ILLINOIS POLLUTION CONTROL BOARD
March 26, 1975

IN THE MATTER OF PROPOSED AMENDMENTS TO CHAPTER 2: AIR POLLUTION REGULATIONS	))))	R73-8, 10, 17

OPINION OF THE BOARD (by Mr. Dumelle):

This Opinion and Order concludes the Board's consideration of three proposals to amend Chapter 2: Air Pollution Regulations which were submitted, separately, by three parties and therefore assigned separate docket numbers. For purposes of public hearings, the three were consolidated into one set of hearings held during May and June of 1974.

The first proposal, R73-8, was submitted on May 14, 1973 by the Illinois Oil and Gas Association (IOGA), and sought to amend Chapter 2: Air Pollution Regulations as they pertain to storage tanks used for organic materials as well as oil-water separation tanks. The specific changes proposed were the following:

Change Number 1: Amend Rule 103(i) by adding the following permit exemptions:

> (17) all storage tanks of volatile organic material with capacity of less than 40,000 gallons;
>
> (18) all organic material - water single or multiple compartment effluent water separator facilities for Illinois crude oil of vapor pressure of less than 5 pounds per square inch absolute (psia).

Change Number 2: Amend Rule 205(c)(2)(B) by deletion as follows:

~~(B)--The location of such tank is outside a major metropolitan area~~

Change Number 1 would exempt two additional types of equipment from the permit requirement (Rule 103). Change Number 2 would broaden the exemption from the organic material-water separation emission limits (Rule 205(c)) by removing the geographic requirement.

The second proposal, R73-10, was submitted by Amoco Oil Company on September 4, 1973. This proposal would amend Rule 206(c), Petroleum and Petrochemical Processes, to increase the allowable emissions of carbon monoxide (CO) from 200 parts per million (ppm) corrected to 50% excess air to 750 ppm corrected to 50% excess air for existing catalyst regenerators and to 350 ppm corrected to 50% excess air for new catalyst regenerators. The changes proposed are to add paragraphs (2) and (3) to the Rule as follows:

> (c) Petroleum and Petrochemical Processes. (1) No person shall cause or allow the emission of a carbon monoxide waste gas stream into the atmosphere from a petroleum or petrochemical process unless such waste gas stream is burned in a direct flame afterburner or carbon monoxide boiler so that the resulting concentration of carbon monoxide in such waste gas stream is less than or equal to 200 ppm corrected to 50 percent excess air, or such waste gas stream is controlled by other equivalent air pollution control equipment approved by the Agency according to the provisions of Part I of this Chapter.
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> (2) Notwithstanding paragraph (1) of this Rule 206(c), any existing petroleum or petrochemical process using catalyst regenerators of fluidized catalytic converters equipped for stoichiometric combustion of carbon monoxide internally within the regenerator, may emit a carbon monoxide waste gas steam into the atmosphere if the carbon monoxide concentration of such waste gas stream is less than or equal to 750 ppm corrected to 50 percent excess air.
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> (3) Notwithstanding paragraph (1) of this Rule 206(c), any new petroleum or petrochemical process using catalyst regenerators of fluidized catalytic converters equipped for stoichiometric combustion of carbon monoxide internally within the regenerator, may emit a carbon monoxide waste gas stream into the atmosphere if the carbon monoxide concentration of such waste gas stream is less than or equal to 350 ppm correct to 50 percent excess air.

The third proposal, R73-17, was submitted by the Illinois Environmental Protection Agency (Agency) on December 13, 1973. It would modify Rule 204(f)(2), Sulfuric Acid Mist Standards and Limitations and Rule 204(g)(2), Sulfuric Acid Mist and Sulfur Trioxide Measurement, of Chapter 2: Air Pollution Regulations as follows:

Rule 204(f)(2)

~~(2)~~ Sulfuric Acid Mist Standards and Limitations.

(A) No person shall cause or allow the emission of sulfuric acid mist into the atmosphere from any process emission source to exceed 0.15 pound of acid mist per ton of acid ~~used or~~ manufactured.

(B) With the exception of Rule 204(f)(2)(A) and fuel combustion sources, no person shall cause or allow the emission of sulfuric acid and/or sulfur trioxide from any emission source either alone or in combination with the emissions of sulfuric acid and/or sulfur trioxide from all other similar emissions sources at a plant or premises to exceed 0.1 lb. in any one hour period.

Rule 204(g)(2)

~~(2)~~ Sulfuric Acid Mist and Sulfur Trioxide Measurement.

(A) Measurement of sulfuric acid mist and sulfur trioxide from sources manufacturing sulfuric acid shall be according to the Barium-thorin titration method as published in 36 Fed. Reg. 24893.

(B) With the exception of Rule 204(g)(2)(A), measurement of sulfuric acid mist and sulfur trioxide shall be according to the Turbidimetric Method using barium chloride as specified by the Agency according to the provisions of Part 1 of this Chapter.

Public hearings on the above proposals were held as follows:

DATE	LOCATION	TESTIMONY PRESENTED
May 8, 1974	Chicago	R73-10, R73-17
May 14, 1974	Springfield	R73-8, R73-17
May 28, 1974	Belleville	R73-8, R73-10
June 9, 1974	Chicago	R73-17

Following a review of the testimony and exhibits submitted by industry and Agency witnesses at the hearings, a Proposed Final Draft of amendments was published on January 28, 1975 in the Environmental Register #97 with a public comment period extending until March 1, 1975. Comments concerning the Proposed Final Draft were received from the Agency, Dr. Wadden (University of Illinois School of Pubic Health), Clark Oil, Commonwealth Edison, Olin Brass, Keystone Wire, TRW, and Bell and Howell.

All of the information submitted for the record in this proceeding, including comments received with regard to the Proposed Final Draft, has been reviewed by the Board in arriving at the conclusions and orders contained in this Opinion and Order of the Board.

DISCUSSION OF R73-8, ORGANIC MATERIAL

Public hearings were held on this proposal on May 8, 1974 in Chicago, May 14, 1974 in Springfield, and May 28, 1974 in Belleville, the IOGA presenting evidence at the Springfield and Belleville hearings. The Agency, at the Chicago hearing, moved to dismiss the proposal on the basis of a deficient petition (R. 4), said motion being ruled against by the hearing officer at the Belleville hearing (R. 261).

Testimony centered on the oil field sites in Illinois. These fields contain 26,000 wells (R. 166) and are serviced by 9,500 oil-water separators. There are approximately 10,000 oil field sites in Illinois (R. 270) which produced 50 million barrels of oil in 1971 but only 30 million barrels in 1973 (R. 168). The number of wells drilled has declined also (R. 168). The IOGA submitted exhibits 1 to 9, photographs, to show the age and condition of typical oil field facilities.

Although the IOGA proposal concerns both storage tanks and oil-water separators, the IOGA was concerned primarily about the oil-water separators (R. 135). Since all fields must practice oil-water separation, "storage" tanks are part of the separation process, and only about 200 to 300 tanks are actually for storage and not for oil-water separation (R. 140, 272). There is an existing permit exemption for organic liquid storage tanks of less than 5,000 gallons capacity (Rule 103(i)(14)), so that the aforementioned 200 to 300 tanks relates to tanks in the size range of 5,000 to 40,000 gallons. Ninety percent of the oil-water separator tanks have a capacity of 210 barrels (8,800 gallons) (R. 282). It is uneconomical to have separation tanks processing less than 200 gallons per day and in fact some tanks process 2,000 barrels per day of fluid (84,000 gallons per day) consisting of an oil and water mixture (R. 282-284).

Various arguments were raised by the Petitioner in support of the proposal; the Board didn't intend to regulate the emissions from the oil field facilities, the emissions from these facilities are insignificant, and no permits are required for oil field facilities since these are not, by definition, emission sources.

The primary argument of the IOGA was that there is no public benefit in requiring permits for facilities not regulated by substantive regulations (R. 254). As contained in their petition the IOGA asserted the following:

> "The undersigned are of the opinion that Rule 103 (PERMITS) requires a permit for "emission sources", as defined in Rule 101 (DEFINITIONS) to be equipment or a facility of a type capable of emitting "specified air contaminants" into the atmosphere. "Specified air contaminants", as defined in Rule 101, are those air contaminants as to which Chapter II contains emission standards or other specified limitions. Since Chapter II contains no standards or specified limitations for a stationary tank, reservoir or other container of less than 40,000 gallons, see Rule 205, or for a single or multiple compartment effluent water separator facility for production of Illinois crude oil under certain conditions, see Rule 205(c)(2), it is the belief of the undersigned that such facility is not, therefore, an "emission source" and a permit is not required under Rule 103."

The Agency argued that there are substantive regulations covering these facilities and that permits should be required (R. 98). Specifically, the Agency asserted that there are rules governing the loading of storage tanks under 40,000 gallons capacity (Rule 204(b)) which would rebut Petitioner's argument regarding these facilities (R. 257). These rules are essentially tank design and operation rules and the Agency needs the permit procedure to check that the construction or operation of these tanks is in compliance with Board regulations (R. 259). There are also rules governing organic material-water separators (Rule 205(c)) with exemptions for facilities outside major metropolitan areas handling low vapor pressure crude oil (Rule 205(c)(2)). While 205(c)(2) may mean that most separators are in compliance assuming they meet the requirements of the exemption, the Agency felt that permits still were required (R. 261). Also, the Agency was willing to have special permit applications for storage tanks and oil-water separators to ease alleged industry burden in filing permit applications (R. ibid).

The Board agrees with the Agency that there are substantive regulations covering some of these facilities. We find, however, no necessity for permits for the 9,500 tanks located on oil field sites because of the likely exemption of most of them by Rule 205(c)(2) as will be discussed later.

The IOGA's argument of Board intent is based on the original air emission standards proceeding, R71-23. The IOGA quotes the following portion of page 39 of the R71-23 Opinion of the Board to indicate Board intent (R. 112) in regulating storage tanks:

> "Based on proof of hardship by the Illinois oil and gas producers, we have made an exception for storage tanks used in the production of Illinois crude oil because of the low vapor pressure and consequent low emission rate of the oil, the generally remote location of these installations, and the declining nature of the industry, which increases the burden of building floating roofs that would have to be abandoned in a short time (Brown, R. 1022-36; Ex. 114, Nos. 25, 100). The specification of positive pressure vent valves and vacuum breakers in such cases was suggested by the industry, (ibid)."

The Agency's response was that there is an existing permit exemption for storage tanks of 5,000 gallons capacity or less (Rule 103(i)(14)) in addition to the storage regulation (Rule 205(a)) and these regulations are indicative of Board intent. In addition, Board intent in regulating oil-water separators is specified on pages 39 and 40 of the R 71-23 Opinion according to the Agency (R. 259). The following portion of page 40 indicates the intent.

> "Other significant sources of offensive organic emissions are facilities for the loading of gasoline and other products, and for the separation of hydrocarbons from water. Rules 205(b) and (c) require such established good practices as submerged loading pipes, gas-tight connections for tank-truck loading, and enclosed separators with appropriate controls. See Hydrocarbon Techniques, supra, pp. 4-5 to 4-14; the supporting testimony of Conoco and Amoco as to loading (Ex. 114, Nos. 29, 37); EPA's backup document (Ex. 60); and the suggestion by Sullivan (Ex. 114, No. 37) and Knowles (Ex. 60, p. 24) that separators may be controlled without requiring the modification of existing vessels."

It was alleged by the IOGA that the emissions from the roughly 10,000 oil field sites is equivalent to the burning of one ton of coal per day (R. 265, 269). Extensive questioning by Board and Agency personnel as to the basis for the one ton figure (R. 276-280, 285-290) revealed discrepancies as to the accuracy and completeness of the supporting data (R. 299-301). In particular, Exhibit 10, submitted by the IOGA, states that hydrocarbon vapor emissions from eleven test

sites ranged from zero up to 27 standard cubic feet (scf) per barrel. Using these data, along with the 1972 Illinois crude oil production figures, results in a total daily emission from all sites of up to 3.75×10^6 scf. Averaged over the area where oil is produced, up to a height of 100 feet, the atmospheric concentration of hydrocarbons is 0.06 parts per million (ppm) according to Exhibit 10. The IOGA witness testified, however, that the total hydrocarbon emissions from all the separators and storage tanks is only 110,000 cubic feet (R. 283); but neglected to give the duration of the emission, i.e. hour, day, year. The witness also confused the 0.06 ppm atmospheric concentration with the concentrations of emissions from the tanks and separators (see Exhibit 10 and R. 283). Our conclusion is that insufficient reliable information is contained in the record to support the one ton per day figure testified to by the Petitioner. We believe, however, that the emissions are not excessive and are likely to be non-photochemically reactive in nature.

The Petitioner's proposal to delete the location requirements from Rule 205(c)(2)(B) is based on the rural location of these separator facilities. Only three counties within the major metropolitan areas, St. Clair, Madison, and Sangamon, contain oil producing facilities and these produced in 1972 only 362,000 barrels of the 50 million total for the state, a percentage of 0.72 percent (incorrectly stated by the IOGA as 0.0072 percent) (R. 267). It seems that most facilities would be exempt with or without 205(c)(2)(B) and the impact of the others will therefore not be significant.

Our review of the record indicates, therefore, that both proposals of the IOGA as modified by us should be adopted. We have modified the proposed language of Rule 103(i)(17) to reflect the hearing record, which was concerned with oil field sites producing Illinois crude oil. In addition, our intent in adopting additional permit exemptions, Rules 103(i)(17) and 103(i)(18), is to limit these exemptions to facilities located on the oil field sites, containing the oil wells producing Illinois crude oil, testified to at the hearings. The specific language of the amendments we are adopting is contained in our Order attached hereto.

DISCUSSION OF R73-10, CARBON MONOXIDE

The proposal is intended to allow Amoco to use its new technology catalyst regeneration process (Ultracat) on its fluidized bed catalytic cracking (FCC) unit without additional emission controls for CO. According to Amoco's petition, their Ultracat process converts over 99% of the CO in the regenerator, reduces CO emissions, corrected to 50% excess air, to below 750 ppm for existing units and 350 ppm for new units, improves liquid hydrocarbon yields from the FCC by 0.7 to 3.0%, and decreases coke production by 15 to 25%.

The catalyst in the FCC unit becomes coated with carbon and its efficiency in producing liquid hydrocarbons, including gasoline, decreases. The catalyst is regenerated by burning off the carbon in the regeneration unit, the exhaust gases from which typically have CO concentrations of 5 to 10% (Pet. Ex. 1) and are combusted in a CO boiler to produce additional steam for process use. The Ultracat process more completely regenerates the catalyst and thus improves FCC performance while at the same time reducing the CO in the regenerator exhaust to levels of 1000 ppm, i.e., 0.1% on a continuous basis (R. 15).

Clark Oil and Refining Corporation (Clark) testified at the hearings and suggested that Rule 206(c) be changed to increase the allowable emissions of CO to 0.2 percent (2000 ppm) for existing FCC regenerators and 0.05 percent (500 ppm) for new FCC regenerators. Clark is presently converting their existing FCC units to the new Universal Oil Products (UOP) hot regenerator technology which will result in better hydrocarbon yields, less coke production, and decreased CO emissions from the regenerators (R. 46-47). The UOP system will result in a 98% reduction of CO emissions and a discharge to the atmosphere of 2000 ppm (R. 50).

Comparing the two regenerator systems, Ultracat and UOP, they are basically the same in that they use increased amounts of air and operate at higher temperatures than conventional regenerators (R. 347); there are, however, certain metallurgical differences (R. 368). The increased yields of hydrocarbons from the FCC would probably be identical between Ultracat and UOP (R. 345). The economics are also similar, the capital costs for installing either the UOP or Ultracat system would be approximately the same (R. 366). There is, however, a matter of royalties; because Clark has existing UOP units, it would cost Clark $500 to $1000 per day in royalties to use the Amoco process and it was for this reason that Clark chose UOP over Amoco (R. 365).

Except for the two Clark facilities and Amoco's Wood River facility, the other petroleum refineries in Illinois have CO boilers. Amoco has the Ultracat process and the Clark facilities are presently being converted to the UOP process, Clark's decision having been made in 1972 (R. 368). This proposal of Amoco then concerns three existing petroleum refineries plus all new refineries that would be constructed with the new technology catalyst regenerators. The Board takes judicial notice of the sizes and locations of the existing refineries in Illinois (obtained from 1973 American Petroleum Institute data) as follows:

REFINERY	LOCATION	SIZE(barrels/calendar day)
Amoco Oil	Wood River	107,000
Clark Oil and Refining	Blue Island	68,000
Clark Oil and Refining	Hartford	36,000
Marathon Oil	Robinson	195,000
Mobil Oil	Joliet	175,000
Shell Oil	Wood River	260,000
Texaco Oil	Lawrenceville	84,000
Texaco Oil	Lockport	72,000
Union Oil	Lemont	152,000
Wireback Oil	Plymouth	1,500
Yetter Oil	Colmar	1,000

Much testimony concerned the environmental impact of the CO emissions from the refineries. Atmospheric dispersion modelling and ambient air sampling showed that at CO emission limits of 1,000 ppm or 2,000 ppm, there would not be a significant adverse effect on the ambient concentrations of CO. The dispersion modelling at Clark's Blue Island facility showed that for the worst possible meteorological conditions, the existing facility could produce a maximum 1-hour ambient concentration of 11 ppm while the facility as modified could produce a maximum concentration of 0.2 ppm (R. 320). The maximum 8-hour ambient concentration would be 6.26 ppm with the existing Blue Island facility and 0.14 ppm with the modified facility (R. 323). Modelling for the Amoco Wood River refinery shows maximum downwind CO concentrations of 8 to 9 ppm for conventional regeneration and less than 0.1 ppm for Ultracat regeneration (R. 18-19). The federal primary standards for CO are 35 ppm for one hour and 9 ppm for eight hours, these levels not to be exceeded more than once a year (R. 451). Ambient air sampling performed at three locations in the vicinity of Amoco with Ultracat in operation showed negligible contributions by Amoco to the ambient air concentrations of CO (Pet. Ex. 1, Appendix I). They did, however, indicate a contribution from the Clark facility (which is south of Amoco) for short periods of time, the levels of which are "not inconsistent with those values calculated...for the present Clark operation in Blue Island" (R. 398).

The Agency also performed dispersion modelling (Agency Ex. 1) to compare with Clark and Amoco. The maximum contribution using the Amoco proposal for existing facilities (750 ppm corrected to 50% excess air) would be less than 0.5 ppm for the one hour maximum (R. 454). This ambient level is approximately 4 times that which would occur under the existing emission regulation of 200 ppm. The Agency concluded that the impact of the Amoco proposal on air quality would be negligible at present (R. 455) because the existing

instrumentation is not sensitive enough to detect the difference (R. 466). The Agency did not do dispersion calculations for multiple refineries, their results being for a single refinery ignoring background levels (R. 465). The Board notes that conclusions reached from modelling studies performed for single emission sources by either Amoco, Clark, or the Agency only indicate the possible contribution to air pollution levels and not the total ambient air pollution levels.

As was pointed out by Dr. Wadden, the total amounts of CO emitted from the FCC units may represent a significant number of automobiles based on their exhaust emissions of CO. Wadden estimates, referencing the R71-23 Opinion of the Board, that a relaxation of the existing CO emission standard from 200 ppm to 750 ppm, corrected to 50% excess air, as proposed by Amoco, is equivalent to the emissions from 7000 additional cars (1970 model) driven 20 miles a day. He concludes that this is a significant amount because the assimilative capacity of the atmosphere is not infinite and because violations of the CC air quality standards do occur in major metropolitan areas of Illinois.

It is clear from the record that these new catalyst regeneration processes are being installed at Clark and Amoco in order to improve product yields, the reduction in CO emissions being of secondary concern. Amoco's Ultracat process is promoted as a process that improves yields (R. 426, 428) and Clark chose the UOP process over Ultracat and CO boilers because it offered the best cost benefit (R. 342). In 1972 a short test run of the UOP system at Clark's Blue Island refinery showed an increased liquid yield of 1.5% and a CO reduction of more than 90% (R. 340, 352). Although this CO reduction was not adequate to meet the existing emission limits, Clark decided to install the UOP system at both their refineries in 1972 and early 1973 (R. 340); a decision the Board cannot condone. The decision to install a CO boiler behind an Ultracat system would depend on the cost-benefit analysis; (R. 428) in addition, there may not be sufficient CO in the new technology regenerator exhaust to use a CO boiler to reduce the emissions to 200 ppm (R. 432). If it were not for the latter fact, the Board would require compliance with the existing standard by the use of a CO boiler to clean the remaining CO from these regenerators.

Yield information was submitted both by Amoco and Clark. Amoco Exhibit 3 shows gasoline yields for 4 commercially operating Ultracat units to have increased by approximately 3% based on the feed volume; the range of data for 35 tests on the 4 units varied between 0.8% and 5.9%. Other data included in Petitioner's Exhibit 1 shows gasoline yield improvements of between 0.7% and 4.7% for three Amoco units. Clark calculated that the benefit of their hot regeneration process compared to a CO boiler is enough additional fuel to

heat 2200 homes each year (R. 341). Although Clark did not submit any yield data during the hearings, Table 1 of the affidavit submitted by Clark following the hearings projects an increase in gasoline yield of 7.9%, and a decrease in cycle (fuel) oil of 8.8%, after their hot regeneration plus riser cracking system is installed. The increase in yield depends on the product mix for each refinery.

Carbon monoxide emission data for the Amoco Ultracat unit at Wood River were included in Petitioner's Exhibit 1. These data were taken at hourly intervals between February 28, 1973 and April 27, 1973 and show CO emissions from the stack varying from a trace to in excess of 1,000 ppm. According to Amoco these data show that the unit can meet a limit of 1000 ppm at stack conditions, or 750 ppm at 50% excess air, as set forth in their petition on a continuously operating basis (R. 15). An examination of the data shows, however, that the emissions are significantly less than 1,000 ppm most of the time, as shown in the following table.

CO concentration in stack	Percent of time
⩾ 1,000 ppm	0.15
⩾ 800 ppm	0.22
⩾ 700 ppm	0.95
⩾ 600 ppm	1.91
⩾ 500 ppm	4.11
:	:
< 500 ppm	95.9
:	:
⩽ 200 ppm	74.0
< 100 ppm	54.0

During 54 percent of the time the emissions were less than 100 ppm; during 74 percent of the time the CO emissions were less than 200 ppm; and during ninety-six percent of the time the emissions were less than 500 ppm which is equal to the federally proposed new source standard (Pet. Ex. 1).

Clark did not present any emission data since their UOP units are under construction. Their proposal is based on statements from UOP that an emission concentration of 2000 ppm could be guaranteed (R. 49). However, Clark Exhibit 4, a letter to Clark from a C.W. Strother of UOP, indicates that after installation of the hot regenerator system, and reasonable operating experience, "we would expect the CO content could be reduced to less than 500 ppm by volume with minor operating and mechanical changes."

At the conclusion of the hearings, the Agency took the position that the 200 ppm standard is technically and economically feasible based on the R 71-23 record, but that the Amoco proposal was an acceptable loosening of air quality in that

health and welfare are not impaired; while the benefits to the people (improved gasoline yields) would be increased, citing Rule 303, Nondegradation, of the Air Pollution Regulations. The Agency felt, however, that the Clark proposal would result in further degradation of air quality without providing any additional benefits beyond that provided by the Amoco proposal (R. 478-480). We agree with this interpretation of the non-degradation rule by the Agency.

Based on the record in this matter, the Amoco proposal (750 ppm corrected to 50% excess air for existing sources, 350 ppm corrected to 50% excess air for new sources) is the maximum relaxation to the existing regulation supportable. A case could possibly be made for a tighter limit in that 96% of Amoco's data show CO emissions lower than 500 ppm at stack conditions and the UOP process can, with minor modifications, reduce emissions to 500 ppm at stack conditions. The federal new source standard for CO emissions from FCC catalyst regenerators is 0.05 percent by volume (500 ppm) based in part on the recognition of in situ combustion of CO in the regenerators (R. 14). However, because the Amoco proposed limits will not significantly degrade the environment, and will result in benefits in terms of improved yields, the Board will accept the Amoco proposal with the language refinements suggested by the Agency as contained in our Order attached hereto. It should be noted that the new paragraphs (2) and (3) of Rule 206(c) are intended to be applied only to the new technology catalyst regenerators such as Ultracat or UOP hot regeneration.

DISCUSSION OF R73-17, SULFURIC ACID MIST

Activity in reviewing the existing Rule 204(f)(2), Sulfuric Acid Mist Standards and Limitations, was initiated by Bell and Howell by petition to the Board on February 13, 1973. Bell and Howell suggested an amendment to distinguish between manufacturers and users of sulfuric acid because small scale users of acid such as Bell and Howell were, in their opinion, unable to meet the existing limit of 0.15 lb/ton of acid used or manufactured. Although the Board was not required to hold hearings since the petition did not contain 200 signatures, by order of March 8, 1973 the Board requested the Agency to advise it on the necessity for modifying the regulation. The Agency response was the proposal submitted to the Board on December 13, 1973.

For the most part, emissions of sulfuric acid mist result from the manufacturing or use of the acid (R. 184), although as will be seen later, combustion processes, flue gas conditioning, and stack gas scrubbers also are emitters of acid mist. Submissions to the Agency for permits and other purposes show that one of the biggest problem areas, aside from acid manufacturing, is the use of sulfuric acid in baths to pickle iron and steel products (R. 181, 187).

These baths contain about 15 percent acid and their purpose is to clean the surface of the metal immersed. The amount of acid mist evolving from the tank surface depends on the temperature, the surface area of the tank, and the activity of the reaction (R. 186). The use of acid per ton of metal is not an important parameter. These pickling facilities are usually ground-level type sources with the emissions vented through the roof or side of the building (R. 188).

The Agency presented, initially, information on the environmental harm caused by acid mist. This information, exhibit 1, included effects on plants, human health, and objects (corrosion). The Agency witness testified (R. 66-91) that the industrial hygenists threshold limit value (TLV) for acid mist is 1 mg/m^3, based on 8 hour exposures, 5 days a week, and that this level can be detected by odor, taste, and irritation (R. 67-68). Research has shown bronchio-spasms, increased pulmonary air flow resistance and other reactions at acid mist levels of 0.35 to 0.5 mg/m^3 beginning after 3 minutes of exposure and continuing throughout a fifteen minute exposure period (R. 69). This research also showed the occurrence of chronic bronchitis during long term intermittent exposures. Human studies indicate 4 times greater sensitivity to sulfuric acid than to sulfur dioxide (R. 73). The Russian acid mist level, not a standard but a goal to be attained, is 0.3 mg/m^3. Sulfuric acid causes a spotting type injury to plant leaves, the sensitivity depending on factors such as humidity, light intensity, and nutrient level; in conjunction with fog (R. 74-75). The effects on materials (corrosion of metal) depend on humidity and temperature, and based on data for sulfur dioxide and the transformation to sulfuric acid, it is concluded that corrosion can take place at a concentration of 0.32 mg/m^3 (R. 77).

The Agency witness concluded that a maximum 1 hour ambient concentration of sulfuric acid of 0.2 mg/m^3 would not have an adverse affect on humans, plants, animals, and materials (R. 78). It should be noted that the witness originally concluded that the maximum 1 hour level should be 0.08 mg/m^3 based on the possibility of corrosion (R. 82); but considerations of control equipment availability, attainability, and economics resulted in a maximum 1 hour ambient level of 0.2 mg/m^3 which will provide some small margin of safety in terms of human health (R. 88). This testimony was not rebutted by other witnesses and in fact Monsanto (R. 600) and Edison (R. 648) suggested regulations based on attaining an ambient concentration of 0.2 mg/m^3. The environmental impact data were presented by the Agency in order to justify its proposal and the Board does not construe it as establishing an ambient air quality standard for sulfuric acid mist.

The Agency then made dispersion calculations to determine the allowable emission rate of acid mist. These calculations, Agency Exhibit 1 of June 19, 1974, assumed a ground level source, stable atmospheric conditions, a wind speed of 1 meter/sec, and a distance of 100 meters from the source; and resulted in a maximum allowable emission rate of 0.1 lb/hr (actually the calculation results in 0.073 lb/hr). Under cross examination, the Agency witness stated that the stable atmospheric condition can occur in Illinois from 25 to 40 percent of the time, and that the wind speed used is appropriate for the stability class used (R. 536-537). The distance of 100 meters was used as a compromise since it does allow over 300 feet of dispersion even though companies using sulfuric acid are interspersed in the neighborhood (R. 190) and thus located "very near locations where people are expected to occur for some period of time, such as residential areas" (R. 534).

The Agency based their modeling on a "ground level" emission source; the reason being that most sources of acid mist consist of short stacks or vents so that aerodynamic influences due to the buildings, which could cause downwash, could occur (R. 529-530). Edison suggested that dispersion from stacks be taken into account; but their exhibit 8, a paper by Briggs, showed that for stacks less than 50% higher than the building, aerodynamic downwash will cause a plume to behave like a ground level source. This exhibit therefore supports the Agency position. The Agency, in Attachment F to their post hearing response, made a random sampling of their permits to see the elevations where acid was emitted. Of 43 sulfuric acid mist sources, no acid mist was emitted through a stack of sufficient height to improve the dispersion beyond that of a ground level source according to the Agency. Monsanto also presented dispersion calculations to show the benefits of stack height, and suggested a regulation based on maintaining a ground level concentration of 0.2 mg/m^3 for acid users (R. 600). Neglecting power plants and confining ourselves to users of acid, we find that the emissions are usually from vents on top of buildings and therefore can be considered "ground level" sources.

The technical feasibility and economic reasonableness of the proposed amendment was based on a case study of a controlled pickling facility. This facility, characterized as a large user of acid, uses over 1,000 tons/year of acid (R. 202) and pickles 20 tons/hr of steel plate (Exhibit 2 of 5/14/74). A description of the facility (R. 195-199) indicates one pickling line consisting of six tanks, two of which compose the actual pickling operation; exhausted through a push-pull system having a total flow rate of 48,000 cfm into three stacks. Each exhaust system contains control equipment consisting of demisters and the stacks themselves are 5 to 6 feet above and across the street from houses, the plant being located in a cut (R. 198-199).

Stack tests were performed on each stack at the facility on April 3, 1973. The results show average total emissions for three tests of the stacks to be 0.058 lb/hr of sulfuric acid, with the maximum total emission measured being 0.067 lb/hr (Exhibit 2 of 5/14/74). The test was observed by the Agency (Exhibit 1 of 5/14/74) and found to have been properly conducted. This facility is therefore able to comply with the proposed amendment.

Economic analyses were performed by the Agency to show the costs of complying with the 0.1 lb/hr proposal. Data from the aforementioned controlled facility were used along with estimates from control equipment vendors in generating cost estimates for small, medium, and moderately large facilities (R. 222). Control equipment efficiency of 98 percent was used even though higher efficiency equipment is available, based on the stack tests (R. 229). In addition, costs for the small facility were based on 98 percent collection, even though compliance would require a less efficient system. Costs of equipment and installation were compared to the gross income expected from these facilities. The following table summarizes the results of the economic study (Exhibit 3 of 5/14/74):

Facility	Exhaust Gas Flow	Quantity of Steel Pickled	Cost of Control as Percent of Income
Small	10,000 scfm	16,000 ton/year	3.8%
Medium	20,000 scfm	32,000 ton/year	3.1%
Large	40,000 scfm	64,000 ton/year	2.5%

In absolute terms the control system costs vary from $6,100 to $15,950 annually. The Illinois Manufacturers Association presented profit information for U.S. manufacturers and compared it with the above percentage compliance costs in attempting to show the economic unreasonableness of the proposed amendment (IMA letter dated August 5, 1974); but incorrectly interpreted the Agency's conclusions. Agency compliance costs are 2.5 to 3.8 percent of income (sales minus expenses) whereas IMA profits of 4.0 to 5.6 percent are in terms of sales and cannot be compared directly. The Agency compliance costs, in terms of sales, are considerably less than the profits and are not found by us to be unreasonable.

A significant issue concerns the applicability of the Agency's case study to other acid users. The Agency characterized their case study as being an adequate test; the largest user of sulfuric acid for which valid information was available to the Agency (R. 204). Comments from Keystone Steel and

Wire and others indicated facilities using considerably larger quantities of acid. For example, Keystone uses about 8 times the acid as in the case study facility (R. 203) and they estimate six other companies in Illinois as having similar usage rates (R. 204). These very large facilities have several pickling lines and have exhaust gas flow rates considerably in excess of the 48,000 cfm of the facility studied. Testimony from Keystone was that in 1973, 6,765 tons of acid were used and 300,000 tons of rods and wire were pickled on their three lines (R. 558). To comply with the proposed limit of 0.1 lb/hr for their plant would require Keystone to install a collection system having 99.53 percent efficiency; and would result in a stack emission concentration of 0.14 mg/m^3, which is lower than the ambient level of 0.2 mg/m^3 recommended by the Agency (R. 562).

The Board finds that for these few large facilities a regulation taking into account the size of the facility is necessary based on the testimony. The 0.1 lb/hr limit proposed by the Agency is suitable for the great majority, but there is a certain size facility beyond which compliance may not be feasibl.

Keystone proposed a regulation based on the surface area of the pickling tanks which, assuming a collection system efficiency of 95%, would allow them to emit 1.08 lb/hr (R. 565). They did not, however, perform dispersion modelling to determine the resulting ambient levels of acid (R. 567). Keystone controls emissions from the tanks using a layer of foam but does not have other controls (R. 571).

Olin Brass proposed the 0.1 lb/hr limit for facilities using 1,333 lb/hr of acid or less, and the existing limit of 0.15 lb/ton for facilities using in excess of 1,333 lb/hr (Written submission dated July 30, 1974). On a yearly basis, assuming 6,000 hours/year, this breakpoint would represent a facility using 4,000 tons/year of sulfuric acid. Other witnesses suggested other methods of accounting for facility size.

The record contains information as to the factors to be used in formulating a size-dependent regulation. The first issue is the uncontrolled emissions of sulfuric acid mist. Exhibit 1 of 5/14/74 states that the Agency case study at one time had vapor emissions of 34.7 mg/m^3 based on test results and that uncontrolled emissions in the range of 20 to 50 mg/m^3 can be expected. Keystone suggests 30 mg/m^3 as an average value for pickling operations (R. 562) and KSF Chemical Processes, manufacturers of mist removal equipment, notes that acid mist levels up to 50 mg/m^3 can exist in the inlets of control equipment (Exhibit 1 of 6/19/74). Therefore,

a value of 35 mg/m^3 for the uncontrolled emissions is supported by the record and is used by us in structuring the regulation.

The second factor is the degree of control possible. PUREco, designers of pickling facilities and acid recovery facilities, testified that an emission concentration of 0.4 mg/m^3, achieved in the Agency case study, can be achieved (R. 626), based on the results of an emission test; and a concentration 50 to 100 percent greater can be routinely maintained (R. 629). The facility tested by PUREco had a push-pull exhaust system and mesh demister pads. In terms of equipment efficiency, 95 or 98 percent would be a practical level using mesh demister pads (R. 632). The PUREco testimony indicates that an emission concentration of 0.6 to 0.8 mg/m^3 can be routinely maintained and this suggests, using an uncontrolled value of 35 mg/m^3, a collection system efficiency of 97.7 to 98.2 percent. Agency data for the controlled facility (Exhibits 1 and 2 of 5/14/74) can be used to calculate a controlled emission concentration of 0.37 mg/m^3 which, when compared to an average uncontrolled emission of 35 mg/m^3, results in a collection system efficiency of 98.9 percent. The Keystone witness was of the opinion that efficiencies greater than 95 percent could not be achieved on a day-by-day basis using demister pads (R. 574). The majority of the information indicates the reasonableness of using 98 percent collection efficiency as a factor in developing the regulation which we are ordering today.

The final factor is the tie-in with the size of the facility. The Agency data is for a facility using 1,000 tons/year of acid, operating 6,240 hours/year, and having an exhaust flow rate of 48,000 cfm. Keystone uses 6,765 tons/year of acid, operates 6,600 hours/year, and would need an estimated exhaust flow rate, based on their calculations, of 194,000 cfm. Other facilities mentioned by KSF and PUREco used up to 15,000 tons/year of acid and had exhaust flow rates as high as 600,000 cfm. (Exhibit 1 of 6/19/74, R. 626).

Based on all the above materials, we find that a regulation limiting the emissions of sulfuric acid mist to 0.5 lb/ton of acid used is justified for the few large facilities. This would require control equipment of approximately 98 percent efficiency; achievable with a well maintained push-pull exhaust system plus demister. Applied to Keystone's facility, the resulting emission rate allowed would be approximately 0.51 lb/hr; and applied to the Agency case study facility, the resulting emission rate allowed would be approximately 0.08 lb/hr. The Agency proposal of 0.1 lb/hr is equivalent to this 0.5 lb/ton regulation at a yearly acid usage rate of approximately 1,300 tons. Therefore, the emission limits we order are the following:

0.1 lb/hr for less than 1,300 tons per year acid used; 0.5 lb/ton acid used for greater than or equal to 1,300 tons per year acid used.

This regulation is consistent with the Agency proposal for most users of sulfuric acid, and would in addition allow some relief for the few large scale users of acid.

In their comment relating to the Proposed Final Draft the Agency points out, correctly, that the emission limit of 0.5 lb/ton for the large facilities will result in an ambient concentration greater than the desired 0.2 mg/m3 using their dispersion model. We believe, however, that the few large facilities such as Keystone Wire would be unable to meet the Agency's 0.1 lb/hr. emission standard but are able to comply with our 0.5 lb/ton standard.

The Agency also suggests in their comment that references to acid mist and acid usage be based on 100% sulfuric acid. They point out that the test method referred to in Rule 204(g)(2) measures acid mist as 100% acid and that their facility study was in terms of 100% acid. Keystone specified acid usage in terms of 66^{o} Baume acid which is 93.2% sulfuric acid. For consistency we hereby specify that all references to sulfuric acid are to be based on 100% acid.

Other comments received on the Proposed Final Draft related to acid recovery systems, and to the aggregating of emissions from multiple sources, among other things; all of which have been considered by the Board.

The above discussion applied to users of acid. The existing regulation as applied to manufacturers of acid was not proposed to be amended by the Agency, and little testimony concerning manufacturers was presented.

Testimony also concerned the application of the proposed amendment to non-users of sulfuric acid. Glass container manufacturers and utilities using flue gas conditioning or sulfur oxide scrubbing devices at their power plants were concerned that the Agency may apply the limits to them. The Agency reiterated that they were mainly concerned, in this proposal, with users of acid and intend the regulation to apply to users of acid (R. 544). In addition, when testimony regarding emissions of sulfur compounds from flue gas conditioning devices was presented, the Agency stipulated that the proposed regulation is not intended to include flue gas conditioning (R. 548). We accept the limitation on the applicability of the regulation.

The Agency proposal to amend Rule 204(g)(2), Measurement Techniques, was withdrawn during the hearings (R. 520). They plan to reintroduce a modified procedure in the future.

I, Christan L. Moffett, Clerk of the Illinois Pollution Control Board, hereby certify the above Opinion was adopted on the 26th day of March, 1975 by a vote of 4-0.

Christan L. Moffett, Clerk
Illinois Pollution Control Board