, a new provision not included in the proposed rule requires the permitting authority to transmit all permit applications to the FWS and NMFS upon receipt and provides the Services 60 days to review the permit application. The Services will have the opportunity to review draft permits and other materials and provide any additional input or suggested control measures to address effects on listed species or critical habitat. The Services might, for example, recommend to the facility and the permitting authority measures to minimize incidental take. Where the permitting authority requires additional measures to protect listed species, monitoring and reporting requirements for those measures will be included in a permit. EPA notes in the final rule that it has authority under the CWA to object to a permit proposed by a state or tribe that is likely to jeopardize the continued existence of a listed T&E species or result in the destruction or adverse modification of critical habitat. If the state permit is not modified to address EPA's objections, EPA will issue the permit in consultation with FWS and/or NMFS.

Compliance Schedule

Under the 2011 proposal, compliance with the rule, when promulgated, would be required as soon as possible. For individual facilities, specific compliance deadlines would be set when the facility next seeks renewal of its existing CWA discharge permit; such permits are issued for five-year periods and then must be reissued by the permitting authority (state or EPA). Permitting agencies often allow facilities some time period to come into compliance with new requirements.

As proposed by EPA, for facilities already in compliance with the rule or needing to install technologies other than cooling towers, the compliance period was assumed to be a five-year period from 2013 to 2017. EPA expects that facilities required to install cooling towers for entrainment mortality control would do so over a longer period of time. Under the proposal, fossil-fuel electric power generating facilities would achieve compliance from 2018 to 2022, and nuclear power generating and manufacturing facilities would achieve compliance from 2023 to 2027. Thus, 2028 would be the first year in which all covered existing facilities would be expected to have achieved compliance with the proposed rule. A new unit installed at an existing facility would be required to comply when it begins operation.

Final Rule: Compliance Schedule

As in the proposal, under the final rule, compliance will be required as soon as possible when the rule becomes effective, according to a schedule of requirements set by the permitting authority. However, under the proposal, compliance deadlines for I&E mortality requirements were to be set separately. Facilities would have been required to meet impingement mortality reduction requirements as soon as possible, but not more than eight years after the effective date of the rule. Compliance with entrainment reduction requirements would be set in a schedule by the permitting authority.

Commenters sought better synchronization of the compliance timeline to prevent a facility from having to install technology to comply with impingement mortality requirements and then later be required to install entrainment mortality technology. Under the final rule, the permitting authority is to first establish entrainment requirements. The facility will then be required to comply with the impingement mortality standard as soon as practicable thereafter. EPA believes that the change under the final rule will avoid situations where investments in impingement mortality controls would later be rendered obsolete by entrainment control requirements.

EPA determined that for many existing facilities it may take as long as 39 months to plan, collect, and compile the data and studies required to be submitted with a permit application, such as entrainment characterization data. Thus, the final rule specifies that all permit application requirements are to be submitted to permitting authorities 45 months after the effective date of the rule.

The final rule omits a requirement in the 2011 proposal for compliance with the impingement mortality standards within eight years, but EPA expects that the final rule will generally result in compliance within a similar period of time, that is, by 2022. The final rule does not contemplate different compliance timelines for fossil-fuel electric generating units compared with nuclear power generating units and manufacturing facilities (as had been proposed). For existing facilities, EPA assumes that all facilities subject to the final rule will begin bearing costs associated with the rule in 2014 and likely will complete needed investments and achieve compliance by 2030, depending on technology installation schedules and regulatory options considered. As in the proposed rule, a new unit installed at an existing facility would be required to comply when it begins operation.

Phase I Restoration Measures

The CWIS Phase I rule for new facilities included a provision that would have allowed facilities to use "restoration measures" or other mitigation such as restocking with fish bred in a hatchery, reclamation (for example, improving the habitat surrounding the intake structure), and migration barrier removal, as part of demonstrating that alternative technologies are comparable to closed-cycle cooling systems. A federal court invalidated this provision of the Phase I rule in 2004,[33] but EPA had never removed the provision from the regulations. EPA proposed in 2011 to remove the restoration provisions from the Phase I rule. Phase I facilities still could demonstrate alternatives to cooling towers, but the change may reduce the alternatives available to some facilities.[34]

Final Rule: Phase I Restoration Measures

The final rule removes the restoration measures provisions of the Phase I rule, as proposed.

[33] Riverkeeper, Inc. v. EPA, 358 F.3d 174 (2d Cir. 2004). See the **Appendix** for details.

[34] CWIS Proposal, p. 22,183.

Costs and Benefits

Compliance Costs

Not surprisingly, much of the interest by stakeholders in EPA's CWIS proposal was on costs of meeting new regulatory requirements, especially under one of the possible scenarios, mandating cooling towers for all existing facilities (Option 3). Several reports and analyses preceding the proposed rule examined potential impacts of mandating cooling towers (as well as other environmental rules, in some cases) on power plants and the adequacy/reliability of electricity supply that would result from such requirements.

Two earlier Department of Energy (DOE) reports examined potential impacts of an across-the-board requirement that existing power plants retrofit with closed-cycle cooling systems and concluded that the potential energy penalty of such a mandate could result in adverse effects on energy supplies. In a 2002 report, DOE said that, depending on the type of cooling tower installed (wet or dry) and weather conditions (peak summer demand or not), energy penalties ranging from 0.8% to 8.8% could occur. In a hypothetical worst-case scenario of retrofitting 100% of power plants with cooling towers, a number of additional power plants would have to be constructed to account for the energy penalty: 19 additional 400-megawatt plants if all retrofits were made to wet cooling towers, or 66 new 400-megawatt plants if some portion were dry cooling towers.[35] In a related 2008 report, DOE concluded that a mandatory cooling tower rule for existing power plants could result in a loss of generation capacity that could jeopardize adequate reserve capacity margins of electricity available to meet peak demand growth. This loss of generating capacity would be due to a combination of reduced operational efficiency[36] and early retirement of facilities that cannot or choose not to retrofit. The report estimated that 90% of facilities likely to retire are older oil- and natural gas-fired steam plants, which are not as likely to be used for baseload purposes as coal-fired plants.[37]

Other reports also focused on potential electricity reliability problems that could occur if EPA were to mandate closed-cycle cooling everywhere.[38] It is important to recognize that potential impacts and scenarios described in these reports, including need for additional power plant capacity, depended on a number of assumptions such as tight compliance deadlines, many of which differed greatly from EPA's actual 2011 proposal. Thus, while they indicated the types of issues (e.g., reliability) raised in anticipation of the proposal—and which EPA attempted to

[35] U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, Argonne National Laboratory, *Energy Penalty Analysis of Possible Cooling Water Intake Structure Requirements on Existing Coal-Fired Power Plants*, October 2002, pp. 2-3.

[36] As described above, retrofitting an existing once-through system reduces output from the power plant due to additional equipment (pumps and fans) that must be run to operate the cooling system.

[37] U.S. Department of Energy, Office of Electricity Delivery and Energy Reliability, *Electricity Reliability Impacts of a Mandatory Cooling Tower Rule for Existing Steam Generation Units*, October 2008. Baseload plants generally are operated continuously, in contrast to peaking plants that operate during periods of high electricity demand.

[38] See North American Electric Reliability Corporation, *2010 Special Reliability Scenario Assessment: Resource Adequacy Impacts of Potential U.S. Environmental Regulations*, October 2010, http://www.nerc.com/files/EPA_Scenario_Final_v2.pdf; and Metin Celebi, Frank Graves, and Gunjan Bathla, et al., *Potential Coal Plant Retirements Under Emerging Environmental Regulations*, The Brattle Group, December 8, 2010, http://www.brattle.com/_documents/uploadlibrary/upload898.pdf.

address in the proposal—they did not accurately predict impacts of the actual proposed rule (or the final rule).

As described in this report, EPA did not propose uniform closed-cycle cooling, which the agency acknowledged would be the most costly technology. Based on potential energy penalty and other factors, EPA recommended site-specific determination of the need for entrainment mortality controls, which might require cooling towers, or it might not. **Table 2** summarizes EPA's estimated annual costs of compliance under the final rule and two of the regulatory options considered in the CWIS proposal. For manufacturers and power producers, these costs include one-time technology costs of complying with the rule, one-time costs of installation downtime, annual operation and maintenance costs, recurring costs for permit renewal, and the value of electricity requirements for operating compliance technology.

For federal and state regulators, administrative costs for rule implementation include start-up activities, permit issuance and reissuance, analysis of entrainment studies, and annual monitoring. Implementation of EPA's proposed rule will depend significantly on the capacity of state regulatory agencies, many of which already are coping with constrained resources and budgets. The need for regulators to review facilities' reports and studies and to make case-by-case determinations would be greater under options requiring site-specific review to determine if entrainment mortality controls are needed (e.g., Option 4), but would be much less under an option that assumes closed-cycle cooling for all facilities (Option 2).[39] The incremental administrative burden on state regulators also depends on the extent of the state's current practices for regulating CWIS. To the extent that permitting authorities already incur costs for administering permits based on Best Professional Judgment, incremental costs of the final rule to permitting authorities are overstated. [40]

Table 2. Annualized Social Costs of CWIS Regulatory Options and Final Rule for Existing Facilities

(millions of 2011 dollars)

	Option 2	Option 4	Final Rule
Direct Compliance Cost for Manufacturers	$229.2	$47.8	$67.7
Direct Compliance Cost for Electric Generators	$3,413.3	$202.9	$203.7
Total Direct Compliance Cost	**$3,642.5**	**$250.7**	**$271.4**
State and Federal Administrative Cost	$0.7	$1.0	$1.0
Total Social Cost	**$3,643.2**	**$251.8**	**$272.4**

Source: CWIS Final Rule, Exhibit IX-4.

[39] Conversely, direct compliance costs for manufacturers and power producers would be higher if they were required to utilize closed-cycle cooling.

[40] Economic Analysis, p. 3-22. See infra footnote 9 regarding state permitting authorities.

Notes: See **Table 1** for details of regulatory options considered by EPA. Social costs include federal and state government costs for administering the rule. Costs do not includes costs associated with site-specific, case-by-case determinations. Costs are annualized over 51 years and discounted at a 3% rate. See the CWIS Final rule for cost estimates using a 7% discount rate. In developing the final rule, EPA focused its estimates for costs and benefits on two of the options in the 2011 proposal (Option 2 and Option 4).

Final Rule: Estimated Costs

EPA estimates the costs of the final rule for existing facilities to be $272.4 million per year at a 3% discount rate (compared with $384 million for the preferred option in the proposed rule). The new unit provision of the final rule will result in an annualized cost of $2.5 million using a 3% discount rate. The estimated costs reflect permit applications, studies, recordkeeping, monitoring, and reporting required by the rule. The costs also include costs of technologies for complying with the impingement mitigation requirements of the rule under the seven compliance alternatives included in the final rule. However, considering the flexibility included in the final rule and uncertainty about which impingement mitigation alternatives will be chosen for individual facilities, one might question EPA's ability to estimate with any level of certainty the costs for the impingement control portion of the rule.

As with the proposed rule, the cost estimates reflect the incremental costs attributed only to the final rule. Thus, facilities that already have closed-cycle cooling systems will not incur capital costs to retrofit new technologies, but they still will incur permitting costs.

Significantly for the overall estimated costs, the costs of additional technologies that may be required to meet the site-specific requirements for entrainment mitigation were not included in EPA's analysis—nor were they included in EPA's estimates of options in the 2011 proposal for site-specific determinations for some or all facilities—because EPA cannot estimate with any level of certainty what site-specific determinations will be made by permitting authorities. Costs for additional measures that may be required for protection of threatened and endangered species also are not included. That does not mean that covered facilities will not incur costs, however.

As shown in **Table 2**, EPA estimates that the final rule will impose administrative costs on federal and state governments (i.e., permitting authorities) of $1 million per year. Some states are likely to argue that these costs are substantially underestimated because of the level of effort and resources that will be needed for the site-specific analyses required by the rule.

On a per-facility basis, EPA estimates the annual pre-tax compliance costs of the final rule for electric generators will be $400,000, and for manufacturers, the average annual cost per regulated facility will be $100,000. EPA expects that the final rule will have relatively minor economic impacts on regulated facilities. It estimates that 86% of electric generators and 99% of facilities in the non-power sector will incur compliance costs of less than 1%. The agency also estimates that the annual increase in electricity costs to consumers is approximately $1.03 per household—less than the $1.41 estimated for the preferred option in the 2011 proposed rule.

In the Economic Analysis for the final rule, EPA evaluated costs for facilities not already in compliance with the rule. For electric power producers, the agency analyzed potential closures/retirements, which it concluded would not be significant. EPA estimated that the final rule would have a net result of full or partial closure of 10 power plant units by 2030, representing 2 gigawatts of power. Overall, 22 units would close, and 12 would *avoid* closure, because they are expected to become more attractive sources of electricity due to changes in the economics of electricity production across the full market.[41]

EPA also analyzed the electricity price impacts if utilities pass through all CWIS compliance costs to consumers. Looking across three consumer groups (industrial, commercial, and residential), industrial consumers would experience the highest price increases, and residential consumers are expected to experience the lowest price increases.[42] On average, for a typical U.S.

[41] Economic Analysis, pp. 6-16 – 6-20.

[42] Ibid., p. 4-16.

household, EPA estimated that the final rule would result in average annual electricity increase per household of $1.03.[43]

For manufacturers, EPA evaluated how compliance costs would likely affect the financial health of facilities, including the potential for closures or financial stress short of closure. EPA estimated that no manufacturing facilities would be at risk of closure as a result of the final rule and that 12 facilities (mainly in the chemicals and paper products sectors) could experience financial stress short of closure.[44]

Uncertainties of Compliance Cost Estimates

EPA acknowledged a number of uncertainties about compliance cost estimates in the final rule. First, the agency's analysis omitted some costs. In particular, EPA made no attempt to estimate manufacturers' and electricity generators' compliance costs associated with site-specific, case-by-case determinations under some of the proposed options. EPA believes that costs of these site-specific determinations are highly speculative, because permitting authorities will consider waterbody-specific data, local impacts, public comments, costs and benefits, land availability, grid reliability, and other factors. If those determinations result in few requirements for existing facilities to install closed-cycle cooling, then actual compliance costs are likely to be close to EPA's estimates. However, if permitting authorities make site-specific determinations that widely require retrofitting with cooling towers, compliance costs will be higher than costs shown in **Table 2**—perhaps much higher.

Second, because the cost of cooling tower installation and operation varies based on the size and configuration of the unit, to the extent that the size and configuration of a potential new unit is different from EPA's assumptions, the relative magnitude of compliance costs for new capacity may be under- or over-estimated.[45]

Third, EPA recognized a number of data limitations and other uncertainties. For example, for both electric generators and manufacturing facilities, EPA relied heavily on industry and facility data collected during previous phases of the CWIS rulemaking, and some of it may no longer reflect current circumstances of facilities, business conditions, or cooling water usage. Downtime schedules and cost estimates are uncertain. There may be economic and operating differences between analyzed facilities (based on sampling) and all affected facilities. Further, impacts of electricity cost increases to various consumer classes could be different based on whether or not generators fully pass costs of compliance through to consumers, or do not allocate costs uniformly across consumer classes.[46]

Estimated Benefits

EPA believes that environmental benefits would occur as a result of the rule because of reductions in impingement and entrainment. Thus, while none of the recent reports by DOE and other organizations described above addresses benefits of requiring CWIS controls, the 2011 proposal

[43] CWIS Final Rule, p. 48,392, Exhibit IX-9.

[44] Ibid., p. 48,398, Exhibit IX-16.

[45] Economic Analysis, p. 4-33.

[46] Ibid.,, pp. 4-17 – 4-18, 4-29, 5-16.

did do so. EPA's analysis considered three categories of benefits: use benefits such as increased harvests of recreational and commercial fisheries, nonuse benefits such as improved ecosystem function, and reduced harm to threatened and endangered species. EPA estimated the economic benefits from the regulatory options using a range of valuation methods, depending on the benefit category, data availability, and other factors, and derived national benefit estimates from a series of U.S. regional studies. As discussed below, the agency did acknowledge large uncertainties in its analysis of benefits.

EPA believes that, by reducing I&E mortality rates, the rule would likely increase the number of fish, shellfish, and other aquatic organisms in affected bodies of water. In turn, this increased number of aquatic organisms directly improves the welfare of individuals who use the affected aquatic resources; this is referred to as "use benefit," such as increases to the value of recreational and commercial fisheries. EPA relied on a number of studies to estimate a "baseline" of aquatic organisms that are lost due to impingement and entrainment, in the absence of additional regulation, and then estimated reductions in losses likely to occur under various regulatory options. EPA's analysis of fish mortality found that uniform closed-cycle cooling would result in the greatest reduction in I&E mortality. Similarly, the estimated benefits on commercial and recreational fisheries were greatest under an option requiring uniform closed-cycle cooling (see **Table 3**).

Reducing I&E mortality also improves the welfare of individuals independent of any specific use of the affected resources; this is referred to as "nonuse benefits" such as improved ecosystem function and resource bequest values.[47] Individuals may not use these resources directly, but they may value change in their status or quality. Monetizing nonuse benefits involves analytic methods which ask people to state their willingness to pay for particular ecological improvements, such as abundance of migratory fish species, and then attempts to calculate total values. For the 2011 proposal, EPA estimated the nonuse benefits of increased abundance of winter flounder in the North Atlantic and Mid-Atlantic regions (see **Table 3**).

Finally, EPA estimated the benefits from improved protection of threatened and endangered (T&E) species, since I&E mortality may either lengthen population recovery time, or hasten the demise of the species. Threatened and endangered species are characterized by low population levels to begin with, and based on available data, EPA was unable to quantify effects on T&E populations from 316(b) regulation. However, EPA was able to obtain use values for only a small subset of all affected T&E species. The agency concluded that the primary value of T&E species is in the nonuse category. Nevertheless, because of data limitations, EPA was unable to quantify nonuse benefits of T&E species, so the estimates shown in **Table 3** are actually based on nonuse valuation techniques applied to two species.[48]

[47] Nonuse benefits, or values, are values that individuals place on goods or services that are not consumed directly, but because the amenity or resource simply exists. For discussion, see CRS Report RL30242, *Natural Resources: Assessing Nonmarket Values through Contingent Valuation*, by Joseph T. Breedlove and (name redacted).

[48] Final CWIS Rule, pp. 48,410-48,411.

Table 3. Annualized National Social Benefits from Eliminating or Reducing I&E Mortality: Regulatory Options and Final Rule

(monetized benefit categories only)

Regulatory Option	Recreational and Commercial Fishing Benefits (million 2011 $)	Nonuse Benefits (million 2011 $)	T&E Species Benefits (million 2011 $)	Social Cost of Carbon (million 2011 $)[a]	Total Benefits (million 2011 $)
Baseline	$86.8	$99.1	$1.2	N.A.	$187.1
Option 2	$46.9	$51.1	$0.7	-$1,643.1	-$1542.8
Option 4	$19.0	$0.3	$0.4	$12.4	$33.8
Final Rule	$19.1	$1.0	$0.4	$12.4	$32.8

Source: Calculations by CRS from CWIS Final Rule.

Notes: Baseline represents the annual economic benefit of eliminating I&E mortality losses entirely. Benefits estimates are annualized over 51 years and discounted at a 3% rate. See Section X of the Final Rule for benefits estimates using a 7% discount rate. In developing the final rule, EPA focused its estimates for costs and benefits on two of the options in the 2011 proposal, not all four of the proposed options.

a. EPA estimates that both the final rule and proposed Option 4 would result in a net reduction in carbon emissions for existing units during the analysis period. Proposed Option 2 would result in a net increase in emissions and negative benefits for existing units. N.A.=not available.

Final Rule: Benefits

EPA estimates the benefits to society of the final rule to be $33 million annually at a 3% discount rate (compared with $17.6 million in estimated benefits under the agency's preferred option in the proposed rule). Many of the expected benefits are not or cannot be monetized or quantified, such as existence values for threatened and endangered species and other nonuse benefits. The estimates omit important categories of benefits that EPA expects the rule will achieve, such as most of the benefits that are associated with fish other than commercially and recreationally harvested fish. As a result, EPA believes that the estimates are likely to understate substantially the rule's expected benefits.

The final rule includes in the monetized benefits EPA's estimate that the rule will reduce greenhouse gas (GHG) emissions by 9.3 million tons of CO_2-equivalent emissions over the 40-year compliance period for the analysis. The estimated benefits in the final rule—ranging from $12 million to $13 million annually—are based on the social cost of carbon (see **Table 3**). The proposed rule did not include benefits of GHG reductions; thus, the additional estimate of these benefits is primarily responsible for the higher overall estimate of benefits in the final rule, compared with the 2011 proposal. (The social cost of carbon is an estimate of the monetized damages associated with an incremental increase in carbon emissions in a given year. It is estimated using methodology developed by a federal interagency working group in November 2013 (see http://www.whitehouse.gov/sites/default/files/omb/assets/inforeg/technical-update-social-cost-of-carbon-for-regulator-impact-analysis.pdf). The concept of estimating the social cost of carbon is controversial, and stakeholders have critiqued the estimates in the interagency document, with some saying they should be lower and others saying they should be higher.)

The final rule requires facilities that withdraw 125 MGD or more of cooling water to submit an entrainment study to the permitting authority. The study is to include, among other items, information on the benefits of entrainment controls, taking into account all benefits including categories that cannot be quantified. However, the rule does not direct permitting authorities to require a facility owner or operator to conduct a willingness-to-pay survey to assess benefits. EPA expects that permitting authorities will consider the costs and what the magnitude of non-monetized benefits would have to be to justify the costs.

Uncertainties of Benefits Estimates

EPA's estimated benefits for the 2011 proposal and the final rule were partial estimates only, as the agency was not able to monetize all benefits, especially non-use values (e.g., values that people may hold for an environmental improvement that are not tied to any use of the resource such as recreation). EPA acknowledged that quantifying and monetizing the benefits of reductions in I&E mortality losses is challenging because of a large number of uncertainties in approaches used to value benefits. Examples of uncertainty and limitations include simplifying assumptions used in order to make national-scale estimates may over- or underestimate losses and benefits; and species-specific quantitative estimates may not be precise. The agency acknowledges that the combined effect of these uncertainties is of unknown magnitude or direction—that is, the estimates may over- or understate the anticipated national-level benefits—but overall, EPA expects that actual benefits will be greater than it estimates.[49]

At the time of proposal in 2011, EPA used the best available scientific and economic methodologies but could only partially monetize benefits. Nonuse benefits are sometimes measured by asking consumers about their willingness to pay for a particular good or service. The agency hoped to improve its benefits estimates by incorporating the results of a new national willingness to pay survey, which it hoped could be used to inform the final CWIS rule. Thus, EPA undertook a survey of U.S. households seeking to determine how much most ratepayers would be willing to pay to reduce fish losses and mitigate other aquatic concerns resulting from the use of

[49] CWIS Final Rule, pp. 48,414-48,415.

CWIS, as a way to measure the benefits of the regulation. However, EPA's announcement of this stated preference survey in January 2011[50] was criticized by industry groups who said that the survey design would make inappropriate conclusions about the loss of life in fish populations due to CWIS, and thus would likely overstate the benefits of strict regulation.[51]

In June 2012 EPA published a notice reporting preliminary data from the stated preference survey, which consisted of four regional and one nationwide survey.[52] At the time of this notice, EPA had completed analysis of the data from one region only (the Northeast). Until all analyses and external peer review are complete, EPA said, the agency would not decide whether to use results of the stated preference survey in the benefits analysis for the final rule. The purpose of the notice was to solicit public comment on the information gathered so far and on what role, if any, it should play in EPA's assessment of the benefits of regulatory options for the final rule. In mid-2013, the agency announced that it had asked its Science Advisory Board, which provides scientific and engineering advice to the EPA Administrator, to evaluate the stated preference survey and results of the survey. In developing the final rule, EPA did not rely on the results of the stated preference survey, which remains preliminary and has not yet been reviewed by the agency's Science Advisory Board.

The final rule is affected by many of the same uncertainties as the proposed rule: (1) not all ecological goods and services affected by CWIS at regulated facilities are modeled or monetized, suggesting that the total benefits of regulation may be underestimated; and (2) when particular ecological goods and services are monetized, data are not always available at the national level.

Congressional Interest and Conclusion

Congressional interest in EPA's CWIS proposal has been evident within the broad context of legislators' concerns over potential impacts, individually and cumulatively, of EPA regulatory proposals involving air quality, climate change, and water quality on electric generating facilities and other sectors of the economy. Several recent legislative proposals have sought to restrict or prohibit EPA's and other agencies' regulatory authority in a number of areas, such as requiring more frequent and detailed regulatory analyses and consideration of regulatory alternatives. Some suggest that upcoming EPA rules should be more attentive to costs, for consistency with President Obama's Executive Order 13563, which provides for a retrospective review of existing significant regulations by agencies "to quantify anticipated present and future benefits and costs as accurately as possible."[53]

[50] U.S. Environmental Protection Agency, "Agency Information Collection Activities; Submission to OMB for Review and Approval; Willingness to Pay Survey for §316(b) Existing Facilities Cooling Water Intake Structures (New)," 76 *Federal Register* 3,883-3,884, January 21, 2011.

[51] American Chemistry Council, American Forest & Paper Association, American Petroleum Institute, Utility Water Act Group, "Comments on ICR for Willingness to Pay Survey for §316(b) Existing Facilities Cooling Water Intake Structures," February 22, 2011.

[52] U.S. Environmental Protection Agency, "National Pollutant Discharge Elimination System—Proposed Regulations to Establish Requirements for Cooling Water Intake Structures at Existing Facilities; Notice of Data Availability Related to EPA's Stated Preference Survey," 77 *Federal Register* 34,927-34,931, June 12, 2012. Additional documents related to the stated preference survey can be found at http://water.epa.gov/lawsregs/lawsguidance/cwa/316b/index.cfm.

[53] Executive Order 13563, "Improving Regulation and Regulatory Review," 76 *Federal Register* 3,821, January 21, 2011.

In December 2010, Representative Fred Upton, chairman of the House Energy and Commerce Committee, wrote to then-EPA Administrator Lisa Jackson about the possible direction of EPA's CWIS proposal, since potential retrofit costs, if EPA were to mandate cooling towers everywhere, could be substantial, he said. He asked the Administrator to take all necessary time to "produce a well-reasoned, well-supported proposal" and to allow generous time for the public to comment on the proposal.[54] In response, the Administrator said that the proposal, when released, would be intended to reasonably accommodate site-specific circumstances while minimizing adverse environmental impacts, and would not be a "one-size-fits-all federal mandate." She wrote to Chairman Upton , "I do not want EPA to spend another five years litigating over cooling water intake structures."[55]

Viewed exclusively on a strict cost/benefit basis, none of the options in EPA's 2011 CWIS proposal would be justified. Under all of the options that EPA considered in its proposal, and under the final rule announced on May 19, 2014, estimated costs greatly exceed estimated economic benefits, even when allowing for conservative estimation of benefits. The differences are based on a comparison of a partial measure of benefits, due to data and other limitations, with a more complete measure of costs; therefore, EPA believes that the results must be interpreted cautiously. However, EPA determined that costs do not outweigh total benefits when both monetized and nonmonetized benefits are considered. Overall, EPA believes that the benefits of the final rule justify its costs, taking into account quantified and qualitative benefits and costs.[56]

The CWA does not require that the benefits of regulation exceed or even equal the costs. Moreover, the Supreme Court, in its ruling on the use of cost/benefit analysis in the development of 316(b) regulations, said that EPA has the discretion to consider costs, but is not required to do so.[57] In the 2011 proposal, the agency clearly did consider costs, preferring a flexible, less costly regulatory option than a more costly one that would provide greater reduction in I&E mortality (and greater economic benefits of reducing I&E mortality). Even so, critics argued that the costs of the rule were underestimated and were wholly disproportionate to its benefits. The final rule, with its additional flexibility regarding impingement mitigation and other requirements, reflects still more modification in response to concerns by regulated industries about compliance costs and technology options. For example, after commenters questioned the costs and feasibility of monitoring provisions in the 2011 proposal, EPA made a number of changes in the final rule to significantly reduce those requirements.[58]

Stakeholder groups differed in their evaluation of the proposed rule. Environmental advocates supported the uniform requirements of the proposed impingement standards, but criticized EPA for not requiring uniformity in the entrainment portion of the rule in order to protect aquatic resources and provide for timely permitting. Industry groups were pleased that EPA did not

[54] Honorable Fred Upton, letter to Lisa P. Jackson, Administrator of EPA, December 3, 2010, http://upton.house.gov/UploadedFiles/Upton_letter_to_Admin_Jackson_re_Cooling_Water_Intake_Structures.pdf.

[55] EPA Administrator Lisa P. Jackson, letter to Honorable Fred Upton, December 16, 2010, http://www.epa.gov/ocir/pdf/2010_1216_adm_jackson_upton.pdf.

[56] CWIS Final Rule, pp. 48,351, 49,421.

[57] Entergy Corp. v. Riverkeeper, Inc., 556 U.S. 1498 (2009). See the **Appendix** for details.

[58] CWIS Final Rule, pp. 48,357, 48,360. The final rule consolidates the biological data and study requirements for both impingement mortality and entrainment into one comprehensive set of permit application requirements. As a result, EPA expects that approximately half of all affected facilities will be able to complete the initial permit application within a few months. For example, facilities that were subject to the 2004 Phase II rule will already have collected most of the required data and information as part of that rule.

propose closed-cycle cooling for all existing facilities—as many in industry had feared—so they focused their critiques on the impingement standards and urged EPA to revise the rule to provide greater flexibility that would be more cost-effective. States were somewhat divided in their responses, with many favoring more flexibility in the rule to lessen the administrative burden on permitting authorities, but some advocating a more prescriptive approach regarding entrainment, rather than one calling for site-specific determinations, as in EPA's preferred option in 2011.

Stakeholder groups again differ in evaluating the final rule, but their views diverge from those on the 2011 proposal. Environmental groups, who had advocated that EPA include stringent closed-cycle cooling as a uniform requirement representing BTA, said that they were extremely disappointed with the final rule and likely would challenge it in federal court.[59] They contend that the rule is substantially weaker than the Phase III rule that EPA promulgated in 2006, which a federal court remanded to the agency for revision in 2007. On the other hand, representatives of the electric power industry indicated their overall approval: "Based upon our initial review of the rule, we are pleased that EPA has avoided imposing a categorical one-size-fits-all approach to compliance; has embraced significant elements of flexibility; and has acknowledged the importance of weighing costs with environmental protection." The statement also observed that implementation of the rule presents operational and compliance challenges that will depend in part on how much flexibility will be provided by permitting authorities.[60]

Some state agencies and environmental groups are concerned that the site-specific entrainment determinations in the final rule will create additional administrative burdens on already extended permitting authorities. For example, the rule would require permitting authorities to consider such factors as land availability, remaining useful plant life, and social costs and benefits, and it allows consideration of additional factors such as water consumption, thermal impacts, and local energy reliability. While flexibility is widely desired and supported, providing flexibility can result in increased decisionmaking time and resources needed by permitting authorities to deliver on a flexible regulatory process. EPA agrees that site-specific entrainment has potential to create additional burdens for states and responded in the final rule by trying to limit the information collection requirements compared with the proposed rule. It is also likely that evaluating the multiple compliance alternatives provided in the final rule for impingement control—even though several involve "pre-approved technologies"—will similarly increase administrative burdens on permitting authorities.

Following publication of the final rule in the *Federal Register* on August 15, environmental groups filed legal challenges in three U.S. courts of appeals (1st, 2nd, and 9th circuits), seeking review of whether the final rule complies with the CWA. The American Petroleum Institute also filed a legal challenge (7th circuit), as did the electric power industry (5th circuit), despite their initial generally positive statements about the flexibility of the final rule. Other lawsuits by industry groups or states could be filed, as well. The Judicial Panel on Multi-District Litigation will decide whether to consolidate the cases and, if so, to which court to transfer the cases.

[59] Annie Snider, "Enviro Lawsuit Likely over 'Largely Worthless' Cooling Water Rule," *Greenwire*, May 20, 2014.

[60] "EEI Statement on the EPA's Final Rule for Regulating Cooling Water Intake Structures," May 19, 2014, http://www.eei.org/resourcesandmedia/newsroom/Pages/Press%20Releases/EEI%20Statement%20on%20the%20EPA%E2%80%99s%20Final%20Rule%20for%20Regulating%20Cooling%20Water%20Intake%20Structures.aspx.

Since release of the final rule, some Members of Congress argue that the rule's costs threaten the affordability and reliability of electricity. Senator Jim Inhofe characterized the final rule as "degrading the backbone of the electric power grid" and pledged to bring the rule to an up-or-down vote under procedures in the Congressional Review Act.[61] Whatever the outcome of possible congressional consideration of the final rule, the fact that it has now been challenged in federal court means that the already long and complicated history of federal efforts to regulate cooling water intake structures is likely to be unresolved for months or longer, yet again.

[61] See "Obama's Radical EPA Assaults Affordable Electricity Again," May 20, 2014, http://whitfield.house.gov/media-center/press-releases/obama-s-radical-epa-assaults-affordable-electricity-again; and "Inhofe Announces Plans for CRA of EPA's 316(b) Rule," May 19, 2014, http://www.inhofe.senate.gov/newsroom/press-releases/inhofe-announces-plans-for-cra-of-epas-316b-rule-. The Congressional Review Act (CRA, 5 U.S.C. §§801-808) establishes special congressional procedures for disapproving a broad range of regulatory rules issued by federal agencies. Before any rule covered by the act can take effect, the federal agency that promulgates the rule must submit it to both houses of Congress and the Government Accountability Office (GAO). If Congress passes a joint resolution disapproving the rule under procedures provided by the act, and the resolution becomes law, the rule cannot take effect or continue in effect. Also, the agency may not reissue either that rule or any substantially similar one, except under authority of a subsequently enacted law. For information, see CRS Report RL32240, *The Federal Rulemaking Process: An Overview*, coordinated by (name redacted).

Appendix. History of Regulating Cooling Water Intake Structures

Efforts to regulate cooling water intake structures have a lengthy regulatory and judicial history, spanning several decades, since Congress enacted CWA Section 316(b) in 1972.

EPA first promulgated a rule to implement the provision in 1976. That regulation was challenged by utility companies, and in 1977 a federal court determined that the agency had failed to adhere to the procedural requirements of the Administrative Procedure Act, thus invalidating the rule without reaching the merits of the regulations themselves.[62] EPA withdrew the remanded portions of the rule, but left intact those unremanded portions that required each permitting authority to use its best professional judgment to determine the best technology available for regulating cooling water intake structures. The agency published draft guidance for use in implementing 316(b)'s requirements through case-by-case, site-specific permit decisions. This draft guidance did not establish national standards based on the best technology available for minimizing adverse environmental impact of cooling water intake structures. Rather, it left decisions on the appropriate location, design, capacity, and construction of each facility to the appropriate permitting authority (EPA or a state).

This regulatory regime remained in effect but was challenged in 1993 by a coalition of individuals and environmental groups that sued EPA for failing to promulgate regulations under 316(b). In 1995, EPA entered into a consent decree which, as subsequently amended, set a multiphase timetable for regulations, first for new facilities and later for existing facilities.[63]

Phase I

In the first phase, in December 2001, EPA promulgated a rule governing certain new, large cooling water intake structures.[64] This rule, called Phase I, apply to new facilities with water-intake flow greater than 2 million gallons per day (MGD), at least 25% of which is used for cooling. New facilities with smaller water-intake systems are regulated by permitting authorities on a site-by-site basis, not by EPA standards. For the largest new facilities, those with water-intake flow greater than 10 MGD, the Phase I rule require that their inflow be restricted to a level commensurate with what can be attained by a closed-cycle cooling water system. In addition, new facilities with water-intake flow between 2 MGD and 10 MGD may alternatively comply by reducing the volume and velocity of water removal to certain levels, and all new facilities may alternatively comply by demonstrating that the technologies employed will reduce adverse environmental impacts to a level comparable to a closed-cycle cooling system. This rule was challenged but were largely upheld in 2004.[65] However, the court invalidated a provision of the rule that would have allowed facilities to use "restoration measures" or other mitigation such as restocking with fish bred in a hatchery, reclamation (for example, improving the habitat

[62] Appalachian Power Co. v. Train, 566 F.2d 451 (4th Cir. 1977).

[63] Settlement Agreement among the United States Environmental Protection Agency, Plaintiffs in *Cronin, et al. v. Reilly*, 93 CIV. 314 (LTS) (SDNY), and Plaintiffs in *Riverkeeper, et al. v. EPA*, 06 CIV. 12987 (PKC) (SDNY), October 10, 1995.

[64] 66 *Federal Register* 65,256, December 18, 2001.

[65] Riverkeeper, Inc. v. EPA, 358 F.3d 174 (2nd Cir. 2004). ("Riverkeeper I")

surrounding the intake structure), and migration barrier removal, as part of demonstrating that alternative technologies are comparable to closed-cycle systems. "Restoration measures correct for the adverse environmental impacts of impingement and entrainment, they do not minimize those impacts in the first place," the court said.[66]

Phase II

Next, in July 2004 EPA promulgated the Phase II rule. It applied to existing facilities whose primary activity is the generation and transmission (or sale for transmission) of electricity, and whose water-intake flow is more than 50 MGD, at least 25% of which is used for cooling purposes. Over 500 facilities, accounting for approximately 53% of the nation's electric-power generating capacity, were covered by the Phase II rule.[67] The Phase II rule identified five compliance alternatives to meet the performance standard. EPA expressly declined to mandate adoption of closed-cycle cooling systems or equivalent reductions in impingement and entrainment, as it had required for new facilities under the Phase I rule. As justification, EPA cited the generally high costs of converting existing facilities to closed-cycle operations and the availability of other technologies approaching closed-cycle performance. Instead, the rule required Phase II facilities to reduce impingement and entrainment by specified ranges (e.g., 80% to 95%) from baseline, and the rule allowed issuance of site-specific variances from the national performance standards if a facility could demonstrate either that the costs of compliance would be significantly greater than costs considered by EPA in setting the standards, or would be significantly greater than the benefits of complying with the applicable performance standards. The Phase II rule allowed use of restoration measures to demonstrate compliance with the standards—even though a similar provision in the Phase I rule had been invalidated by a federal court.

Multiple parties challenged the Phase II rule. In 2007, the U.S. Second Circuit Court of Appeals—in an opinion authored by then-Circuit Court Judge Sonia Sotomayor—ruled the cost-benefit variance provision of the regulations to be unlawful. The court held that, while cost could be considered to determine benchmark technology or to engage in cost-effectiveness analysis, Section 316(b) does not permit the use of cost-benefit analysis. The court also found that EPA had exceeded its authority by permitting existing plants to meet national performance standards by using restoration measures.[68]

Utility companies appealed this ruling to the Supreme Court, and the Court agreed to review the single question of whether Section 316(b) authorizes use of cost-benefit analysis in determining best technology available for cooling water intake structures. The Court's ruling, in 2009, held that it is permissible to apply a cost-benefit analysis in determining the best technology available to minimize adverse environmental impacts and in providing for cost-benefit variances from those standards as part of the Phase II rule. The Court held that EPA has the discretion to consider costs and benefits under 316(b) but is not required to do so.[69] In September 2009, the Second Circuit granted the government's request to remand the Phase II rule for further review in light of the Supreme Court's ruling.

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[66] Ibid., p. 189.

[67] 69 *Federal Register* 41,576, July 9, 2004.

[68] Riverkeeper, Inc. v. EPA, 475 F.3d 83 (2nd Cir. 2007). ("Riverkeeper II")

[69] Entergy Corp. v. Riverkeeper, Inc., 556 U.S. 1498 (2009).

Phase III

Concurrent with the judicial consideration of the Phase II rule, in June 2006 EPA promulgated the final required 316(b) rule.[70] The Phase III rule applied to existing power plants whose water-intake flow is between 2 MGD and 50 MGD and existing industrial facilities (including paper, chemical, petroleum, aluminum, and steel manufacturers) whose water-intake flow is greater than 2 MGD. For these existing facilities, EPA determined that uniform national performance standards would not be the most effective way to address cooling water intake structures, so the Phase III rule continue to rely on case-by-case decisions by permitting authorities. Phase III also applies to new offshore oil and gas extraction facilities that had been expressly excluded from Phase I. The rule specified requirements for new offshore oil and gas extraction facilities with water-intake flow of more than 2 MGD, at least 25% of which is used for cooling purposes; those not meeting that threshold also would continue to be authorized via case-by-case permitting.

Challenges to the Phase III rule were filed in several federal courts of appeals and were consolidated in the Fifth Circuit, but proceedings were stayed during the Supreme Court's consideration of the Phase II rule in *Entergy v. Riverkeeper*. After that decision, the government and environmental plaintiffs jointly asked the Fifth Circuit Court of Appeals to remand the existing facilities provisions of the Phase III rule to EPA, for consideration along with the remanded Phase II rule for existing large facilities, in light of the *Entergy* decision. The court approved this request in July 2010.[71]

Separately, environmental groups also had filed a challenge related to the existing facilities provisions of the Phase III rule in the same federal court that in 1995 had approved the consent decree providing for the multiphase promulgation of the 316(b) rules.[72] To settle that litigation, in November 2010 EPA entered into a consent decree that provides a schedule for proposing and promulgating combined Phase II and Phase III existing facilities regulations. In December 2010, the court approved a schedule that established a March 14, 2011, deadline for the agency to propose a revised cooling water intake rule. On March 15, EPA announced that parties to the litigation had agreed to EPA's request to delay release of the proposed rule until March 28. The resulting proposal is discussed in this report. Under the settlement agreement, EPA was required to promulgate a final rule by July 27, 2012. As described previously in this report, after several delays, EPA announced the final rule on May 19, 2014.

After 1977 and prior to promulgation of the Phase I rule in 2001, applicable CWIS requirements for all facilities were developed on a case-by-case bases by permitting authorities, using best professional judgment. As a result of litigation involving all three phases of rulemaking since 2001 and court-ordered and government-requested remands, only certain facilities are subject to technology-based standards in EPA CWIS rules that remain in effect—new facilities with water-intake flow greater than 2 MGD (Phase I rule) and new offshore oil and gas facilities (Phase III). Until EPA promulgation of revised rules, existing facilities of all sizes have continued to be subject to requirements developed on a case-by-case basis by permitting authorities. Additionally,

[70] 71 *Federal Register* 35,006, June 16, 2006.

[71] At the same time, the Fifth Circuit rejected industry's challenge to the new facilities provisions of the Phase III rule. ConocoPhillips Co. v. EPA, No. 06-60662 (5th Cir., July 23, 2010).

[72] In that court (U.S. District Court for the Southern District of New York), environmental groups challenged what they termed EPA's "inaction" in the Phase III rule for existing facilities, which continued to allow case-by-case permitting.

new facilities with water-intake flow of less than 2 MGD also are subject to case-by-case permitting, under provisions of the Phase I rule unchanged since 2001.

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