8.0 ENVIRONMENTAL IMPACTS OF ALTERNATIVES TO LICENSE RENEWAL

This chapter examines the potential environmental impacts associated with (1) the closed-cycle cooling system alternatives to replace the Indian Point Nuclear Generating Unit No. 2 (IP2) and Unit No. 3 (IP3) existing once-through cooling-water systems, (2) denying the renewal of both operating licenses for IP2 and IP3 (i.e., the no-action alternative), (3) replacing the electric generation capacity of both units with alternative electric-generation sources, (4) importing electric power from other sources to replace power generated by IP2 and IP3, and (5) combinations of generation and conservation measures to replace power generated by IP2 and/or IP3. In addition, this chapter discusses other alternatives that were deemed unsuitable for replacement of power generated collectively by IP2 and IP3.

The U.S. Nuclear Regulatory Commission (NRC) staff considered alternatives to the existing IP2 and IP3 cooling-water systems because the New York State Department of Environmental Conservation (NYSDEC) identified closed-cycle cooling (e.g., cooling towers) as the best technology available (BTA) to reduce fish mortality in the draft New York State Pollutant Discharge Elimination System (SPDES) discharge permit (NYSDEC 2003a). These alternatives are described in Section 8.1 of this draft supplemental environmental impact statement (SEIS). IP2 and IP3 have been operating under timely renewal provisions of the New York SPDES permit process since 1992. In 2003, NYSDEC issued a draft SPDES permit for public comment, including the BTA determination. The requirements, limits, and conditions of the draft SPDES permit had not been finalized at the time the NRC staff performed the assessment presented in this draft SEIS,.

The environmental impacts of alternatives are evaluated using the NRC's three-level standard of significance—SMALL, MODERATE, or LARGE—developed based on the Council on Environmental Quality (CEQ) guidelines and set forth in the footnotes to Table B-1 of Appendix B to Subpart A, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," of Title 10, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," of the *Code of Federal Regulations* (10 CFR Part 51). The following definitions are used for each category:

> SMALL—Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

> MODERATE—Environmental effects are sufficient to alter noticeably, but not to destabilize important attributes of the resource.

> LARGE—Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The impact categories evaluated in this chapter are the same as those used in NUREG-1437, Volumes 1 and 2, "Generic Environmental Impact Statement for License Renewal of Nuclear Plants" (hereafter referred to as the GEIS) (NRC 1996, 1999)[1] with the additional impact

[1] The GEIS was originally issued in 1996. Addendum 1 to the GEIS was issued in 1999. Hereafter, all references to the GEIS include the GEIS and its Addendum 1.

categories of environmental justice and transportation.

8.1 Alternatives to the Existing IP2 and IP3 Cooling-Water System

IP2 and IP3 currently use once-through cooling-water systems that withdraw water from and discharge water to the Hudson River as described in Section 2.1.3 of this draft SEIS. The circulating water systems for IP2 and IP3 include two intake structures, each containing seven pumps. The normal design flow rate of 3,180,000 liters per minute (lpm) (840,000 gallons per minute (gpm)) for each unit is achieved using dual-speed pumps for IP2 and variable-speed pumps for IP3.

Warm discharge water from IP2 and IP3 flows from the condensers through six pipes that are 2.4 meters (m) (96 inches (in.)) in diameter and exits beneath the water surface into a discharge canal 12 m (40 feet (ft)) wide. Water flows from the discharge canal to the Hudson River through an outfall structure located south of IP3 at a discharge velocity of about 3.7 meters per second (mps) (10 feet per second (fps)). The design of the outfall is intended to reduce the thermal impact the warm water has on the river. An assessment of the impacts of the current cooling-water system on the environment is presented in Section 4.1 of this draft SEIS.

Surface water withdrawals and discharges at IP2 and IP3 are regulated under the New York SPDES permit program. In 1975, the U.S. Environmental Protection Agency (EPA) issued National Pollutant Discharge Elimination System (NPDES) permits for the facility. Subsequently, the NYSDEC issued an SPDES permit for the facility in 1987. In 1992, a timely renewal application was filed with the NYSDEC, and terms of the 1992 SPDES have been continued under provisions of the NY State Administrative Procedure Act. Petitioners commenced proceedings in 2002 to mandate that the NYSDEC act on the SPDES permit renewal application. On April 8, 2003, the NYSDEC proposed to modify the SPDES permit to require that IP2 and IP3 reduce the impacts to aquatic organisms caused by the once-through cooling systems and that Entergy Nuclear Operations, Inc. (Entergy), complete a water quality review. A draft SPDES permit identifying closed-cycle cooling as the BTA was issued on November 14, 2003 (NYSDEC 2003a).

The draft SPDES permit requires that immediate and long-term steps be taken to reduce the adverse impacts on the Hudson River estuary once the permit is issued (NYSDEC 2003a). The short-term steps include mandatory outage periods, reduced intake during certain times, continued operation of fish-impingement mitigation measures, the payment of $25 million to a Hudson River Estuary Restoration Fund, and various studies. In the long term, IP2 and IP3 will have to implement the BTA to minimize environmental impacts to the aquatic ecology. Should the BTA determination in the draft SPDES permit go into effect, final implementation of the BTA is subject to NRC's approval only insofar as the NRC oversees the plant's safety performance and ability to cool itself. Based on NYSDEC's fact sheet addressing the draft SPDES permit, NYSDEC will not require closed cycle cooling if IP2 and IP3 do not receive renewed licenses from the NRC (NYSDEC 2003c).

Specifically, the draft SPDES permit states the following:

> Within six months of the effective date of this permit, the permitee must submit to the NYSDEC…its schedule for seeking and obtaining, during its permit term, all necessary approvals from the NRC, Federal Energy Regulatory Commission

(FERC), and other government agencies to enable construction and operation of closed-cycle cooling at Indian Point.

NYSDEC (2003a) has also indicated that an alternative technology or technologies may be proposed for IP2 and IP3 within 1 year of the permit's effective date. These technologies must be able to minimize the adverse environmental impacts to a level equivalent to that achieved by a closed-cycle cooling system at IP2 and IP3 (NYSDEC 2003b).

The NYSDEC identified construction and operation of a closed-cycle cooling system at IP2 and IP3 as its preferred alternative to meet current national performance standards for impingement and entrainment losses. Entergy indicates that Entergy or its predecessors have proposed and NYSDEC has rejected the following alternative cooling technologies as described in the IP2 and IP3 ER (Entergy 2007). As a result, these options are not discussed further in this draft SEIS.

- Evaporative ponds, spray ponds, or cooling canals all require significantly more land area than exists at the site.
- Dry cooling towers, which rely totally on sensible heat transfer, lack the efficiency of wet or hybrid towers using evaporative cooling, and thus require a far greater surface area than is available at the site. Additionally, because of their lower efficiency, dry towers are not capable of supporting condenser temperatures necessary to be compatible with IP2 or IP3 turbine design and, therefore, are not a feasible technology.
- Natural draft cooling towers, while potentially feasible, would be 137 to 152 m (450 to 500 ft) above ground level with significant adverse aesthetic impacts in an important viewshed corridor. This option also would raise plume-related and sound effects concerns. In the original EPA permitting proceeding, New York State opposed natural draft cooling towers on aesthetic grounds.
- Single-stage mechanical-draft wet cooling towers for a number of reasons including, but not limited to, the dense water vapor plumes that may compromise station operations (including visual signaling) and equipment over time, and result in increased noise (Enercon 2003).

The EPA has concluded that, in some circumstances, retrofitting a plant to a closed-cycle cooling system lacks demonstrated feasibility or economic practicality (EPA 2004). In addition, Entergy asserts that retrofitting facilities the size and configuration of IP2 and IP3 with a closed-cycle cooling system is neither tried nor proven (Entergy 2007). Entergy also considers mitigation measures currently implemented to protect aquatic wildlife as part of the once-through cooling system to be adequate in terms of minimizing impacts from current operations and operations during the license renewal period (Entergy 2007).

Entergy expressed a number of concerns regarding financial or technical issues related to a closed-cycle cooling retrofit (Entergy 2007), including high cost, a lengthy forced outage, and lost power output due to parasitic losses from new cooling system components. In the Hudson River Utilities FEIS, NYSDEC indicated that the previous owners' closed-cycle cooling cost estimates were likely generally reasonable (NYSDEC 2003d), while EPA indicated that costs may have been somewhat inflated (EPA 2004). EPA also indicated some uncertainty with regard to outage duration for the plant retrofit.

Entergy notes that replacement power during the outage may carry negative air quality impacts, and that the outage may have negative impacts on electric-system reliability and market pricing.

Finally, Entergy indicates that closed-cycle cooling would result in a loss of generating capacity due to lowered thermal efficiency and parasitic loads related to cooling system pumps and auxiliary systems (an average annual loss of 26 MW(e), per unit) because of power demands of the closed-cycle system (Entergy 2007).

In the following chapter, the NRC staff will evaluate the environmental impacts associated with installing a closed-cycle cooling system at Indian Point, as well as the environmental impacts associated with a potentially-equivalent combination of plant modifications and restoration activities. Regardless of the NRC staff's findings, the NRC does not have the regulatory authority to implement the requirements of the Clean Water Act , and it is not up to the NRC staff to judge the validity of Entergy's or others' claims in the ongoing NYSDEC SPDES permit process. The NRC staff, however, notes that both NYSDEC (2003b) and EPA (2004) indicated that estimates for cooling conversion by the previous owners of IP2 and IP3 overestimated a variety of costs and selected a more-expensive technology than was necessary. Further, EPA (2004) indicated that Entergy's outage duration was likely exaggerated.

In 2004, EPA issued regulations for reducing impingement and entrainment losses at existing electricity-generating facilities (EPA 2004). These regulations, know as the Phase II rule, established standards for compliance with the requirements of Section 316(b) of the Clean Water Act (CWA), which calls for intake structures to reflect the BTA for minimizing adverse environmental impact. The EPA's Phase II rule established two compliance alternatives that reduce impingement mortality by 80 to 95 percent of baseline and reduce organism entrainment by 60 to 90 percent of baseline (EPA 2004). These regulations supported the requirements of the draft New York SPDES permit's requirement that immediate and long-term steps be taken to minimize adverse impacts on the Hudson River estuary.

The EPA's rules concerning Phase II of Section 316(b) of the CWA were struck down by the U.S. Court of Appeals in the Second Circuit in January, 2007. The Court also mandated the conduct of a cost-benefit analysis under Section 316(b) of the CWA. That decision is currently on appeal before the U.S. Supreme Court. Specifically, the EPA suspended 40 CFR Part 122.2(r)(1)(ii) and (5) and Subpart J, "Requirements Applicable to Cooling Water Intake Structures for Phase II Existing Facilities Under Section 316(b) of the Act," of 40 CFR Part 125, "Criteria and Standards for the National Pollutant Discharge Elimination System," with the exception of 40 CFR 125.90(b) (EPA 2007). However, the issued SPDES permit remains in effect, pending the conclusion of related administrative and legal proceedings.

8.1.1 Closed-Cycle Cooling Alternative

As indicated in Section 8.1, NYSDEC identified closed-cycle cooling as a BTA in its 2003 draft SPDES permit (NYSDEC 2003a, 2003c). Entergy's preferred close-cycle alternative consists of two hybrid mechanical-draft cooling towers (Enercon 2003, Entergy 2007). IP2 and IP3 would each utilize one cooling tower. Entergy rejected single-stage mechanical draft cooling towers, indicating that the dense water vapor plumes from the towers may compromise station operations (including visual signaling) and equipment over time, and single-stage towers may result in increased noise (Enercon 2003).

Entergy asserts that a hybrid mechanical-draft cooling tower system, also referred to as a "wet/dry" or "plume-abated" mechanical-draft cooling tower, addresses some of the shortcomings of the cooling system types described in Section 8.1 (Entergy 2007). In the ER, Entergy indicates that hybrid towers are "appreciably more expensive" than single-stage towers (2007).

A hybrid tower consists of a standard efficiency wet tower segment combined with a dry heat exchanger section above it. The dry section eliminates visible plumes in the majority of atmospheric conditions. After the plume leaves the lower "wet" section of the tower, it travels upward through a "dry" section where heated, relatively dry air is mixed with the plume in the proportions required to achieve a nonvisible plume. Because of the "dry" section, which is on top of the "wet" section, hybrid towers are slightly taller than comparable wet towers and require a larger footprint (Entergy 2007). Hybrid towers are also appreciably more expensive, both in initial costs and in ongoing operating and maintenance costs (Entergy 2007). A potential exists for increased noise from additional fans in the dry section, although Entergy indicates that sound effects can be attenuated (Entergy 2007).

Portions of the site where Entergy could construct cooling towers are heavily forested, with rocky terrain and some steep slopes. Entergy indicates that these areas can be more environmentally sensitive and costly to build on.

The NRC staff has previously assessed closed cycle cooling with a hybrid cooling tower in the license renewal SEIS for Oyster Creek Nuclear Generating Station (OCNGS) (NRC 2006). The NRC staff finds that a hybrid cooling tower system is a reasonable design for the purpose of evaluating potential environmental impacts in a NEPA document. However, the NRC staff does not intend for this analysis to prejudice potential requirements imposed by NYSDEC or other authorities.

Should hybrid towers prove prohibitively expensive (as determined by other, non-NRC authorities), the NRC staff notes that single-stage mechanical draft towers will produce similar decreases in impacts to aquatic life and may result in less land-clearing or blasting debris than the hybrid cooling tower option. Additionally, single-stage towers will be shorter, though plumes in cool or highly-saturated atmospheric conditions will impose slightly greater aesthetic impacts as well as creating greater deposition of ice or dissolved solids near the towers than the circular, hybrid towers proposed by Entergy would cause.

8.1.1.1 Description of the Closed-Cycle Cooling Alternative

As described in the ER (Entergy 2007), new hybrid cooling towers would be large, approximately 170 m (560 ft) in diameter and 46 to 50 m (150 to 165 ft) high. To provide construction access for tower erection and clearance for air intake, the excavation diameter for each tower would be approximately 700 ft. The locations for the IP2 and IP3 towers are expected to be approximately 305 m (1000 ft) north of the IP2 reactor and approximately 305 m (1000 ft) south of the IP3 reactor, respectively. A detailed description of a round hybrid cooling tower conceptual design is presented in the 2003 cooling tower evaluation (Enercon 2003). Crews excavating areas for the cooling tower basins and associated piping may need to blast substantial amounts of rock during the construction process.

As noted in Section 8.1, the closed-cycle cooling alternative would introduce parasitic losses from additional pumps and other equipment. The new circulating pumps would likely be housed in a new pumphouse located along the discharge canal (Enercon 2003). The new, enclosed pumphouse would supply circulating water to the new towers via two concrete-lined steel pipes 3 m (10 ft) in diameter. Flow from the cooling tower basin to the condenser is expected via two pipes 3.7 m (12 ft) in diameter (Enercon 2003).

Enercon also reported that two dedicated substations would likely supply electricity to the closed-cycle cooling system from the 138-kilovolt (kV) offsite switchyard. The substation transformers, switch gear, and system controls for each tower and pumphouse would be housed in prefabricated metal buildings (Enercon 2003).

8.1.1.2 Environmental Impacts of the Closed-Cycle Cooling Alternative

In this section, the NRC staff addresses the impacts that would occur if Entergy constructs and operates the closed-cycle cooling system described in Section 8.1.1.1. The NRC staff summarizes anticipated impacts of the closed-cycle cooling alternative summarized in Table 8-1. In the areas of land use, terrestrial ecology, waste, and aesthetics, the environmental impacts of constructing and operating this closed-cycle cooling system would be greater than the impacts associated with the existing once-through cooling system, primarily due to construction-stage impacts. The closed-cycle cooling alternative significantly reduces impacts to aquatic ecology, including impacts from entrainment, impingement, and heat shock. Impacts to aquatic threatened and endangered species are also likely to decline. In the following sections, the NRC staff presents the potential environmental impacts of installing and operating a closed-cycle cooling alternative at Indian Point. The NRC staff addresses impacts for each resource area.

- **Land Use**

Construction of hybrid mechanical-draft cooling towers would entail significant clearing and excavation of the currently timbered areas within the IP2 and IP3 exclusion area. Each cooling tower requires an excavated area of approximately 3.6 hectares (ha) (9 acres (ac)). Ultimately, approximately 16 ha (40 ac), most of which is presently wooded (though previously disturbed; ENN 2007), would need to be cleared for the two cooling towers, access roads, and support facilities (Enercon 2003). The towers would be located within the property exclusion area boundary adjacent to existing facilities as described in Section 8.1.1.1.

Entergy indicates that roughly 305 m (1000 ft) of river bank would be clear-cut and excavated to allow for the installation of the four large-diameter water pipes (two 3-m-diameter supply pipes and two 3.7-m-diameter pipes to each condenser) required for each tower (Entergy 2007). In addition, Enercon reports that the base of each tower would be constructed on bedrock at an elevation of about 9.1 m (30 ft) above mean sea level. This would entail the removal of approximately 2 million cubic yards (cy) (1.5 million cubic meters (m^3)) of material, primarily rock and dirt, using traditional excavation methods as well as a significant amount of blasting (Entergy 2007). Disposal of 2 million cy (1.5 million m^3) of material from the excavations for the cooling towers may create offsite land use impacts. Excavated material also may be recycled or reused, which would reduce these impacts.

Entergy's proposed IP3 cooling tower would be located in the permanent right-of-way (ROW) easement granted to the Algonquin Gas Transmission Company (AGTC) for constructing, maintaining, and operating the three natural gas pipelines that traverse the IP2 and IP3 site (Entergy 2007). These pipelines transport natural gas under the Hudson River, across the IP2 and IP3 site, and exit the site between Bleakley Avenue and the Buchanan substation (see

Figure 2-3 in Chapter 2 of this SEIS for a graphical representation).

Entergy indicates that ROW easement agreement calls for AGTC to relocate the pipelines at Entergy's request. The Federal Energy Regulatory Commission (FERC) would first have to review and approve any such action. Entergy must also provide a suitable location for the pipeline on its land or land that it has acquired (Entergy 2007). Entergy indicates that pipeline relocation may require blasting and could also require Entergy to purchase additional land adjacent to the IP2 and IP3 site if onsite areas aren't suitable for the pipeline (Entergy 2007). Feasibility studies and other regulatory approvals may also be necessary (Enercon 2003).

The IP2 and IP3 site is within New York's Coastal Zone. As indicated in Chapter 2, the IP2 and IP3 site is located adjacent to a Significant Coastal Fish and Wildlife Habitat. Construction activities, such as grading, excavating, and filling, would require a coastal erosion management permit. Permitting restrictions would influence the construction of the cooling towers but they would not likely prevent Entergy from building the towers.

Excavation for the cooling towers would cut into the side of the hills east of IP2 and IP3, resulting in the removal of approximately 2 million cy of material, including significant rock as well as dirt (Entergy 2007).

The NRC staff concludes that construction activities associated with cooling tower installation at IP2 and IP3 would result in SMALL to LARGE land use impacts, depending largely on how much material Entergy is unable to reuse or recycle, and where Entergy disposes of excavated material that cannot be reused or recycled.

- **Ecology**

Aquatic ecology. Land-clearing and construction activities can cause short-term, localized impacts on streams and rivers from increased site runoff. These impacts are generally mitigated through the use of erosion and sediment controls. Because of the size of the construction area needed for the cooling towers at the IP2 and IP3 site, such measures would be necessary to limit erosion and sediment deposition in the Hudson River. Construction impacts, however, would be relatively short-lived, and would be offset to some degree by reduced water consumption during prolonged outages at IP2 and IP3 when Entergy or its contractors would connect the closed-cycle cooling system to the units.

Following construction, the closed-cycle cooling alternative will significantly reduce operational impacts compared to the current once-through cooling system. During the summer months, when water use is at its highest, service and cooling tower makeup water would be withdrawn at a rate of approximately 250,000 to 314,000 lpm (66,000 to 83,000 gpm) for the combined needs of IP2 and IP3. This would be a 93-to-95-percent reduction in water use compared to the existing IP2 and IP3 once-through systems, which have a normal design flow rate of 3,200,000 lpm (840,000 gpm) for each unit. Without modifications to the intake screening technologies, the NRC staff assumes that the reduction in water intake results in an equivalent reduction in entrainment and impingement. The staff concludes that this significant reduction in water demand would likely result in a similarly significant reduction in entrainment- and impingement-related losses compared to the losses created by the current once-through cooling system.

New circulating-water intake pumps would likely continue to utilize the Ristroph traveling screens and fish-return system currently in operation (Entergy 2007), as well as the current intake bay area. The greatest impact of the closed-cycle system would be a reduction in entrainment and impingement of aquatic species. As described in Section 4.1.3.3 of this draft SEIS, the NRC staff has concluded that the once-through cooling system has a direct impact on some representative important species (RIS), which ranges from SMALL to LARGE depending on the species affected. The reduction in flow may also reduce impingement or entrainment of RIS to which the NRC staff could not assign a specific impact level, including blue crab (*Callinectes sapidus*), the endangered shortnose sturgeon (*Acipenser brevirostrum)*, and macroinvertebrates, such as small clams and mussels (bivalves), snails, worms, crustaceans, and aquatic insects. In Section 4.6.2, the NRC staff had indicated that the impacts to the shortnose sturgeon could range from SMALL to LARGE, because of uncertainty due to the lack of current sampling data.

Under a closed-cycle cooling system, most discharged blowdown water is unheated. Because the closed-cycle cooling system discharges a smaller volume of water, and because the water is cooler than in a once-through system, the extent of thermal impacts would be significantly reduced. Thus, the effects of thermal shock also decline. However, the discharge water may be higher in salinity and may contain higher concentrations of biocides, minerals, trace metals, or other chemicals or constituents. To maintain compliance with discharge permits, the water may need to be treated.

Overall, operation of the closed-cycle cooling alternative would produce substantially fewer impacts to the aquatic environment relative to those caused by the existing once-through system. The NRC staff concludes that the aquatic ecological impacts (including those to threatened and endangered species) from the construction and operation of the hybrid mechanical-draft closed-cycle cooling alternative for IP2 and IP3 would be SMALL.

<u>Terrestrial ecology</u>. Construction of the closed-cycle cooling alternative would entail clear-cutting of onsite trees and excavation of areas for the two cooling towers as described in the Land Use section. These activities would destroy fragments of onsite eastern hardwood forest habitat (NYSDEC 2007; NYSDEC 2008a). Effects of removing these habitats could include localized reductions in productivity or relocations of some species.

Operation of the cooling towers also could have adverse localized impacts on terrestrial ecology. The cooling towers would be about 46 to 50 m (150 to 165 ft) tall and would produce a visible plume as well as minimal ground fog (Enercon 2003). The potential physical impacts from a cooling tower plume include icing and fogging of surrounding vegetation during winter conditions. Icing can damage trees and other vegetation near the cooling towers. The salt content of the entrained moisture (drift) also has the potential to damage vegetation, depending on concentrations (Enercon 2003). Enercon reported, however, that the predicted deposition rates for the towers are on the order of the natural ambient salt deposition rate (Enercon 2003). The hybrid cooling towers evaluated in this section have a drift rate of 0.001 percent (Enercon 2003). This amounts to 2.6 lpm (0.7 gpm (0.00001 x 70,000 gpm of water)) drift for both towers. The amount and effects of drift would vary depending on a number of factors, including the concentration of salt in the droplets, the size of the droplets, the number of droplets per unit of surface area, the species of plant affected, and the frequency of local precipitation.

Actual measurements of drift deposition have been collected at only a few nuclear plants. These measurements indicate that, beyond about 1.5 kilometer (km) (about 1 mile (mi)) from nuclear plant cooling towers, salt deposition is generally near natural levels (NRC 1996). The NRC staff reported in the GEIS that the salt-drift rate estimated to cause acute injury to the eastern/Canadian hemlock (a particularly sensitive species) is in excess of 940 kilograms (kg) per square kilometer (km^2) (8.4 pounds per acre) per week (NRC 1996), well above the anticipated deposition rates from the IP2 and IP3 cooling towers.

The NRC staff does not expect bird collisions with cooling towers to be a significant issue. The NRC staff found in the GEIS that impacts from collisions would be small at all plants with existing cooling towers (NRC 1996).

Section 4.6.2 of this draft SEIS discusses the effects of license renewal on threatened or endangered terrestrial species. The section identifies the endangered Indiana bat (*Myotis sodalis*), the threatened bog turtle (*Clemmys muhlenbergii*), and the New England cottontail (*Sylvilagus transitionalis*), a candidate species, as being potentially affected. However, because of both the site-specific environment and the lack of evidence of the species existing at the facility, potential impacts to these threatened or endangered species are considered SMALL.

While the effects of this alternative—including onsite land clearing and introduction of cooling tower drift—are greater than the effects of the continued operation of the once-through cooling system and are likely to be noticeable, they are not so great that they will have a destabilizing effect on terrestrial resources in the vicinity of IP2 and IP3. The NRC staff concludes that the overall effect on terrestrial ecology would be SMALL to MODERATE.

- **Water Use and Quality**

During construction of the alternative closed-cycle cooling systems at IP2 and IP3, changes in water usage would likely be negligible. Increases may be seen in potable water demand for construction workers and, if concrete is mixed on site, there would be additional demands. However, these water needs would be short lived and would be at least partially offset by a reduction in water use while IP2 and IP3 are in outages to install the closed-cycle cooling system. For the term of construction, the additional water demands would need to be met by the Village of Buchanan, which supplies water to the site. The Village of Buchanan purchases public drinking water from surface water supplies.

The NYSDEC requires a construction general permit for storm water discharges from a project such as construction of the hybrid cooling towers. In addition, the NYSDEC will require a stormwater pollution prevention plan describing the use of silt fencing and other erosion-control management practices that will be used to minimize impacts on surface water quality. The construction project could also affect ground water as a result of dewatering excavations.

Evaporation losses (23,000 to 46,000 lpm (6,000 to 12,000 gpm)) from the cooling towers will have a negligible impact on water flow past the site. The estimated flow 150 m (500 ft) off the shoreline is about 34 million lpm (9 million gpm) in a 150-to-180-m (500-to-600-ft)-wide section (Entergy 2007). Therefore, the evaporation loss would be approximately 0.1 percent of the river flow. Further, the estuarine Hudson River is at sea level, and thus the river’s water level would not be affected by the cooling towers’ consumptive water use.

To compensate for evaporative and discharge losses, makeup water from the Hudson River would be treated to remove silt, suspended solids, biological material, and debris. Makeup water may also need lime softening, a water treatment process that produces a waste sludge that requires disposal. Biocides, such as hypochlorite, are often added to cooling water to diminish the affects of the biofouling organisms (Entergy 2007). Other chemicals, such as acids, dispersants, scale inhibitors, foam suppressants, and dechlorinators may also be needed for water treatment (NRC 1979).

To manage the chemicals and elevated concentrations of dissolved solids in the discharge water, treatment would likely be necessary in accordance with the IP2 and IP3 site SPDES permit. The use of biocides or any other chemicals would likely require discharge treatment and additional monitoring.

The IP2 and IP3 site does not utilize ground water for cooling operations, service water, or potable water. As such, the continued operation of the site is not expected to affect local ground water supplies (EPA 2008a). Localized dewatering of ground water from excavations may be necessary during construction operations, but because this ground water is not used by Entergy or entities off site, and because the ground water discharges to the Hudson River after exiting the IP2 and IP3 site, construction is not likely to affect either ground water quality or ground water use.

Proper controls of runoff and treatment of other site discharges will not result in significant impacts on the surface water (Hudson River) and evaporation losses are very small. Also, ground water impacts from construction and operation of the cooling towers are expected to be minor. Therefore, the NRC staff concludes that overall impacts to water resources and water quality from the closed-cycle cooling alternative would be SMALL.

- **Air Quality**

The IP2 and IP3 site is located within the New Jersey-New York-Connecticut Interstate Air Quality Control Region (40 CFR 81.13, "New Jersey-New York-Connecticut Interstate Air Quality Control Region"). The air quality nonattainment issues associated with the portions of these States located within a 50-mi radius are related to ozone (8-hour standard) and particulate matter less than 2.5 microns (µm) in diameter ($PM_{2.5}$). The entire States of New Jersey and Connecticut are designated nonattainment areas for ozone (8-hour standard). Several counties in Central and Southeastern New York within a 50-mi radius are also in nonattainment status for the 8-hour ozone standard (EPA 2008b). Air quality would be affected by three different factors: replacement power during construction-related outages, construction activities and vehicles (including worker transportation), and cooling tower operations.

Entergy contractors indicate that prolonged outages of IP2 and IP3, such as would be required to install cooling towers (TRC 2002) would require replacement power from existing generating facilities within the New York City metropolitan area. They assert that replacement of IP2 and IP3 energy output during cooling tower installation would result in substantial increases in regulated air pollutants. To the extent that coal- and natural-gas-fired facilities replace IP2 and IP3 output, the NRC staff finds that some air quality effects would occur. The NRC staff finds that these effects would cease when IP2 and IP3 return to service, with the exception of any output lost to new parasitic loads from the closed-cycle cooling system.

Air quality at or near IP2 and IP3 during the construction of the IP2 and IP3 cooling towers would be affected mostly by exhaust emissions from internal combustion engines. These emissions would include carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic compounds (VOCs), sulfur oxides (SO_x), carbon dioxide (CO_2), and particulate matter 10 µm or less in diameter (PM_{10}) from operation of gasoline- and diesel-powered heavy-duty construction equipment, delivery vehicles, and workers' personal vehicles (these vehicles would also produce or contribute to production of $PM_{2.5}$). The amount of pollutants emitted from construction vehicles and equipment and construction worker traffic would likely be small compared with total vehicular emissions in the region.

As noted in Section 3.3 of the GEIS, a conformity analysis is required for each pollutant when the total direct and indirect emissions caused by a proposed Federal action would exceed established threshold emission levels in a nonattainment area. In the GEIS, the NRC determined that a major refurbishment activity may increase the facility workforce by up to 2300 construction, refurbishment, and refueling personnel during a significant refurbishment outage period. The construction of two new cooling towers at IP2 and IP3 could approximate such conditions; however, Entergy estimates that the construction activities would require an average workforce of 300 additional workers with a maximum of about 600 workers (Enercon 2003). Because IP2 and IP3 are in a nonattainment area for ozone, and emissions from vehicles of the additional workforce may exceed the ozone air quality thresholds, a conformity analysis would be required before construction.

Fugitive dust, a contributor to PM_{10}, would be generated from site clearing and construction traffic, blasting, and excavation. Given the size of the disturbed area that would be involved (about 16 ha (40 ac)), and assuming that dust management practices would be applied (e.g., watering, silt fences, covering soil piles, revegetation), the fugitive dust impacts generated during construction should be minor. Furthermore, the amount of road dust generated by the vehicles traveling to and from the site transporting workers or hauling rock and dirt would contribute to PM_{10} concentrations. Construction stage impacts, though significant, would be relatively short lived.

Operation stage impacts would, overall, be minor. As previously discussed, the cooling towers would emit tower drift consisting of water, salt, and suspended solids. These emissions would be considered PM10, and some portion may include PM2.5. Because IP2 and IP3 are located in a nonattainment area for PM2.5, a conformity analysis for the cooling towers would be necessary and may result in additional restrictions on emissions, additional compensatory measures, or further control of drift from the towers. At a minimum, drift eliminators would likely be required to keep these emissions to a low level.

Because air quality effects during construction would be controlled by site practices and compensatory measures required to maintain compliance with the Clean Air Act (CAA) (should a conformity analysis show the need to take other action), because replacement power would be required to also comply with CAA requirements (and it would be short lived), and air quality effects during operations would be minor, the NRC staff concludes that overall impact to air quality is likely SMALL.

- **Waste**

Construction of the closed-cycle cooling alternative at IP2 and IP3 would generate some construction debris and an estimated 2 million cy (1.5 million m^3) of rock and soil (Entergy 2007). This material may be affected by onsite spills or other activities. Depending on the characteristics of the material, it may be possible to reuse or recycle it. If the material cannot be reused or recycled, it will have to be properly managed as a waste. Whether reused, recycled, or disposed of, the material will have to be transported off site. If disposed of, the waste will require additional offsite land use.

Some solid wastes may be generated by water treatment processes. Any such waste would be treated and/or disposed of in accordance with State solid waste regulations. During operation, Entergy will have to maintain release of solids and chemicals to the blowdown water and, subsequently, to the discharge canal and the Hudson River in accordance with IP2 and IP3 SPDES permits. Other solid wastes from tower operation and maintenance (including sludge from the tower basins) would be managed and disposed of in accordance with applicable State regulations at approved offsite facilities.

Based primarily on the large volume of rock and soil that would require offsite transportation and may require disposal, the NRC staff concludes that waste-related impacts associated with the closed-cycle cooling alternative at IP2 and IP3 could range from SMALL to LARGE, depending on whether material can be reused or recycled.

- **Human Health**

Human health impacts for an operating nuclear power plant are identified in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. Potential impacts on human health from the operation of closed-cycle cooling towers at nuclear power plants are evaluated in Section 4.3.6 of the GEIS.

During construction activities there would be risk to workers from typical industrial incidents and accidents. Accidental injuries are not uncommon in the construction industry and accidents resulting in fatalities do occur. However, the occurrence of such events is mitigated by the use of proper industrial hygiene practices, complying with worker safety requirements, and training. Occupational and public health impacts during construction are expected to be controlled by continued application of accepted industrial hygiene protocols, occupational health and safety controls, and radiation protection practices.

Hybrid cooling towers at IP2 and IP3 would likely be equipped with sound attenuators (Entergy 2007). The topography of the area would provide additional attenuation of the noise levels. An analysis of potential offsite noise levels resulting from both cooling towers operating continuously indicated that the increase in noise levels at sensitive receptor sites would be 1 decibel or less, a level most likely not noticeable by the residents of the Village of Buchanan (Enercon 2003).

The GEIS evaluation of health effects from plants with cooling towers focuses on the threat to workers from microbiological organisms whose presence might be enhanced by the thermal conditions found in cooling towers. The microbiological organisms of concern are freshwater organisms that are present at nuclear plants that use cooling ponds, lakes, or canals and that discharge to small rivers (NRC 1996). Because the closed-cycle system at IP2 and IP3 would operate using brackish water, and because the Hudson River does not meet the NRC's definition of a small river, thermal enhancement of microbiological organisms is not expected to be a concern.

Furthermore, as described in Section 4.3 of this draft SEIS, the NRC concludes that continued operation of the facility would not increase the impacts of occupational radiation exposures during the relicensing period. Overall, the NRC staff concludes that human health impacts from the closed-cycle cooling alternative are considered SMALL.

- **Socioeconomics**

Entergy estimates that construction of the cooling towers would require an average workforce of 300 mostly temporary employees or contractors and could take an estimated 62 months.

During the outage phase of the effort, the temporary workforce could peak at 600 (Entergy 2007). For comparison purposes, a workforce of approximately 950 additional workers is on site during a routine refueling outage (Entergy 2007).

As previously described, the impacts of relicensing and refurbishing IP2 and IP3 are addressed in a site-specific case study presented in Appendix C (Section C.4.4) to the GEIS. The case study postulated that major refurbishment activities could result in as many as 2300 workers on site. In the case study, the workers were engaged in a variety of component replacement and inspection activities. The case study employment estimate is significantly larger than Entergy's estimate in the previous paragraph and is considered by the NRC staff to be the maximum potential size of the temporary workforce because the GEIS estimate includes a variety of activities that will not be occurring at Indian Point during an outage to install a closed-cycle cooling system. As of June 2006 the site had approximately 1255 full-time workers (Entergy employees and baseline contractors) during normal plant operations (Entergy 2007).

The GEIS case study concluded that, because the surrounding counties are high population density areas as described in Section 4.4.1 of this draft SEIS, there will be available housing to support the influx of workers. Therefore, the GEIS concluded that any construction-related impact on housing availability would likely be small. With even fewer workers on site than anticipated in the GEIS, impacts would be even less noticeable.

As reported by Levitan and Associates, Inc. (2005), payments-in-lieu-of-taxes (PILOT) are made by Entergy to surrounding taxing jurisdictions. The PILOT amounts would not likely be affected by the construction of new closed-cycle cooling systems or other capital expenditures. In accordance with the PILOT agreements, this payment schedule will remain fixed through the term of the current site licenses (Levitan and Associates, Inc. 2005). Because plant valuation is not likely to change drastically with the installation of closed-cycle cooling (though it may increase), PILOT payments are likely to stay at similar relative levels throughout the renewal term.

The need for replacement power during construction may affect electricity prices, but the size of this effect depends on the cost of replacement power and the duration of the outages. Plant operators would likely schedule outages to avoid—to the extent possible—summer peak demand periods to avoid affecting grid reliability and power transmission into New York City.

The NRC staff concludes that most socioeconomic impacts related to construction and operation of cooling towers at the site would be SMALL.

- **Transportation**

Neither the NRC nor Entergy has conducted a study of the logistics for construction of cooling towers. However, some adverse transportation impacts are likely. The greatest impacts would likely occur during site excavation and would decline during construction. These impacts would return to current levels following construction.

Offsite disposal of approximately 2 million cy (1.5 million m^3) of rock and soil from the excavation of the two cooling tower sites would be expected to have a significant impact on local transportation infrastructure. As indicated by Entergy, the excavation phase of construction would be expected to take at least 30 months to complete. In Entergy's estimates, over 300,000 round trips would be needed over a period of 30 months to remove the excavated materials in 6-cy dump trucks (370 truckloads per day at 7 days per week or 530 truckloads per day at 5 days per week given 10-hour workdays). Traffic in the area is heavy and the additional traffic from construction and site workers would cause increased traffic delays, particularly along US Highway 9 and State Highway 9A (Entergy 2007).

An alternative to shipments of waste by truck may be to ship waste by barge on the Hudson River. Entergy estimates that if 1000-ton barges were used to transport excavation debris, at least five barges per day would have to be loaded and leave the site, with additional barge staging required for returning barges (Entergy 2007). If shipped by barge, the waste would need to be offloaded and likely would be transported by trucks to a disposal site. This would shift the traffic impacts from the trucks to another location but the impacts could still be significant.

During operations, NRC staff anticipates that the closed-cycle cooling system would have little to no effect on transportation, and would likely be limited to occasional shipments of waste cleaned out from cooling tower basins, occasional deliveries of chemicals used to prevent fouling of the towers, and any replacement components necessary throughout the life of the towers. As noted previously, fogging and icing is not expected to be significant.

Based on independent calculations of expected waste volumes from site excavations that were on the same order of magnitude as the Entergy estimates, the NRC staff concludes that impacts from transportation activities, primarily during excavation of the construction site, could be significant and destabilizing, though temporary, during construction and will not be noticeable during operations. Impacts, then, will be SMALL during operations, but LARGE during construction.

- **Aesthetics**

IP2 and IP3 are already visible from the Hudson River, scenic overlooks on area highways, and the Palisades Interstate State Park. The addition of the two cooling towers, standing between 46 and 50 m (150 to 165 ft), would make the entire facility more visible as the developed footprint of the facility would be expanded. The clear-cutting of wooded areas for construction of the towers would remove a visual buffer for some site structures, while the towers may screen out other structures. The towers themselves would be clearly visible from offsite vantage points. Entergy has indicated that it would preserve as many trees as possible and that it would plant new trees to reestablish some visual buffers and help attenuate noise (Entergy 2007). Remaining and new trees could act as a partial visual buffer between the construction sites and the river and a visual and noise buffer on land (Entergy 2007). Construction-related impacts would be relatively short lived.

While the hybrid mechanical-draft cooling towers under consideration are designed to reduce fog and ice production in the local area, fog and ice produced during operation could have an impact on the aesthetics of the surrounding area. In particular, visible drift, though attenuated by the hybrid design, may remain. Less noticeable moisture and salt deposition from the plume may increase dampness and corrosion on surrounding property, which could affect the visual environment. The circular hybrid design proposed by Entergy disperses remaining drift over a greater area at a lower intensity than a single-stage wet mechanical-draft cooling tower (Enercon 2003).

The NRC staff concludes that the impact of construction and operation of a closed-cycle cooling system at IP2 and IP3 on aesthetics would likely be MODERATE, based on the physical dimensions of the cooling towers, the size of deforested buffer areas, and the potential for fog and ice resulting from cooled water vapor.

- **Historic and Archeological Resources**

As noted in Section 4.4.5.1 of this draft SEIS, no previously recorded archeological or above ground historic architectural resources are identified on the IP2 and IP3 property. In addition, a Phase 1A survey was conducted on the property in 2006. The NRC staff identified 76 resources listed on the National Register of Historic Places (NRHP) within 5 miles of IP2 and IP3.

There are registered historically significant buildings and sites within several kilometers of IP2 and IP3 and other nonregistered sites or buildings that may be eligible for registration (NRC 1996). However, the NRC case study presented in the GEIS indicated that some unregistered sites may go unprotected because the sites' significance may be discounted because of their proximity to the IP2 and IP3 facility.

Entergy acknowledges that, before construction of cooling towers at the IP2 and IP3 facility can begin, a survey of cultural resources may be needed to identify the potential resources in previously undisturbed areas. The studies would include consultation with the State Historic Preservation Office and appropriate Native American Tribes, as required under Section 106 of the National Historic Preservation Act (NHPA). If historic or archeological resources are present in previously disturbed areas or in undisturbed areas, they would have to be evaluated for eligibility for listing on the NRHP.

Entergy has procedures for addressing historic and archeological resources (as noted in Section 4.4.5.2), it has acknowledged the need to survey for unknown resources before construction, and no significant historical or archeological resources have yet been identified in areas likely to be disturbed. As a result, the NRC staff concludes that the impact from the closed-cycle cooling alternative is likely to be SMALL.

- **Environmental Justice**

The NRC staff addresses environmental justice impacts of continued operations in Section 4.4.6 of this draft SEIS. Construction and operation of cooling towers at IP2 and IP3 would have an impact on environmental justice if environmental impacts of cooling system construction and operation affected minority and low-income populations in a disproportionately high and adverse manner.

Within the 50-mi (80-km) radius of the IP2 and IP3 site, a number of potential environmental impacts (onsite land use, aesthetics, air quality, waste management, and socioeconomic impacts) could affect populations in the immediate vicinity of the site. However, the potentially affected populations for the construction and operation of the closed-cycle cooling alternative, including residents of the Villages of Buchanan and Verplanck, contain low percentages of minority and low-income populations.

Overall, low-income populations within the 50-mi (80-km) radius represent a small percentage of the total population. The low-income population was approximately 11.7 percent of the total population in the combined four-State reference area, or 10.4 percent when the individual States were used as the geographic area. According to 2004 census data, the percentages of people below the low-income criteria in Dutchess and Westchester Counties were 7.7 percent and 8.9 percent, respectively.

The 2000 census indicates that 32.1 percent of the population within the 50-mi (80-km) radius and 25.1 percent of the population for the four-State reference area were minority for all races combined. The 2000 census also indicates that the total minority populations of the Villages of Buchanan and Verplanck were 7 percent and 11 percent, respectively.

Therefore, the local populations that would be most directly affected by the proposed action contain lower percentages of minorities and low-income populations than the entire 50-mi (80-km) area and the four-State reference area.

As noted earlier in this section, replacement power required during a 42-week outage could increase air quality effects, depending on the location and characteristics of generator units used to replace IP2 and IP3 output. These effects are likely to be short-lived (most will be no longer than the outage period), and may vary with time of year, scheduled outages at other facilities, and generator pricing on the NYISO grid. Additionally, impacts would occur near existing facilities and would result from incremental increases rather than new effects. As a result, impacts are likely to be small. The NRC staff concludes, then, that the overall environmental justice impacts of constructing and operating a closed-cycle cooling system at the IP2 and IP3 site are likely to be SMALL.

8.1.2 Modified Existing Once-Through Cooling System with Restoration Alternative

The NYSDEC proposal of closed-cycle cooling as the site-specific BTA to protect aquatic life in the draft SPDES permit for IP2 and IP3 (NYSDEC 2003a) is intended to dramatically reduce the entrainment and impingement of aquatic life in the IP2 and IP3 cooling system, thus reducing impacts to fish populations in the Hudson River estuary. Under the terms of the draft SPDES permit, Entergy may propose a different approach that would reduce adverse environmental impacts to an equivalent level (NYSDEC 2003b). The alternative proposed in this section combines the existing once-through cooling system with alternative intake technologies and additional restoration alternatives so that the net impact of the IP2 and IP3 cooling water intake structures is equivalent to the impact from the operation of a new closed-cycle cooling system.

8.1.2.1 Description of the Modified Existing Once-Through Cooling System with Restoration Alternative

This alternative would reduce impingement and entrainment losses by retrofitting the IP2 and IP3 existing once-through cooling systems with improved intake technology, altering operations of the cooling system, and implementing restoration measures within the Hudson River estuary. Under the terms of the draft SPDES permit, the combined impacts of these actions would have to meet the same performance measures as a closed-cycle cooling system. As described in Section 8.1.1.2 (Aquatic Ecology for the closed-cycle cooling alternative), the amount of water withdrawn from the Hudson River for IP2 and IP3 following implementation of the closed-cycle cooling system alternative would be reduced by 93 to 95 percent. To meet the requirements of the draft SPDES permit (NYSDEC 2003a), the modified once-through cooling system and combined restoration alternatives would have to result in a net entrainment and impingement reduction of 93 to 95 percent for species most affected by the existing system. The NRC staff examined other potential mitigation options to reduce impacts to aquatic life in Section 4.1.5 of this draft SEIS and concludes that one or a combination of these mitigation measures could be used as part of this alternative.

Restoration of wetlands or other aquatic habitats in the Hudson River estuary would likely be included as an aspect of any program designed to offset the residual impacts of once-through cooling-water systems. The New York-New Jersey Harbor is one of the 28 National Estuary Programs charged with developing and implementing a plan to protect, conserve, and restore the estuary (NY-NJ HEP Undated-a). A Comprehensive Conservation and Management Plan (CCMP) establishes priorities for activities, research, and funding for the estuary program. The core areas of the estuary stretch north on the Hudson to Piermont Marsh (south of IP2 and IP3; Piermont Marsh is near the southern end of the Tappan Zee river segment in Figure 2-10 in Chapter 2) (NY-NJ HEP Undated-b), but priorities identified in the CCMP could guide possible restoration activities. In addition, restoration activities would also be conducted in accordance with the NYSDEC Hudson River Estuary Program, a regional partnership designed to protect, conserve, restore, and enhance the estuary.

The estuarine wetlands and shallows of the Hudson River provide foraging habitat and shelter, serve as nursery areas for early life stages and juveniles of fish and shellfish, and contribute to the aquatic food web. An increase in wetlands or other aquatic habitats in the Hudson River estuary could support increased populations of some species affected by the IP2 and IP3 cooling-system operations and thus offset entrainment and impingement losses of those species.

Staff, consultants, or contractors would need to determine where restoration projects should take place before a wetland restoration plan could be designed. The restoration plan would indicate the size and location of restoration projects needed to add to aquatic populations at essentially the levels that the modified once-through cooling system depletes them. Because of the steep slopes on the banks of the river near the IP2 and IP3 facility, there are no significant wetland areas in the immediate vicinity of the site. Therefore, wetland restoration activities would likely need to take place away from the site.

The restoration alternative could build on features of the Hudson River Settlement Agreement (HRSA; addressed in greater depth in Section 2.2.5.3 of this draft SEIS). Measures to limit aquatic impacts of Hudson River Power plants discussed in the HRSA include partial outages for some Hudson River power plants during key spawning months, funding and operating a striped bass hatchery, conducting biological monitoring, and setting up a $12-million endowment for a new foundation for independent research on mitigating fish impacts by power plants.

As noted in Chapter 2 of this SEIS, the HRSA was replaced by four consecutive judicially approved consent orders. Each of these consent orders effectively continued the HRSA terms and conditions, with two exceptions. Neither consent order required outages at IP2 or IP3 or the continued operation of the striped bass hatchery.

As described in the draft SPDES permit, financial support of organizations that can have a direct impact on the health of the Hudson River estuary, such as the Hudson River Estuary Restoration Fund (HRERF), is another possible piece of a restoration alternative. The draft SPDES permit would require a payment of $24 million to the HRERF by Entergy (NYSDEC 2003a, 2003c) until it constructs closed-cycle cooling. An alternative to the construction and operation of the closed-cycle cooling systems could include additional funding to the HRERF and groups like it.

8.1.2.2 Environmental Impacts of the Modified Existing Once-Through Cooling System with Restoration Alternative

In this section, the NRC staff discusses the impacts that would occur if the existing once-through cooling system intakes at IP2 and IP3 were modified, and restoration actions were implemented, as described in Section 8.1.2.1 of this draft SEIS. These actions would need to meet the expected requirements of the NYSDEC-issued SPDES permit. The anticipated environmental impacts of this alternative are summarized in Table 8-1 with discussions on each impact category provided in the following paragraphs.

For most issues, the impacts of operating the modified once-through cooling system and restoration alternative would be the same or lower than the impacts associated with the existing once-through cooling system presented in Section 4.1 of this draft SEIS. Only the impacts on land use would likely be greater with the modified cooling system and restoration alternative than with continued operation of the existing system.

- **Land Use**

Any restoration plan will have some impact on land use. Because of the steep slopes on the banks of the river near the IP2 and IP3 facility, there are no significant wetland or shallows areas near the site to support restoration activities. Therefore, restoration activities would likely need to take place at locations further away from the site.

There would be noticeable short-term construction impacts on land use in any areas designated for restoration by the restoration plan. Site preparation could include grading and recontouring, removal of contaminated sediments, and/or replacement of sediments. Restoration often requires the removal of invasive and nonnative plant species through the use of herbicides, prescribed burning, biocontrol, or a combination of techniques. Following the removal of invasive species, the planting of native wetland and upland species along a hydrologic gradient is often required. Restoration activities would likely be conducted in accordance with the NYSDEC Hudson River Estuary program.

Once initial restoration activities are complete, restored wetlands usually require periodic maintenance such as prescribed burning, herbicide application, and planting to maintain the desired mix of native plant species. Monitoring may be required for restored nearshore aquatic habitats. These activities could be required throughout the license renewal period. It is unlikely that "operation" of a restoration site will have long-term effects on land use unless restoration converts previously dry land into wetlands. Operation of the restoration site may have some benefits to nearby landowners or users if the site was previously degraded.

Land also would be needed for construction of a new fish hatchery. The impacts to land use would likely be minimal, especially if the construction site was in a previously developed area.

The NRC staff concludes that the activities related to restoration and maintenance of wetlands, and construction and operation of a new fish hatchery, would likely result in SMALL to MODERATE land use impacts.

- **Ecology**

Aquatic ecology. Implementation of a well-developed restoration plan would, as designed, have an overall positive impact on aquatic ecology. There may, however, be some short-term negative impacts during the initial stages of restoration and/or construction activities. A restoration plan would indicate specific locations where restoration activities would take place, as well as the types and duration of activities. In the absence of such a plan, only an estimate of impacts is possible. To achieve performance equivalent to the 93-to-95-percent reduction in impingement and entrainment likely to be achieved with closed-cycle cooling, the restoration alternative would likely also need to include some intake modifications as described in Section 4.1.5 of this draft SEIS, and/or modifications to pumping rates, which could reduce impingement or entrainment.

During wetland restoration and construction of the fish hatchery, the NRC staff expects that impacts to aquatic ecology would be negative. Wetland restoration could initially increase rates of runoff and sedimentation, or release pollutants trapped in sediments. Construction of the fish hatchery could create runoff during construction, though this would likely be minor. During operations, however, any fish hatchery would have to comply with requirements of its own State-issued SPDES permit to control releases of pollutants to any nearby water bodies, likely including the Hudson River.

If this alternative achieves its intended goals—which would require rigorous monitoring—then the NRC staff concludes that the overall net impacts of the cooling system modifications and restoration alternative on aquatic ecology would be SMALL during operation, and MODERATE during construction.

Terrestrial ecology. Implementation of a well-developed restoration plan, cooling system intake modifications, and construction activities will produce few impacts upon the terrestrial environment or threatened or endangered terrestrial species. Impacts to terrestrial ecology would be most noticeable during construction, when any land conversion would take place, and when site crews may need to construct roads or laydown areas for equipment used to restore the wetland or construct the hatchery. Impacts from these activities would be highly site specific, but they are localized and short lived.

Once construction and initial restoration conclude, impacts to terrestrial ecology will be minor, and may be positive for the restoration portion of this alternative. Wetlands can increase the ecological value of nearby land area and provide habitat for some species that are largely terrestrial. Overall, the NRC staff concludes that the terrestrial ecological impacts from the cooling system modification and restoration alternative at IP2 and IP3 would be SMALL to

MODERATE, as some impacts may be noticeable during construction.

- **Water Use and Quality**

As noted in the Ecology section for this alternative, wetland restoration could initially increase rates of runoff and sedimentation or release pollutants trapped in sediments. Wetland restoration will modify the hydrologic behavior of the restoration site, and often includes measures that can affect surrounding water quality once the site is operational. Hydrologic modifications at a restoration site could include (1) installation of structures that control water flow and affect flow patterns, (2) the removal of dikes or berms, (3) the removal of drainage channels that drain water away from a site, and (4) the creation of new drainage channels or basins. Once operational, wetland restoration sites help to improve surface water quality by allowing natural processes to break down pollutants before being transported into open water.

Construction of the fish hatchery will also create some site runoff, though good construction practices should limit this impact. Once operational, the fish hatchery would have to comply with requirements of its own State-issued SPDES permit to control releases of pollutants to any nearby water bodies, likely including the Hudson River. Fish hatcheries produce nutrient-rich water that may require treatment before release.

While some construction-stage impacts may be noticeable, the long-term operational effects are minor, and may be beneficial. Operational impacts are SMALL, while construction impacts are MODERATE.

- **Air Quality**

Because the restoration alternative contains only relatively small-scale construction projects and does not involve the installation of any major sources of air emissions, it is unlikely that this alternative would trigger noticeable air quality impacts. As a result, the NRC staff concludes that overall impacts to air quality from this alternative would be SMALL.

- **Waste**

Construction of a new fish hatchery would generate a small amount of construction debris, and wetland restoration may leave some land-clearing debris that crews would likely dispose of on site. Any cooling system modification activities are expected to generate modest amounts of wastes for a short period of time. Ongoing operation of the fish hatchery is also expected to generate small amounts of waste, most of which would probably leave the site in liquid form under the restrictions of a State-issued discharge permit. Therefore, the NRC staff concludes that waste-related impacts associated with the cooling system modification and restoration alternative at IP2 and IP3 would be SMALL.

- **Human Health**

Construction of a new fish hatchery would present some general construction-related occupational hazards, as would installation of cooling system modifications. Wetland restoration activities also would present some occupational and environmental exposure hazards. Restoration activities may have positive effects if they improve the quality of water in portions of the Hudson that supply drinking water, as well as to the extent that they provide unpolluted habitat for fish or shellfish that humans may consume.

As described in Section 4.3 of this draft SEIS, the NRC concludes that continued operation of the facility would not increase the impacts of occupational radiation exposures during the relicensing period, nor would they likely affect radiation exposures to the public. Furthermore, there would be no significant noise sources associated with construction or operation of the fish hatchery or restoration activities that could not be effectively mitigated to protect site workers or offsite individuals.

Overall, the NRC staff concludes that human health impacts from the cooling system modification and restoration alternative are SMALL.

- **Socioeconomics (including Transportation)**

Section 4.4 of this draft SEIS describes the socioeconomic impacts of the continued operation of the IP2 and IP3 facility. The cooling system modification and restoration alternative at IP2 and IP3 would not significantly change employment at or near IP2 and IP3. There would also be no significant changes in the tax base for the region or in traffic flow or traffic patterns.

Therefore, the NRC staff concludes that overall socioeconomic impacts of the alternative would be SMALL.

- **Aesthetics**

The proposed restoration alternative would have no significant impact on the aesthetic value of the IP2 and IP3 facility. Cooling system modification and restoration likely would not have any onsite impacts that would change the overall appearance of the site. Wetland restorations could have a long-term positive impact on aesthetics, or at least minimal negative impacts. Construction of a new fish hatchery would have limited visual effects because most structures (tanks or ponds, storage buildings, pumphouses) are unobtrusive. Even if some negative impacts occur during construction, long-term negative impacts during operation are unlikely.

The NRC staff concludes that the impact of the cooling system modification and restoration at IP2 and IP3 on aesthetics would be SMALL.

- **Historic and Archeological Resources**

As noted in Section 4.4.5.1 of this draft SEIS, no previously recorded archeological or above-ground historic architectural resources have been identified on the IP2 and IP3 site. In addition, a Phase 1A survey was conducted for the site in 2006. The NRC staff identified 76 resources listed on the NRHP within 5 miles of IP2 and IP3.

The NHPA requires archeological surveys to identify and evaluate historic and archeological resources in areas identified for restoration and construction would be required before initiation of ground-disturbing activities. The studies would include consultation with the State Historic Preservation Office (NYSHPO) and appropriate American Indian Tribes.

Many shell midden sites (ancient shell mounds) or other signs of past human activities occur adjacent to wetland areas, and such sites may be encountered during surveys. Aspects of the NHPA require that lands not previously surveyed be investigated by a professional archeologist in consultation with the NYSHPO before any ground-disturbing activities. Through consultation, whatever entity constructs the fish hatchery or wetland restoration site would identify ways to reduce or avoid adverse impacts. It is possible that construction may have a noticeable effect on historic and archeological resources.

Once operational, the restoration option would essentially have no impact on historic or archeological resources. The impact of restoration and construction on historic and archeological resources could range from SMALL during operation to MODERATE during construction, depending on the locations chosen for wetland restoration and construction of a new fish hatchery, the number of sites recorded in those locations, and whether the recorded sites are significant (i.e., eligible for listing on NRHP).

- **Environmental Justice**

Section 4.4.6 of this draft SEIS discusses the environmental justice impacts of continued plant operation. Modification to the existing once-through cooling system intakes at IP2 and IP3 and restoration of wetlands could have an impact on environmental justice if environmental impacts of modifications affected minority and low-income populations in a disproportionately high and adverse manner.

However, as described in Section 8.1.1.1 of this draft SEIS, under the Environmental Justice section, the local populations that would be most affected by the proposed action contain lower percentages of minorities and low-income populations than the entire 50-mi radius area and the four-State reference area. As such, the NRC staff concludes that the environmental justice impacts of the modified once-through cooling system and restoration alternative at the IP2 and IP3 site would be SMALL.

Table 8-1. Summary of Environmental Impacts of a Closed-Cycle Cooling Alternative and a Modified Existing Once-Through Cooling System with Restoration Alternative at IP2 and IP3

Impact Category	New Closed-Cycle Cooling Alternative		Once-Through Cooling with Restoration Alternative	
	Impact	Comments	Impact	Comments
Land Use	SMALL to LARGE	Construction of towers requires about 16 ha (40 ac). Waste disposal may require much offsite land.	SMALL to MODERATE	Short-term land disturbances may result from habitat restoration; land use changes at the fish hatchery site.
Ecology: Aquatic	SMALL	Entrainment and impingement of aquatic organisms, as well as heat shock would be reduced substantially.	SMALL to MODERATE	Entrainment and impingement of aquatic organisms reduced, while restoration of habitat benefits many species. Noticeable impacts occur during construction.
Ecology: Terrestrial	SMALL to MODERATE	Onsite forest habitats disturbed while drift from towers may affect vegetation.	SMALL to MODERATE	Impacts may occur from offsite construction and temporary impacts in the restoration area. Operational issues are minor.
Water Use and Quality	SMALL	Releases to surface water would be treated as necessary to meet permit requirements. Runoff from construction activities is likely to be controlled.	SMALL to MODERATE	Short-term impacts from construction and restoration can be controlled using management practices, though noticeable impacts may occur.

Table 8-1 (continued)

Impact Category	New Closed-Cycle Cooling Alternative		Existing Once-Through Cooling with Restoration Alternatives	
	Impact	Comments	Impact	Comments
Air Quality	SMALL	Primary impacts from vehicles and equipment emissions during construction, as well as replacement power. Existing regulations should limit effects.	SMALL	Minor impacts from fugitive dust and emissions from vehicles and equipment occur during construction.
Waste	SMALL to LARGE	Construction would generate about 2 million cy of soil, rock, and debris requiring offsite disposal.	SMALL	Activities would generate easily managed volumes of waste.
Human Health	SMALL	Workers experience minor accident risk during construction. No impacts on human health during operation.	SMALL	Workers experience minor accident risk during construction. No negative impacts on human health during operation.
Socioeconomics	SMALL	No impact to offsite housing or public services occurs.	SMALL	This alternative creates insignificant changes in area employment levels or tax revenues.
Transportation	SMALL to LARGE	Increased traffic associated with construction (workers and waste disposal) would be significant, though little effect during operations.	SMALL	Insignificant changes in traffic volumes result.
Aesthetics	MODERATE	Construction of two towers,150 to 165 ft tall, would have a noticeable impact on the aesthetics of the site. Minor plume and noise issues could occur.	SMALL	Onsite aesthetics would not likely change significantly. Wetland restorations would have a long-term positive effect on aesthetics.

Table 8-1 (continued)

Impact Category	New Closed-Cycle Cooling Alternative		Existing Once-Through Cooling with Restoration Alternatives	
	Impact	Comments	Impact	Comments
Historical and Archeological Resources	SMALL	Existing procedures are adequate to protect resources on the largely-disturbed site.	SMALL to MODERATE	Impacts could reach moderate during construction in sensitive areas.
Environmental Justice	SMALL	No significant impacts are anticipated that could disproportion-ately affect minority or low-income communities.	SMALL	No significant impacts are anticipated that could disproportion-ately affect minority or low-income communities.

8.2 No-Action Alternative

The NRC regulations implementing the National Environmental Policy Act of 1969, as amended (NEPA) (see 10 CFR Part 51, Subpart A, Appendix A, paragraph 4), specify that the no-action alternative will be discussed in an NRC environmental impact statement.

For license renewal, the no-action alternative refers to a scenario in which the NRC would not renew the IP2 and IP3 operating licenses and Entergy would then cease operating both units on or before the expiration of their current operating licenses. Following the shutdown of each unit, Entergy would initiate decommissioning of the facility in accordance with the NRC decommissioning requirements in 10 CFR 50.82, “Termination of License.” Full dismantling of structures and decontamination of the site may not occur for up to 60 years after plant shutdown.

Regardless of whether or not the IP2 and IP3 operating licenses are renewed, the facility’s owner will eventually be required to shut down the reactors and decommission the IP2 and IP3 facility. If the operating licenses are renewed, shutdown and decommissioning activities would not be avoided but would be postponed for up to an additional 20 years.

The environmental impacts associated with decommissioning, following a license renewal period of up to 20 years or following the no-action alternative, would be bounded by the discussion of impacts in Chapter 7 of the GEIS, Chapter 7 of this draft SEIS, and NUREG-0586, “Final Environmental Impact Statement on Decommissioning of Nuclear Facilities” (NRC 2002). The impacts of decommissioning after 60 years of operation are not expected to be significantly different from those occurring after 40 years of operation.