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CHARACTERIZATION OF WATER QUALITY AND PHYTOPLANKTON DYNAMICS IN THE COOLING POND OF THE OTTERTAIL POWER PLANT, MILBANK, SD

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ABSTRACT

Ottertail Power Plant maintains a 350-acre artificial pond to provide cooling water to the boilers within their plant. Over the past several years, plant managers have witnessed frequent blooms of noxious algae, fish kills, fish stunting and odor problems within the pond and calcium carbonate build-up on structures within the plant. The objective of this project was to develop baseline data describing current physical, chemical and biological conditions within the cooling pond. Characteristics measured were water temperature, dissolved oxygen, specific conductance, total hardness, nitrate and ammonia nitrogen, total phosphorus, water transparency, chlorophyll *a* and total and relative abundance of phytoplankton.

Water temperatures varied seasonally by site and temperatures were highest and most variable near the plant effluent structure. Total hardness (mean = 1699, range = 1250 to 2070 mg/L as CaCO₃) and specific conductance (mean = 4315, range = 3151 to 5847 uS/cm) also varied seasonally and both were highest near the effluent structure. Total phosphorus concentrations (mean = 0.93, range = 0.32 to 2.16 mg/L) were two to five times higher than measured ammonia (mean = 0.44, range = 0.13 to 3.48 mg/L as N) and nitrate (mean = 0.31, range = 0.10 to 2.6) nitrogen combined. Chlorophyll *a* (mean = 33.7, range = 0 to 352.4 ug/L) and Secchi depth (mean = 64.7, range = 25 to 120 cm) were found to be highest during the winter months. Total phytoplankton cell counts averaged 31,088 cells/ml and ranged from 13,392 to 66,423 cells/ml. Diatoms, green algae and euglenophytes were found in greater abundance during the winter months (mean = 11,043, range = 0 to 43,101 cells/ml) while cyanobacteria predominated during the warmer summer months (mean = 11,030, range = 0 to 28,709 cells/ml) at all sites. Calcium carbonate precipitation appears to be a function of high primary production and high calcium concentrations during the months of December to February. High nutrient concentrations and low nitrogen to phosphorus ratios appear to favor cyanobacteria during the summer months.

Results of this effort provide a baseline against which future changes can be measured within the cooling pond. Data collected from this effort will be used to guide cooling pond management.