

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

Name of Facility: AES Cayuga LLC.
Owner/Operator: AES Cayuga LLC.
SPDES #: NY- 000 1333
Location: Tompkins County, New York
Town of Lansing
Cayuga Lake

1. Description of Facility

The AES Cayuga Generating Station is a 305 megawatt coal fired station, located along the east bank of Cayuga Lake, approximately 12.5 miles north of the lake's southern end. Constructed in the 1950's, the station withdraws a maximum 245 million gallons per day of lake water in a "once through" mode for condenser cooling. The intake structure consists of an 8 foot diameter pipe placed along the lake bottom to a point about 520 feet offshore in approximately 40 feet of water depth. The top half of last 14 feet of the pipe is cut away so that water is drawn in from both horizontal and vertical directions. A three inch bar grating covers the intake to keep large debris out of the pipe. At design flow, the intake velocity is approximately 3.4 feet per second. Cayuga Station does not have intake screens to keep debris from plugging the condenser tubes. Instead it uses a backflush capability to keep the condensers clear. Because there are no screens, conventional samples of fish impingement cannot be obtained. Cooling water is discharged at a maximum delta T of 18 degrees F, into a weir box at the lake shoreline (NYSEG 1975).

2. Ecological Resource

Cayuga Lake is located in the Oswego River drainage basin. The lake, carved out by glaciers, is oriented on a northwest-southeast axis and is 39 miles long, and averages 1.7 miles in width. Maximum lake width is 4 miles and maximum depth is 435 feet. The total surface area of the lake is 67 square miles and the total lake volume is 331 billion cubic feet. The lake bottom is steep sided along its east and west shorelines, with the north and south ends being relatively shallow (NYSEG 1975).

Cayuga Lake is considered to be oligotrophic, and has clear well oxygenated water at all depths. The lake is well noted for fine trout and salmon fishing. In the open water of the central lake basin, cold water species such as lake trout, rainbow trout, brown trout, chinook salmon, cisco and whitefish are found. Sculpin and burbot inhabit the deep bottom waters. The littoral region, located along the north and south ends and in a narrow zone along the lake's east and west shores, supports a warm water fishery. Northern pike, chain pickerel, largemouth bass and brown bullhead are important sport fish of the littoral zone. Other important warm and/or cool water species include smallmouth bass, yellow perch and panfish such as rockbass. Alewife, a major forage species in the lake, migrates to these inshore areas to spawn during June and July

(NYSEG 1975).

Cayuga Lake in the area of the station is designated a class AA(T) water. The best usage of Class AA waters are: a source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish (including trout), shellfish, and wildlife propagation and survival (NYSDEC 2008). The south basin of Cayuga Lake is currently on the Federal Clean Water Act Section 303(d) list of Impaired Waters due to excessive levels of phosphorous, silt/sediment and pathogens, originating from both municipal and non-point sources of pollution. For impaired waters, the state must develop a strategy to reduce the input of specific pollutant(s) in order to restore and protect the designated uses of the waterbody (NYSDEC 2008).

During several plant inspections in the 1980's, large numbers of gulls were observed feeding in the waters near the plant's cooling water discharge, suggesting that dead and injured fish were abundant at that location. However, due to the absence of intake screens, conventional samples of impinged fish could not be obtained, and the number of fish being killed by the station was uncertain.

In 1986-1987, a glass viewing port was installed in one condenser as a means to assess the numbers and species of fish entrained through the station. The study was conducted in conjunction with a hydro-acoustic study designed to describe fish distribution in the area of the offshore intake and possibly relate it to entrainment. Alewife and rainbow smelt were the most abundant species observed through the viewing ports, but due to a number of study limitations, no estimate of the number of fish entrained through the station was possible.

In 1992, the Department required, as part of the station's SPDES permit, an evaluation of a Strobe Light System (SLS) as a means to repel fish from stations intake. Strobe lights have been used with some success in guiding certain species of fish toward bypass sluices at hydroelectric stations. A pilot study was conducted in December 1993 and from April to August 1994. Partial netting of the cooling water discharge was used to estimate the number of fish entrained with the strobe lights either on or off. The study indicated that the lights seemed to repel some species and life stages of fish from the intake and that a more intensive study was warranted.

A full year evaluation of the SLS was conducted between December 1995 and November 1996. The goals of the study were to assess: 1) the abundance of fish species entrained through the station, and 2) the effectiveness of the SLS on a year round basis. Study results proved to be extremely variable. Seasonally, some species and life stages of fish were repelled while others were attracted. It was estimated that about 573,000 fish would have been entrained through the station over the one year period with the SLS off (the baseline impact). Alewife and rainbow smelt accounted for 79.8 % and 17.9 % of the total catch, respectively. The study concluded that an overall 40% reduction in the number of fish entrained was achieved when the SLS was in use, compared to when it was off. (Ichthyological Associates 1997).

An biological monitoring program was conducted in 2006. Sampling of both near shore and offshore fish populations were conducted with beach seines, hydroacoustic monitoring and bottom trawls. Ichthyoplankton samples were collected with plankton nets at both near and offshore locations, concurrently with pump collected entrainment samples. Adult and juvenile fish entrained through the station were sampled with a net deployed at the discharge structure. Results of the sampling program, having not yet been submitted to the Department, will be required as part of the SPDES permit.

3. Alternatives Evaluated

The following feasible technologies are to be evaluated at this facility:

1. Closed Cycle Cooling: full and partial retrofit
2. Wedge Wire Intake Screens
3. Variable Speed Pumps
4. Flow Management (including outages)
5. Traveling Intake Screens (including fine mesh panels)
6. Relocation of Intake

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. In keeping with the Department’s established, environmentally-protective BTA requirements for existing facilities with cooling water intake structures, an 80% reduction in impingement mortality and 60% reduction in entrainment, from full flow baseline level, 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 Department will determine the technology or combination of technologies and/or operational measures which are BTA for minimizing adverse environmental impacts from the cooling water intake structure(s).

6. Monitoring Requirements

Following approval of the schedule for implementing the alternative(s) 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. The plan details 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 No. 5 of the modified SPDES permit.

7. 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)

8. Summary of Proposed Permit Changes

Additions (New Permit Conditions)

New Permit Condition	Reason for Addition or Change
Biological Monitoring Requirement No. 1.	Requires submittal of an impingement and entrainment characterization (IM&E) study.
Biological Monitoring Requirement No. 2.	Requires submittal of a Design Construction Technology Plan (DCTP) which will assess potential BTA alternatives.
Biological Monitoring Requirement No. 3.	Requires submittal of a Proposed Suite of Technologies and Operational Measures (PSTOM), in which the applicant will propose the alternative(s), for Department approval, to achieve BTA for the facility’s cooling water intake.
Biological Monitoring Requirement No. 4.	Requires submittal of a Technology Installation and Operation Plan (TIOP) which contains the schedule for installing and implementing the Department approved BTA alternative(s).
Biological Monitoring Requirement No. 5.	Requires submittal of a Verification Monitoring Plan demonstrating performance of BTA measures and compliance with IM&E reduction requirements set forth in No. 3.
Biological Monitoring Requirement No. 6.	Requires submittal of a report, upon completion of the VMP, which demonstrates compliance with 6 NYCRR Part 704.5
Biological Monitoring Requirement No. 7.	Additional reporting requirement.
Biological Monitoring Requirement No. 8.	Additional reporting requirement.
Biological Monitoring Requirement No. 9.	Requires submittal of a report to assess cumulative reductions in impact achieved and potential to achieve further reductions.
Biological Monitoring Requirement No. 10.	General requirement which requires prior notification and approval by the Department before changes are made to the facility’s cooling water intake structure.

9. References

Ichthyological Associates, Inc. 1997. An Evaluation of Fish Entrainment and the Effectiveness of the Strobe Light Deterrent System at the Milliken Station on Cayuga Lake, Tompkins County, New York. Prepared for New York State Electric and Gas Corporation. Final Report, April 10, 1997.

NYSDEC. (2008). Part 701: Classifications-Surface Waters and Groundwaters. 701.5 Class AA fresh surface waters. dec.ny.gov. <http://www.dec.ny.gov/regs/4592.html#15990> (17 January 2008).

NYSDEC. (2008). The Draft New York State 2008 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy. dec.ny.gov. http://www.dec.gov/docs/water_pdf/303dlistdraft08.pdf (15 January 2008).

New York State Electric and Gas Corporation. 1975. Request for Alternate Thermal Effluent Limitations. Milliken Station Units 1 and 2. Volume 1. September 30, 1975.

Document prepared by Michael J. Calaban and last revised on 3 August 2009.