United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
408 Atlantic Avenue – Room 142
Boston, Massachusetts 02210-3334

March 6, 2007

9043.1
ER 06/1220

Mr. Michael Lesar, Chief
Rules Review and Directives Branch
U.S. Nuclear Regulatory Commission
Mail Stop T6-D59
Washington, DC 20555-0001

REF: NUREG-1437 Supplement 30, draft
Vermont Yankee Nuclear Power Station
COMMENTS

Dear Mr. Lesar:

This is in response to the Nuclear Regulatory Commission's (NRC) draft Generic Environmental Impact Statement for License Renewal of Nuclear Plants-Supplement 30 (dSEIS) for the Vermont Yankee Nuclear Power Station (Vermont Yankee), dated December, 2006. The Department of the Interior (Department) has reviewed the dSEIS and offers the following comments.

BACKGROUND

Entergy Nuclear Vermont Yankee, LLC (Entergy) owns and operates Vermont Yankee, located on the Connecticut River in Vernon, Vermont. The plant is licensed to operate through March, 2012. On January 25, 2006, Entergy filed an application with the NRC to renew the operating license for an additional 20 years.

Under the NRC's environmental protection regulations in Title 10, Part 51, renewal of a nuclear power plant operating license requires the preparation of an EIS. The NRC considered the environmental impacts of renewing an operating license in its Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), NUREG-1437, Volumes 1 and 2. The GEIS identifies 92 environmental issues and reaches generic conclusions related to environmental impacts for 69 of these issues that apply to all plants or those with specific design or site characteristics. The dSEIS evaluates a subset of the remaining 23 issues that apply to Vermont Yankee.

In the dSEIS, NRC staff concludes that for all issues evaluated, the significance of the potential environmental impacts of renewal of the operating license is SMALL,[1] and that no additional mitigation is warranted.

PROJECT DESCRIPTION

VY is located on the banks of the Connecticut River in Vernon, Vermont. The plant was originally licensed with an electrical capacity of 540 MW. In March 2006 the NRC authorized a 20 percent uprate to bring the plant's output to 650 MW. Approximately 0.75 mile downstream of VY is the Vernon Hydroelectric Project, which includes the Vernon Dam. All of VY's cooling water intake and discharge points are located within the lower portion of the Vernon Project's impoundment (Lower Vernon Pool, or LVP), which extends upstream 25 miles to the base of the Bellows Falls Hydroelectric Project Dam.

Throughout the year, VY is operated in open, closed, or hybrid cycle. Under closed cycle, cooling water is withdrawn from the river, pumped through an array of mechanical draft cooling towers, then returned to the intake area for reuse as cooling water until a portion is discharged to the river as cooling tower blowdown. Under open cycle, the plant is operated in a "once through" cooling mode, with all cooling water passing through the condenser cooling system and then discharged to the LVP. Under hybrid cycle, VY may modify the amount of cooling water that passes through the cooling towers and the amount that is recirculated, such that the discharge to the river may vary in both temperature and volume.[2]

VY's current National Pollution Discharge Elimination System (NPDES) permit sets limits on the amount of heated effluent allowed to be released to the Connecticut River. During the winter period (October 15 through May 15), the plant-induced temperature at downstream River Monitoring Station 3 shall not exceed 65ºF, the rate of change of temperature at Station 3 shall not exceed 5ºF per hour, and the increase in temperature above ambient at Station 3 shall not exceed 13.4ºF. During the summer period (May 16 through October 14), the temperature increase at Station 3 is required to be less than 2ºF above ambient for water that is above 63ºF and less than 5ºF above ambient for water that is below 55ºF.

GENERAL COMMENTS

While the Department has many and varied interests in this proceeding, it is limiting the scope of its comments on the dSEIS to potential impacts that extending the operating license of VY may have on the aquatic resources of the Connecticut River.

The U.S. Fish and Wildlife Service (FWS) has been actively involved in VY through the Environmental Advisory Committee (EAC) established by the Vermont Agency of Natural Resources (VANR) via the NPDES permit it issues for the project. The NPDES permit requires Entergy to meet with the EAC at least annually to review and evaluate the aquatic environmental monitoring and studies program established in Part IV of the permit. The purpose of the EAC is to review environmental data and provide comments and recommendations to the VANR.

---

[1] SMALL is defined as "Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource."

[2] Normandeau Associates. April 2004. §316(a) Demonstration in Support of a Request for Increased Discharge Temperature Limits at Vermont Yankee Nuclear Power Station during May through October.

In addition to its role on the EAC, the FWS is a founding member of the Connecticut River Atlantic Salmon Commission (CRASC), and has actively participated in the licensing and post-licensing proceedings of the federally-regulated hydroelectric projects within the watershed.

Interjurisdictional Fisheries Management

The Connecticut River watershed is a resource of tremendous importance. The Department has been actively involved in interjurisdictional fisheries management on the Connecticut River since 1951, when the FWS began consultation on the first upstream passage facilities at the Holyoke Hydroelectric Project.

In 1967, a partnership between the FWS, the National Marine Fisheries Service (NMFS), and the states bordering on the Connecticut River was established to restore Atlantic salmon to the Connecticut River. The partnership was formally authorized by Congress in 1983 as the Connecticut River Atlantic Salmon Commission. The CRASC administers the inter-jurisdictional, cooperative effort to restore Atlantic salmon to the Connecticut River Basin (Public Law 98-138). CRASC's mission is to protect, conserve, restore and enhance the Atlantic salmon population in the Connecticut River Basin. Both the Departments of the Interior through the FWS and the Department of Commerce through the NMFS are members of the CRASC.

The CRASC released a revised *Strategic Plan for the Restoration of Atlantic Salmon to the Connecticut River* in 1998. The goals, objectives and strategies outlined in the plan, broad in scope and flexible, are designed to guide restoration activities by providing a framework that supports actions intended to increase the abundance of Atlantic salmon in the basin and define expectations and benchmarks for program evaluation. One specific goal (No. 2) defined in the plan is to "enhance and maintain the quantity, quality and accessibility of salmon habitat necessary to support re-established spawning populations." The third objective under this goal is relevant to the subject proceeding:

> Minimize passage obstructions, migratory delays and mortality of Atlantic salmon smolts and kelts downstream of areas stocked with fry, parr, smolts or adults.

In 1991, an updated plan for shad management in the Connecticut River was completed by the CRASC Shad Studies Subcommittee.[3] The goal of the management plan is to achieve the restoration and maintenance of a spawning population of American shad within its historical range in the Connecticut River Basin. Seven management objectives are listed in support of the restoration goal. In short summary, the CRASC calls for an adult return population of 1.5 to 2 million individuals, a maximum rate of exploitation of 40 percent of the population, annual passage of 40 to 60 percent of the spawning run at each successive upstream barrier on the mainstem river, and the maximization of outmigrant survival of juvenile and spent adult shad.

---

[3] CRASC. February 4, 1992. A Management Plan for American Shad in the Connecticut River Basin.

SPECIFIC COMMENTS

2.1.3 Cooling and Auxiliary Water Systems

Page 2-8: In this section there is no mention of how the plant's operation has changed since it first went on-line. It is the Department's understanding that initially the plant operated in closed cycle year-round. Then, gradually the plant operated in open or hybrid cycle more often as variances to the state's thermal discharge limits were granted through the Environmental Protection Agency's (EPA) 316(a) process. We recommend that the FSEIS contain a chronology of how the plant has operated from the 1970s up through today.

Page 2-9: The dimensions of the discharge structure are provided, but not for the intake structure. The FSEIS should include intake dimensions so that approach velocities can be determined.

2.2.2 Water Use

Page 2-21: The dSEIS states that TransCanada (owner of the Vernon Project) regulates the river discharge to maintain a minimum sustained flow of 1,250 cfs. A more appropriate characterization is that TransCanada regulates river flow to maximize power production, while maintaining a minimum flow of 1,250 cfs (or inflow, if less) below the dam at all times.

Page 2-23: The dSEIS notes that "Vernon Pond" may fluctuate as much as 8 feet. However, according to the Order Amending License for the Vernon Project, dated June 22, 1992, "NEP responded that their ability to regulate a wider range of river flows could actually reduce pool level fluctuations. They further responded that their ability to fluctuate the pond would be small, on the order of one foot, and that any fluctuations would be gradual…"[4] The Department recommends that the FSEIS verify the licensed operating range and the actual operating range of the Vernon Project with TransCanada.

Page 2-23: The Cooling Water Use section discusses the recent power uprate at VY and its potential impact on consumptive water use. However, NRC staff bases its determination on the current NPDES permit limits, not the amended limits presently under appeal. Depending on how the appeal is decided, this evaluation may not be valid. Also, the determination in this section appears to be inconsistent with the evaluation on page 2-32, which considers an outcome resulting in an increased thermal limit.

The dSEIS does not adequately or clearly discuss the uprate, the 316(a) variance request, the license extension, or how these actions relate to each other, including operationally. The environmental implications may include effects of an increased thermal limit, and entrainment and impingement. This should be remedied in the FSEIS.

2.2.3 Water Quality

Page 2-27: The section discussing the NPDES permit should clarify that the EPA, or a delegated state, has the ability to include restrictions on cooling water intake structures. The current language suggests that conditions are limited to discharge standards and monitoring requirements for effluents from outfalls.

---

[4] Federal Energy Regulatory Commission. June 22, 1992. Order Amending License, Project No. 1904-008.

Page 2-28: The dSEIS states that the New England Coalition appealed the NPDES permit amendment that was issued on March 30, 2006. It is the Department's understanding that Entergy also appealed the permit (over the denial of a thermal increase for the period May 16 through June 15). Therefore, there may be a third outcome; if Entergy wins its appeal, the thermal limits would increase for the entire summer period. In fact, this scenario is the one explicitly contemplated and evaluated by NRC staff in the SEIS (page 2-32). The FSEIS should explain why all three possibilities were not considered in the evaluation of the environmental impact of the plant.

Page 2-32: The dSEIS refers to the equation developed decades ago to calculate the plant-induced temperature increase. While NRC staff provides a concise overview of how the model was developed, the Department recommends that the FSEIS explain why it is still appropriate to use a very old model when many conditions on the river are different than they were in the 1970s. From the Department's perspective, it would be a very useful exercise to revisit the concept and parameters that go into the equation and to validate it under present-day conditions. VY's compliance with its thermal limits is determined based on *calculated* temperature at Station 3, not by *measured* temperature. To date, any discrepancy between the two numbers has been attributed to atmospheric loading. While this may be true, Entergy has not provided any data to support that contention.

Page 2-34, Table 2-6: The NPDES permit does not contain a condition regarding a maximum temperature exceedance rate for the summer period; therefore, the Department is unclear why the last column is included.

Page 2-38: The FSEIS should clarify that the thermistor data were not collected with the intent to "characterize the circulation and distribution of heated water," but were used to develop and calibrate a hydrothermal model, which was then used to estimate how raising the thermal limits would affect water temperatures within the LVP and at Station 3. The hydrothermal model showed that under existing conditions, the thermal plume from VY extends across the river over to New Hampshire and downstream to Vernon Dam.

Another issue the Department recommends the FSEIS investigate is the geographic extent of VY's influence on water temperature. Presently, the thermal effluent is considered "fully mixed" at Station 3, for the purposes of the NPDES permit. However, at that point the water temperature is still up to 2ºF higher than ambient. In order to fully understand the impact VY's thermal effluent has on the aquatic community of the Connecticut River, resource agencies need to know how far downstream the raised river temperature extends. This is especially pertinent to Atlantic salmon smolts, that could be adversely impacted by extended periods at elevated temperatures.

2.2.5 Aquatic Resources

Page 2-47, lines 3-4: The dSEIS states that fish are routinely sampled as part of the NPDES monitoring requirements, and that samples are collected by electroshocking in May, June, September and October. The FSEIS should note that in addition to the resident fish collections, American shad are sampled downstream of Vernon Dam by electroshocking and upstream of Vernon Dam by beach seine hauls, from July through October.

Page 2-47, lines 6-35: This section summarizes the species assemblage at VY for the pre-operational period and for the period 1991-2004. Based on this information, NRC staff concludes that "The fish community near the VYNPS has remained relatively stable…," yet the two communities compared are quite disparate:

Period	
Pre-Operational[a]	1991-2004[b]
smallmouth bass	yellow perch
white sucker	bluegill
yellow perch	pumpkinseed
rock bass	spottail shiner
walleye	largemouth bass
white perch	white sucker

[a] assumed decreasing abundance
[b] identified in decreasing abundance

As part of the 316(a) process, the FWS recommended that VY analyze the entire long-term fisheries data set; however, VY declined to use data prior to 1991 for its statistical analyses. While some indication of change to the fish communities upstream and downstream of Vernon Dam can be ascertained by comparing the percent composition of selected species over time (Figures 1 and 2, below), the full extent of VY's thermal effluent impact cannot be determined until a thorough evaluation of the entire data set is conducted, including pre-operational data and data collected under different permit limits.

Page 2-50, lines 22-23: The citation used for optimal temperature range of salmon smolts appears to be based on somewhat dated references, with the most recent being Shepherd 1991. The FSEIS should consider more recent research that shows a relationship between temperature and smolt physiology (McCormick *et al.* 1999) and temperature and smolt behavior (Barbin Zydlewski *et al.* 2005). These studies relate directly to potential impacts of VY's thermal effluent on smolt physiology. Higher water temperature increases the degree days experienced by smolts, which narrows the smolt window (the opportunity for smolts to successfully migrate to the estuary while they still retain their salinity tolerance). In addition, as the dSEIS points out, dams can delay migrating smolts. Given the extent of VY's thermal plume and its proximity to Vernon Dam and the downstream bypass facility, it is highly likely that the two projects, in combination, act to adversely affect smolt behavior and physiology (although the extent to which this impacts smolt survival has not been documented, to date).

Page 2-50, lines 33-35: Although adult Atlantic salmon returns had declined to less than 100 prior to 2005, the returns for 2005 and 2006 were 186 and 211, respectively.[5]

Page 2-51, lines 7-14: Given that downstream bypass facilities at hydroelectric projects on the river have only improved over time, presumably reducing turbine mortality, it does not appear that citing turbine mortality as a factor for declining American shad returns is accurate. Likewise, while the increase in the Connecticut River striped bass stock is a valid concern, no real habitat modifications to the impoundments have occurred in the past two decades. The FSEIS should either delete the reference to predation pressure in the impoundments or provide documentation to support the contention.

---

[5] http://www.fws.gov/r5crc/fish/daily.html.

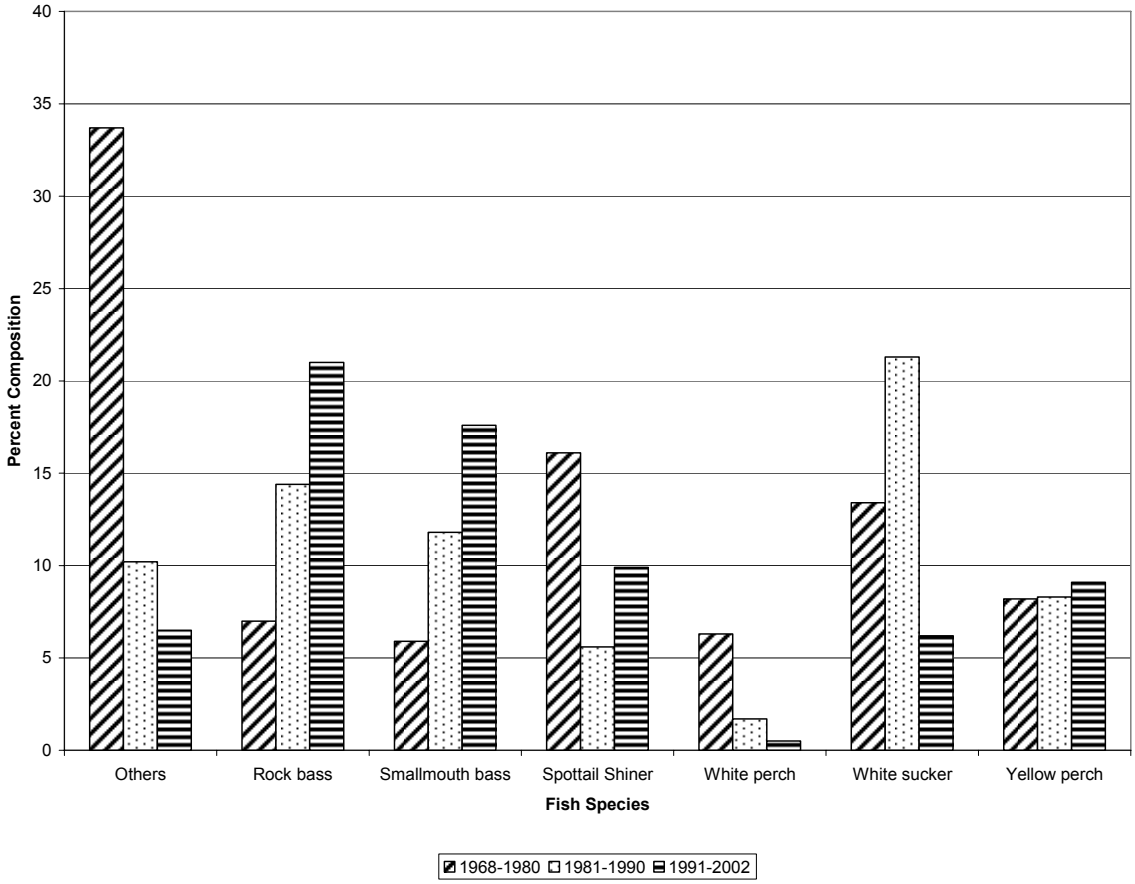

Figure 1. Percent composition of numerically important species collected downstream of Vernon Dam [from Table 5-14 of the 316(a) Demonstration, April, 2004].

Page 2-51, lines 20-25: In addition to the passage problems noted for the Cabot (Turners Falls) fish ladder, the FSEIS should identify that a second passage problem exists at the Gatehouse fishway (located at the upstream end of the hydropower canal). Efforts are underway to correct both issues. With respect to passage efficiency between hydro projects, from 2004-2006, 17 percent of the shad that passed Turners Falls Dam also passed Vernon Dam.[6]

Page 2-51, lines 25-29: The Department does not dispute the changes noted to the population structure of American shad on the Connecticut River. However, ascribing these changes solely to the implementation of fish passage facilities is not appropriate. The Department is aware of studies on other rivers without large dams or fish passage facilities that have shown similar changes in the structure of river herring stocks.[7]

---

6 2006 data are still preliminary.

7 Justin Davis, presentation at the Connecticut River Atlantic Salmon Commission Research Forum, February 16, 2007.

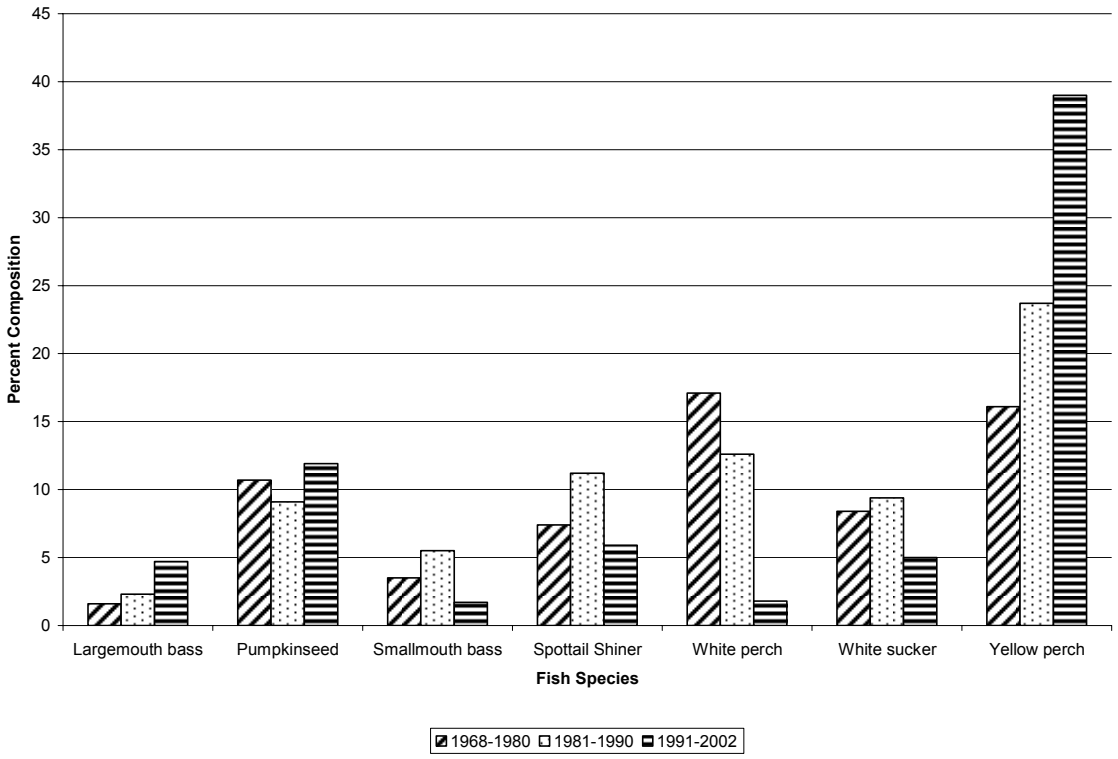

Figure 2. Percent composition of numerically important species collected upstream of Vernon Dam [from Table 5-14 of the 316(a) Demonstration, April, 2004].

Page 2-55, lines 9-11: This statement requires clarification. While American eel are common in many rivers and streams in Massachusetts and Connecticut, there are some notable exceptions; no eels have been collected recently upstream of the third dam (Shepaug) on the Housatonic River in Connecticut, and no eels have been collected recently in the Massachusetts portion of the Blackstone watershed.

2.2.5.2 Threatened and Endangered Aquatic Species

Page 2-57, lines 18-19: Although the shortnose sturgeon population downstream of Turners Falls Dam is 20 miles away from VY, the impact of the thermal effluent may still persist at that location.

4.1.1 Water Use Conflicts

Page 4-13, lines 17-19: The operation of downstream dams would have no effect on the water surface elevation of the Vernon impoundment.

4.1.2 Entrainment of Fish and Shellfish in Early Life Stages

Pages 4-14, 4-15: NRC staff provides a clear, concise summary of the 316(b) statutory requirements. However, since the dSEIS was issued, new developments have occurred (detailed below) that the FSEIS should address.

On January 26, 2007, the U.S. Second Circuit Court of Appeals ruled on a lawsuit Waterkeeper Alliance and other parties filed against the EPA over the Phase II 316(b) regulations issued in 2004. In its decision, the court remanded to EPA the provision establishing Best Technology Available and the site-specific cost-cost variance. The court remanded based on impermissible constructions of the statute, including those provisions that (1) set performance standards as ranges without requiring facilities to achieve the greatest reduction of adverse impacts they can; (2) allow compliance through restoration measures; and, (3) authorize a site-specific cost-benefit variance.[8]

VY has cooling towers but is only required to use them in order to meet the thermal limits specified in the NPDES permit. As part of the long-term biological monitoring that has been required at the plant, impingement and ichthyoplankton samples are collected annually during the summer period to document the extent of impingement and entrainment at the intake. Under the existing NPDES permit, there are no limits on impingement and entrainment rates of resident fish, but there are limits set for Atlantic salmon and American shad.

Given that VY has always had cooling towers, which is commonly accepted as the Best Technology Available (BTA), the Department recommends that the FSEIS give thorough consideration to an alternative that requires Entergy to operate VY in closed-cycle mode year-round. The Department's position is that this alternative would meet the statutory standard of "minimizing adverse environmental impact" pursuant to 316(b).

Page 4-16, Table 4-3: The Table presents percentages and numbers of fish eggs and larvae entrained at VY. According to the dSEIS (pg. 4-15), sampling for larvae is conducted weekly from early May through mid-July. While Table 4-3 includes quantities of eggs and larvae collected during the sampling period, it does not provide a clear sense of the number of eggs and larvae that are actually entrained. The dSEIS does not describe the sampling procedures, therefore it is unclear what these numbers represent. To develop representative estimates of entrainment, time and flow rates would have to be factored in with larval concentrations on a weekly basis. The FSEIS should provide total entrainment estimates for the species listed in Table 4-3.

Page 4-17, lines 11-13: Although Entergy believes no observable adverse impacts to any fish species or to the overall fish community of Vernon Pool due to entrainment by VY has been demonstrated, the fact remains that Figures 1 and 2 above show a decline in the percent composition of white sucker and white perch in the LVP, and both of these species do show up in entrainment collections. Whether this relationship is causal or coincident is unknown.

Page 4-15, 4-17: The dSEIS states, "When ichthyoplankton are at their peak in the Connecticut River (e.g., late spring through early summer), VYNPS is generally operating in an open-cycle or hybrid mode." However, NRC staff concludes on page 4-17 that potential impacts from entrainment of fish and shellfish by VY would be "SMALL," based in part by the utilization of the closed- or hybrid-cycle mode during much of the spawning season. These statements contradict each other. If the first statement erroneously states "open-cycle" instead of the intended "closed-cycle", then the FSEIS should reflect that. If, however, the first statement is accurate, the NRC should re-evaluate its basis for a conclusion of SMALL impact.

---

[8] Riverkeeper, Inc., *et al.* v. U.S. EPA, United States Court of Appeal for the Second Circuit. January 26, 2007.

The NRC's conclusion related to entrainment potential over the 20-year renewal period suggests that plant operations will continue as they have historically. However, within the last year, two significant changes to plant operations have occurred that change entrainment dynamics. First, if the power uprate results in a proportionate increase in waste heat, additional cooling water withdrawal may be needed, which, in turn, could increase entrainment. In addition, VY requested and received from the VANR a seasonal temperature increase[9] that would allow the plant to operate less frequently in the closed-cycle mode during periods when larval and juvenile fish are most vulnerable to entrainment and impingement. The FSEIS should fully evaluate the potential entrainment impacts of these new or planned modifications in plant operations.

4.1.2 Impingement of Fish and Shellfish

Page 4-17: The dSEIS provides no specific information on the cooling water intake structure (CWIS) to use in assessing its potential to impinge fish, or in assessing the likelihood that impinged fish are returned to the river alive and unharmed. The FSEIS should include a detailed description of the CWIS, including the intake velocities under the various operational modes, the water pressure(s) of the spray wash system used to remove fish and debris from the traveling screens, the mesh size and operation frequency of traveling screens, and the design of the fish return system.

According to the dSEIS, the authorized discharge flow limit for both the open- and hybrid-cycle cooling modes is 543 mgd. The amount of water withdrawn when in hybrid-cycle mode varies depending in part on the water temperature of the Connecticut River. NRC staff concludes that potential impacts from entrainment of fish and shellfish by VY would be "SMALL," based in part on the utilization of the closed- or hybrid-cycle mode during much of the spawning season. However, since hybrid-cycle mode can utilize up to the same flow as open-cycle mode (360,000 gallons per minute), its use does not necessarily assure a reduction in fish entrainment mortality. The FSEIS should include historical flow data for the hybrid-cycle mode during peak periods of ichthyoplankton presence in order provide a better assessment of entrainment potential as compared to closed-cycle (10,000 gpm) and open-cycle modes.

Page 4-18, lines 25-42: NRC staff provides impingement data from the 1970s and 1980s in numbers of fish impinged per day. For later data, the number reported is apparently total number collected. This method of reporting is confusing and makes it difficult to compare data sets. The FSEIS should standardize units and note any differences in sampling methodology between time periods.

Page 4-19, Table 4-4: This Table provides the percentages and numbers of fish impinged at VY during the summer period. It is unclear why data are combined for years 1988 and 1990-1997. It would be more helpful to include the information for each individual year. Under the current NPDES permit, no impingement monitoring is required during the winter period, which makes it impossible to determine annual impingement rates. Unlike ichthyoplankton entrainment, which is fairly discreet in its periodicity, impingement could occur year-round. In fact, impingement during the winter period may be higher than during the summer, if the heated effluent acts to attract resident species such as yellow perch.

Page 4-20, lines 5-15: The NPDES permit calls for weekly and 24-hour sampling. On the first day, the traveling screens are backwashed and the debris is examined for salmon and shad only.

---

9 The amended permit has been stayed while the appeal is resolved.

This provides the quantity of shad and salmon impinged during the previous six days.[10] Then, 24 hours later, the process is repeated, except the debris is examined for all impinged fish.[11] In the most recent draft biological monitoring report,[12] during the summer period over 2,000 fish were impinged, with a total weight of over 65 kg. This number represents approximately 21 days of sampling (or less than 6 percent of a year). In comparison, only 376 fish were sampled via electrofishing during that same period (335 upstream of Vernon Dam). American shad had the highest impingement rate (577), yet no shad were collected in the general electrofishing sample upstream of Vernon Dam, and only 120 were caught in the beach seining conducted specifically for American shad.[13] The report contains a scatter plot of juvenile American shad abundance for the period 1991 through 2005, showing a statistically significant negative trend (i.e., decreasing shad stock). Impingement of shad could be a contributing factor in the stock decline.

NRC staff asserts that VY operates in closed- or hybrid-cycle modes during much of the year. The Department recommends that the FSEIS provide supporting information showing, on an annual basis, the percentage of time that VY operates in each mode. The NRC's conclusion related to impingement potential over the 20-year renewal period suggests that plant operations will continue as they have historically. However, the two significant changes to plant operations referred to above (i.e., the uprate and thermal increase) could change impingement dynamics. The FSEIS should fully evaluate the potential fish impingement impacts of these new or planned modifications in plant operations.

4.1.4 Heat Shock

Page 4-20: This section of the dSEIS provides a discussion of some potential environmental impacts associated with the discharge of heated effluent. The use of the term "heat shock" implies a fairly limited scope of review for a pollutant (i.e., heat) that can affect aquatic organisms and their habitats in many ways. We recommend that the discussion in the FSEIS on this subject be expanded to address heat's less conspicuous ability to: 1) prevent the use of affected areas by temperature-sensitive species; 2) attract and expose organisms to areas of elevated temperature during spawning periods; and 3) expose eggs and larvae to water temperatures well above levels that are typical under ambient conditions.

4.7.2 Evaluation of Potential New and Significant Information Concerning Thermal Discharges to the Connecticut River

Page 4-50, lines 12-21: The dSEIS identifies an upper feeding limit for salmon of 72.5ºF, an upper limit for survival of 82ºF, and a smolt residency time of 12 hours. First, neither of the temperatures referenced relates to salmon smolts. The upper feeding limit mentioned is for parr, and the survival limit is for adults. Little, if any, information exists on temperature thresholds of smolts. However, as mentioned previously, recent research has shown a relationship between temperature and smolt physiology and temperature and smolt behavior. Second, the radiotelemetry studies done by Aquatec were conducted prior to the most recent thermal limits

---

[10] The inherent assumption is that all impinged fish stay on the traveling screens and are not passively or actively (e.g., predation) removed prior to sampling.

[11] Ecological Studies of the Connecticut River Vernon, Vermont, Report 35, January-December 2005, DRAFT. May 2006. Normandeau Associates.

[12] Ecological Studies of the Connecticut River Vernon, Vermont, Report 35, January-December 2005, DRAFT. May 2006. Normandeau Associates.

[13] Vermont Yankee/Connecticut River System, Analytical Bulletin 83: Abundance of Juvenile American Shad in the Vernon Pool during 2005. May 2006. Normandeau Associates.

going into effect. The conclusions reached may or may not be valid under present-day conditions. Third, the 12-hour residency time is an average, and some smolts had residency times of up to 3½ days.[14]

The radiotelemetry studies conducted in the 1990s were intended to assess the efficiency of the downstream bypass facility at Vernon Dam, not to evaluate the thermal impact of VY on smolt behavior or physiology. Smolts are surface-oriented, and while they may indeed sound down to avoid the warmest water in the LVP, no data exist to support that presumption. Unfortunately, the configuration of the two projects (Vernon and VY) presents a worst-case scenario for smolts (and shad) because the fishways are located on the same side of the river as VY's discharge and the plume extends across the river. Whether migrants travel through the plume (the most direct route, but warmest water), or negotiate a path around the plume (cooler water, but longer residency time), ultimately they are exposed to elevated temperatures that could influence their survival.

Page 4-50, lines 26-30: NRC staff concludes that because impingement of shad and salmon has always been below annual limits stipulated in the NPDES permit, these species do not frequent the LVP; therefore, VY's thermal plume does not delay shad or salmon movements or function as an attraction to these species. First, as noted above, in 2005, the number of shad impinged greatly exceeded the number collected by seining and electroshocking. A conservative conclusion that could be drawn from this information is that shad production in the LVP is low to begin with, and many of those juveniles end up impinged on the traveling screens. Second, salmon and shad must frequent the LVP in order to migrate downstream. Third, no information provided in the dSEIS supports the contention that VY does not delay shad or salmon movements; those data simply do not exist for shad under the present thermal limits. Moreover, salmon smolt studies show a longer maximum residency time at Vernon than at Wilder or Bellows Falls Dams,[15] which could lead one to conclude that VY is a contributing factor to migration delay. In order to sort out whether, and to what extent, Vernon and VY each contribute to migration delay, a rigorous scientific study designed specifically to address the issue is needed.

While we know that shad are able to ascend the Vernon fish ladder, we do not know if they are delayed at the entrance due to any temperature differential, or in the LVP as they migrate upstream to spawn. We also do not know whether temperatures in the LVP affect spawning success. The trend analysis referred to above[16] showed declining juvenile shad abundance, which could be attributed to one or more factors, possibly including the thermal regime of the LVP. Directed studies like those done during Project SHARE have not been undertaken since the most recent thermal limits went into effect.

Page 4-51, lines 10-12: The dSEIS concludes that none of the observed changes in fish community composition or distribution in over 30 years of study in the LVP and upper Turners Falls Pool can be reasonably attributed to operations of VY. Based on the available information, the Department does not agree that the conclusion can be made that the changes to the fish

---

[14] Table 5-23 of the §316(a) Demonstration in Support of a Request for Increased Discharge Temperature Limits at Vermont Yankee Nuclear Power Station during May through October. 23 Normandeau Associates. April 2004.

[15] See Footnote #14.

[16] See Footnote #14.

community structure upstream and downstream of Vernon Dam since VY began operating,[17] or the recent declining trends in several fish species,[18] are not, at least in part, due to impacts caused by VY's impingement, entrainment, and/or thermal effluent. The FSEIS should provide documentation to support NRC staff's conclusion.

Page 4-51, lines 15-18: Regarding the discussion of solar radiation's contribution to the difference in river temperature between monitoring stations, please refer to our comments under the Water Quality section above.

Page 4-51, lines 23-28: The dSEIS focuses on potential thermal impacts to the Vernon Pool, in particular the LVP, but there is very little information about thermal impacts to habitat below the Vernon Dam. The FSEIS should include temperature data that graphically depict the spatial extent of the thermal plume below the Vernon Dam under various seasonal and flow conditions. This information would provide a sense of when and how much habitat may be unsuitable to certain species less tolerant of heat.

The dSEIS states that no observable adverse impacts to any fish species or to the overall fish community of Vernon Pool due to thermal discharges from VY have been demonstrated. Again, the most recent biological monitoring report, the first to include a long-term trend analysis, shows statistically-significant declining catch-per-unit-effort for three species, including American shad in the LVP, walleye in the Vernon tailrace, and white sucker both upstream and downstream of Vernon Dam. The Department is concerned by these results, and does not concur with the reasons put forth by Entergy that attribute the declines to factors other than VY.[19] At a minimum, these data highlight the need for a more detailed investigation of possible causes for the declines.

4.8.1 Cumulative Impacts on Aquatic Resources

Page 4-54, lines 16-19: The dSEIS states that VY impacts are localized and have a minimal contribution to the cumulative impact on aquatic resources in the Connecticut River. The Department respectfully disagrees, especially with regard to Atlantic salmon. Roughly 70 percent of all salmon-rearing habitat in the watershed is located upstream of VY, and that habitat produces nearly 60 percent of the system's smolts,[20] which must pass through VY. Research has shown that higher water temperature increases the degree days experienced by smolts, which narrows the smolt window (the opportunity for smolts to successfully migrate to the estuary while they still retain their salinity tolerance). VY's thermal effluent and the location of the discharge within the Vernon impoundment could contribute significantly to the cumulative impact on Atlantic salmon smolts migrating from upstream tributaries. If exposure to elevated temperatures at VY contributes to a reduction in at-sea survival of post-smolts, fewer adults may return to the river.

---

[17] Table 5-14 of the §316(a) Demonstration in Support of a Request for Increased Discharge Temperature Limits at Vermont Yankee Nuclear Power Station during May through October. Normandeau Associates. April 2004.

[18] See Footnote #11.

[19] Entergy's consultant argues that CPUE of shad and white sucker upstream of VY's thermal influence also declined; therefore the trend cannot be attributed to VY. However, this rationale assumes that fish do not move between the two areas, which is not a reasonable assumption, given these species' mobility.

[20] Jay McMenemy, personal communication. Smolt production based on a five-year average (range 55.6-67.4).

The dSEIS notes that "if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline." NRC staff goes on to conclude that the cumulative impact of continued operation of VY would be SMALL and no additional mitigation is warranted. The Department does not agree that the cumulative impact would be SMALL. However, even if the impact was SMALL, the fact that the resource (e.g., American shad, blueback herring) is declining argues strongly for mitigation measures. In this instance, the obvious mitigation would be to require VY to operate in closed-cycle mode year-round, which would greatly reduce impacts associated with impingement, entrainment and thermal effluent.

8.0 Environmental Impacts of Alternatives

The Department recommends that the FSEIS evaluate at least two more alternatives: (1) continued operation of VY under a year-round closed-cycle mode of operation; and (2) continued operation of VY under the present NPDES permit requirements, but with removal of the Vernon Dam.

9.2 Relative Significance of the Environmental Impacts of License Renewal and Alternatives

Page 9-7, line 19: The dSEIS states that closed-cycle cooling systems were assumed for all power-generation alternatives. The FSEIS should explain why closed-cycle operation was assumed for other power generation alternatives, but not for VY.

Thank you for the opportunity to comment on the dSEIS. Please do not hesitate to contact me at (617) 223-8565, or Melissa Grader of the U.S. Fish and Wildlife Service at (413) 548-8002, extension 124, if we can be of further assistance.

Sincerely,

Andrew L. Raddant
Regional Environmental Officer

REFERENCES

Barbin Zydlewski, G., A. Haro and S.D. McCormick. Evidence for cumulative temperature as an initiating and terminating factor in downstream migratory behavior of Atlantic salmon smolts. *Canadian Journal of Fisheries and Aquatic Sciences.* 62:68-78, 2005.

McCormick, S.D., R.A. Cunjak, B.D. Dempson, M.F. O'Dea and J.B. Carey. Temperature-related loss of smolt characteristics in Atlantic salmon (*Salmo salar*) in the wild. *Canadian Journal of Fisheries and Aquatic Sciences.* 56(9):1649-1658, 1999.