ATTACHMENT 6

SECTION 316(a) DEMONSTRATION FOR THE PRAIRIE ISLAND NUCLEAR GENERATING PLANT ON THE MISSISSIPPI RIVER NEAR RED WING, MINNESOTA NPDES PERMIT NO. MN0004006

L. M. GROTBECK AND L. W. EBERLEY
PROJECT SUPERVISORS
ENVIRONMENTAL REGULATORY
ACTIVITIES DEPARTMENT

NORTHERN STATES POWER COMPANY
MINNEAPOLIS, MINNESOTA

AUGUST 1978

PREPARED BY
HENNINGSON, DURHAM AND RICHARDSON, INC.
ECOSCIENCES DIVISION

804 ANACAPA STREET
SANTA BARBARA, CALIFORNIA 93101

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EXECUTIVE SUMMARY

A. INTRODUCTION

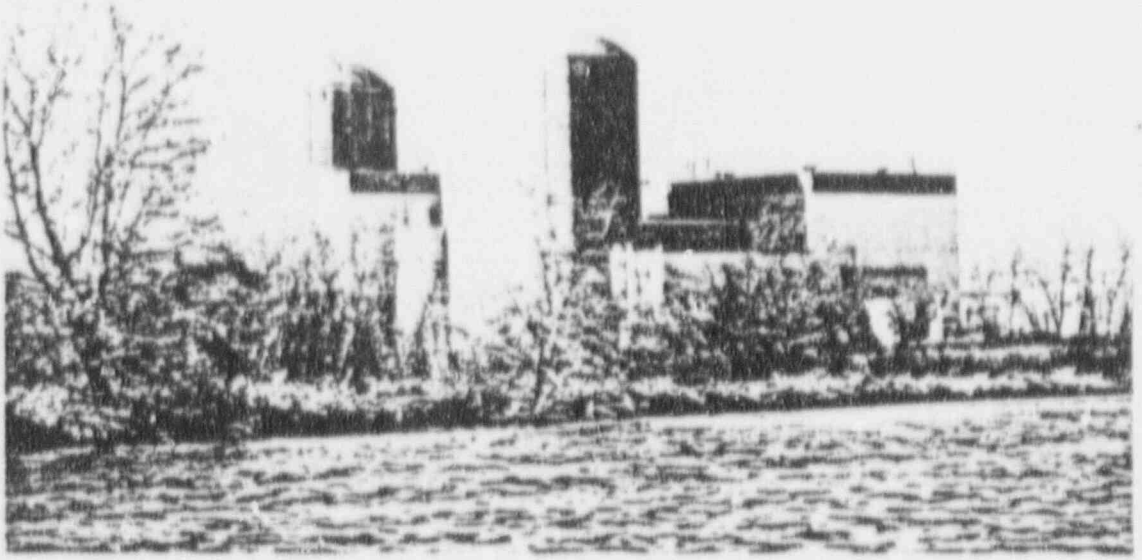
Thermal discharges, including power plants such as PINGP, are regulated by state and federal laws. All dischargers to surface waters are required by the FWPCA Amendments of 1972 ("the Act," P.L. 92-500) to obtain a National Pollution Discharge Elimination System (NPDES) permit from an authorized agency. In Minnesota, the Minnesota Pollution Control Agency (MPCA) has been designated as lead agency to the Environmental Protection Agency (EPA) and administers the law using the Act and MPCA Regulation WPC 36(u)(3).

For this 316(a) demonstration, a predictive Type 2 approach was selected for assessing future impacts of the PINGP thermal discharge upon indigenous biota. This involves selection of representative important species (RIS), including fish and invertebrates, and relies primarily on literature data for thermal tolerances and on thermal plume models to estimate potential impacts. Appropriate site-specific data were utilized to supplement the predictive approach.

B. ENVIRONMENTAL CHARACTERISTICS

PINGP is located on the west bank of the Mississippi River approximately 2.4 km (1.5 mi) upriver from Lock and Dam No. 3 (Figure I-1). The plant intake and discharge areas are separated from the main river channel by a series of small islands that delineate the outlet channels of Sturgeon Lake, a backwater lake connected to the river by numerous small channels. The river is 300 to 370 m (1,000 to 1,200 ft) wide near PINGP, and the banks of the main channel slope fairly steeply to the bottom. The Sturgeon Lake outlet area is quite shallow, and consequently, the intake and discharge areas have been dredged to a depth of about 3.1 m (10 ft). The thermal effluent flows approximately 610 m (2,000 ft) before entering the main channel of the river at Barney's Point.

River flows are regulated to maintain a minimum pool level for navigation during ice-free months (usually mid-March to early December). The annual average discharge rate at Prescott, Wisconsin, was 16,200 cfs for the period 1928 to 1976. River flows have seasonal fluctuations with a peak in April (weekly average of 44,000 cfs) and a low in December (weekly average of 7,000 cfs). The maximum rate recorded was 228,000 cfs on 18 April 1965, and the minimum was 2,100 cfs on 14 August 1936. River



The Prairie Island Nuclear Generating Plant is located on the west bank of the Mississippi River approximately 2.4 km (1.5 mi) upriver from Lock and Dam No. 3. Heated effluent is discharged into the southern end of Sturgeon Lake, which is separated from the main river channel by a series of small islands, and enters the river at Barney's Point.

temperatures also have seasonal variations with a low of 0° C (32° F) in winter when the river freezes over and a high of 29° C (85° F) in summer. Intake temperature data from Northern States Power Company's Red Wing Generating Plant (RWGP) located 15 km (9.4 mi) downriver from PINGP were used to represent PINGP ambient river temperatures since long-term data were not available near the plant. Daily temperature fluctuations are low in the river [1.1° C (2° F)] but may be fairly high in backwater areas. In Sturgeon Lake, the average fluctuation was 2° to 3° C (3.5° to 5.4° F) with a maximum of 9.7° C (17.5° F) during ice-free months of 1974 through 1977.

Extensive water quality analyses have been conducted by NSP in the vicinity of PINGP since 1969 in addition to the U.S.G.S. measurements conducted at Lock and Dam No. 3 since 1969. Although dissolved oxygen (DO) levels never reach critically low levels, the high nutrient concentrations reflect the upriver discharge of domestic wastewater into the Mississippi River from the Minneapolis-St. Paul Metropolitan Sewage Treatment Plant. The Minnesota River also influences water quality in the

Northern bald eagles and various waterfowl migrate through the Mississippi River Valley in spring and fall with some overwintering in areas of open water. The PINGP area does not appear to be an important eagle overwintering area although the discharge may enhance the number of mallards overwintering. Peregrine falcons, an endangered species, are being reintroduced in former nesting areas along Lake Pepin approximately 48 to 80 km (30 to 50 mi) downriver from PINGP.

C. PLANT DESCRIPTION AND OPERATING PROCEDURE

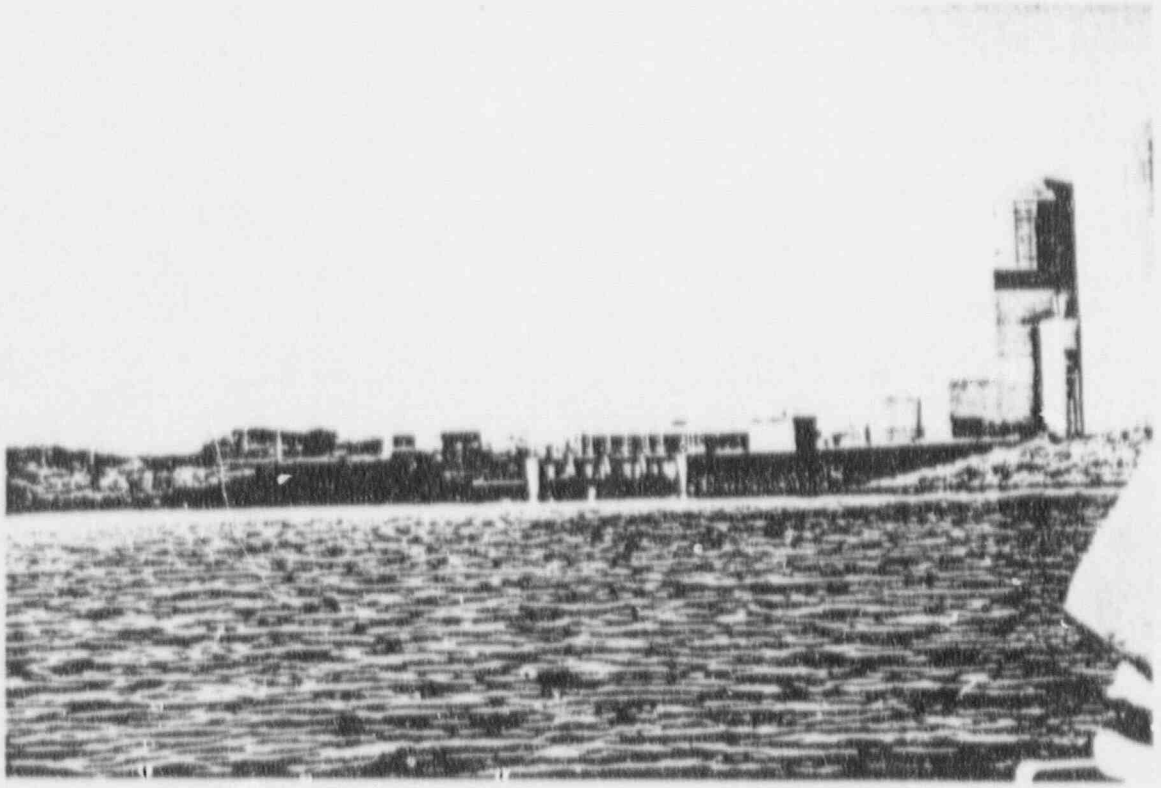
The PINGP circulating water system may be operated in four basic modes: closed, partial recycle, helper, or open cycle. Closed cycle is normally used during the cooler parts of the year, and blowdown is held at approximately 150 cfs. When the temperature of the mixed, makeup and recycled water reaches 29.4° C (85° F) at the condenser, partial recycle is begun and increased as necessary to maintain the condenser inlet temperature at or below 29.4° C. In this mode, cooling towers are still used, but the blowdown and makeup water flows are increased. Helper cycle (no recycle) and open cycle operation are optional modes that have not been used in the past but could be used if needed.

The circulating water system is not chlorinated since the condenser tubes are cleaned mechanically (Amertap method). The cooling water system, however, is chlorinated to prevent biofouling of heat exchanger surfaces, and this water is discharged to the circulating water system. The volume of the cooling water is only 4 percent of the circulating water volume, and chlorine may be lost to the atmosphere in the recycle canal. Measurements of total residual chlorine at the discharge gates have shown the concentration to be less than 0.03 ppm.

PINGP is a base load facility and each of the two units is rated at 507 MWe in summer and 533 MWe in winter. Refueling of one unit occurs during winter while refueling of the other is usually in early spring. These refueling periods are generally 4 to 6 weeks long. Based on past operation, the probability of a forced trip (outage) occurring while the other unit is being refueled is 0.55, and the probability of simultaneous forced trips is 0.00035.

Operating modes should remain similar to those utilized in the past. During summer, however, full helper cycle is proposed from 16 June through 31 August to increase the efficiency of the plant. This would cause the temperature differential between ambient river water and blowdown to decrease, thus decreasing the maximum temperatures in the plume during summer.

Based on preferred temperatures reported in the literature, all of the fish RIS would prefer to reside in some portion of the PINGP thermal plume when ambient water temperatures are low, and some species should avoid at least the warmer areas within the plume during summer. These predictions have been confirmed by field studies which indicated that white bass, carp, emerald shiner, walleye, and gizzard shad were definitely attracted to the discharge during winter and/or spring. Shorthead redhorse, white bass, carp, and gizzard shad showed a distinct avoidance of the warmest discharge areas during summer. Upper lethal temperatures were used to estimate the potential areas of exclusion for long-term use by adults during typical summer conditions. These areas were calculated to be less than 4.4 ha (10.9 A) for all of the RIS fish and would occur only in July and August.



The PINGP thermal discharge attracts fish during most of the year, although some species avoid the warmest portion of the plume in summer. Impacts to the representative important species (RIS) of fish and macroinvertebrates, however, are predicted to be minimal.

as well as parasitism and diseases are likewise predicted to be negligibly affected. Fish population structure should not be changed although such changes are very difficult to measure and are generally indistinguishable from other influences, both natural and man-induced.

Sport fishing has not been in the past and should not be degraded as a result of the PINGP thermal discharge. Fishing success in recent years has been higher above Lock and Dam No. 3 than in the tailwaters of the Dam, although the fishing pressure and harvest have been lower. In the immediate discharge area, fishing success should be enhanced during all but the warmest periods in summer. Fishing pressure has been observed to be higher in the discharge during spring which indicates that some fishermen were taking advantage of the higher fish densities in the plume, and the catch at that time was primarily white bass.

Site-specific invertebrate and primary producer field data were reanalyzed primarily for the operational years of 1975 and 1976. Data for phytoplankton from 1973 and from the first 6 months of 1977 for macroinvertebrates were also utilized. Between station and between date sample variability were computed by ANOVA, Duncan's Multiple Range Test, and the Student t-Test. Pow calculations were also used to establish the likelihood that actual differences between samples would be detected as significant by the above tests. In addition to the sample variance testing, multiple regressions were conducted in order to determine whether or not temperature was highly related to abundances of biota on a spatial basis (i.e., between intake and discharge stations).

From these reanalyses, impacts appear to be minimal or non-existent in most biotic categories. The following characteristics of biotic categories were found not to differ significantly between intake and discharge stations: phytoplankton species diversity or biovolume; periphyton density, species diversity, and phaeophytin a content; zooplankton species diversity and density; and macroinvertebrate (dredge and artificial substrate) density. The power of these statistical tests, however, is limited by the inability to discern differences between station values as a result of the low number of replicate samples taken at each station

The following characteristics of biotic categories were found to differ significantly between intake and discharge stations: phytoplankton primary productivity, periphyton chlorophyll a, and macroinvertebrate species diversity for dredge samples. The significant differences in phytoplankton chlorophyll a between intake and discharge samples probably resulted from plant entrainment damage, while the significant differences between intake and discharge for dredge macroinvertebrate species diversity could have resulted from differences in substrate and current rather than, or in addition to, thermal effects. A study of aquatic insect emergence rates showed that only the mayfly, *Caenis*, may have emerged slightly earlier from heated water stations than from ambient temperature stations. All other aquatic macroinvertebrates including one RIS (*Hydropsyche*)

predictions indicate that warmer water areas of the discharge canal may favor more thermally tolerant taxa, but this area would be insignificant compared to the area of Sturgeon Lake. The thermal plume should not favor the encroachment or proliferation of nuisance organisms, such as blue-green algae; blooms of these phytoplankton have occurred seasonally long before PINGP became operational. Moreover, no federally protected flora or fauna will be impacted by the thermal discharge.

The operation of past and proposed discharge modes at PINGP, therefore, have not and should not exhibit the protection and propagation of a balanced, indigenous invertebrate and primary producer biota. The discharge plume will cause neither appreciable harm nor adverse levels of impact to non-fisheries biota. No drifting forms are expected to or have been observed to be damaged by passage through the plume. Even during extreme environmental conditions, the maximum area of avoidance as a result of heated water for certain RIS macroinvertebrates is small in relation to the total area available in the adjacent backwater habitat of Sturgeon Lake. Moreover, emergence schedules of aquatic macroinvertebrates are expected to be altered only slightly by the heated plume and only negligible losses are expected as a result of premature emergence. Finally, the occurrence and distribution of aquatic macrophytes near PINGP appears to be more influenced by fluctuations in water level, sedimentation, and current conditions than by temperature. Any losses of aquatic macrophytes that may result from the thermal discharge is small in comparison to the total distribution of macrophytes in Sturgeon Lake, as suitable habitat for these plants in the discharge canal is extremely limited.

F. CONCLUSIONS

It is concluded that the thermal discharge resulting from past operation of PINGP has not caused appreciable harm to any aquatic biota, and the protection and propagation of a balanced, indigenous biota has been maintained. During future operation in past or proposed modes, impacts are expected to remain similar to those in the past.