Admin #194 cc: Madam Permits

(96)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
400 RALPH PILL MARKETPLACE
22 BRIDGE STREET
CONCORD, NEW HAMPSHIRE 03301-4901

T. E. LANDRY

SEP 13 1991

Mr. David Fierra, Director
Water Division
U.S. Environmental Protection Agency
J.F. Kennedy Federal Building
Boston, MA

September 10, 1991

Dear Mr. Fierra,

Following are assessments of potential impacts to Merrimack River aquatic biota associated with heated water discharges from the Public Service Company of New Hampshire's Merrimack Electric Power Station in Bow, NH (permit # NH0001465). The assessments are provided in response to inquiries by your staff regarding the significance of heated effluent to aquatic biota, in general, and in particular, to efforts to complete the reestablishment of anadromous fish populations to the Merrimack River.

The July 20, 1991 letter from the NH Fish and Game Department to the NH DES presents assessments with which we agree. Our letter is intended to supplement specific points in NHFGD's letter, and to provide you with our recommendations as a federal trustee of anadromous fish resources.

We concur with the logic set forth in **Quality Criteria for Water**, that heated discharges should be regulated with respect to two temperature parameters - a maximum allowable absolute temperature (T_{max}), and a maximum allowable change in temperature (ΔT). The existing permit for the Merrimack Station establishes a T_{max} of 69°F and a ΔT of 1°F (for ambient river temperatures exceeding 68°F), **except when river temperatures exceed 69°F.** We assume this contradiction is the result of an unfortunate choice of words in the permit, and that the intent was to maintain a ΔT of 1°F if ambient temperatures exceeded 69°F. Although we are not aware of the history of the original permit, and the logic and data supporting the selection of the particular temperature criteria specified in that permit, it is likely that they are based on the temperature tolerance criteria presented in **Quality Criteria for Water.** When we calculate temperature limits using Temperature Criterion 2 (**Quality Criteria for Water - 1986**) for highly temperature-sensitive species known to inhabit the affected reach of the Merrimack, such as brown trout, brook trout and Atlantic salmon, acceptable temperatures approximate the 68°F standard referenced in the permit. More specifically, we applied the criterion that adds to the physiological optimum temperature, a value of one-third the difference between the optimum and the ultimate upper incipient lethal temperature for sensitive species. For brown trout, we calculate the acceptable average weekly temperature as approximately 22°C

(71.6°F)[1]. For brook trout, the corresponding value is approximately 19°C (66.2°F)[2]. The level for adult Atlantic salmon is similar to that for brown trout (22°C)[3]. More temperature-tolerant species found in the area of the effluent include smallmouth and largemouth bass. The respective acceptable average weekly temperatures for adults of these species during April through October are 30.5°C (86.9°F) and 32°C (89.6°F)[4], as calculated by the method used above. However, fry of both bass species are less tolerant of high temperatures than are adults, and therefore have lower acceptable average weekly temperatures during this life stage (approximately 1 - 60 days post-hatch). Respective temperatures for smallmouth and largemouth bass fry, based on Criterion 2, are 25.7°C (78.3°F) and 22°C (71.6°F)[5]. Therefore, depending on the species and life stage targeted for protection from thermal impacts, an April to October T_{max} can be established using these (or other) temperature tolerance data.

In addition to the T_{max} value, a maximum allowable ΔT should be included in the permit. A ΔT criterion is desired to guard against "cold shock" in the event of a sudden shutdown of the cooling system, and to reduce behavioral modification of fish associated with either attraction to, or avoidance of, a heated discharge. However, selection of an appropriate maximum allowable ΔT to protect against behavior modification will likely have to be somewhat arbitrary, unless comprehensive fish behavior studies are undertaken for this effluent. It may be appropriate to prescribe a ΔT of 2°C for conditions described in Temperature Criterion 2a until a decision is made regarding the potential need to comply with Temperature Criterion 2c (site-specific requirements - **Quality Criteria for Water-1986**).

With respect to site-specific temperature requirements, there are at least two discrete biological communities that you should consider in establishing allowable effluent characteristics. They are the aquatic community resident in the vicinity of the Merrimack Station, and migratory fishes, including Atlantic salmon, American shad and river herring. As indicated in NHFGD's letter, significant numbers of adult shad and herring are not expected to be present in the Hooksett Dam Pool until at least 1997. However, immature salmon and shad are in the Pool yearly, as transient out-migrants, and beginning in 1993, adult salmon will be present throughout the Merrimack River. While there is ample time prior to 1997 to assess existing data and to conduct additional studies of potential impacts to in-migrating fish, interim permit standards should consider the protection of resident and transient aquatic biota that presently inhabit the locale of the Merrimack Station. The temperature tolerance data provided above regarding T_{max}, and the 2°C ΔT recommended in Temperature Criterion 2a should assist in the development of interim standards for the heated effluent. More refined standards can be developed by assessing existing and future site-specific data, and subsequently included in a "final" permit for the facility.

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[1] Based on a maximal optimum temperature of 19°C and an upper incipient lethal temperature of 27°C (Fish and Wildlife Service, 1986).

[2] Based on a maximal optimum temperature for adult brook trout of 16°C and an upper incipient lethal temperature of 24°C (Fish and Wildlife Service, 1982).

[3] Based on a maximal optimum of 19°C and a upper incipient lethal temperature of 27.5°C (Decola, 1970).

[4] Based on respective maximal optima for SMB and LMB of 29.5 and 30°C, and upper incipient lethal temperatures of 32 and 36°C (Fish and Wildlife Service - 1983, 1982).

[5] Ibid.

To our knowledge, the impact of the existing effluent on aquatic biota has not been assessed. Although monitoring reports indicate that surface temperatures frequently exceed the 1°F ΔT, the extent and configuration of the heated plume are presently unknown. A better understanding of the nature of the plume under various flow and temperature conditions will be necessary in order to allow the assessment of site-specific impacts. We recommend that existing data regarding the configuration of the thermal plume be summarized and presented to a technical advisory group consisting of the USEPA, NHDES, NHFGD, USFWS and any other appropriate entity, with the objective of using those data to help design additional studies, as appropriate. Based on our understanding of the nature of the existing data, it is likely that additional study of the impacts associated with the thermal plume will be required. You may wish to condition the pending permit to require additional study, should the previously-mentioned technical advisory group recommend such a study.

Recent discussions among USEPA, NHDES, NHFGD and USFWS considered the question of potential impacts to aquatic resources within the Merrimack Station's cooling canal. Those discussions considered three related issues: 1) the biological significance of the fishery inside the canal; 2) the need to protect the fishery inside the canal; and 3) whether to prevent fish access to the canal from the river.

The first issue, the significance of the fishery inside the canal, is most appropriately addressed by NHFGD, or perhaps by PSNH, if it has surveyed the cooling canal's biota. Our assumption is that the canal presently supports resident fish species throughout the year, but that there could also be anadromous species in the canal during the migration periods. Chlorine levels in portions of the canal nearest the actual outfall are likely to be toxic to most aquatic biota. However, dissipation of TRC in the outer portions of the cooling canal evidently is sufficient to allow some fish (and their prey) to inhabit the cooling canal. Additionally, it is probable that during the warmest months, temperatures in portions of the canal exceed upper incipient lethal temperatures for most fish species.

The second issue, the need to protect the fishery inside the cooling canal, is probably more a legal than a biological issue. Even if you were to determine that he aquatic community inside the habitable portions of the cooling canal is "insignificant", if the canal is legally considered a component of Waters of the State, or Waters of the United States, NHDES and EPA will have to require some level of protection for its aquatic biota. However, if the canal is a Water of the United States, designating the canal as a mixing zone may provide you with additional guidance (and options) with respect to the level of protection required.

The final issue, whether to prevent fish from entering the canal from the Merrimack River, is biologically problematical. If PSNH were to construct a barrier to river water and fish ingress to the cooling canal, the barrier would limit recruitment of fish stocks to those fish resident in the canal at the time the barrier became effective, or to fish surviving entrainment in the cooling water system at Merrimack Station. If we assume that some unspecified thermal or chemical "event" will eventually kill all fish stocks in the cooling canal, a barrier between the River and the canal would prevent reestablishment of aquatic biota in the habitable portions of the canal following recession of the toxic event. The result of preventing the reestablishment of a fish community in the canal would be the overall loss of biological productivity for the locale.

However, if we assume that the heated effluent could be an attractive nuisance for migrating (or resident) biota, then a barrier to fish ingress to the cooling canal would have beneficial biological aspects because it would presumably prevent fish from being exposed to toxic chlorine levels in the canal, or distracted from their migration, by virtue of their attraction to the heated effluent. Overall, a barrier would probably be beneficial to Merrimack River biota, although the subject deserves more consideration and study. Since we do not expect significant numbers of in-migrating anadromous fish in this river reach for several years, it is probably not critical that a barrier be constructed immediately to protect **anadromous** fish. You may decide, however, that the pending permit should require construction of a fish barrier in order to protect **resident** fish species. A decision regarding the need for, and timing of, a fish barrier to protect **resident** fish will probably rely heavily on an assessment of existing monitoring data for the thermal plume, and on the reported frequency of fish kills in the canal.

In summary, we believe that the thermal component of the effluent should be regulated according to two temperature criteria - a T_{max} value, and a ΔT. Specific temperature tolerance data are provided for fish species known and expected to occur in the project area. Temperature criteria corresponding to temperature tolerance data are calculated for sensitive species. We do not have data regarding the significance of the fishery in the cooling canal, and refer you to NHFGD (or PSNH) for those data. If the cooling canal is determined to be a Water of the United States, the degree of protection given to the aquatic biota inhabiting the cooling canal may depend on your designation of the mixing zone for the Merrimack Station. Although we think the issue deserves additional study and consideration, we believe that a barrier or other means of preventing fish access to the cooling canal would be of net benefit to the aquatic biota of the locale. Many of the points raised in meeting and correspondence deserve additional study. We would be pleased to assist EPA and NHDES assess existing data that describe the thermal effluent, and help design studies that will address additional data needs.

Please direct further coordination in this matter to Kenneth Carr of this office.

Sincerely,

Gordon E. Beckett

Gordon E. Beckett
Supervisor
New England Field Offices

LITERATURE CITED

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