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October 25, 2000

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C99-F-1164

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Re: Case 99-F-1164: In the Matter of Southern Energy Bowline, L.L.C. Article X of the Application of Southern Energy Bowline, L.L.C., for a Certificate of Environmental Compatibility and Public Need to Construct and Operate a Nominal 750 Megawatt Combined Cycle Combustion Turbine Electric Generating Plant in Haverstraw, Rockland County, New York

Dear Presiding Examiner Lynch and Associate Examiner Casutto:

On August 25, 2000, Southern Energy Bowline L.L.C. provided a document entitled "SPDES Permit Application - BTA Analysis" to the Department of Environmental Conservation. Inadvertently, the document was not served on any other party. Enclosed is a copy of that document, which is being served on all parties to the proceeding.

Very truly yours,

COUCH WHITE, LLP

Barbara S. Brenner

Barbara S. Brenner

BSB/sem

Enclosure

cc: Attached Service List (w/enc.)

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CASE 99-F-1164
SOUTHERN ENERGY BOWLINE, L.L.C. ARTICLE X
SERVICE LIST

October 26, 2000

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SPDES PERMIT APPLICATION - BTA ANALYSIS

Introduction

Southern Energy Bowline, L.L.C. has proposed a mechanical draft (evaporative) cooling system for Bowline Unit 3. Based on the location of the Project on the Hudson River and the use of the slipstream from Bowline Units 1 and 2, Southern Energy believes that the mechanical draft cooling system reflects the best technology available ("BTA") for minimizing adverse environmental impacts.¹

Legal Standard

Section 316(b) of the Clean Water Act provides that:

Any standard established pursuant to section 1311 of this title or section 1316 of this title and applicable to a point source shall require that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

The New York State regulation, 6 NYCRR 704.5, provides that:

The location, design, construction and capacity of cooling water intake structures, in connection with point source thermal discharges, shall reflect the best technology available (BTA) for minimizing adverse environmental impacts.

In the Interim Decision, issued on June 2, 2000, pertaining to the Athens Generating Company SPDES Permit application, Commissioner John P. Cahill, on behalf of the New York State Department of Environmental Conservation ("NYSDEC"), stated that the issue of the

¹ Southern Energy has analyzed once - through cooling, mechanical draft (wet) cooling, hybrid (wet/dry) cooling, and air condenser (dry) cooling. The analysis is set forth in Attachment 2 to the Bowline Unit 3 SPDES Permit Application.

BTA for minimizing environmental impact is a site specific determination.² In the Interim Decision, he stated:

Preliminary, I find that the issue properly before me is much narrower than the intervenors assert. The issue as framed by the intervenors implies that should I find that dry cooling technology is BTA for cooling water intake structures, dry cooling is the only acceptable BTA for cooling water intake structures. This view is misguided. Given the site specific nature of BTA determinations, the veritable issue before me is whether the application of dry cooling technology for this project at the proposed location satisfies BTA.³

In the Interim Decision, citing Hudson Riverkeeper Fund, Inc. v. Orange and Rockland Utilities, Inc., 835F. Supp. 160 (S.D.N.Y.1993) Commissioner Cahill stated that:

Determining BTA for an individual facility is an 'issue of fact', which turns on a variety of factors including, inter alia cost, age of the facility, the number of fish killed, the additional energy, if any, needed to support improved technology, or other relevant concepts.⁴

Thus, in making a BTA determination the review is not limited to the impacts of the proposed technology only on aquatic species.⁵ Rather, the analysis must consider other relevant concepts, including the cost, additional energy usage required by the alternate technology and

² DEC No.: 4-1922-0005/00001, Athens Generating Company, LP SPDES Application, Interim Decision (June 2, 2000) at 11.

³ Id. (emphasis in the original)

⁴ Id. at 8.

⁵ Citing Parts 700 - 705 of the NYSDEC's regulations, Commissioner Cahill stated that the "adverse environmental impacts that must be minimized by the BTA standard relate to only potential water quality and aquatic resources." Interim Decision at 12, n.8. However, in Hudson Riverkeeper Fund, supra, the Court did not impose that limitation on the factors to be considered in determining BTA pursuant to Section 316 of the Clean Water Act.

the other impacts on the environment, including air quality, land use, and visibility. Based on these criteria, BTA for Bowline Unit 3 is mechanical draft cooling.

As set forth below, when all of the environmental impacts of alternative technologies are considered, wet cooling, utilizing the Bowline Unit 1 and Unit 2 discharge when those units are operating, is the BTA for minimizing adverse environmental impact.

Technology Selection

The proposed design for Bowline Unit 3 will utilize a mechanical draft cooling tower (wet cooling system). Given the "brownfield nature" of the Bowline Unit 3 site, the wet cooling system was selected for the following reasons:

- It reduces the footprint and overall "bulk" of the proposed facility when compared with installation of an air condenser cooling system. Limiting the overall size of the cooling alternative reduces the overall visual impacts of the development and enhances park expansion and recreational potential of land immediately north of the Facility.
- It maximizes electrical output compared to an air cooled condenser system, thereby minimizing air quality impacts and the net cost of power generation. With respect to net power output, the mechanical draft cooling system will increase plant output by an estimated 18.5 MW during the summer peak electrical demand season when compared to use of an air cooled condenser. Operating air cooled condensers impacts plant output in two ways: it requires an additional 6 to 8 MW of electricity to run the fans needed for cooling (i.e., increases in-plant electrical use) and increases the back pressure on the steam turbine when air

temperatures are elevated which reduces steam turbine output by 9 to 11 MW during the summer.

- It reduces the capital costs of the Facility by over \$21M when compared with installation of an air cooled condenser.
- It reduces the operating costs of the Facility over the life of the Facility.

Cooling Water Intake Structures

Intake Description

Cooling tower makeup requirements for Bowline Unit 3 are estimated to range from 6 to 7.5 million gallons per day (mgd). The primary source of cooling tower makeup requirements will be reuse of circulating water from the existing Bowline Unit 1 or Unit 2 discharge streams. When either Bowline Unit 1 or Unit 2 is operating, cooling tower makeup for Bowline Unit 3 will be obtained from the discharge side of the existing condensers. When Bowline Units 1 and 2 are offline, cooling tower makeup water will be obtained from a new intake constructed in Bowline Pond.

To minimize overall facility water needs, cooling tower demands will be augmented through recycle/reuse of several internal process waste streams. Process waste streams targeted for recycle/reuse include boiler blowdown, demineralizer rinse water, neutralized regenerant water, and water collected in Bowline Unit 3 floor drains and sumps.

Reuse of the discharge stream from Bowline Unit 1 and/or Unit 2 will not impact adversely the operating characteristics of the existing units. Adequate water supply is available through reuse during all seasons and under all modes of operation. As such, the reuse option, when available, will not increase cooling water withdrawals from the Hudson River over existing station use. In fact, based on application of the Multi-Area Production Cost Simulation Model (MAPS), an overall reduction in cooling water withdrawals from the Hudson can be expected following construction of Bowline Unit 3.

When Bowline Units 1 and 2 are offline, make up water for Bowline Unit 3 will be obtained from a new intake constructed adjacent to the existing intake in Bowline Pond. The new cooling water intake structure will be screened with 2 mm Johnson Company cylindrical vee-wire screens, or equivalent, (Johnson wedgewire) composed of a copper-nickel alloy. Two wedgewire screens will be mounted in a tee configuration at mid-depth within the water column. Each screen will be 42 inches in diameter and the overall length of the screened section will be 12 feet.

Intake Location

Bowline Point is located significantly downstream of the principal Hudson River spawning areas for American shad, striped bass, white perch, rainbow smelt, river herring (*Alosa* spp.), and shortnose sturgeon. This downstream geographical location limits entrainment impacts for the early life stages of these species because, on a riverwide basis, they are more concentrated in the upper reaches of the estuary. As organisms continue to grow and mature, swimming ability increases and the geographical distribution of early life stage larvae within the Hudson River increases. To a lesser extent, larvae also become less vulnerable to entrainment as they grow and develop.

Reuse of the discharge stream from existing Bowline Units 1 and 2 to satisfy cooling tower makeup requirements for Bowline Unit 3 optimally satisfies DEC and EPA criteria for selection of an intake location that minimizes potential impacts to aquatic resources. The reuse option effectively limits the withdrawal of water from the Hudson River, thereby avoiding impacts to fish migration routes, shellfish resources, and critical spawning areas. Because the existing cooling water withdrawals will not be increased when Bowline Units 1 and/or 2 are operating, there will be no additional impacts from impingement resulting from the operation of Bowline Unit 3.

The new intake will be located adjacent to the existing intake structure in Bowline Pond. The existing Bowline Units 1 and 2 cooling water intake pumps are located in an enclosed building on the northwest shoreline of Bowline Pond. Bowline Pond is a sheltered embayment off Haverstraw Bay having a surface area of 0.22 km² (54 acres). The inlet opening to the pond has a depth of 4.6 m (15 feet) below mean low water and a top width of approximately 73 m (240 feet). In the vicinity of the intake structure, the depth typically ranges between 9 and 11 m (30 to 36 feet). Bowline Pond has a maximum depth of approximately 12 m (40 feet).

The new intake pumps will be installed within the existing intake enclosure. This will preclude the need for construction of a new intake pump station along the shoreline. The intake will consist of a Johnson Wedgewire Screen (or equal) installed off the south side of the existing Bowline Units 1 and 2 intake structure. Locating the new intake adjacent to the existing intake structure avoids important spawning areas, fish migration routes, shellfish beds and other areas where aquatic life may be concentrated.

Intake Design

The new cooling water intake structure will be screened with 2 mm Johnson Company

cylindrical vee-wire screens (Johnson wedge-wire) or equivalent, composed of a copper-nickel alloy. Each screen measures approximately 1.4 m in length and 1.4 m in diameter. One pair of screens are mounted at mid-depth within the water column.

Use of a Johnson wedge-wire design (or equal) for the new intake is ideally suited for the Bowline Unit 3 project. Given the limited capacity requirements, the wedgewire screen offers a proven technology for Hudson River applications. Use of a 2 mm slot size has been found effective in limiting entrainment of larval fish greater than 15 mm total length. In addition, limiting through slot velocity to less than 0.5 fps limits the potential for impingement of aquatic life.

Johnson wedge-wire screening systems generally are designed to provide sufficient surface area to accommodate the required flow volumes at through slot velocities of 0.5 fps or less. The velocity of the water approaching the slots declines rapidly with increasing distance from the screen and becomes negligible at several inches from the surface of the water column. These low approach velocities make it easier for fishes to swim at velocities sufficient to escape the water intake point. Other design features, which influence the effectiveness of these particular systems, are the size of the slots, the orientation of the screens, and the relative velocities of the through slot and ambient currents. Each of the features of the Johnson screen, i.e. simple passive design, low intake velocity, vee-wire construction, smooth surfaces and *in situ* cleaning, are specifically designed to reduce the entrainment and impingement of fish and invertebrate species.

Construction

The proposed location will have minimal construction related impacts. Positioning the wedgewire intake pipe and screen off the southern façade of the existing structure effectively

minimizes loss of potential habitat associated with the intake structure; limits the potential for increased turbidity levels due to erosion of unprotected slopes, precludes the need for dredging operations and minimizes fill of aquatic areas associated with construction activities.

Intake Capacity

Bowline Unit 3 will recycle/reuse the discharge stream from Bowline Unit 1 and Unit 2 when they are operating. When either Bowline Unit 1 or Unit 2 is operating, Bowline Unit 3 will not need to draw additional Hudson River water for cooling water. Southern Energy performed an analysis using the Multi-Area Production Cost Simulation Model (MAPS). The MAPS simulations that were performed indicate that water withdrawal from the Hudson River will be reduced if Bowline Unit 3 is constructed.

Based on the MAPS runs, there are very few hours in the year that Bowline Unit 3 is projected to operate when neither Bowline Unit 1 nor Bowline Unit 2 is operating. Based on the MAPS simulations, in 2002, Bowline Unit 3 would operate only 174 hours, or 7.25 days, when neither Bowline Unit 1 nor Bowline Unit 2 were operating. Thus, it would draw water directly from the Hudson River only during that limited period of time. At all other times Bowline Unit 3 would be utilizing the discharge from Bowline Units 1 and/or Bowline Unit 2. In 2005, Bowline Unit 3 would not be using discharge water during 608 hours or 25 days. In 2010, Bowline Unit 3 would be operating 48 days when it would not be utilizing the Bowline Unit 1 and/or Bowline Unit 2 discharge.

The following table shows the distribution of hours of operation of Bowline Unit 3 without Bowline Unit 1 or Unit 2 operating:

**Hours of Operation of Bowline Unit 3
Without Bowline Units 1 or 2 Operating**

MONTH	2002	2005	2010
January	0	168	168
February	0	0	134
March	0	0	134
April	24	56	40
May	150	24	248
June	0	0	36
July	0	0	0
August	0	0	0
September	0	0	190
October	0	60	106
November	0	300	58
December	0	0	172
TOTAL	174	608	1152

Thus, the installation of an air condensor (dry) cooling system would reduce the use of water drawn directly from the Hudson River by Bowline Unit 3 during only 174 hours of the year in 2002 (2% of the year), 608 hours in 2005 (6.9%) and 1152 hours in 2010 (13.2%). During the other hours of operation of Bowline Unit 3, the use of a mechanical draft cooling system will not result in additional water being taken directly from the Hudson River because Bowline Units 1 and/or Unit 2 will be operating and Bowline Unit 3 will utilize their discharge water. The only reduction in water usage resulting from the installation of dry cooling at Bowline Unit 3 will be 6.6 gpm/MW of cooling water during the limited number of hours when neither Bowline Unit 1 nor Unit 2 is operating.

Additional Energy Needed to Support Dry Cooling

One of the factors that must be considered in determining BTA for a facility is the additional energy, if any, needed to support an alternative technology.⁶ The dry cooling system is not as efficient as the mechanical draft cooling system and will reduce the output and efficiency of Bowline Unit 3. The plant output and heat rate associated with wet and dry cooling systems were evaluated. GateCycle_{TM} power plant simulation software was utilized to determine the effects of output and heat rate using both technologies.

If Bowline Unit 3 utilizes dry cooling, the greatest loss of efficiency will occur at 87°F. The following table sets forth the net power output loss due to loss of efficiency of the steam turbine and parasitic electrical loads that will result from installing an air-cooled condenser at Bowline Unit 3:

Temperature	Decrease
40° F	-6.7 MW
59° F	-10.3 MW
87° F	-18.5 MW

It is important to note that dry cooling has the greatest plant net power decrease in the warm weather, which is when the southeastern area of New York State experiences its largest demand for electrical energy. Thus, at 87° F, there will be 18.5 MW less electricity to sell into the wholesale electricity market, if dry cooling is required. Because demand in the wholesale and retail electric markets will not experience a corresponding reduction, the additional electricity needed to meet demand probably will be generated by an older, less efficient generating facilities.

⁶ Interim Decision, supra, at 8.

Aquatic Impacts

A CMR analysis of the recycle/reuse of the once-through cooling water discharge stream from Bowline Units 1 and/or 2 was performed. The analysis evaluated potential impingement and entrainment related impacts of Bowline Unit 3 assuming cooling tower makeup water was obtained from the discharge from the existing Bowline Units 1 and 2, when they are online, and through the use of a new intake with a Johnson wedgewire screen when the existing units were off-line.

The analysis found that:

- There will be no impingement related losses attributable to operation of Bowline Unit 3 with recycle/reuse of effluent from the operation of existing Bowline Units 1 or 2;
- Based on operational experience in the Hudson River estuary, impingement related losses associated with use of an appropriately sized/designed Johnson wedgewire type screen having 2 mm openings and a through slot velocity less than 0.5 fps are negligible; and
- Based on operational experience in the Hudson River estuary, a 2 mm wedgewire screen having a through slot velocity less than 0.5 fps will effectively limit potential entrainment related impacts to organisms having a total length greater than 15 mm.

A. CMR Analysis

Southern Energy performed a CMR analysis for Bowline Unit 3. The Case 1 analysis assumes that Bowline Unit 3 is utilizing the Bowline Units 1 and 2 discharge. In the instance of Case 1, Bowline Unit 3 will withdraw water from the Bowline Unit 1 and/or Unit 2 cooling water discharge lines to satisfy cooling tower makeup requirements. Under Case 2, when Bowline Units 1 and 2 are off line, Bowline Unit 3 cooling tower make-up requirements will be met through the new cooling water intake structure. As indicated below, both average and worst case Scenario Unit 3 CMR₁₀₀ values were considerably less than those obtained from Bowline Units 1 and 2. Percent decreases range from 95-100 percent. When CMR values associated with average Case 1 CMR values are compared to worst-case Case 1 values, there was no significant change, despite an increased flow volume.

Average and Worst Case CMR (%) for Target Fishes

BOWLINE UNIT 3 CASE SCENARIOS					
Species	Bowline Units 1 and 2**	Unit 3 Average** (Case 1)	Unit 3 Worst*** (Case 1)	Unit 3 Average (Case 2)	Unit 3 Worst (Case 2)
White perch	0.21	0.0021	0.0024	0.0024	0.0028
Bay anchovy	3.39	0	0	0.0245	0.0286
River herring	0.10	0.0002	0.0002	0.00049	0.00057
American shad	0.01	0.00001	0.00001	0.000025	0.000029
Striped bass	0.63	0.0131	0.0151	0.0083	0.0096
Spottail shiner	0.41	0.02	0.023	0.02	0.0247
Atlantic tomcod	7.87	0.05	0.0579	0.03	0.0351

Data Source: DEIS 1999

* DESIGN values obtained from DEIS (1999) Table VI-1.

** Average Case 1 and 2 values incorporate 6.5 mgd and an Adj. Factor for eggs, YSL, and PYSL.

*** Worst Case 1 and 2 values incorporate 7.5 mgd and an Adj. Factor for eggs, YSL, and PYSL.

Average and worst-case Case 2 values were higher than Case 1 values for four of the seven species, while both striped bass and Atlantic tomcod decreased slightly under Case 2 and spottail shiner values remained virtually unchanged. Overall, changes in entrainment CMR by scenario vary only slightly by species. For example, the CMR values for striped bass ranged from 0.0083% (Case 2 average) to 0.0151% (Case 1 worst), yielding a total decrease Case 1 to Case 2 of only 0.0068%. Other species displayed similarly small CMR ranges amongst the different scenarios: white perch (0.0021%-0.0028%); American shad (0.00001-0.000029); river herring (0.0002%-0.00057%); and spottail shiner (0.02%-0.0247%). Bay anchovy exhibited the widest CMR range (0%-0.02%).

B. Equivalent Adult Loss Estimate

An equivalent adult loss analysis is a relatively simple technique used to translate the number of ichthyoplankton lost to entrainment into an estimate of the number of age 1 adults that would have resulted. The analysis was performed for white perch, striped bass, bay anchovy, river herring (Alewife) and American shad. Note that revisions to the equivalent adult loss estimates contained in Attachment 2 to the SPDES permit application for Bowline Unit 3 have been made. The revisions expand the analysis to include additional life stage data for some species and correct a spreadsheet programming error identified during subsequent review.⁷

Equivalent adult losses were estimated by coupling life stage specific Bowline Unit 3 CEMR estimates to the estimated 1991-1997 local population (i.e., a staged analysis was performed). Where sufficient data were available, the analysis considered eggs, yoke sack larvae (YSL), post yoke sac larvae (PYSL), and juveniles (JUV). The evaluation conservatively assumed a cooling

⁷ The species-specific CMR values were used for selected species to estimate the size of the local population were incorrect. Appropriate corrections have been made.

tower makeup requirement of 7.5 mgd.

Local population estimates were derived from intensive in-plant monitoring conducted from 1981 through 1987 and survey data collected by the utilities in support of the DEIS submitted for renewal of SPDES permits at the Roseton, Indian Point and Bowline Point Generating Stations (DEIS, 1999). These surveys included the Long River Survey (LRS), Fall Shoals Survey (FSS), and the Beach Seine Survey (BSS). The selection of a data set was species and life stage specific. For egg, YSL and PYSL life stages, the LRS data set was used. For JUV fishes a combination of all data sets was used.

The Equivalent Adult Loss calculation requires the estimated numbers of ichthyoplankton lost and estimates of life stage specific survival rates for each life stage entrained and for all subsequent life stages up to age (k) to estimate total adults lost:

$$N_k = \sum_i^k (S_i \times N_i)$$

where:

N_k = Equivalent number of organisms at age (k)

S_i = Total survival from life stage (i) to age (k)

N_i = Number of life stage (i) lost to entrainment/impingement

For this analysis, a matrix was set up that incorporated the estimated number lost and the survival fraction by life stage (Attachment 1). The number remaining at each successive life-stage was simply the product of the number present at the preceding life-stage and the survival

value for that life-stage. Where data were available, this calculation was performed for all life-stages. The total number of adults lost equals the sum of all adults lost from the entrainment of eggs, YSL, PYSL, and JUV.

The local population (1981-1987) was first estimated by life stage for each the target species by: (1) obtaining a mean of the Bowline Unit 1 and Unit 2 13-region CMR_{EST} values reported during the (1981-1987) sampling period; and (2) obtaining an average of the number of ichthyoplankton killed by entrainment by year during the (1981-1987) sampling period.

The estimated local population subject to entrainment-related impacts was then estimated using:

Local population (1981-1987) = Average # killed by year / Average Bowline Units 1 & 2 CMR fraction

The estimated local population subject to entrainment-related impacts during (1991-1997) was calculated as the product of the in-river abundance (1981-1987) and a scaling factor based on the ratio of (1991-1997) abundance estimates to (1981-1987) abundance estimates:

Local Population (1991-1997) = (In-river abundance 1981-1987) (Average abundance 1991-1997 / Average abundance 1981-1987)

Where earlier life stage data were not collected, a default ratio of 1.0 was assigned.

Projected mortality associated with the operation of Bowline Unit 3 was calculated as follows:

Estimated Life Stage Lost (Bowline 3) = (Local Population 1991-1997) (Unit 3 CMR Fraction)

Calculation sheets for each species are included in Attachment 1. Results of the analysis are summarized in the following table:

**Bowline Unit 3 Equivalent Adult Loss Estimates based on
Local Population Estimates for 1991-1997**

Species	Equivalent Adult Loss Estimate at 7.5 MGD	Notes
White perch	80	Life stage survival rates assumed identical to striped bass. Analysis applies to all life stages.
Bay Anchovy	0	Assumes 100% mortality in once-through cooling.
River herring (alewife)	192	Analysis applies to all life stages.
American shad	1	Analysis applies to PYSL and JUV.
Striped bass	199	Analysis applies to all life stages

Species-Specific Survival Values and Assumptions

Striped bass

Survival from EGG to YSL was 0.2520 (PSE&G, 1999); survival from YSL to PYSL was 0.1100; survival from PYSL to JUV was 0.006 (PSE&G, 1999); and survival from JUV to Adult was 0.103 (PSE&G, 1999).

White perch

Survival values for white perch were assumed to be similar to those of striped bass. This is based on the observation that the temperate basses are classed with the perches and as such are taxonomically linked. Survival from EGG to YSL was 0.2520 (PSE&G, 1999); survival from

YSL to PYSL was 0.1100; survival from PYSL to JUV was 0.006 (PSE&G, 1999); and survival from JUV to Adult was 0.103 (PSE&G, 1999).

American shad

The equivalent adult analysis was restricted to PYSL and JUV stages, because Bowline Unit 3 would be projected to result in a loss of only 0.58 eggs. Furthermore, no YSL were collected during either the entrainment sampling or the Long River Survey. Survival for PYSL was arbitrarily assumed to be 0.5. The survival value for JUV was estimated to be 0.0010 (PSE&G, 1999).

Bay anchovy

The survival value for eggs was 0.20 (ERC, 1998). The survival value for YSL was 0.08 (ERC, 1998). The survival for PYSL was 0.0123 (ERC, 1998). The survival value for JUV was estimated to be 0.1 (ERC, 1998).

Alewife

Survival values reported for the Atlantic silverside were used as a surrogate for alewife. The survival value for eggs was 0.411 (PSE&G, 1999). The survival value for YSL was 0.2383 (Log linear interpolation; LMS, 2000). The survival value for PYSL was 0.1372 (Log linear interpolation, LMS, 2000). The survival value used for JUV was 0.0655 (Log linear interpolation, LMS, 2000).

Air Emissions

Based on the MAPS run, with wet cooling, Bowline Unit 3 will reduce statewide NO_x, SO_x, and CO₂ emissions in New York State as follows:

Reduction in NO_x, SO_x and CO₂ Emissions With Bowline Unit 3 (in tons)

	2002	2005	2010
NO _x	3,300 (3.7%)	3,900 (4.6%)	3,400 (4.0%)
SO _x	7,200 (2.6%)	10,000 (3.9%)	8,480 (3.1%)
CO ₂	663,000 (1.0%)	672,999 (1.0%)	689,000 (1.0%)

With dry cooling, the reductions in NO_x, SO_x and CO₂ emissions will not be as significant. The 18.5 MW that will not be available for consumers at 87° F because of the inefficiency of dry cooling will have to be supplied by other generating facilities. Without rerunning the MAPS model, assuming the impact is linear and that the additional 18.5 MW would come from older generating facilities in the region, when dry cooling is compared to wet cooling, the loss of 18.5 MW could result in the following increases in air emissions (in tons):

	2002	2005	2010
NO _x	79.2	93.6	81.6
SO _x	172.8	240	203.5
CO ₂	15,912	16,152	15,536

Land Use

Land Use Requirements (in feet)

	Length	Width	Height
Mechanical Draft Cooling	600	60	53
Air-Cooled Condenser	320	200	120

The mechanical draft cooling tower proposed by Southern Energy would be located at the southeast end of the plant adjacent to the Hudson River (See Article X Application: Appendix 3A; Drawing G499-823-004). A conventional mechanical draft cooling tower is depicted on the drawing. The tower plan area for the mechanical draft cooling tower is 60 feet wide by 600 feet long by 53 feet tall (10 cells).

If an air cooled condenser were used it would have to be located adjacent to the turbine building. The air cooled condenser would be 320 feet long by 200 feet wide and 120 feet tall. The duct feeding the condenser would be 25 feet in diameter. An air cooled condenser needs to be in close proximity to the steam turbine in order to minimize pressure drop through the exhaust duct and minimize the exhaust duct run. This alternative would require a modification to the turbine building arrangement. The steam turbine would be relocated to the north side of the building and the air cooled condenser would be located north of the relocated steam turbine.

The air-cooled condenser, although not as long as the mechanical draft cooling system, would be far more visually intrusive to the local community. It would be more than three times as wide (200 feet vs. 60 feet) and more than twice as tall (120 feet vs. 53 feet) and clearly visible from Pecks Pond and the single-family homes located immediately west of the Project Site. The air-cooled condenser would be placed on the site approximately 800 and 1500 feet from the boundaries of Pecks Pond Park and the nearest residential property, respectively.

The additional land area requirements of an air-cooled condenser also may affect adversely Southern Energy's ability to allow Rockland County to develop a proposed County Park on a portion of the Bowline Generating Station Property. Even if adequate space would remain for development of the county park following construction of the air-cooled condenser, the condenser, which would be 120 feet in height, would be clearly visible from within the park. These concerns are avoided with mechanical draft cooling tower because of its location on the Bowline Generating Station property and its height, which is 53 feet. In response to the Staff of the Department of Public Service's first set of discovery requests, dated August 22, 2000, Southern Energy will provide drawings showing the site plan and required construction laydown areas for both wet and dry cooling systems, as well as drawings showing the location of the temporary construction and permanent terrestrial and aquatic habitats that would be disturbed or eliminated by the cooling systems.

Wetlands

The construction of the air-cooled condensers would result in significantly greater impacts to aquatic and wetland resource areas than the mechanical draft cooling condensers. The configuration of the air-cooled condensers would result in the filling of approximately 44,100 square feet (1.0 acres) of forested wetland. The siting of the water-cooled condensers results in limited filling of approximately 4,975 square feet (0.1 acres) of forested wetland. Thus, the air-cooled condensers would impact approximately 9 times more forested wetland than mechanical draft cooling. The impacts (1.0 acres) to the forested wetland would be direct and eliminate much of this 1.6 acre wetland area. In addition, the air-cooled condensers would result in an additional 30,500 square feet (0.7 acres) of direct and indirect impacts to the former stream channel of Minisceongo Creek.

The additional impacts to wetlands and aquatic habitats would result from the actual footprint of the air-cooled condensers, as well as the access driveway around the condensers. Although only a portion of the former stream channel of Minisceongo Creek would be impacted directly at two locations by the access drive, the placement of the condensers over the additional area of Minisceongo Creek would impact indirectly the functions and values provided by this aquatic habitat due to the loss of vegetation and disturbance associated with the operation of the condensers.

Visual Impacts

The potential visual impacts associated with Bowline Unit 3, including the proposed mechanical draft cooling tower, were evaluated in Section 10: Visual Resources, of the Project's Article X Application. The analysis concluded that Bowline Unit 3, with the proposed mechanical draft cooling tower, "will result in an incremental change in the appearance of the Bowline Generating Station Property but will not appreciably change or diminish the landscape quality of the region." The air cooled condenser would be significantly taller and wider than the mechanical draft cooling tower, and would be located on a portion of the Bowline Generating Station property in closer proximity to recreational and residential areas, it would have a more significant visual impact.

Costs

The capital costs of the air-cooled condenser are more than twice the costs of mechanical draft cooling.

Capital Costs

Mechanical Draft Cooling	\$18,880,000
Air-Cooled Condenser	\$40,592,000

The items included in the costs for the mechanical draft cooling tower include engineering, procurement and construction. The differences in cost of the technologies are mainly due to the increase in physical size, electrical equipment (switch gear and transformers), mechanical equipment (fans) and noise abatement equipment. The additional cost is wholly disproportionate to the environmental benefit of dry cooling.

Conclusion

Bowline Unit 3 will withdraw cooling water directly from the Hudson River only in a limited number of hours. Thus, the benefits of an air cooled condenser to the aquatic environment, if any, would be extremely small. In addition, dry cooling will have adverse effects on land use, wetlands, and air quality. Also, an air cooled condenser will have a more significant adverse impact on the viewshed than the proposed mechanical draft cooling system or a hybrid system. Thus, the recycle/reuse of the discharge stream from Bowline Units 1 and 2, when available, coupled with installation of a wedgewire screen intake in Bowline Pond for use when Bowline Units 1 and 2 are not available is the BTA for operation of Bowline Unit 3 at this site.

ATTACHMENT A

AMERICAN SHAD

Local Population (1981-1987)				
Mean Bowline 1&2 CMR (EST) (Fraction)	Lifestage	Average # Killed/Year (1981-1987)	Fraction of Total Numbers Killed (1981-1987)	Local Population (#)
0.0003714				
	EGG	20000	0.0710	
	YSL	None Collected	-	
	PYSL	231666	0.8220	
	JUV	30166	0.1070	
		281832		
	EGG			5.385E+07
	YSL			-
	PYSL			6.238E+08
	JUV			8.122E+07

Local Population (1991-1997)				
Sampling Methods/Units	Lifestage	Mean Abundance (1991-1997)	Mean Abundance (1981-1987)	Local Population (#)
Long River Survey				
Sum of Weighted Average #/m^3	EGG	Insufficient data (1=default)	Insufficient data (1=default)	5.385E+07
Sum of Weighted Average #/m^3	YSL	none collected	none collected	-
Sum of Weighted Average #/m^3	PYSL	0.30	0.60	3.119E+08
Beach Seine Survey	JUV	11.23	14.70	6.205E+07
Average Number/100' seine haul (Aug-Oct)				

CASE 1 (7.5 MGD)			
Estimated Mortality (1991-1997)	Lifestage	Unit 3 CMR by Lifestage	# Killed
	EGG	1.080E-08	5.816E-01
	YSL	none collected	-
	PYSL	1.150E-07	3.587E+01
	JUV	1.410E-08	8.749E-01

AMERICAN SHAD (Case 1)(7.5 MGD)

ENTRAINMENT LOSSES

Life Stage	# Killed	Survival
EGGS	1	NA
YSL	none collected	NA
PYSL	36	0.50
JUV	1	0.00

EQUIVALENT ADULT LOSS CALCULATION

Life Stage	EGGS	YSL	PYSL	JUV
EGGS	NA			
YSL		none collected		
PYSL			36	
JUV			18	1
AGE 1+			0	0
Total Adults Lost			0.019	

BAY ANCHOVY

Local Population (1981-1987)

Mean Bowline 182 CMR (EST) (Fraction)

0.031714

Lifestage Average # Killed/Year (1981-1987)

Fraction of Total Numbers Killed (1981-1987)

Local Population (#)

EGG 70857
YSL 65857
PYSL 76571428
JUV 917143
77625285

0.0091
0.0008
0.9784
0.0117

2.234E+06
2.077E+06
2.414E+09
2.892E+07

Local Population (1981-1987)

Sampling Methods/Units

SEE NOTE 1 BELOW

Lifestage

Mean Abundance (1981-1987)

Mean Abundance (1981-1987)

Local Population (#)

Long River Survey

EGG Insufficient data (1=default)
YSL Insufficient data (1=default)

Insufficient data (1=default)
Insufficient data (1=default)

2.234E+06
2.077E+06

Weighted Average #/m³

PYSL 12.49

1.58

1.833E+10

Fall Shoals Survey

JUV 149.54

29.70

1.456E+08

Weighted Average #/1000 m³

CASE 1 (7.5 MGD)

Estimated Mortality (1981-1987)

Lifestage

Unit 3 CMR by Lifestage

Killed

EGG 0.000E+00
YSL 0.000E+00
PYSL 0.000E+00
JUV 0.000E+00

0.000E+00
0.000E+00
0.000E+00
0.000E+00

NOTE 1: A default value of 1 assumes that the local population can be estimated using 1981-1987 data.

BAY ANCHOVY (CASE 1) (7.5 MGD)

ENTRAINMENT LOSSES

Life Stage	# Killed	Survival
EGGS	0	0.25
YSL	0	0.08
PYSL	0	0.01
JUV	0	0.1

EQUIVALENT ADULT LOSS CALCULATION

Life Stage	EGGS	YSL	PYSL	JUV
EGGS	0			
YSL	0	0		
PYSL	0	0	0	
JUV	0	0	0	0
AGE 1+	0	0	0	0
Total Adults Lost			0	

ALEWIFE

Local Population (1981-1987)				
Mean Bowline 1&2 CMR (EST) (Fraction)	Lifestage	Average # Killed/Year (1981-1987)	Fraction of Total Numbers Killed (1981-1987)	Local Population (#)
0.0009571				
	EGG	34000	0.0031	
	YSL	41000	0.0037	
	PYSL	10957143	0.9892	
	JUV	45142	0.0041	
	EGG			3.552E+07
	YSL			4.284E+07
	PYSL			1.145E+10
	JUV			4.717E+07

Local Population (1991-1997)				
Sampling Methods/Units	Lifestage	Mean Abundance (1991-1997)	Mean Abundance (1981-1987)	Local Population (#)
SEE NOTE 1 BELOW				
	EGG	insufficient data (1=default)	insufficient data (1=default)	3.552E+07
	YSL	insufficient data (1=default)	insufficient data (1=default)	4.284E+07
Beach Seine Survey	PYSL	insufficient data (1=default)	insufficient data (1=default)	1.145E+10
Average Number/100' seine haul (Aug-Oct)	JUV	1.31	1.34	4.611E+07

CASE 1 (7.5 MGD)			
Estimated Mortality (1991-1997)	Lifestage	Unit 3 CMR by Lifestage	# Killed
	EGG	7.100E-09	2.522E-01
	YSL	8.500E-09	3.641E-01
	PYSL	2.150E-08	2.461E+04
	JUV	8.200E-09	3.761E-01

NOTE 1: A default value of 1 assumes that the local population can be estimated using 1981-1987 data.

(ALEWIFE)(CASE 1) (7.5 MGD)

ENTRAINMENT LOSSES

Life Stage	# Killed	Survival
EGGS	0	0.4
YSL	0	0.2383
PYSL	24610	0.13
JUV	0	0.06

EQUIVALENT ADULT LOSS CALCULATION

Life Stage	EGGS	YSL	PYSL	JUV
EGGS	0			
YSL	0	0		
PYSL	0	0	24610	
JUV	0	0	3199	0
AGE 1+	0	0	192	0

Total Adults Lost **192**

STRIPED BASS

Local Population (1981-1987)

Mean Bowline 1&2 CMR (EST) (Fraction)	Lifestage	Average # Killed/Year (1981-1987)	Fraction of Total Numbers Killed (1981-1987)	Local Population (#)
0.008171	EGG	3743	0.0008	
	YSL	1292857	0.2768	
	PYSL	3271429	0.7005	
	JUV	101857	0.0218	
	EGG			4.581E+05
	YSL			1.582E+08
	PYSL			4.004E+08
	JUV			1.247E+07

Local Population (1991-1997)

Sampling Methods/Units	Lifestage	Mean Abundance (1991-1997)	Mean Abundance (1981-1987)	Local Population (#)
Long River Survey				
Sum of Weighted Average #/m ³	EGG	3.35	0.11	1.395E+07
Sum of Weighted Average #/m ³	YSL	4.43	0.57	1.230E+09
Sum of Weighted Average #/m ³	PYSL	7.90	1.08	2.929E+08
Sum of Weighted Average #/m ³	JUV	24.50	29.70	1.028E+07

CASE 1 (7.5 MGD)

Estimated Mortality (1991-1997)	Lifestage	Unit 3 CMR by Lifestage	# Killed
	EGG	1.218E-07	1.699E+00
	YSL	4.207E-05	5.173E+04
	PYSL	1.064E-04	3.117E+05
	JUV	2.960E-06	3.043E+01

STRIPED BASS (Case 1)(7.5 MGD)

ENTRAINMENT LOSSES

Life Stage	# Killed	Survival
EGGS	2	0.25
YSL	51730	0.11
PYSL	311700	0.006
JUV	30	0.103

EQUIVALENT ADULT LOSS CALCULATION

Life Stage	EGGS	YSL	PYSL	JUV
EGGS	2			
YSL	0	51730		
PYSL	0	5690	311700	
JUV	0	34	1870	30
AGE 1+	0	4	193	3

Total Adults Lost

199

WHITE PERCH

Local Population (1981-1987)		Average # Killed/Year (1981-1987)		Fraction of Total Numbers Killed (1981-1987)	Local Population (#)
Mean Bowline 1&2 CMR (EST) (Fraction)		Lifestage			
0.00355		EGG		0.2304	
		YSL		0.0427	
		PYSL		0.7179	
		JUV		0.0090	
		EGG			5.231E+08
		YSL			9.898E+07
		PYSL			1.830E+09
		JUV			2.044E+07

Local Population (1991-1997)		Mean Abundance (1991-1997)		Mean Abundance (1981-1987)	Local Population (#)
Sampling Methods/Units	Lifestage				
Long River Survey					
Sum of Weighted Average #/m^3	EGG	0.52		1.47	1.851E+08
Sum of Weighted Average #/m^3	YSL	0.59		0.87	8.540E+07
Sum of Weighted Average #/m^3	PYSL	3.96		4.66	1.385E+09
Sum of Weighted Average #/m^3		3.40		7.66	9.074E+06
Beach Seine Survey					
Average Number/100' Seine Haul (Aug-Oct)	JUV				

CASE 1 (7.5 MGD)		Unit 3 CMR by Lifestage		# Killed
Estimated Mortality (1991-1997)		Lifestage		
		EGG		1.065E+03
		YSL		9.113E+01
		PYSL		2.392E+04
		JUV		1.830E+00

WHITE PERCH (CASE 1) (7.5 MGD)

ENTRAINMENT LOSSES

Life Stage	# Killed	Survival
EGGS	1065	0.25
YSL	91	0.11
PYSL	23920	0.006
JUV	2	0.5

EQUIVALENT ADULT LOSS CALCULATION

Life Stage	EGGS	YSL	PYSL	JUV
EGGS	1065			
YSL	266	91		
PYSL	29	10	23920	
JUV	15	0	144	2
AGE 1+	7	0	72	1

Total Adults Lost

80