

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region I

J. F. K. Federal Building, Boston, Massachusetts 02203-2211

MEMORANDUM

DATE: 10-15-91

SUBJ; Merrimack Station-PSNH
NH0001465

FROM; T. Landry, Senior Permit Engineer

TO: See Distribution

Traditionally, power plant thermal discharges are limited by two temperature conditions:

1. The maximum temperature (T_{MAX}) of the discharge is limited so that the lethal temperature of the locally occurring most sensitive aquatic organism, at the edge of the approved mixing zone, will not be exceeded. This is the reason that some of the power plants have maximum discharge temperatures (T_{MAX}) from 90° to 105° F.
2. The temperature rise or increase across the power plant (commonly called Delta-T or T : discharge temperature minus intake temperature) is also limited to a maximum value that will protect the fishes residing in the thermal plume from "cold shock". Nominally, this Delta-T value is about 15° to 25° F. However, some of the older units that went on line before 1972 had design Delta-Ts of 25° to 40° F. Basically, these older units were exempt from lower Delta-Ts because of the capital cost to update the condenser systems.

All the power plants in New England were evaluated when the first NPDES Permits were issued for design and operation of the intake structure (Section 316B of the CWA) and for the impact of the thermal component of the plant discharge upon the aquatic community (Section 316A of the CWA). At that time, I cannot remember of any facility that presented unusual Delta-T problems that were not addressed in the permit through study programs.

Merrimack Station was an exception in that the State had required them to perform a study program to demonstrate that the plant discharge plume provided an acceptable level of protection to the

aquatic community in the river after the installation of the Power Spray Modules (PSMs). This program also provided that when the anadromous fish program returned shad and salmon to the river near the power plant, the biological impact of the thermal plume would be reviewed by the state and federal regulatory agencies. That time has arrived!

When the regulatory agencies accepted the original company report on the thermal discharge from the PSMs, no correlation was developed between the river temperature, the maximum plant discharge temperature, the maximum Delta-T across the plant (canal discharge temperature minus the river intake temperature) or the thermal plume configuration that would allow for the inclusion of a Maximum Discharge Temperature (T_{MAX}) or a Maximum Temperature Rise (Delta-T) in the NPDES Permit. The only requirement was that the PSMs were to be operated between two seasonal dates from late Spring to early Fall. The date requirement was later changed to a river temperature requirement wherein the PSMs would be turned on when the temperature of the river exceeded 69° F or if the temperature between Location N-10 and Location S-4 exceeded 1° F. No maximum temperature conditions were imposed--rather, the PSMs were to be fully operational during certain critical river temperatures and that the resulting thermal plume was acceptable whatever its thermal characteristics or its configuration might be.

The historical permit thermal requirement which was found acceptable to the various state and federal agencies is:

Power Spray Module (PSM) Operation

The power spray module system shall be operated, as necessary to maintain either a mixing zone (Station S-4) river temperature not in excess of 69° F, or a Station N-10 to Station S-4 change in temperature (Delta-T) of not more than 1° F when the Station N-10 ambient river temperature exceeds 68° F. All available PSM's shall be operated when the Station S-4 river temperature exceeds both the above criteria.

Figure 1 is included to illustrate a typical year's (1988) temperature excursions at Station N-10 upstream of the plant (the maximum monthly temperatures and the monthly average temperatures) and the same temperature regimes for Station S-4 downstream (measured 6 inches below the water surface).

The US Fish and Wildlife Service has calculated the "Acceptable Average Weekly Temperatures" for several resident indigenous fish and for adult Atlantic Salmon. These values are also included in this figure to demonstrate the problem of attempting to satisfy the maximum fish temperatures with the seasonal river temperatures before and after introduction of the Merrimack Station thermal heat load. Note this does not take into account any diurnal temperature

variations.

It is interesting to note, there is a resident fish population of unknown size in the discharge canal itself. During 1988, The maximum temperatures experienced at the discharge canal outlet was 39° to 40° C and the average temperatures were 30.2° and 32.0° C for the months of July and August respectively which are above the "Acceptable Average Weekly Temperatures" calculated by the US F&W Service.

I must, therefore, presume that the Delta-T discussed by Ken Carr and others and as found in the existing permit represents the temperature rise across the plant which includes the temperature rise of the condensers and the temperature reduction provided by the PSMs during all seasons not just during the colder months of the year. In hindsight what is the exact meaning of this Delta-T off 1° to 2° C for Merrimack Station? It is not in the "traditional" Delta-T connotation of protecting resident fish in a thermal plume from a cold shock of 20° to 30° F of a typical facility like Pilgrim, Brayton Point, etc. Is it to protect fish and aquatic organisms in the river in case the plant shuts down or is it considered a measure of fish blockage or is it considered a Water Quality problem or is it associated with the "cold water" fish survival temperatures? This facility has two separate units which will seldom have simultaneous emergency shutdowns; therefore, the thermal impact is nominally from one unit only.

With the arrival of the anadromous fish in a couple of years, the thermal discharge characteristics of the plume must now be reevaluated. We, the regulatory agencies, do not have any hard information on the correlation of the canal (plant) maximum temperature or maximum temperature rise values with the in-stream thermal plume configuration and the concomitant fish blockage/passage and resident fish problems.

We, the regulatory agencies, lack data that would define the plume configuration (temperature distribution) in several vertical river cross-sections (fish passage ways). This now poses a dilemma in that we would like thermal limitations but have NO data to support them. We only know:

1. The thermal plume is greater than 6 inches thick at Stations S-0 and S-4.
2. The calculated "Acceptable Average Weekly Temperature" for the indigenous fish and anadromous fish (US F&W).
3. It is not possible to determine if a fish passage way exists in the Merrimack River under or around the thermal plume from the known thermal data provided by the company or any of the regulatory agencies.

4. Fish survive in the thermal discharge canal even at temperatures above those normally accepted as suitable for them.
5. There have been no reported fish kills in the vicinity of the power plant due to the thermal stress; however, one fish kill has been associated with excess chlorination.

CONCLUSIONS

The current draft permit for Merrimack Station expired on September 9, 1990. We have two options to reissue this permit:

1. To reissue the permit with the thermal limits similar to the existing permit, with all the non-thermal changes desired by the State/EPA and with a study program carefully scheduled so that in a reasonable time the permit can be modified to include thermal limits justified and approved by the several regulatory agencies. It would be possible to hold a technical planning meeting about 3 months after issuance of the permit and receive a final report in the spring of 1993. This would allow sufficient time for PSNH to review all existing data (reported 20+ boxes) and to supplement this historical data with additional thermal measurements in the river during the worst summer case scenario of the low flow with the high atmospheric temperature regime of 1992. This option is suggested because the new permit would implement all non-thermal changes, update the permit, and have an enforceable schedule for completion of the thermal project in 1993 and make appropriate plant modifications ahead of the 1997 date for the return of the salmon to the Hooksett Pool.

The problem of the resident fish in the thermal discharge canal could be evaluated and recommendations developed by the permittees an integral part of the thermal plume study.

2. To delay the reissuance of the permit until a multi-year study program is completed by the company using a "308-letter" to establish the above thermal project schedule. However, in this option, the non-thermal aspects and updated portions of the permit would not be implemented for several years. Consequently, this is not the preferred option.

I would appreciate any concerns you may have. Since this permit has been held up for several months on this issue, the permit section intends to proceed with Option 1 unless information is presented to alter this intended course of action. Please call Nick Prodany at 617-565-3587 or me at 617-565-3508 if you have any questions or any comments.

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1988
 JUNE JULY AUG SEPT OCT

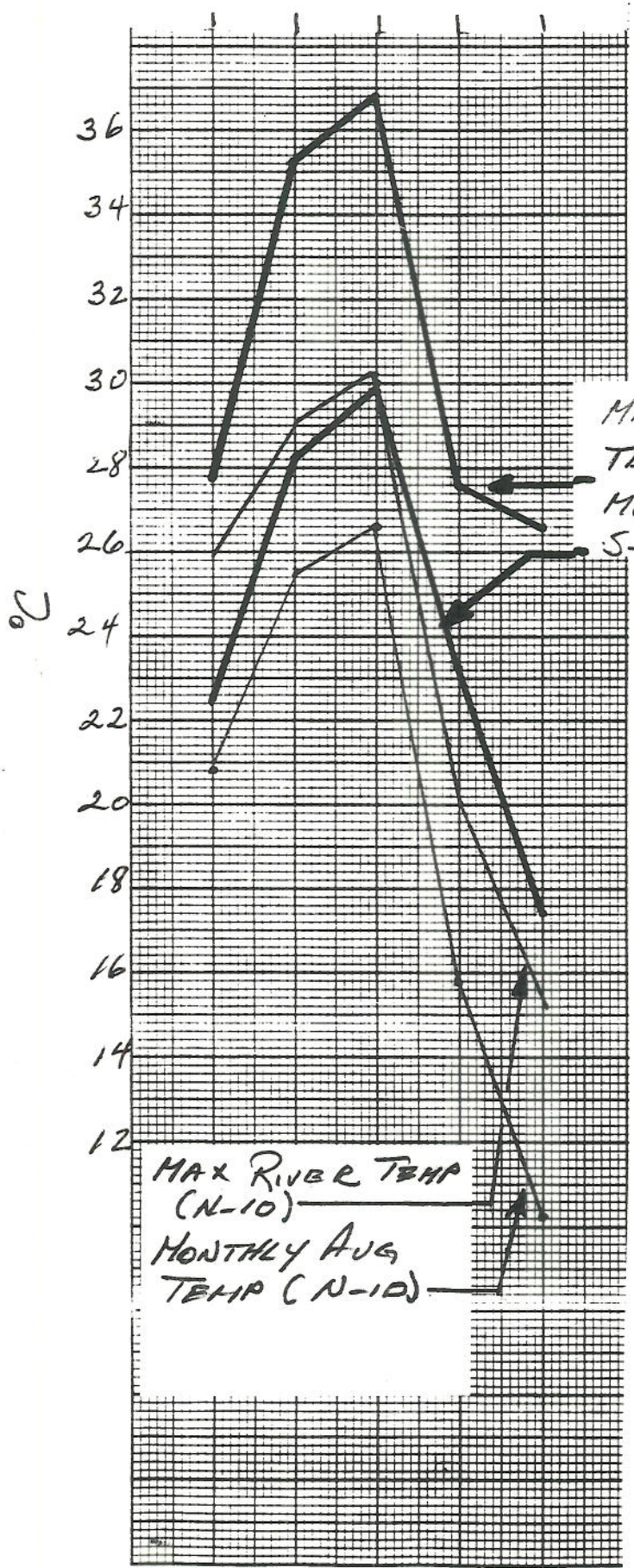


FIGURE 1

CALCULATED "ACCEPTABLE AVERAGE WEEKLY TEMPERATURES" (US F&W)

- 32° C - Largemouth Bass
- 30.5° C - Smallmouth Bass
- 25.7° C - Smallmouth Bass Fry
- 22° C - Brown Trout
- 22° C - Adult Atlantic Salmon
- 22° C - Largemouth Bass Fry
- 19° C - Brook Trout

MAX S-4
 TEMPERATURE
 MONTHLY AVG
 S-4 TEMP.

MAX RIVER TEMP
 (N-10)
 MONTHLY AVG
 TEMP (N-10)