An Analysis of the Discharges of Geo. A. Hormel & Co. Into Spring Brook
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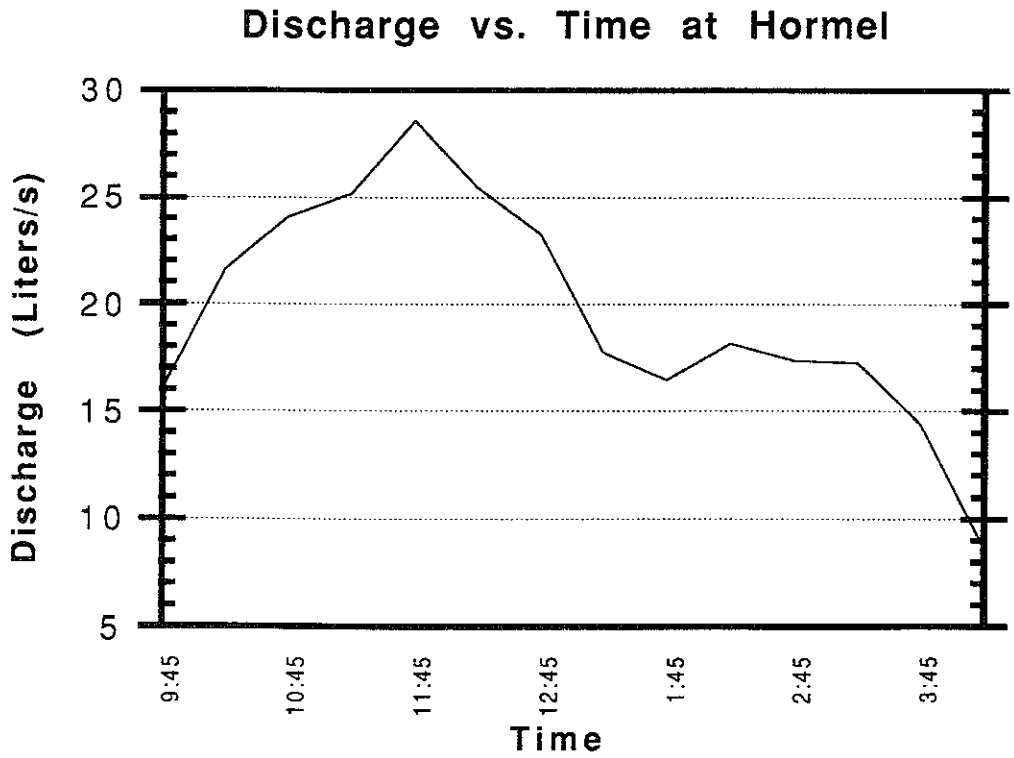
This study analyzed the chemical, biological and physical aspects of discharge by Geo. A. Hormel and Co. into Spring Brook as they relate to the Clean Water Act and the health of the stream. Stream gages have been operating on Spring Brook at the Wisconsin Power and Light Station (WPL) and the Halverson Station (HAL) for several years. Hormel's discharge pipe is a half a mile downstream from HAL and three miles upstream from WPL. Hydrographs have operated at these stations during the summer for several years and discharge peaks have consistently shown up on the hydrographs at WPL that have not been observed at HAL, but the source of these peaks and their effect on the stream have not been investigated previously.

After cleaning out the stilling wells at WPL and HAL and installing the gages, daily peaks in discharge were noted immediately. Discharge rose sharply at 3:30 to 4:00 pm in the afternoon and usually stayed high, with some fluctuation, until 8:00 or 9:00 the next morning. These peaks were observed on every weekday during the observation period, but not on any weekends. The consistency in the timing of the flow peaks and their uniform nature suggested that we were dealing with an industrial source that discharged the same amount daily. There was only one precipitation event during the study period, providing us with a near constant background.

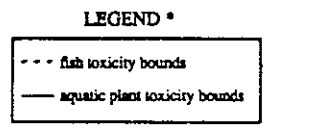
We located the discharger by examining the city storm sewer maps to see where storm sewers emptied into the stream and by walking along it. Three 54" pipes draining the Beloit Industrial Park appeared the most likely sources of the discharge. Further investigation yielded the location of a large cooling pond behind the Hormel plant, only 200 feet from one of the large storm sewers. There was a discernable flow coming out of this pipe, but little flow was evident from the other two pipes..

We determined when effluent flowed from the Hormel plant by measuring discharge from the storm sewer every half hour for a day. We observed that the Hormel discharge peaked at 11:45 am, and when we compared this to the hydrograph for that day, we found a lag time of three and a half hours. In storm events a lag time of two and a half to three hours can be seen between HAL and WPL.



Once we had isolated the major discharger, we took water samples at WPL, HAL, the drain pipe behind Hormel, 50 feet upstream of the pipe, and 50 feet downstream of the pipe. We ran tests in the field for conductivity, pH, temperature, color, turbidity, and dissolved oxygen. Back in the lab we analyzed for coliform bacteria, fecal coliform bacteria, fecal streptococcus bacteria, and Biochemical Oxygen Demand (BOD). We also ran these samples

FIGURES 2-6: Dissolved Heavy Metals Concentrations and Corresponding Toxicity Ranges for Aquatic Plants and Fish.



*Values from Moore and Ramamoorthy, 1984.

FIGURE 2: ZINC

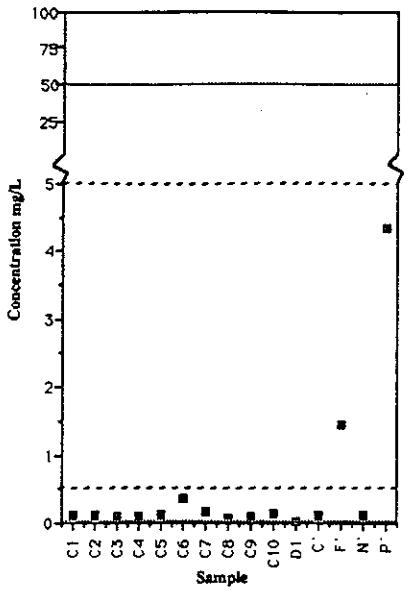
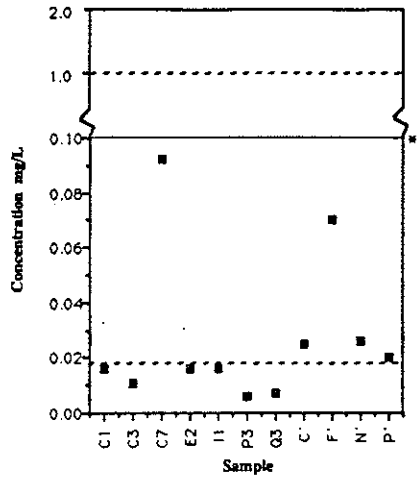


FIGURE 3: COPPER



* Conc. > 0.1 mg/L is toxic regardless of conditions or species.

FIGURE 4: NICKEL

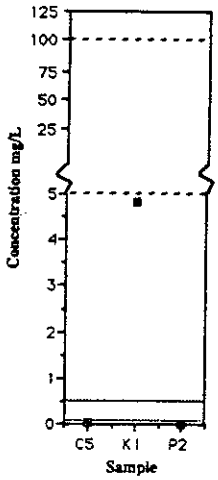


FIGURE 5: LEAD

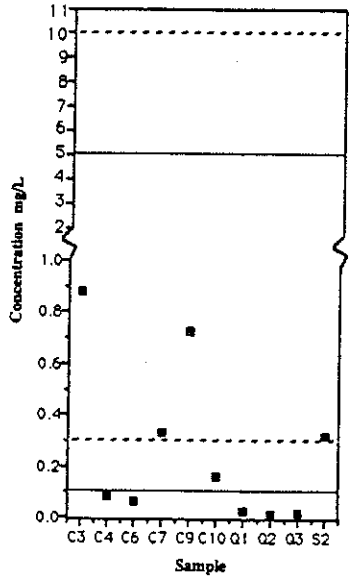
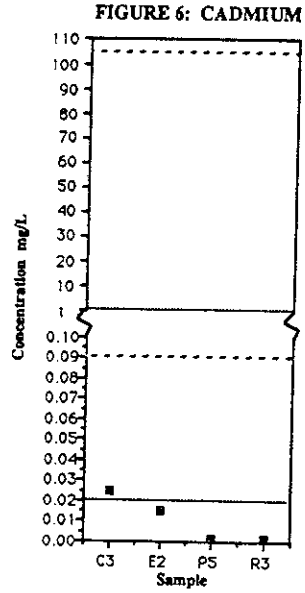
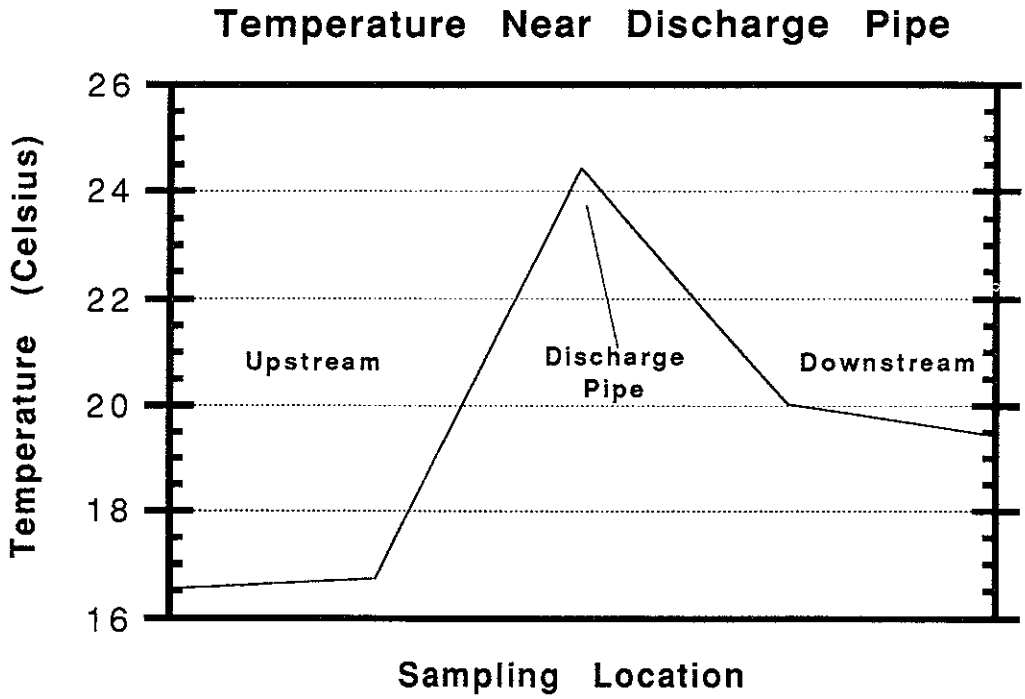


FIGURE 6: CADMIUM



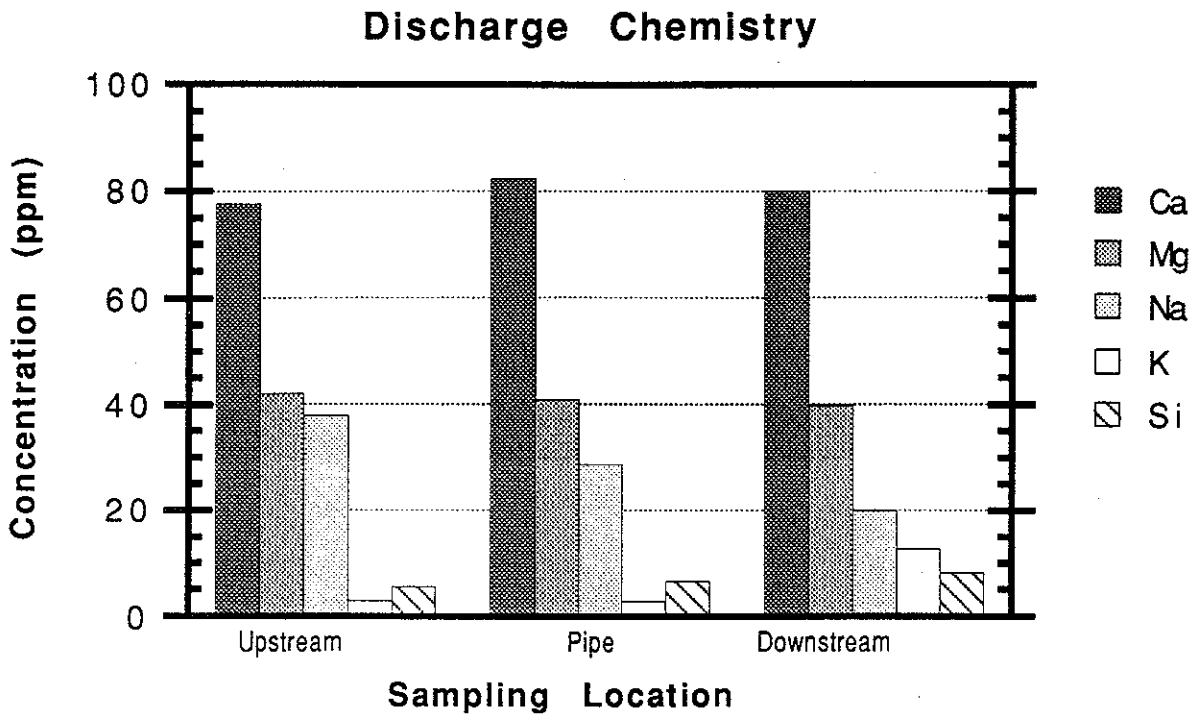
on the Inductively Coupled Argon Plasma (ICP) with attached spectrometer for 15 different elements, and on the Ion Chromatograph for anions.

The field tests revealed that Hormel's discharge was similar to the stream water in conductivity and pH, but had a lower color and turbidity, a higher dissolved oxygen content, and a significantly higher temperature. The clearness of the water results from filters at the plant, and the high oxygen content comes from the aerators in the cooling pond and the lack of oxygen consuming algae. The high temperature is due to the fact that the effluent is primarily water that has been used to cool canned product. Hormel's chief engineer, Don Row, explained that contact cooling water is discharged into the aerated cooling pond and then down a storm sewer into Spring Brook. The can cooking and cooling water is from continuous hydrostatic cookers which run 16-20 hours per day, five days per week. This corresponds excellently with the observed 18-20 hour per day peaks seen on the hydrograph at WPL. Mr. Row added that the flow varies from 300,000 to 680,000 gallons per day, depending on the level of production, and is estimated to have been about 315,000 gpd (0.0184 m^3/s) for the month of July. This is in accord with our discharge figures for the day at Hormel which varied from 0.0158 to 0.0285 m^3/s over their observed discharge period. The aerators in the pond come on when the water temperature reaches 75 degrees F and the summer temperature of water discharged into the storm sewer averages 75 to 80 degrees F.



The bacterial data showed that Hormel's discharge was much cleaner than the stream water. The stream had high levels of coliform and fecal coliform bacteria due to upstream discharge from the Clinton sewage treatment plant and run-off from upstream cow pastures. In the cooling process, the water in the plant is heated to near the boiling point, sterilizing it. The bacteria that are present are probably from the cooling pond.

The ICP data showed high levels of calcium and magnesium which is to be expected because the area is underlain by dolomite bedrock. The samples were also high in sodium. There were low levels of potassium, iron, barium, and silicon, which are elements in the dolomite or the underlying St. Peter sandstone. The Ion Chromatograph data showed high levels of chloride, sulfate and nitrate. All three of these come in large part from the leaching of agricultural soils and the fertilizers applied to them. The chloride may be coming in part from the chlorination of the effluent at the Clinton sewage treatment facility. Some sulfate may also come down in acid precipitation because Beloit is a highly industrialized city.



The Clean Water Act requires every industry to have a discharge permit if they discharge anything into a water body, stream or river. These permits are called National Pollution Discharge Elimination Permits and are issued and enforced by each state. Hormel has WPDES (Wisconsin) permit number WI-0025941-4 for their discharge into Spring Brook via the storm sewer. This permit was issued April 19, 1985 and expired on June 30, 1989. Hormel filed an application for a permit renewal before this deadline, but the Wisconsin Department of Natural Resources has not acted on it yet, so this permit remains in effect. Industries can be held civilly and criminally liable for violations of their permits.

Hormel does not discharge any chemical or biological pollutants, but their discharge is 7.9 degrees Celsius warmer than the stream water. This is legal within Hormel's WPDES permit requirements, but they may still be causing thermal pollution to Spring Brook. Thermal pollution is defined as changes in temperature that affect the physiological functioning of aquatic organisms. A rise in temperature of as little as 0.5-1.75 degrees C alone may not be that harmful, but the accompanied drop in dissolved oxygen and increase in parasites/predators that thrive at the higher temperature may be devastating to the aquatic life. Usually, however, it is not the adult of the species that are harmed by the increase in temperature, but the eggs, larvae and young of the species which have a much lower natural tolerance to thermal change. When assessing the impact of a heat discharge into a stream or lake, it is the thermal sensitivity of these early life stages that is the most crucial area of study.[1] A study such as this has yet to be done on Spring Brook, but is necessary to assess the impact of Hormel's thermal discharge.

The Clean Water Act mandates that all thermal dischargers implement the Best Available Control Technology that is economically achievable by July 1, 1983. Dischargers can get variances exempting them from the regulations if they can prove that the effluent limitations are more stringent than is necessary to protect the shellfish, fish and wildlife in the water body into which they discharge. Hormel uses a large aerated cooling pond, which is considered by many to be the best available technology. Intense litigation has been going on for 15 years between power companies and state and the federal governments over whether cooling ponds and ditches or cooling towers are the best available technology that is economically feasible.[2] The power companies do not want to have to

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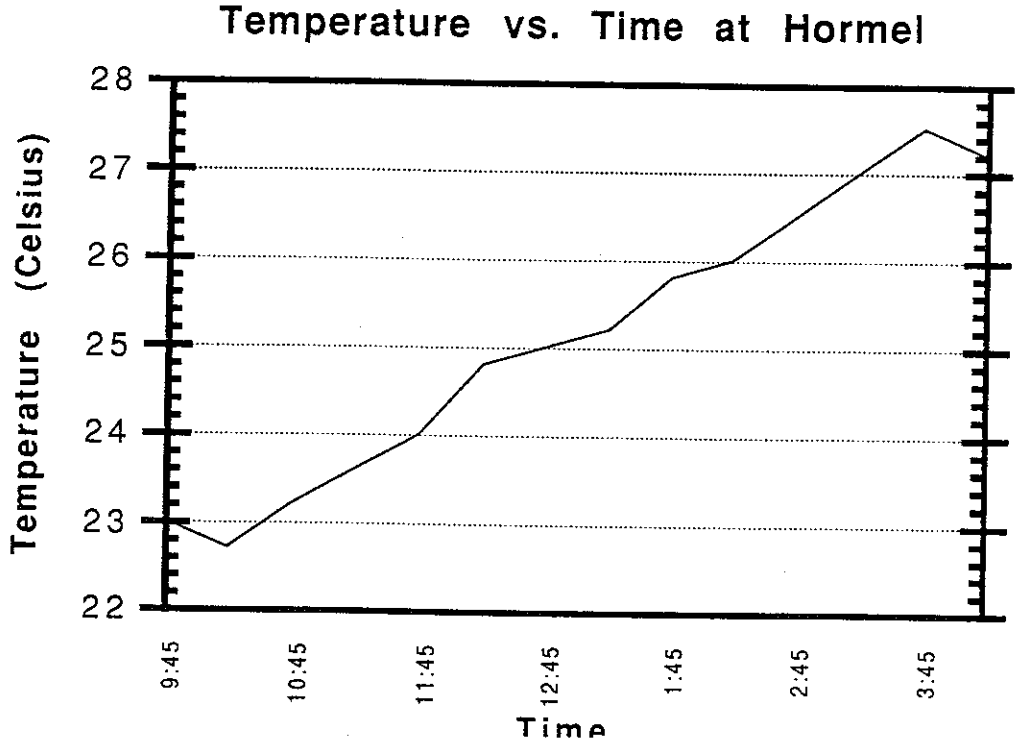
[1]Victor J. Yannaconne and Bernard S. Cohen, Environmental Rights and Remedies, 1972.

[2]William Goldfarb, Water Law, Lewis Publishers Inc., 1988, p 178-181.

build expensive cooling towers when they can simply discharge their cooling water into a ditch. As the common law stands, cooling ponds are the best available technology, but the outcome of this litigation may change that fact. Hormel is abiding by both the Clean Water Act's best available technology requirement and the restrictions set forth in the WPDES permit.

Hormel's discharge is clean, and while the thermal disturbances cause an increase in algae and weeds, it does not appear to be having a devastating effect on the stream. Hormel is a responsible industry that has a discharge permit and is abiding by it. The Beloit Industrial Park has a whole series of new roads that are awaiting industries to inhabit them. Part of the threat to Spring Brook comes from these new, unknown industries. The other two storm sewers from this study service Frito Lay and Enzyme Biosystems, but there are another two storm sewers that were being constructed over the summer on newly built roads We can only hope that these new industries are as conscientious and responsible as Hormel.



AN INVESTIGATION INTO THE DEGRADATION OF A WATERWAY

By: Debra L. Piette

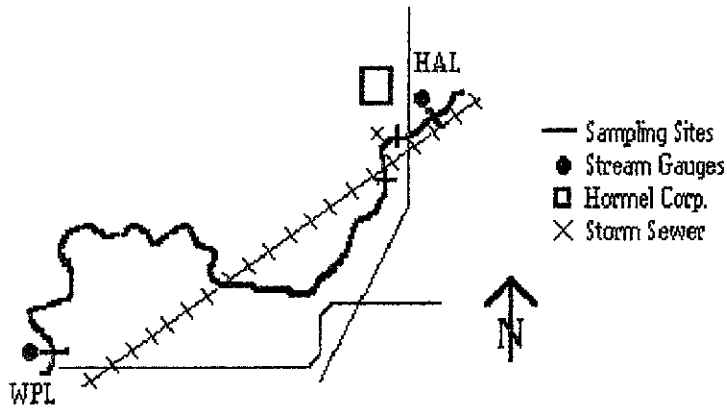
INTRODUCTION

Spring Brook is located east of the city of Beloit in south-central Wisconsin. The stream originates 12.5 kilometers east of the city in an agricultural region. On the outskirts of the town, the stream encounters the City of Beloit's industrial park. From this point, it travels approximately 5.6 kilometers into town, where it then converges with the Rock River.

Two stilling wells, equipped with hydrographs, were installed at two location on the stream, as shown in Fig. 1. These recorded the height of the stream continuously over the period of one week. The upstream hydrograph (HAL) differed greatly from the downstream hydrograph (WPL). It was observed that daily peaks were occurring at the downstream station that were not present at the upstream station even though no precipitation occurred. This confirmed that Spring Brook was receiving an impact through storm sewer influx and discharges from the industrial park. The one that was suspected of discharging into the stream is a storm sewer pipe located directly behind the Hormel Co. Plant and is the first encountered downstream from the HAL station. (Fig. 1).

The purpose of this study was to determine if there were any levels of substances that were above regulation being discharged from the storm sewer behind Hormel. The first step in this study was to take water samples and onsite measurements at HAL, Hormel, and WPL. Those measurements would then be analyzed and compared to World Health Organization, EEC, and state regulations. The discharge would also be compared to the composition of the stream.

Map Of Spring Brook



(Figure 1)

SAMPLING PROCEDURE

Water samples at HAL and WPL were taken equal-distant from one another across the width of the stream with a depth integrated sampler. Three samples taken at each location were then pooled to insure a sample that was representative of the entire portion of the sampling site. Samples were also taken upstream and downstream from the storm sewer behind Hormel in the same manner. At the storm sewer samples were taken directly from the mouth of the pipe to insure that the sample would be representative of the discharge. Figure 1 shows the location of the sampling sites with respect to one another. To determine if there was any variation in the discharge throughout time, samples were taken at thirty minute intervals over a period of six and a half hours.