Public Service of New Hampshire

PSNH Energy Park
780 North Commercial Street, Manchester, NH 03101

Public Service Company of New Hampshire
P.O. Box 330
Manchester, NH 03105-0330
(603) 669-4000

The Northeast Utilities System

May 8, 2002

D18597

Mr. John King
US EPA - Region 1
Office of Ecosystem Protection (CPE)
NPDES Permit Unit
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Subject: Merrimack Station NPDES Permit No. 0001465
Proposed Temperature Limitations

Dear Mr. King:

On behalf of PSNH, Normandeau Associates (NAI) compiled the attached letter to summarize our position regarding the proposed thermal limits for Merrimack Station, as presented and discussed at the interagency meeting on April 17. This letter is to support the technical findings submitted by NAI and to directly provide additional comment. PSNH is pleased to have the opportunity to participate in these preliminary negotiations and compliments you on the professional manner in which they have been conducted.

The agencies have stated that the time has come to assign numeric temperature criteria in the Merrimack Station NPDES permit. While we believe the current regulatory scheme provides adequate protection, we recognize its uniqueness and understand EPA's preference for more traditional temperature limits. Given your directive that the limit setting process will be science-based, and having the vast library of research that exists for the target fish in general, and for the Hooksett pool specifically, PSNH feels that fair, reasonable limits are certainly achievable. Unfortunately, the limits that have been proposed are based upon only a scant amount of the available technical information. The suggested maximum limits for the migratory seasons were selected from a source that provided preferential, not lethal, temperatures. There appears to have been little to no science applied to the derivation of the temperature limit assigned for the remainder of the year. Of greatest concern, is the imposition of these overly protective limits at the worst case location, Station S0. This approach ignores further scientific evidence that shows the plume stratifies in the top meter of the river and that an ample supply of cooler water exists below the surface lens. And while the surface discharge temperatures can considerably exceed river temperatures, near ambient temperatures are always available to the fish beneath the plume. In fact, even at Station S0, approximately one third of the river cross section is maintained at near ambient temperatures. If the intent is to apply temperatures that fish prefer, then the limits should be assigned in the water body where the fish live. If the intent is to apply limits at Station S0, then additional modeling is necessary to refine the correlation between downstream subsurface temperatures and canal discharge temperatures.

The limits as proposed impose significant consequences to PSNH and the electric consumers of New Hampshire, from both economic and power supply perspectives. At present, the available research documentation does not justify a multimillion dollar expediture to provide cooler water for the anadromous fish program as it currently exists or for the resident populations. It is important to recognize that this stretch of the river typically begins to exceed the "cold water fishery" standard not long after the spring runoff is complete. For the salmon smolts migration time frame, the naturally occurring river temperature can exceed the proposed 68°F limit nearly 20-percent of the time. And in nearly 35 years of operations, there is not one significant fish kill event attributed to the normal thermal discharge from Merrimack Station. In fact a strong argument can be made, and corroborated by numerous fishermen logs, that the indigenous fish prosper from the thermal discharge. If an agreement can not be reached based upon the existing documentation, PSNH requests the opportunity to perform further site specific investigations to gather the lacking information. To gain more knowledge and to further substantiate the zone of passage, we are already installing additional RTDs at Station S4 to record temperatures at two greater depths this summer.

Again, thank you for this opportunity to present our position on this extremely important issue. Please contact Allan Palmer at 603-634-2439 to continue the discussions.

Very truly yours,

John M. MacDonald
Vice President

cc: Roger Janson, USEPA
Eric Nelson, USEPA
Carl Deloi, USEPA
Andrew Major, USFWS
John Warner, USFWS
Bill Ingham, NHFGD
George Berlandi, NHDES
Bob Estabrook, NHDES
Sterg Spanos, NHDES
Rick Simmons, NAI

NORMANDEAU ASSOCIATES, INC.
25 Nashua Road
Bedford, NH 03110-5500
(603) 472-5191
(603) 472-7052 (Fax)

May 6, 2002

Mr. John King (CPE)
US EPA - Region 1
1 Congress Street, Suite 1100
Boston, MA 02114-2023

Dear Mr. King:

Normandeau Associates, Inc (NAI) has reviewed the maximum seasonal temperature limits for the Merrimack Station proposed by the NHFGD, USFWS and the USEPA, and discussed at our meeting on April 17, 2002. We understand the limits to be tiered in the following manner:

- The proposed maximum seasonal temperature limit for the spring fish passage season (May 1 through June 15) is 20°C (68°F). The primary basis is to protect emigrating salmon smolts from thermal stress or an accelerated desmoltification process.
- The proposed maximum seasonal temperature limit for the autumn fish passage season (September 1 through October 31) is 26°C (78°F). The primary basis is to protect emigrating juvenile river herring and shad from thermal stress or a thermal barrier.
- The proposed maximum temperature limit for the remainder of the year is 30°C (86°F) to ensure survival of resident fish species.

NAI believes these temperature and seasonal limits are stringent for four primary reasons:

1. The proposed maximum temperature limits are too low given the peer-reviewed research that indicates the target fish can withstand warmer conditions,
2. The duration of the two migration seasons are too long based on actual migration data for the Merrimack River,
3. The limits should take into account the numerous site specific and Connecticut River studies that demonstrate resident fish, salmon smolts and juvenile clupeids detect and avoid potentially harmful conditions by passing under or around thermal plumes, and
4. The assignment of the limits at the surface of Station S0 does not take into account the extensive zone of passage that exists throughout the thermal plume.

Spring Migration of Salmon Smolts

The proposed spring (May 1 through June 15) thermal limit of 20°C was taken from Table 3-1 of a Saunders report (1993) on the effects of thermal discharge on anadromous and indigenous fish of the Merrimack River. This temperature value is actually the upper end of the *preferred* migration range for salmon smolts as derived from existing literature. In the Merrimack River, the very limited numbers of salmon smolts moving downstream in June typically encounter ambient water with temperatures in excess of 20°C. Research shows that for juvenile salmon acclimated at 20°C, the 6-hour TL50 is 28°C and the 1-hour TL50 is 29.4°C (DeCola 1970), demonstrating that juvenile salmon can withstand high temperatures

for short periods. Studies of radio-tagged smolts in the Connecticut River demonstrated that the fish skirted the edge of the Vermont Yankee thermal plume or passed directly through it with no apparent problem or delay in migration (McAvoy 1980; 1981). Studies of the downstream movements of radio-tagged smolts in the Merrimack River showed that there is no delay in migration due to the thermal plume at Merrimack Station (Saunders 1992). Saunders concluded that travel times of radio-tagged salmon smolts between Eastman Falls Dam and Garvins Falls Dam and between Garvins Falls Dam and Amoskeag Dam did not differ significantly (Mann-Whitney test) and concluded that the Merrimack Stations thermal plume does not impede the downstream salmon smolt migration. In reviewing the station's thermal plume data, Saunders (1993) looked at two dates that were considered representative of low flow conditions, high ambient temperatures and high station thermal output (summer conditions). The analysis established that there is a substantial area of water temperatures within 1-2° C of ambient in those portions of the river cross section that are more than 1–1.5 m below the surface. With the exception of the discharge transect (Station S0), this region of near-ambient temperatures comprises approximately 45% or more of the river's cross sectional area downstream from the discharge. Even at the discharge transect, the near-ambient region comprises about one-third of the cross sectional area.

The proposed spring fish passage season should be shortened to the month of May only. USFWS personnel captured very few salmon smolts after the first week of June at the Eastman Falls Dam in 1991 (McKeon 1991). Most salmon smolts in the Merrimack River migrate from late April through May, with the vast majority passing in May. A study in the lower Merrimack River at the Lawrence Dam in 1993 demonstrated that more than 96% of the wild salmon captured in the project's fish bypass migrated between May 5 and June 2 and only 3 smolts were captured after June 2 – the study continued through the month of July (NAI 1994a). Because this is the lowermost dam on the river, the study shows that the Merrimack River downstream salmon run occurs primarily during May and that only a small number of salmon smolts are still moving downstream in the river during June.

Given that the Merrimack River salmon smolts can withstand higher temperatures and mostly migrate downstream in May, that studies in the Merrimack and Connecticut Rivers have demonstrated that salmon smolts successfully negotiate thermal plumes without delay or blockage, and that a large zone of passage exists below Merrimack Station even under low flow conditions, Normandeau recommends the following:

- The spring migration period be shortened to May 1 through May 31.
- The maximum temperature limit should be considerably higher, or take into account the mixing zone instead of imposing the limit at Station S0.
- If 20°C (or ambient river) is the maximum limit, then it should be established at mid-depth at Station S4 to account for mixing and the zone of passage present just underneath the thermal plume.

Autumn Migration of Juveniles

The proposed autumn (September 1 through October 31) thermal limit of 26°C was also taken from Table 3-1 of the Saunders 1993 report on the effects of thermal discharge on anadromous and indigenous fish of the Merrimack River. Again, this temperature reflects the upper end of the *preferred* migration range for juvenile clupeids (American shad, alewife, blueback herring) as derived from existing literature. It is similarly restrictive in terms of absolute temperature, the time period to which it will be applied, and where the temperature measurement will be made.

The time period was selected to protect downstream migrating juvenile clupeids. However, this time frame is excessive since the downstream migration in the Merrimack River does not begin in earnest until the end of September. Peak catches of juvenile clupeids at the Lowell Project in 1991 occurred between 10/1 and 10/9 when water temperatures were 14°C – only twenty individuals were captured between mid-September and October 1 (NAI 1992). During similar studies at Lowell in 1992 and 1993, low numbers of juvenile clupeids were captured in late September, with peak catches occurring after mid-October in both years when water temperatures were 15°C and dropping (NAI 1993; NAI 1994b). This trend was also noted during a study at the Lawrence Hydroelectric Project in 1993, when nearly all the clupeids were captured during October – the run peaked between 10/18 and 10/28 (NAI 1994c).

Much of the derivation of the 26°C temperature limit is from Marcy (1976a), where it is stated that the greatest number of juvenile shad were captured at a temperature of 26°C in a Connecticut River study. However, the same source states that juvenile alewives were captured at temperatures as high as 30°C, and one was captured at 31°C. Shad have the ability to avoid potentially lethal temperatures (Weiss-Glanz et al. 1986), and can survive water temperatures outside of their preferred temperature tolerances. Studies by Moss (1971) and Marcy et al (1972) at Connecticut Yankee concluded that although lethal temperatures existed, migrating juvenile shad were able to detect and avoid the thermal plume by going under it. Juvenile alewives and blueback herring can also detect and avoid thermal plumes (Meldrim and Gift 1971). Otto et al (1976) reported that the 7-day upper incipient lethal temperatures (UITL's) for alewives was 30.3°C if they were acclimated to 20°C, and those individuals acclimated to 26°C had UITL's of 32.1° C (adult alewives were similar).

Given that juvenile clupeids in the Merrimack River can withstand higher temperatures and typically begin downstream movements in late September, that studies have demonstrated that all three species of clupeids can detect and avoid thermal plumes, and that a large zone of passage exists below Merrimack Station even under low flow conditions (33% zone of passage at S0, 45%+ zone of passage below S0 under low flow conditions), Normandeau recommends the following:

- The autumn fish migration period be shortened to September 23 through October 31.
- The maximum temperature limit should be considerably higher, or take into account the mixing zone instead of imposing the limit at Station S0.
- If 26°C (or ambient river) is the maximum temperature limit, then it should be established in mid-depth at Station S4 to account for mixing and the zone of passage that exists just underneath the thermal plume.

Remainder of the Year

The proposed temperature limit for the remainder of the year is 30°C, which the NHFGD believes to be the upper recommended level of a warm water fishery in New Hampshire. The basis for this limit is to protect warm water fisheries, however, this limit is not well supported. There is ample evidence cited in Saunders (1993) that warm water fish can tolerate temperatures well in excess of 30°C. Smallmouth bass, largemouth bass and pumpkinseed are all tolerant of higher temperatures and the UILT's for these species range from roughly 35°C for smallmouth bass to the upper 30°C range for pumpkinseed. Both adults and

juveniles of these species respond to temperature gradients and seek areas of preferred temperatures. As reported by Saunders (1993), during the low flow period in the summer, some parts of the thermal plume may exceed the acute thermal preference of most resident species. However, since there is an area of near-ambient temperatures extending from a depth of a meter or so below the surface to the bottom, resident fish are able to avoid the warmest areas of the plume and seek out nearby areas of preferred temperatures. The lack of reported fish kills or distressed fish in the discharge canal potentially related to high temperatures over the past 35 years of operations indicates that as temperatures increase to unfavorable levels, fish leave the canal (Saunders 1993). In a 1995 fisheries study conducted at the Merrimack Station, it was reported that the canal populations of largemouth bass, smallmouth bass, pumpkinseed, bluegill and yellow perch displayed a pattern of decreasing catch per unit effort (CPUE) during periods of highest water temperatures (July and August), and increasing CPUE in other segments of the study area (NAI 1996). This data demonstrates that these fishes simply leave the canal and seek refuge in the cooler waters of the Hooksett pool. The same report noted increasing CPUE in the canal during September and October as fish returned to the warm waters of the canal as water temperatures decreased in the river.

Given that summertime ambient water temperatures in the Hooksett pool can approach 30°C, that resident fish species (adults and young) sense and avoid potentially lethal temperatures when placed in a temperature gradient, and that yellow perch, smallmouth bass, largemouth bass and pumpkinseed (target species) were commonly captured in the discharge canal at temperatures up to 35°C (Saunders 1993), Normandeau recommends the following:

- The maximum temperature limit should be considerably higher, or take into account the mixing zone instead of imposing the limit at Station S0.
- If 30° C (or ambient river) is the maximum temperature limit, then it should be established in the mid-depth of the river at Station S4 to account for mixing and the zone of passage present just underneath the thermal plume.

In summary, Normandeau recommends taking the temperature readings at mid-depth at Station S4 as a reasonable location. If the plan is to apply the temperature limits at Station S0, then additional research is prudent to refine the linkage between downstream river temperatures and canal discharge temperatures. PSNH is planning on expanding the monitoring capability at Station S4 to record temperatures at two additional depths beside the surface this summer. In light of existing site specific scientific evidence, as well as the significant consequences that the proposed limits present, NAI recommends the EPA reconsider all aspects of the proposed permit restrictions, including the migratory seasons, the magnitude of the temperature limits and the location the temperatures are taken.

Sincerely,

NORMANDEAU ASSOCIATES, INC.

Richard Simmons
Senior Fisheries Biologist

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