Biological Fact Sheet - Cooling Water Intake Structure
Bureau of Habitat, Steam Electric Unit

Name of Facility:	East River Generating Station
Owner/Operator:	Keyspan Corporation
SPDES #:	NY-000 5126
Location:	Manhattan New York City East River

1. Description of Facility

The East River Generating Station, located along the East River, first began operations in 1927. The station currently has two oil and gas fired units, built in 1951 and 1955 with rated capacities of 137 and 180 megawatts. The facility has a combined condenser cooling and service water flow of 369 million gallons per day. The shoreline intake structure consists of a common intake screenwell for the two operating units, leading to four dual flow traveling screens to keep the station's condensers clear. Screens are washed continuously to remove impinged material (marine organisms and debris), which enters a common sluiceway for discharge into the East River.

2. Ecological Resource

The East River is part of the Hudson-Raritan Estuary System which extends approximately 170 miles from the dam at Troy, NY to Sandy Hook, NJ. This estuary system connects to the coastal marine waters of the New York Bight, between Sandy Hook, New Jersey and Rockaway Point, New York, and to the western end of the Long Island Sound through the East River.

The East River is a tidal strait extending about 16 miles from the Battery in New York City to Throgs Neck at Long Island Sound. At Hell's Gate, a natural sill divides the East River into two distinct hydrological sections. The upper East River, which connects to Long Island Sound, is broader, more shallow and characterized by more natural shoreline habitat. The Lower East River, where the East River Generating Station is located, is a narrower 10 mile section, bulkheaded along most of its length. The channel here is steep sided with depths of approximately 35 to 80 feet. Current velocities in the vicinity of the Station are high, with average peak flood and ebb currents at about 4.6-4.7 feet per second, and maximum tidal velocities exceeding 5.5 feet per second (ASA 2001).

For many decades, the Hudson-Raritan estuary was severely polluted due to discharges of untreated sewage, industrial effluents and urban runoff. Since the late 1970s, when the most significant abatement of untreated sewage occurred, water quality in the estuary, in terms of dissolved oxygen and coliform bacteria levels, has greatly improved (Brosnan and O'Shea 1996). More than 140 species of fish have recently been reported from the Hudson-Raritan Estuary System, representing marine, estuarine, freshwater and diadromous fish, as well as species

adapted to northern and southern climates.

Under a 1992 Order-On-Consent with the Department, Con Edison conducted a series of studies to assess the Station's impact on aquatic resources in the East River and determine best technology available for the cooling water intake system. Impingement and entrainment (IM&E) studies were conducted in 1993. Sixty eight species of fish, mostly marine in origin, were collected at the Station. Approximately 455,000 fish were estimated to be impinged that year, mainly bay anchovy (50%), Atlantic herring (8.8%), Atlantic tomcod (7.7%) and winter flounder (6.9%). Results of the entrainment studies estimated that 48.9 million eggs, larvae and juvenile fish were entrained annually. The principal species entrained were four beard rockling, bay anchovy, grubby, winter flounder, gobidae and silver hake (Normandeau 1994).

Under this Order-On-Consent, the Department also required: 1) An assessment of the thermal tolerance of impinged fish; 2) A study to investigate the potential to re-impinge fish that are washed off the intake screens and sluiced back to the East River and; 3) A review of cooling water intake structure (CWIS) technologies to determine the best technology available to minimize impingement mortality and entrainment. Although adequate thermal tolerance data for most of the species impinged was lacking, it was concluded that, except for winter flounder, the potential for thermal stress was likely low. This was mainly due to the fact that the impinged fish are returned to the East River about 100 feet from the discharge outfall, and that mixing of the discharge with ambient water prior to exposure probably lowers temperatures below thermal tolerance limits.

To determine if returned fish were re-impinged by the CWIS, more than 4,000 marked fish were released into the East River. No marked fish were recaptured, indicating that each of the fish return locations studied would minimize the potential to re-impinge fish. The cooling water intake structure alternative technology review estimated the expected reductions in impingement mortality and entrainment for several viable mitigation alternatives, such as closed cycle cooling, Ristroph modified and wedge wire screens and variable speed pumps. The technology review concluded that cooling towers would have significant noise, visual and land use impacts, and would have significant energy impacts and prohibitively high costs. It was further concluded that the use of flow reduction alternatives that include variable speed pumps could approach the lower end of the performance range contained in the EPA Phase II rule (ASA 2004).

The Department required an impingement mortality and entrainment (IM&E) study to be conducted in 2005-2006. Consistent with other New York Harbor and East River power plants, results of this study indicated a large increase in IM&E from the 1990s abundances. An estimated 1.5 million fish were impinged, with Atlantic croaker, Atlantic tomcod, scup, bay anchovy and Atlantic menhaden making up 84 percent of the total. It was estimated that 1.34 billion fish eggs and larvae were entrained with 92.6 percent being eggs. Cunner, bay anchovy, Atlantic menhaden, weakfish, and tautog were the principle species entrained.

3. Alternatives Evaluated

The Department required the development of a *Design Construction Technology Plan* (DCTP) providing an updated intake technology review which was completed in December 2007. The Department used this report to make a BTA determination for the East River Generating Station. The following alternatives were evaluated in the DCTP for this facility:

- Closed Cycle Cooling
- Wedge Wire Screens
- Variable Speed Pumps
- Ristroph Intake Screens
- Impingement Barrier Net
- Aquatic Filter Barrier
- Other Cooling Water Management Alternatives

4. Discussion of Best Technology Available

According to 6NYCRR Part 704.5 - *Intake structures* and Section 316(b) of the federal Clean Water Act, the location, design, construction, and capacity of cooling water intake structures must reflect the "best technology available" (BTA) for minimizing adverse environmental impact.

Feasibility of Closed Cycle Cooling

A. Location. The only area of sufficient size to locate hybrid mechanical draft cooling towers for this facility is the area to the north of the main building, between 15th and 16th streets. This area is occupied by the John J. Murphy Park and Ball Fields that are heavily utilized by the local community. Cooling towers will eliminate a significant portion of these recreational facilities and would also be in close proximity to high density residential development. Community impacts such as cooling tower plume, noise, and recreational impacts would need to be addressed through the SEQRA.

B. Design. The small volume of cooling tower makeup (5,700 gallons per minute) can be handled by modifications to the existing traveling intake screens or a small number of wedge wire intake screens which could be accommodated under the existing wharf. No significant impacts to the East River waterway are anticipated.

C. Construction. Impacts from construction of hybrid mechanical draft cooling towers would be confined to upland recreational facilities, parking lots etc. An Article 15 permit would be required for the minor disturbance to the East River waterway that would occur through the installation of wedge wire screens.

D. Capacity. Hybrid mechanical draft cooling towers would minimize capacity by reducing total water withdrawals by 93.6 percent at Unit 6 and 94.1 percent at Unit 7

(ASA 2003).

Feasibility of Alternative Technologies other than Closed Cycle Cooling

A. Location. Alternative locations for the cooling water intake structure were not considered to be feasible for any of the alternatives evaluated for this facility. Relocating the intake upstream or downstream is not possible as the shoreline in the vicinity of the station is completely developed. Additionally, such action would provide little or no additional environmental benefit.

B. Design. – Intake designs such as barrier nets and aquatic filter barriers are not considered feasible due to a combination of factors including the inappropriate substrate composition (bedrock) available to anchor these technologies, the steep profile of the channel and the strong currents in the East River. These alternatives are not discussed further. Wedge wire screens (2.0 mm) could possibly be installed under the existing wharf however, issues including marine fouling and cleaning would need to be resolved, possibly through a pilot study. Screens with a 2.0 mm slot will minimize impingement mortality, but will provide little entrainment reduction. Wedge wire screens having 0.5 or 1.0 mm will encounter greater fouling and cleaning problems and it has not been determined whether sufficient space exists. Ristroph modified screens are a feasible intake design which would reduce impingement mortality by approximately 90 percent from baseline conditions in conjunction with current plant operations.

A fine mesh screens is the only design technology that is likely to reduce entrainment. In 2008, the applicant conducted a three month study of the ichthyoplankton exclusion ability of an intake screen fitted with 1.0 mm mesh panels. Overall, the 1.0 mm mesh reduced entrainment by 4.0 percent, due to the fact that approximately 96 percent of the eggs collected were 1.0 mm or less in diameter (larval entrainment was reduced by 56 percent). The report concluded that the ability of a 1.0 mm mesh to reduce egg entrainment is negligible, and a 0.75 mm mesh could be expected to exclude about 80 percent of the fish eggs currently vulnerable to entrainment (Normandeau 2008).

C. Construction. – Wedge wire intake screens, due to construction out into the East River, will also result in construction impacts requiring an Article 15 permit. Construction involved with installing of Ristroph modified screens is confined to within the station's screenhouse.

D. Capacity. – Variable speed drive pumps, pump shutdowns and outages are the only alternatives (besides closed-cycle cooling) that would affect cooling water withdrawal capacity. These alternatives are not likely to substantially reduce entrainment, considering that the highest density of fish eggs and larvae occur during the summer period when the

high water temperatures in conjunction with high electric generation do not allow large reductions in cooling water flow without substantial heat rate penalties and possible tripping of units. In keeping with the Department's established, environmentally-protective BTA requirements for existing facilities with cooling water intake structures, an 80 percent reduction in impingement mortality and 60 percent reduction in entrainment, from the Calculation Baseline levels, are the minimum impact reductions the Department expects to achieve from implementation of these permit conditions.

5. Determination of Best Technology Available

After evaluating all of the available alternatives, the New York State Department of Environmental Conservation (NYSDEC) has determined that modified Ristroph screens with a dedicated low stress fish return system and the seasonal use of fine mesh panels represent the best technology available for minimizing adverse environmental impacts from the cooling water intake structure. The Department believes that these technologies, coupled with the decrease in flow due to the use of cogeneration during winter, can achieve an estimated 90 percent reduction in impingement mortality and a 75 percent reduction in entrainment from baseline conditions. This is a substantially higher reduction than other non closed-cycle cooling alternatives. Con Edison may be required to investigate additional means to reduce entrainment if verification monitoring shows that performance requirements have not been met or the use of the 0.75 mm mesh is not feasible at the East River Generating Station.

Although closed-cycle cooling may be a technically feasible alternative, it was rejected due to a combination of high cost, and several siting issues, which include the loss of recreational open space, proximity to high density residential areas and the FDR Highway.

The use of variable speed pumps or an additional pump will provide small increases in both impingement and entrainment reduction. Requiring one of these technologies is not considered to be necessary at this time but may be re-evaluated as part of a contingency plan to meet performance requirements in the future if the selected BTA does not prove to be sufficient.

6. Monitoring Requirements

Following approval of the schedule for implementing the technologies selected as BTA, and the methodology for assessing their efficacy, the permittee is required to submit a *Verification Monitoring Plan* for Department review and approval. This plan will detail the procedures necessary to confirm that the reductions in impingement mortality and entrainment required by this permit are being achieved. The specific requirements of the monitoring plan are set forth in Biological Requirement B.4 of the modified SPDES permit, and includes a five year averaging period for cooling water flow with a minimum of two years of biological sampling to verify performance.

8. Legal Requirements

The requirements for the cooling water intake structure in this State Pollutant Discharge Elimination System permit are consistent with the policies and requirements embodied in the New York State Environmental Conservation Law, in particular - Sec.1-0101.1.; 1-0101.2.; 1-0101.3.b., c.; 1-0303.19.; 3-0301.1.b., c., i., s. and t.; 11-0107.1; 11-0303.; 11-0535.2; 11-1301.; 11-1321.1.; 17-0105.17.; 17-0303.2., 4.g.; 17-0701.2. and the rules thereunder, specifically 6NYCRR Part 704.5. Additionally, the requirements are consistent with the Clean Water Act, in particular Section 316(b) and the rules thereunder.

9. Summary of Changes

Deletions (Former Permit Conditions)

Former Permit Condition	Reason for Deletion or Change
Additional Requirement B.1	Requirement to submit an Impingement Mortality and Entrainment Characterization study has been met.
Additional Requirement B.2	Requirement to submit a Design Construction Technology Plan has been met.

Additions (New Permit Conditions)

New Permit Condition	Reason for Addition or Change
Additional Requirement B.5	Requirement to complete installation of BTA technologies by permit expiration (31 August 2012). (Formerly Additional Reporting requirements)
Additional Requirement B.6	Requirement to submit a contingency plan if fine mesh panels are determined to be not feasible, or if verification monitoring studies show that BTA performance requirements have not been met. (Formerly General Requirement)
Additional Requirement B.7	Renumbering of Additional Reporting

	Requirements from B.5 to B.7
Additional Requirement B.8	Renumbering of General Requirement from B.6 to B.8

10. References

ASA 2003. Evaluation of Cooling Water Intake System Alternatives for Fish Protection at the East River Generating Station Units No. 6 & 7. Phase 1 Report. Prepared for Consolidated Edison Company of New York, Inc. By ASA Analysis & Communication, Inc. October 2003.

ASA 2004. Evaluation of Cooling Water Intake System Alternatives for Fish Protection at the East River Generating Station Units No. 6 & 7. Phase 2 Report. Prepared for Consolidated Edison Company of New York, Inc. By ASA Analysis & Communication, Inc. December 2004.

Brosnan, T.M. and M. O'Shea. 1996. Long Term Improvements in Water Quality Due to Sewage Abatement in the Lower Hudson River. Estuaries 19(4): 890-900.

Con. Ed. 1996. East River Generating Station. Diagnostic Study Report. Prepared by Consolidated Edison Company of New York, Inc. Pursuant to the December 23, 1993 Order On Consent in DEC file No. R2-2985-90-04. June 30, 1996.

Con. Ed. 1999. Thermal Tolerance Assessment for East River Generating Station. Prepared by Consolidated Edison Company of New York, Inc. April 1999.

Normandeau Associates. 1994. East River Generating Station, Impingement and Entrainment Report: January Through December 1993. Prepared for Consolidated Edison Company of New York, Inc., by Normandeau Associates, Inc. April 1994.

Normandeau Associates. 2008. Intake Flow and Entrainment Through an Experimental Fine Mesh Intake Screen at East River Generating Station. Prepared for Consolidated Edison Company of New York, Inc., by Normandeau Associates, Inc. R-21359.000. December 2008

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