

ILLINOIS POLLUTION CONTROL BOARD
August 22, 1984

IN THE MATTER OF:)
)
VOLATILE ORGANIC MATERIAL) R82-14
EMISSIONS FROM STATIONARY) Dockets A & B
SOURCES; RACT III)

PROPOSED RULE. PROPOSED OPINION.

OPINION OF THE BOARD (by J. Theodore Meyer):

The petition which initiated this rulemaking proposed to regulate the emissions from one type of stationary source and from five industrial categories of stationary sources. The source specific regulation was for storage tanks containing volatile organic liquids, and the five industry specific regulations pertained to (1) wood furniture coating, (2) heatset web offset printing, (3) synthetic organic chemical manufacturing, (4) asphalt roofing manufacturing, and (5) petroleum dry cleaning. The proposal also included language to amend the existing general rule, then Rule 205(f) of the Board's Chapter 2: Air Pollution and now contained in Subpart K of 35 Ill. Adm. Code 215, which limits emissions of photochemically reactive material or odor causing materials from all stationary air pollution sources. This rule was adopted in the Board's first major rulemaking on air pollution, R 71-23 (4 PCB 191, April 13, 1972). The principal distinction between the existing rule and the proposed amendment, entitled the Generic Rule, is that the latter is intended to regulate volatile organic emissions, not just the photochemically reactive or odor causing emissions, from those stationary sources not included in industry specific and source specific regulations.

Nineteen public hearings were held concerning the entire regulatory proposal and the three Economic Impact Studies (EcIS) (Doc. Nos. 83/15; 83/31; 83/32) prepared pursuant to Section 27 of the Environmental Protection Act (Ill. Rev. Stat. 1983, ch.111½, par. 1027). After four of those hearings, it became evident that the existing definition of volatile organic materials would be expanded under the proposed Generic Rule. Thus, the sources affected by such a rule, the feasibility of controlling the additional materials, and the amount of emissions involved were

It is the wish of the Board that the knowledge and concern contributed to this proceeding by Irvin G. Goodman before his death, and his legacy of inspiration be recognized and remembered. The Board also acknowledges the work of Marili McFawn, hearing officer and administrative assistant in this matter.

not yet identified or quantified by the proponent, the Illinois Environmental Protection Agency (Agency). To provide additional time to compile such documentation without delaying the remainder of the proceeding, on its own motion the Board established two dockets. The industry and source specific rules were assigned to Docket A; the Generic Rule to Docket B (49 PCB 247; October 27, 1982). As comprehension of the Generic Rule expanded, Docket A did not proceed independently as expected. It became necessary to compare the Generic Rule to certain industry specific rules. For example, the proposed heatset web offset rules regulated materials not included in the existing definition of VCM, and not proposed for regulation pursuant to the Generic Rule. The Printing Industry of Illinois requested additional time to submit a study on the reactivity of the inks used in that segment of the industry. Not only was additional time granted, but that action necessitated preparation of and hearings on a separate EcIS. Additionally, as awareness of the Generic Rule grew, segments of the affected industries proposed industry specific rules as alternatives to the Generic Rule which required separate documentation and Board consideration. Although time consuming, both outgrowths made for superior rulemaking in the end.

Twice before the Board has adopted industry specific regulations to control the emissions of volatile organic materials (VOMs) from existing stationary sources in Illinois. Those regulations, adopted subsequent to the rulemakings known as RACT I (R78-4,5) and RACT II (R80-5) are now contained in 35 Ill. Adm. Code 215: Organic Material Emission Standards and Limitations. This rulemaking, commonly known as RACT III, is obviously the third in a series. The acronym for all three rulemakings is derived from the statutory mandate found in Part D of the Clean Air Act (42 U.S.C.A. 7401 et seq.). Section 172 therein requires that "reasonably available control technology" be implemented at existing stationary sources in the nonattainment areas of those states needing an extension from the 1982 deadline until 1987 to achieve the air quality standard for ozone. Illinois is such a state, having requested the extension in its 1979 and 1982 State Implementation Plans (SIP), and as of the date of this Opinion, having nine counties designated as nonattainment areas for ozone.

The definition of "reasonably available control technology" is contained in 40 CFR 51, along with the requirements for a federally acceptable SIP. However, the specific parameters of what constitutes reasonably available controls, and, therefore, the parameters which the states must adopt to insure that RACT is implemented, are not. Instead, the United States Environmental Protection Agency (USEPA) publishes a series of documents entitled "Control Technique Guidelines" (CTGs). Each of the CTGs, which are summaries of industry specific case studies, contains the means and the degree of control which the USEPA requires the state to adopt categorically as a part of its SIPs in order to have an acceptable SIP. Failure to adopt rules identical to

those presented in the CTGs, or other ones demonstrated by the individual state as comparable, can mean that the state will have an inadequate SIP, which in turn can trigger the sanction provisions of the Clean Air Act found at Sections 110, 113, and 176 (42 U.S.C.A. 7410, 7413, 7506). While the mandate for sanctions is contained in the Clean Air Act, the mandate to adopt the CTGs or otherwise demonstrate a state rule to be comparable is not. It is not even contained in the federal regulations, but instead is articulated in the "General Preamble for Proposed Rulemaking and Approval of State Implementation Plan Revisions for Nonattainment Areas" (44 FR 20372).

This federal policy statement includes yet another requirement which is relevant to this rulemaking. The USEPA allows the states until the January after one year from the finalization of a CTG to adopt either the "rules" contained therein, or comparable rules, if sources covered by that particular CTG are within a state's nonattainment areas. Also of interest is the unstated policy of the USEPA to publish draft CTGs. Presumably adoption of rules comparable to the information contained within these is not mandatory. Of final concern, and possibly of most importance to this rulemaking, is the requirement that RACT be implemented at existing stationary sources in nonattainment areas as expeditiously as practicable in order to demonstrate reasonable further progress (42 U.S.C.A. 7501, 7502). These provisions in Part D of the Clean Air Act mean that the states are required to adopt means to control VOM from all stationary sources, regardless of whether CTGs have been published. The USEPA, again in the General Preamble, has limited the application to sources with the potential to emit more than 100 tons per year, i.e. major stationary sources. Therefore, for those not covered by a final CTG, the only principle governing the state's rulemaking is that the degree of control be premised on technology which is reasonably available.

At the outset of this rulemaking, only one of the six categories under consideration, the petroleum dry cleaners, was the subject of a final CTG. Despite the fact that a final CTG has been issued on the petroleum dry cleaning industry, the Board is not adopting rules pertaining to it. The remaining categories proposed by the Agency were the subject of draft CTGs. Since that time, the USEPA has finalized the CTG drafted for synthetic organic chemical and polymer manufacturing equipment. Rules pertaining to that category are adopted. The reasons for these two decisions, as well as those on the categories with only draft CTGs, the Generic Rule, and the additional two industry specific rules resulting from the Generic Rules proposal, are discussed separately below.

On June 14, 1984 the Board adopted as final a series of rules for the vegetable oil processing industry, which was one of the Generic Rule spin-offs, and an exemption for the viscose casing manufacturers from Subpart K. Those rules, along with

rules pertaining to petroleum dry cleaners, had been proposed for First Notice on February 9, 1984 and published in the Illinois Register on February 24, 1984 (8 Ill. Reg. 2407). The Second Notice version was adopted on May 3, 1984, but the rules proposed for the petroleum dry cleaners were deleted, because after closely reviewing the record in pertinent part, the Board determined those rules to be unnecessary. The Joint Committee on Administrative Rules issued a Certificate of No Objection to that portion of this rulemaking on June 12, 1984. On June 29, 1984 the Board amended its June 14th Final Order in order to have the rules accepted by the Administrative Code Unit of the Secretary of State's Office. The rationale supporting the final action taken on the vegetable oil processing rules and the viscose exemption is contained in this Opinion, along with that supporting the remainder of this rulemaking. It should be noted that the viscose exemption adopted as final is repealed. That exemption was adopted anticipating that the general rule contained in Subpart K would be amended with some form of the Generic Rule, and would, therefore, be more restrictive. Since it is not to be so amended, the previously adopted exemption is unnecessary. Again, this action is discussed in further detail under the section of the Opinion entitled Viscose Casing Process.

GENERIC RULE

The Generic Rule was proposed by the Agency to be applicable to air pollution emission sources and facilities with the potential to emit more than one hundred tons of volatile organic materials into the atmosphere annually and not already controlled pursuant to another Subpart of Part 215. The proposed rule differed from the general rule to control organic material emissions already found in Subpart K, in that it eliminated the concept of exempted (non-photochemically reactive) materials as defined in Part 211. The proposed Generic Rule would require controls at levels determined by the concentration of hydrocarbons in the exhaust stream and the vapor pressure of the compounds. These determinations would then be used to assess the percentage of control required. Since some of the vapor pressures listed were lower than those already contained in the definition of volatile organic materials, application of the proposed rule could have been more restrictive than any of the industry specific rules already contained in Part 215, or those adopted in this rulemaking.

In order to identify the facilities possibly affected by the rule, a survey was circulated by the Agency. Approximately 36 facilities were identified which collectively contribute approximately 30,000 tons of uncontrolled emissions annually. Approximately 25,000 tons of the total are attributable to sources, primarily vegetable oil processing facilities, in the attainment areas. In fact, vegetable oil processing facilities contribute 63 percent of that total, and only three of the thirteen facilities identified are in nonattainment or contiguous counties (P.C. 47,

Table III B). The other types of affected facilities identified by the Agency are coke by-product plants and chemical manufacturing facilities. Since industry specific regulations are adopted for the vegetable oil processing industry and coke-by product recovery plants, this only leaves the chemical manufacturing facilities and possibly other parts of steel-making plants subject to the proposed Generic Rule. As noted in the part of this Opinion pertaining to coke by-product recovery plants, regulations under the National Emission Standards for Hazardous Air Pollutants program have been adopted to control benzene and other emissions from steel-making plants. Need to regulate them as major sources is virtually mooted because benzene emissions constitute the major portion of their hydrocarbon emissions. As for the chemical manufacturing industry, it was determined that further control at these facilities was not reasonably available in the RACT II proceeding. No additional evidence was presented in this rulemaking to demonstrate that the proposed Generic Rule differed from that proposed in RACT II, and that it, therefore, represents reasonably available control technology for these facilities. Finally, uncontrolled emissions from three of the nine chemical facilities identified in nonattainment and contiguous counties are estimated to be less than 100 tons per year. If the rule were adopted to control the remaining six major sources, presumably 96 percent of 3,465 tons of uncontrolled emissions would have been controlled. However, the part of this total already controlled as organic materials under the existing general rule was not quantified.

The Board finds that the Generic Rule, as proposed, is not necessary to control major sources in Illinois, since the majority of them are subject to industry specific regulations in Part 215. For those only subject to the existing general rule, the Board finds that amount of emissions to be controlled does not justify adoption of the Generic Rule without some quantification of the estimated uncontrolled emissions already controlled as organic materials under that rule. Furthermore, since most of these sources are in the chemical manufacturing industry, an industry specific rule premised on reasonably available technology would be preferable. As mentioned above, this showing was not made to reverse the decision made in RACT II that technology is not now reasonably available.

INDUSTRIAL CATEGORIES ADOPTED

Subpart F: Coating Operations

Section 215.204(1): Wood Furniture Coating

Like the other subparagraphs in Section 215.204, subparagraph (1) regulates a surface coating operation. In this instance the prescribed VOM limitations are applicable to operations for coating furnishings made of wood, wood composition or simulated

wood materials. Five facilities in Illinois were identified to be operating coating lines possibly affected by this rule. A typical furniture coating line includes application equipment, flash-off areas, spray booths, ovens and conveyors. Examples of products coated are cabinets, tables, chairs, beds, sofas, shutters, doors, paneling and floor coverings. The rule establishes the maximum VOM content for seven types of coatings and the minimum transfer efficiency to be achieved in applying each type of coating.

Traditionally, reducing the VOM emissions from coating operations has been premised on substituting existing coatings with coatings containing higher solids content or higher water content. In this instance, emissions are not expected to be reduced by reformulating existing coatings. Instead, the seven VOM limits included in the rule are based on the percentage of solids in the materials reportedly used by the five Illinois facilities or elsewhere. For example, the percent of solids by volume in sealers reported to be currently in use is between 14 and 16 percent. The emission limit required at Section 215.204(1) for sealers is 0.67 kilograms of VOM per liter. When converted to a minimum solids content, this is equivalent to 15 percent solids per volume (R. 275, Ex. 14, Table II). The rule does not anticipate that the five identified facilities will have to switch from coatings they currently use. In the event that they do, the reported use of coatings with VOM contents at or below those which the rule is based upon, evidences that compliance coatings are available. As for waterborne coatings, compliance with the rules is not dependent on their availability.

In drafting the CTG for this industrial category, the USEPA anticipated the availability of waterborne coatings [Ex. 29(b)]. That CTG, however, was never finalized because the USEPA did not document the availability of such coatings (R. 280). The Agency on the other hand, testified that it believed such coatings to be available (R. 276). If they are, then these five facilities will be able to substitute waterborne coatings for those currently in use, and thereby achieve compliance directly, or indirectly through the internal offset provision found at Section 215.207 or under the rules for Alternative Control Strategies contained in Part 202.

In addition to the VOM limitations, the rule adopted by the Board requires that two transfer efficiencies be achieved at surface wood coating operations. The rule requires a 65 percent transfer efficiency in applying all coatings, except for the repair coat. A transfer efficiency of 30 percent is required for the repair coat because it generally involves a small amount of coatings and is a spot application process. In adopting the 65 percent transfer efficiency, a reduction in VOM emissions from surface wood coating is anticipated, not from the coatings themselves, but from the application process. Improving the transfer

efficiencies generally reduces the amount of coating used, which in turn reduces emissions of VOM.

Conventional spraying operations have at least a 40 percent transfer efficiency. Electrostatic spraying processes typically have a 65 percent transfer efficiency. More sophisticated electrostatic equipment, such as disc and bell equipment can achieve a transfer efficiency between 85 and 95 percent (R. 277). Evidence indicates that the industry has used this type of equipment since 1978 (Ex. 29(b), pp. 2-9, 2-10). Given the effectiveness of these systems, VOM emissions should be reduced by 35 percent from operations equipped with electrostatic systems, and by 53 to 58 percent from those equipped with the more sophisticated systems. The affected facilities can install simple electrostatic spray systems to achieve the 65 percent or a combination of systems to demonstrate compliance under Part 202: Afterburners or reformulated coatings, mentioned above, are also available to achieve compliance either alone or in combination with improved coating application systems. It is noted, however, that these two traditional methods are not necessarily available to wood surface coaters.

Based on information contained in permit applications, uncontrolled emissions from the five Illinois facilities were estimated to be 2,900 tons annually (R. 274, Ex. 14: Table I). Three of the five facilities are located in nonattainment counties and account for 845 tons per year. Assuming a 44 percent reduction in emissions, as was done by the Agency, emissions would be reduced annually by 1,265 tons statewide, and by 372 tons in the nonattainment areas. Based on annualized capital costs and annual operating and maintenance costs, the EcIS estimated the total annual costs to range between \$512,200 and \$1,304,200. Using the above emission figures, cost effectiveness would then range between \$1,291 and \$5,581. However, this cost is considered to be overstated because the annual operating and maintenance costs used in calculating it included the existing operating and maintenance costs (R. 1899). It is noted that both the EcIS and the Agency allowed that any increased operation and maintenance costs are probably offset by the paint savings (Ex. 48, p. 4-11, R. 282). That would mean that the cost of compliance would be the annualized capital cost divided by the tons reduced annually. If used in developing a cost effectiveness figure, the range is then reduced to \$400 and \$3,600 (Ex. 48, p. 4-11). On the average, the EcIS found the cost effectiveness to be \$725 per ton of reduced emissions (R. 1889).

In adopting this rule for the surface coating of wood furnishings, a definition of the process is provided as well as definitions of the coatings used by the industry. These are found in Section 215.104. It is also necessary to amend Section 215.211 and 215.212 which address compliance dates and compliance plans, respectively. The sources located in nonattainment counties or

those contiguous thereto are given until December 31, 1985 to comply; the remainder until 1987. In amending Section 215.211 from the language adopted in RACT II, no substantive change is made. The rule now recites all counties currently designated as nonattainment by the USEPA and the counties contiguous to those counties, instead of a partial list of the nonattainment counties. This framework is intended to facilitate more ease in identifying those sources with a 1985 compliance date. The rule pertaining to the compliance plan is amended to delete non-essential language, and to specify that compliance plans are not necessary if redesignation of a county from attainment to nonattainment occurs after December 31, 1986.

Subpart N: Vegetable Oil Processing

Sections 215.340 - 215.347: Hexane Processing of Soybeans and Corn

The rules in this Subpart set out the emission limitations, the methods for determining compliance, the compliance plan requirements and the compliance dates for two types of vegetable oil processing. There are thirteen facilities in Illinois engaged in this industry, only three of which are located in nonattainment counties. Twelve process soybean oil, three of these also process corn oil, and the thirteenth processes only corn oil. Under the original proposal these facilities would have been subject to the Generic Rule. As already mentioned, these facilities accounted for nearly two thirds of the total uncontrolled emissions originally estimated for sources covered by the Generic Rule. At the September 12, 1983 hearing, the Agency proposed an industry specific rule to regulate the vegetable oil processes. The industry, most specifically the soybean industry, found the Generic Rule and the Agency-proposed industry specific rule unacceptable. At the December 8 and 16, 1983 hearings, a joint proposal applicable to conventional soybean processing was entered into the record (R. 2869; Ex. 79). Subsequently, similar regulations applicable to specialty soybean processing (which four of the twelve soybean processors are equipped to do) were proposed (P.C. 40). Rules for corn oil processing were also proposed by the affected facilities (R. 2930, 2937; P.C. 37).

Extracting oil from soybeans is a complex, multi-step process. Prior to extraction, raw soybeans are cooked and pressed into flakes. The flakes are then saturated with a solvent, usually hexane, and the resulting oil and solvent mixture is separated from the soybean meal. The solvent laden flakes are then desolventized and toasted to drive off residual solvent for recovery and reuse. The oil and solvent mixture is similarly stripped and condensed to recover the solvent for reuse.

In addition to extracting the oil, these facilities process

the resulting soybean meal. So that the protein contained in the meal can be utilized by animals, including humans, the proteins must be broken down by heat and/or exposure to moisture. This is known as denaturization, and the extent to which it is achieved is a direct function of temperature, moisture, and the length of time exposed to elevated temperature and moisture. Increasing any of these variables increases the denaturization process.

There are two types of soybean meal processing: conventional and specialty processing. Conventional processing utilizes a desolventizer-toaster (DT) to denature soybeans in the process of extracting hexane from crushed and oil-extracted meal or flakes. The DT, therefore, both desolventizes the meal and denatures the protein contained in the meal. It does so by exposing the meal to high temperatures in the presence of steam for a lengthy period. The meal or flour produced, using conventional processing is suitable for animal, excluding humans, consumption.

The second process, specialty processing, produces meal suitable for human consumption by beginning with un-denatured soymeal or flour. This means that the oil must be extracted and the resulting meal desolventized and cooled without exposure to excessive heat or moisture for lengthy periods of time. For that reason, a DT cannot be used. Instead vapor and flash desolventizing are used to desolventize soymeal or flakes with a minimum of protein denaturization. Neither system is as effective in driving off the hexane as conventional desolventizing because the meal is not subjected to high heat or elevated moisture levels for long periods, the conditions necessary for the most efficient desolventizing (R. 2599; P.C.40; Ex. 81). It is for this reason the mass balance limitation, discussed later in detail, for specialty processing is double that adopted for conventional soybean processing.

There are three major sources of emission at these processing plants: the main vent, the dryer vent, and the cooler vent. The main vent is usually controlled by condensers or mineral oil scrubbers which are capable of achieving 90 percent or greater control efficiencies. If used together, a 99.9 percent control efficiency can be achieved, which is even more than required under the Generic Rule. The other two sources are not controlled by add-on equipment. At conventional processing facilities, control is instead achieved through efficient operation of the DT. If meal dryers or coolers are used with flash or vapor desolventizing systems at the specialty processing facilities, some hexane will be lost to the atmosphere. Based on industry's information no dryers are used at Illinois specialty facilities. Meal coolers may or may not be used. There are additional "sources" present at all these facilities. There are fugitive hexane emissions and solvent losses through retention in finished soybean meal and oil (Ex. 81, P.C.40).

The industry investigated using add-on controls at the dryer

and cooler vents. Incinerating or using the hexane vapors as fuel proved too dangerous, inefficient, and even if the vapors could be used the energy rendered would be three times the amount needed by the facilities. Carbon adsorption was rejected to technical and safety problems. Finally, due to costs, oversized mineral oil scrubbers proved impractical (R. 2906 - 2912, 2944).

Due to the escalating cost of hexane over the past eight years, the industry has been installing control and recovery equipment, and more efficient DT's and flash or vapor desolventizing systems (R. 2599, 2911). Nevertheless, since it is difficult to control most of the vents with add-on equipment and to quantify emissions from the several types of sources at these facilities, the industry would prefer a mass balance limitation for both the conventional and specialty processes. A mass balance limitation is premised on two parameters easily measured - total soybeans crushed and total hexane lost. Framing the rule this way eliminates any requirements to test the vents at the dryers, coolers, mineral oil scrubbers, condensers, and the residual hexane in the meal or oil. Instead, the total hexane and inventory loss at a plant is used to measure emissions.

Based on seven years data, mass balance limitations were developed (Ex. 81, P.C. 40, 50, 51). On the average it was determined that the conventional soybean facility processing could lose no more than 0.0026 pounds of hexane per pound of conventional soybean crush, and no more than 0.0052 per pound of specialty soybean crush. Industry testified that by over controlling at the mineral oil scrubbers, rather than at the dryer or cooler vents it could operate within these mass balance limitations.

For those facilities unable to currently meet the 0.0026 limitation, it may be necessary for them to upgrade or install a modern DT or new mineral oil scrubber. The latter would cost approximately \$100,000 plus annual operating costs of \$43,000. A modern DT would require capital expenditures of \$1.4 million, but would provide lower operating costs (R. 2912 - 2913; Ex. 81). Furthermore, since the regulations are based on mass balance limitations it may be necessary for plants to reduce start-up, shut-down and other non-operational losses. Since these improvements are proven and allow for the recovery and reuse of hexane solvent, the industry had no objection to the associated costs.

The corn processing industry operates in much the same way as the soybean industry. It agreed that a mass limitation was preferential to the Generic Rule and adequately documented that the affected facilities could limit emissions to no more than 2.2 gallons of hexane per ton of raw corn germ processed (P.C. 37).

Recordkeeping and compliance determination with the adopted mass balance limitations is to be done on a 180 day rolling average. Each day the facilities must recalculate the decreases

in solvent inventory and the total conventional and specialty soybean crush or raw corn germ produced over the previous 180 days. If the sum of soybean or raw corn germ processed multiplied by the respective mass balance limitation is greater than the total decrease of the solvent inventory for the same preceding 180 days, the facilities will be deemed out of compliance. It is noted that the solvent loss data for the specialty facilities was gathered during periods of no overflow, and when the attached conventional facilities were inoperative. Therefore, the average loss cannot be measured for the specialty facilities apart from the conventional facilities. The rule provides for the two to be combined for purposes of demonstrating compliance. Mindful of the ozone season, quarterly averaging was considered instead of biannual averaging. However, the Agency and the industry adequately demonstrated that emissions during the ozone period would be no greater than those experienced during the remainder of the year. In fact, emissions would probably be less during this critical period due to the seasonal nature of the industry. Therefore, quarterly averaging was considered unnecessarily cumbersome.

Subpart P: Printing and Publishing

Sections 215.402 - 215.408: Heatset Web Offset Lithographic Printing

Heatset web offset printing is a lithographic printing process, which means it involves printing from a flat surface. Maintaining the distinction between image and non-image areas is done chemically. The non-image areas are receptive to water, or the fountain solution. The image areas are water repellent, or oil or solvent receptive, so that the ink stays on the image areas. Each printing unit of a press has a series of vertically arranged rollers and cylinders above and below the web, i.e., the paper. The fountain solution and the inks are transferred by complexly arranged rollers to the plate cylinder. The image is then transferred from the image plate to a rubber covered blanket cylinder, and then to the web. The infeed section of the press allows the rolls of paper to be mounted, aligned, unwound, and fed through the press. In a typical process-color heatset web offset lithographic printing press, each printing unit simultaneously applies a single color to both sides of the web. Together all printing units can overlay colors for a full color image without drying between printing units. After the last printing unit, the printing web enters the dryer. The most common type of dryer is a high velocity, hot air blower. Air temperatures can be as high as 500° F. Much of the heated air is recirculated, with only enough being discharged to prevent the buildup of explosive solvent vapors. The web leaves the dryer with surface temperatures between 266° F and 329° F and travels over an assembly of driven steel drums with chilled water circulating through them which cool the web to a maximum 86° F. This cooling, in combina-

tion with the evaporation of the ink in the dryers, prevents the ink from transferring to adjacent sheets when the printed web is cut, folded, and stacked (R. 667-668 2713; Ex. 29(e)).

The two major sources for organic emissions are the printing units and the dryers. If highly volatile organic compounds, such as isopropyl alcohol are used in the fountain solutions, significant quantities evaporate at the printing units. The draft CTG in this category assumed that most of the evaporation take place in the fountain pan (Ex. 29(e)). Since much of the total isopropanol used in the system reaches the dryer, the Agency reasoned that evaporation occurs from the thin film on the rollers or that transferred to the web, and then finally in the dryer. Evaporation of the ink solvents is considered to occur primarily in the dryer (R. 669-670). Accordingly, the regulations proposed by the Agency required capturing and controlling organic material emissions with afterburners by at least 90 percent, or reducing the volatile fraction of the fountain solutions to no more than 5 percent and utilizing a condensation recovery system with at least a 75 percent removal efficiency for organic materials. A provision allowing any alternative method equivalent to either of these was also proposed (Ex. 1).

Fountain solutions usually contain isopropyl alcohol as a dampening solution, an etchant such as phosphoric acid, and gum arabic. Isopropyl alcohol, a volatile organic material, is usually maintained at a 20 percent concentration in fountain solutions where automatic controls are used, and 15 to 25 percent where manual make-ups are used. Alcohol substitutes are available, such as ethylene glycol, and generally have vapor pressures less than 0.0019 psia at 70° F and are typically used in concentrations of about 2 percent, by weight, or less in the fountain solutions. The minimum practical level of alcohol in dampening solutions, however, is 5 percent because older, less flexible rollers require more pressure to print properly and the alcohol substitutes may have too high a viscosity to properly pass through the roller systems under the higher pressures. If the isopropyl alcohol concentration is reduced to 5 percent, a control efficiency between 67 to 80 percent should be achievable (R. 666-671). Industry agreed that alcohol substitutes with vapor pressures less than 0.0019 psia at 70° F are available, and offered that, in fact, the industry is voluntarily switching to them. One company testified that by substituting materials at four plants its emissions were reduced from 81.8 tons of VOM annually to 11.5 tons (R. 2198, Ex. 59).

Ink solvents are primarily mixtures of narrow cut petroleum fractions, having an average molecular weight of about 206. C₁₁ C₂₂ hydrocarbons have been identified as ink solvents, and a commonly used one has C₁₂ and C₁₆ hydrocarbons. Most ink formulations contain 30 to 50 percent, by weight, hydrocarbons. Magiesol 47 is frequently a major component of the ink solvents and has

the above mentioned characteristics. It and any other components usually have vapor pressures less than 0.0019 psia at 70° F and, therefore, under the existing Board definition, are not volatile organic materials. Nevertheless, the proposed language required all organic materials to be controlled by either an afterburner or a condensation recovery system. Catalytic or direct flame afterburners can serve to control the emissions associated with the ink solvents and the fountain solutions by 90 percent. If an afterburner is used, reduction of the volatile organic content of the fountain solution was not to be required. Presumably this was because only 25 percent of the VOM in the fountain solution evaporates at the roller and web areas so that it is sufficient that the remaining 75 percent is controlled by the dryer's afterburner (R. 671). A condensation recovery system, on the other hand, cannot control isopropyl alcohol, but can only serve to control the organic ink solvents. Therefore, the requirement to install and operate the same was coupled with the requirement to reduce the volatile organic concentrations of the fountain solutions. As stated above, alcohol substitutes should provide 67 to 80 percent reductions, so only a 75 percent control efficiency was sought from the condensation recovery system (Ex. 1; R. 672).

Industry did not disagree with the Agency about the ability to control the volatile content of the fountain solution. Rather it objected to the requirement that organic components of the ink be controlled. Industry argued that the solvents contained therein are exempt from control under Subpart K, given the current definition of photochemically reactive materials, and for this reason the industry had switched to these solvents; no other industries are required to control comparable materials under Part 215; and if the proposed Generic Rule was applicable instead, these compounds would not have to be controlled. Furthermore, this segment of the printing industry is competitive with the rotogravure and flexographic segments which are not required to control organic material emissions other than under Subpart K, and are, in fact, encouraged to use the same ink solvents this segment would be required to control (R. 720-724; P.C. 4). Finally, industry argued that ink oils used are not any more photochemically reactive than ethane and, therefore, there is no need to control them as ozone precursors.

In addition to disagreeing with the propriety of regulating organic materials, industry disagreed with the Agency's emission estimates, costs of retrofitting existing sources and the recovery costs from selling condensed ink oils as fuel (R. 725-734; 704-705). Finally, industry believed it would be difficult to reduce the VOM concentration of fountain solution to as low as 5 percent because many of the substitutes for isopropyl alcohol have vapor pressures greater than 0.0019 psia at 70° F, and are, therefore, volatile organic materials themselves. To resolve this dilemma, industry suggested that the percentage be increased to 8 percent, or the content of the fountain solution be limited to 5 percent

isopropyl alcohol, as opposed to 5 percent volatile organic material (R. 702-704).

In support of its argument that the organic materials need not be controlled, industry presented two parts of a five part study underway at Battelle concerning the reactivity of the ink solvents used in heatset web offset printing (Exs. 22, 39). The first part evaluated the volatility of heatset printing oils and the capability of conducting tests within smog chambers to determine their photochemical reactivity. The second part evaluated the ink oils reactivity in comparison with the hydrocarbon ethane. A third part, not finished at the time of hearings, is to collect stack samples and compare them to the ink oils in order to determine if the printing and drying alters their composition in such a way as to increase or decrease reactivity (R. 1615-1618; 1650).

Two ink oils were studied, Magiesol 47 and 470. The latter is predominantly paraffinic, but also contains just in excess of 10 percent olefinic and aromatic hydrocarbons. Magiesol 47 is its counterpart having similar paraffinic content, but is without the olefinic and aromatic hydrocarbons. Using a high ratio of hydrocarbons to nitrogen oxides, a photochemical aerosol appeared within approximately two hours of irradiation during the experiments with Magiesol 470, but did not with those conducted with Magiesol 47. The importance of the first task's results was that it demonstrated that it is technically feasible to proceed and evaluate the same materials' photochemical reactivity under ratios of hydrocarbons to nitrogen oxides known to lead to ozone formation (R. 755-758). The standard urban mix would have a much lower ratio than that used in the first part of the Battelle study (R. 782).

There are a variety of parameters that can be used to evaluate photochemical reactivity. The Battelle study identified eight and chose one, maximum ozone concentration, to be used as the yardstick for the second task. One series of experiments was conducted to compare the reactivity of the two ink oils to each other and with ethane. Some compared reactivity on a mass basis, that is parts per million of carbon, while some employed comparable molar concentration, that is parts per million by volume. In both cases, the oils produced a higher ozone concentration than ethane within the first twelve hours of irradiation, although ethane eventually generated more ozone when compared by mass. It must be noted that the ratio of hydrocarbons to nitrogen oxide was 5/1, much higher than normally found in an urban mixture.

Another series of experiments used a typical atmospheric hydrocarbon mixture composed of seventeen hydrocarbons. Recallin that part of the purpose of the second part is to compare the oils' reactivity to ethane's, in half of this series of experimer the oils were substituted in place of the ethane used in the other half. When ethane was replaced by Magiesol 47 the maximum

ozone concentration dropped 5 percent. When it was replaced with Magiesol 470, it dropped about 13 percent. So this series demonstrated that replacing ethane with either of the ink oils results in a reduction in the maximum concentration of ozone formed in the first twelve hours.

Industry pointed out that the concentrations of ink oils used were greater than those found in normal atmospheric conditions. It was also argued that ethane is continuously in a gaseous state and is therefore always available for ozone formation, whereas the vast majority of the heatset ink oils when emitted condense to form a liquid particulate droplet, and, therefore, are not available for ozone formation. Setting these two points aside, industry asked that the ink oils used in the heatset web offset printing be adjudged nonreactive because the experiments demonstrated that the photochemical reactivity of the oils to be comparable to ethane (R. 1617-1644; Ex. 39).

The USEPA commented on the Battelle study, and agreed that the urban environment simulated tests to show the oils to be slightly less reactive, although the difference may not be significant (Ex. 58; R. 2174-2175). Not surprisingly, the USEPA wanted some of the test parameters changed. For instance, it suggested lower ratios of hydrocarbons to nitrogen oxides, and the addition of an eighteenth component to the background urban mixture. Benefits to be achieved by either of the recommendations are questionable. The ratios used by Battelle ranged between 2.8/1 and 5.0/1, which include the urban ratio identified in a technical study introduced by the Agency (Ex. 41). Secondly, since all seventeen of the hydrocarbons in the mixture were volatile organic materials, adding one more would not seem to be necessary.

The Agency offered no supporting evidence that the emissions from the ink oils used in heatset web offset printing should be controlled as ozone precursors. Presumably, like the USEPA, they seek to control these compounds because they are released into the atmosphere as vapors. However, the USEPA has not finalized its draft CTG in this category, and has not changed its standard definition of volatile organic materials to include these compounds or comparable ones (Ex. 24). Furthermore, much of the control mechanisms now in place at these facilities is to control plume opacity which is indicative of rapid condensation of the emissions. Should the third part of the Battelle study demonstrate that the ink oils are changed in some fashion by the printing and drying process so that they are more photochemically reactive than ethane, it may be necessary to reconsider the decision to only regulate volatile organic materials. At this time, however, the evidence indicates that the present approach is all that is necessary for air quality purposes.

As already mentioned, industry and the Agency had different total hydrocarbon emission estimates. Originally, the dispute

centered around the hours of press operation. It became clear that the maximum hours of operation listed in the Agency's Total Air System represented the number of hours the presses are manned, rather than actually operated. Through cooperative efforts, the maximum hours of operation were revised downward accordingly, and average operating hours were also provided by industry.

It is possible that these figures should be reduced even further. Pursuant to conditions contained in its permit, one company has performed stack testing as a part of a yet incomplete study, to quantify actual hydrocarbon emission amounts. The test results indicate that actual emissions are 53 percent less than originally calculated using a mass balance formula. That formula assumes that only 20 percent of the hydrocarbons applied to the web are retained. The test data suggests that much more is retained. For example, using mass balance calculations the annual hydrocarbon emissions from the facility where the tests were conducted are estimated to be 347 tons, while based on the test data annual emissions would only amount to 163 tons (Ex. 75; R. 2680-2682; P.C. 49).

Of course the disagreements on total estimated emissions and the possible error in the mass balance formula would color the control cost estimates. Industry and the Agency also disagreed on the costs and practicality of afterburners and condensation recovery systems. (Exs. 21; 47; 59; 71; 74 R. 1714-1716; 2182-2188; 2650-2660; 2672-2674; 2689-2694). A detailed analysis of the rightfulness of these disputes is not necessary. Since only volatile organic materials, i.e., primarily the fountain solutions, must be controlled, the total emission estimates at issue are greatly reduced. In fact, one company estimated that use of isopropyl alcohol and its substitutes account for only 4.6 percent of its annual emissions (R. 2194). For the same reason, the types of control and, therefore, the costs are also greatly reduced. Affected facilities will only have to change their fountain solutions. Afterburners or condensation recovery systems will be optional, or only necessary if the ink formulas contribute sufficient amounts of volatile organic emissions to necessitate control. The Board notes that nearly half of the presses at facilities in nonattainment and contiguous counties are already controlled in some fashion. Therefore, compliance expenditures should be minimal.

Originally an exemption for facilities emitting less than 100 tons per year of organic materials was proposed. That level of exemption becomes inappropriate since the affected facilities will only have to consider controlling volatile organic materials. Furthermore, only two facilities in Illinois use sufficient amounts of isopropyl alcohol, i.e. 30,000 gallons or more, to emit more than 100 tons annually. (Ex. 21). Industry suggested a 40 ton per year exemption level in keeping with the levels of significant impact contained in the new source review and the prevention

of significant deterioration programs (R. 727, Ex. 21). However, an exemption limit of 25 tons per year is adopted which means that facilities using more than 7,500 gallons of volatile organic materials, generally isopropyl alcohol, will be required to control emissions either by reformulating the fountain solution or by add-on equipment. According to an industry survey only about fifteen of 52 companies contacted will be affected, and 56 of their 68 presses are already controlled (Ex. 21, Table A).

Three final comments on the rules adopted. First, the ink reformulation and afterburner requirements are included as alternatives to reducing the VOM content of the fountain solution. However, if the ink solvents themselves contain volatile organic materials, one of these alternatives would also be necessary if uncontrolled emissions are greater than 25 tons a year. Secondly, it is the VOM in the fountain solutions which is required to be reduced rather than the isopropyl alcohol, and the reduction must be to 5 percent instead of to 8 percent, because testimony indicated that nonvolatile organic substitutes are available (R. 703). Finally, the condenser recovery system requirement is included, but assumed to be applicable only to those facilities using inks containing volatile organic materials. Installation of the same will otherwise not be required.

Subpart Q: Synthetic Organic Chemical and Polymer Manufacturing

Sections 215:420 - 428: Leak Inspection and Repair Program

The synthetic organic chemical manufacturing industry produces high volume intermediate and finished products from chemical feedstocks derived from petroleum, natural gas, and other raw materials. Approximately 375 intermediate and finished products have been identified for this segment of the chemical industry. The polymer manufacturing segment of this industry includes operations which convert monomer or chemical intermediate materials from the synthetic organic chemical segment into polymer products, namely polyethylene, polypropylene, and polystyrene. The regulations contained in Subpart Q only apply to facilities manufacturing these chemical products which are listed in full in Appendix D of Part 215, and only serve to control fugitive volatile organic material emissions. Given that, these regulations establish a leak inspection and repair program for these manufacturing facilities. The Agency had proposed that resin and synthetic rubber manufacturers falling under SIC codes 2821 and 2822 be regulated; they are not under the rules adopted.

Sixty-four facilities manufacturing synthetic organic chemicals, polymers, resins and plastics were identified in Illinois; sixteen in counties designated as attainment for ozone, and the remaining forty-eight located in nonattainment counties or counties contiguous thereto (Ex. 8, Table 12). Since this accounting was done under

the assumption that all four types of manufacturing facilities would be regulated, some of the sixty-four may only manufacture resin and synthetic rubber products. If so, they are not affected by the regulations adopted. For those remaining, the regulations only apply if the facility contains more than 1,500 components in gaseous or light liquid service, and monitoring is only required at equipment containing more than 10 percent volatile organic materials.

The process units in the synthetic organic chemical and polymer manufacturing segments of the industry are similar. They include material handling of feedstocks and finished products, heat transfer, reaction, sorption, distillation, evaporation, crystallization, and separation. Likewise the equipment used in both segments is similar, each utilizing pumps, compressors, in-line valves, pressure relief valves, open-ended valves (including process drains), sampling connections, flanges, agitators and cooling towers. Fugitive emissions generally result when either gaseous or liquid process fluids leak from the equipment because the sealing materials deteriorate or the sealing effect is reduced due to improper design, construction, installation, maintenance and operation. The most commonly used seals are compressed packings, gaskets, finely machined surfaces (mechanical seals), valves seats, ball valves and plug valves.

The definition of "component" contained in Section 215.204 lists the types of equipment, primarily sealing mechanisms, which are subject to the regulations. Excluded from the definition are any pieces of equipment in heavy liquid service since fugitive emissions of volatile organic material would not be material. Four sealing mechanisms are also excluded: valves not externally regulated, flanges, ball valves and plug valves. Either it is not cost effective to control fugitive emissions from these sources or the emission amounts are not significant. Two specific pieces of equipment, agitators and cooling towers, are also excluded because emissions from these two sources cannot be quantified*. Since all of these sources are excluded from the definition, none are to be counted in determining whether or not a facility has more than 1,500 components, and none of these sources are subject to the inspection program.

The rules proposed by the Agency for this industrial category were originally premised in the draft CTG "Control of Volatile Organic Chemical, Polymer, and Resin Manufacturing Equipment" published by the USEPA in January, 1981 (Ex. 29(a)). This document presumed that the equipment, process materials and emissions

*The terms "agitators" and "cooling towers" were inadvertently omitted from the definition of "component" in Section 215.204. At Second Notice, both will be added.

involved are similar to those found at petroleum refineries. The rules suggested in the draft CTG and, therefore, those submitted by the Agency, were patterned after the leak inspection program for petroleum refineries. In fact, the Agency proposed that the rules be incorporated into Subpart R: "Petroleum Refining and Related Industries; Asphalt Materials" (Ex. 1, R. 186). The petroleum industry objected to this on the grounds that the process materials used in each industry are different, and should Subpart R be amended as proposed, the petroleum refineries would be subject to additional requirements (R. 596 - 599). In April of 1982 the USEPA published "Fugitive Emission Sources of Organic Compounds - Additional Information on Emissions, Emission Reductions and Cost" (AID), which studies in more detail the synthetic organic chemical and polymer manufacturing facilities (Ex. 8). Most importantly, this study changed the emission factors assigned to the various sources used in the industry. The draft CTG had identified the types of sources to be regulated based on the industry, but had premised emission factors on information pertinent to both the petroleum refineries and the synthetic organic and polymer manufacturing. The revised emission factors contained in the AID document were developed after further investigation of the latter (R. 191). The Agency amended its proposal and supporting documentation pursuant to the petroleum industry's objections and the new information provided in the AID document (R. 1314, 1322; Ex. 8).

In order to estimate emissions, control costs and environmental impacts for process units, the USEPA studies developed three model units. Each model plant is defined according to the number of components in volatile organic material use it contains, because fugitive emissions were found to be proportional to the number of potential fugitive emission sources, i.e. the number of components, in the plant, rather than related to plant capacity or throughput (R. 190). Model A was defined as having approximately 1,020 components, excluding cooling towers and agitators; Model B, 4,060 components; and Model C, 19,495 components. These examples of plant complexity were considered representative of facilities nation-wide by the USEPA, with 52 percent of existing facilities to be similar to Model A, 33 percent similar to Model B, and 15 percent similar to Model C (Ex. 29(a), p. 2 - 18). The Agency believed these models representative of the industry in Illinois, and were accepted for use in developing the EcIS (R. 193; Ex. 48, p. 3-10).

The Agency proposed an exemption for facilities with less than 100 valves in gaseous or light liquid service (R. 1314). The background documents indicated that this type of facility, having so few potential sources of fugitive emissions, would have only approximately 5 tons of fugitive emissions to be controlled. The Agency testified that the cost of a leak inspection and repair program is not warranted for this small of a return, estimating it would cost more than 400 times that instituted at a larger plant (R. 1320 - 1321). While it is understandable that

the exemption level is premised on the plant's complexity, it is perplexing that it was based only on valves, and not the total number of components in a facility. Furthermore, this level of exemption, which only represents controlling 5 tons annually, appears to be rather low.

Model A plants have approximately 388 components, excluding agitators, cooling towers, flanges, and valves and pumps in heavy liquid service. Approximately, 225 components of the total are estimated to be valves in gaseous or light liquid service. As discussed above, ball and plug valves are not to be included in determining the total number of components at a facility. It is difficult to determine which of the 225 valves are of the ball and plug variety. (The reason for excluding ball and plug valves is discussed below.) Monsanto estimates that 95 percent of the valves in its facilities are ball and plug valves (R. 1215). If this percentage is common across the industry, it is likely that Model A plants, given the exclusion of ball and plug valves from the definition of "component", have fewer than 100 valves and, therefore, would be exempt from regulation under the Agency's suggested exemption level. Model B plants contain approximately 1,525 components, excluding agitators, cooling towers, flanges, and valves and pumps in heavy liquid service. Again, the number of ball and plug valves is uncertain. If 95 percent of the estimated 925 valves are ball and plug valves, the number of valves at Model B plants would also fall below the suggested 100 valve exemption level. If the same components excluded for Model A and B plants are not counted, Model C plants contain approximately 4,690 components. Again, assuming the 95 percent figure, 143 of the estimated 2,850 valves contained in these facilities are not ball and plug valves. (All figures based on Ex. 8, Table 4.) Therefore, if the Agency's exemption level was adopted, along with a ball and plug valve exclusion, only Model C plants would be subject to regulation.

The 1,500 component exemption level adopted by the Board takes into consideration the entire complexity of the plant, rather than just the number of valves contributing to its potential fugitive emissions. Furthermore, it links estimated annual emissions to facility complexity in establishing a limit. Fugitive emissions from Model A plants are estimated to be 42 tons per year; from Model B plants, 165 tons per year; and from Model C plants, 520 tons per year (Ex. 8, Table 5). These emission estimates include potential fugitive emission amounts from ball and plug valves, which the Board has chosen to eliminate. Even so, it is only at plants as complex as Model B, which contain 1,500 components before ball and plug valves are excluded, that potential emissions are greater than 100 tons per year. Assuming that ball and plug valves do not contribute greatly to annual fugitive emissions, it is unnecessary to include them when assessing the plant's complexity, and once their contribution is deleted, it is probable that emissions from Model B plants are less than

100 tons per year. If the 95 percent figure is not representative of the amount of ball and plug valves used in the industry, then the number of components (i.e. non-exempt valves) to be counted will rise accordingly and those facilities with the potential to emit more than 100 tons per year will be subject to regulation. Although the Board is unable to unravel the 100 valve exemption level and the potential to control only 5 tons per year, the exemption level adopted is based on the plant's complexity and the potential of its emissions to harm the environment.

Premising the exemption level on plant complexity coupled with its potential to emit more than 100 tons per year, still leaves one problem unresolved. Some facilities are operated year round, while some use the equipment subject to regulation intermittently for batch processes (R. 1382). It would be very costly to undertake a monitoring program, even once a year, if that equipment is used only for a few hours. It was suggested that an exemption for facilities limited to emitting less than 100 tons per year either by operation or by permit be adopted. Having adopted an exemption level different than that proposed, it is difficult for the Board to determine whether an annual emission exemption is still advisable. Furthermore, it is not clear how many batch process facilities are affected and the amount of annual fugitive emissions each contributes. Comments are invited.

Ball and plug valves have been excluded from the definition of "component" and, therefore, from determining the complexity of a plant because they have extremely low leak rates. Unlike the globe and gate valves commonly used at refineries, they do not have packing seals. There is no packing gland mechanism for leakage. They are used by the synthetic organic chemical and polymer manufacturers for just that reason and to comply with Occupational Safety and Health Administration (OSHA) regulations (R. 1806). Should the process materials be allowed to leak, the outside seat of the valve would deteriorate and freeze the valve. The emission factors for ball valves is 200 times smaller than that for gate or globe valves. (R. 1215-1217). For the same reasons, ball and plug valves are also exempt from monitoring program even if a facility is subject to an inspection and repair program because it contains more than 1,500 components.

Pursuant to Section 215.422(h), storage tank valves, pumps equipped with mechanical seals and pressure relief devices connected

*At First Notice the term "inaccessible valves" was also listed at Subsection (h). Subsection (a), however, also applies to "inaccessible valves" and requires that they be tested annually. To eliminate this contradiction, the term shall be deleted from Subsection (h) unless public comments indicate that subsection (a) should be deleted instead.

to an operating flare header or vapor recovery device are also exempt from monitoring requirements.* The Agency suggested that all these devices be exempt, except for pumps equipped with mechanical seals. Mechanical seals are used in place of packing glands to control emissions (R. 1217). Based on studies of five typical chemical compounds used in the industry, the average emission rate from mechanical seals was determined to be 11.7 grams/hour, as opposed to the 120 grams/hour estimated by the USEPA and the Agency (R. 1233; Ex. 33). It should be noted that the AID document revised the USEPA emission rate for all pump seals to 49 grams/hour. The emission factors are still far apart. Industry suggested, and the Board agrees, that if mechanically sealed pumps are exempted from the monitoring requirements, the affected facilities are encouraged to switch to this type of sealing device, which will more effectively reduce fugitive emissions than will annual inspection and repair (R. 1224).

Once it has been determined that a facility is subject to the regulations, two types of inspections must be conducted. First, all pumps (except those with mechanical seals) must be visually inspected weekly. If found to be dripping, they must be repaired within 22 days, unless such a repair must await shutdown, or the availability of a repair part. In those events, the leaking pump must be repaired as soon as possible. Secondly, all non-exempt components must be tested with monitoring equipment approved by the Agency at least once a year. Equipment considered inaccessible, that is out of reach or unsafe to test without special precautions, must be monitored only once a year. The remaining components must be tested once a year immediately preceding or at the outset of the ozone season. If found to be dripping or to be leaking in amounts greater than 10,000 parts per million of volatile organic material when tested, these components, usually valves, must be repaired within 22 days or as soon as possible. If more than 2 percent of the total number of components tested are found to be leaking, then a second testing and repair program must be conducted during the ozone season. This second inspection is triggered because it was generally found that if the percentage of leaks is below 2 percent, only one percent of the components leak during the course of a year. However, the second inspection only involves testing pressure relief and pipeline valves in gaseous service and compressor seals and, of course, any of those components found leaking the first time.

The Agency proposed a quarterly monitoring program with skip periods provided if one quarter's tests indicated that only 2 percent or less of total valves tested were leaking. The program described above, however, is adopted as sufficient to reduce emissions from leaking equipment during the ozone season, the period of most concern for public health and welfare. Furthermore, in comparing the number of leaking components found in refineries and those in the synthetic organic chemical and polymer manufacturing

facilities, the latter is found to have 50 fewer percent leaking components than refineries when the materials are subject to OSHA workplace concentrations (R. 1211-1212). Since most of the affected facilities are subject to OSHA, it would be incongruous to require quarterly monitoring at these industrial facilities, and not at petroleum refineries. The Agency did offer that quarterly inspections are more cost effective than annual inspections because leaks are detected earlier, which causes corrective measures and product savings to occur earlier. Consequently, this would enhance cost effectiveness (R. 1314). Affected facilities, are, of course, free to monitor more frequently than just during the ozone season.

The Agency proposed that all open-ended lines be equipped with double block sealing mechanisms (Ex. 1, Rule 205(1)(10); R. 195). This would mean that the ends of sampling lines be double sealed with a cap, blind flange, plug or other sealing devices. According to industry's testimony, many line ends are already equipped with ball or plug valves, the efficiency of which has already been discussed. Industry further offered that installation of a second sealing device would mean that a second union craftsman would be required to remove the second seal in order to take a sample. Industry added that plant safety procedures often prohibit installation of a second sealing device. Finally, one company estimated that replacing existing valves on sampling lines with double block valves could cost over \$75,000, or approximately \$225 per valve, for what it considered negligible emission reductions (R. 1215 - 1216). The Board did not adopt this requirement. Rather it anticipates that the affected facilities will be encouraged to replace ordinary valves with the more efficient plug or ball valves, in turn reducing the potential for fugitive emission, much in the same way as was argued for mechanical seals. However, it does recognize that many affected facilities may continue to use flanges which are also not counted in determining the exemption level and are not subject to the monitoring requirements.

The variety of chemicals used and manufactured by this industry is diverse and difficult to quantify. The control mechanisms already in place at the affected facilities is also difficult to ascertain. Therefore, the authors of the EcIS found it is difficult to estimate expected annual reductions in fugitive emissions and future control costs. The information contained in the EcIS was developed using the Agency's proposal. The applicability of the leak inspection and repair program adopted by the Board is very different than that originally proposed. This, in turn, makes it even more difficult to quantify expected reductions and costs.

Assuming quarterly inspection and double blocked seals, the net annualized costs and cost effectiveness were estimated for each of the model plants in the EcIS. It was estimated that Model A plants would have to incur net annualized cost of \$11,130

at a cost per ton of \$742; Model B plants, \$22,410 at a cost per ton of \$412; and Model C plants, \$39,000 at a cost per ton of \$191 (Ex. 48, p. 4-6). Industry found these investment costs and average cost of \$334 per ton far too low (R. 2137, 2165). Much of the disagreement centered on the emission factors used, the emission reductions assumed, and that some of the facilities affected were never studied federally. For instance, industry argued that the USEPA did not study plastic or resin facilities. However, these are not affected in the regulation adopted by the Board. Likewise, the number of inspections required and the number of facilities affected, and number and types of components to be tested have been substantially reduced than originally proposed. Therefore, the estimates for the model plants are askew. Nevertheless, some of the information contained in the EcIS as well as other information presented at hearing can help estimate costs for individual facilities. The capital cost of a monitoring instrument was estimated to be \$11,990, which, of course, can be annualized. Labor, repair work and parts would require additional outlays by a facility undertaking its own inspections. Another alternative would be to hire outside contractors. An independent contractor testified that his company performs inspections charging \$1.50 per component on original testing, and \$1.00 for the follow up (R. 1968). This would mean that a plant containing the 1,500 components would have to pay \$2,250 for an initial annual inspection, and less for retesting or a follow-up inspection in the ozone season. Of course, repair work and parts would be at an additional cost. Since the investment for double block valves is eliminated and the cost of inspection, repair and recordkeeping is reduced to once or twice a year, the cost and administrative burden to affected facilities should now be reasonably related to the potential to emit fugitive emissions.

Subpart U: Coke Manufacture and By-Product Recovery Plants

Sections 215.500, 215.510 - 215.517 Coke By-Product Recovery Plants

Three coke by-product plants were identified in Illinois; each located in a nonattainment area. Originally the VOM emissions from these plants, and any other possibly unidentified coke by-product recovery plants, were to be controlled under the proposed Generic Rule, the proposed storage tank regulations, and the regulations proposed for the synthetic organic chemical manufacturers (R. 355, 356, 406). After visiting a coke by-product recovery plant, the Agency, however, agreed with the affected industry that a limited, industry specific rule was more appropriate. Accordingly, at the December 7, 1982 hearing the Agency submitted proposed language for a leak inspection program (R. 1324). Those process components dedicated to light oil liquid service would be subject to a visual inspection and repair program to reduce fugitive emissions. Light oil liquid was defined as a

liquid condensed or absorbed from coke oven gas and composed of a mixture of benzene, toluene and xylene. In later testimony the Agency suggested that in addition to the inspection program, and instead of the all encompassing Generic Rule, only the uncontrolled emissions from four types of sources would have to be reduced by 85 percent or more (R. 3041-3045).

At hearing, description of the processes involved and the means of control was minimal. A paper, "Benzene Emissions from Coke By-Product Recovery Plants - National Emission Standards for Hazardous Air Pollutants", authored by L. L. Beck was introduced [R. 2586, Ex. 69(c)]. It contained a description of the coke by-product recovery plants and possible control methods for benzene, a VOM. Industry disputed the emission amounts represented therein, but did not dispute the ability to control the same four types of sources identified by the Agency or the feasibility of the leak inspection program (R. 3054-3055, P.C. 42). Furthermore, although it did not agree with the emission figures, industry found the rule acceptable (R. 1402), and believed that, as revised, the regulations would provide emission reductions equal to or greater than that anticipated under the Generic Rule (R. 3055).

The Agency proposed different compliance dates for the two programs involved, allowing the affected industries until the end of 1985 to implement the inspection program, and until the end of 1986 to install any equipment necessary to reduce emissions at the four emission sources by 85 percent. Industry requested until the end of 1986 to comply with both programs for capital planning purposes (R. 3056). Given the short compliance deadlines under the federal National Emission Standards for Hazardous Air Pollutants (NESHAP) programs for benzene, as adopted and proposed (discussed further below), and since these facilities are located in nonattainment areas, it seems unnecessary to delay compliance. Therefore, compliance for both programs will be required to be achieved no later than December 31, 1985.

Generally coke by-product recovery plants are a part of a steel-making facility. Coke, which is derived from coal, is a necessary material for converting iron ore to iron. The coking process (converting coal to coke) takes place in coke oven batteries, producing a gas with a high Btu value. This gas is, therefore, used to underfire those very same ovens and other parts of the facility. However, before it is used, the various chemicals evolving from the coal are separated and recovered by passing the coke oven gas through the coke by-product recovery plant. It is the cleansed gas which is used as fuel to make more coke [R. 3052-3053; Ex. 69(c)].

According to the Beck paper, four areas of the coke by-product recovery plant, involving approximately a dozen major sources, emit the VOM benzene. The four areas are: (1) naphthalene separation and processing, (2) tar separation and processing, (3) light

oil recovery, and (4) leaks from pumps, valves, exhausters and other equipment components. Only three of the four areas are subject to this regulation; the naphthalene process is not. Two of the remaining three areas are processes, each involving two of the four emission sources subject to Subpart U. In the first process subject to this regulation, tar is removed from the gas by tar decanters and is then held in storage for later use or sale. The two largest emission sources in this process are the tar decanter and the tar intercepting sump. Each type is subject to 85 percent reduction requirement under Section 215.510. In the second process, light oil is recovered from the coke oven gas. Light oil is composed primarily of benzene. The largest emission source in this process is the vent attached to the light oil separator/condenser, used to exhaust non-condensable constituents. Also involved in this process is a sump, which receives the process' wastewater. Uncontrolled emissions from both the light oil condenser/separator and the light oil sump are required to be reduced by 85 percent. According to the Beck paper, these reductions can be achieved by sump covers, condensers, and closed vent systems. Technical or safety problems were acknowledged to possibly preclude closed vent systems at light oil sumps.

The final area subject to regulation is the leaking from process equipment such as pumps, exhausters and pipeline valves, and other equipment components. As stated above, only those involved in light oil liquid service are subject to an inspection and repair program. Furthermore, those components servicing coke oven gas lines, operating flare headers, and vapor recovery devices are exempt.* Under Section 215.512 the non-exempt components must be visually observed weekly. If found leaking, the components must be repaired within twenty-two days unless it is impossible to repair it for lack of a part or while the component's unit is in service. Then the repair can be delayed until the part is received or until process turn-around. Records of leaks, repairs, and delays must be maintained for two years. These requirements are parallel to those for petroleum refineries.

At the outset, actual emission data for these sources was sparse. Beginning with the total emission estimate for all coke by-product recovery plants in the United States, as given in the Beck paper, and estimating that 40 percent of the total is attributable to fugitive emissions, the Agency arrived at an estimated 1,800 tons per year of fugitive volatile organic emission from the Illinois facilities. The 40 percent figure was premised on

*Since those components servicing coke oven gas lines are exempt, and light oil liquid is the condensate from coke oven gas, was the intent to require leak inspection of the components in light liquid service rather than light oil liquid service?

information documenting the synthetic organic chemical manufacturing category (R. 417-418). Industry disagreed with the extensive extrapolation exercised by the Agency to arrive at an emission figure for fugitives at coke by-product recovery plants.

After the industry specific rule was developed, emission figures specific to the four types of sources to be controlled by 85 percent were provided. Using the benzene emission factors, presumably those used in the Beck paper (as provided by industry in Ex. 85), along with a multiplier of six to arrive at total VOM emissions, the Agency developed total VOM emission estimates for the four specified emission sources at two of the three identified facilities. Total uncontrolled estimated emissions amounted to 2,575 tons per year. If 85 per cent control requirement is achieved, fugitive emissions from these sources should be reduced to 386 tons per year (P.C. 47). No cost data was provided by the Agency or in the EcIS. (R. 3060; P. C. 47; Ex. 76, pp. 28-29) However, at hearing one facility estimated that compliance may cost it \$1 million (R. 3059). Based on the emission amounts attributable to that facility, cost effectiveness per ton is estimated to be \$643. Emission data pertaining to the inspection program was not quantified further. Exact figures are not critical, however, since only visual inspection is required. Product saving and plant safety should be sufficient incentive to justify this program.

In the interest of cohesiveness, two interesting aspects about the regulating of coke by-product recovery plants are noted. Industry testified that numerous sources at coke by-product plants are subject to other existing rules, but are exempted by the terms of those rules (R. 3053-54). For instance, the storage tanks used in the three processes are subject to Subpart B: Organic Emissions from Storage and Loading Operation, but are exempted presumably due to size or material content. The separators used in the processes are subject to Subpart C: Organic Emissions from Miscellaneous Equipment. Finally, other operations may be subject to the general rule for organic materials found at Subpart K. It may be prudent to group the exemptions and applicable regulations under this new Subpart U. Suggested language would be welcome.

Secondly, on June 6, 1984 the USEPA adopted final rules under Section 112 of the Clean Air Act to control benzene as hazardous air pollutants, except from process units located at coke by-product recovery plants (49 FR 23498). That same day it proposed standards for benzene emissions from the coke by-product recovery plant (49 FR 23522). The proposed rule encompassed emission standards, equipment, work practices and operational requirements. The sources considered were more numerous than the four named in this rulemaking, and the inspection and repair requirements more stringent in parts. On June 29, 1984 the Board

adopted these NESHAP regulations under its preemptory rulemaking authority (R 84-24) [Ill. Rev. Stat. 1983, ch. 111, par. 1009.1(c)]. Should the proposed NESHAP standards for the coke by-product recovery plants be finalized by the USEPA, the Board will be required to adopt the same pursuant to Section 9.1 of the Act (id.) (It may then be necessary to have a rulemaking to delete the rules adopted herein.) In the meantime, this new Subpart U will require a reduction in all VOM, including benzene, from those emission sources at coke by-product recovery plants, albeit fewer sources, where it has been demonstrated that controls are reasonably available. Comments on the necessity of this Subpart should the NESHAPS program be finalized by the USEPA are invited.

INDUSTRIAL CATEGORIES NOT ADOPTED

Storage Containers

Pursuant to the concurrently adopted definition of volatile organic material (VOM), the storage container regulations adopted in R 71-23: Emission Standards (4 PCB 191, at 239; April 13, 1972) and now found in Subpart B of 35 Ill. Adm. Code 215 are applicable if the material stored is an organic material with a vapor pressure of 2.5 pounds per square inch absolute (psia) or greater at 70° F. If used to store such material, those containers with storage capacity greater than 40,000 gallons or more must be equipped with either a floating roof or a vapor recovery system. At the outset of this rulemaking it was proposed that the existing rule be amended to include those storage containers used to store volatile organic materials with vapor pressures of 1.5 psia or greater at storage temperature. To implement the same, a definition of volatile organic liquids, as opposed to an amendment to the existing definition of volatile organic material, was proposed. A volatile organic liquid was to be any material, other than a petroleum liquid (already defined) with a vapor pressure of 1.5 psia or greater when it is at equilibrium with its own vapor at storage temperature (Ex. 1). That definition, therefore the applicability of the rule, would have included 1,1,1-trichloroethane, a compound exempt under the definition of volatile organic material. Twenty-five examples of other compounds qualifying as volatile organic liquids, due to vapor pressure and storage temperature, were provided (Ex. 17, Tables I and II).

As originally proposed, those tanks storing volatile organic liquids would have been required to be equipped with full contact floating roofs and secondary seals. Due to revisions in the emission factors for contact roofs and secondary seals, the proposal was changed at hearing to only require internal floating roofs and primary seals (R. 362-363, 922-924). Finally, it was proposed that tanks storing organic liquids be subject to record keeping and inspection programs. An organic liquid was to be

defined as any organic material other than a petroleum liquid, which has a vapor pressure of 0.9 psia or greater when it is at equilibrium with its own vapor at 70° F (Ex. 1).

As was the case when the original rule was adopted in R 71-23, the facilities most likely to be affected by the proposal are the bulk storage operations. Others affected are those facilities which maintain sufficiently large storage containers as a part of the over-all operation. Five bulk terminals, owning and operating 36 tanks in nonattainment areas, were identified as possibly being affected due to the redefining of VOM for purposes of this Section. Assuming that these 36 storage containers are equipped only with fixed roofs, annual emissions were estimated by the Agency at 130 tons per year (Ex. 17, Table III). Using an average control efficiency of 95 percent, the annual emissions reductions were estimated to be 124 tons per year, or in other words, the annual emissions from these sources, if regulated, would collectively be six tons. Industry estimated annual emissions from tanks equipped with fixed roofs to contribute only 70 tons per year, and if required to install floating roofs, emissions would be reduced by 61 tons per year, or emissions after regulation would be 9 tons per year (R. 446). The difference in the two sets of emissions estimates is that industry's figures did not include tanks containing 1,1,1,-trichloroethane (R. 446, Ex. 18). As noted above, this compound is exempt under the definition of volatile organic material. The Board exempted this compound in RACT II (R 80-5), finding that it did not appreciably contribute to ozone formation and, therefore, is not properly regulated under Part 215 (49 PCB 76; October 5, 1982). Nevertheless, the Agency would have it included under the definition of volatile organic liquids, and have containers storing it subject to regulation (R. 455; Ex. 17, Table IV).

The initial objection to the proposal by industry was that the equipment specifications and the recordkeeping and inspection requirements were more stringent than those required at those storage tanks originally regulated and containing material more volatile. Installation of full contact floating roofs was estimated on the average to cost double than for pontoon style internal or external roofs (Ex. 18). Secondary seals were estimated to cost \$640,104 for the affected tanks in Illinois, and only provide reduced emissions of 6.7 tons per year (R. 450, Ex. 18). As already mentioned, due to revisions in the applicable emission factors, and acknowledging that contact floating roofs have more operational difficulties than pontoon type roofs, the Agency amended its proposal, eliminating these two requirements. The tanks would only be required to install floating roofs with a single seal or a vapor recovery system, which is the same as that required of tanks storing VOM under the existing rule.

Even after the proposal was rewritten, industry objected, arguing that the costs incurred were not justified given the

small amount of reduced emissions involved. The Agency estimated that installation of internal floating roofs would cost in the range of \$3,800 and \$7,800 and anticipated that this figure would be offset by product loss savings (Ex. 17, Table III). The Agency estimated the cost effectiveness to range between \$45 and \$5,600 per ton. On the other hand, industry estimated the cost of installing non-contact floating roofs, i.e., pontoon type roofs, to range between \$12,000 and \$26,000, and cost effectiveness to be \$8,975 per ton overall. Since the affected facilities generally do not own the commodity, product loss savings were not included to offset the installation cost, while lost revenue during installation was included in estimating total costs (R. 447, Ex. 18). Finally, industry's figures also included costs for cleaning the tanks prior to installation. These differences, along with the conflicting emission estimates, appear to account for the wide differences between the two estimates. The EcIS estimated cost effectiveness, on the average, to be \$2,328 (Ex. 48, p. 4-15). Since this figure is closer to the Agency's estimate, and since the figure does not appear to include lost revenue and cleaning costs, it is assumed that they were not included.

Based on the Agency's estimates and emission factors, uncontrolled these sources collectively contribute no more than 130 tons per year, or on the average only 3.6 tons individually per year. It must be remembered that these figures assume that tanks storing 1,1,1-trichloroethane, would be regulated. Since no new evidence was presented to support controlling this exempt compound as an ozone precursor, that assumption must be rejected. Industry's estimated uncontrolled emission figure of 70 tons per year more accurately represents the amount of emissions at issue. Even if the Agency's cost figures are accepted as accurate, requiring installation of internal floating roofs is not justified. In other industrial categories, sources individually emitting less than 100 tons per year are exempted from regulation. At this time these sources shall be subject only to Subpart K. Should it be demonstrated that such floating roofs are already in place at a majority of the facilities, so the cost figures are evidenced to be non-existent, then reconsideration would be proper. As an aside, the Board notes that this rulemaking is not necessary for a satisfactory State Implementation Plan as required by the USEPA since the sources identified in this rulemaking are not, individually or collectively, emitting more than 100 tons of volatile organic materials per year.

Two other questions are outstanding: whether recordkeeping should be required of these tanks storing organic liquid and whether the proposal, as amended, encompassed tar storage tanks at steel-making facilities, including those at coke by-products recovery plants. While they both are mooted with the decision not to adopt the proposed rules, some discussion is warranted. To implement these regulations, a definition of organic liquid,

in addition to the definition of volatile organic liquids, was proposed. That definition set 0.9 psia at 70° F as the minimum vapor pressure for organic liquids. Use of this term, in conjunction with the definition of volatile organic liquid (as well as in lieu of volatile organic material) causes problems. First, it is unclear why the applicability of the recordkeeping requirement was premised on the term organic liquid. Did this mean that those containers storing volatile organic materials were not included? Did it mean that those containing volatile organic liquids were required to keep records? If it was intended to encompass all storage tanks regulated and proposed to be regulated under Subpart B of the Board's rules, it was never so stated. If it was intended to only require records from tanks which are heated, this likewise was never explained. Secondly, the possible conflict between the two definitions caused problems for the steel industry. Only at hearing did the possibility arise that the storage container rules were to be applicable to storage tanks containing tar at steel facilities. Industry argued that tar is not an organic liquid under the proposed definition. At equilibrium with its own vapor at 70° F, tar has a vapor pressure less than 0.9 psia. Reading the definitions together, industry argued that since tar is not an organic liquid, it cannot be a volatile organic liquid, and therefore the containers are not subject to the rules. The Agency argued that the rules must be read independently, and should tar's vapor pressure at storage temperature exceed 1.5 psia, the regulations would be applicable. (R. 1401; P.C. 26).

Both problems apparently are caused because the proposed definition of organic liquid did not encompass all volatile organic liquids in the same fashion that the definition of organic materials encompasses volatile organic materials. This demonstrates the difficulty in regulating pursuant to a definition of volatile organic liquids instead of amending the term volatile organic materials. Both problems remained unresolved and although they are mooted, it is troublesome. Has the Agency, in its permitting capacity, found it desirable that the storage tanks now subject to Subpart B maintain records? If so, this was not made clear to the Board at hearing. Secondly, did the Agency choose not to provide information documenting the need to control tar storage tanks either under this category or in the industry specific proposal for the coke by-product recovery plants because it assumed that they would be regulated hereunder? If either be the case, the Board welcomes further enlightenment.

Subpart K
Section 215.305: Viscose Casing Process

As the Generic Rule was proposed, two Illinois manufacturers of regenerated cellulose casings would have been required to control the carbon disulfide emissions from their plants. One

company is located in a nonattainment area; the other in an attainment area. Based on the descriptions offered by each, the viscose processes of both companies appear to be similar. Gaseous emissions of carbon disulfide and hydrogen sulfide occur at the coagulation, regeneration and purification stages of the process (R. 933-934, 975-976). The company in the nonattainment area estimated its annual emissions of carbon disulfide to be 1,500 tons per year after passing through a hydrogen sulfide scrubbing system installed in 1972 (R. 934). The company in the attainment area exhausts its gaseous carbon disulfide as a diluted stream through three large capacity, tall stacks (R. 976). To control the odor problem associated with hydrogen sulfide, this company installed extensive roof duct work in 1972 (R. 978).

Between the two companies, four alternative methods of complying with the proposed Generic Rule were examined. The first would involve material substitution. However, carbon disulfide is an integral part of the chemical reaction necessary to produce viscose and both plants, as are those worldwide, are designed to manufacture cellulose casings by the viscose process (R. 935). The second alternative, condensation, was not feasible due to the low concentrations of carbon disulfide in the gas streams and the relatively high vapor pressure of the compound, approximately 6 psia at 70°F. The company located in the nonattainment area investigated carbon adsorption. However, carbon adsorption poses serious safety problems given the extremely wide explosive range of carbon disulfide (R. 936). Additionally, the hydrogen sulfide present in the gas stream rapidly oxidizes to elemental sulfur and acts to impede the adsorption capability of the carbon bed for the carbon disulfide. This "poisoning" also reduces the life of the carbon bed by one to three months. In the instance of the nonattainment company, this means the bed would have to be replaced 16 to 48 times per year (Ex. 65).

Both companies agree that of the four alternatives, incineration is the only technically feasible method to reduce carbon disulfide emissions in order to comply with the proposed Generic Rule. However, this alternative proves to be economically unreasonable. The nonattainment company estimated installation of this type of control equipment for its facility at \$16 to \$20 million (R. 938); the attainment company set the initial capital cost at \$24 million (R. 983). Both estimated annual operating costs at \$10 million (R. 938, 984). Likewise, both estimated the cost per ton to control carbon disulfide emissions at \$7,000 (R. 938, 985; Ex. 27).

Although both manufacturers agree that incineration is the only technical method for control given the physical characteristics of carbon disulfide, the feasibility of incineration is questionable. No cellulose casing processes in the world are currently equipped with carbon adsorption equipment or incinerators. The advisability of requiring incineration is also dubious.

Should the two companies in Illinois be required to control carbon disulfide with afterburners and choose to do so using natural gas, the cost and competition for the fuel would have severe economic impacts. Furthermore, should incineration be used to control carbon disulfide emissions of the criteria pollutants, nitrogen oxides, sulfur dioxides, total suspended particulates, and carbon dioxide, these would increase on a ratio of two to one (R. 940, 980). In addition, initial studies have indicated that carbon disulfide reacts less efficiently than most hydrocarbons to produce ozone, and provides no daughter products which assist in ozone formation (R. 952-955). For the foregoing reasons, it is apparent that well enough is left alone.

It is apparent that the means to control carbon disulfide, to the extent required under the proposed Generic Rule, is neither reasonably available nor advisable. As mentioned in the introduction to this Opinion, an exemption to Subpart K was adopted for the viscose casing process so that it would not be subject to the Generic Rule. However, Subpart K is not being amended as anticipated with any form of the Generic Rule. Both companies testified that they have existing equipment to control odors pursuant to Sections 215.301 and 215.302 of the existing Subpart K. Repeal of the exemption will require nothing new of these two companies, but will insure that this control equipment, installed by both companies in 1972, is maintained and operated.

Asphalt Roofing Manufacturers

Regulations to control the non-methane hydrocarbon emissions from asphalt roofing manufacturing processes were proposed, including an exemption for those facilities emitting less than one hundred tons of volatile organic materials annually. The applicable definition of volatile organic material for this industrial category was to be those organic materials with vapor pressures of 0.0019 psia or greater. Production lines at roofing manufacturing facilities can be used to manufacture saturated organic and inorganic felts, glass felts, asphaltic roofing goods for commercial and industrial application, and shingle products for use primarily in the residential markets. Four steps are involved in manufacturing asphaltic roofing products. First, the asphalt must be prepared at a blowing still, described below. Then the felt is impregnated with the heated asphalt at a saturator. Next the saturated felt is coated with granules, and finally is cut into shingles or simply rolled prior to sale.

Preparing the asphalt consists of blowing air through it to reduce its volatile organic material content and raise its melting point. This blowing process is performed in stills or tanks at 430° - 500° F which are located at either the manufacturing facility or at oil refineries. Given the definition of "asphalt roofing manufacturing process", the rules, as proposed, were not

intended to be applicable to stills located at the refineries. Those at the manufacturing facilities would have been required to be equipped with afterburners capable of oxidizing 90 percent of the non-methane volatile organic materials or with alternative, equivalent control mechanisms. Since the purpose of this blowing is to drive off the volatile organic materials, the resulting emissions should be greater than at the other steps, and in fact, leave less volatile organic materials to be emitted at the subsequent stages, especially the saturation step. The felt saturation process is accomplished by passing a continuous roll of felt along rollers in a saturator, which is a long trough containing the treated asphalt heated to 400° - 450° F. Most saturators are designed to coat the felt on both sides by dipping; the other method is to spray the asphalt onto the felt. Emissions from dip saturators are generally less than those resulting from spray applications. As proposed, the rule would have required that saturators at roofing manufacturing facilities be vented to afterburners with the same capabilities of those required at the blowing stills, or, again, controlled equivalently by alternative devices. It should be noted that if a fiberglass substrate is used instead of organic felt, the saturation step is eliminated. The last two steps, coating and cutting, do not involve significant VOM emissions. For reasons that will be discussed, it should be noted that for purposes of identifying emission sources and quantifying emissions, saturators and coaters were combined by the Agency.

Yet another source of emissions, which precedes the manufacturing process, is the asphalt storage tanks. The greatest incidents of emissions occur during material transfers to and from these tanks. The proposed rules would require that these be equipped with afterburners comparable to those described for the blowing stills and saturators, or equivalent controls. Given the language of the existing Board rule for storage tanks, Section 215.121, asphalt storage tanks are required to control emissions if the vapor pressure of the asphalt stored is 2.5 psia or greater, and the tank's storage capacity is 40,000 gallons or more. Since a new rule is proposed, it is presumed that most asphalt storage tanks do not fit that description. However, transfer operations at these tanks are presumably subject to Section 215.122: Loading Operations, due to probable odor nuisances. Pursuant to subsection (b) of that rule, those tanks with storage capacities greater than 250 gallons are required to be equipped with submerged loading pipes (Ex. 1, R. 257-262, P.C. 18).

Volatile organic emissions from asphalt manufacturing processes are composed of particulate and gaseous emissions. The Agency testified that either process controls or add-on equipment were available to reduce these emissions. The process controls included the following: use of reduced temperatures in asphalt storage, the asphalt saturant pan, and in asphalt blowing; and use of

higher flash point asphalts. Unfortunately, data quantifying the organic vapor and particulate emissions, as related to various crudes and temperatures, is not available. Therefore, although the Agency acknowledges that these processes reduce emissions, it is not clear how they would be determined to be equivalent to the afterburner requirement. Two other process controls, use of vertical rather than horizontal blowing stills and the use of dip saturators as opposed to spray saturators, were suggested and their respective emission factors provided. (Ex. 34). However, no comparison was made between these two process control methods and the afterburner requirement. (Furthermore, it would seem that these processes would necessitate rebuilding the blowing still or the saturator. It is difficult to conceive either as simply an alteration in "process".)

Six types of add-on controls were considered, all of which are intended to control particulate matter. They are: afterburners, mist eliminators, electrostatic precipitators, high efficiency air filters, scrubbers, and fabric filters. To control gaseous emissions, all of the devices, except for afterburners, would require that the gaseous hydrocarbons be cooled to about 90° - 120° F, condensing them to liquid particulates which the add-on device is capable of collecting. Cooling must be accomplished by either a direct heat exchange, diluting the exhaust stream with air or water sprays, or by an indirect heat exchange provided by additional devices such as a tube and shell exchanger (R. 262). Afterburners serve to control gaseous VOM emissions; however, only if the retention time is long enough and the operating temperatures are high enough. Furthermore, catalytic afterburners cannot be used due to rapid poisoning and plugging of the catalyst bed.

Much of the equipment at the eight roofing manufacturers identified in Illinois is already vented to afterburners. Twenty six of the ninety-three storage tanks operated by these facilities are equipped with high efficiency afterburners, six are controlled by afterburners, eight are vented to an existing boiler, and five are controlled by mist eliminators. The remainder are not controlled. Seventeen of twenty-six blowing stills are equipped with high efficiency afterburners; the remaining nine are vented to a tank heater. Half of the eighteen saturators are equipped with high efficiency afterburners, while five are controlled by high efficiency air filters, one by a cyclone spray settling chamber, and one by an electrostatic precipitator. Apparently, the Agency would consider most of the alternative control mechanisms mentioned above to be equivalent to the afterburners since it only recommended that coolers be added at the high efficiency air filters and that the heater control for the blowing stills be upgraded. For those storage tanks uncontrolled, the Agency recommended that mist eliminators be installed (Ex. 13, Table III).

The emission factors used and the estimated amounts of

uncontrolled emissions were the subject of considerable disagreement. In developing its estimates the Agency used the emission factors for saturators/coaters contained in AP-42, Supplement No. 8, published in 1978 (Ex. 25; R. 265, 824), and factors from the new source performance standard environmental impact statement for storage tanks (Ex. 25 R. 859). It is not clear what the factors for the blowing stills were based on. At hearing, industry argued that in so doing the Agency incorrectly assumed the emission factor for saturators to include or to be applicable to coaters, while it admitted coaters cause substantially less emissions than the saturation process (R. 815, 824). Furthermore, it was discovered that the emission factors for saturators in Supplement No. 8 had been revised with the publication of AP-42, Supplement No. 12 in 1981, based on testing performed to develop the new source performance standard for this industrial category (R. 867 - 868). Nevertheless, the Agency advised against using the revised version for several reasons. It alleged that in compiling the revision, a portion of the available stack tests relied on in Supplement No. 8 were eliminated, and that Supplement No. 8 data was more conservative overall (R. 1283). The Agency suggested that the Board use an average emission factor for saturators developed from the tests done for both Supplements and from its own permit information (R. 1283; Ex. 34, Tables IV and V). The emission factor for saturators in Supplement No. 8 was 0.48 pounds per ton of saturated felt, i.e. product. In Supplement No. 12 it was 0.10 lbs/ton of product for dip saturators and 0.25 lbs/ ton of product for spray/dip saturators. The average developed and advocated by the Agency was 0.30 lbs/ton of product (Exs. 25; 34, Table V).

Industry, of course, advocated the use of the revised emission factors contained in Supplement No. 12. Their argument is based in part on the fact that these factors distinguish between dip and spray saturators. Industry not only disagreed with the emission factors contained in Agency's initial use of Supplement No. 8's, but also with the application. The Agency assumed that the saturator's emission factors pertained to total shingle weight rates, whereas industry argued that these factors pertain to saturated felt throughput rates. The difference between the two applications at one facility's line was a factor of three (R. 1831-1832, Ex. 44). Ironically, the emission factors for dip saturators published in Supplement No. 12 were designed to pertain to total shingle production throughput weight rates. Finally, one dip saturation line was actually tested by the USEPA. The test results were one-sixteenth of that estimated by the Agency (R. 1833, Ex. 44).

In addition to disagreeing with the emission factors the total emission amounts were the subject of a two pronged dispute. Some testimony indicated that much of the industry is switching to fiberglass substrate. This eliminates the saturation step, yet no credit was given in calculating total emissions. (R. 1082, 1776, 1834). For those that are not committed to converting

to fiberglass products, it was argued that annual emissions were less than those calculated by the Agency. The Agency's figures were based on the total hours a line is in operation, whereas the industry would prefer it to be broken down into hours of operation for the various types of sources or on a "per blow" basis. (R. 1775-1777).

According to the Agency's own testimony, testing done for Supplement No. 8 did not distinguish between spray and dip saturators (R. 1281), and did not include test results the Agency used from a 1974 publication (Ex. 25; R. 122). On the other hand, it is noted that the results from only one test were available for spray-dip saturators and only one outlying value was provided for the three plants using dip saturators, according to the background data for Supplement No. 12. Although this undermines the reliability of Supplement No. 12, it is the more recent emission factors contained therein that new sources in Illinois are subject to under federal and Board regulations. Given the uncertainty of the emission factors in either Supplement, which incidentally were developed from tests for particulates, and the fact that new sources are judged against Supplement No. 12, the Board is persuaded to accept the revised factors contained in Supplement No. 12. As a result, the emission amounts, at least for saturators, are significantly less than originally estimated by the Agency (Ex. 13, Table 3; Ex. 42; Ex. 44).

A second controversy focused on the type of control devices advocated by the Agency. It was suggested that uncontrolled storage tanks be equipped with mist eliminators. (Ex. 13, Table III). However, according to the new source performance standard background document, this type of equipment is intended to control particulates and one of its disadvantages is the inability to control gases (R. 887, Ex. 25, pp. 4-14-4-17). In order to collect gaseous emissions the mist eliminators would have to operate at temperatures lower than those for which they are designed for currently and at which they are operated (R. 886). Likewise, the other equipment, such as the high energy absorptive filter systems operated at several facilities, cannot capture gaseous volatile organic material unless the exhaust stream is cooled to 120° F from the operating temperature of approximately 450° F. (Ex. 25, pp. 4 - 8). As already mentioned, the Agency testified that the necessary cooling could be achieved through direct or indirect heat transfer systems (R. 893). One industry witness, who had visited twenty-five facilities, testified to knowing of no roofing manufacturers with capacity to cool in connection with high energy absorptive filtration units. (R. 1086).

One facility in Illinois did experiment with water cooling in connection with its high energy absorptive filters. Problems developed because the ductwork was not designed to be watertight, so oil and water in the ductwork leaked onto the facility's

floor. Also, water ran backwards to the fan housing, unbalancing the fan, which in turn damaged the bearings and overheated the motor. Another problem was that the oil collected at the demister was contaminated with water. It, therefore, could not be used as a fuel and had to be disposed of as a hazardous waste. Finally, some of the spray condensed after the demister, resulting in droplets of water containing oil being exhausted to the atmosphere. For these reasons, industry argued, correctly it seems, that direct cooling has been tried and proven to be an inoperable addition to this type of existing control mechanism (R. 1078 - 1080). As for afterburners, testimony indicated that these are the least desirable type of control, although the only type to control gaseous emissions. If combustion is not complete, the volatile organic materials not destroyed and other partially burned fuel components are likely to be exhausted as well. Also, fuel and maintenance costs are extremely high. Industry favored the other add-on controls which are not designed to control gaseous emissions (R. 1770-1781).

A third area of dispute between the Agency and industry revolved around appropriate testing protocol. Industry asserted that the testing methods developed for the new source performance standard were specifically designed for measuring particulate emissions, and that reliable measurement methods for gaseous emissions are still being developed (R. 1134). Since the rule proposed a control efficiency, specifically 90 percent at the afterburners, industry assumed that field testing would involve inlet and outlet testing. First, the location of the probes along the ductwork was debated, with the Agency ultimately allowing that ductwork could be considered part of the pollution control equipment (R. 1777). The Agency suggested that location of the inlet testing probes would be done on a case by case basis in accordance with its stack testing manual. Unfortunately, that manual did not contain information about inlet testing (P.C. 8, R. 1307). More importantly, the reliability of such testing was demonstrated to be questionable. Using emission factors from the new source performance standard, one company found that non-methane hydrocarbon emissions from its saturator would range between 0.1 and 1.0 pounds per hour. It argued that variations or even minor errors in testing could easily evidence noncompliance when attempting to demonstrate 90 percent control efficiency at such a low range (R. 1134 - 1135).

As indicated in the Agency's permit files, much of the equipment at asphalt roofing manufacturers is already controlled by afterburners, mist eliminators, and high energy absorptive filters. Presumably, these controls were installed to control particulate emissions and odors. The proposed rule was intended to control gaseous volatile organic emissions. Yet the technology suggested to do the same was discredited. Quantifying and testing for gaseous emissions was disputed and demonstrated to be more appropriately geared to measuring particulates. Accepting

the emission factors developed federally for the new source performance standards for this industry, the emission amounts at issue are significantly below the one hundred ton per year exemption for some, if not all of these facilities (Ex. 32; 42). Finally, the new source performance standards do not require new or reconstructed facilities to install control for gaseous hydrocarbon emissions because neither the equipment to do the same could be identified, nor could the gaseous emissions be isolated from the particulate emissions (47 FR 34137; August 6, 1982). For these reasons, as discussed at length above, no new regulations to control volatile organic emissions from existing asphalt roofing facilities will be adopted. If, in addition to the rules now contained in Part 212 further control of the associated particulate emissions is advisable, or revision of the storage container rules be deemed necessary, a separate rulemaking would be an appropriate vehicle.

Petroleum Dry Cleaners

The rules which were proposed for First Notice at Subpart Z of Part 215 for this industrial category were modeled after the CTG finalized by the USEPA in September of 1982. The proposed rules would have required dry cleaners using petroleum based cleaning solvents to have observed certain housekeeping practices, to have provided a dryer exhaust system with a capture and control efficiency of 81%, and to have begun still boildown of the distillation unit only after the flow rate of the condensed liquid between the condenser and moisture separator had been reduced by at least 75 percent and then to continue still boildown. As such, had this series of rules been adopted and submitted as part of the Illinois SIP, it would have satisfactorily met the requirements of the Clean Air Act and the regulations adopted thereunder. Nevertheless, deleting this series at Second Notice (Board Order of May 3, 1984) does not jeopardize federal approval of the SIP.

Review of the record revealed that only two petroleum dry cleaners are currently known to exist in the state, and that the rules, as proposed at First Notice, were not applicable to either of them. One of the two sources is located in a nonattainment area. The proposed rules did not apply to it because its allowable annual emissions are less than half of the one hundred ton annual exemption established by the CTG and subsequently proposed by the Board at First Notice. The second dry cleaner which would have been possibly effected by the rules is located in an attainment area. Therefore, imposition of the CTG rules, or comparable, is not required under the Clean Air Act. Yet, as proposed, the rules would have required this source to comply by the end of 1987, since it is located in a county designated attainment, and not contiguous to a nonattainment area. This compliance scheme was proposed in conformance with that established in RACT II, R 80-5. However, the proposed rules, as written, were not applicable

to the equipment used by this company, and, therefore, do not represent reasonably available control technologies for its sources.

This company, located in Champaign, uses petroleum based solvents to dry clean collegiate caps and gowns. To process the caps it uses box dryers. The CTG rules and, thus, the First Notice proposal, assumed that tumble dryers were the equipment to be regulated. To comply, the company testified that it would have to change from box dryers of 400 pound capacity to tumble dryers with 100 pounds capacity at a cost of \$279,000. In addition to the cost the company testified that it did not have sufficient space to accomodate such a conversion. The Board notes that such a switch would probably make the equipment subject to the new source review permitting program, thereby rendering these rules, if adopted, obsolete. The company also argued that the house-keeping rules were inapplicable because they were premised in part on the use of cartridge filters. This company uses powder filters which, incidentally, are pre-dried to minimize emissions. Again, due to space problems, the company testified that it could not convert to cartridge filters (R. 1062).

The Agency estimated the uncontrolled annual emissions from this company to be 193 tons per year; the company estimated its emissions to be 170 tons per year (T/yr). Given the control efficiency anticipated under the proposed rule, the Agency predicted emission would be reduced by 139 T/yr; the company, 122 T/yr. Even if the proposed rules were adopted, these reductions would not be fully achieved since the company has adequately demonstrated that the rules do not apply to their types of equipment.

To conclude, since the rules are not applicable to either company, adoption would neither expedite achievement of the air quality standard nor serve to protect public health. It is also not necessary to adopt an exemption from the Board's general rule at Section 215.301. There is no evidence in the record that the emissions at either source exceed the eight pound per hour limit that rule establishes, or that either cannot comply with that rule as it was adopted in 1972.

CONCLUSION

Five industry specific regulations are adopted. The first series pertains to wood surface coating operations at five facilities identified in Illinois. It is estimated that combined they contribute 2,900 tons per year of volatile organic material emissions. Compliance with the rules will require that the existing application processes be improved which will reduce emissions to 1,635 tons per year. The second series affects thirteen vegetable oil processing facilities. In order to comply with the mass balance limitations established for corn and soybean

processing, these facilities will probably have to install or upgrade mineral oil scrubbers and/or condensers and desolventizer-toasters. Based on historical hexane consumption, these facilities contribute an estimated 11,000 tons per year of hydrocarbons, as opposed to the 25,000 tons per year estimated originally under the Generic Rule. This correction notwithstanding, the annual reductions under the adopted rule are anticipated to be greater than had the Generic Rule been adopted, and to be achieved at lower cost and administrative burden. The affected facilities have already improved or installed the necessary control equipment, or are willing to do so because of the high cost of hexane.

The regulations adopted pertaining to the heatset web offset printers and the synthetic organic chemical and polymer manufacturers are extensively rewritten from the rules originally proposed. Therefore, it is difficult to calculate annual emissions, estimated reductions, and costs for either category. Nevertheless, the rules, as rewritten, only require that the affected facilities control volatile organic materials by procedures reasonably available. The last series of regulations affects three coke-by-product recovery plants, all in nonattainment areas. In addition to instituting a visual leak inspection and repair program, they are required to control emissions from four types of sources. It is estimated that these uncontrolled four sources at all the facilities contribute 2,575 tons per year. Compliance with the rules should reduce emissions to 386 tons per year at an estimated cost of \$648 per ton.

This being the third in a series of regulations adopted to control volatile organic materials from existing stationary sources, it stands to reason that the number of facilities, and, therefore, the amount of uncontrolled emissions, is less than those considered in RACT I and RACT II. Although the estimated uncontrolled emissions are sometimes undeterminable, and other times are not comparable to those estimated in the RACT I and RACT II proceedings, the estimated reductions and costs are comparable. Therefore, the burden to the affected industries is no greater than that imposed in the industrial categories regulated in those proceedings.

IT IS SO ORDERED.

Messrs. Dumelle and Nega dissented.

I, Dorothy M. Gunn, Clerk of the Illinois Pollution Control Board, hereby certify that the above Opinion and Order was adopted on the 22nd day of August, 1984, by a vote of 4-2.


Dorothy M. Gunn, Clerk
Illinois Pollution Control Board