CP-nn / Best Technology Available (BTA) for Cooling Water Intake Structures

New York State Department of Environmental Conservation

DEC Policy

Issuing Authority: Alexander B. Grannis, Commissioner

Date Issued:	**Latest Date Revised: March 4, 2010**

I. Summary:

This policy prescribes the reductions in impingement mortality and entrainment required to minimize the adverse environmental impact caused by industrial facilities having a cooling water intake structure (CWIS) in connection with a point source thermal discharge. Water withdrawals from surface waterbodies through a CWIS cause injury and mortality to fish and other aquatic organisms through impingement at the intake and/or entrainment through the cooling system. Through this policy, the Department establishes closed-cycle cooling or its equivalent as the performance goal for the best technology available (BTA) to minimize adverse environmental impact pursuant to Section 704.5 of 6 NYCRR, Section 316(b) of the Clean Water Act, 40 C.F.R. Part 125 subpart I, 40 C.F.R. Part 125.90(b), and 40 C.F.R. Part 125 subpart N in State Pollutant Discharge Elimination System (SPDES) permits.

II. Applicability:

This policy applies to all existing and proposed industrial facilities designed to withdraw twenty (20) million gallon per day (MGD) or more of contact or non-contact cooling water from the waters of New York State and that are subject to the requirements of Section 704.5 of 6 NYCRR. Existing and proposed industrial facilities subject to the requirements of 6 NYCRR § 704.5, that are designed to use less than 20 MGD of contact or non-contact cooling water will continue to be subject to the requirements of 6 NYCRR § 704.5 and CWA § 316(b) or another subpart of 40 C.F.R. Part 125, as determined by the Department on a case-by-case, site-specific, best professional judgment (BPJ) basis.

III. Policy:

Through the general powers and duties of the Commissioner and the Department of Environmental Conservation [ECL Articles 1 and 3] to conserve and protect the natural resources of the state and to minimize adverse impact to the environment, the Commissioner hereby establishes the following performance goals to minimize adverse environmental impact from a CWIS:

1. Dry closed-cycle cooling as the performance goal for all new industrial facilities sited in the marine and coastal district (ECL § 13-0103) and along the Hudson River up to the Federal Dam in Troy;

2. Wet closed-cycle cooling as the minimum performance goal for all new industrial facilities located along all waters other than those covered by No. 1;
3. Wet closed-cycle cooling or its equivalent as the minimum performance goal for existing industrial facilities that operate a CWIS in connection with a point source thermal discharge; and
4. Wet closed-cycle cooling as the minimum performance goal for all repowered industrial facilities that operate a CWIS in connection with a point source thermal discharge.

Furthermore, for an existing industrial facility where the Department determines that wet closed-cycle cooling is not an available technology, this policy establishes a performance goal of at least 90 percent or greater reduction in both entrainment and impingement mortality from that which would be achieved by a wet closed-cycle cooling system at that facility. Any existing industrial facility meeting these performance goals will be deemed in compliance with the requirements of 6 NYCRR § 704.5 and CWA § 316(b) to implement BTA for minimizing adverse environmental impact related to the operation of cooling water intake structures.

Definitions:

Adverse environmental impact – the fish killed or injured through entrainment and impingement by the operation of cooling water intake structures. The "adverse environmental impact" that must be minimized by the BTA standard of 6 NYCRR §704.5 relates only to aquatic resources.

Available –technically feasible with costs not wholly disproportionate to the benefits.

Best Technology Available (BTA) – technology based standard authorized under CWA Section 316(b), 40 C.F.R. Part 125, subpart I; 40 C.F.R. Part 125.90(b); and 40 C.F.R. Part 125, subpart N and 6 NYCRR Part 704.5 as the most effective technology, process or operational method for minimizing adverse environmental impact from a CWIS.

Calculation baseline – an estimate of impingement mortality and entrainment that would occur at a facility CWIS assuming that: the cooling water system has been designed as a once-through system; the opening of the cooling water intake structure is located at, and the face of the standard 3/8-inch mesh conventional traveling screen is oriented parallel to, the shoreline near the surface of the source waterbody and is operated at the full rated capacity 24 hours a day, 365 days a year. This is the baseline of adverse environmental impact to be used in estimating reductions in impingement mortality and entrainment resulting from operating a closed-cycle cooling system.

Cooling water - the water used for contact or non-contact cooling, including water used for equipment cooling, evaporative cooling tower makeup, and dilution of effluent heat content. The intended use of the cooling water is to absorb waste heat rejected from the process or processes used, or from auxiliary operations on the facility's premises [6 NYCRR § 700.1(a)(11)].

Cooling water intake structure (CWIS) - the total physical structure and any associated constructed waterways used to withdraw cooling water from waters of New York State.

The cooling water intake structure extends from the point at which water is withdrawn from the waters of the State up to, and including the intake pumps [6 NYCRR § 700.1(a)(12)].

Dry closed-cycle cooling - cooling system that uses air flow, rather than the evaporation of water, to remove heat from the power station in order to reduce or eliminate the consumptive use of surface waters.

Entrainment – the incorporation of all life stages of fish with intake water flow entering and passing through a cooling water intake structure and into a cooling water system. It is assumed that entrainment results in 100 percent mortality of the entrained organisms.

Equivalent to –providing a reduction in adverse environmental impact within a ten (10) percent margin of error of that which is attainable with the use of wet closed-cycle cooling.

Feasible – capable of being done; able to be installed and function efficiently within the operating constraints of the facility.

Impingement mortality – the death of all life stages of fish as a result of being entrapped on the outer part of a cooling water intake structure or against a screening device during periods of water withdrawal.

Industrial facilities –includes all facilities listed in CWA § 306(b)(1)(A) and all other facilities that have a cooling water intake structure in connection with a point source thermal discharge.

Minimize - reduce to the smallest amount, extent or degree reasonably possible.

Once-through cooling water system - a system designed to withdraw water from a natural or other water source, use it at the facility to support contact and/or noncontact cooling uses, and then discharge it to a waterbody without recirculation.

Repowering – the process of increasing the efficiency of older, less efficient industrial facilities through the installation of new, improved equipment. Repowering with more efficient equipment can significantly reduce non-contact cooling water requirements thereby rendering closed-cycle cooling available for an existing industrial facility. Repowering includes but is not limited to the partial or complete demolition and replacement of the existing industrial facility.

Wet closed-cycle cooling – a system designed to withdraw the smallest amount of water to support contact and/or non-contact cooling uses within a facility. A closed-cycle cooling system uses between 93 and 98 percent less water than a once-through cooling system. The water is usually sent to a cooling canal, channel, pond, or tower to allow waste heat to be dissipated to the atmosphere and then is returned to the system. New source water (makeup water) is added to the system to replenish losses that have occurred due to cooling tower blow-down, drift, and evaporation.

Wholly disproportionate test – a comparison of the proportional reduction in impact (benefit) as compared to the proportional reduction in revenue (cost) of installing and operating BTA technology to mitigate adverse environmental impact. This comparison does not monetize the resource and gives presumptive weight to the value of the environmental benefits to be gained.

IV. Purpose and Background:

State regulations and federal laws mandate that industrial facilities employ BTA to minimize adverse environmental impact when proposing a new or operating an existing CWIS. The purpose of this policy is to identify the goals of the Department in implementing this standard and to ensure consistent application of those goals to industrial facilities in New York State.

Throughout New York, over 16 billion gallons of water are withdrawn from state waters through a CWIS system each day for the purpose of industrial cooling. The adverse environmental impact of these CWIS systems is staggering, resulting in over 17 billion fish of all life stages (eggs, larvae, juveniles and adults) being entrained or impinged annually. The fish can suffer from lethally high water temperatures, contact with screens, impellers or heat-exchangers, or from exposure to the chemicals used to maintain heat-exchanger cleanliness. Steam electric power plants account for the majority, though not all, of this environmental impact with some of these power plants using well over a billion gallons of water every day for cooling purposes.

Establishing Closed-Cycle Cooling or the Equivalent as the Performance Goal:

One of the most efficient and effective ways to minimize or eliminate the number of and mortality to aquatic organisms impinged and entrained during industrial cooling is to minimize or eliminate the use of once-through, non-contact cooling water from the surface waters of New York. The demonstrated technology that achieves the greatest reduction in non-contact cooling water use is closed-cycle cooling. Under the U.S. EPA CWA 316(b) Phase I Rule (40 C.F.R. Part 125, subpart I), wet closed-cycle cooling was identified as the best technology available for new facilities to minimize impingement and entrainment, and New York already requires closed-cycle cooling technology to be employed on all new facilities and for electric generating facilities being repowered. Given the effectiveness of closed-cycle cooling at reducing adverse environmental impact caused by a CWIS, and the biological importance of New York's surface waterbodies for commercial and recreational uses, particularly in the marine and coastal district, the tidal reach of the Hudson River, and the Great Lakes, this policy establishes closed-cycle cooling as the performance goal for all new, existing and repowered industrial facilities in New York.

The Establishment of a Ninety (90) Percent Reduction Minimum Threshold:

Wet closed-cycle cooling can reduce cooling water requirements by approximately 93-98 percent from that required by once-through cooling technology depending on the closed-cycle design and the amount of make-up and blow-down water required.[1] Where the Department determines that wet closed-cycle cooling is available at an existing facility, closed-cycle cooling will be required as BTA to comply with 6 NYCRR § 704.5. However, due to site-specific conditions, wet closed-cycle cooling may not be an available mitigative technology for some existing industrial facilities in New York. For a facility where the Department determines that wet closed-cycle cooling is not available, the minimum threshold reduction that must be achieved by alternative mitigative technologies and/or operational measures is 90 percent of what would otherwise be attainable with installation of wet closed-cycle cooling at that facility. However, this policy establishes only the minimum reduction goal and the Department reserves the right, in any case, to require more stringent protective measures at a particular facility and will require the most protective technology and/or operational measures available.

Exemption from the Performance Goal

An existing electric generating facility operated at less than fifteen (15) percent of its electric generating capacity over a current 5-year averaging period may be exempt from meeting the performance goals of this policy provided that the reduction in operation results in the minimization of the impingement and entrainment of all life stages of fish in accordance with this policy.

Additional Supportive Documentation

Additional information on this policy can be found in Appendices A and B. Appendix A, *BTA Policy Technical Document*, provides background information on the aquatic impacts associated with the operation of CWIS in New York State, supportive documentation on selecting closed-cycle cooling as BTA in New York State, and anticipated impacts due to the implementation of this policy. Appendix B, *Department Procedures for the Determination of "Best Technology Available", or BTA, under 6 NYCRR Part 704.5 and Section 316(b) of the Clean Water Act*, outlines the procedures Department staff use in determining BTA for an industrial facility operating a CWIS in connection with a point source thermal discharge.

V. Responsibility:

The Division of Fish, Wildlife and Marine Resources has the primary responsibility to ensure that BTA determinations are made consistent with this Policy. Additionally, the Divisions of Water and Environmental Permits will ensure that the requirements of this policy are reflected in all final SPDES permits issued to industrial facilities that operate or propose to operate a CWIS in connection with a point source thermal discharge. Specific Division responsibilities are as follows:

Division of Environmental Permits (Permits) - As the Project Manager, Permits staff will coordinate the BTA determination with the development of the SPDES

[1] Phase II Rule – 69 Fed.Reg. 41,601, footnote 44 (July 9, 2004). *See also* Maulbetsch and DiFilippo (2008).

permit and will provide liaison to the New York State Department of Public Service and other state and federal agencies as needed. In addition, Permits staff will assess BTA determinations with respect to compliance with Uniform Procedures Act (UPA) and State Environmental Quality Review Act (SEQRA) requirements. With respect to other land use impacts, Permits staff will seek other agency or outside expertise as needed.

Division of Fish, Wildlife and Marine Resources (DFWMR) - DFWMR staff will conduct the biological assessment for and take the lead role in developing the BTA determination with respect to aquatic resource impacts. For the SPDES permit, DFWMR staff will also assess other fish and wildlife impacts, especially within the context of ECL Articles 11, 13, 15, 24 and 25.

Division of Water (DOW) - DOW Staff will assess BTA determinations with respect to water quality impacts and incorporate the final BTA determination into the SPDES permit.

VI. Procedure:

Implementation of this Policy:

This policy will be implemented when: (i) an applicant seeks a new SPDES permit; (ii) a permittee seeks to renew an existing SPDES permit; or (iii) a SPDES permit is modified either by the Department or by the permittee, for a facility that operates a CWIS in connection with a point source thermal discharge pursuant to 6 NYCRR § 704.5; 40 CFR Part 125, subpart I and subpart N; and 40 CFR Part 125.90(b). In addition, when issuing SPDES permits for industrial facilities using a CWIS, staff are guided by the applicable SPDES regulations, including 6 NYCRR 750-1.11 “Application of Standards, Limitations and Other Requirements.” These regulations require that both federal minimum requirements and State water quality requirements are met, and that other impacts are evaluated and mitigated as required by applicable law and regulations.

DFWMR staff will make final BTA determinations on a site-specific, case by case basis following the *BTA Determination Procedures* (<u>see</u> Appendix B, *BTA Determination Procedures* and *Matter of Athens Generating Co., L.P.,* Interim Decision of the Commissioner, June 2, 2000). The BTA determination made under this policy for a new SPDES permit or during the renewal or modification of existing SPDES permits is only concerned with minimizing the adverse environmental impact associated with a CWIS. Once a site-specific BTA determination is made by DFWMR staff, the Department will undertake a SEQRA review to ensure that any significant impacts associated with the construction and operation of the selected BTA are avoided, minimized, or mitigated. In situations where SEQRA does not apply (*e.g.*, Public Service Law Article VII siting cases) consideration of the significance of impacts associated with construction and operation of the selected BTA, and whether avoidance, minimization or mitigation would be appropriate, will occur according to the governing procedural statute.

Cost Considerations in Making Site Specific BTA Determinations

After selecting the best technology available for an industrial facility, the Department will consider the cost of the feasible technologies and will determine whether or not the cost of the technologies are wholly disproportionate to the environmental benefits to be gained from the technology. The Department will not undertake a formal cost-benefit analysis whereby the environmental benefits would be monetized. Such an analysis is neither desirable nor required by law. See *Entergy Corp v Riverkeeper, Inc., et al.,* 556 U.S. __, 129 S.Ct. 1498 (2009). For each site-specific BTA determination, the Department will select a feasible technology whose costs are not wholly disproportionate to the environmental benefits to be gained (*see* Appendix B, *BTA Determination Procedures*).

Variances to the Policy's Performance Goal

Other than the exemption due to operating capacity noted previously, the Department will not allow facility variances from the performance goals established by this policy. Any facility that is unable to meet the performance goals established in this policy will need to repower, reduce operations, shut down, or otherwise meet the performance goals through a suite of operational measures (*e.g.,* seasonal outages, installation of screening mechanisms, variable-speed pumps, etc.).

Additional Actions Required:

The Department is required to make a SEQRA determination prior to the implementation of this policy and has determined that the adoption of this policy will not have a significant adverse impact on the environment. Rather, adoption of the policy will result in greater protection for aquatic resources from the impingement mortality and entrainment impacts that result from industrial facilities using surface water for non-contact cooling. The policy will also result in the reduction of withdrawals from surface waterbodies and the reduction of thermal impacts at some facilities where the discharge of waste heat will be dissipated by the use of cooling towers.

VII. Related References:

California Environmental Resources Control Board. 2008. Scoping Document: Water quality control policy on the use of coastal and estuarine waters for power plant cooling. State Water Resources Board. March 2008. 91pp.

Clean Water Act, 33 U.S.C. §§ 1251 – 1387

Clean Water Act §§ 306, 316(b)

Environmental Protection Agency. 1977. Permits Division, Office of Waste Enforcement, EPA, *Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b)*, PL 92-500 (Draft 1977).

Entergy Corp. v Riverkeeper, Inc., et al., 556 U.S. __, 129 S.Ct. 1498 (2009).

Maulbetsch, John S., and Michael N. DiFilippo. 2008. *Performance, Cost, and Environmental Effects of Saltwater Cooling Towers.* California Energy Commission, PIER Energy-Related Environmental Research Program. CEC-500-2008-043.

Matter of Athens Generating Co., L.P., Interim Decision of the Commissioner, June 2, 2000

Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer, LLC, Decision of the Deputy Commissioner, May 24, 2006 [2006 WL 1488863 (N.Y.Dept.Env.Conserv.)]; Riverkeeper, Inc. v Johnson, 52 AD3d 1072 (3d Dept. 2008), appeal denied 11 NY3d 716 (2009).

National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule, 66 Fed.Reg. 65,255 (Dec. 18, 2001) (codified at 40 C.F.R. pts. 9, 122-25 [Phase I Rule].

National Pollutant Discharge Elimination System: Regulations to Establish Requirements for Cooling Water Intake Structures at Phase II Existing Facilities; Final Rule, 69 Fed.Reg. 41,576 (July 9, 2004) (codified at 40 C.F.R. pts. 9, 122-25) [Phase II Rule].

NERC (2008). Electric reliability impacts of a mandatory cooling tower rule for existing steam generating units, U.S. Department of Energy/North American Electric Reliability Corporation**:** 46 pp.

Riverkeeper I: *Riverkeeper, Inc. et al. v U.S. EPA*, 358 F.3d 174 (2d Cir. 2004) Riverkeeper II: *Riverkeeper, Inc. et al. v U.S. EPA*, 475 F.3d 83 (2d Cir. 2007).

Stark letter (2005) 24 January 2005 letter to EPA B. Grumbles from Deputy Commissioner L. Stark.

Tetra Tech, Inc. 2008. California's coastal power plants: alternative cooling system analysis. Final report to the California Ocean Protection Council. February 2008.

Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Parts 700, 704 and 750.

Establishing Closed-cycle Cooling or the Equivalent as the Best Technology Available in New York State for Industrial Facilities

Background on the Impact to Aquatic Resources

Throughout New York State, over 17 billion gallons of water are withdrawn from state waters each day for the purposes of industrial cooling resulting in over 18 billion fish of all life stages (eggs, larvae, juveniles and adults) being entrained or impinged annually. These fish can suffer from lethally high water temperatures, contact with screens, impellers or heat-exchangers, or from exposure to the chemicals used to maintain heat-exchanger cleanliness. Steam electric power plants count for the majority, though not all, of this impact with some of these power plants using well over a billion gallons of water every day for cooling purposes (Table 1). More than 25 steam electric facilities are located in New York with almost half of them sited along the East River and the Hudson River estuary (Table 2). Other industries in New York requiring non-contact cooling water include manufacturing facilities (*e.g.,* cement and sugar industry) and large office building facilities.

Regulatory Requirements

The Clean Water Act as amended in 1972 includes requirements for the protection of fish, shellfish and wildlife from the potential harm caused by the non-contact cooling water systems and thermal discharges of industrial facilities. One of the requirements is included in Section 316(b) and reads:

> "Any standard established pursuant to section 301 or section 308 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 impacts." *See* 33 U.S.C. Section 1326(b).

Table 1: Estimated impingement mortality, entrainment and water use at major industrial facilities in New York State (MW = megawatts; MGD = million gallons per day). Impingement numbers are absolute and do not consider survival off traveling screens. Estimates are based on the most recent site-specific data collected (Date). When two dates are indicated, the first date corresponds with entrainment and the second date with impingement. Estimated entrainment for the cement plants is based on modeling; no site specific data were available.

Estimated Entrainment and Impingement at Major New York Facilties Using Once-through Cooling Water

Facility	Owner	MW	MGD	Waterbody	Entrainment*	Impingement*	Date
Steam electric							
AES Cayuga	AES	306	219	Cayuga Lake	576,000	*ND**	1994
AES Greenidge	AES	161	113	Seneca Lake	*ND*	29,000	1977
AES Somerset	AES	675	279	Lake Ontario	141,469	12,445	2000
AES Westover	AES	146	102	Susquehana River	3,900,000	10,200	1977
Arthur Kill	NRG Energy	842	713	Arthur Kill	1,548,314,607	4,406,742	2007
Astoria Generating	Astoria Generating	1,290	1,254	East River	629,832,154	2,916,328	2007
Barrett	National Grid	384	294	Barnum's Cove	906,259,233	176,044	2004
Black River Power	Black River Power	50	55	Black River	41,000	0	1993
Bowline 1&2	Mirant	1,139	912	Hudson River	127,000,000	30,000	1987
Brooklyn Navy Yard	Brooklyn Navy Yard	286	55	East River	38,998,201	0	1997
Danskammer	Dynegy Northeast	491	457	Hudson River	161,019,074	144,429	2008
Dunkirk Steam Station	NRG Energy	600	579	Lake Erie	47,940,000	62,778,786	2007
East River Generating	ConEd	317	369	East River	1,342,191,677	1,500,873	2007
Far Rockaway	National Grid	109	84	Jamaica Bay	117,662,685	6,560	2006
Fitzpatrick	Entergy	825	596	Lake Ontario	18,004,625	239,357	2007/2004
Ginna	Rochester Gas & Electric	496	490	Lake Ontario	28,616,000	35,612	2007
Glenwood	National Grid	210	179	Hempstead Harbor	177,879,210	9,562	2005
Huntley	NRG Energy	760	846	Niagara River	105,500,000	96,700,000	2007
Indian Point	Entergy	1,910	2,801	Hudson River	1,200,000,000	1,180,000	1990
Nine Mile Point 1&2	Constellation	1,757	490	Lake Ontario	86,700,000	1,061,900	1997
Northport	National Grid	1,522	939	LI Sound	8,430,808,238	127,118	2003
Oswego Steam Station	Oswego Harbor Power	1,700	1,399	Lake Ontario	12,824,104	1,246	2007
Poletti	NYPA	875	622	East River	638,749,772	37,557	2002
Port Jefferson	National Grid	385	399	Pt Jeff. Harbor	1,014,950,951	76,104	2004
Ravenswood	Trans Canada	2,410	1,391	East River	199,000,000	82,303	1994
Roseton	Dynegy Northeast	1,200	926	Hudson River	712,000,000	44,096	1987/2007
Non-steam electric							
Holcim Cement	Holcim Cement	*NA**	4.6	Hudson River	403,743	*ND*	*ND*
LaFarge Cement	Lafarge Cement	*NA*	8.6	Hudson River	870,834	*ND*	*ND*
Empire State Plaza	OGS	*NA*	108	Hudson River	37,739,611	*ND*	2007
World Trade Center	NY/NJ Port Authority	*NA*	173	Hudson River	140,000,000	10,335	1993

	MW	MGD		Entrainment*	Impingement*
Total	20,846	16,854		17,727,923,188	171,616,597
Mean	802	562		611,307,696	6,600,638
Median	638	428		117,662,685	60,100
STD	637	588		1,572,249,191	22,083,594
Maximum	2,410	2,801		8,430,808,238	96,700,000
Minimum	50	5		41,000	0

***Notes: NA=not applicable; ND=no data available**
All estimated impingement and entrainment values are based on actual cooling water use.

Table 2: Estimated annual entrainment and impingement by waterbody caused by cooling water intake structures at 28 major steam electric facilities in New York State. "Other" waterbodies include Cayuga and Seneca Lakes and the Black River. Data are summarized from Table 1 estimates.

Waterbody	Number Power Plants	Annual Entrainment	Annual Impingement
East River	6	4,397,086,411	8,943,803
Hudson River	6	2,205,019,337	1,398,525
Lake Erie	1	47,940,000	62,778,786
Lake Ontario	5	146,286,198	1,350,560
Long Island Sound	3	9,623,638,399	212,784
Niagara River	1	105,500,000	96,700,000
South Shore Long Island	2	1,023,921,918	182,604
Susquehana River	1	3,900,000	10,200
Other	3	617,000	29,000

In 1974, 6 NYCRR Part 704 became effective with section 704.5 requiring the minimization of impacts caused by cooling water intake structures (or CWIS). This regulation contains similar language to section 316(b) of the Clean Water Act and states:

> "The location, design, construction, and capacity of cooling water intake structures in connection with a point thermal discharge shall reflect the best technology available for minimizing adverse environmental impact."

In recent years, the U.S. EPA developed and promulgated three phased rules to provide formal regulations for states to address the impacts caused by cooling water intake structures (CWIS). The Phase I Rule governs all new industrial facilities that propose to withdraw two million gallons of water or more each day (MGD) with 25 percent or more of the water to be used for cooling. This rule establishes the use of wet closed-cycle cooling or the equivalent as BTA for all new industrial facilities that meet these criteria. The Phase II Rule governed large, existing power plants withdrawing 50 MGD or more. This rule has since been suspended by the EPA due to a legal decision (Riverkeeper II Decision 2007) and a revised draft rule is not anticipated to be released until sometime in 2010. The Phase III Rule regulates offshore gas and oil extraction facilities. No such facilities exist in the coastal waters of New York State.

Need for a Statewide Policy to Implement Clean Water Act Section 316(b) and 6 NYCRR Part 704.5

Since 1975, the Department of Environmental Conservation has been responsible for ensuring the requirements of CWA § 316(b) are effectively implemented in New York State through the State Pollutant Discharge Elimination System (or SPDES) Permit Program. However, after more than 30 years of regulating industrial facilities the adverse environmental impacts have only been reduced at a few facilities while others have not implemented technology or operational measures to minimize impingement mortality and/or entrainment. As a result of the failure of the U.S. EPA to effectively promulgate a Phase II Rule, no federal guidance or rules exist to set performance requirements for the majority of the facilities in New York State regulated under CWA § 316(b) and 6 NYCRR Part 704.5. This policy sets a performance goal for all new and existing industrial facilities throughout New York State based on the best technology available that will result in a substantial decrease in adverse environmental impacts caused by cooling water intake structures.

Definition of "Adverse Environmental Impact"

Regulations and law define the adverse environmental impact that must be minimized under CWA § 316(b) and 6 NYCRR Part 704.5 as the number of aquatic organisms entrained and impinged by cooling water intake structures (EPA 2001, Riverkeeper I Decision 2004, and Riverkeeper II Decision 2007). Industry disagrees with this definition and as recently as March 2009, has been attempting to reopen this debate before the New York State Supreme Court (Entergy Nuclear Indian Point 2, LLC, and Entergy Nuclear Indian Point 3, LLC *v.* Alexander B. Grannis).

The "Best Technology Available" or BTA Performance Goal for New York State

The Department establishes closed-cycle cooling or equivalent as the performance goal for "Best Technology Available" (BTA) to minimize the adverse environmental impacts caused by an industrial facility's operation of a cooling water intake structure (CWIS) in connection with a point source thermal discharge. Furthermore, for an existing industrial facility where the Department determines closed-cycle cooling is not available, this policy establishes a performance goal of 90 percent or greater reduction in both entrainment and impingement mortality that would be achieved by installing and operating a wet closed-cycle cooling system at that facility. The designation of a performance goal requiring a 90 percent reduction of that obtainable using wet closed-cycle cooling provides the allowance for a ten percent margin of measurement error (Riverkeeper I Decision 2004). Therefore, the appropriate application of this performance goal will be for the facility owner to aim for the same reduction in adverse impacts obtainable if a closed-cycle cooling system were operated at the facility.

The reduction in impingement mortality and entrainment required will be determined on a site specific, case-by-case basis and will be calculated as follows:

1. An estimation of impingement mortality and entrainment that would occur at a facility assuming that: the cooling water system has been designed as a once-through system; the opening of the cooling water intake structure is located at, and the face of the standard 3/8-inch mesh conventional traveling screen is oriented parallel to, the shoreline near the surface of the source waterbody and is operated at the full rated capacity 24 hours a day, 365 days a years (e.g., Calculation Baseline) (Riverkeeper v. Johnson 2009, Phase II Rule) will be made;
2. An estimated reduction in impingement mortality and entrainment if the facility were to install and operate wet closed-cycle cooling will be made; and
3. If wet closed-cycle cooling is determined to be unavailable for the facility, the permittee will be required to demonstrate that by using alternative technologies and operational measures impingement mortality and entrainment will be reduced by at least 90 percent of that obtainable by step No. 2.

The reductions afforded by closed-cycle cooling will be dependent on the total reduction of cooling water withdrawal realized. For marine waters, wet closed-cycle can reduce the total amount of water from once-through cooling by 93-95 percent when make-up and blowdown flows are minimized (Maulbetsch *et al.* 2008, EPA 2004). Actual reductions in water use at a facility may be lower depending on other air and water quality restrictions that would restrict the cooling water cycles of concentration which for most marine cooling towers would typically be approximately 1.5 cycles (Maulbetsch *et al.* 2008). For freshwater, the reduction is greater: 96-98 percent (EPA 2004). Therefore, the final, verifiable percent reduction in the adverse environmental impact that must be achievable at a facility where closed-cycle cooling is *not available* will range from 84-86 percent in marine waters to 86-88 percent or greater in freshwater from the calculation baseline.

Why Choose Closed-cycle Cooling Technology as "BTA"?

There are many alternative technologies, processes and operational methods to closed-cycle cooling that have been demonstrated to reduce entrainment and impingement. For some industrial facilities operating once-through cooling systems, these alternatives have been demonstrated to reduce entrainment and impingement to levels commensurate to that achievable using a closed-cycle cooling system. However, the effectiveness of these technologies, especially on reducing mortality, varies greatly depending on the facility location, the waterbody drawn from, fish species and life stages impinged and entrained, and the ability of the facility owner to maintain and operate the equipment effectively. Therefore, it is not possible to select any one of these alternative technologies or suites of technologies to install and operate on all existing industrial facilities that will consistently, effectively and efficiently minimize the adverse environmental impacts caused by CWIS.

One of the most effective and efficient methods to minimize or eliminate the number and mortality of aquatic organisms impinged and entrained during industrial cooling is to minimize or eliminate the use of once-through, non-contact cooling water from surface waters (EPA 2004, footnote 44). The demonstrated technology that achieves the greatest reduction in non-contact cooling water use is closed-cycle cooling. Under the U.S. EPA CWA 316(b) Phase I Rule (40 C.F.R. Part 125, subpart I), the EPA identified wet closed-cycle cooling as best technology available for new facilities requiring non-contact cooling. Prior to the promulgation of the Phase I Rule, New York had already required closed-cycle cooling technology to be employed on all new and repowered steam electric facilities (Athens Decision 2000).

There are four categories of cooling water systems in use at industrial facilities in New York to dispense of waste heat: once-through cooling, wet closed-cycle cooling, dry cooling, and hybrid closed-cycle cooling (see Table 3).

Table 3: Cooling-water system technologies currently in use in New York State. All of the example facilities using a dry closed-cycle cooling system are located in the marine district and on the Hudson river south of the Federal Dam.

Cooling Water System Type	Description of Technology	Examples
Once-through cooling	Water withdrawn from waterbody, passes through condensers to absorb waste heat and returned to the source waterbody. Requires the most water.	Most steam electric facilities in New York (see Table 1**)**
Wet Closed-cycle cooling	Cooling water is recycled. Requires 93-98% less water than a once-through cooling system.	Nine Mile Point Nuclear Power Plant Unit 2
Dry Closed-cycle cooling	Uses the air to transfer heat to the atmosphere and requires <u>little to no</u> water.	Athens Generating Station; New Poletti Station; Astoria SCS
Hybrid closed-cycle cooling	Combines wet and dry cooling technology to reduce vapor plumes. Water use commensurate with wet closed-cycle.	Bethlehem Energy Center

Closed-cycle systems use significantly less water than once through because these systems are designed to allow for waste heat to be transferred from the cooling water to the atmosphere (by either a reservoir or tower) so the cooling water can be recycled. With the exception of some forms of dry-cooling systems, cooling water intake structures are still required for many of these closed-cycle systems for the uptake of replacement water but the total volume of water required is between 93 and 98 percent less than that required with once-through cooling (Maulbetsch *et al.* 2008, EPA 2002). Albany Steam Station (now called Bethlehem Energy Center), located on the Hudson River was required to use a closed-cycle cooling system when this facility repowered in 2005. By doing so, the owner of Albany Steam Station was able to reduce cooling water use by more than 98 percent. This has resulted in an estimated reduction in entrainment of 98.7% and with the inclusion of wedge wire screens on the intake structure and a low intake velocity, impingement mortality has been eliminated.

Dry closed-cycle cooling can eliminate the need for any cooling water withdrawals from state waters and has been selected as the appropriate technology for a few new industrial facilities sited in New York (Table 3). However, both the U.S. EPA and the State of California found this technology is rarely available for retrofitting existing facilities due to insurmountable technical and logistical problems (EPA 2004, Havey & Blackburn 2008). In addition, both the U.S. EPA and California determined that the projected cost of retrofitting existing facilities with dry closed-cycle cooling technology could not be reasonably borne by the industry. Nevertheless, the added environmental benefits that dry closed-cycle provides over wet closed-cycle is enough for New York to identify this technology as the performance goal for new industrial facilities sited in the marine and coastal district in New York including the Hudson River up to the Federal Dam in Troy. Given that several marine and coastal fish stocks are dangerously low (*e.g.*, winter flounder, American shad, Atlantic sturgeon, and river herring), dry closed-cycle cooling would provide the greatest environmental benefit to help New York marine and coastal fish stocks rebound. In addition, the use of dry closed-cycle cooling systems in the marine district would eliminate the potential impact salt water plumes associated with wet closed cycle-cooling systems would have on the surrounding environment. Dry closed-cycle cooling is already being used at new and repowered steam electric power facilities in the marine and coastal district (see Table 3).

California is developing a policy to establish wet closed-cycle cooling as the performance benchmark in meeting the requirements of CWA § 316(b) (CA Env. Protec. 2008, Appendix A). California's policy consists of the following two tracks:

> **Track 1**: An existing power plant must reduce intake flow and intake velocity, at a minimum, to a level commensurate with that which can be attained by a closed-cycle cooling system; and
>
> **Track 2**: If an existing power plant owner or operator demonstrates to the Water Board's satisfaction that Track 1 is not feasible, the power plant must reduce the level of adverse environmental impacts from the cooling water intake structure to a comparable level to that which would be achieved under Track 1, using operational or structural controls, or both. A reduction in environmental impacts

under Track 2 will achieve a "comparable level" if both impingement mortality and entrainment of all life stages of marine life are reduced to 90 percent or greater of the reduction that would be achieved under Track 1, using closed-cycle wet cooling.

The State of California has set draft compliance dates of 2018 for non-nuclear facilities and 2021 for nuclear facilities. California has also made an exception for nuclear steam generating facilities where compliance with the policy will jeopardize required health and safety regulations. In these cases, California will make BTA decisions on a site specific basis to ensure all safety requirements are met with the implementation of BTA.

Is Closed-cycle Cooling Available at All Existing Industrial Facilities in New York?

Closed-cycle cooling is required for all new industrial facilities in New York with non-contact cooling water needs. However, closed-cycle cooling may not be an available technology at many existing facilities in New York State without requiring a major reconstruction, or repowering, of the existing plant. Some of the issues that may limit the availability of closed-cycle cooling for existing facilities are as follows:

1. Lack of physical space to site or efficiently operate cooling towers;
2. Costs wholly disproportionate to benefits due to requiring reconstruction of condensers and other infrastructure to site and efficiently operate cooling towers;
3. Facility would not operate efficiently or safely with closed-cycle cooling;
4. Nuclear Regulatory Commission health and safety requirements will not be met; and
5. Tower drift, fogging, icing, and salt deposition on local neighborhoods, roads, and vegetation may have significant impacts.

Over the past several years, the Department has been making BTA determinations using performance goals based on the Phase II Rule requirements (60-90% reduction in entrainment and 80-95% reduction in impingement mortality)(Riverkeeper v. Johnson 2009, Stark 2005 letter to EPA). Since 2004, the Department has completed BTA determination for six existing industrial facilities resulting in an average estimated reduction in impingement mortality of 89 percent and entrainment by 72 percent (Table 4). Closed-cycle cooling is likely not available for these facilities for one or more of the above stated reasons; therefore the Department selected the next best available technology to minimize impingement mortality and entrainment. Without retrofitting these facilities with closed-cycle cooling, four of the six facilities would likely meet the performance goal established by this policy for impingement mortality reduction but it is possible that only one facility would meet the goal for entrainment reduction with the currently selected BTA. Additional technologies and operational measures would be required.

Table 4: Estimated reductions in impingement mortality and entrainment obtainable at facilities recently implementing Department selected BTA. Closed-cycle cooling is likely not available for these facilities without repowering. It will likely be the most difficult for facilities to meet the performance goals for entrainment. Note that World Trade Center will be implementing a partial closed-loop cooling system as part of the BTA determination. The *Policy Based Reduction* ranges listed in this table include both impingement mortality and entrainment.

			Percent Reductions:	
Facility	Type	Water Body Type	Impingement Mortality	Entrainment
Arthur Kill	Steam Electric	Marine	80	70
Astoria	Steam Electric	Marine	85	60
Danskammer	Steam Electric	Freshwater	85	80
Dunkirk	Steam Electric	Freshwater	98	75
Ravenswood	Steam Electric	Marine	90	65
World Trade Center	Office Cooling	Estuarine	95	84
		Average:	***89***	***72***
Policy Based Reductions - Marine Waters:			***84-86***	
Policy Based Reductions - Freshwater:			***86-88***	

Alternative Technologies, Processes and Operational Methods That Reduce Entrainment and Impingement Mortality

There are many technologies, processes and operational measures that have been demonstrated to reduce entrainment and impingement mortality (Table 5). For some industrial facilities, these alternatives have been demonstrated to reduce entrainment and impingement mortality to levels commensurate to that achievable using closed-cycle cooling. Prior to its closing in 2008, the Lovett Generating Station on the Hudson River had seasonally employed filter fabric technology (Gunderboom Marine Life Exclusion System or MLES™) resulting in a reduction in entrainment and impingement greater than 90 percent from plant operations prior to the use of this technology. Bowline Point generating station was able to reduce impingement mortality by 91 percent using an exclusion barrier net (Hutchinson and Matouse 1988). However, for most facilities, a combination of physical barriers, fish return systems, and deterrent systems along with flow reductions and outages would be required to reduce entrainment and impingement mortality to 90 percent of that achievable using wet closed-cycle technology.

Table 5: Alternative technologies to closed-cycle cooling that are used in New York and have been demonstrated to reduce levels of entrainment and impingement mortality (modified from Taft and Cook 2003).

Technology Category	Technologies	Mode of Action	Where Used in New York
Physical Barriers	- Wedge wire screens - Barrier nets - Aquatic filter barriers	Physically block fish passage (usually in combination with low water velocity)	Brooklyn Navy Yard Somerset Lovett Bowline Point Ravenswood Bethlehem Energy Center
Collection/Return Systems	- Conventional Traveling Screens - Ristroph Traveling Screens - Fine Mesh Traveling Screens - Fish pumps	Actively or passively collect fish for transport through a return system	Arthur Kill Black River Danskammer Oswego Steam E.F. Barrett Far Rockaway Indian Point Ravenswood Somerset Dunkirk Huntley Port Jefferson Roseton
Diversion Systems	Angled screens	Divert fish to a return system or safe area	Oswego Steam
Flow Reduction	Variable Speed Drive Pumps	Closely match cooling water use to heat load	Danskammer Arthur Kill Astoria
Behavioral Deterrent Technologies	Acoustic systems	Alter or take advantage of natural behavior patterns to repel or attract fish	James A. Fitzpatrick Danskammer

Anticipated BTA Policy Compliance Costs to Industry

To estimate the compliance cost industry would have to bear with the implementation of this policy, some assumptions had to be made and several sources of public information and data were relied upon. Since the cost of retrofitting and operating a wet closed-cycle cooling system on a facility is directly related to the amount of cooling water used and the heat load that is required to be dissipated, the steam electric generating industry would bear the greatest cost to comply with this policy.

Though other manufacturing facilities would also be required to comply with the policy, the overall cost would be significantly less than that for the steam electric industry. In fact, the U.S. EPA found that for new manufacturing facilities, the total annualized compliance costs to install and operate wet closed-cycle cooling were below 0.5 percent of gross annual revenues for several industries (e.g., pulp & paper, chemicals, petroleum, steel and aluminum) (EPA 2005). In the same document, the EPA estimated compliance costs to the steam electric industry would be much higher, at greater than five percent gross annual revenues for some facilities but still determined that the industry as a whole could bear this cost. The U.S. EPA had previously rejected dry closed-cycle cooling as the performance benchmark in the Phase I Rule, which applies to all new industrial facilities, with cost estimates exceeding ten percent of gross revenues for many proposed facilities. The U.S. EPA considers costs greater than 10 percent of gross revenue could be a barrier for new facilities to enter the industry (EPA 2001). However, in New York, new steam electric facilities have recently been constructed that utilize dry closed-cycle cooling technology clearly demonstrating that this technology is in fact economically achievable.

Compliance costs listed in Table 6 were only generated for the existing steam electric generating facilities in New York with the assumption that wet closed-cycle cooling is available for all existing plants. Given the large amount of revenue information available for the steam electric generating industry, it is possible to estimate the overall cost of compliance the implementation of this policy will have. Revenue was estimated by calculating the average net energy production (in MWh) for each facility for the period from 2002 to 2007 from the *NYISO Load and Capacity Data "Gold Books" (2003-2008)* and multiply that number by the average zonal price per MWh reported for 2007. This revenue was then projected for 20 years which is the approximate functional life of wet cooling towers before major maintenance and reconstruction is required (Havey and Blackburn 2008).

The cost to construct and operate cooling towers at each facility was estimated using the relationship between costs and cooling water use in gallons per minute (gpm) reported by Maulbetsch (2005). In order to determine a current cost per gpm, the median cost of $555 per gpm was calculated using the costing data provided in Havey and Blackburn (2008) for 11 steam electric facilities in California. Annual cooling tower operation and maintenance costs were estimated using the relational factor to capital cost of 1.6 percent reported by Maulbetsch (2005). By applying these cost factors to existing New York steam electric facilities, it is estimated that the compliance cost for the steam electric industry over 20 years would be over $8.5 billion (Table 6). This would be approximately 6.7 percent of the gross annual revenues for the industry for this time period. If Oswego Power were not included in the estimation, the overall cost of compliance would fall to 6.2 percent of revenue. At present, Oswego Steam operates at less than three percent capacity.

For steam electric facilities where wet closed-cycle is not feasible, the costs of alternative technologies are generally much less costly than cooling towers for most facilities in New York State (Table 7). EPA estimated that for 99 percent of the firms across the country that own large power plants, compliance costs for implementing these other technologies under the Phase II Rule would be less than three percent of revenues (EPA 2004). However, some facilities will likely not meet the performance goals set by this policy by utilizing alternative feasible technologies and would likely be required to reduce cooling water use further by reducing electric generating capacity. This could significantly reduce revenue for these facilities.

Table 6: Estimated compliance costs for the steam electric industry in New York State. Note that Oswego Steam Station operated on average less than 3.0% of capacity. Parasitic and efficiency losses are not included.

Facility Name	Capital Costs	Operation & Maintenance Costs (20 years)	Total Costs	20-year Revenue	Cost - Revenue Ratio
Indian Point	$1,079,451,875	$345,424,600	$1,424,876,475	$24,168,528,480	5.9
Astoria Generating	$540,431,250	$172,938,000	$713,369,250	$6,232,600,000	11.4
Oswego Steam Station	$539,120,833	$172,518,667	$711,639,500	$523,857,252	135.8
Ravenswood	$536,076,042	$171,544,333	$707,620,375	$7,796,876,244	9.1
Northport	$361,728,958	$115,753,267	$477,482,225	$15,362,526,680	3.1
Roseton	$356,807,188	$114,178,300	$470,985,488	$3,183,683,722	14.8
Bowline 1&2	$351,553,958	$112,497,267	$464,051,225	$1,414,251,573	32.8
Huntley	$325,904,479	$104,289,433	$430,193,913	$2,409,262,820	17.9
Arthur Kill	$274,956,250	$87,986,000	$362,942,250	$1,855,000,000	19.6
Fitzpatrick	$240,153,125	$76,849,000	$317,002,125	$8,038,232,251	3.9
Poletti	$239,617,396	$76,677,567	$316,294,963	$3,582,202,485	8.8
Dunkirk	$222,971,250	$71,350,800	$294,322,050	$3,573,800,000	8.2
Ginna	$188,923,542	$60,455,533	$249,379,075	$4,612,289,070	5.4
Nine Mile Point	$188,723,125	$60,391,400	$249,114,525	$16,490,083,300	1.5
Danskammer	$176,324,271	$56,423,767	$232,748,038	$3,490,140,317	6.7
Port Jefferson	$153,704,167	$49,185,333	$202,889,500	$3,162,734,117	6.4
EF Barrett	$113,447,396	$36,303,167	$149,750,563	$2,865,381,700	5.2
AES Somerset	$107,346,250	$34,350,800	$141,697,050	$5,792,311,378	2.4
AES Cayuga (Milliken)	$84,406,250	$27,010,000	$111,416,250	$2,697,921,458	4.1
Glenwood	$66,939,167	$21,420,533	$88,359,700	$952,476,512	9.3
Russell	$48,285,000	$15,451,200	$63,736,200	$1,433,606,013	4.4
AES Greenidge	$43,552,083	$13,936,667	$57,488,750	$1,048,558,645	5.5
AES Westover(Goudey)	$39,258,542	$12,562,733	$51,821,275	$879,510,146	5.9
Far Rockaway	$32,182,292	$10,298,333	$42,480,625	$559,636,320	7.6
East River	$122,177,083	$39,096,667	$161,273,750	$1,126,860,000	14.3
Black River Power	$21,197,917	$6,783,333	$27,981,250	$497,623,667	5.6
Brooklyn Navy Yard	$21,197,917	$6,783,333	$27,981,250	$2,935,918,696	1.0
Total Compliance Costs:	**$6,476,437,604**	**$2,072,460,033**	**$8,548,897,638**	**$126,685,872,845**	**6.7**

Table 7: Estimated costs of installing alternative technologies at existing steam electric facilities in New York State.

Estimated Costs*:	**Ristroph Screens**	**Wedge wire**	**Variable Speed Pumps**	**Fish Deterrent Systems**	**Barrier Nets**
Average	$9,920,476	$20,019,002	$39,306,075	$2,248,500	$5,173,333
Maximum	$18,689,000	$65,000,000	$55,657,000	$3,050,000	$8,000,000
Minimum	$3,746,000	$3,892,000	$16,400,000	$1,447,000	$3,539,000

*All estimates include construction and 20-year operation and maintenance expenses. All cost estimates are based on data provided to New York State for 12 steam electric facilities.

Cost Considerations in Implementing the Performance Goals of this Policy

Cost-Benefit Analysis

The U.S. Supreme Court (2009) determined that it is up to the discretion of the U.S. EPA, or the U.S. EPA's designee, to determine how costs will be considered when establishing requirements to minimize the adverse environmental impacts caused by CWIS. The Court decided that the need for, and the rigor of a cost-benefit analysis were rightly left to the U.S. EPA's discretion when they established the performance standards in the Phase II Rule (Entergy v. Riverkeeper, Inc. 2009 Decision). The Supreme Court decision reverses the 2007 U.S. Court of Appeals, Second Circuit decision which ruled that the U.S. EPA was prohibited from making cost-benefit analyses under CWA § 316(b) (Riverkeeper II 2007 Decision).

Prior to the 2007 decision of the Second Circuit Court of Appeals, the Department had been making BTA determinations in New York for individual facilities on a site-specific, case by case basis (Athens Decision 2000). For each site-specific BTA determination, the Department selected a feasible technology whose costs were not wholly disproportionate to the environmental benefits expected to be gained. (Athens Decision 2000).

Wholly Disproportionate Test

The Department contends that the only relevant environmental benefit to be considered in any CWA §316(b)/6 NYCRR §704.5 BTA analysis is the reduction in impingement mortality and entrainment of fish and shellfish, afforded by the minimization alternative (Stark letter 2005, Athens Decision 2000). The selection of the BTA is a technology forcing decision but the Department will select technologies that are not *wholly disproportionate to the environmental benefits* (Stark letter 2005, Athens Decision 2000). In the 2000 Athens Interim Decision the Commissioner stated "…..a lone finding that costs outweigh environmental benefits to be gained is insufficient; instead, a finding must be made that the costs are "wholly disproportionate" to the environmental benefits to be gained. This more rigorous standard gives presumptive weight to the value of the environmental benefits and places the burden on a permit applicant to demonstrate that the relative costs are unreasonable." The Department will continue to use the wholly disproportionate test when determining BTA on a site-specific basis.

Costs Reasonably Borne by the Industry

The estimated compliance cost for the performance goals stated in this policy for existing facilities in New York State is 6.7 percent of revenue with 11 facilities falling below six percent (Table 6). Unfortunately, no specific threshold is available for the electric generation industry for determining an absolute threshold for cost reasonably borne, but based on several EPA documents, a range around such a threshold can be estimated. In establishing the Phase I Rule, the EPA rejected dry cooling citing that the annualized compliance costs would be "*…. greater than 4 percent of revenues for all of 83 projected electric generators within the scope of the rule. For 12 generators, costs would exceed 10% of revenues. EPA has determined that higher capital and operating costs associated with dry cooling may pose barrier to entry for some new sources in certain circumstances. (In general, barrier to entry means that it is too costly for a new facility to enter into the marketplace).*" (EPA 2001). The EPA decided that industry on the whole could not bear the cost of dry closed-cycle technology.

The EPA (2006) also stated that small entities (not electric generating facilities) with annualized compliance costs that equal or exceed three percent of revenue *might* experience a significant financial impact. Thus, costs less than three percent can be assumed to be generally achievable. Costs that exceed three percent of revenue may still be economically achievable but achievability would depend on the specific industry in question since operating margins and profit margins vary by industry. The EPA (Putnam *et al.* 1982) estimated that a cost of greater than six percent of revenue *might* not be economically achievable for the perfumes and cosmetics industry.

The EPA ultimately settled on wet closed-cycle cooling to set the performance requirements under the Phase I Rule after finding that the compliance costs for new electric generators ranges between 0.07 and 5.24 percent of annual gross revenue. Under the Phase II Rule, the EPA concluded that the costs of technologies, other than closed-cycle cooling, to minimize impingement and entrainment could be borne by the industry since compliance costs for implementing these other technologies would be less than three percent of revenues for 99 percent of the existing steam electric facilities (EPA 2004).

While this information provides some insight into the financial condition of the electric generation industry, the upper threshold is still unclear. However, the "magic number" of what could be reasonably borne by a specific industry most likely falls between three and ten percent.

Energy Capacity and Reliability Issues

Retrofitting wet closed-cycle cooling towers onto existing steam electric facilities originally designed for once-through cooling will have an impact on the existing energy capacity and reliability in New York State (DOE 2008). Reliability can be affected by the long durations of plant shutdown required for the switch over. Total capacity of the electrical system will be reduced by parasitic losses that include the energy required to run the fans and pumps associated with the cooling towers and the loss of capacity due to losses in efficiency. For some facilities, these efficiency losses can be mitigated by increasing thermal input to generate more electricity. However, this will not be available for all facilities especially pressure water nuclear reactors and some combined cycle facilities (Havey and Blackburn 2008). For these facilities, additional energy will be required to be imported to make up for these losses which if not wind or hydro generated, will likely be generated by coal or natural gas facilities. Considering that the coal and natural gas steam facilities would also be required to make up the lost capacity to comply with this policy, additional capacity will need to be added to the grid.

Approximately 80 percent of New York State's electric generating capacity consists of nuclear, natural gas, coal, and oil fueled generating facilities (NYISO 2008). The remaining 20 percent is shared by hydro, wind, solar, solid waste, and biomass generators. The North American Electric Reliability Corporation estimates that the total energy generation capacity in the United States would be reduced by 4.3 percent with the retrofitting of existing steam electric facilities with closed-cycle cooling (DOE 2008). New energy production would be required to offset these losses and based on the total energy generated in New York State in 2007 (NYISO 2008), this would come to approximately 4,813 GWh of electricity required or the equivalent of a new 550 MW steam turbine unit operating at full-generating capacity.

Additional Impacts of this Policy to Natural Resources

In making a BTA determination, the only adverse environmental impact that will be taken into consideration is the reduction in impingement mortality and entrainment of fish afforded by the minimization alternative (Athens 2000). After the BTA determination is made, the Department will make a SEQRA determination on the facility specific SPDES permit prior to issuance (Indian Point Interim Decision 2008).

Implementing this policy at a facility may have an impact on the following natural resources (note that this is not an exhaustive list):

1. Air resources caused by the operation of cooling towers with both an increase in air borne pollutants (i.e., carbon, nitrogen, sulfur, mercury) due to additional power generation required to offset power losses associated with the operation of cooling towers and the localized effect of cooling tower drift;
2. The potential of localized fogging, icing and salt deposition caused by cooling tower water vapor plumes;
3. Visual impacts of cooling towers on the local communities and open spaces;
4. Local impacts caused by the physical construction of towers and potential loss of protected wetlands and other wildlife habitat and open space; and
5. Local noise ordinances caused by the operation of mechanical draft towers.

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Department Procedures for the Determination of "Best Technology Available", or BTA, Under 6 NYCRR Part 704.5 and Section 316(b) of the Clean Water Act

Consistent with our responsibilities under 6 NYCRR Part 704.5, other SPDES regulations, appropriate case law and Commissioners' decisions (see References), and the federal Clean Water Act, staff of the Steam Electric Unit should use the following procedure when making "Best Technology Available" (BTA) determinations at power plants and other facilities having cooling water intake structures (CWIS). The purpose of the BTA determination is to identify the best technology available for minimizing adverse environmental impact from the cooling water intake structure. Prior to following the procedures in this document, staff will determine whether the facility's CWIS is causing or may result in an adverse environmental impact. The adverse environmental impact being assessed is the mortality of fish caused by impingement and entrainment. This assessment will be made by reviewing the results of previous impingement mortality and entrainment studies conducted at the facility and/or by requiring the applicant or facility owner to conduct additional biological studies.

Step 1

Staff, in conjunction with the applicant or facility owner, will develop an array of potential alternatives for minimizing adverse environmental impact that are considered *feasible* with respect to the physical properties of the site and the specifications of the proposed or existing cooling water intake structure (location, design, construction and capacity). *Feasible* means "capable of being done" and does not involve consideration of cost. Staff will require the applicant or facility owner to provide an analysis of these alternatives that evaluates both the effectiveness at protecting aquatic resources and the cost of implementation. Staff may require the applicant or facility owner to evaluate alternatives not endorsed by the applicant or facility owner but that staff believe are feasible. Finally, the applicant or facility owner will be required to propose an alternative or array of alternatives that they believe will achieve BTA.

Step 2

Next, staff will consider the standards for aquatic resource protection contained in Section 316(b) of the Clean Water Act. For *new* facilities regulated by the 40 CFR Part 125 - Subpart I (Phase I Rule), any feasible alternatives or combination of feasible alternatives from Step 1 that do not provide aquatic resource protection at least equivalent to the protection afforded by closed-cycle cooling will be eliminated from further consideration as BTA. For *existing* power plants regulated by 316(b) of the Clean Water Act, any feasible alternatives or combination of feasible alternatives from Step 1 that do not provide a 90 percent or greater reduction in both entrainment and impingement mortality from that which would be achieved by a wet closed-cycle cooling system will be eliminated from further consideration as BTA.

Step 3

For each of the mitigation alternatives remaining after conducting Step 2, staff will consider the extent to which adverse environmental impacts are minimized. *Minimize* means reduce to the smallest amount, extent or degree reasonably possible. *Adverse environmental impact* means impact resulting in any injury or mortality of aquatic organisms caused by impingement and/or entrainment. Staff will then determine whether minimizing adverse environmental impact is wholly disproportionate to the resulting aquatic resource benefit[1] (i.e., increase in the level of aquatic resource protection) using cost information provided by the applicant or facility owner, and other publicly-available information, as appropriate. Staff will not perform a formal cost-benefit analysis; however, they will use a quantitative approach when making this determination. The analysis will not be done on the basis of absolute value (the cost of the mitigation alternative compared to the value of the aquatic resource benefit) because there is no generally agreed upon methodology for placing a dollar value on environmental benefits. Instead, staff will compare relative changes in cost when assessing the effectiveness of the different mitigation alternatives. Cost and benefits will be aggregated over the expected life of the facility. If the applicant or facility owner does not provide information on the expected life of the facility and no other information is available, staff will use 20 years as a default time frame.

> Cost.– Cost will be assessed using the proportional cost of the mitigation alternative when compared to either total cost or total revenues. Proportional cost for an **existing** facility will be expressed as the ratio of the cost of the mitigation alternative (construction plus operation and maintenance) to the projected

[1] See discussion regarding Matter of Athens Generating Co., L.P., Interim Decision of the Commissioner, June 2, 2000 Matter of Mirant Bowline, LLC, Decision of the Commissioner, March 19, 2002, page 14-26.

revenues for that facility. Proportional cost for **new** facilities will be expressed as the ratio of the cost of the mitigation alternative (construction plus operation and maintenance) to either the total cost for the proposed facility (capital plus operation and maintenance), or the projected revenues for the proposed facility. These costs will be aggregated over the life of the facility and calculated as shown below.

$$\text{Proportional cost (C)} = \frac{\text{Cost of mitigative technology}}{\text{Total cost (or revenues)}}$$

<u>Benefit</u>.– As with cost, staff will assess the proportional aquatic resource benefit (or effectiveness) of the mitigation alternative. Effectiveness will be measured as the proportional change in the number of vulnerable aquatic organisms estimated to be protected by the mitigation alternative compared to the number at risk. Vulnerable organisms are those which would be killed by impingement or entrainment if the plant used a once-through cooling system without any additional mitigation[2]. Aquatic resource benefits will be aggregated over the life of the facility and calculated as shown below.

$$\text{Proportional benefit (B)} = \frac{\text{Number of organisms protected with mitigative technology}}{\text{Number of organisms at risk of impingement/entrainment mortality}}$$

The results of the cost effectiveness comparison will be expressed as a narrative: "An increase in facility expenditures of [C x 100] percent would yield a [B x 100] percent increase in aquatic resource protection."

This process provides a way to develop a cost - benefit comparison to determine whether the cost is wholly disproportionate. Staff will use statutes, case law, Commissioner's decisions, guidance documents[3], and professional judgment to determine whether the cost

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[2] compared with baseline impingement and entrainment when the facility is operating at full flow and full capacity - See <u>*Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer, LLC*</u>, Decision of the Deputy Commissioner, May 24, 2006 [2006 WL 1488863 (N.Y.Dept.Env.Conserv.)]; <u>Riverkeeper, Inc. v Johnson</u>, 52 AD3d 1072 (3d Dept. 2008), <u>appeal</u> <u>denied</u> 11 NY3d 716 (2009).

[3] See Technical and Operational Guidance Series (TOGS), 1.2.1, Section I.B.2.b which references USEPA 1982.

of the mitigation alternative is wholly disproportionate to the aquatic resource benefits (i.e., increase in the level of aquatic resource protection).

Any of the feasible alternatives from Step 3 with cost determined to be wholly disproportionate to the benefits provided will be eliminated from consideration as BTA.

Step 4

Of the alternatives remaining after Step 3, staff will identify as the most protective alternative the one that most effectively minimizes adverse environmental impacts. Staff then will use professional judgment in making a site-specific determination of: a) whether the level of mitigation provided by the most protective alternative is reasonable and necessary for minimizing adverse environmental impacts at the facility, b) whether the alternative or array of alternatives proposed by the applicant or facility owner will achieve BTA, and c) whether one or more of the other remaining alternatives can achieve an approximately equivalent level of mitigation as the most protective alternative.

Step 5

As a final step in the process, staff will identify the preferred alternative and develop a narrative explanation of the reasons for selecting the preferred alternative and rejecting other feasible alternatives. This narrative should form the basis of the analysis of alternatives presented in the Biological Fact Sheet for the SPDES permit for the facility.

References:

New York

Letter to Environmental Energy Alliance of New York Director John G. Holsapple from DEC Executive Deputy Commissioner Denise M. Sheehan, dated January 31, 2005.

Matter of Dynegy Northeast Generation, Inc., on behalf of Dynegy Danskammer, LLC, Decision of the Deputy Commissioner, May 24, 2006 [2006 WL 1488863 (N.Y.Dept.Env.Conserv.)]; Riverkeeper, Inc. v Johnson, 52 AD3d 1072 (3d Dept. 2008), appeal denied 11 NY3d 716 (2009).

Matter of Athens Generating Co., L.P., Interim Decision of the Commissioner, June 2, 2000 *Matter of Mirant Bowline, LLC*, Decision of the Commissioner, March 19, 2002.

Title 6 of the Official Compilation of Codes, Rules and Regulations (6 NYCRR) Parts 700, 704 and 750.

Federal

Entergy Corp. v Riverkeeper, Inc., et al., 556 U.S. __, 129 S.Ct. 1498 (2009).

EPA 2001. Environmental Protection Agency; National Pollutant Discharge Elimination System: Regulations Addressing Cooling Water Intake Structures for New Facilities; Final Rule; 66 Fed. Reg. 65256 (12/18/2001).

In re Brunswick Steam Electric Plant, 1976 WL 25235, (E.P.A.G.C.).

Riverkeeper, Inc. v. U.S. Envtl. Protect. Agency, 358 F.3d 174, 189-92 (2nd Cir. 3 February 2004).

Riverkeeper, Inc. v. U.S. Envtl. Protect. Agency, (2nd Cir. 25 January 2007).

Seacoast Anti-Pollution League v. Costle, 597 F.2d 306 (1st Cir. 1979).

Guidance Documents

Commissioner Policy-nn. Best Technology Available (BTA) for Cooling Water Intake Structures. (Draft 2010).

USEPA. 1982. Work book for determining economic achievability for national pollution discharge elimination system permits. Prepared by Putnam, Hayes, and Bartlett, Inc. (August 1982).

USEPA. Permits Division, Office of Waste Enforcement, EPA, Guidance for Evaluating the Adverse Impact of Cooling Water Intake Structures on the Aquatic Environment: Section 316(b) PL 92-500. (Draft 1977).