

ILLINOIS POLLUTION CONTROL BOARD  
November 8, 1971

MONSANTO COMPANY )  
 )  
 v. ) PCB 71-110  
 )  
 ENVIRONMENTAL PROTECTION AGENCY )  
 )

Messrs. Hackbert, Rooks, Pitts, Fullagar & Poust, by Mr. Harlan L. Hackbert, for Monsanto Company

Mr. Fred C. Prillaman, for the Environmental Protection Agency

Opinion of the Board (by Mr. Dumelle)

Monsanto Company (Monsanto) petitioned for a variance to be allowed to discharge mercury (Hg) into the waters of Illinois beyond the limitation specified in recently adopted Mercury Regulations (Docket No. R70-5). In response to the Recommendation filed by the Environmental Protection Agency (EPA) Monsanto filed an amended petition which recounted additional mercury-controlling measures and specified attainable effluent concentrations on a daily average basis. We grant the requested variance to the extent of allowing a maximum daily output of 0.5 pounds. The daily amount is approximately equivalent to 5 ppb on a total plant effluent basis and is about 10 times the maximum discharge permitted under the regulation.

The instant petition was filed with the Board on May 14, 1971. A hearing in the matter was held in Sauget, Illinois on September 9 and 10, 1971. The petitioner made an express waiver of the ninety day requirement of the Environmental Protection Act and the Board's Rules in a stipulation joined by the Environmental Protection Agency and filed with the Board on July 22, 1971.

The regulation from which the company sought to be exempt was adopted by the Board on March 31, 1971. The regulation was initially proposed on August 19, 1970. Its enactment represented Illinois' response to the much heralded mercury environmental hazard. At the rule-making proceeding it was demonstrated that an exemption should be provided to preclude the necessity of forcing an industrial enterprise to shut down immediately upon the effective date of the regulation. The exemption was provided for discharges which would be at least 95% controlled within eight months of the adoption of the regulation and which, in the aggregate, would not exceed five pounds per year. The exemption was put in as the result of testimony from the paint manufacturing industry.

The mercury regulation is both a water quality and effluent standard. The limitation of both the water quality and effluent standard is 0.0005 mg/l as Hg (approximately 0.5 ppb). The effluent standard applies to mercury discharges into all Illinois waters including discharges into sewers. All users of more than 15 pounds per year of mercury and those who discharge any mercury are required to submit annual reports to the EPA describing the nature of the mercury use, the amount discharged and programs underway taken to reduce or eliminate the discharge of mercury-bearing wastes. The regulation also deals with the disposal of mercury bearing sludge and provides that recycling be used where feasible and for disposal in such a manner so as to minimize both air and water hazards if the sludge containing mercury residues can not be practicably reclaimed. The effluent standard was set at the same 0.5 ppb level as the quality standard as a reflection of the principle that no discharge of mercury should be allowed unless it is essentially unavoidable. Because mercury discharges are not degradable and therefore cumulative and because mercury is so highly toxic the effluent standard was set to preclude discharges wherever possible.

Incorporated in the Mercury Regulations are the analytical methods by which mercury concentrations are to be determined. Both flameless atomic absorption spectroscopy and neutron activation analyses are specified as acceptable methods for determining mercury levels. At the rule-making hearings the Director of the Water Purification Laboratory of the City of Chicago testified that they have refined their analytical technique with the flameless atomic absorption method to detect 0.1 part per billion with acceptable precision. The precision is reported to be greatly increased at the level of 0.5 ppb. Other testimony by Dr. Leonard G. Goldwater indicated that the neutron activation method of analysis was more precise, could possibly be available on a contract basis, and for large scale use would probably not be economically prohibitive when compared with other analytical methods. Dr. Goldwater stated that the neutron activation analyses could detect mercury down to the presence of one atom of mercury.

Since 1917 Monsanto has owned and operated at Sauget, Illinois an industrial plant known as its "W.G. Krummrich Plant", one portion of which is a chlor-alkali facility which uses mercury. The plant employs 1,350 persons and produces about a hundred different chemical products (R.25).

Mercury is not a raw material at the plant but is used chiefly as a carrier of sodium or potassium ions and a conductor of electricity in the production of chlorine gas and sodium hydroxide (NaOH) or potassium hydroxide (KOH). By passing a direct electrical

current through a flowing salt brine from a fixed anode through the brine to a flowing mercury cathode the salt is converted to chlorine gas and to a mercury-sodium (or potassium) amalgam. The amalgam is passed through a decomposer where it is reacted with water and forms NaOH or KOH, hydrogen gas, and elemental mercury (R.33-34). The mercury is then returned to the cell to be reused as the cathode. The NaOH or KOH is processed and sent to storage and the hydrogen gas is processed and compressed for use in other processes. Mercury is also present in the plant in various instruments and devices such as thermometers, manometers and electrical switches (R.34-35). There are more than 2,000 instruments in the plant which contain mercury (R. 122-123). These devices contain 840 pounds of mercury (R.123). The principal concern about mercury, however, is that amount used and reused in the chlor-alkali process. In that process the plant is presently using mercury at the rate of 32,000 pounds/year (R.222). For calendar year 1970 the plant's usage was 61,932 pounds. The consumption for 1969 was approximately the same as for 1970 (R.223).

The total plant discharge of waste water is 8,900 gallons per minute or about 13,000,000 gallons per day. The plant's aqueous wastes are collected first in the complex sewer system of the plant, those from the chlor-alkali facility are treated and then together with the rest of the plant's wastes are routed to the Village of Sauget sewers which lead to the Sauget treatment plant and then into the Mississippi River.

Samples of the plant effluent taken on August 18 and 19, 1971 show a discharge of 0.72 pounds/day of mercury or approximately 7 ppb Hg on a total plant basis (R. 145, 148). Before the company embarked upon its mercury control program the discharge was approximately ten times higher. In January, 1971 the discharge was estimated to be 7.7 pounds/day as Hg.

The company has since becoming aware of the problem in early 1970, installed a sulfide precipitation process for the removal of mercury from its waste streams in the chlor-alkali facility (R.102-103). The research and engineering program for the treatment process cost \$400,000 (R.103) and the cost of installation of the process was \$600,000 (R.111).

The plant sewer system was changed so that all the waste streams in the chlor-alkali facility are collected for treatment by the sulfide process (R.106-107, Pet. Ex. 4,5). The sewer system has been modified to provide a closed collection system, a "bathtub concept" (R. 111). The process wastes flow from various sources to a collection basin, the pH is adjusted with sulfuric acid and the wastes are pumped to a storage tank. The material is then treated with sodium bisulfite and transported to the clarifier. The solids

settle out and are removed on a batch basis (R. 107). After the clarifier the effluent stream goes through sand filters, polishing filters, and an activated carbon filter (R. 108). The effluent is then moved to storage for reuse or discharge. Two tanks which can be alternately used are available for storage and the effluent can be analyzed before discharge into the sewer (R. 109). An effort is being made to use recycled water in every place possible (R. 110). The sulfide removal system was designed by Monsanto and is the only facility of its type operating on a commercial scale in the United States (R. 202). The removal process was designed to accept wastes in the 5,000 to 7,000 ppb Hg range and discharges an effluent containing 200 or less ppb Hg (R. 230). The operating efficiency of the system is better than 99%. A recent measurement was at 99.2% removal (R. 234). Expressed as amounts, the mercury removal process has a mercury discharge in the range of 0.08 - 0.11 pounds/day (R. 152-153).

The sludge drawn from the clarifier is predominantly mercury sulfide similar to the naturally occurring cinnabar (R. 108). The liquid which flows from the dewatering when the sludge is transferred from the clarifier to the dumpster for land disposal is recycled back through the treatment system (R. 110-111). The solids from the removal process are deposited on the company's own land disposal site located west of the plant and across the highway from it (R. 204-205). The sludge or gyp accumulates at a rate of approximately 500 to 1,000 pounds per week and is buried at the site. The range of mercury concentration of the sludge is not known (R. 235-236).

Mr. Jack W. Molloy, Manufacturing Manager of the plant testified that no commercially feasible system was available to achieve the limitation of the mercury regulation, 0.5 ppb Hg (R. 104, 120, 152). He said that he and others evaluated other known processes (R.103-104) and concluded that the sulfide treatment process in use at the plant was reflective of the best use of present technology (R. 154-157).

A summary of the measures taken to reduce the use of mercury and reduce the concentration of mercury in the effluent include the installation of steel bottoms in the cells, modification of existing sewer system to implement the bathtub concept waste water reuse and flow reduction, and research, engineering and installation of the sulfide removal process. As a result of the mercury abatement measures significant reductions in mercury loss have been noted. Although the company has acted with dispatch it must not either stop or slow the pace at which it is working but must continue to consider new and untried measures such as sewer cleanups, improvements in monitoring and selection of incoming raw materials, improvements in the levels of Hg contamination of products used and shipped and improvements in plant practices. It is clear that although virtually all of the mercury is used at the chlor-alkali facility the bulk of the mercury contamination of the waste water is coming from the remainder of the plant. Perhaps some unknown

interconnections still exist. In that portion of the plant other than the chlor-alkali facility in which essentially no mercury is being used the company must continue to decrease mercury levels in its effluent.

Quite obviously the use of mercury at the Krummrich Plant represents a first order environmental concern. The annual usage of 32,000 or 69,000 pounds of mercury has to go somewhere. That amount which does not leave with the plant's effluent which is not environmentally broadcast as an air emission and which is not completely inventoried at the solid waste disposal site must be leaving the plant as a product contaminant and thereby being distributed. The present rate of use is approximately half of the former rate of use due to the mercury control program now in effect. This reduced rate of consumption represents a net dollar savings to the company of about \$140,000. The fraction of the mercury consumption of direct concern in this proceeding is of course, only the amount in the plant's aqueous effluent.

Monsanto reported on a river testing program undertaken by independent consultants. Mr. Molloy testified to the effect that allowance of a variance permitting the discharge of 0.5 pounds/day of mercury would make no measurable change in the background level of the Mississippi River (R. 161-167). Analysis of fish taken from the River all showed less than 0.5 parts per million of mercury (R. 163). Although this testimony shows that there is no immediate hazard in the river we cannot feel secure that no mercury pollution threat exists.

We learned in our rule-making hearings that the principal difficulty with mercury pollution is the phenomenon of biological magnification. Mercury compounds are concentrated in aquatic organisms by direct uptake from the water and sediment and subsequent ingestion of the smaller species by larger fish. Some fish at the end of the food chain are known to have levels of mercury about 3,000 times as great as the mercury concentration of the water in which they were caught. Further, at this time we cannot be sure that mercury in the bottom sediment is not a future problem.

We find that application of the Mercury Regulation would work an unreasonable hardship on the petitioner in this case and accordingly grant a variance. Up to this point of time the petitioner has seemingly made all practicable efforts to reduce the amount of mercury discharged from its operations. It must continue to do no less. We grant the variance for one year to the extent of allowing the discharge of up to 0.5 pounds/day from the W.R. Krummrich Plant. The grant is a conditional one with three conditions precedent to its continuance. First is a requirement that the company monitor the mercury content of its waste water in the storage tank immediately prior to sewer discharge and when necessary to reprocess the wastes for further removal of mercury.

Second is a requirement that the company submit monthly reports to the EPA and the Board on the operation and progress of its mercury abatement program including a report on the mercury concentrations monitored in the waste storage tanks. The reports are important both to the company and the government agencies as a means of knowing whether any progress in fact is being made. We do not wish to be in a position, a year from now, of discovering for the first time that no progress has been made in further reducing mercury pollution. The first report shall cover the period from the present through December 31, 1971. Monsanto should submit such reports to the EPA and the Board a reasonable time after the end of the month and in no case shall this period extend beyond two weeks.

We shall further require Monsanto to submit a report dealing with the likelihood of making the same products, i.e. sodium (or potassium) hydroxide and chlorine without the use of mercury. The percentage of sodium and chlorine produced by the mercury cell has steadily increased from 47 in 1946 to over 72 in 1956, to 76 in 1960, and is expected to reach 80 by 1968. Projected figures suggest that by 1975 the amount produced in the mercury cell will be 75% of the total. From an environmental perspective it may be desirable for the production to be shifted toward the non-mercuric sodium chlorate process.

Monsanto has made a significant effort to reduce mercury discharge made to water. The Board is not satisfied that the situation is not as good as it could be. A discharge as high as still very much exceeds mercury discharge limits for the Mississippi River or any other large body of water as certified, as the EPA stated in its program order. "The Chlor-Alkali Division has invested a great deal of money and effort in solving the problem of mercury discharge into its electrolysis process" (p. 3). Mr. Staley testified in great detail on the company's abatement program which has been undertaken at its plant situated on the River (A-11-62). For three and a half months prior to the hearing Mr. Staley has had direct responsibility for mercury control throughout the plant (R. 172). Along with the engineering and scientific aspects of the process the company has undertaken a massive and hopefully effective education program aimed at its employees (Det. RA-21). In briefest summary we can say that the Company has not hesitated to make a positive response to allegations of pollution and it has become aware of the mercury environmental problem. We wish to see an every continuing effort to abate mercury pollution.

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


11. Naukath, D.M., "Trends in Usage of Mercury," in a Report of the National Materials Advisory Board, National Research Council, Washington, D.C., Sept. Dec. 1969.

ORDER

The Board having considered the petition, recommendation, transcript and exhibits in this proceeding hereby grants Monsanto Company a variance from the operation of the Mercury Regulation (Docket No. R70-5) subject to the following conditions:

1. Variance is granted to the extent of permitting discharge of mercury up to 0.5 pounds/day as a daily average.
2. Variance herein granted extends to November 7, 1972.
3. Monsanto shall sample and analyze the mercury-bearing waste water which is alternately put in one of the two storage tanks prior to release to the village sewers and treatment plant. If the concentration of mercury is too high the wastes must be rerouted for further treatment.
4. Monsanto shall submit to the EPA and the Board monthly reports on the progress of its mercury abatement program. The first report shall cover the period through December 31, 1971. The reports shall include a listing of the mercury concentration of the waste water storage tanks before discharge and shall be submitted a reasonable time after the end of the month.
5. Monsanto shall submit to the EPA and the Board within six months from date a report dealing with the feasibility of alternative, non-mercury using methods of production of sodium (or potassium) hydroxide and chlorine at the Krummrich Plant.
6. Failure to adhere to any of the conditions of this variance shall be grounds for revocation of the variance.

I, Christan Moffett, Acting Clerk of the Illinois Pollution Control Board, certify that the Board adopted the above Opinion and Order on the 7 day of November, 1971.

  
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Christan Moffett, Acting Clerk  
Illinois Pollution Control Board