ILLINOIS POLLUTION CONTROL BOARD
March 17, 1977

IN THE MATTER OF	)	
	)	
TOTAL DISSOLVED SOLIDS EFFLUENT STANDARD	)	R75-6
	)	
	)	

OPINION OF THE BOARD (by Mr. Dumelle):

A petition for regulatory change was filed by the Village of Sauget on March 27, 1975, proposing amendment to Rule 408(b) of Chapter 3, Water Pollution Regulations. This Rule sets forth the effluent standard for total dissolved solids. Accompanying the proposal was a petition with 200 signatures.

The proposal was published in Environmental Register #101, and hearings were held on September 23, 1975 in Sauget and October 3, 1975 in Chicago to receive testimony and comments regarding the proposal. An Economic Impact Study (IIEQ Document No. 76/17) was submitted to the Board by the Institute on August 24, 1976 pursuant to Section 6 of the Act. Hearings to receive comments on this study (Exhibit 19) were held on November 3, 1976 in Chicago and December 17, 1976 in Peoria. All testimony, exhibits, and public comments included in the record of this proceeding have been considered by the Board in rendering a decision on the proposed regulation.

The effluent standard in Rule 408(b) requires that total dissolved solids in an effluent shall not increase more than 750 mg/l above background concentration levels unless caused by recycling or other pollution abatement practices, and at no time may they exceed a concentration of 3500 mg/l. This standard is discussed in the Board Opinion of January 6, 1972 (R70-8, R71-14, R71-20), supporting the effluent regulations.

The proposal presented by the Village of Sauget in this proceeding R75-6 is to exempt from the total dissolved solids effluent standard those sources that meet water quality standards for total dissolved solids in receiving waters to which they discharge. The argument stated in the petition and discussed further in testimony is that, although the technology is available to meet the effluent standards, such treatment is economically unreasonable. The petitioner also stated that the present

effluent standard discourages the use of water recycling techniques, because recycling results in increased concentrations of total dissolved solids in a smaller volume of effluent, which may then violate the standard.

At the first hearing the petitioner requested that the original proposal be limited to apply only to discharges to the Mississippi River. The testimony was limited to the Village of Sauget treatment plant operation, the costs required for Sauget to install and operate treatment facilities to meet the present effluent standard, and the impact of the Sauget treatment plant total dissolved solids discharges on the water quality in the Mississippi River.

Sauget Wastewater Treatment Plant

At the time of the hearings in 1975 the Sauget plant provided primary treatment to approximately 15 million gallons per day (MGD) of waste stream, average dry weather flow. The wastes treated are 99% industrial wastes from companies in Sauget. The waste stream had been steadily reduced from a 1961 volume of 38 MGD, and the industrial dischargers were committed to reducing flow to 8 MGD in 1976.

The reason for the flow reduction was to concentrate the wastes in the stream to make it easier to treat as well as to reduce costs for construction and operation of a new treatment facility. Such a facility was under construction at the Sauget plant in 1975, designed to provide secondary treatment by means of chemical waste treatment. The process includes lime neutralization followed by precipitation of metals through addition of polyelectrolyte and removal by sedimentation and filtration. This plant will discharge to the Mississippi River until a Metro East area regional treatment facility is completed, at which time it will discharge to that larger facility.

In 1975 the Sauget treatment plant effluent contained 3500-5500 mg/l total dissolved solids (Exhibit 5). The effluent from the new secondary treatment facility is expected to have a concentration of 8000 ppm, without any actual increase in dissolved solids loading from industrial wastes. The increased concentration will result from flow reduction plus a contribution of 700-1000 mg/l from lime added during neutralization. The projected total dissolved solids concentration in the discharge from the Metro East regional facility will be 3800 mg/l. Therefore none of the effluents will meet the 3500 mg/l standard.

It is noted that the Village of Sauget's total dissolved solids measurements are obtained using an evaporation procedure at 103°C (R. 30), whereas the Agency uses a procedure which evaporates at 180°C (R. 236). The procedure used by Sauget will result in higher values, as much as 50% higher according to the Agency (R. 222), because organics and water of hydration and occlusion will be retained in the residue which at the higher temperature would evaporate.

A representative of Sauget testified that an Illinois EPA computer printout of source effluent data for 1972 through 1974 showed that the Sauget plant was the only discharger to the Mississippi River in violation of the standard (R. 47). The Agency could not verify which measurement procedure was used to obtain that data. There appears therefore to be some ambiguity in the effluent data presented in the record and in the present status of Sauget regarding compliance with the effluent standard. However, when its secondary treatment plant is completed, its 8000 mg/l effluent will clearly be in violation of the standard, regardless of the measurement method used.

Availability and Cost of Treatment Technology

Four treatment processes are considered to be available to remove total dissolved solids from wastewater. These are reverse osmosis, electrodialysis, distillation, and ion exchange. The processes are described briefly on pages 4-6 of Exhibit 1, and Dr. James Patterson also described them in his testimony (R. 109-113). All four processes remove solids from the waste stream and concentrate them in a brine stream, which must be retreated or disposed of in an environmentally sound manner.

The capital and operating costs involved with each of the four processes demonstrate that reverse osmosis is the most economical process, and it is also the smallest consumer of energy (R. 115-118; Exhibit 10, Table 1). Dr. Patterson, consultant to Sauget, considered it to "represent a potential feasible process" (R. 123).

There are several interferences which can affect the reverse osmosis process, which thereby limit its applicability and increase its costs. Reverse osmosis is susceptible to organic material in the wastewater which fouls the membranes, as well as to bacteria which degrade the membranes. Also, when the brine produced by the process becomes saturated with salts, they will precipitate on the membranes, causing irreparable damage. The first interferences require pretreatment of the wastewater with activated carbon, adding to the total costs. The second one limits the amount of concentration of salts and requires careful control of the system to prevent precipitation (R. 123-125).

The flow diagram in Exhibit 11 is a conceptual design of the reverse osmosis process which would be needed to treat the Sauget secondary treatment plant effluent to meet the 3500 mg/l standard. Only 5.6 MGD (69%) of the 8.11 MGD flow is treated, resulting in 1.41 MGD brine stream as waste and 4.19 MGD treated effluent which, when mixed with the remaining 2.51 MGD (31%) of secondary effluent will yield a 6.7 MGD discharge which meets the required 3500 mg/l total dissolved solids. Pretreatment prior to reverse osmosis includes filtration, pH adjustment, softening, and carbon adsorption.

Total costs for the complete process, including waste brine disposal by deep well injection, were estimated to be $7.72 million capital and 51.8¢ per 1000 gallon operating costs (Exhibit 10, Table 9). These figures represent an 87.9% increase in total capital cost and 157% increase in total operating costs for the new chemical treatment plant (R. 144). The cost estimates in the Economic Impact Study (Exhibit 19) included the $7.72 million capital cost, but annual operating costs of $1.74 million (or 58.8¢ per 1000 gallon) were utilized instead of the Village of Sauget estimates. This higher estimate includes annualized capital cost as well as fuel consumption and labor. These costs for reverse osmosis with deep well injection for brine disposal were compared to costs anticipated using two other brine disposal methods. Treatment with deep well injection is shown to be by far the most economical method, though very expensive and possibly not an environmentally acceptable one.

Impact of Sauget Effluent on Mississippi River Water Quality

Water samples taken in 1974 from the Mississippi River just downstream from the Sauget outfall showed a maximum concentration of 368 mg/l total dissolved solids and a low reading of 324 mg/l (Exhibit 6). Samples taken in 1975, also close to and downstream from the outfall, yielded a high value of 397 mg/l and a low of 262 mg/l. All of these values are well below the applicable water quality standard of 500 mg/l for water supply and food processing waters.

Discharge from the new secondary treatment plant will have little or no effect on concentrations in the river, because the industrial waste loadings of dissolved solids will remain the same, though concentrated in a smaller waste stream. The only increase will be from the lime added during neutralization. If, on the other hand, these wastes were treated to meet the 3500 mg/l effluent standard, the improvement in river water quality was estimated to be only 1 mg/l total dissolved solids (Exhibit 19 p. 121), reflecting the relatively small contribution of this plant to total loadings in the Mississippi River.

Economic Impact of the Regulation

Costs to Sauget calculated in the benefit cost analysis, as cited above, were $1.74 million per year for reverse osmosis with deep well injection of brine wastes, to meet the standard. These costs were allocated to the industries discharging into the treatment plant, and their economic response to their increased cost burden was predicted. The response involved a potential loss of 0-652 jobs and possible price increases for their products of 0-1.3%. Long term loss of industry to the area was also projected as a possible outcome.

The total benefits resulting from a 1 mg/l improvement in dissolved solids water quality in the Mississippi River were estimated to be $460 per year, resulting from reduction in corrosion damage to power-generating cooling systems and to residential household plumbing fixtures and appliances. The dissolved solids properties considered in the analysis were corrosiveness, effects on osmotic pressure, and hardness. Toxicity of individual constituents was not included. This regulation will have a slight economic impact on the people in Illinois using Mississippi River water, but the impacts resulting from compliance by Sauget with the effluent standard are found to be greater.

Because the Village of Sauget is at this time the only discharger to the Mississippi in violation of the effluent standard, exempting sources on that river from the standard will result in minimal water quality impacts, as discussed above. Sources expected to exceed the 3500 mg/l level would be industrial processes discharging directly or plants such as the one in Sauget which treat wastewaters primarily from industrial operations. The water recycling efforts of such sources, both for resource conservation and to allow more effective treatment of hazardous waste constituents, are relevant considerations in this matter. When evaluated along with the costs to Sauget and environmental problems involved with treating total dissolved solids, as well as the minimal expected impacts on users of the Mississippi River, an exemption from the effluent standard is merited as long as the water quality standard for total dissolved solids is met.

We are not satisfied, however, that there is enough information in the record on the remaining waters of the State to apply the amendment statewide. Dilution ratios and background dissolved solids concentrations vary widely for different receiving waters, which may affect the relative water quality impacts of individual point sources discharging into them. Discharge characteristics and control capabilities of those sources may also be relevant. Data presented for a number of rivers in Illinois show that some violations of the water quality standard already exist and that concentrations of total dissolved solids are increasing slowly

over time in the Mississippi and Illinois Rivers. These facts must be considered thoroughly before a statewide exemption could be allowed.

A proposal to delete the total dissolved solids effluent standard from the Water Pollution Regulations is pending before the Board in R76-21 Effluent Standards Revision. Further consideration of the standard and submission of additional information regarding its merits will be possible in R76-21, and the record of this proceeding R75-6 can be incorporated into the R76-21 record. Therefore, at this time an exemption from the effluent standard is allowed only for sources on the Mississippi River, while leaving open the proposal in R76-21 for continued deliberation on the merits of the statewide effluent standard for total dissolved solids.

This Opinion constitutes the Board's findings of fact and conclusions of law.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the above Opinion was adopted on the 17th day of March, 1977 by a vote of 4-0.

Christan L. Moffett
Christan L. Moffett, Clerk
Illinois Pollution Control Board