ILLINOIS POLLUTION CONTROL BOARD
July 25, 1974

MOBIL OIL CORPORATION (JOLIET REFINERY) PETITIONER	)	
v.	)	PCB 73-452
ENVIRONMENTAL PROTECTION AGENCY RESPONDENT	)	

OPINION AND ORDER OF THE BOARD (by Mr. Marder)

This case comes to the Board on Petition of Mobil Oil Corporation, filed October 29, 1973, for variance from Rule 408 (a) and Rule 1002 of Chapter 3 of the Board's Rules and Regulations, until December 31, 1974.

The Agency filed its Recommendation on December 17, 1973. This Recommendation suggested a grant subject to certain conditions.

On March 25, 1974, Mobil filed an Addendum to its Petition for Variance supplying more information as to research in cyanide, and an update on sampling done by Mobil.

On April 8, 1974, the Agency filed a Supplement to its Recommendation, again suggesting a grant.

No hearing was held.

The facility in question is Mobil's relatively new petroleum refinery, located in Will County near Joliet on I-55. This refinery has a design rate of 164,000 barrels of oil per day. The products from the refinery range the entire gamut of petroleum products, including liquid petroleum gas, motor gasoline, jet fuel, diesel fuel, heating oils and coke.

The refinery construction was completed in late 1972 and was operating at design capacity in early 1973, with a full-time work force of 500 people.

Water for use in the facility comes from the Des Plaines River, for boiler feed, cooling tower makeup, and non-contact cooling water. Well water is used for general domestic type uses. Wastewater streams are segregated in the refinery with one system for storm water runoff, one for non-contact cooling water, and one for "oily" process water, which is processed through on-site waste treatment facilities. This facility was issued construction and operating permit #1971-EA-738 on September 17, 1971, by the Agency. Upon expiration of this permit, Mobil applied

for and received permit #1972-EA-1347 OP on November 1, 1972. As Mobil did not contemplate a cyanide problem, this constituent was not presented in the permit proceedings.

Rule 408 (a) sets a limit of cyanide discharge at .025 mg/l.

It is alleged that refineries have not historically been significant sources of cyanide discharge.

After startup and initial operation at design capacity, Mobil sampled refinery effluent for cyanide concentrations. The initial sample taken February 27, 1973, showed a 1.30 mg/l concentration. As will be explained below, Mobil does not have great confidence in the results of its sample testing, but does state that it believes with a reasonable certainty that the effluent exceeds the .025 mg/l limit.

Mobil believes that most of the cyanide is formed in the refinery fluid catalytic cracking unit (FCC). Cyanide formation is a function of high temperatures in the FCC mechanism, and depends on the nitrogen content in the crude state processed.

Some of the cyanide formed enters the waste water system when certain pipes in the FCC are washed by water to remove deposits of soluble salts which accumulate in the piping. It is estimated that 90% of the cyanide formed in the refinery comes from the FCC. The remainder is probably formed in the coker unit.

At the present time, 80% of the cyanide is removed from the wastewater stream at the refinery sour water stripper. The unit was designed to remove sulphides, phenols, and ammonia from the water, and coincidentally it removes 80% of the cyanide. Mobil feels, but has no test data to show, and in fact alleges that there are no tests to show, that the discharge from the stripper is complex as opposed to simple cyanide.

Mobil treats 2.4 mgd of waste water per day. This is alleged to be considered low for a refinery the size of Mobil's, but water conservation measures are alleged to be used. With this output, Mobil will be able to discharge 0.5 lbs/day cyanide. Mobil further states that by using discharge volume as a criteria for measuring cyanide limits, Mobil is being discriminated against as compared to other refineries that do not practice water conservation.

This problem is not unique to Mobil Oil. The Agency notes that the same type of relief has been requested in Union Oil of California v. Environmental Protection Agency, PCB 72-447; Texaco Oil Co. v. Environmental Protection Agency, PCB 73-6; Shell Oil Company v. Environmental Protection Agency, PCB 73-116; and Clark Oil & Refining Co. v. Environmental Protection Agency, PCB 73-238. The Agency notes that from these cases the following statements can be made:

1. Recent water conservation measures by refineries are largely responsible for increased cyanide concentrations in refinery effluents.

2. Cyanide in refinery waste water is not amenable to traditional cyanide treatment (e.g.: alkaline chlorination process) because of the presence of relatively stable inorganic and organic cyanide complexes in addition to the existence of excessive oxidizable substances (e.g., ammonia and residual organic matter not removed in secondary wastewater treatment).

3. Methods for reducing refinery cyanide problems are still in the research stage.

There is a question as to the validity of the sampling method used for cyanide in the sub-milligram range. When Mobil initially tested for cyanide, tests were done in the refinery laboratory. Then Mobil sent duplicate samples for analysis by ARRO Laboratories, Joliet, to the Mobil Lab in Paulsboro, N.J., and to the laboratories of the Illinois Petroleum Council.

Results of the refinery tests and those done by ARRO are as follows:

	Refinery Lab.	ARRO Lab.	Difference
	0.780	0.150	-0.630
	0.153	0.330	+0.177
	0.085	0.180	+0.095
	0.155	0.193	+0.038
	0.054	0.190	+0.136
	0.099	0.200	+0.101
	0.144	0.040	-0.104
	0.057	0.053	-0.004
	0.211	0.480	+0.269
	0.244	0.018	-0.226
Average	0.198	0.183	-0.015

Duplicative tests of other samples have shown that the reliability of tests on refinery effluent is not high. Mobil, along with the Illinois Petroleum Council, is now preparing a study on testing being conducted for presentation to the Illinois Environmental Protection Agency.

In the Amended Recommendation, the Agency agreed with Mobil's conclusion regarding the inadequacies of cyanide testing. Agency investigations have reached the same conclusion.

The average cyanide concentration in the refinery effluent of 32 samples analyzed from June through September 1973 was 0.175 mg/l. Petitioner alleges that it can maintain a consistent concentration of 0.50 mg/l or less.

Agency effluent grab samples have shown cyanide concentrations as follows:

Date	CN (mg/l)
12/21/72	0.03
8/21/73	0.18
8/29/73	0.22
2/20/74	0.65

Petitioner's testing showed concentrations of cyanide as follows:

DATE	MAXIMUM	MINIMUM	AVERAGE	NO. OF ANALYSES
Feb. 1973	1.30	1.30	1.30	1
March 1973	0.78	0.15	0.47	2
April 1973	0.68	0.40	0.54	3
May 1973	1.77	1.77	1.77	1
June 1973	0.329	0.022	0.193	8
July 1973	0.344	0.081	0.175	13
August 1973	0.337	0.040	0.140	17
Sept. 1973	0.480	0.018	0.253	6
Oct. 1973	0.690	0.018	0.311	4
Nov. 1973	0.756	0.063	0.283	5
Dec. 1973	0.461	0.261	0.390	4
Thru Jan. 11, 1974	0.058	0.034	0.046	2
For last 12 months	1.77	0.018	0.258	66

Mobil has and is investigating various methods to abate the cyanide problem. These include: 1) Parson's HCN Destruction Process, 2) Procon's Removal Process, 3) Ultraviolet Radiation, 4) Powdered Activated Carbon, and 5) FCC Process Improvements.

Parson's HCN Destruction Process:

This process is described as a vapor phase hydrolysis by catalytic action. A pilot unit is being set up at Mobil's Torrance, California, refinery. Mobil states that experimental data shows a 99% removal of cyanide in coke ovens but the life of the catalyst was relatively short because tar constituents foul the catalyst pores. Mobil has allocated $40,000 to carrying out the pilot project. The unit was to have been installed in May of this year and run for a 3-4 month test.

Procon's Removal Process:

No details have been worked out in this case. Procon is evaluating a sample of Mobil's effluent to determine if the process will be applicable.

Ultraviolet Radiation:

Experimentation is being done at Mobil's refinery laboratory to determine whether this is a viable method for removing cyanide.

Powdered Activated Carbon:

The initial research on this method was done by the Calgon Corporation, using adsorption and catalytic oxidation on granular activated carbon.

Mobil has experimented with the same concept using powdered carbon in the refinery activated sludge system. During a four-day full-scale test the carbon level was maintained at 400 mg/l in the second aeration tank. For the first two days of the test cupric chloride was absorbed onto carbon for 20 minutes prior to carbon addition by Mobil. For the last two days, cupic chloride was pumped continuously into the second aeration basin.

Mobil feels that results from carbon-copper addition are inconclusive. Though Mobil acknowledges a certain degree of removal, it is Mobil's conclusion that this amount is not adequate to meet the Rule 408 (a) required level. Mobil will continue research on this method of removal.

FCC Process Improvements:

Bench scale work is being done toward lowering cyanide formation in the catalytic processing unit. It might be possible to steam purge the effluent to strip the catalyst of flue gas containing carbon monoxide. Carbon monoxide in the presence of nitrogen promotes the development of cyanide. Mobil does not feel that this method will be a solution for achieving the 0.025 mg/l required effluent concentration.

Environmental Impact:

Mobil alleges that its cyanide discharge has no significant effect on the levels found in the Des Plaines River. Mobil further alleges that analysis of water samples taken above and below its effluent outfall to the river show no increase in cyanide levels. Mobil has assumed a flow rate of approximately 4.0 billion gallons per day in stating that it is not practical to measure cyanide using current techniques.

The Agency has calculated that based on a 0.5 mg/l average cyanide discharge and an average flow for the Des Plaines River being 4.0 billion gallons per day, the increase of cyanide in the river would be .0003 mg/l. At a low flow of 1.18 billion gallons per day, the increase caused by the effluent would be .0010 mg/l.

The Board takes particular notice and expresses some concern that no data is given for concentration at the edge of the mixing zone. This data will be required in future proceedings.

Mobil alleges that the measured cyanide concentrations in the river are below the water quality level set in Rule 203 (f) of Chapter 3 of our Rules and Regulations. Mobil further alleges that the cyanide discharged from its refinery is a complex type cyanide which is not toxic as is the free cyanide ion.

The Agency in its Supplement to Recommendation states that it is its belief that granting of this variance would have a negligible adverse environmental impact, as long as Mobil's effluent cyanide concentration does not exceed 0.50 mg/l as a monthly average or 0.80 mg/l at any time. Since Mobil has stated above that it can maintain its effluent in the 0.50 mg/l range, this suggestion will be incorporated in our order.

Hardship:

Mobil alleges that enforcement of Rule 408 (a) would impose an arbitrary and unreasonable hardship on it in that there is no commercially proven method of removing cyanide to the required level. Therefore, to comply, Mobil would have to shut down the entire refinery. This would result in a loss of employment to 500 persons at the refinery plus the loss of 157 million gallons of gasoline, 5.7 million gallons of jet fuel, 62.9 million gallons of heating oil, 8.3 million gallons of liquefied petroleum gas, and 4.7 million gallons of residual oil per 30-day period. Closure would also impose a great economic loss to Mobil.

This Board does not usually grant variances to continue to pollute, unless there is a date certain in which the non-complying facility can be brought into compliance. Usually this is done by setting down a compliance schedule as a condition to a variance which must be accepted by the Petitioner before the variance takes effect. Here we have a situation where not only are there no removal techniques that will bring Mobil into compliance, but also it is agreed by both parties that the measurement method has such a low reliability that it cannot be determined with any type of certainty what Mobil's exact discharges are.

For these reasons, the Board will grant Mobil a variance from Rule 408 (a) as it applies to cyanide, without a fixed compliance plan. The Board has granted variances such as this where it appeared that there was no technology to abate the violation. The Board has conditioned such variances on Petitioner's entrance into a research program to ultimately bring the facility into compliance. Sherwin Williams v. Environmental Protection Agency, PCB 71-111; Union Oil Co. v. Environmental Protection Agency, PCB 72-447; Koppers Co., Inc. v. Environmental Protection Agency, PCB 73-365, PCB 74-63. The Board shall continue that practice in this matter. Mobil Oil will submit bi-monthly reports to the Agency as to research being done to abate the cyanide in its effluent and also to report on any research being done in techniques for measurements of low levels of cyanide in refinery effluent.

The Board will grant a variance for six months from the date of this Order, which constitutes an eight-month variance from the original filing date. The reason for this somewhat shorter grant is that the Board finds certain allegations unproven and would desire additional proof in future proceedings. Data as to what percentage of cyanide is complex and what percentage is free cyanide must be generated, and data at the edge of the mixing zone will also be required. Additional information on the status of compliance (results of research and development) as well as advances in analytical techniques will also be required.

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

ORDER

IT IS THE ORDER of the Pollution Control Board that Mobil Oil Corporation is granted variance from Rule 408 (a) as it applies to cyanide for six months from the entry of this Order, subject to the following conditions:

1. Petitioner's cyanide effluent concentration shall not exceed a monthly average of 0.50 mg/l during the period of this variance.
2. At no time shall Petitioner's effluent exceed 0.8 mg/l cyanide.
3. Petitioner shall utilize any methods it may find useful to keep its effluent at the lowest possible cyanide level.
4. Petitioner shall continue to diligently pursue its program of research and development in regards to cyanide reduction.
5. Petitioner shall, starting in 30 days after the entry of this Order, file with the Agency bi-monthly reports. Said reports shall include, but not be limited to:

   A. Progress on all methods being pursued by Petitioner regarding cyanide reduction.
   B. Future work anticipated or methods being pursued by Petitioner.
   C. Any and all records of cyanide concentration in Petitioner's effluent. At least one determination of cyanide shall be run per week.
   D. What methods if any are being used to comply with (3) of this Order.

6. As soon as a technologically feasible program for cyanide reduction has been found, Petitioner shall commence on a compliance plan to implement this program.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, certify that the above Opinion and Order was adopted by the Board on the 25th day of July, 1974, by a vote of 4 to 1.

Mr. Henss dissents.

Christan L. Moffett