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Planning and Standards
Research Triangle Park NC 27711

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June 1982

Air

EPA

# VOC Fugitive Emissions in Synthetic Organic Chemicals Manufacturing Industry—

# Background Information for Promulgated Standards

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16. ABSTRACT

Standards of performance to control equipment leaks of VOC from new modified, and reconstructed Synthetic Organic Chemical Manufacturing Industry (SOCMI) plants are being promulgated under the Authority of Section 111 of the Clean Air Act. These standards apply only to equipment in process units producing one or more SOCMI chemicals and for which construction or modification began on or after the date of proposal of the standards. This document contains a summary of public comments, EPA responses, and a discussion of differences between the proposed and promulgated standards of performance.

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# VOC Fugitive Emissions in Synthetic Organic Chemicals Manufacturing Industry— Background Information for Promulgated Standards

Emission Standards and Engineering Division

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

June 1982

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ENVIRONMENTAL PROTECTION AGENCY

Background Information
Final Environmental Impact Statement for
Equipment Leaks of VOC in the Synthetic Organic
Chemical Manufacturing Industry

Prepared by:

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1. The promulgated standards of performance will limit emissions of volatile organic compounds (VOC) from new modified, and reconstructed synthetic organic chemical manufacturing industry (SOCMI) process units. Section 111 of the Clean Air Act (42 U.S.C. 7411) as amended, directs the Administrator to establish standards of performance for any category of new stationary source of air pollution that ". . . causes or contributes significantly to air pollution which may reasonably be anticipated to endanger public health or welfare."

2. Copies of this document have been sent to the following Federal Departments: Labor, Health and Human Services, Defense, Transportation, Agriculture, Commerce, Interior, and Energy; the National Science Foundation; the Council on Environmental Quality; members of the State and Territorial Air Pollution Control Officials; EPA Regional Administrators; and other interested parties.

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# 1. SUMMARY

On January 5, 1981, the Environmental Protection Agency (EPA) proposed standards of performance for fugitive emission sources in the Synthetic Organic Chemical Manufacturing Industry (46 FR 1136) under the authority of Section 111 of the Clean Air Act. Public comments were requested on the proposal in the Federal Register. There were 52 commenters. Most of the commenters were industry representatives. Also commenting were representatives of state and local air pollution agencies, vendors of equipment used to control fugitive emissions, and a representative of an environmental group. The comments that were submitted, along with responses to these comments, are summarized in this document and in the Additional Information Document (AID) published on April 26, 1982. The AID contains a technical discussion of methodologies and estimates of emissions, emission reductions, and costs. Comments on the AID and EPA's responses to those comments are presented in Appendix A. This summary of comments and responses and the AID serve as the basis for the revisions made to the standards between proposal and promulgation.

## 1.1 SUMMARY OF CHANGES SINCE PROPOSAL

The proposed standards were revised as a result of review of public comments. Significant changes were made in the following areas:

- Alternative standards for valves
- Standards for pumps
- Requirements for inaccessible valves
- Requirements for existing reciprocating equipment
- Standards for control devices
- Delay of repair provisions
- Reporting requirements
- Requirements for equipment "in vacuum service"
- Definition of "in VOC service"

- Requirements for units with no equipment in VOC service
- Exemption of beverage alcohol producers
- Calibrantion gas requirements
- Equivalency provisions
- Production rate cutoff
- Definition of "no detectable emissions"

1.1.1 Alternative Standards for Valves

At proposal, two alternative standards were provided for valves in gas/vapor and light liquid service. Both of these alternatives called for one year of monthly monitoring to obtain data on which to base the alternative standard. The first alternative standard was based on an allowable percentage of valves leaking. Since an industry-wide allowable leak percentage was not possible due to variability of leak frequency among process units, an allowable percentage of valves leaking was to be determined for that unit based on data collected on that unit. The allowable percentage was to be the sum of the monthly baseline percentage and the monthly incremental percentage. A minimum of one performance test was required annually. The second alternative standard for valves allowed the development of work practices that would achieve the same result as the proposed leak detection and repair program. This alternative would allow a unit to vary the monitoring interval and to use valves with a low probability of leaking in order to achieve an overall goal of emission reductions.

Based on comments received on the proposed alternative standards and on analysis of the results from SOCMI screening and maintenance studies, the alternative standards for valves were reexamined. As a result, these standards were clarified in their intent and refined to reflect the information gathered on SOCMI units.

The first alternative standard was simplified to a 2 percent limitation as the maximum percent of valves leaking within a process unit, determined by a minimum of one performance test annually. This alternative will provide a cutoff for valves to eliminate unreasonable costs. It will also provide an incentive to maintain a good performance level and promote low-leak unit design as was indicated by one commenter. Inaccessible valves that would not be monitored on a routine basis under §60.482-7 would be included in the annual test since an annual test of these valves is not considered burdensome. The standard could be met by implementing any type of leak detection and repair program and engineering controls chosen at the discretion of the owner or operator. This alternative standard would allow an affected facility to comply with an allowable percentage of valves leaking without having to determine a specific performance level by a year-long monthly monitoring program. If the results of a performance test show a percentage of valves leaking higher than 2 percent, however, the process unit would not be in compliance with the alternative standard. Finally, if an owner or operator determines that he no longer wishes to comply with this alternative standard, he can submit a notification in writing to the Administrator stating that he will comply with the work practice standard in §60.482-7.

EPA also recognized benefits which may be derived from statistically-based skip-period leak detection and repair programs. Under the skip-period leak detection provisions in the final standards, an owner or operator could skip from routine monitoring (monthly) to less frequent monitoring after completing a number of successful sequential monitoring intervals.

Considering a performance level of less than 2 percent leaking and better than 90 percent certainty that all periods have this performance level, the two following sets of consecutive periods and fractions of periods skipped were determined for SOCMI units:

(1) two consecutive quarterly periods achieved to skip to semi-annual monitoring, and

(2) five consecutive quarterly periods achieved to skip to annual monitoring.

This alternative also requires that, if an owner or operator does not meet the required statistical level of performance, he/she must revert to the monthly leak detection and repair program that is specified in §60.482-7. Compliance with this alternative work practice standard would be determined by inspection and review of records.

### 1.1.2 Standards for Pumps

Since proposal, EPA has analyzed the annualized cost of controlling VOC emissions and the resultant VOC reduction for each alternative control technique. The resultant cost effectiveness ratios were used as the basis for the selection of the final standards. (Section 3.1)

For pumps the control costs incurred for each megagram of VOC emissions reduced and emission reductions achieved were determined for two leak detection and repair programs and for the use of dual mechanical seals with controlled degassing vents. Both leak detection and repair programs incur lower costs than the costs which would be incurred with equipment installation. The lowest average and incremental costs per Mg are associated with a monthly leak detection and repair program. The monthly program achieves a higher degree of control than the quarterly program, but it achieves a lower degree of control than installation of control equipment. Even though control equipment provides for the greatest amount of VOC reduction, the costs to obtain this reduction are high. Because the incremental costs for equipment are unreasonably high in light of the resulting incremental emission reductions, monthly leak detection and repair was selected as the basis for the standard for pumps.

The leak detection and repair program requires monthly leak detection of pumps in light liquid VOC service. Leak detection is to be performed with a portable VOC analyzer according to Reference Method 21. If a reading of 10,000 ppmv or greater is obtained, a leak is detected. Initial repair of the leak must be attempted within 5 days and the repair must be completed within 15 days. Delay of repair in order to equip a leaking pump with dual seal systems (required by the standards) is allowed for a period of 6 months. Delay of repair also would be allowed for pumps that could not be repaired without a process unit shutdown. Delay of repair is not expected to be needed for most situations, however, because pumps are commonly spared in SOCMI.

The equipment standards also have been incorporated into the final standards, since they are equivalent to the monthly leak detection and repair program that is the basis of the standards for pumps in light liquid service. An owner or operator may comply with the equipment standards (which have not been changed since proposal) if he or she prefers.

1.1.3 Requirements for Inaccessible Valves

Some valves are difficult to monitor because access to the valve is restricted. Difficult to monitor valves can be eliminated in new process units but can not be eliminated in existing process units. In new units, all valves will be subject to the proposed leak detection and repair program. However, for process units that become affected by a modification or reconstruction, the standards have been changed since proposal to allow an annual leak detection and repair program for valves which are difficult to monitor. Valves which are difficult to monitor are defined as valves which would require elevating the monitoring personnel more than two meters above any permanent available support surface. The intent of this definition is that ladders should be used to elevate monitoring personnel under safe conditions. However, valves that cannot be safely monitored by, at least, the use of ladders are classified as difficult to monitor, and, therefore, they may be monitored annually rather than monthly.

In addition, some valves are unsafe to monitor. Valves which are unsafe to monitor cannot be eliminated in new or existing units. The final standards have been changed to allow an owner or operator to submit a plan that defines a leak detection and repair program conforming with the routine monitoring requirements of the standards as much as possible given that monitoring should not occur under unsafe conditions. Valves which are unsafe to monitor are defined as those valves which could, based on the judgment of the owner or operator, expose monitoring personnel to imminent hazards from temperature, pressure, or explosive process conditions.

1.1.4 Requirements for Existing Reciprocating Equipment

Even though reciprocating pumps and compressors are not common in SOCMI, they do exist in some SOCMI units and may even be necessary in some applications. In the proposed standards a provision was made that required reciprocating pump and compressors to enclose the seal area and vent any emissions to a suitable control system. This provision remains in the final standards. Based on a review of public comments, EPA has concluded that this option is feasible for reciprocating pumps, as well as for most reciprocating compressors.

However, there may be potential problems associated with retrofitting a seal vent system to some existing reciprocating compressors. On older compressors, the distance piece between the cylinder and driver may not be enclosed and vented. In such cases, retrofitting a vent system to the compressor in order to comply with the standards could require recasting of the distance piece or even replacement of the compressor. The cost of doing recasting or replacement was determined to be unreasonable. Therefore, in the final regulation EPA has provided an exemption for reciprocating compressors within facilities which have become affected by virtue of modification and reconstruction. The exemption applies only to those specific instances where the distance piece or the compressor must be replaced. Such compressors will be exempt from the standards until they are replaced by new compressors or the distance pieces are replaced.

### 1.1.5 Standards for Control Devices

1.1.5.1 Flares. At proposal, flares were not specifically listed as an acceptable control option for the reduction of fugitive VOC emissions. The results of available flare efficiency studies were not considered relevant. The gas streams tested were not considered representative of the streams to be controlled in SOCMI. In some cases the flare design was not representative of flares in the industry. In others the analytical method was questionable. No method for measuring flare efficiency (evaluating flare performance) was available. Theoretical calculations indicated that flare efficiency could be as low as 60 percent for destruction of VOC in low-flow intermittent streams sent to a large flare. This efficiency was cited in several background documents (Ethylbenzene/Styrene, Benzene Fugitive, SOCMI Fugitive VOC) and served as a primary consideration in not specifically allowing the use of flares.

Since proposal, the use of flares was reconsidered for the SOCMI standards. Further actual flare measurement results have become available, most notably from the CMA-EPA study (IV-A-32)*, since the 60 percent

*References to Docket Entry Numbers for Docket No. A-79-32 are presented in this manner throughout this document.

theoretical estimate was made. In the CMA-EPA study, steam-assisted flares, air-assisted flares, and flares operated without assist were investigated over a wide range of exit velocity, gas composition, and flare gas heat content conditions. After review of available flare efficiency data (see Section 4.1), EPA has concluded that smokeless flares operated with a flame present and exit velocities less than 18 m/sec (60 ft/sec) with flare gas heat contents greater than 11.2 MJ/scm (300 Btu/scf) for steam-assisted flares or exit velocities less than 18 m/sec (60 ft/sec) and flare gas heat contents greater than 7.45 MJ/scm (200 Btu/scf) for flares operated without assist are acceptable alternatives to enclosed combustion devices (incinerators, boilers, process heaters) and vapor recovery systems such as carbon adsorbers and condensation units. Air-assisted flares operated smokelessly with a flame present are also permitted if the heat content of the flared gas is above 11.2 MJ/scm (300 Btu/scf) and the exit velocity meets maximum velocity criterion which is dependent upon the heat content of the gas. They may be applied to control of emissions from pump seals (or degassing reservoirs), compressor seals (or degassing reservoirs), and pressure relief devices. The requirement for the presence of a flame can be ensured by monitoring the flare's pilot light with an appropriate heat sensor, such as a thermocouple. To ensure smokeless operation, visible emissions from a flare would be limited to less than 5 minutes in any 2-hour period.

1.1.5.2 Combustion Device. The temperature and residence time specified for combustion devices in the proposed regulation were based on data analyzed in an EPA memo ("Thermal Incinerators and Flares") dated August 22, 1980 (II-B-31). The data base contained in this memo included Union Carbide laboratory studies, EPA and industry field tests, and 147 tests on existing incinerators in Los Angeles county. These data indicate that greater than 98 percent efficiency is attainable by incinerators operating at 1500°F (816°C) and 0.75 seconds residence time. The memo concludes that 98 percent efficiency, or less than 20 ppmv in the exhaust stream, is achievable in many situations at less than 1600°F (871°C) and 0.75 seconds residence time. Furthermore, the data indicate that greater than 93 percent efficiency is achievable in many situations at 1400°F (760°C) with 0.75 seconds residence time.

While thermal incinerators are proven control devices for destruction of VOC emissions, they are not the only enclosed combustion devices that could be used to achieve 95 percent destruction efficiency. In fact, boilers and process heaters already existing on-site are expected to be used for eliminating the small VOC streams covered by the standards. In order to ensure that these combustion systems achieve the requisite degree of control, the temperature-residence time requirements for enclosed combustion devices have been retained in the final regulation. By meeting the requirements of 1500°F (816°C) and 0.75 seconds residence time, an owner or operator will ensure that his combustion device attains the required 95 percent efficiency.

However, other combustion systems, such as catalytic incinerators, are also applicable to the control of small VOC streams. Systems which employ catalysts typically operate at lower temperatures and would not be able to meet these operating requirements. Therefore, the temperature-residence time requirements will not apply to combustion systems which employ catalysts. Such systems will have to meet a design requirement which assures a destruction efficiency of 95 percent. This change will permit the use of catalytic combustion units for control of fugitive VOC emissions without an equivalency determination.

1.1.6 <u>Delay of Repair Provisions</u>

EPA recognizes that, in a few cases, repair of leaking sources may need to be delayed for technical reasons. Based on comments concerning the proposed delay of repair provisions, the delay of repair provisions have been expanded in the final standards. Five provisions for delay of repair are included in the final standards. The first provision allows delay of repair where repair is technically or physically infeasible without a process unit shutdown (complete or partial). An example of such a situation would be a leaking valve that could not be isolated from the process stream and requires complete replacement or replacement of internal parts. When a valve cannot be physically isolated from the process stream, the process unit must be shutdown to effect certain repairs on the valve. Thus, because EPA believes shutdown to effect repair of valves is unreasonable, EPA allows delay of repair when repair is infeasible without a process unit shutdown.

The second provision allows for delay beyond a process unit shutdown in limited instances due to the lack of spare valve assemblies. The delay will be allowed if valve assembly replacement is necessary, valve assembly supplies are depleted, and valve assembly supplies were sufficiently stocked before they are depleted.

A third provision has been added to avoid causing unreasonable delays in returning a process unit to production if a unit goes down briefly due to unforeseen circumstances. Delay of repair beyond an unscheduled process unit shutdown will be allowed if the shutdown is less than 24 hours in duration. This provision allows for delay of repairs until the next shutdown if an unscheduled shutdown is too short to allow repair or replacement of equipment which cannot be repaired on-line. However, repair of the leaking equipment would be required at the next process unit shutdown.

A fourth provision also has been added to clarify the applicability of the standards to sources that are out of service (usually spare equipment). Delay of repair of spare fugitive emission sources for which leaks have been detected will be allowed for sources which are isolated from the process and which do not remain in VOC service. This provision is applicable only to those pieces of equipment that have been isolated from VOC service and properly purged. Delay of repair will not be allowed for spare equipment that is pressurized and prepared to be placed on-line; such equipment is considered to be in (VOC) service.

In addition, a fifth provision has been added to allow delay of repair for certain leaking pumps. Sometimes, leaking pumps cannot be repaired under the leak detection and repair program unless the owner or operator installs dual seals with barrier fluid systems. For these leaking pumps, a delay of repair for a period of six months will be allowed to install the required equipment.

### 1.1.7 Reporting Requirements

The proposed standards included reporting provisions requiring periodic reports of leak detection and repair efforts within a process unit. The reported information was regarded by EPA as a good way to judge how diligently the required leak detection and repair program had been implemented. The reporting requirements were considered a means of reducing in-plant inspections. The costs of reporting were assessed and judged reasonable.

EPA continues to believe that reporting requirements would reduce in-plant inspections as a means of determining compliance. But the quarterly reporting requirements have been reduced to semiannual requirements in the final standards. The semiannual reports will consist of data recorded on leak detection and repair of valves, pumps, and other equipment. The semiannual reporting requirements may be waived for process units in States where the program has been delegated for enforcement, if EPA, in the course of delegation, approves reporting requirements or an alternative means of compliance surveillance adopted by the State and if the process unit complies with the requirements established by the State. EPA maintains the authority for discretionary use of Section 114 of the Clean Air Act to obtain records and make in-plant inspections. One-time reporting requirements, such as the notification requirements in the General Provisions, have also been retained in the final standards.

### 1.1.8 Requirements for Equipment "in Vacuum Service"

The proposed regulation defined a source to be in vacuum service if it is operating at an internal pressure which is continuously less than 100 kPa. It should be noted that 1 atmosphere equals about 100 kPa. Fugitive emission sources may operate at a pressure below 100 kPa. It would be inappropriate, in EPA's judgement, to cover such sources because sources operating even at a slight vacuum would have little if any potential to emit VOC. There was some confusion over the 100 kPa definition because it is so near atmospheric pressure. Therefore, to avoid any further misunderstanding about the standard, the definition for vacuum service has been changed as follows:

"In vacuum service" means that equipment is operating with an internal pressure which is at least 5 kPa below ambient pressure.

1.1.9 Definition of "in VOC Service"

EPA proposed a 10 percent VOC cutoff to avoid covering those sources that have only small amounts of ozone forming substances in the line. An additional provision has been added to clarify EPA's intent that streams fluctuating above and below 10 percent VOC will be covered by the standards.

VOC is defined as any reactive organic compound. Organic compounds are considered to participate in atmospheric photochemical reactions unless thay are specifically designated by the Administrator as not participating in atmospheric photochemical reactions. The following compounds are considered non-photochemically reactive by EPA:

- methane
- ethane
- 1,1,1-trichloroethane
- methylene chloride
- trichlorofluoromethane
- dichlorodifluoromethane
- trifluoromethane
- trichlorotrifluoroethane
- dichlorotetrafluoroethane
- chloropentafluoroethane

Quantities of these compounds present in the line may be excluded from the total quantities of organic materials present in determining whether the piece of equipment is covered by the standards.

1.1.10 Requirements for Units With No Equipment in VOC Service

EPA believes it appropriate to grant an exemption to any SOCMI unit which does not process VOC. A few SOCMI process units may produce their products without the use of VOC; however, these units are expected to be the exception rather than the rule. SOCMI units which do not process VOC would not have any potential to emit VOC. Therefore, a provision has been added to the final standards which exempts an owner or operator of a facility producing a chemical listed in 40 CFR 60.489 from the standards if that facility processes no VOC. SOCMI units which cease processing of VOC would be able to show when VOC processing ceased by maintaining records of processing operations.

### 1.1.11 Exemption of Beverage Alcohol Producers

During the public comment period, beverage alcohol producers said that they should be exempt from coverage by the standards because beer and whiskey producers were exempted from the priority list. EPA concluded that process units within beer and whiskey plants that are producing fermented beverages solely for purposes of human consumption should be exempt from the standards. However, any process units (e.g., a distillation train to produce industrial grade alcohols from fermentation products) in beer and whiskey plants that are used to manufacture nonbeverage fermented products are subject to the standards. Therefore, a specific exemption has been included in the final regulation for beverage alcohol producers.

### 1.1.12 Calibration Gas Requirements

There are two candidate calibration gases for the use of Reference Method 21 in screening fugitive emission sources in SOCMI: hexane and methane. Prior to proposal, hexane was specified as the calibrant for the draft of Reference Method 21. At proposal, the calibration gas was changed to methane because methane is more readily available in the required concentration range and because SOCMI test data were gathered using methane as a calibrant. The change was made in response to public comments on the draft regulatory package.

During the public comment period for the proposed standards, other public commenters objected to the change from hexane, saying the change would mean that more leaks were detected. They also noted that the change eliminated the feasibility of using photoionization monitors that would be allowed by Reference Method 21.

EPA has considered the differences in the results which would be obtained with the two calibrants and has found the differences insignificant. The differences are in the same range as the variability seen in repeated emission measurements from the same source. Data collected using hexane and methane can be used interchangeably within ±30 percent at the action level. Therefore, because the differences are insignificant in terms of the long-term number of leaks detected and because the allowance of hexane as a calibration gas will provide for the use of photoionization monitors, EPA has changed the leak detection requirements to allow hexane as an alternate calibration material. Methane may still be used where it is the appropriate calibrant. In addition, EPA will likely use methane as the calibrant for determining compliance with the alternative standards for valves and for other such determinations.

1.1.13 Equivalency Provisions

The final standards have been changed to allow a vendor or manufacturer to apply for equivalency for control systems or equipment (see Section 111(h)(3) of the Clean Air Act). This change was made to increase efficiency in the equivalency process and to provide SOCMI owners and operators the incentive to purchase improved control systems and equipment as they are developed. Even though the provision allowing vendors and manufacturers to apply for equivalency have been added, it should be remembered that equivalency determinations, where the effectiveness of the alternative means of emission reduction depends on the owner or operator, not the vendor or manufacturer, must be submitted by the plant owner or operator.

1.1.14 Production Rate Cutoff

Because the costs of the standards for process units with low production rates are exorbitantly high in comparison to the emissions reduction achievable, EPA provided an exemption for low production rate units. Facilities with production rates of 1,000 Mg/yr or less are exempt from the standards. It is expected that, even though this cutoff will exempt most R&D facilities, facilities producing on a semi-commercial or commercial scale would still be covered.

1.1.15 Definition of "No Detectable Emissions"

The screening level associated with a "no detectable emissions" determination using the instrument testing techniques described in Reference Method 21 has been revised to 500 ppmv in the final standards. The standards for various fugitive emission sources, including no-leak equipment and pressure relief devices, require maintaining a condition of "no detectable emissions." At proposal, the level associated with this condition was set at 200 ppmv, based on considerations of the calibration procedures and instrument reading variability at low screening levels. While no comments were received on the "no detectable emissions" level, several comments were received on the instrument and calibration gas (see Chapter 12). The reference method was subsequently revised to allow other instruments and calibration gases to be used. With these changes in the reference method, EPA provided additional latitude in its definition of "no detectable emissions." Using five percent of the leak definition (which is 10,000 ppmv) as an allowance for calibration procedures and instrument variability, the definition of "no detectable emissions" for the final standards became a VOC concentration indicated by a screening value of less than 500 ppmv above background concentration at the leak interface.

## 1.2 SUMMARY OF IMPACTS OF PROMULGATED ACTION

### 1.2.1 Alternatives to Promulgated Action

The regulatory alternatives are discussed in Chapter 6 of the Background Information Document for the proposed standards. These regulatory alternatives reflect the different levels of emission control. They were used to help in selection of the best demonstrated technology, considering costs, nonair quality health, and environmental and economic impacts for fugitive emission sources in the synthetic organic chemical manufacturing industry. These alternatives remain the same.

### 1.2.2 Environmental Impacts of Promulgated Action

Environmental impacts of the proposed standards are described in 46 FR 1136. Most of the changes in the standards (described above) will have no effect on the environmental impacts ascribed to the standards. However, the change in the standards for pumps will reduce the overall emission reductions and costs of the standards. In addition, EPA has revised the estimate of emissions of VOC to the atmosphere which will be reduced by the standards. The revisions were made as a consequence of revising methods of analysis and numerical estimates as described in the Additional Information Document (AID).

The standards will reduce fugitive emissions of VOC from process units constructed, modified, or reconstructed between 1981 and 1985 from about 83,000 Mg/yr to about 37,000 Mg/yr. This reduction represents about a 55 percent decrease in emissions from the current industry baseline level of emissions. The water quality and solid waste impacts are the same as those presented in the Background Information Document (BID) for Proposed Standards (III-B-1).

Based on the estimates of emissions, emission reductions, and costs of controlling fugitive VOC emissions presented in the AID, the analysis of the environmental impact in the fifth year after promulgation presented in the proposal BID (III-B-1) was revised. With these revisions noted, the environmental impact analysis now becomes the final Environmental Impact Statement for the promulgated standards.

1.2.3 Energy and Economic Impacts of Promulgated Action

Section 7.4 of the BID (III-B-1) describes the energy impacts of the standards. The changes made in the standards have no effect on these impacts. Chapters 8 and 9 of the BID (III-B-1) describe the cost and economic impacts of the proposed standards. In general, there has been little change to the cost and economic impacts of the standards since proposal. With the revised cost analysis presented in the AID and the changes in the level of control required by the standards, the cost and economic impacts of the final standards are less than the impacts presented at proposal. The net annualized cost (including recovery credits) will be about $14.6 million, with a cumulative capital cost of about $44 million for the five-year period considered. These costs are not expected to result in industry-wide price increases.

1.2.4 Other Considerations

1.2.4.1 Irreversible and Irretrievable Commitment. Section 7.5.1 of the BID (III-B-1) for the proposed standards concludes that the standards will not result in any irreversible or irretrievable commitment of resources. It was also concluded that the standards should help to save resources due to the energy savings associated with the reduction in emissions. These conclusions remain unchanged since proposal.

1.2.4.2 Environmental and Energy Impacts of Delayed Standards. Tables 1-1 and 7-7 in the BID (III-B-1) for the proposed standards summarize the environmental and energy impacts associated with delaying promulgation of the standards. The revised air and energy impacts are shown in Table 1-1. The emission reductions and associated energy savings shown would be irretrievably lost at the rates shown for each of the five years.

## 1.3 SUMMARY OF PUBLIC COMMENTS

A total of 56 letters commenting on the proposed standards and the background information document for the proposed standards were received. Comments from the public hearing on the proposed standards were recorded, and a transcript of the public hearing was placed in the project docket. At the request of some of the commenters, the comment period was extended to allow them more time for review and comment. A list of commenters, their affiliations, and the EPA docket item number assigned to their correspondence is given in Table 1-2.

The comments have been categorized under the following topics:

- Need for the Standards (Section 2)
- Basis for the Standards (Section 3)
- Control Technology (Section 4)
- Applicability of Standards (Section 5)
- Environmental Impact (Section 6)
- Economics (Section 7)
- Legal (Section 8)
- Modification and Reconstruction (Section 9)
- Equivalency (Section 10)
- Recordkeeping and Reporting (Section 11)
- Test Method (Section 12)
- Enforcement and Compliance Concerns (Section 13)
- Alternative Standards (Section 14)
- Miscellaneous (Section 15)

The comments, the issues they address, and EPA's responses are discussed in the following sections of this document.

TABLE 1-1. IRRETRIEVABLE LOSSES WHICH WOULD OCCUR IF STANDARD IMPLEMENTATION WERE DELAYED

| Year | Emission Reductions Achievable Under the Standards,[a] Gg | Energy Value of Emission Reductions,[b] Terajoules | Crude Oil Equivalent of Emission Reductions,[c] Thousand Barrels |
|---|---|---|---|
| 1981 | 8 | 124 | 20 |
| 1982 | 17 | 264 | 43 |
| 1983 | 26 | 403 | 66 |
| 1984 | 36 | 558 | 91 |
| 1985 | 46 | 713 | 116 |
| 5-year Total | 133 | 2,062 | 337 |

[a]Estimated total VOC emission reduction from Model Units A, B, and C. Annual industry growth used is the same as presented in Chapter 7 of the Background Information Document.

[b]Based on 1.55 x $10^{13}$ joules/kg[21]; this may be slightly over estimated if safety/relief valves and closed vent systems are controlled by a flare system.

[c]Based on 5.8 x $10^{6}$ Btu/bbl crude oil.

TABLE 1-2. LIST OF COMMENTERS ON PROPOSED STANDARDS OF PERFORMANCE FOR FUGITIVE EMISSION SOURCES IN SOCMI

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. J.D. Martin<br>Chemical Manufacturers Association<br>c/o Union Carbide<br>Box 186<br>Port Lavaca, Texas 77979 | IV-F-1 |
| Mr. D.E. Ellison<br>Synthetic Organic Chemicals Manufacturing Assoc.<br>c/o Virginia Chemicals<br>3340 W. Norfold Road<br>Portsmouth, Virginia | IV-F-1 |
| Mr. John T. Barr<br>Air Products & Chemicals, Inc.<br>Box 538<br>Allentown, Pennsylvania 18105 | IV-F-1, IV-D-28; IV-D-43 |
| Mr. A.H. Nickolaus<br>Texas Chemical Council<br>1000 Brazos, Suite 200<br>Austin, Texas 78701 | IV-F-1, IV-D-40 |
| Mr. G. Wells<br>The Fertilizer Institute<br>1015 18th St., N.W.<br>Washington, D.C. | IV-F-1 |
| Mr. Glenn Hoffman<br>Hercofina<br>P.O. Box 327<br>Wilmington, N.C. 28402 | IV-F-1 |
| Mr. R.B. Dickson<br>SOCMA Counsel<br>Cleary, Gottlieb, Steen & Hamilton<br>1250 Connecticut Avenue, N.W.<br>Washington, D.C. 20036 | IV-F-1 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
| --- | --- |
| Mr. M.R. Keller<br>John Zink Company<br>4401 S. Peoria Street<br>Tulsa, Oklahoma 74105 | IV-F-1 |
| Mr. Joseph C. Ledvina<br>Conoco Chemicals<br>P.O. Box 2197<br>Houston, Texas 77001 | IV-F-1, IV-D-18 |
| Mr. T.A. Kittleman<br>Senior Engineer<br>E.I. DuPont de Nemours & Company<br>Wilmington, Delaware 19898 | IV-D-1 |
| Mr. Louis R. Harris<br>Marketing Manager<br>BS&B Safety Systems, Inc.<br>P.O. Box 45590<br>Tulsa, Oklahoma 74145 | IV-D-2, IV-D-33 |
| Mr. Bruce C. Grefrath, Manager<br>Environmental Affairs<br>Synthetic Organic Chemical Manufacturers Assoc.<br>1075 Central Park Avenue<br>Scarsdale, New York 10583 | IV-D-3 |
| Mr. F.L. Piguet<br>Plant Manager<br>Allied Chemical<br>Post Office Box 761<br>Hopewell, Virginia 23860 | IV-D-4 |
| Mr. J.F. Cooper<br>Vice President<br>Texaco Chemical Company<br>4800 Fournage Place<br>Bellaire, Texas 77401 | IV-D-5 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Jerry M. Schroy<br>Monsanto Company<br>800 N. Lindbergh Boulevard<br>St. Louis, Missouri 63166 | IV-D-6, IV-D-36 |
| Mr. A.G. Smith, Manager<br>Environmental Affairs<br>Shell Oil Company<br>P.O. Box 4320<br>Houston, Texas 77210 | IV-D-7 |
| Mr. David W. Carroll<br>Assistant General Counsel<br>Chemical Manufacturers Association<br>2501 M Street, N.W.<br>Washington, D.C. 20037 | IV-D-8 |
| Mr. Edwin M. Wheeler<br>President<br>The Fertilizer Institute<br>1015 18th Street, N.W.<br>Washington, D.C. 20036 | IV-D-9 |
| Mr. James F. McAvoy<br>Director<br>State of Ohio Environmental Protection Agency<br>Box 1049<br>361 E. Broad Street<br>Columbus, Ohio 43216 | IV-D-10 |
| Mr. Simon Feigenbaum<br>Air Pollution Engineer<br>Allegheny County Health Department<br>Bureau of Air Pollution Control<br>301 Thirty-ninth Street<br>Pittsburg, Pennsylvania 15201 | IV-D-11 |
| Mr. Robert E. Jones<br>Technical & Environmental Affairs<br>The Quaker Oats Company<br>Merchandise Mart Station<br>P.O. Box 3514<br>Chicago, Illinois 60654 | IV-D-12 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Richard J. Samelson, Manager<br>Environmental Programs<br>PPG Industries, Inc.<br>One Gateway Center<br>Pittsburgh, Pennsylvania 15222 | IV-D-13 |
| Mr. T.C. Owen, Corporate Director<br>Office of Environmental Affairs<br>Union Camp Corporation<br>P.O. Box 1391<br>Savannah, Georgia 31402 | IV-D-14 |
| Mr. D.P. Mykytiuk, Manager<br>Environmental, Health & Safety<br>ARCO Chemical Company<br>3801 West Chester Pike<br>Newtown Square, Pennsylvania 19073 | IV-D-15 |
| Mr. D.B. Rathbun<br>Vice President<br>American Petroleum Institute<br>2101 L Street, Northwest<br>Washington, D.C. 20037 | IV-D-16 |
| Mr. Edmund B. Frost<br>Vice President & General Counsel<br>Chemical Manufacturers Association, Inc.<br>2501 M Street, N.W.<br>Washington, D.C. 20037 | IV-D-17 |
| Mr. R.G. Dillard, President<br>Texas Chemical Council<br>c/o Shell Chemical Company<br>One Shell Plaza<br>Houston, Texas 77001 | IV-D-17 |
| Mr. Paul J. Sienknecht, Manager<br>Environmental Regulatory Activities for Air<br>The Dow Chemical Company<br>2020 Dow Center<br>Midland, Michigan 48640 | IV-D-19 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Herb Schuyten<br>Manager, Environmental Programs<br>Chevron U.S.A., Inc.<br>P.O. Box 3069<br>San Francisco, California 94119 | IV-D-20 |
| Mr. J.C. Edwards, Manager<br>Clean Environment Program<br>Tennessee Eastman Company<br>Eastman Kodak<br>Kingsport, Tennessee 37662 | IV-D-21 |
| Mr. John W. Drake<br>Staff Environmental Engineer<br>Kerr-McGee Corporation<br>Kerr-McGee Center<br>Oklahoma City, Oklahoma 73125 | IV-D-22 |
| Mr. W.F. Blank, Manager<br>Pollution Control<br>Corporate Environmental Affairs<br>Allied Chemical<br>P.O. Box 2332R<br>Morristown, New Jersey 07960 | IV-D-23 |
| Mr. James W. Tracht, Director<br>Energy and Environmental Affairs<br>Pennwalt Corporation<br>P.O. Box 0<br>900 First Avenue<br>King of Prussia, Pennsylvania 19406 | IV-D-24 |
| Mr. J.J. Moon, Manager<br>Environment and Consumer Protection Division<br>Phillips Petroleum Company<br>Bartlesville, Oklahoma 74004 | IV-D-25, IV-D-41 |
| Mr. Thomas A. Robinson, Director<br>Environmental Affairs<br>Chemicals Division<br>Vulcan Materials Company<br>P.O. Box 12283<br>Wichita, Kansas 67277 | IV-D-26 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Lawrence D. Vanell<br>Product Line Manager<br>Foxboro Analytical<br>Box 5449<br>South Norwalk, Connecticut 06856 | IV-D-27 |
| Mr. Jesse Coates<br>Chloromethanes Technology Center<br>Dow Chemical Company<br>Louisiana Division<br>Plaquemine, Louisiana 70764 | IV-D-29 |
| Ms. Janet S. Matey, Manager<br>Air Programs<br>Chemical Manufacturers Association<br>2501 M Street, N.W.<br>Washington, D.C. 20037 | IV-D-30, IV-D-31, IV-D-50,<br>IV-D-53 |
| Mr. Edward Palgyi<br>Bureau of Air Quality Management<br>Florida Department of Environmental Regulation<br>Twin Towers Office Building<br>2600 Blair Stone Road<br>Tallahassee, Florida 32301 | IV-D-32 |
| Mr. D.E. Park, Director<br>Environmental Affairs<br>Ethyl Corporation<br>P.O. Box 341<br>Baton Rouge, Louisiana 70821 | IV-D-34 |
| Mr. Henry L. Ramm<br>Environmental Engineer<br>Government and Regulatory Affairs Dept.<br>Rohm and Haas Company<br>Independence Mall West<br>Philadelphia, Pennsylvania 19105 | IV-D-35, IV-D-51, IV-D-52,<br>IV-J-3 |
| Mr. V.J. Marchesani, Director<br>Energy & Environmental Quality<br>ICI Americas Inc.<br>Concord Pike & New Murphy Road<br>Wilmington, Delaware 19897 | IV-D-37 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Ronald A. Lang<br>Executive Director<br>Synthetic Organic Chemical Manufacturers Assoc.<br>1612 K Street, N.W., Suite 308<br>Washington, D.C. 20006 | IV-D-38, IV-D-38a |
| Mr. Joseph Gordon, Director<br>Environmental Affiars<br>Lubrizol Corporation<br>29400 Lakeland Boulevard<br>Wickliffe, Ohio 44092 | IV-D-39 |
| Mr. Russell W. Shannon<br>Associate General Counsel<br>Distilled Spirits Council of the<br>United States, Inc.<br>1300 Pennsylvania Building<br>Washington, D.C. 20004 | IV-D-42 |
| Mr. J.S. Cerrito<br>Environmental Protection Operation<br>General Electric Company<br>One River Road<br>Schenectady, New York 12345 | IV-D-44 |
| Mr. M.J. Rhoad<br>Managing Director<br>International Institute of Synthetic Rubber<br>Producers, Inc.<br>2077 South Gessner Road<br>Houston, Texas 77063 | IV-D-45 |
| Mr. David D. Doniger<br>Senior Project Attorney<br>Natural Resources Defense Council, Inc.<br>1725 I Street, N.W.<br>Suite 600<br>Washington, D.C. 20006 | IV-D-46 |

TABLE 1-2. (CONTINUED)

| COMMENTER AND AFFILIATION | DOCKET ITEM No. |
|---|---|
| Mr. Steven A. Tasher<br>Legal Department<br>E.I. DuPont de Nemours & Company, Inc.<br>Wilmington, Delaware 19898 | IV-D-47 |
| Mr. Thomas V. Malorzo<br>Senior Regulations Analyst<br>Diamond Shamrock Corporation<br>717 North Harwood Street<br>Dallas, Texas 75201 | IV-D-48, IV-D-48a |
| Mr. J.L. McGraw, Chairman<br>Environmental Impact Committee<br>Rubber Division<br>American Chemical Society<br>P.O. Box 32960<br>Louisville, Kentucky 40232 | IV-D-49 |
| Mr. W.F. Muller, Jr., Vice Chairman<br>Environmental Impact Committee<br>Southern Rubber Group<br>c/o The Goodyear Tire & Rubber Co.<br>P.O. Box 5397<br>Houston, Texas 77012 | IV-J-1 |
| Mr. Kenneth E. Blower<br>Corporate Environmental Consultant<br>The Standard Oil Company<br>Midland Building<br>Cleveland, Ohio 44115 | IV-J-2 |

[a]The docket number for this project is A-79-32. Dockets are on file at EPA headquarters in Washington, D.C., and at the Office of Air Quality Planning and Standards in Durham, N.C.

An Additional Information Document (AID) (III-B-2) was published in April, 1982. A notification of its availability and a request for comments was published in the Federal Register (47 FR 19724, May 7, 1982). A list of persons commenting on the AID, their comments, and EPA's responses are presented in Appendix A of this document. Comments on the AID have been categorized under the following topics:

- Emission Factors (Section A1)
- Model Units (Section A2)
- Emission Reductions (Section A3)
- Costs (Section A4)
- Economics (Section A5)
- Comments on Subjects not Covered in the AID (Section A6)
- Previously Submitted Comments (Section A7)

# 2. NEED FOR THE STANDARDS

## 2.1 SIGNIFICANCE OF EMISSIONS AND ENVIRONMENTAL IMPACT OF THEIR CONTROL

Comment:

Commenters questioned the need for standards of performance for SOCMI on the grounds that SOCMI emits small quantities of VOC (IV-F-1, No. 1; IV-F-1, No. 2; IV-F-1, No. 3; IV-D-28; IV-D-26; IV-D-24; IV-D-23; IV-D-21; IV-D-18; IV-D-12; IV-D-19; IV-D-17; IV-D-7; IV-D-34; IV-D-38; IV-D-40; IV-D-47; IV-D-48; IV-D-50). One commenter (IV-F-1, No.2) said that EPA had estimated total VOC emissions (including emissions from natural sources) at 39,100 Gg with stationary sources contributing 19,100 Gg. Emissions from SOCMI were estimated at only 1,000 Gg, of which 300 Gg were fugitive VOC emissions. Several commenters added that SOCMI fugitive emissions represented a small percentage of total VOC emissions.

Contrasted with this comment, another commenter (IV-D-46) emphasized the significance of VOC emissions from SOCMI (including fugitive emissions) and the need to reduce these emissions. He said that expressing VOC emissions from SOCMI as a percentage of total VOC emissions nationwide is misleading since it dilutes the importance of the industry's emissions in major nonattainment areas and elsewhere where SOCMI is concentrated. He said that SOCMI plants make a substantial contribution to VOC emissions in major nonattainment areas. VOC emissions come from many diverse types of sources and each source category may account for only a relatively small percentage of emissions. But all these sources need to be controlled since, together, they account for much VOC.

Another commenter (IV-D-47) supported the implementation of appropriate regulatory programs to minimize fugitive emissions for new and modified facilities pursuant to Section 111 of the Clean Air Act. However, he challenged EPA's conclusion that fugitive emission leaks from SOCMI facilities cause or contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare.

Response:

Emissions of VOC from SOCMI represent a significant source of VOC emissions to the atmosphere. EPA estimates that 540 Gg of VOC/year (540,000 Mg/yr) of VOC are emitted to the atmosphere from all sources in SOCMI (IV-B-24). This estimate of emissions is based on detailed studies of individual process source types including air oxidation processes, distillation operations, storage operations, carrier gas processes, equipment leaks, and secondary sources. Because VOC emissions come from many, diverse source categories, each source category contributes a relatively small percentage to the large overall total. Because of this diversity, the relevant figures to consider are the total emissions, not emissions expressed as a percent. 540 Gg of VOC/year is a significant quantity of VOC to be emitted as air pollution. This quantity is large in absolute terms and is large relative to other VOC source categories.

The SOCMI source category ranked first on the Priority List, 40 CFR 60.16 (44 FR 49222, August 21, 1979), of 59 major source categories for which standards of performance are to be promulgated by 1982. The Priority List consists of categories of air pollution sources that, in EPA's judgment, cause or contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare. In developing the priority list, major source categories were ranked according to three criteria specified in section 111(f) of the Act: (1) the quantity of emissions from each source category, (2) the extent to which each pollutant endangers public health or welfare, and (3) the mobility and competitive nature of each stationary source category.

The commenters expressing concern over new source standards for SOCMI have not presented any new information which would change the decision ranking SOCMI on the Priority List. Therefore, standards of performance will be promulgated for the SOCMI source category. As discussed in the response to the next comment, the decision to regulate the fugitive emission source subcategory of SOCMI is based not on the significance of the contribution of fugitive emission sources (although that contribution is indeed large), but rather on EPA's ability to identify the best demonstrated technology (considering costs) for SOCMI fugitive emission sources.

Comment:

Commenters stated that the total mass of VOC emissions would not be reduced significantly as a result of implementation of the standards and there was, therefore, no need for the standards (IV-D-24; IV-D-38; IV-D-18; IV-D-17; IV-D-19; IV-F-1, No. 2). Several commenters (IV-D-24; IV-D-18; IV-D-17; IV-D-19; IV-F-1, No. 2; IV-F-1, No. 3) pointed out (1) that VOC emissions from stationary sources would be reduced by less than 1 percent in 1985, (2) that total VOC emissions would be reduced by only 0.4 percent if the standards were implemented, and (3) that recent SOCMI data indicated that VOC emissions reductions due to the proposed standards would be only about 0.15 percent of the total VOC emissions in 1985. They questioned the need for a standard which would reduce emissions of VOC by only one tenth of the total VOC emissions on a national level. Another commenter (IV-D-47) referred to a recent EPA report (EPA-450/3-80-023) which shows the reduction expected in 1982 from promulgation of the proposed standards to be only 0.25 percent.

Response:

Since SOCMI has been listed as a significant contributor to air pollution under Section 111(f), EPA must promulgate standards of performance for those new sources within this source category for which the EPA can identify the best demonstrated technology (considering costs). The amount of emission reduction achievable is plainly an important factor in identifying best demonstrated technology (considering costs). It is conceivable that for certain source categories or subcategories there may be no technology that achieves emission reductions at reasonable costs. In such a case, EPA would not be required to establish standards under Section 111 for those groups of sources. By contrast, EPA has identifed several alternative systems of control capable of achieving additional emission reduction at reasonable cost at SOCMI fugitive emission sources. EPA must therefore establish standards based on the most effective of those systems.

Although the specific bases for comparison of the numbers cited by the commenters are unclear, they are comparing large numbers to still larger numbers which results in percentages which are small. In addition, the commenters are comparing emission reductions to emissions. By 1985 up to approximately 830 newly constructed, modified and reconstructed facilities would be affected by these standards. These facilities would contribute an additional 83 Gg/yr of VOC to the atmosphere if left uncontrolled. These numbers represent large quantities of organic material being emitted into the atmosphere where ozone is formed. By implementing the final standards, approximately 46 Gg/yr of emission reduction is achieved. This represents a 56 percent decrease in uncontrolled fugitive emissions.

In summary, the standards of performance for SOCMI fugitive emission sources of VOC serve the intent of Section 111 of the Clean Air Act. They minimize VOC emissions at a reasonable cost. The standards also fulfill, in part, the requirements of Section 111(f) by providing standards for the SOCMI source category for which standards must be promulgated.

Comment:

Two commenters (IV-F-1, No. 2; IV-D-38) said that emissions from small manufacturers in SOCMI were insignificant and that reductions in this small amount of emissions would also be insignificant. The commenter said that the relative contribution to VOC fugitive emissions from new and modified facilities by 1985 would be only 14.2 percent for Model A plants, 36.2 percent for Model B plants, and 49.5 percent for Model C plants. The commenter interpreted these figures to mean that 52 percent of the affected facilities would contribute less than 15 percent of the emissions. This argument was used to support the contention that small businesses should not be covered by the standards.

Response:

About 10 to 30 percent of SOCMI process units are owned by small businesses. However, there is no known relationship between small businesses and process units which are similar to Model Unit A. The three different types of model units will likely be owned by any size business. As a consequence, the level of VOC emissions from process units owned by small businesses is no different than the level of VOC emissions from process units owned by other businesses. As shown previously, emissions of

VOC from SOCMI units are large. Small businesses which own and operate SOCMI units are a part of this industry and, as such, contribute to the air pollution which EPA considers to be significant. Therefore, model-unit size, emissions, or emissions per process unit do not provide an objective basis for exempting small businesses.

The only objective basis for exempting small businesses from the standards would be to decide whether the level of the standards is appropriate for small businesses that is, whether best demonstrated technology (considering costs) is available for small businesses. In making this decision, EPA must consider whether the control technology is demonstrated and whether the costs are reasonable for small businesses. As discussed elsewhere in this document, EPA has concluded that the control technology is demonstrated (Section 4) and that the costs are reasonable for small businesses (Section 7). Therefore, EPA has not provided an exemption from the standards for small businesses.

An exemption is provided where costs are exorbitant in comparison to the emission reduction benefit achieved. As explained in Section 5.5, an exemption is provided for process units with low production volumes. This exemption is based on a cost that is unreasonably high in comparison to the VOC emission reduction achieved for low production volumes. Some small businesses may be exempted if they own process units that qualify for the low production volume exemption.

Comment:

One commenter (IV-D-42) wrote that emissions from natural alcohol fermentation processes were low and that natural alcohol plants should not be regulated.

Response:

SOCMI consists of numerous processes that produce numerous chemicals each of which may by itself emit a relatively small amount of VOC. The total amount of VOC emissions contributed by SOCMI is, however, significant. The fact that one process in the industry contributes a small amount of the total does not provide a basis for exempting that one isolated part, e.g., anhydrous alcohol. As before, the only basis for exempting processes from the standards would be to decide whether the control technology is demonstrated and has reasonable costs. Based on this type of analysis, EPA has provided an exemption for processes with low production volumes. However, EPA has concluded that the control technologies which form the basis of the standards are demonstrated and that they have reasonable costs for SOCMI process units, including anhydrous alcohol process units.

Comment:

One commenter (IV-D-50) stated that uncontrolled SOCMI fugitive emissions might well approach the regulatory goal of 26 Gg/yr and thus no standards would really be needed. He made an estimate of uncontrolled emissions of 55 Gg/yr based on data collected recently in SOCMI. He considered the estimate low because it was based on data from plants in the high-leak category, and SOCMI is largely comprised of low-leak and non-leak processes.

Response:

EPA's intent is not to set a regulatory goal of 26 Gg/yr. Rather, the intent is to develop standards based on the use of the best demonstrated technology (considering costs) [BDT]. At proposal, EPA estimated that use of BDT on affected facilities would limit emissions of VOC in 1985 to 26 Gg/yr. Since proposal, the estimate has been revised to 36 Gg/yr. This is the estimated effect of the standards five years after proposal of the standards. However, as discussed in other responses, the purposes of these standards and Section 111, in general, look beyond any specific effect within a short time period like five years.

With regard to the specific data cited by the commenter, the high leak category of processes referenced by the commenter was presented in the SOCMI Data Analysis report (IV-A-14). The category was one of three artifically derived categories that were derived for purposes of statistical analysis. The categories do not reflect distributions of leak frequencies among the process units in SOCMI. However, as discussed in the section on Alternative Standards, EPA has provided alternative standards which would establish BDT for low-leak process valves and provide an incentive to design and operate process units which have low-leak frequencies. In addition, owners of process units capable of achieving emission reductions at least equivalent to BDT may apply for a determination of equivalency.

Comment:

One commenter (IV-D-46) wrote that emissions of volatile organic compounds (VOC) from SOCMI are important contributors to levels of ozone and other photochemical oxidants. In many nonattainment areas, meeting the health standard for ozone requires effective control of these emissions. He felt that this standard will provide a meaningful floor level of emissions control -- a reasonable starting point for analysis of the need for additional controls under state and federal nonattainment programs. He added that NSPS for these emissions is also needed to prevent deterioration of air quality in the large number of areas now nearly violating the health standard.

This commenter said that control of VOC from this industry will also help curb particular chemicals which are known or suspected to cause cancer and other serious long-term illnesses. Here too, an NSPS for this industry will provide a floor level of control, to which further hazardous air pollutant controls can be added.

Response:

EPA agrees with this commenter.

Comment:

One commenter (IV-D-46) requested that EPA calculate the contribution of SOCMI plants to VOC emissions in the major nonattainment areas for ozone. The commenter stated that this should be easy to do from readily available information. He also stated that this calculation would show that the effect of fugitive emissions from this industry is considerably greater than the one percent national average figure indicates. The commenter emphasized that it would make it even clearer that fugitive emissions from SOCMI plants are a significant source of VOC emissions which need to be controlled.

Response:

EPA has made no calculations of ozone contribution due to VOC emissions because of uncertainties in new plant locations and currently available models, and because the formation of ozone and oxidant depends on meteorological and topographical factors as well as chemical reactivity. However, for purposes of new source standard preparation, it is sufficient to know that VOC emissions contribute to ozone formation and that control of VOC emissions will reduce ozone formation. These facts have been documented in Docket No. IV-A-17.

2.2 CONTRIBUTION OF CURRENT REGULATIONS TO FUGITIVE EMISSION CONTROL

Comment:

Several commenters questioned the need for the standards because, in their opinions, fugitive emissions of VOC in this industry are adequately controlled by other regulations. They stated that other environmental regulations and Occupational Safety and Health Administration regulations adequately reduce fugitive emissions of VOC.

Comment 1. Several commenters questioned the need for the standards in light of current environmental regulations imposed on the industry (IV-F-1, No.1; IV-F-1, No.3; IV-D-23; IV-D-22; IV-D-19; IV-D-20; IV-D-18; IV-D-17; IV-D-47). The commenters asserted that fugitive emissions of VOC from SOCMI are now or will be brought under control by such regulatory efforts as State Implementation Plans (SIP's), the Control Techniques Guideline (CTG) for SOCMI fugitives, National Emission Standards for Hazardous Air Pollutants (NESHAP's), prevention of significant deterioration (PSD) requirements, and lowest achievable emission rate (LAER) requirements. One of the commenters (IV-D-22) pointed out that the CTG includes more industrial process unit types and applies to both new and existing units, making the new source performance standard (NSPS) unnecessary. Another (IV-D-17) said that reasonably available control technology as defined by States (RACT) would achieve almost the total reductions expected under the NSPS and that the incremental cost and emissions reductions between the two levels were unjustifiable. Another commenter (IV-D-19) said that PSD and non-attainment requirements, both of which apply to new sources, would accomplish the same emission reductions. He explained that the Clean Air Act requires that best available control technology (BACT) for attainment area sources and LAER for nonattainment area sources must be at least as stringent as NSPS and that BACT and LAER may even be more stringent and are set on a case-by-case basis. One commenter (IV-D-17) said that the State Implementation Plans have been designed to meet the National Ambient Air Quality Standards (NAAQS) for ozone. With the NAAQS achieved, he could see no need for additional regulations.

Comment 2. Other commenters stressed the potential overlap of OSHA regulations with the proposed standards (IV-D-6; IV-D-12; IV-D-38; IV-D-32). One of the commenters (IV-D-6) asserted that OSHA regulations for control of contaminant levels in the workplace are in fact fugitive emission control regulations. Pointing out that OSHA regulations require engineering controls and work practices unless such methods are unavailable, he said that the engineering controls considered by OSHA are identical to those described by EPA in the BID (EPA 450/3-80-033a). Another commenter (IV-D-12) said that many of the chemicals listed in Section 60.489 are listed in Table Z-1 of OSHA regulation 29 CFR. The levels required by the OSHA regulations were, he said, lower than 10,000 ppmv in most cases. Citing a particular example from his company's furfural plant, he said that three of the four products or byproducts produced in the furfural process unit were closely controlled by OSHA. All of the four were controlled by industrial hygienists in routine surveillance. Particular attention was said to be paid to leak-prone areas. In all cases concentrations were in the range of 0.1 to 15 ppmv for compounds which vary widely in volatility. A third commenter (IV-D-38) pointed out that nearly one-half of the organic substances subject to the proposed NSPS are already subject to OSHA requirements that result in most new or modified plants being designed to control emissions to low levels. The commenter continued by citing a survey in which thirty-four companies reported producing 183 out of the 358[a] chemicals listed. Most of the 183 were listed in the 1980 bulletin of the American Council of Government Industrial Hygienists (ACGIH). He further explained that many of the chemicals listed by ACGIH have very low volatility and, therefore, pose little emission risk. Based on the survey and the ACGIH listings, the commenter felt that the proposed NSPS would do little more than impose unnecessary operational requirements on plants already designed to minimize emissions.

[a]The list actually contains 378 entries. The count of 358 may have been a typographical error.

Response:

Comment 1: Background. These commenters are referring to four types of environmental regulations: National Ambient Air Quality Standards (NAAQS), State Implementation Plans (SIP's), National Emission Standards for Hazardous Air Pollutants (NESHAP's) and New Source Performance Standards (NSPS). These commenters also are referring to two types of occupational standards. Each of these statutory programs play a uniquely different role in meeting the goals of the Clean Air Act and the Occupational Safety and Health Act. The main thrust of these comments is that fugitive emissions of VOC within SOCMI do not significantly contribute to air pollution, and that there is no need for the standards of performance. However, none of these statutory programs negates the need for new source standards, as explained below.

National Ambient Air Quality Standards (NAAQS) (Section 109 of the Clean Air Act) set a ceiling for public exposure to criteria pollutants ($SO_2$, $NO_x$, ozone, CO, particulates, lead) by establishing an ambient concentration level that must not be exceeded more than one time anywhere in the United States. States implement plans (Section 110 of the Clean Air Act) to attain NAAQS. Based on projections that show attainment of NAAQS, States determine the degree of control that will be imposed on existing sources and on new sources, depending on whether air quality is better than or worse than the NAAQS in the area where the source is or will be located.

State Implementation Plans (Section 110 of the Clean Air Act) (SIP's) are required to include a program for preconstruction review of new or modified stationary sources to ensure that such sources do not interfere with attainment or maintenance of the NAAQS. This statutory program is set forth in Parts C and D of Title 1 of the Clean Air Act. Part C, "Prevention of Significant Deterioration of Air Quality" (PSD), is for areas of the country that have attained the NAAQS. The PSD rules require certain new sources to meet the "best available control technology" (BACT) considering energy, environmental, and economic impacts and other costs. This type of emission limitation must be determined on a case-by-case basis. In no event may the application of BACT result in emissions of any pollutants which will exceed the emissions allowed by applicable standards of performance established pursuant to Section 111 (or 112) of the Clean Air Act.

Part D, "Plan Requirements for Nonattainment Areas" applies to areas of the country that have not attained the NAAQS. Most existing sources in nonattainment areas are required to install, at a minimum, "reasonably available control technology" (RACT). RACT is defined by the State typically with reference to a Federal control techniques guideline document (CTG). Certain sources in nonattainment areas are required to install the control equipment that will result in the lowest available emission rate (LAER) as defined by the State. Applicable costs do not necessarily play as prominent a role in determining LAER as they do in determining BACT. The Clean Air Act defines LAER as that rate of emissions based on the following, whichever is more stringent:

(A) The most stringent emission limitation which is contained in the implementation plan of any State for such class or category of source, unless the owner or operator of the proposed source demonstrates that such limitations are not achievable, or

(B) The most stringent emission limitation which is achieved in practice by such class or category of source. In no event can the emission rate exceed any applicable new source performance standard.

CTG's provide guidance to States in developing RACT-based environmental regulations. These regulations are established to correct existing air pollution problems and affect existing sources in particular. The draft CTG entitled "Control of Volatile Organic Fugitive Emissions from Synthetic Organic Chemical, Polymer, and Resin Manufacturing Equipment" was presented to the National Air Pollution Control Techniques Advisory Committee on April 30, 1981. This CTG, once it is published in a final form, will represent Federal guidance to States for RACT-based provisions applicable to SOCMI facilities. The CTG discusses control techniques which are completely compatible with the techniques considered for the SOCMI NSPS.

National Emission Standards for Hazardous Air Pollutants (NESHAP's), as mandated under Section 112 of the Clean Air Act, are distinctly separate from NAAQS or standards of performance. NESHAP's were developed to control pollutants that are hazardous because they are carcinogens or cause other serious diseases. Some of the individual SOCMI chemicals have been identified as hazardous pollutants and some SOCMI units may be affected by NESHAP regulations. However, SOCMI fugitive emissions as a class have not been identified as hazardous pollutants and, therefore, are not subject to NESHAP's.

Response:

Comment 1. Standards of performance required by Section 111 play a unique role under the Clean Air Act. The main purpose of standards of performance is to require new sources, wherever located, to reduce emissions to the level achievable by the best technological system of continuous emission reduction considering the cost of achieving such emission reduction, any nonair quality health and environmental impact, and energy requirements. . . [(Section 111(a)(1)]. Congress recognized that establishing such standards would minimize increases in air pollution from new sources, thereby improving air quality as the nation's industrial base is replaced over the long-term. NSPS's thereby serve as a distinct means of achieving the Act's goals, supplementing the role played by RACT-based requirements for existing and new sources within state implementation plans developed for the purpose of attaining the NAAQS.

Where RACT-level control is already in place, however, the impact of NSPS will be smaller than calculated. RACT and the systems chosen as the best demonstrated technology for this industry's standards of performance for new stationary sources are not conflicting types of control; therefore, where RACT already applies, the standards of performance will supplement RACT-level control. EPA has determined that existing RACT-level facilities that become subject to the standards of performance (e.g., through modification) can achieve the additional reduction required at a reasonable cost.

Congress also intended NSPS to play an integral role in the new source review programs of the Act. Standards of performance required by Section 111 also serve as the minimum level of emission control for BACT and LAER, which are determined case-by-case. Promulgation of these standards therefore assures that BACT and LAER for individual sources are not less stringent than the "best demonstrated technology" for the class of sources into which those individual sources fall. Absent identification of "best demonstrated technology" through promulgation of NSPS's, BACT and LAER might be less stringent than BDT-level control.

Standards of performance have other benefits in addition to achieving emissions reductions. Standards of performance establish a degree of national uniformity to air pollution standards, and, therefore, preclude situations in which some States may attract new industries as a result of having relaxed standards relative to other States. Further, standards of performance provide documentation that reduces uncertainty in evaluations of available control technology. This documentation includes identification and comprehensive analyses of alternative emission control technologies, development of associated costs, evaluation and verification of applicable emission test methods, and identification of specific emission limits achievable with alternate technologies. This documentation also provides an economic analysis that reveals the affordability of controls in a study of the economic impact of controls on an industry.

After EPA considered the statutory requirements and concluded that SOCMI is a significant contributor to air pollution, within the meaning of Section 111, standards for fugitive emission sources of VOC within SOCMI were selected. These standards are based, as required by Section 111, on a demonstrated system of continuous emission reduction considering costs, nonair quality health and environmental impacts and energy requirements. The selection of the standards was based on technological, cost, energy, and environmental factors.

EPA was aware of other Clean Air Act programs during preparation of the standards. As discussed in the next response, the level of control under existing environmental regulations was considered in estimating emissions from SOCMI. Further, as discussed in the next section, the selection of the final standards was based on a comparative analysis of the incremental costs and emission reductions for the different levels of control considered. It should be noted that one of the regulatory alternatives considered

(Regulatory Alternative II) was very similar to the draft CTG. The existence of other environmental regulations was considered during selection of BDT, but their existence does not lead EPA to conclude that standards reflecting better control technology cannot be applied at reasonable costs.

Response:

Comment 2. The commenter also referred to various occupational standards. Many of the chemicals listed in Section 60.489 of the SOCMI fugitive emission standards are also listed in Table Z-1, Toxic and Hazardous Substances, in the general provisions for the Occupational Safety and Health Act (OSHA) (29 CFR 1910.1000), and some of these chemicals are also covered by more specific health standards under OSHA and may be listed by other groups such as the American Council of Government Industrial Hygienists (ACGIH). As a consequence, the SOCMI standards and the OSHA standards have the potential to impact the same fugitive emission sources. However, the SOCMI standards of performance do not conflict with OSHA standards; they ensure emission reductions, and they do not require duplicate equipment. In fact, in many cases they may be supplementary.

Standards of performance and OSHA regulations have different purposes and may result in different environmental benefits. New source standards serve to limit directly mass emission rates. In contrast, implementation of OSHA standards for toxic chemicals does not necessarily limit emissions directly. Under OSHA, control of emission sources may include substitution with less hazardous materials, process modification, worker rotation, process or worker isolation, ventilation controls, or modification of work practices. These controls may reduce occupational exposures, but they do not necessarily reduce the mass rate of VOC emissions to the atmosphere.

Furthermore, the OSHA regulations would require control to different concentration levels, depending on the toxicity of a specific chemical, while NSPS regulations would require emission control based on BDT for all VOC. Fairly high emission rates from fugitive emission sources may be diluted to the extent necessary to protect workers, but the emissions would still be released to the atmosphere, adding to the air pollution burden. Relying on indirect controls that may or may not reduce emissions that would degrade air quality would be an unreasonable approach to reducing fugitive emissions of VOC.

One commenter had stated that many chemicals listed by ACGIH have low volatility and thus pose little emission risk. The NSPS for SOCMI fugitive VOC emissions considers the volatility of the SOCMI chemicals. Standards apply to sources that have a great tendency to leak, and exemptions are provided for these sources that have a low potential to emit VOC. Data from fugitive emission studies show that more volatile chemicals (those with higher vapor pressures) have a greater tendency to leak and at a higher mass emission rate. Thus, fugitive emission sources are classified in the standards by volatility (vapor pressure) service: in heavy liquid, in light liquid, or in gas or vapor services. These data on which the classifications were developed were collected in process units that are currently subject to OSHA regulations.

The commenter gave examples of chemicals which were controlled by OSHA to concentration limits well below 10,000 ppmv. Many of the chemicals listed in Table Z-1 of the OSHA regulations do have concentration limits under 10,000 ppm. However, those concentration levels are not comparable to the screening value concentration levels measured with Reference Method 21. The screening value concentrations are obtained at the leak surface. The concentration levels required by TLV's are time-weighted average concentrations in the workers' air. As noted before, a fairly large emission rate can be diluted sufficiently to obtain workplace air within certain limits. The magnitude of dilution effects can be seen in measurements of various distances from a leak surface. An experiment of this type was reported in Evaluation of the Maintenance Effect On Fugitive Emissions from Refineries in the South Coast Air Quality Management District (IV-A-30). The data presented in this report show the dramatic effect of moving just 20 cm from the leak surface for pump and compressor seals. All but a few leaks of more than 10,000 ppmv measured at the surface could no longer be detected at a distance of 20 cm from the surface and area monitors were typically much further removed than 20 cm.

Even though the standards affect the same sources, the SOCMI standards of performance do not require duplicate equipment. The substantive equipment or engineering controls that can be required by OSHA standards are not duplicated by the standards of performance. The same equipment, even though it may be employed to meet both standards, would not be installed in duplicate. More importantly, the standards may be supplementary. In many cases the fugitive emission standards may facilitate compliance with the OSHA regulations and vice versa. By keeping chemical substances out of the air, the workers' health and safety and the public welfare are protected.

The NSPS would apply to newly constructed, modified, and reconstructed facilities. If the two standards require different levels of control and apply to the same source, an owner of the source would meet the most stringent standard which would insure that both standards are met. This choice would be easily made by an owner or operator. In addition, to the extent that an OSHA standard results in low leak frequency or low emission rates, the NSPS provides alternative standards which would provide an incentive to design and operate such process units. For example, if an owner uses engineering controls for valves (such as sealless valves) in a process unit and the unit has few valves which leak, then an owner could select one of two alternative standards for valves which would substantially reduce the effort required to comply with the standards for valves (see Section 14). In addition, if an owner uses engineering controls for pumps that result in low emission rates (such as dual mechanical seals and a heavy liquid barrier fluid system), an owner would have a pump that would be exempt from the routine leak detection and repair requirements of the standards. An owner could select which of the two standards to meet.

Another potential area of conflict may arise in the leak detection and repair programs. Leak detection and, especially, repair may require workers to complete tasks near VOC emission sources. Exposure for these workers could be increased. Work practices including provisions for insuring that employees work upwind from any leaks would be sufficient to control exposures during repair of leaking equipment. In some cases personal protective equipment may be required. However, this type of situation would occur from time to time whether the standards were in effect or not. The same practices could be used during leak detection and repair as are used during routine plant maintenance and repair.

In summary, the OSHA regulations and the standards of performance may impact the same fugitive emission sources. However, the two regulations have different purposes and have different environmental effects. The standards are not duplicative, nor is there a conflict between them.

Comment:

Two commenters (IV-F-1, No.2; IV-D-28) said that EPA had failed to consider adequately the effects of other regulations affecting SOCMI when determining the costs and benefits of the proposed standards.

Response:

EPA has considered the costs and benefits of other regulations in developing the promulgated standards. Cost considerations are discussed in Chapter 8 of the BID and in Section 7 of this document. Benefits of other regulations are discussed here.

The benefits of other regulations were considered in establishing the baseline level of control. The baseline was established by examining the actual level of control which exists in the industry. The actual level of control reflects the effects of all circumstances acting to affect control, whether they are regulatory (e.g., OSHA regulations) or economic circumstances. The only relevant circumstances are regulatory circumstances that control release of VOC into the atmosphere from fugitive emission sources. As discussed above, there are two potential types of regulations which have the potential to accomplish this control: air pollution regulations and Occupational Safety and Health Administration regulations.

SOCMI units that are located in areas currently attaining the NAAQS for ozone probably would not be subject to any VOC fugitive emission regulations. Facilities located in nonattainment areas would be subject to applicable state implementation plans (SIP's). However, only a few states have developed or are considering near-term development of these specific regulations. NESHAP's are being developed for vinyl chloride and benzene, but these standards apply to only a small portion of SOCMI. For the most part, there are currently no environmental regulations applicable to fugitive emission sources in SOCMI.

In addition to environmental regulations, OSHA standards and provisions have the potential for effecting control of fugitive emissions. There does not seem to be a clear correlation between leak frequencies and chemicals controlled by OSHA. Analysis of TLV's and leak frequencies found in SOCMI showed no recognizable trend. However, there might be a situation in which OSHA programs effectively control fugitive emissions. Where OSHA standards achieve what the NSPS would require, no additional control would be necessary. Where OSHA standards would achieve somewhat less control, fugitive emission standards would serve as an important supplement. In addition, where an OSHA standard results, as discussed in the previous response, in low leak frequencies or low emission rates the NSPS provides relief from any overlap in requirements. Thus, since the NSPS is written in a manner which allows flexibility in the approach to control, both regulatory aims can be accomplished without conflict.

Provisions of insurance policies for fire and explosion protection also have the potential for effecting control of fugitive emissions. Lately, economics have also been a factor contributing to the control of fugitive emissions because of the increase in prices for petroleum-derived products. However, as noted previously, the emission estimates for baseline are based on the current status of fugitive emission sources which already reflect these impacts.

Comment:

One commenter (IV-D-32) said that if the material is hazardous, the Toxic Substances Control Act (TSCA) could control it.

Response:

Even though several of the VOC's covered by the standards are toxic, as discussed in a previous response, fugitive emissions of VOC from SOCMI have not been declared hazardous as a class under TSCA. TSCA requires that substances presenting a risk to man or his environment by virtue of their toxicity be controlled by other statutes if possible. NESHAP's developed under Section 112 of the Clean Air Act would control emissions of those particular pollutants determined hazardous under that section. NSPS's, however, apply more broadly to new sources in industrial categories determined to contribute to air pollution which may reasonably be anticipated to endanger public health or welfare. This application includes significant contributors of <u>all</u> types of VOC emissions. For this reason, EPA has listed SOCMI sources for regulation under Section 111.

Comment:

One commenter (IV-D-12) said that control of odors had caused control so stringent in his plant that the quantities of VOC in the air are too small to be identified. Even though the streams are so dilute, they have been subjected to special incinerators which consume all organics.

Response:

Many organic compounds have offensive odors and some have extremely low odor thresholds. A detectable odor is a sign of VOC in the air, even though in cases of chemicals with low odor thresholds the concentration may be very low. On the other hand, even a low concentration, by the time it reaches the public, indicates an emission rate of some magnitude.

Odor control and VOC emissions control may accomplish comparable emission reductions. Also, the control techniques applicable are virtually the same. Therefore, compliance with the fugitive emission standards should aid an owner or operator in his efforts to control odor; although, for some chemicals odor control may require even more stringent measures. In addition, where odor control results in low leak frequencies and low emission rates, the NSPS, as discussed in a previous response, eliminates the burden from any overlap in control programs.

Comment:

One commenter (IV-D-42) wrote that it would be a waste of government funds and enforcement resources to have EPA regulate the fermentation alcohol industry. He argued that this industry is already regulated stringently by the Bureau of Alcohol, Tobacco and Firearms (BATF) which has rules requiring distillers to control leaks and spills and account for all product in order to protect the federal revenue. The commenter cited 27 CFR, Part 19, Subpart I in support of his argument. He also noted that BATF rules require that all tanks, pipes, valves, and other equipment used for the production, storage or handling of alcohol be constructed not only to prevent leaks and spills, but also to prevent plant personnel from gaining access to any alcohol. The commenter concluded that EPA would be duplicating what BATF already does.

Response:

The regulations in 27 CFR, Part 19, Subpart I require equipment be installed and operated in a manner which protects the revenue derived from spirits. The purpose of the regulation is, thus, different from the standards of performance which are aimed at protecting the environment. In 27 CFR, Part 19 Subpart I there are no provisions specifically relating to fugitive emission sources. But, protecting the environment by preventing leakage from fugitive emission sources might provide protection for revenues. The standards are not duplicative, nor are they conflicting. In fact, they are complementary because attainment of two different sets of goals may be facilitated by the same measures.

## 2.3 STANDARDS' BENEFIT TO PUBLIC HEALTH; CONTROLLING VOC TO CONTROL OZONE

Comment:

Several commenters questioned the need for the standards to protect the public health and welfare. One commenter (IV-F-1, No.3) said that the ambient air quality standard for ozone which is set to protect the public has recently been raised. He concluded that because most of the country is in compliance with the ozone standard, the public health and welfare is protected and the standards of performance are unnecessary.

The commenter (IV-F-1, No.3) continued his argument that the standards would have no beneficial effect on the public health and welfare by considering the two cases of people living in attainment areas and those living in nonattainment areas. He said that those persons residing in attainment areas would derive no benefit because the ozone levels are below the level requisite to protect public health and welfare. In considering the other case, he said that those residing in nonattainment areas would not benefit because of the insignificance of the emissions being controlled when compared to the other sources present. He repeated this argument in a set of written comments (IV-D-28).

In a similar vein he continued by saying that 24 states have requested extensions beyond 1982 for achieving compliance with the ozone NAAQS. Those areas within the 24 states which are not expected to be in compliance are primarily large urban areas. To add to the uneven distribution of ozone problem areas addressed by this standard, the SOCMI industry is not evenly distributed throughout the U.S. He concluded that there were no benefits from the standards for large portions of the nation either because there is no SOCMI industry or because the area is already in compliance.

Response:

The ozone standard referred to by one of the commenters, is the national ambient air quality standard (NAAQS) for ozone. Compliance with NAAQS does not preclude the development of new source performance standards (NSPS). New source performance standards are not directly designed to achieve the ambient air quality goals. An overriding purpose and long range goal of a NSPS is to minimize emissions at all new and modified sources, wherever they are located, in order to prevent new pollution problems from developing and to enhance air quality as the Nation's industrial base is replaced.

The standards will limit VOC emissions from all new, modified, or reconstructed SOCMI process units and will result in emission reductions well into the future. Even though these reductions may not bear directly on attainment or nonattainment of NAAQS for ozone, they will make room for future industrial growth while preventing future air quality problems. Clearly, residents in both attainment and nonattainment areas would benefit from these standards. The NSPS complements the PSD and nonattainment rules as a means of achieving and maintaining the NAAQS, while on a broader basis they prevent new sources from making air pollution problems worse regardless of the existing quality of ambient air. Therefore, while new source standards may help in the attainment of NAAQS, the consideration of compliance or noncompliance with NAAQS does not influence directly the decision to set standards of performance.

Comment:

Another commenter (IV-D-42) added that EPA had cited little or no evidence that ethanol emissions from distilling endanger public health or welfare.

Response:

The Clean Air Act was developed to establish national air quality and environmental goals that would protect and enhance the quality of the nation's own resources to promote public health and welfare and the productive capacity of its population. The Administrator clearly documented the need to regulate VOC in order to protect public health and welfare in the EPA publication "Air Quality Criteria for Ozone and Other Photochemical Oxidants" (IV-A-17). VOC emissions are precursors to the formation of ozone and other oxidants (ozone). Ozone results in a variety of adverse impacts on health and welfare, including impaired respiratory function, eye irritation, necrosis of plant tissues, and the deterioration of synthetic rubber. An independent determination for each of the SOCMI chemicals as suggested by the commenter calling for an individual finding in the case of ethanol is unnecessary. VOC emissions as a class have been determined to contribute to ozone formation. Since ethanol is a VOC and may be produced with and from other VOC, it remains on the list of SOCMI chemicals.

Comment:

One commenter (IV-D-12) said that complying with the standards would contribute nothing to air quality in the area of his plant where the major air problems are carbon monoxide and particulates.

Response:

New source performance standards are aimed at preventing air quality from deteriorating due to an increase in the number of industrial sources. If ozone is not a problem in a particular area, the SOCMI fugitive VOC standards will help, as discussed above, to ensure that ozone levels do not become a problem in that area. The standards will help in other ways as well, such as in reducing odors and hazardous air pollutants.

Comment:

One commenter (IV-D-43) wrote that the Proposed Notice of Revocation for the NAAQS for hydrocarbons (46 FR 25655; May 8, 1981) destroys the basic premise for the priority listing of VOC from SOCMI as a class of substances that endanger public health and welfare. He wrote further that only those individual substances whose emissions have a measureable impact on health and welfare are appropriate for regulation.

Response:

As discussed in Section 8 of this document, the revocation of the NAAQS for hydrocarbons does not prevent the regulation of VOC emissions as precursors to ozone for which there is a NAAQS. In establishing the level of the NAAQS for ozone, EPA made the determination that ozone may endanger health and welfare, and established the need for controlling VOC as precursors to ozone (IV-A-17).

Comment:

Two commenters (IV-F-1, No.3; IV-D-50) said that EPA's calculations assume that there is a direct correlation between hydrocarbon emissions and ozone levels. They said that this assumption is not necessarily correct. The commenters continued, saying that there had been no demonstration that any of the chemicals regulated are directly related to ozone. They said that EPA had speculated on this relationship.

Response:

EPA has determined that VOC contribute to ozone formation through photochemical reactions in the atmosphere. These findings were published in Air Quality Criteria for Ozone and Other Photochemical Oxidants (IV-A-17). In this same document there are descriptions of several models which relate emissions of VOC to oxidant levels. It should be noted, however, that at no point during this standards-setting process has EPA attempted to relate quantitatively the emissions of VOC which would be affected to the resultant air quality. It is sufficient for the purposes of new source standards to aim at preventing degradation of air by new sources, knowing that emissions of VOC contribute to ozone formation and, therefore, degradation of the air.

Comment:

One commenter in several sets of comments (IV-F-1, No.3; IV-D-43; IV-D-28) questioned EPA's controlling ozone on the one hand while it has work underway on the other hand to prevent the loss of ozone from the upper atmosphere. The commenter asked how the agency could decide that chlorofluorocarbon or chloroform or carbon tetrachloride, for example, must be regulated because they destroy ozone in the stratosphere and also must be included in a category for regulatory action because they form ozone in the troposphere. The commenter referred to 45 FR 66726 as support for his argument.

Response:

As discussed in Section 5.1, the chlorofluorocarbons, carbon tetrachloride, chloroform and other negligibly photochemically reactive compounds remain on the SOCMI list because photochemically reactive VOC's are processed in producing these chemicals using fugitive emission sources. The criteria for removing them from the list would be that none of the raw materials, additives, intermediates, or finished products is a photochemically reactive VOC. Since the chemicals cited by the commenter are all produced from photochemically reactive substances, they are covered by the standards. However, EPA has added provisions to the standards that would allow an owner or operator to eliminate coverage of fugitive emission sources that do not contain VOC.

EPA's program to control ozone depletion by chlorofluorocarbons is described in the Federal Register notice referenced by the commenter. Congress required that EPA undertake this control effort in the Toxic Substances Control Act. Controlling emissions of chlorofluorocarbons and their reactants to prevent ozone formation in the lower levels of the atmosphere does not conflict with controlling chlorofluorocarbon emissions to protect degradation of the upper levels of the atmosphere. Both purposes are served by controlling chlorofluorocarbon emissions.

Chlorofluorocarbons (produced from such substances as perchloroethylene, carbon tetrachloride, and fluorinated derivatives of acetylene) are not being regulated because they form ozone but because they are produced from chemicals that form ozone in the troposphere. In any case, to the extent that chlorofluorocarbons are controlled, the standards will reduce the destruction of ozone in the stratosphere.

# 3. BASIS FOR THE STANDARDS

Section 3 presents the basis for the final standards and summarizes the comments and responses on the basis of the proposed standards. The selection of the final standards is presented in Section 3.1 and the selection of the formats of the standards is discussed in Section 3.5. The remaining sections summarize the conclusions from the Additional Information Document (AID) (III-B-2) on emission factors (Section 3.2), model units (Section 3.3), and emission reductions (Section 3.4).

## 3.1 SELECTION OF FINAL STANDARDS

### 3.1.1 Basis for the Final Standards

Comment:

Many people (IV-D-17; IV-D-24; IV-D-28; IV-D-40; IV-F-1, No.3) commented on the basis for selection of the proposed standards. The commenters questioned the choice of Regulatory Alternative IV; they said that it was not cost effective. Some of the commenters recommended the selection of Regulatory Alternative II; some recommended Regulatory Alternative III. Another commenter recommended adoption of Regulatory Alternative II with the addition of closed loop sampling systems (part of Regulatory Alternative IV) which he considered cost effective. Some commenters said that the incremental cost-effectiveness of Regulatory Alternative IV was unreasonable.

Response:

Section 111 of the Clean Air Act, as amended, requires that standards of performance be based on the best system of continuous emission reduction that has been adequately demonstrated, considering costs, nonair quality health and environmental impacts, and energy requirements. The control techniques for fugitive emissions have been adequately demonstrated as discussed in Section 4, Control Technology. The magnitude of fugitive emissions of VOC from SOCMI and the emission reduction achievable if fugitive emission control techniques are implemented are discussed in

Section 6, Environmental Impact. The nonair quality health and environmental impacts are also discussed in Section 6 of this document and Chapter 7 of the BID for the proposed standards.

Since proposal, EPA has decided to accept the suggestions of commenters and focus further on cost-effectiveness in selecting the basis for the selection of final standards. In making this decision, EPA is accepting the suggestions of commenters to base the standards on cost-effectiveness considerations. After considering the cost-effectiveness of control techniques for each fugitive emission source covered by the standards, EPA analyzed the economic impact on the industry of the control techniques selected on a cost-effectiveness basis.

Cost-Effectiveness Considerations. EPA analyzed the annualized cost of controlling VOC emissions and the resultant VOC reduction for each alternative control technique. Costs for implementing the standards are presented in Section 7. Emission reductions are presented in Section 6. The control costs per megagram of VOC reduced are presented in Table 3-1 for each fugitive emission source covered by the standards. These costs do not represent the actual amounts of money spent at any particular plant site. The cost of VOC emission reduction systems will vary according to the chemical product being produced, production equipment, plant layout, geographic location, and company preferences and policies. However, these costs and emission reductions are considered typical of control techniques for fugitive emission sources within SOCMI units and can be used in selecting the level of control to be required by the standards.

Pressure Relief Devices. The annualized costs and VOC emission reductions achieved for monthly and quarterly leak detection and repair programs (LDRP) and for the use of control equipment (rupture disks) were determined for pressure relief devices in gas service. As Table 3-1 shows, both the quarterly and monthly leak detection and repair programs are less expensive than installation of rupture disks. Leak detection and repair programs result in average credits of \$240/Mg and \$150/Mg of VOC for quarterly and monthly programs. A monthly leak detection and repair program achieves an additional 0.7 Mg/yr of emission reduction at a cost of \$500/Mg compared to

TABLE 3-1. CONTROL COSTS PER MEGAGRAM OF VOC REDUCED[a]

| Fugitive Emission Source | Control Technique[b] | Emission Reduction (Mg/yr) | Average $/Mg[c] | Incremental $/Mg[d] |
|---|---|---|---|---|
| Pressure relief devices | Quarterly leak detection and repair | 4.4 | credit[e] | - |
| | Monthly leak detection and repair | 5.1 | credit[e] | 500 |
| | *Rupture disks*[f,g] | 10.0 | 510 | 1200 |
| Compressors | *Controlled degassing vents*[f] | 4.0 | credit[e] | credit[e] |
| Open-ended lines | *Caps on open-ended lines*[f,g] | 6.2[h] | 400[h] | 400 |
| Sampling Systems | *Closed purge sampling*[f] | 3.4 | 590 | 590 |
| Valves | Semi-annual leak detection and repair | 17.1 | credit[e] | - |
| | Quarterly repair leak detection and repair | 26.9 | credit[e] | credit[e] |
| | *Monthly leak detection and repair*[f] | 33.6 | 62 | 480 |
| Pumps | Quarterly leak detection and repair | 4.1 | 1200 | - |
| | *Monthly leak detection and repair*[f] | 7.6 | 610 | credit[e] |
| | Dual mechanical seal systems vented to a flare | 12.6 | 2300 | 5600 |

[a]Costs and emission reductions based on fugitive emission source counts in Model Unit B. See Section 3.2.

[b]Further discussion of control techniques can be found in Section 4.

[c]Average dollars per megagram (cost effectiveness) = (net annualized cost per component) ÷ (annual VOC emission reduction per component).

[d]Incremental dollars per megagram = (net annualized cost of the control technique - net annualized cost of the next less restrictive control technique) ÷ (annual emission reduction of control technique - annual emission reduction of the next less restrictive control technique).

[e]Values indicated as a credit denote savings. The annualized savings are presented in the text.

[f]Control technique selected as the basis for the standard.

[g]These would be the costs and emission reductions for those sources not already controlled: 75 percent of the safety/relief valves per process unit and nearly all open-ended lines are controlled in the absence of standards.

[h]This cost and emission reduction represent the values if open-ended lines were not controlled in the absence of standards.

a quarterly leak detection and repair program. Rupture disks achieve an additional 4.9 Mg/yr emission reduction at a cost of $1200/Mg compared to a monthly leak detection and repair program. The $1200/Mg incremental cost of achieving this 4.9 Mg/yr of emission reduction is reasonable. The 4.9 Mg/yr is about 7 percent of the total emission that can be reduced by the standards in a model unit B. Thus, the control equipment was selected as the basis for the pressure relief device standard.

Compressors. Only one control technique can be considered for compressor seals: the installation of equipment such as control of barrier fluid systems. As explained in the AID, if a compressor is found leaking, the repair procedure would be the installation of control equipment. Because compressors are not generally spared, repair would be delayed until the next turnaround, thereby reducing the effectiveness of a leak detection and repair program to essentially zero. The installation of control equipment results in a cost savings of $100/Mg, indicating that the value of product retained by controlling the barrier fluid system exceeds the cost of the control equipment. This cost is reasonable, and, therefore, control equipment was selected as the basis for the standard for compressors.

Open-ended Lines. EPA considered caps or closures as the control technique for the standard for open-ended lines. Caps and closures are in wide-spread use in SOCMI and are expected to be used even more frequently in new SOCMI units. The cost and emission reduction presented in Table 3-1 are the cost and emission reduction which would be realized for open-ended lines that are not controlled. The $400/Mg cost for controlling the fugitive emissions of VOC from open-ended lines is reasonable.

Sampling Systems. Closed purge sampling is the control technique for the standard for sampling systems. Closed purge systems are becoming increasingly common in the chemical industry. The $590/Mg cost for fugitive emissions of VOC from sampling systems is reasonable.

Valves. Several leak detection and repair programs were considered for valves. The programs differed in the monitoring frequency which would be implemented. As Table 3-1 shows, the lowest average cost per Mg of VOC and the lowest incremental cost per Mg of VOC is associated with the quarterly program (a cost savings of $41/Mg of VOC on the average). However, the largest emission reduction is associated with the monthly program at an average cost per Mg of VOC of $62. Furthermore, the incremental cost per Mg VOC emissions reduced for the monthly program is $480 per Mg with an incremental emission reduction of 6.7 Mg/yr. EPA considers these costs to be reasonable. Therefore, EPA selected a monthly leak detection and repair program as the basis for the standard for valves.

Pumps. The control costs incurred for each megagram of VOC emissions reduced and emission reductions achieved were determined for two leak detection and repair programs and the use of dual mechanical seals with controlled degassing vents. Both leak detection and repair programs incur lower costs than the costs which would be incurred with equipment installation. The lowest average and incremental costs per Mg are associated with a monthly leak detection and repair program. The monthly program achieves a higher degree of control than the quarterly program at an incremental cost of $25/Mg of additional VOC, but it achieves a lower degree of control than installation of control equipment. However, even though control equipment provides for the greatest amount of VOC reduction, the $5000/Mg incremental cost to obtain the 5 Mg/yr is judged unreasonably high. Because the costs for equipment are unreasonably high, monthly leak detection and repair was selected as the basis for the standard for pumps.

Economic Impact Considerations. At proposal, an economic analysis was performed which evaluated the economic impacts of the standards. None of the comments on this analysis showed significant adverse impacts on SOCMI due to the standards. Since proposal, EPA has reconsidered the economic impact of the standards. The results continue to show no unreasonable impact. The economic impact analysis is discussed in Chapter 9 of the BID for the proposed standards and in Section 7.2 of this document.

### 3.1.2 Other Comments Concerning the Selection of Standards

Comment:

One commenter (IV-D-17) interpreted EPA's choice of the most stringent Regulatory Alternative to mean that EPA deemed 85 to 90 percent control acceptable, and, therefore, EPA chose Regulatory Alternative IV because it achieved 87 percent control.

Response:

The commenter misinterpreted EPA's actions in choosing Regulatory Alternative IV for the proposed standards. The choice did not depend on a particular level of control or on a predetermined acceptable cost limit. As explained before, the most stringent controls which were economically reasonable were chosen. The controls for each Regulatory Alternative were chosen first. Then, the expected emissions reductions and the costs were estimated. The emission reduction estimates presented in the BID for that level of control happened to be about 87 percent and resulted in a reasonable economic impact.

As indicated in Section 3.5.1, in choosing the final standards EPA has looked at revised cost estimates and revised emission reduction estimates for each fugitive emission source to which the standards would apply. The cost-effectiveness values were considered in selecting the final standards. After an initial selection of final standards, the economic impacts associated with the selected standards were analyzed and were found to be reasonable.

Comment:

Another comment concerned the establishment of the baseline level of control. A commenter (IV-D-28) wrote that EPA presumes that the equipment prescribed by the proposed rule would not be used in its absence. This presumption is incorrect because of the greater use of these methods in new plants than in older designs. The commenter indicated that this fact reduces the expected benefits of the proposal. He added that EPA offers no data on the current extent of usage for dual seals, rupture discs, or monitoring programs. Any benefit projected as a result of implementation is, therefore, only speculative. The commenter also stated that various other regulations are in effect which will also control VOC emission independently of this regulation. The use of Regulatory Alternative I, i.e., results of no action, baseline is, therefore, incorrect.

Response:

The commenter is apparently confused about the definition of baseline. The baseline level is representative of current industry practice. EPA's data are very recent and do represent current industry practice. Therefore, the baseline is appropriately chosen.

Baseline control was discussed in the BID, p. 3-17 through 3-21. Included is a discussion of the extent to which monitoring programs are currently used. Information on current control levels for pumps and rupture discs is presented in Chapter 3 of the AID.

It should also be noted that in the final selection of the standards, comparisons of cost effectiveness were made on an incremental basis, not on a baseline basis. Because of the method used in the final choice of the standards, the baseline level has little, if any effect on the selection of the standards.

3.2 EMISSION FACTOR DEVELOPMENT

Numerous comments[a] were received on the interpretation and use of available fugitive VOC emissions data in assessing impacts of regulatory alternatives on SOCMI. An analysis of the available studies is presented in the Additional Information Document (AID) for fugitive VOC emissions (III-B-2) released previously. The studies were compared and considered with regard to their applicability to fugitive emissions and to SOCMI.

As discussed in the AID, the percent of fugitive emission sources which leak and the quantity of emissions from these leaking sources are the primary factors which influence the quantity of VOC emissions from fugitive emission sources. EPA still considers data from petroleum refineries (II-A-26) appropriate in estimating the quantity of VOC emissions from sources which leak, except for valves in gas service. The data from petroleum refineries were gathered for the purpose of developing emissions estimates from fugitive emission sources. Even though data gathered during the Maintenance Study (IV-A-10) were not gathered for the purpose of estimating emissions, they have been used to estimate emissions from valves in gas service.

[a]IV-D-1; IV-D-6; IV-D-7; IV-D-13; IV-D-15; IV-D-17; IV-D-21; IV-D-26; IV-D-28; IV-D-40; IV-D-43; IV-D-50; IV-F-1, No.1; IV-F-1, No.3.

The percent of fugitive emission sources which leak was based on data gathered during the SOCMI 24-Unit screening study (IV-A-11). The 24 units screened are a cross-section of process units in SOCMI but are not a representative selection of process units. Even though the 24 units screened are not necessarily representative of all SOCMI units, EPA decided that the percent of leaking sources determined in this study could be used in combination with quantities of mass emissions from leaking sources to develop average emission factors.

The average emission factors used in the Background Information Document (BID) (III-B-1) are compared in Table 3-2 to those factors developed in the AID. The complete data analysis, evaluation of studies, and comparison of emission factors are presented in Section 2 of the AID. Comments on the AID and EPA's responses to those comments are presented in Appendix A.

Comment:

Several commenters (IV-D-26; IV-D-28; IV-D-13) cited a paper by Monsanto Research Corporation (MRC) in supporting their contention that petroleum refineries and SOCMI were different. One commenter (IV-D-28) pointed out the fact that the report had been disregarded by EPA because the results were not comparable.

Response:

As explained in the BID and the AID, the results of the MRC study were analyzed. The study was performed in a manner that prevented comparisons between it and other studies. Therefore, the results were not useful in performing an analysis for regulatory purposes. The usefulness of the MRC study was in the fact that it pointed out the necessity for doing more work, which EPA did (see II-B-34 for a discussion of limitations of the study).

Comment:

Two commenters cited work done in their own plants (IV-D-6; IV-D-13) showing leak frequencies for an acrylonitrile unit and a chlorinated hydrocarbon unit which were lower than leak frequencies determined in petroleum refineries.

TABLE 3-2. COMPARISON OF EMISSION FACTORS, kg/hr/source

| Source | AID | BID |
|---|---|---|
| Pumps - light liquid | 0.0494 | 0.114 |
| - heavy liquid | 0.0214 | 0.021 |
| Valves - gas | 0.0056 | 0.0268 |
| - light liquid | 0.0071 | 0.0109 |
| - heavy liquid | 0.00023 | 0.00023 |
| Compressors | 0.228 | 0.636 |
| Pressure relief devices - gas | 0.104 | 0.16 |
| Flanges | 0.00083 | 0.00025 |
| Oper-ended lines | 0.0017 | 0.0023 |
| Sampling connections | 0.0150 | 0.0150 |

One of the commenters (IV-D-13) said that studies done in his own plant showed emissions from pumps to range from 6.8 to 9.5 g/hr. He pointed out that both these estimates are significantly different from EPA's rate of 120 g/hr.

Response:

It is certainly conceivable that these lower leak frequencies and emission rates exist. As discussed in the AID, SOCMI contains units with very low fugitive emission rates and units with very high fugitive emission rates. Individual units would be expected to fall within a range of leak frequencies and mass emission rates. The selection of leak frequency and leak rate information to be used as the basis for estimating impacts of the standards on SOCMI are discussed in detail in the AID.

Comment:

Inherent differences in the operations and the materials handled were also offered as supporting arguments for SOCMI's being different from petroleum refineries. As an example of the differences between refinery and SOCMI plants, one commenter (IV-D-15) cited the large number of sources tested in SOCMI that had visible solid residue. Such residue was considered an indication of possible leaks, but no VOC emissions were measured.

Another comment letter (IV-D-17) said because of the broad spectrum of materials within SOCMI, having a wide variation in physical and chemical properties, the emission rates would be expected to vary from SOCMI sector to sector as well as from the refining industry rate.

Another commenter (IV-D-6) cited differences in toxicity and hazardousness of SOCMI chemicals as compared to refinery streams. With chemicals, the commenter said, the exclusion of $O_2$ and explosive concerns dictate operating and design practices. In SOCMI facilities the toxicity of chemicals often controls design and operating practices. These design and operating practices, he said, are even more different because they are influenced by OSHA regulations.

Another commenter (IV-F-1, No. 3) said refineries are characterized by much more strenuous conditions, larger equipment, higher temperatures, and outdoor continuous processes. The chemical industry on the other hand was said to be characterized by smaller batch-type equipment, indoor operation, more valuable products, and less strenuous conditions. Another commenter (IV-D-21) added that these differences are borne out in EPA's own data. He said leak frequencies for high volume SOCMI chemicals such as ethylene are somewhat similar to refinery data. According to the commenter, smaller volume chemicals often produced in batch operations, such as ethylene dichloride processes, have significantly lower emission rates.

Another commenter (IV-D-13) said the value of products in SOCMI is higher than the value of products in refineries; therefore, the fugitive losses are kept under better control in SOCMI.

Response:

As the commenters pointed out, there are some apparent differences between petroleum refinery and SOCMI data. These apparent differences may be due to reasons suggested by the commenters or to other unknown reasons. As stated in the AID, the reasons for the differences are not clear. There is not conclusive evidence to show why such differences are seen. The reasons cited by the commenters are generalizations which do not adequately describe differences between the industries. Many SOCMI processes are outdoor, high-temperature high-pressure processes.

No matter what the reasons are that the most recent data suggest lower emissions from SOCMI, EPA recognized the difference and the estimates of impacts of the standards have been revised. In general, the comparison between SOCMI and petroleum refineries is not appropriate. The determination of best demonstrated technology was performed separately for the two industries. Since the determinations of what constitutes best demonstrated technology were performed independently for the two industries, comparisons of the two industries do not yield useful information.

Comment:

One commenter (IV-D-6) noted an apparent error in the data interpretation in the EPA data base. He pointed out that different values of K, the factor used to correct the units for variables in the emission rate equation, is reported by the EPA contractor in separate documents. The commenter indicated that these values are different from those used by his company. He stated that if these erroneous factors have been used, the reported emission rates are five times higher than actual. The commenter added that evaluation of pump seal literature suggests that this error exists throughout the entire data base.

Another commenter (IV-D-21) wrote that EPA has used inconsistent and, in some cases, inaccurate conversion constants ($K_1$) in evaluating both the SOCMI and refining study data. He charged that these inaccuracies and inconsistencies call into question the validity of both the refining and SOCMI data used as the basis for the proposed NSPS.

Response:

As noted in Docket Item Entry IV-B-7, the computations have been checked and the rates calculated in the refinery assessment study are correct. Unfortunately, the equation as written on page 124 of Appendix A of the refinery assessment report (EPA-600/2-80-076b) contains several errors. The corrected equation is printed below.

CORRECTED EQUATION FOR HYDROCARBON EMISSION RATE

$$E_H = \frac{KQPM_A\ (C_s - C_a)_H}{T}$$

where

$E_H$ = hydrocarbon emission rate, methane and/or nonmethane, lb/hr

K = $2.75 \times 10^6$, conversion factor

Q = flow rate of gas through sample train, CFM

P = sampling system pressure at the dry gas meter, in. Hg

$M_A$ = molecular weight of the air/hydrocarbon gas mixture

T = temperature of the gas stream at the dry gas meter, K

$C_s$ = concentration of methane/nonmethane hydrocarbon in the gas sample from the sampling train, ppm by weight

$C_a$ = concentration of methane/nonmethane hydrocarbon in the ambient air, ppm by weight

EPA has reviewed these computations and is satisfied that they are correct.

## 3.3 MODEL UNITS

The model units developed for SOCMI serve as the basis for aggregating emissions estimates to evaluate the overall impact of regulatory alternatives. They also provide a means of estimating nationwide impacts. A few commenters[a] questioned the development of model units based on process complexity instead of production rate.

The basis for development of the model units was detailed in the AID. A comparison was made between the equipment counts in the units screened in the SOCMI 24-unit screening study (IV-A-11) and in the model units. EPA did not change the model units presented in the BID. But EPA did revise some equipment counts to represent the current level of emissions control reported in SOCMI and to clarify some previous confusion. Comments on the development of model units presented in the AID and EPA's responses to those comments are included in Appendix A. The model units used in the BID and those presented in the AID are compared in Table 3-3. The equipment counts embodied in the model units are used with the emission factors in Table 3-2 to determine the environmental impacts presented in Section 6.

## 3.4 EMISSION REDUCTIONS

The effectiveness of the standards is evaluated, in part, by the emissions reductions achievable by the various regulatory options for the different fugitive emission sources in SOCMI. The control techniques comprising these options are discussed in Section 4. The basis for estimating the effectiveness of control techniques was presented in detail in Section 4 of the AID. Comments on the technical analysis presented in the AID and EPA's response to those commenters are included in Appendix A.

Key elements in the standards are leak detection and repair programs. Such programs are useful in reducing emissions from valves and pumps. The technique used in estimating the effectiveness of these programs in the BID was based primarily on some engineering judgments concerning occurrence, recurrence, and repairability of leaking valves.

During the development of these standards, additional data were gathered to permit an improved evaluation of these phenomena with respect to reducing fugitive VOC. An evaluation was made of the available data on leak

[a] IV-D-38; IV-D-40.

TABLE 3-3. EQUIPMENT COUNTS FOR FUGITIVE VOC EMISSION SOURCES IN SOCMI MODEL UNITS

| | Number of Equipment Components[b] | | | | | |
|---|---|---|---|---|---|---|
| | BID Analysis | | | Revised Analysis | | |
| Equipment Component[a] | Model Unit A | Model Unit B | Model Unit C | Model Unit A | Model Unit B | Model Unit C |
| Pump Seals | | | | | | |
| Light Liquid Service | | | | | | |
| Single mechanical | 5 | 19 | 60 | 5 | 19 | 60 |
| Dual mechanical | 3 | 10 | 31 | 3 | 10 | 31 |
| Sealless | 0 | 1 | 1 | 0 | 1 | 1 |
| Heavy Liquid Service | | | | | | |
| Single mechanical | 5 | 24 | 73 | 5 | 24 | 73 |
| Packed | 2 | 6 | 20 | 2 | 6 | 20 |
| Valves | | | | | | |
| Vapor service | 90 | 365 | 1117 | 99 | 402 | 1232 |
| Light liquid service | 84 | 335 | 1037 | 131 | 524 | 1618 |
| Heavy liquid service | 84 | 335 | 1037 | 132 | 524 | 1618 |
| Safety/relief valves | | | | | | |
| Vapor service | 11 | 42 | 130 | 11[c] | 42[c] | 130[c] |
| Light liquid service | 1 | 4 | 13 | 1 | 4 | 13 |
| Heavy liquid service | 1 | 4 | 14 | 1 | 4 | 14 |
| Open-ended lines | | | | 104[d] | 415[d] | 1277[d] |
| Vapor service | 9 | 37 | 115 | | | |
| Light liquid service | 47 | 189 | 581 | | | |
| Heavy liquid service | 48 | 189 | 581 | | | |
| Compressor seals | 1 | 2 | 8 | 1[e] | 2[e] | 8[e] |
| Sampling connections | 26 | 104 | 320 | f | | |
| Controlled | | | | 19 | 78 | 240 |
| Uncontrolled | | | | 7 | 26 | 80 |
| Flanges | 600 | 2400 | 7400 | 600 | 2400 | 7400 |

[a]Equipment components in VOC service only.

[b]52% of existing units are similar to Model Unit A.
33% of existing units are similar to Model Unit B.
15% of existing units are similar to Model Unit C.

[c]Seventy-five percent of gas safety/relief valves are assumed to be controlled at baseline; therefore, the emissions estimates are based on the following counts: A,3; B,11; C,33.

[d]All open-ended lines are considered together with a single emission factor; 100% are controlled at baseline.

[e]Emission factor estimate incorporates 60 percent control; cost estimates are based on the following counts: A, 0.4; B, 0.8; C, 3.2.

[f]75% controlled.

occurrence, recurrence, and repair effectiveness in the AID. In addition, a model based on recursive equations (LDAR) was developed for evaluating leak detection and repair programs (IV-A-22). In the AID, this model was compared to the model used in the BID (ABCD) and to the BID model with an improvement suggested by industry commenters. EPA determined that the LDAR model more appropriately represented the leak detection and repair programs that are part of the SOCMI standards.

In order to evaluate the effectiveness of leak detection and repair programs for pressure relief devices, some estimate of the efficiency of these programs must be made. The LDAR model, presented in the AID, is a better indicator of effectiveness for leak detection and repair programs than the approach used in the BID for estimating program effectiveness. However, the LDAR model, which was used for valves and pumps, requires occurrence and recurrence rates, which were not determined for pressure relief devices. The ABCD model presented in the BID was based on estimates that may not be representative of the actual situation, considering the comparison of the results of these models for valves and pumps. Therefore, the LDRP effectiveness for pressure relief devices was estimated using the effectiveness for gas service valves based on the LDAR model multiplied by the ratio of the effectiveness for pressure relief devices based on the ABCD approach to effectiveness for gas service valves based on the ABCD approach (IV-B-19).

The efficiencies of controlling the other emission sources were not changed from the ones presented in the BID. The control effectiveness of the techniques on which the emissions reductions are based are summarized in Table 3-4. These values are used in Section 6 to determine the overall effectiveness of the standards in reducing fugitive VOC emissions.

## 3.5 FORMAT OF STANDARDS

Comments on the format of the standards included several requests for regulations in different formats. These requests included:

- performance standards for valves
- equivalent equipment and work practice standards for valves
- work practice standards for pumps

TABLE 3-4. SUMMARY OF CONTROL EFFECTIVENESS FOR SOCMI FUGITIVE EMISSION SOURCES

| Emission Source | Type of Standard | Control Technique Applied | Control Effectiveness (decimal percent) |
|---|---|---|---|
| Pump seals | | | |
| - light liquid | Work Practice | Monthly leak detection and repair | 0.61 |
| Valves | | | |
| - gas | Work Practice | Monthly leak detection and repair | 0.73 |
| - light liquid | Work Practice | Monthly leak detection and repair | 0.46 |
| Pressure relief devices | | | |
| - gas | Performance | Tie to flare; rupture disk | 1.0 |
| Open-ended lines | | | |
| - all services | Equipment | Caps, plugs, blinds | 1.0 |
| Compressor seals | Equipment | Mechanical seals with vented degassing reservoirs | 1.0 |
| Sampling connections | Equipment | Closed purge sampling systems | 1.0[a] |
| Control device | Design | Incinerator, vapor recovery system, flare | 0.95[a] |

[a]Where a control device is applied as supplement to equipment, e.g. for compressor seals, the control effectiveness of the equipment is reduced from nearly 100 percent by the 95 percent effectiveness of the control device.

- performance standards for pumps and compressors
- performance standards for sampling systems

Other comments regarding format of the standards included one concerning complexity of the standards, several suggesting that concentration limits are a performance standard format, and one requesting separate standards for separate equipment types.

### 3.5.1 Performance Standards for Valves

Comment:

Two commenters (IV-F-1, No.4; IV-D-21) requested that a performance standard be set for valves in addition to the work practice standard.

Response:

A performance standard offers more flexibility to industry and, in that regard, allows for more innovative control techniques. However, as explained in the preamble to the regulation (46 FR 1136), for most SOCMI fugitive emission sources, it is not feasible to prescribe an emission limit performance standard. Except in those cases in which a standard can be set at "no detectable emissions," the only way to measure emissions from SOCMI fugitive emission sources such as valves would be to use a bagging technique for each of the valves in a process unit. The great number of valves and their dispersion over large areas would make such a requirement economically impracticable. Therefore, EPA did not select this format for the standards.

Another approach to prescribing a performance standard would be to specify a number or percent of fugitive emission sources (valves) that would be allowed to leak. This approach would be more qualitative than an approach based on quantitative emission measurements such as bagging. This format would be based on a leak frequency limit rather than an emission limit and would have some of the same benefits of flexibility. The only fugitive emission source for which a leak frequency limit would be applicable is valves because other fugitive emissions are too few in number to allow a meaningful percent to be determined. The variability in the percentage of valves leaking among process units precludes the setting of an allowable percentage of valves leaking which could be achieved by all process units within SOCMI (see Section 14). This variability is observed even among units in which leak detection and repair programs are being implemented. Even so, establishing an allowable percentage of valves leaking may be feasible for some process units. EPA has effectively provided the flexibility afforded by a performance standard while allowing for the variability within the industry, by providing an alternative standard which is an allowable percentage of valves leaking. Alternative standards are explained in more detail in Section 14.

Comment:

One commenter (IV-F-1, No.4), in requesting that a performance standard be set for valves in addition to the work practice standard, recommended a leak frequency of 2 percent be considered as equivalent to the standard as proposed. He cited work by Snee and Kittleman of DuPont as the basis for the 2 percent figure.

Response:

Mr. Kittleman and Dr. Snee have been very active proponents of the use of statistical sampling plans called skip-period plans (II-B-26; II-D-87; IV-D-1). One of the requirements of the plans is the establishment of a "good performance level." Based on data presented in the SOCMI BID for quarterly monitoring, they have recommended that a leak frequency of 2 percent be considered a good performance level for such plans. The commenter is recommending that this recommended good performance level be adopted as the compliance level for a performance standard which specifies an allowable percentage of valves leaking.

A good level of performance based on the percent of valves found leaking cannot be established for all process units. But it may be achievable by some units and may be readily achievable by employing a less frequent leak detection and repair program than is required under the non-optional standards. Therefore, EPA has set an allowable percentage of valves leaking for the alternative standard at 2 percent. Alternative standards are discussed in detail in Section 14.

While agreeing with Mr. Kittleman and Dr. Snee that the compliance level should be 2 percent, EPA differs in the manner in which the determination was made. Using the estimates for occurrence and recurrence of valve leaks presented in the BID, (p.4-10), Mr. Kittleman and Dr. Snee compared the estimates of initial leak frequency and leak frequency after a quarterly leak detection and repair program had begun to arrive at 90 percent reduction in the number of leakers. They assumed this level of control as an acceptable level which should be targeted. The quarterly comparison was chosen from a table showing monthly, quarterly, and annual estimates. The estimates were made solely for purposes of comparison of regulatory alternatives and were based on engineering judgment. They were not presented as acceptable or actual levels.

The standards for valves are based on a monthly leak detection and repair program. Using the LDAR model (IV-A-22) for leak detection and repair programs, EPA examined the cost and effectiveness of monthly programs applied to process units exhibiting various leak frequencies for valves. Leak frequencies associated with high cost effectiveness were identified. And the corresponding statistical level of performance was computed. The compliance level of 2 percent that is the basis of the alternative standards was selected to exempt units exhibiting low leak frequencies and consequently high cost/effectiveness ratios.

Comment:

Another commenter (IV-D-21) who requested a performance standard for valves wrote that the proposed work practice standards fail to provide for innovative technology and fail to provide true incentives to reduce VOC fugitive emissions. He said that a facility would be judged in compliance if all monitoring was performed, all records kept, and all reports made even if all monitored equipment was found to leak at each subsequent inspection. The commenter concluded that the work practice approach would not result in significant control of VOC fugitive emissions.

Response:

EPA believes that effective emission reductions can be achieved through the required work practices. Records of the activities performed under such a standard will serve as an indicator of the diligence of the owner or operator in performing the required work practices. Using these records as an indicator, compliance with the work practices can be judged. The commenter is correct in stating that using the work practice standard approach, a unit would not be in violation if a leak were found. Rather, the unit clearly would be in violation if no attempt was made to repair it. This requirement for repair is the incentive for reducing emissions. Test results (IV-A-10) show that attempting repair of leaking valves results in 71 weight percent reduction in emissions. Furthermore, successful repair of leaks (i.e., reducing the screening value below 10,000 ppmv) reduced mass emissions by 98 percent and even unsuccessful repair (i.e., attempted repair not reducing the screening value below 10,000 ppmv) reduced mass emissions by 63 percent. Therefore, effective emission reduction is expected under the work practice standard.

EPA has provided two alternative standards for valves (see Section 14). These alternative standards provide flexibility to the owner or operator in meeting good performance levels based on the number (or percent) of leaking valves found in a process unit. They are similar to performance standards in providing initiatives for innovative control techniques. The owner or operator may use any other program for leak detection and repair, provided equivalency with the valve standards is established.

Comment:

One commenter (IV-D-17) recommended a performance standard in the form of a required percentage of reduction in fugitive VOC emissions. He reasoned that this approach would allow a unit to develop a program incorporating equipment or monitoring or both to achieve the required reduction at the least cost. He referred to this approach as the "bubble concept." The commenter noted that the relationship between screening values and emission rates could be used to determine total emissions and emission reductions.

Response:

A major goal of the SOCMI fugitive VOC NSPS is to reduce emissions of VOC from all fugitive emission sources throughout the industry. Since these are new source standards, an inherent purpose is to build new process units that would have low emissions. To implement a performance standard based on a percentage reduction in fugitive VOC emissions, the total uncontrolled emissions for the new process unit would need to be determined. This procedure seems inappropriate for a new process unit that, in order to meet the objectives of these standards, would have incorporated some fugitive emissions control devices in the original design. Under the suggested performance standard, a new process unit that incorporates effective fugitive emissions control features into its original design would be penalized by having to meet a more stringent emissions level than a process unit that did not include such controls originally.

As discussed in the proposal and in the previous responses, a performance standard for valves was not possible as the basis of the standards for valves. EPA has provided an alternative standard for valves that allows a unit to meet and maintain a performance level of 2 percent valves leaking (see Section 14). EPA believes this alternative standard provides the type of standard recommended by the commenter.

The commenter also suggested using the relationship between screening value and emission rate to determine emissions and emission reductions. These relationships were developed for all sources in petroleum refineries and for pumps and valves (gas and light liquid) in SOCMI. The uncontrolled emissions on which the suggested performance standard would be based would have to be determined for each affected unit. Determining total emissions in this manner would be extremely time consuming and the results would be inaccurate. Furthermore, SOCMI represents a wide variety of processes, and results of fugitive emissions studies indicate that emissions (leak frequency and emissions rate) vary with process type (IV-A-14). EPA has considered this variability in emissions characteristics by source and process in setting the standards. Flexibility in the emissions control techniques is provided by considering each source individually and providing a format appropriate to that source (see other responses in this section). For example, alternative standards for valves have been provided that permit a process unit to comply with a performance standard based on the percentage of leaks in the unit.

3.5.2 Equivalent Equipment and Work Practice Standards for Valves

Comment:

One commenter (IV-F-1, No.4) recommended that if a performance standard for valves is not possible, at the least, equipment and equivalent work practice standards should be set. He said that allowing equivalent compliance alternatives would allow the industry the flexibility necessary to design and implement the most efficient and economical compliance programs.

Response:

As previously discussed, compliance with a performance standard for valves is not being required. The alternative standards for valves (see Section 14), however, do provide a performance standard as requested by the commenter. In addition, an alternative work practice standard provides for a statistical skip-period leak detection and repair program. The plans would allow skipping inspections as long as a good performance level has been maintained for a series of inspections and continues to be maintained at each subsequent inspection.

An equipment standard for valves was considered as explained in the preamble to the proposed regulation (46 FR 1145). Leakless equipment, such as diaphragm valves and bellows-sealed valves were not selected as the standard for valves because of their limited applicability. However, as noted, use of these valves would be at least equivalent and is allowed. Valves of this type would be required to operate with no detectable emissions and would be subject to an annual performance test, but they would be exempt from the monthly leak detection and repair requirements for conventional valves.

3.5.3 Work Practice Standards for Pumps and Compressors

Comment:

Several commenters requested that an alternative work practice standard be set for pumps and compressors (IV-F-1, No.4; IV-D-17; IV-D-16; IV-D-17). The commenters cited flexibility, efficiency, and economics as reasons for the request.

Response:

EPA has determined that a work practice standard for pumps which requires monthly leak detection and repair within 15 days is a reasonable alternative to dual seals equipped with a non-VOC barrier fluid system. The technical applicability of such programs for pumps is discussed in Section 4. The effectiveness and cost of leak detection and repair programs for pumps were examined in the AID (III-B-2).

EPA also considered a work practice standard for compressors. Examination of information on existing compressors indicated most were already using the required equipment and only retrofits of seals to existing reciprocating equipment would be technically impractical (see Section 4.12). The number of compressors in a process unit was small compared to the number of pumps as well, and compressors did not generally have spares. The absence of a spare would make repairs difficult, if not impossible, without a unit shutdown, and allowing a compressor to leak until shutdown would severely reduce the effectiveness of a leak detection and repair program. EPA concluded that the equipment standard proposed for compressors would provide the highest degree of control at a reasonable cost and the equipment standard was selected as the final standard.

### 3.5.4 Performance Standards for Pumps and Compressors

Comment:

Several commenters requested a performance standard for pumps and compressors (IV-D-6; IV-D-20; IV-D-17). The reasons given included flexibility, efficiency, and cost-effectiveness.

The wide variability within the industry was cited by one of these commenters (IV-D-6) as one reason why a single standard was technically infeasible. Another reason given by this commenter for a performance standard was that it would make the VOC regulations compatible with OSHA actions and prevent duplication of federal activities and needless cost to industry. The same commenter cited an example for an acrylonitrile plant owned by his company where the equipment standards as proposed for pumps would be difficult to comply with.

Response:

As noted in the preamble to the proposed regulations (46 FR 1143-1145), performance standards based on emission limits were not possible for pumps and compressors because of technological and economic limitations. Moreover, it was not possible to set concentration limit performance standards based on concentration limits. Even pumps and compressors using the equipment required by the standards have the potential to leak and any leak would be a violation of such a performance standard. Additionally, there are too few pumps and compressors to set a meaningful percent leaking performance standard.

EPA has provided a work practice standard for pumps and has established the equipment standards as alternative control techniques for pumps. In addition, the equipment standards as proposed allow for several options. Dual mechanical seals of any configuration with pressurized or non-pressurized barrier fluid systems or an enclosed and vented seal area were all offered for pumps. Compressors can be controlled by using any type seal with a barrier fluid or enclosed and vented seal areas.

EPA believes that the standards for pumps and compressors are reasonable and allow all owners or operators of affected facilities to comply. The standards incorporate provisions for complying by using sealless equipment, dual seals with barrier fluid systems, or vented seal areas without requesting permission or an equivalency determination. EPA has also provided equivalency procedures for these standards that permit an owner or operator of a process unit to comply with other requirements if the other requirements are shown to provide emissions reductions equivalent to the required equipment standards. The technical problem cited by the commenter in Docket Item No. IV-D-6 is addressed in Sections 4.8 and 4.12.

3.5.5 Performance Standard for Sampling Systems

Comment:

One commenter (IV-D-6) recommended that a performance standard be established for sampling systems. He felt there were better methods of sampling which could not be used under the proposed regulations which could be used without discussion if a performance standard were established.

Response:

As explained in the preamble to the proposed standards (46 FR 1145), an emission limit was not specified because measuring mass emissions from each sampling system would require bagging each system, a measurement method which is time-consuming, costly, and impractical. The standard for emissions from sampling systems concerns the material purged prior to collection of the sample; it does not cover the sample material. Emissions from this purged material cannot be easily measured. Furthermore, a no detectable emissions limit is not feasible because some VOC could be emitted during the transfer of sample to a collection device or during its disposal.

The standard for sampling systems was proposed as an equipment standard. The final regulation has been modified slightly to take the form of an operational standard. Essentially, any sampling system which collects purged material and returns it to the process or disposes of it properly and which eliminates emissions of purged material to the atmosphere would be acceptable. EPA recognizes the fact that some VOC may be emitted when disconnecting a sample container. These small amounts of emissions are allowed, but the sample purge must be destroyed or recycled to the process. Discarding the sample purge to an open drain system is not allowed under the standards. Sampling systems are treated in more detail in Section 4.9.

### 3.5.6 Emission Limit vs. Concentration Limit

Comment:

Several commenters (IV-D-16; IV-D-7; IV-D-17) pointed out that a performance standard need not be in the form of an emission limit. They said that a performance standard could also take the form of a concentration limit.

Response:

Performance standards establish a numerical emission limit that place an upper limit on the amount of pollutant mass allowed from a source. The amount of mass is generally set as a mass rate per unit time, as a mass per unit of production, or as a mass per unit of exhaust gases (concentration). In some cases, these limits can be closely correlated with other measurements such as opacity as is the case for particulate matter. Opacity and mass emission rates are related by physically measureable parameters found in exhaust gases from many industrial processes. These parameters can be reasonably defined for opacity and mass emission rates.

These parameters are not precisely defined for concentrations measured by Reference Method 21 and fugitive emission rates. The variability among process units makes it impracticable to set a limit or allowable percent leaking for all emission sources. It may be practicable to set a lower limit for valves, however, to remove unreasonable costs. If the variability for valves is controlled by operators to reduce the longer-term average percent leaking to less than 2.0 percent, then routine monthly leak detection and repair have unreasonable costs. And a performance level can be established to exclude units with too few leaks for control with reasonable cost. Therefore, a performance standard generally is not technically practicable for many sources of fugitive emissions, but it is possible to set a lower limit which excludes low-leaking plants.

The intent of the standards is to reduce fugitive VOC emissions by finding and repairing fugitive emission leaks or preventing them from occurring. It is not the intent to allow fugitive emission sources to continue leaking, thereby emitting VOC. Standards have been provided that allow the owner or operator to meet the objectives of the standards with a variety of control options. For example, EPA has provided a performance standard for valves by setting a performance level of 2 percent leaking that can be met as an alternative to the normal valve standard. EPA believes that this was what the commenter was seeking in making his recommendations.

3.5.7 Complexity of the Standards

Comment:

One commenter (IV-D-11) asked that the regulations be simplified. He asked if the desired objectives could be achieved with simpler regulations.

Response:

The basic concept underlying the fugitive VOC emission standards is one of finding leaks and repairing them or of preventing them from occurring. The concept is simple and no one has challenged the desirability or appropriateness of this philosophy. Complexity arises in incorporating this philosophy in the regulatory framework. For regulatory purposes, it is necessary to lay out rules governing methods, frequency, and degree of control. It is also necessary to write the rules in sufficient detail to prevent misunderstandings between industry and EPA. The required detail is increased by considering the range of affected facilities to which the standard applies. Still further complexity is introduced in endeavoring to fit the regulation to various situations which provide more effective control than the requirements in the standards, and thereby allow industry sufficient flexibility.

An optimum balance between simplicity and flexibility is desirable. EPA has sought to achieve this balance in the standards. For example, since proposal, EPA has provided a work practice standard for pumps and has simplified and clarified alternative standards for valves.

# 4. CONTROL TECHNOLOGY

This section addresses comments received on the technical aspects of the control technologies considered for reducing fugitive VOC emissions from SOCMI. Twelve technology areas are discussed in the following sections:

4.1 Flares
4.2 Leak Detection and Repair Programs
4.3 Leak Definition
4.4 Safety Considerations
4.5 Pressure Relief Devices
4.6 Combustion Device
4.7 No Leak Equipment
4.8 Dual Seals
4.9 Sampling Systems
4.10 Closed Vent System
4.11 Open-ended Lines
4.12 Reciprocating Pumps and Compressors

## 4.1 FLARES

Several commenters expressed the desire to use flares as alternatives to enclosed incinerators or vapor recovery systems. The comments focused on six areas of concern: (1) data base support of low flare efficiency; (2) high efficiencies reported for flares on refinery gases; (3) alternative flare designs for low-flow applications; (4) safety considerations in choosing control systems; (5) equivalency; and (6) Executive Order 12291. Each of these areas is discussed in the following comments and responses. But an explanation of EPA's analysis and final decision on flare usage for fugitive VOC control is presented first because all the responses to the six areas of concern are prefaced by this analysis and final decision.

At proposal, flares were not considered an acceptable control option for elimination of fugitive VOC emissions. The results of studies that were available were considered inapplicable to the streams to be controlled in

SOCMI. In some studies the flare design was not representative of flares in the industry. In others the analytical method was questionable. At that time no approved method for measuring flare efficiency (evaluating flare performance) was available .

Theoretical calculations indicated that flare efficiency could be as low as 60 percent for destruction of VOC in low-flow intermittent streams sent to a large flare. This efficiency was cited in several background documents (Ethylbenzene/Styrene, Benzene Fugitive, SOCMI Fugitive VOC) and served as a primary consideration in not allowing the general use of flares. However, this theoretical computation was based on assumptions that may not be applicable to the design situation under study.

The use of flares, therefore, was reconsidered for the SOCMI standards. Commenters pointed out potential operational difficulties associated with the use of incinerators that could be avoided with the use of flares. A major difficulty seen was in designing systems for the low-volume and intermittent flow to the control device. In addition, consideration was given to the extensive use of flares by industry to handle emergency releases. Since flares are currently in widespread use in SOCMI, they represent a large investment in control by the industry.

The following presents a review of flares and operating conditions used in five studies of flare combustion efficiency. Each study can be found in complete form in the docket.

Palmer (IV-M-8) experimented with a 1/2-inch ID flare head, the tip of which was located 4 feet from the ground. Ethylene was flared at 50 to 250 ft/sec at the exit, ($0.4 \times 10^6$ to $2.1 \times 10^6$ Btu/hr). Helium was added to the ethylene as a tracer at 1 to 3 volume percent and the effect of steam injection was investigated in some experiments. Destruction efficiency (the percent ethylene converted to some other compound) was 97.8 percent.

Siegel (IV-D-17) made the first comprehensive study of a commercial flare system. He studied burning of refinery gas on a commercial flare head manufactured by Flaregas Company. The flare gases used consisted primarily of hydrogen (45.4 to 69.3 percent by volume) and light paraffins (methane to butane). Traces of $H_2S$ were also present in some runs. The flare was operated from 0.03 to 2.9 megagrams of fuel/hr (287 to 6,393 lb/hr), and the maximum heat release rate was approximately 235 x $10^6$ Btu/hr. Combustion efficiencies (the percent VOC converted to $CO_2$) averaged over 99 percent.

Lee and Whipple (IV-M-18) studied a bench-scale propane flare. The flare head was 2 inches in diameter with one 13/16-inch center hole surrounded by two rings of 16 1/8-inch holes, and two rings of 16 3/16-inch holes. This configuration had an open area of 57.1 percent. The velocity through the head was approximately 3 ft/sec and the heating rate was 0.3 M Btu/hr. The effects of steam and crosswind were not investigated in this study. Destruction efficiencies were 99.9 percent or greater.

Howes, et al. (IV-A-27) studied two commercial flare heads at John Zink's flare test facility. The primary purpose of this test (which was sponsored by the EPA) was to develop a flare testing procedure. The commercial flare heads were an LH air-assisted head and an LRGO (Linear Relief Gas Oxidizer) head manufactured by John Zink Company. The LH flare burned 2,300 lb/hr of commercial propane. The exit gas velocity based on the pipe diameter was 27 ft/sec and the firing rate was 44 x $10^6$ Btu/hr. The LRGO flare consisted of 3 burner heads 3 feet apart. The 3 burners combined fired 4,200 lbs/hr of natural gas. This corresponds to a firing rate of 83.7 x $10^6$ Btu/hr. Steam was not used for either flare, but the LH flare head was in some trials assisted by a forced draft fan. Combustion efficiencies for both flares during normal operation was greater than 99 percent.

An excellent detailed review of all four studies was done by Joseph, et al. (IV-M-20), and a summary of the studies is given in Table 4-1. A fifth study by McDaniel, et al. (IV-A-32) determined the influence on flare performance of mixing, Btu content and gas flow velocity. A steam-assisted flare was tested at the John Zink facility using the procedures developed by Howes. The test was sponsored by the Chemical Manufacturers Association (CMA) with the cooperation and support of the EPA. All of the tests were with an 80 percent propylene, 20 percent propane mixture diluted as required with nitrogen to give different Btu/scf values. This was the first work

## TABLE 4-1. FLARE EMISSION STUDIES COMPLETED AS OF OCTOBER 1982

| Investigator | Sponsor | Docket No. | Flare Tip Design | Flared Gas | Throughput $10^6$ Btu/hr | Flare Efficiency % |
|---|---|---|---|---|---|---|
| Palmer (1972) | E.I. du Pont | IV-M-8 | 0.5" dia. | Ethylene | 0.4 - 2.1 | 97.8 - >99 |
| Lee & Whipple (1981) | Union Carbide | IV-M-18 | Discrete Holes in 2" dia. cap. | Propane | 0.3 | >99.9 |
| Siegel (1980) | Ph.D. Dissertation University of Karlsruhe | IV-D-17 | Commercial Design (27.6" dia. steam) | ≈50% $H_2$ plus light hydro-carbons | 49 - 178 | >99 |
| Howes et al. (1981) | EPA | IV-A-27 | Commercial Design (6" dia. air assist) | Propane | 44 | >99 |
| | | | Commercial Design H.P. (3 tips @ 4" dia.) | Natural Gas | 28 (per tip) | >99 |
| McDaniel et al. (1982) | CMA-EPA | IV-A-32 | Commercial Design | Propylene | 0.01 - 57 | 83 - 99.9 |

which determined flare efficiencies at a variety of nonideal conditions where lower efficiencies had been predicted. All previous tests were of flares which burned gases which were very easily combustible and did not tend to soot. This was also the first test which used the sampling and chemical analysis methods developed for the EPA by Howes.

The steam-assisted flare was tested with exit flow velocities ranging from 0.02 to 60 ft/sec, with Btu contents from 200 to 2,183 Btu/scf and with steam to gas (weight) ratios varying from 0 (no steam) to 6.8611. Steam-assisted and air-assisted flares were tested with fuel gas heat contents as low as 300 Btu/scf. Flares without assist were tested down to 200 Btu/scf. This efficiency was also found to be achievable for air-assisted flares combusting gases with heat contents over 300 Btu/scf and with exit gas velocities below a maximum value (depending upon the heat content of the gas stream). All of these tests, except for those with very high steam to gas ratios, showed combustion efficiencies of over 98 percent. Flares with high steam to gas ratios (about 10 times more steam than that required for smokeless operation) had lower efficiencies (69 to 82 percent) when combusting 2,183 Btu/scf gas.

After consideration of the results of these five tests, EPA has concluded that 98 percent combustion efficiency can be achieved by steam-assisted flares with exit flow velocities less than 60 ft/sec combusting gases with heat contents over 300 Btu/scf and by flares operated without assist with exit flow velocities less than 60 ft/sec gases with heat contents over 200 Btu/scf. Flares are not normally operated at the very high steam to gas ratios that resulted in low efficiency in some tests because steam is expensive and operators make every effort to keep steam consumption low. Flares with high steam rates are also noisy and may be a neighborhood nuisance.

EPA has a program under way to determine more exactly the efficiencies of flares used in the petroleum/SOCMI industry and a flare test facility has been constructed. The combustion efficiency of four flares (1 1/2 inches to 12 inches ID) will be determined and the effect on efficiency of flare operating parameters, weather factors, and fuel composition will be established. The efficiency of larger flares will be estimated by scaling.

According to the current knowledge of flare design, the best available flare design (i.e., the state-of-the-art flare design) is the smokeless flare. The smokeless flare introduces air into the flame by injection of steam or air. This injection of steam or air increases the mixing of the flared compounds within the flame zone thereby increasing the destruction of the compounds. Smoking flares are environmentally less desirable because they emit particulate. It is difficult, however, to maintain smokeless operation unless the off-gas flow to the flare is constant. When the off-gas flow rate increases, there is a short period of time before the smoke sensor responds and additional steam (or air) reaches the flare tip. During this period, the flare smokes. Smoking may also occur during large emergency discharges because insufficient steam (or air) is available in the plant to make these infrequent discharges nonsmoking. A number of engineering practices currently used in industry help to achieve continuous smokeless operation. These include staged elevated flares, dual flare tips (small tip for low-flow, large tip for emergency releases), and continuous flare gas recovery systems. These systems are further discussed later in this section.

Taking all these factors into consideration, EPA decided to allow use of smokeless flares operated with a flame present to control fugitive VOC emissions in SOCMI. In order to ensure that the smokeless flare operates with a flame present, the flare's pilot light is to be monitored with an appropriate heat sensor, such as a thermocouple. To ensure smokeless operation, visible emissions from a flare would be limited to less than five minutes in any 2-hour period. In addition, steam-assisted flares would have to be operated with exit velocities less than 60 ft/sec combusting gases with heat contents greater than 300 Btu/scf. Flares operated without assist would have to be operated with exit velocities less than 60 ft/sec combustion gases with heat contents greater than 200 Btu/scf. Air-assisted flares would have to be operated with exit velocities below a maximum value, depending upon the gas heat content which must be greater than 300 Btu/scf. Flares operated within these requirements are considered as acceptable alternatives to enclosed combustion devices (incinerators, boilers, process heaters) and vapor recovery systems such as carbon adsorbers and condensation units. They may be applied to control of emissions from pump seals (or degassing reservoirs), compressor seals (or degassing reservoirs), and pressure relief devices.

As mentioned above, EPA has a program under way to determine the effectiveness of flares not studied to date. As this data and information are collected and evaluated, EPA plans to update the requirements for flares. It is not expected that the requirements would become more restrictive. Until the requirements are updated, plant owners and operators are allowed to determine whether other flare systems are equivalent to the systems required in the standards.

Comment:

One commenter (IV-F-1, No.4, p.61) objected to EPA's taking the position, without supporting data, that flares do not achieve good control. Another commenter (IV-D-16) stated that EPA had presented no data in support of the argument that flares may only achieve 60 percent efficiency. Another commenter (IV-D-17) agreed, adding that EPA has stated without qualifications, on page 4-19 of the proposed NSPS VOC Fugitive Emission Sources in SOCMI* [sic], that flaring efficiency is 60-99 percent. The commenter quoted the following from page 4-20 of this document: "This efficiency (60 percent) reflects the fact that many flare systems are not of optimum design. As a result, flares that are designed to handle large volumes of vapors associated with overpressure releases are used to handle low-volumes of fugitive emissions. With such designs, optimum mixing is not achieved because the vent gas exit velocity is low and large flares generally cannot properly inject steam into low-volume streams."

In a previous letter, the commenter (IV-D-17) questioned the relationship between steam injection into a low-volume stream and burning efficiency. He pointed out that, even though improper balance of steam may cause flare smoking, low steam injection does not appear to influence burning efficiencies of flares.

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*VOC Fugitive Emissions in the Synthetic Organic Chemical Manufacturing Industry - Background Information for Proposed Standards of Performance.

Response:

In the Background Information Document for Ethylbenzene/Styrene (EB/S) (EPA-450/3-79-035a), the efficiency of a flare system operated alone to control a small vent stream was estimated to be 60 percent. The estimates of destruction rates were based on the "Afterburner Systems Study" by Shell Development Company (II-I-13) and represented a generalized correlation for hydrocarbons combusted at 1410°F.

Further actual flare measurement results have become available, most notably from the CMA-EPA study, since the 60 percent theoretical estimate was made. In the CMA-EPA study, steam-assisted flares and flares operated without assist were investigated over a wide range of exit velocity, composition, and flare gas heat content conditions. After review of available flare efficiency data, EPA has concluded that smokeless flares operated with a flame present and exit velocities less than 60 ft/sec with flare gas heat contents greater than 300 Btu/scf for steam-assisted flares or exit velocities less than 60 ft/sec and flare gas heat contents greater than 200 Btu/scf for flares operated without assist are acceptable alternatives to enclosed combustion devices or vapor recovery systems.

Comment:

Several commenters argued that the use of flares should not be excluded as a means of controlling barrier fluid degassing emissions. Two commenters (IV-D-18; IV-D-26) pointed out that flares are common in most SOCMI processes and that a final decision on the use of flares should not be made until the current John Zink flare study by Battelle Memorial Laboratories has been completed. One of these commenters (IV-D-26) also maintained that, although flare technology may not be suitable for the burning of certain chemicals (e.g., chlorinated hydrocarbons), the use of this technology should not be precluded where appropriate. This commenter further stated that there is evidence that properly designed and operated flares will achieve 95 to 99 percent efficiency.

Several commenters (IV-D-7; IV-D-15; IV-D-16; IV-D-17; IV-D-23; IV-D-48) cited the German flare study Degree of Conversion of Flare Gas in Refinery High Flares by K.D. Siegel as the most recent study on flare systems. This study indicated efficiencies for flares to be greater than 95 percent.

One of these commenters (IV-D-17) specifically referenced data from the study to indicate better than 95 percent efficiency for the almost 1300 test samples measured over a wide range of operating conditions: 42 mass rates, 23 flare gas densities, and 114 steam/gas ratios. Conversion efficiency was found to be independent of mass flow, wind speed, or gas composition for the refinery gases studied. The commenter (IV-D-17) had previously submitted Dr. Siegel's dissertation as a total rebuttal to EPA's position on flare efficiencies. He presented the dissertation's conclusions as:

(1) In soot-free flare flames, the organically-bound carbon of the flare gas is converted to carbon dioxide to at least 99 percent.

(2) The emission factor for flames containing soot or soot-free flames, independent of the optical flame picture, comprises a maximum of one percent of the organically-bound carbon in the flare gas.

(3) The mass concentration of the organically-bound carbon at the flame end is less than 50 $mg/m^3$, even in the case of sooty flare flames.

(4) The bulk of the organically-bound carbon at the flame end consists of methane and acetylene.

(5) The nitrogen oxide emission of flare flames is low.

Also citing Dr. Siegel's work and the John Zink study by Battelle, one commenter (IV-D-48) stated that minimum efficiencies for flares are greater than 95 percent. Another commenter (IV-D-15) agreed and acknowledged that EPA has conducted an evaluation of Siegel's work which concluded that universal application of the 99 percent conversion to all flares is doubtful. He stated that, even though there are questions regarding validity and interpretation of results, these questions should not preclude the use of flares as acceptable VOC emissions control systems.

Another commenter (IV-D-17) also noted that Battelle Memorial Laboratories has conducted a study for EPA to demonstrate measuring techniques for use at flare towers. The study was conducted over a three-day period using a John Zink facility flaring propane. Although the test has long been completed, the Battelle study has not been made available, even in draft form, for public review and comment. The commenter stated that although not a specific objective of the study, data exist demonstrating that the flare system was able to achieve a destruction efficiency of greater than 95 percent even with a smoking flare.

One commenter (IV-D-41) suggested that, as a viable alternative, the standards allow any combustion device providing that 95 percent efficiency can be maintained. He wrote that flares would be precluded with the current requirement of 0.75 seconds as a minimum VOC residence time.

Response:

As discussed initially in this section, EPA has determined that smokeless flares operated with a flame present and exit velocities less than 60 ft/sec with flare gas heat contents greater than 300 Btu/scf for steam-assisted flares or exit velocities less than 60 ft/sec and flare gas heat contents greater than 200 Btu/scf for flares operated without assist may be considered as acceptable alternatives to enclosed combustion devices or vapor recovery systems for controlling fugitive VOC emissions in SOCMI.

Comment:

Although disagreeing with EPA's 60 percent efficiency statement, one commenter (IV-D-17) stated that there are a number of engineering practices currently in use within industry to deal with flaring low-flow continuous emissions. One such system involves the use of staged flare systems where a small diameter flare is operated in tandem with a large diameter flare. The system is designed such that the small flare takes the continuous low-flow releases and the larger flare accepts emergency releases. A second system involves the use of a separate conveyance line to the flare tip for continuous low-volume, low-pressure releases. A third system, sometimes used in conjunction with either of the above systems, involves the use of continuous flare gas recovery. In the latter system, a compressor is used to recover the continuously generated flare gas base load. The compressor is sized to handle the base load and any excess gas is flared.

Response:

The commenter is correct in pointing out systems that provide smokeless flare operation. The techniques noted are particularly applicable to handling low-flow streams. Use of a separate conveyance line to the flare tip for continuous low-flows would reduce explosion and flammability potential resulting from air seepage into large vent lines. But smaller lines may necessitate the addition of an auxiliary fan to overcome the increased pressure drop. The third system described by the commenter is an effective means of recovering flare header gases and is currently used by industry.

Comment:

A group of commenters (IV-D-17; IV-D-6) cited that several emergency situations, including releases from pressure relief devices, exist in which enclosed combustion devices would be unable to handle flow and pressure loads safely. They contended that flare systems are designed to handle such widely ranging feed conditions as cold liquids and hot gases. One of the commenters (IV-D-6) stated that his company avoids the use of enclosed incinerators, specifying flares instead, for control of relief valve emissions since incinerators involve complex design to supply adequate combustion air and to handle widely varying flows.

One commenter (IV-D-34) felt that flares should not be precluded from use to control emissions. He agreed with another commenter (IV-D-17) that the proposed system is unsafe, wastes energy, and is not cost effective. He further remarked that his studies show adequate combustion efficiencies from flares to meet the present requirements. And he noted that, where enclosed burning is currently required, two enclosed incineration systems are maintained simultaneously at operating temperature to avoid destruction of the units' ceramic lining.

Response:

The new source standards for fugitive VOC emissions in SOCMI do not cover situations such as emergency releases from pressure relief devices. In fact, the standard for relief devices requires that a performance level of no detectable emissions (less than 500 ppmv above background) be met;

there are no equipment requirements for fugitive emissions from relief devices. One method of meeting this performance standard is to pipe the relief device to a flare which is a common practice in the industry.

There are other potential emergency situations, such as catastrophic pump seal failure that must be considered. In such cases, as the commenters noted, incinerators present a difficult design and operation consideration resulting from the rapid changes in vent flow rate and temperature. For the reasons noted in the introduction to this section, EPA has decided to allow the use of smokeless flares for controlling fugitive VOC emissions in SOCMI, provided that the flares are operated with a smokeless flame present. Steam-assisted flares would have to be operated with exit velocities less than 60 ft/sec combusting gases with heat contents greater than 300 Btu/scf. Flares operated without assist would have to limit exit velocities to less than 60 ft/sec combusting gases with heat contents greater than 200 Btu/scf. Air-assisted flares would have to operate below a maximum exit velocity dependent upon the gas heat content which must be greater than 300 Btu/scf.

Other emergency conditions may occur with control device systems. For example, during failure of a compressor, a flare system may be used to combust the process fluid from the compressor. When this occurs, the flare may not be operating in compliance with the requirements in the standards for flares. Such conditions may be representative of startups, shutdowns, and malfunctions as discussed in the General Provisions of 40 CFR Part 60. However, at all times, including periods of startup, shutdown, and malfunction,* owners and operators shall, to the extent practicable, maintain and

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*"Startup" means the setting in operation of an affected facility for any purpose.

"Shutdown" means the cessation of operation of an affected facility for any purpose.

"Malfunction" means any sudden and unavoidable failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner. Failures that are caused entirely or in part by poor maintenance, careless operation, or any other preventable upset condition or preventable equipment breakdown shall not be considered malfunctions.

operate any affected facility including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions [40 CFR 60.11(d)]. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to EPA which may include, but is not limited to, monitoring results, opacity observations review of operating and maintenance procedures, and inspection of the source. It should be noted that closed vent systems and control devices used in complying with the standards are part of the affected facility.

Comment:

One commenter (IV-D-17) expressed the understanding that it is EPA's intention not to preclude flare systems but to require any company choosing such a control system to demonstrate equivalency pursuant to §60.484. He wrote that this is an unreasonable, costly, and time-consuming process in light of the significant and representative data and information that industry has already submitted demonstrating the equivalency of flare systems. The commenter pointed out that EPA has an absolute obligation to include flare systems as an appropriate control system for purposes of regulating fugitive emissions. He further added that the clear language of the proposed regulations contradicts statements made by EPA's OAQPS staff, the preamble, and various support documents that fugitive emissions can be transported by a closed vent system to an enclosed combustion device or vapor recovery system, as well as a flare system, and other equivalent control devices. Failure to correct this inconsistency and revise the regulatory language could result in unanticipated enforcement initiatives based on the language of the proposed regulations.

In a previous letter that had been attached, the commenter (IV-D-17) accused EPA of taking the position that the burden of proof of high efficiency of flares is on the industry. He disagreed, arguing that since flares are standard abatement devices of long-standing in both the chemical and petroleum refining industries, the burden of proof, with data, is on EPA. He added that SOCMI has a heavy investment in flares and will strongly resist EPA's position that flares are not acceptable emission control devices. In a later letter, the commenter (IV-D-50) stated that flares are common and efficient control devices used in SOCMI. He was concerned that flares had been excluded from use on the basis of lack of efficiency data.

Another commenter (IV-D-48) stated that, in light of the data from the German flare study by Siegel and the John Zink flare study by Battelle Memorial Laboratory, an effective equivalency determination had been made. Therefore, the Administrator should authorize the use of flares to control fugitive VOC emissions.

Response:

After considering this and previous comments on the use of flares for controlling fugitive VOC emissions in the SOCMI, EPA has determined that smokeless flares operated with flames present and exit velocities less than 60 ft/sec with flare gas heat contents greater than 300 Btu/scf for steam-assisted flares or exit velocities less than 60 ft/sec and flare gas heat contents greater than 200 Btu/scf for flares operated without assist are acceptable alternatives to enclosed combustion devices or vapor recovery systems. In addition, air-assisted smokeless flares may be used provided they operate below a maximum exit velocity that is based on gas heat content which must also be greater than 300 Btu/scf. Their use does not require further demonstration of equivalency. The determination to allow smokeless flares was based on EPA's belief that smokeless flares can achieve about 98 percent efficiency and techniques are well established that help flares maintain smokeless operation.

Comment:

One commenter (IV-D-17) wrote that, in order for EPA to be consistent with the spirit, if not the express language, of the recently issued Executive Order No. 12291, the Agency is under an affirmative duty to allow those control options that data demonstrate achieve the environmental objectives of the regulation at a lower cost to industry. In this regard EPA should not preclude technically sound and cost-effective regulatory options, such as flares, unless an administrative record is established that clearly documents that these cost-effective regulatory options will offset a significant environmental benefit that could otherwise result.

Response:

Since proposal, the determination was made that smokeless flares should be allowed as acceptable control devices, when steam-assisted flares are operated with exit velocities less than 60 ft/sec with flare gas heat contents greater than 300 Btu/scf or when flares without assist are operated with exit velocities less than 60 ft/sec with flare gas heat contents greater than 200 Btu/scf or when air-assisted flares are operated below a maximum exit velocity based on gas heat content which must be below 300 Btu/scf.

## 4.2 LEAK DETECTION AND REPAIR PROGRAMS

A number of comments were received concerning the leak detection and repair program which is incorporated in the valve standard. The main subject areas of the comments were the monitoring interval, the repair requirements, and the estimates made by EPA of time required for leak detection and repair. Other comments gave suggestions for alternate approaches and pointed out potential problems which might be encountered in performing the leak detection and repair program.

### 4.2.1 Monitoring Interval

Several commenters requested that the monitoring intervals for the leak detection and repair program be lengthened. Various monitoring intervals were recommended and a variety of reasons were cited for the recommended changes. A recommendation for a shorter monitoring interval was also made.

Comment:

Some commenters (IV-F-1, No.1; IV-F-1, No.4; IV-D-17; IV-D-40; IV-D-48) challenged the occurrence/recurrence relationship assumed by EPA in developing the monitoring strategy. One of these commenters (IV-F-1, No.4) said that EPA had assumed a complex leak occurrence rate which is biased to favor monthly monitoring. He stated that using a linear leak occurrence rate would show quarterly monitoring to achieve the same results as the proposed program. He cited recent data published by EPA in An Evaluation of Maintenance for Fugitive VOC Emissions Control which seemed to support a linear leak occurrence rate.

Another commenter echoed these objections in two sets of comments (IV-F-1, No.1; IV-D-17) and said that EPA had not offered any rationale or supportable basis for imposing a monthly monitoring program. The commenter objected to the assumptions in the BID and said that, until representative data were made available, it would be logical to assume a linear leak occurrence rate and that the recurrence rate is proportional to the occurrence rate.

One commenter (IV-D-48) recommended quarterly monitoring for valves based on the assumption that leak occurrence is linear and the recurrence rate for SOCMI is much lower than that for refineries.

Response:

The commenters are challenging two technical assumptions made by EPA in the development of the standard for valves. The first one is the rate at which the number of leaks found in a process unit will increase with time. The estimates of leak accumulations with time as shown in the BID on page 4-15 are shown here in Table 4-2.

TABLE 4-2. LEAK OCCURRENCE/RECURRENCE RATE ESTIMATES FROM BID

| Monitoring Interval | $n_m$ [a] | $\bar{n}_m$ [b] |
|---|---|---|
| 1 month | 0.1N[c] | 0.05N |
| 3 months | 0.2N | 0.1N |
| 1 year | 0.4N | 0.2N |

[a] $n_m$ = Total number of leaks which occur, recur, and remain between monitoring intervals.

[b] $\bar{n}_m$ = Average number of leaks over the monitoring interval.

[c] N = Total number of sources at or above the action level.

As pointed out by the commenters, the numbers assumed form a non-linear relationship with time for accumulated leaks. However, the numbers include (as noted in the footnote) the number of leaks which occur, recur, and remain between monitoring intervals. They are not simple occurrence rate estimates.

The commenters are partially correct in stating that occurrence rates should be linear. Occurrence rates have been found to be essentially linear in recent SOCMI studies as reported in An Evaluation of Maintenance for Fugitive VOC Emissions Control (IV-A-7.) In this report, the leak occurrence rate is described by an exponential distribution model and the leak recurrence rate is described by a mixed distribution model, which incorporates an exponential model to describe long-term leak recurrences. Both models are non-linear in format. But, as applied to the data collected in the SOCMI studies, the models result in a nearly linear relationship with time. In fact, only slightly non-linear leak occurrence and recurrence rates are noted when considering a monitoring interval of one year.

Since proposal, analysis of the results of the SOCMI maintenance study (IV-A-7) led to the development of a new model describing leak detection and repair programs. This model is described in detail in Docket Item No. IV-A-22 and in the recently distributed AID (III-B-2). The results of the model evaluating various possible leak detection and repair programs for valves and using inputs from the SOCMI maintenance study are shown in Figure 4-1. The fraction of valves operating improperly (occurring, recurring, and unrepairable) is presented as a function of monitoring interval.

The second assumption being challenged is the relationship of valve leak occurrence to valve leak recurrence. As explained in the preamble to the proposed regulation (46 FR 1146), the proposed monitoring program for valves included an allowance to monitor valves that leak infrequently on a quarterly basis. This was based on the assumption that recurrence of leaks is a significant contributor to the total number of leaks. Data from SOCMI fugitive emission studies do not conclusively confirm this assumption.

Valve leak occurrence and recurrence rates are shown in Table 4-3. These numbers indicate the difference between occurrence and recurrence rates.

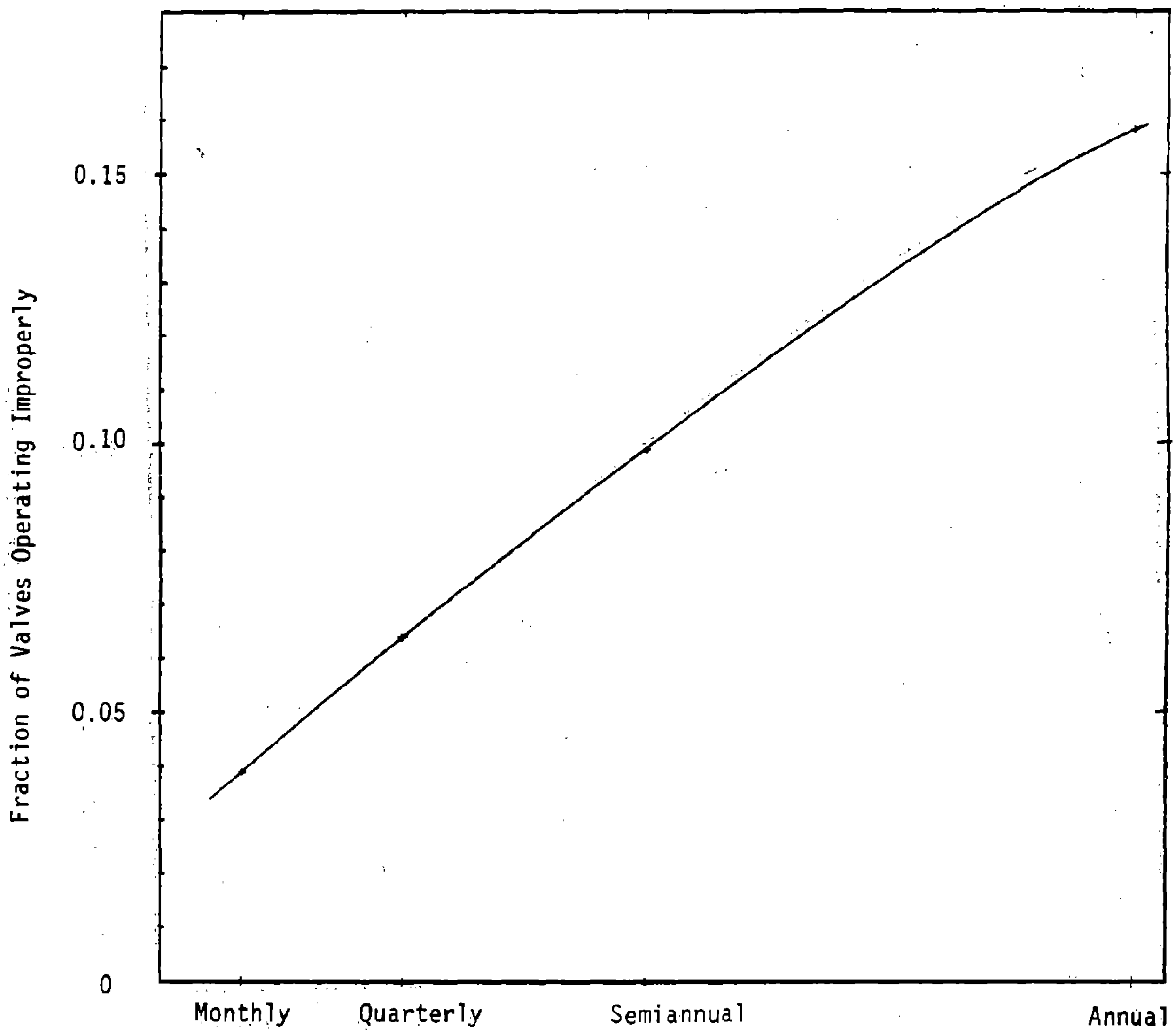



Figure 4-1. Fraction of valves operating improperly at the end of the initial year under leak detection and repair programs of various monitoring intervals for an average SOCMI unit.

TABLE 4-3. OCCURRENCE RATES AND RECURRENCE RATES FOR VALVES DETERMINED IN SOCMI UNITS[a]

| | 30 Days (Percent) | 90 Days (Percent) | 180 Days (Percent) |
|---|---|---|---|
| Occurrence | 1.3 | 3.8 | 7.4 |
| Recurrence | 17.2 | 23.9 | 32.9 |

[a]Data taken from Evaluation of Maintenance for Fugitive VOC Emission Control (IV-A-7).

Recurrence rates are most evident within the first five days after attempted repair. Beyond that time period, the recurrence rate is essentially equal to the occurrence rate. Therefore, it is appropriate to discuss recurrence only in terms of early recurrence, i.e., leaks which recur within the first five days after attempted repair. Also, even though the recurrence rate seems high compared to the occurrence rate, it must be applied to only those valves on which repair was attempted, not the entire valve population. This, coupled with an assumed lower emission factor for early recurrence leaks, reduces the impact of leak recurrence compared to leak occurrence. However, leak recurrence does contribute significantly to the total number of leaks.

In selecting the basis of the promulgated standards, EPA mainly considered two regulatory alternatives for valves -- monitoring at monthly intervals and monitoring at quarterly intervals. The incremental cost of monthly versus quarterly monitoring was judged to be reasonable for the additional emission reduction achieved by monthly valve monitoring. Consequently, monthly monitoring was selected as the basis of the standard. This judgement was based on emission reductions and costs calculated at the rate at which valve leaks typically occur at SOCMI process units. However, EPA recognizes that some valves have lower leak occurrence rates than others. Monthly monitoring of valves that do not leak for 2 consecutive months was judged to be unreasonable when compared to the additional emission reduction achieved by monthly monitoring over quarterly monitoring. Therefore, although EPA is proposing that leak detection and repair programs include monthly monitoring for valves, the standard would allow quarterly monitoring for valves which have been found not leaking for 2 successive months.

Comment:

Another argument given for extending the monitoring interval was that EPA has improperly calculated the emission reductions achievable under Alternative IV. One commenter (IV-F-1, No.1) said that quarterly monitoring would result in a 97.8 percent control efficiency and not 86 percent as reported in the BID. He said that an analysis had been submitted previously (IV-D-17) which documented this improper calculation. The commenter urged that EPA adopt quarterly monitoring since his calculations showed that a quarterly monitoring interval would achieve the desired environmental goals at a lower cost to industry.

Response:

The commenter did submit the referenced analysis on June 30, 1980. It may be found in Docket Item No. II-D-72. The same analysis was resubmitted as a part of written comments on the proposed standards (IV-D-17).

The commenter's analysis differs from EPA's in two major areas. The first major area of difference is in the emission sources included in the fugitive emissions estimate calculations. EPA's methodology includes contributions from fugitive emission sources which are not regulated as well as contributions from the emission sources which are regulated. This methodology is clearly documented in an example on page 7-6 of the BID. As the table shows, the contributions from heavy liquid equipment and flanges are included.

On the other hand, the commenter neglected to include the contribution to emissions from fugitive emission sources which are not controlled by the regulation.

The second major area of difference is in assumptions made. The BID described a method for estimating control efficiency for a leak detection and repair program. The model describing such a program incorporated four factors defined as following.

Reduction Efficiency = A x B x C x D

where:

A = Theoretical Maximum Control Efficiency = fraction of total mass emissions for source type with VOC concentrations greater than the action level.

B = Leak Occurrence and Recurrence Correction Factor = correction factor to account for sources which start to leak between inspections (occurrence); for sources which are found to be leaking, are repaired and start to leak again before the next inspection (recurrence); and for known leaks which are not repaired.

C = Non-Instantaneous Repair Correction Factor = correction factor to account for emissions which occur between detection of a leak and subsequent repair; that is, repair is not instantaneous.

D = Imperfect Repair Correction Factor = correction factor to account for the fact that some sources which are repaired are not reduced to zero emission levels. For computational purposes, all sources which are repaired are assumed to be reduced to a 1000 ppmv emission level.

The commenter and EPA made different assumptions for these four factors.

The commenter assumed a C factor of 4.5 days; EPA assumed 7.5 days. EPA assumed for the D factor that valves would be repaired on the average to 1,000 ppmv. The commenter assumed that 25 percent of the valves would be repaired to a level of 0 ppmv, and the remainder would be repaired to 1000 ppmv. The commenter assumed a linear increase for B, while EPA assumed a non-linear function. (This factor was discussed in the previous comment and response.)

Two areas of differing assumptions caused the difference in the control efficiency estimates: (1) consideration of both controlled and uncontrolled fugitive emission sources and (2) assumptions regarding the effectiveness of leak detection and repair programs (primarily with respect to leak occurrence rate estimates). When these differences are taken together, the effect on overall control effectiveness is compounded. The results indicate a control effectiveness of 97.8 percent (using the commenter's assumptions) vs. 86 percent (under EPA's assumptions).

The LDAR model describing leak detection and repair programs (IV-A-22) has been used to evaluate the overall effectiveness of such programs for valves. Using the inputs to the model detailed in the AID, valve leak detection and repair programs were evaluated for the average SOCMI unit, as well as for the three process types tested in SOCMI. The quarterly monitoring with monthly follow-up program that was part of the proposed standards results in an overall control efficiency of 57 percent for an average SOCMI unit. The impact of leak detection and repair programs on the overall effectiveness of the new source standards was discussed in the AID and is presented here in Section 3.3.

Comment:

In three sets of comments (IV-D-17; IV-D-26; IV-D-48) it was argued that since leak frequencies in SOCMI units are less than in refineries, the monitoring interval should be lengthened to quarterly intervals.

Response:

The selection of a monitoring interval was not based on a comparison of industries and emissions from them. It was selected as a part of the best system (considering costs) of continuous emission reduction, or best demonstrated technology (BDT) [see Section 3.1]. As discussed in response to the next comment, the determination of BDT for valves (in terms of monitoring interval of leak detection and repair) was based not only on cost and cost effectiveness, but also on the total emissions reduction achievable. These considerations were made for this source category, independent of comparison to standards development for other source categories. Furthermore, leak frequency was taken into consideration in the standards in the form of alternative standards (see Chapter 14). For instance, annual leak detection and repair is allowed for units demonstrating and maintaining a leak frequency for valves of less than 2 percent.

Comment:

One commenter (IV-D-17) said that the quarterly plus monthly monitoring program cannot be justified based on VOC emissions reductions, in light of the tremendous time and effort required to locate, tag, record, and remonitor leaking valves. Similar concerns were expressed by another commenter (IV-D-7) who wrote that the leak detection and repair program is very time-consuming and labor-intensive.

Another commenter (IV-D-18) suggested that the monitoring requirements for valves be reduced to quarterly monitoring for the first year. Those valves which are not found leaking would be monitored once annually after that time. The commenter explained that this lengthening of the monitoring interval would allow a two-man full-time monitoring team to complete the first year monitoring requirements. In subsequent years the team would be free to perform other tasks in the interest of productivity.

Two commenters (IV-D-34; IV-D-50) stated that monitoring on a semi-annual basis would be adequate. But another commenter (IV-D-46) expressed concern that the monitoring intervals were too long and would result in large leaks going unrepaired for too long. Because of this, the commenter felt longer inspection intervals could slow attainment of health standards in many areas, especially if similar concessions were made to other VOC-emitting industries.

Response:

The commenters are expressing concern over the monitoring interval chosen and the justification for that choice. The proposed standards required monthly monitoring because it would provide the greatest emission reduction potential without imposing difficulties associated with a more frequent leak detection and repair program (LDRP). Since proposal, additional data from SOCMI screening and maintenance studies (IV-A-7; IV-A-11) led to the development of the LDAR model for evaluating the effectiveness of various LDRPs. The details of the LDAR model are given in Docket Item No. IV-A-22 and its application is discussed in the AID (III-B-2).

Several monitoring plans for valves were evaluated using the LDAR model: annual (A), semiannual (SA), quarterly (Q), quarterly with monthly follow-up on leaking valves (M/Q), and monthly (M). Each of these plans was then compared in terms of cost effectiveness of the LDRP and the emissions reduction achievable.

The cost effectiveness of valve LDRPs is presented as a function of monitoring interval in Figure 4-2, assuming 14 percent early recurrence. A

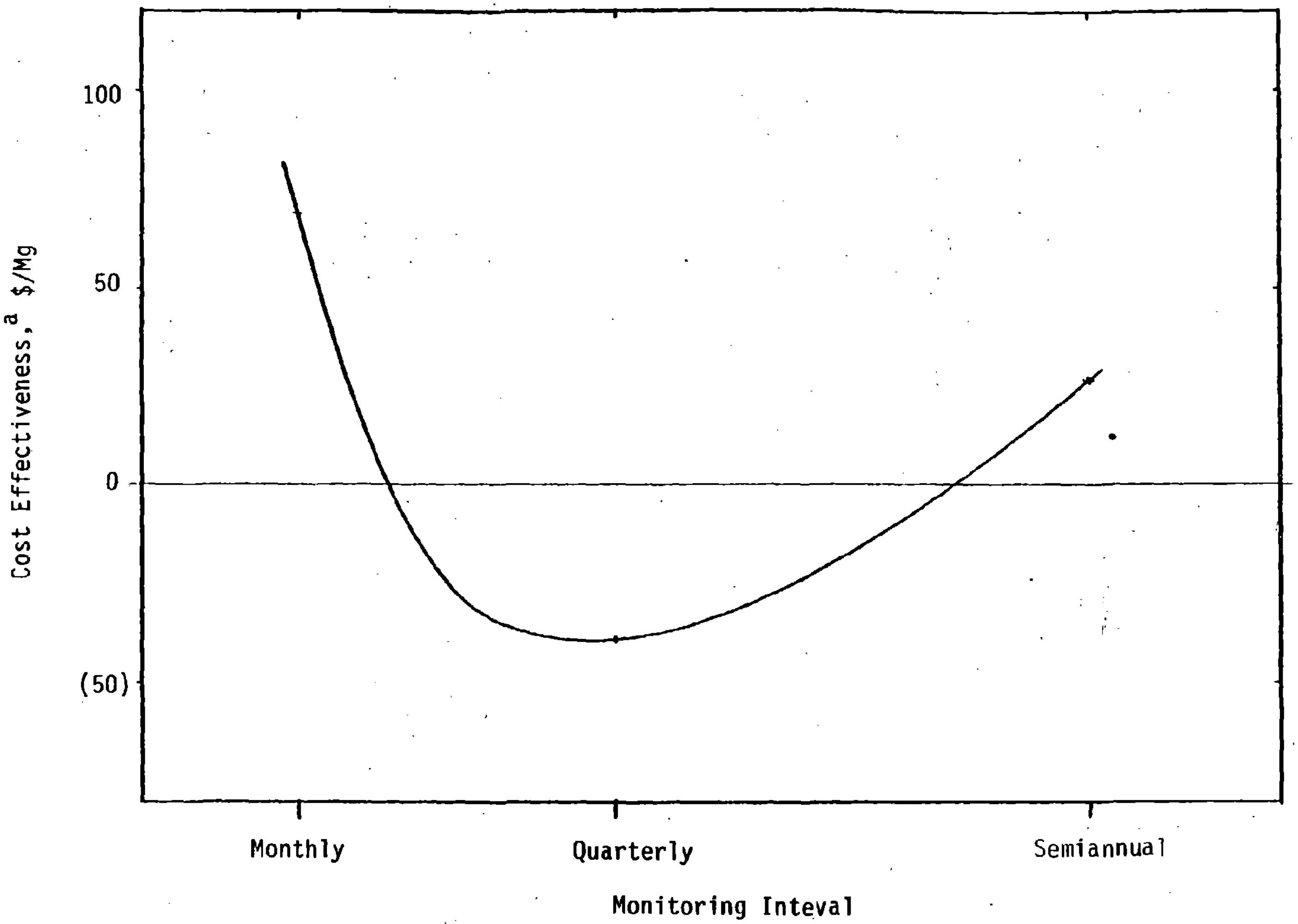



Figure 4-2. Cost effectiveness of leak detection and repair programs for valves as a function of monitoring interval for an average SOCMI unit.

[a]Parentheses indicate net credit of program due to product recovery.

quarterly monitoring interval is noted as the most cost effective plan. Quarterly monitoring with monthly follow-up is of comparable cost effectiveness, however. These two programs resulted in a net credit considering the saved product, while semiannual and monthly monitoring resulted in positive cost effectiveness.

While cost effectiveness of the LDRP was an important consideration in selecting the monitoring interval, the emissions reduction achievable was of equal importance in making a final determination. Figure 4-3 presents cost effectiveness of the various LDRPs examined versus the emissions reductions achievable for SOCMI model unit C. The curves for model units A and B have the same shape, but span a lower range of emission reductions due to a smaller number of valves. The figure clearly shows the increase in emissions reduction between semiannual and quarterly programs (57 percent increase) and between quarterly and monthly programs (26 percent increase). It also shows the small difference in emission reduction between the quarterly plan and the more complex plan requiring quarterly monitoring with monthly follow-up.

The incremental effectiveness of going to increasingly more frequent monitoring programs was examined in Table 4-4. The incremental cost effectiveness of going from quarterly or monthly/quarterly to monthly is seen as resulting in a net cost. The other cases indicated the value of increasing the frequency of monitoring intervals since credits are still obtained with each increase in frequency. Even though a cost is incurred to increase monitoring frequency from quarterly to monthly, the cost effectiveness is considered reasonable.

Based on the analysis of the effect of monitoring interval on costs and emissions reduction, EPA determined that a monthly monitoring program is to be used for the SOCMI fugitive VOC emissions standards. While less frequent programs were more cost-effective, monthly monitoring also had reasonable cost effectiveness, reasonable incremental cost effectiveness, and yielded the largest emissions reduction of the programs examined.

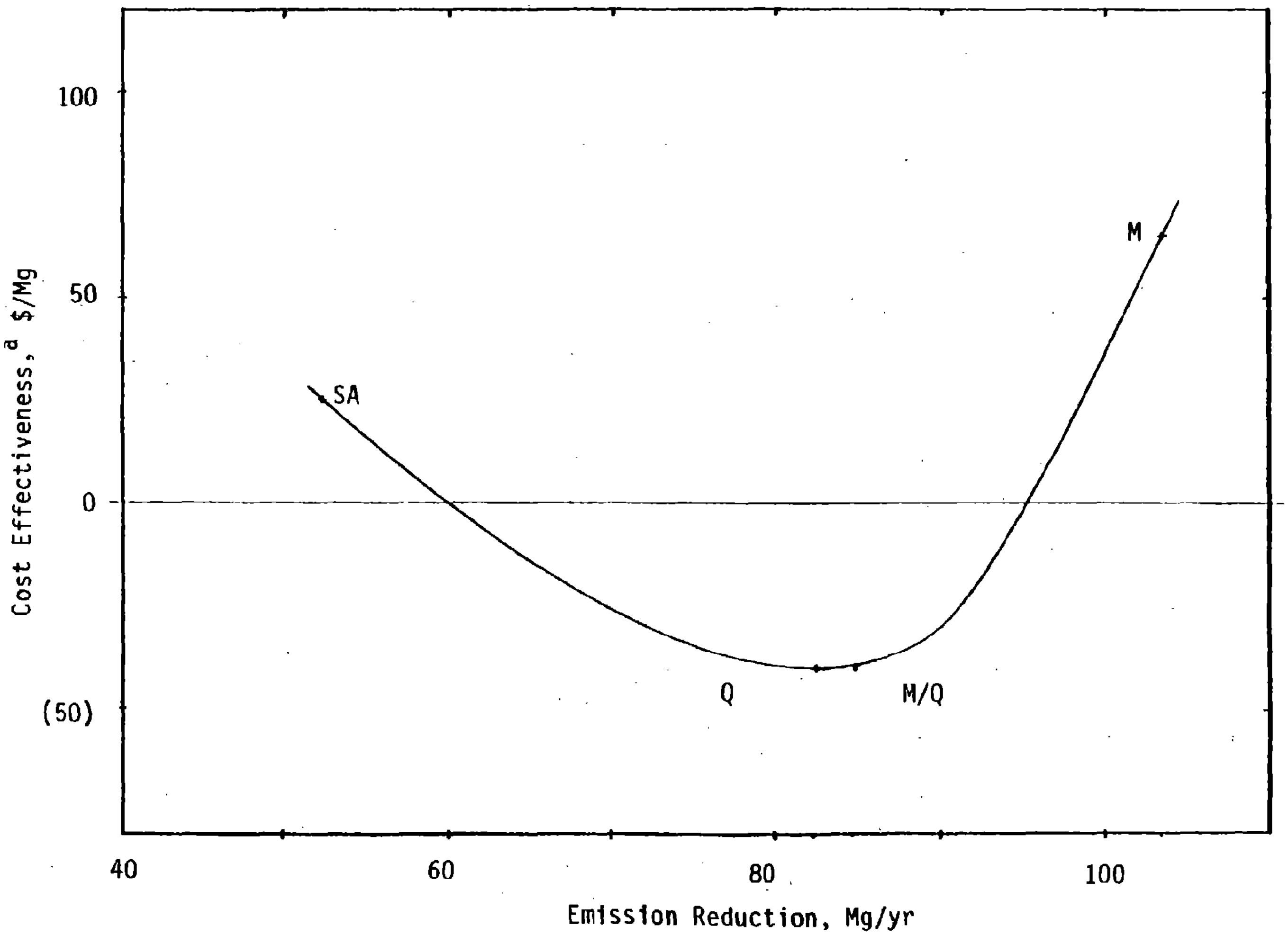



Figure 4-3. Cost effectiveness of valve leak detection and repair programs as a function of emission reduction for average SOCMI model unit C.

[a]Parentheses indicate net credit of program due to product recovery.

TABLE 4-4. EMISSIONS REDUCTION AND COST EFFECTIVENESS OF LEAK DETECTION AND REPAIR PROGRAMS FOR VALVES WITH 14 PERCENT RECURRENCE, FOR SOCMI MODEL UNIT C

| Monitoring Interval | EMISSIONS REDUCTION, Mg/Yr | COST EFFECTIVENESS, $/Mg |
|---|---|---|
| M | 103.3 | 62 |
| M/Q | 85.3 | (41) |
| Q | 82.7 | (41) |
| SA | 52.6 | 25 |
| A | (4.6) | -- |

| Monitoring Interval Change: From | To | INCREMENTAL EMISSIONS REDUCTION, Mg/Yr | INCREMENTAL COST EFFECTIVENESS, $/Mg |
|---|---|---|---|
| A | SA | 57.2 | (252) |
| SA | Q | 30.1 | (156) |
| Q | M/Q | 2.5 | (37) |
| M/Q | M | 18.0 | 550 |

KEY: M = monthly; M/Q = quarterly with monthly follow-up of repaired leaks;
Q = quarterly; SA = semiannual; A = annual.
Parentheses indicate credits.

Comment:

One of the same commenters (IV-D-17) alleged that EPA's proposed program is slanted more toward gathering data concerning repair efficiency than controlling emissions.

Response:

The standards for valves are designed to reduce VOC emissions at a reasonable cost. Data show that valves in SOCMI process units contribute a large portion of the VOC emissions from equipment in SOCMI. Moreover, leak detection and repair programs have been found to reduce emissions from valves effectively. The proposed leak detection and repair program was selected as best demonstrated technology (BDT) for valves in gas and light liquid service based on the cost effectiveness of controlling fugitive VOC emissions and the emissions reduction achievable.

The proposed standards required quarterly reports to aid in determining compliance with the standards. Since proposal, though, considering comments and in an effort to reduce paperwork, EPA decided that these reports are beneficial in determining compliance, but they are not necessary on a quarterly basis. Therefore, semiannual reports are required in the final regulation; States that are delegated the authority to enforce the standards, however, may waive such reports through their own programs if EPA, in delegating the program to the State, approves the reporting requirements or an alternative means of compliance surveillance adopted by the State and if the process units comply with the requirements adopted by the State. In addition to the semiannual reporting requirements, the standards still require notifications (construction; anticipated startup; initial startup; physical operational changes; use of alternative standards; performance test) and performance test results according to the General Provisions.

Even though reporting has been streamlined, the recordkeeping requirements have not been changed. Recordkeeping has been deemed necessary for determining compliance because the standard is a work practice standard. Section 9 addresses in detail the comments and concerns on reporting and recordkeeping.

Comment:

One commenter (IV-D-17) recommended that monthly monitoring be required only for equivalency demonstrations. Another commenter (IV-D-25) said that the proposed frequency of inspection appears satisfactory for valves that operate daily; however, for those that operate less frequently he suggested less frequent inspection, e.g., yearly.

Response:

There are many ways to demonstrate equivalency. Certainly, one conceivable way would be to monitor monthly and show how a program meets or exceeds the valve standards. Monthly monitoring is not burdensome in the judgement of the Agency. Moreover, the proposed and final standards require monthly monitoring of only those valves which are found leaking. Therefore, the monitoring interval will not be changed based on frequency of valve operation.

Just as there are many ways to demonstrate equivalency, there are many ways to design leak detection and repair programs. If an owner/operator can devise a more efficient program, he may choose to comply with an alternative standard. Data from the Analysis Report (IV-A-14) indicate that control valves, as a class, exhibit higher leak frequencies than block valves. Since control valves are generally operated more frequencly than block valves, it is reasonable to believe that less frequently operated valves leak less frequently. Therefore, EPA has allowed alternative standards to consider this variability. An owner or operator could make use of a trend of this type in developing an alternative standard if he can demonstrate such standards would achieve equivalent emission reductions. Leak frequency was selected as the basis of the alternative standards, rather than frequency of operation, since it is more readily measured and its effect on leak detection and repair program effectiveness can be examined (see Chapter 14 and Appendix A).

Comment:

One commenter (IV-D-17) said that it is impractical to monitor more frequently than once every three months without resulting in a situation where a detected leak could not be repaired before the next monitoring cycle began. He noted that it is obvious from the proposed standards, though not made clear in the document, that EPA has assumed only one two-man team to conduct the monitoring of valves in a large SOCMI model unit. He argued that using EPA estimates of 116 man-hours to monitor and repair 2800 valves and adding some time for scheduling of repairs, a two-man team could just barely detect and repair all the leaking valves before it would be time to start the next monitoring.

Response:

A detected leak need not necessarily be repaired before the next monitoring cycle begins. Also, since monthly/quarterly monitoring schemes are available, monitoring cycles are not necessarily contiguous. A leak must be repaired within 15 days of its detection. There is no requirement for repairing a leak before monitoring activities resume in the process unit. Using an estimate of two minutes of monitoring time per valve, it would take about 93 hours to monitor the unit completely. And the estimated time required for maintenance is about 53 hours per month. The combined time is within the monthly time limit of 172 working hours.

Comment:

Another commenter (IV-D-40) presented data to show a reduction in effectiveness for frequent leak detection and repair programs. To support his claims, the commenter cited the essentially linear leak occurrence/ recurrence rates determined for SOCMI. He stated that, due to the limited amount of recurrence data and the overlapping confidence intervals, only the occurrence rate can be used. He also cited on-line valve repair efficiencies lower than assumed in the BID among the reasons for the reduced effectiveness. Using additional data from a high-density polyethylene plant, the commenter argued that more frequent inspection and maintenance did not reduce the percentage of valves leaking.

Response:

The comments concerning leak occurrence and recurrence rates were discussed in the initial responses on monitoring intervals for leak detection and repair programs and in the AID (III-B-2). As discussed in the SOCMI Maintenance Study report (IV-A-10), the recurrence rate for valve leaks was sufficiently different from the occurrence rate to be determined as a distinct value. But only a single recurrence rate was determined for the three process types tested because recurrence data was scant.

The efficiencies for valve leak detection and repair programs examined in the BID ranged from 0.86 to 0.90 for gas valves and from 0.62 to 0.74 for light liquid valves. These efficiencies considered imperfect repair of some valves, that is, repair that did not reduce emissions to 0 ppmv. The commenter accurately pointed out that the on-line repair efficiencies determined during SOCMI studies were lower than assumed in the BID. In fact, a repair efficiency of only 29 percent was determined as a result of maintenance. But this efficiency was found for only simple on-line maintenance (tightening bolts). And more importantly, this 29 percent repair efficiency resulted in about 71 weight percent reduction in fugitive emissions. Repair efficiencies are also discussed in the next section on leak definition.

### 4.2.2 Time Estimates

Comment:

One commenter (IV-D-24) pointed out that EPA has used a figure of 2 man-minutes per source for monitoring time even though on page C-9 of the BID, the results of a test run indicate 3 to 4 man-minutes per source. He argued that the labor estimates are low by a minimum factor of two.

Response:

The commenter (IV-D-24) is comparing average times for monitoring fugitive emission sources as determined in the field with an estimate of time required to monitor valves. The comparison is not on the same basis and is, therefore, invalid.

On page C-9 of the BID an average screening time per source of 1.7 minutes is presented. This time was determined in actual field studies and includes time to measure not only valves but also pumps, compressors, safety relief valves, and flanges. A two-man team performed the monitoring, so the average time per source was 3.4 man-minutes.

The time estimates used for costing purposes may be found on page 8-8 of the BID. The monitoring time estimate for valves is 2 man-minutes per valve. However, time estimates for other equipment are much higher. The average manpower requirement per source would undoubtedly be higher than the 2 man-minutes estimated for valves. For example, applying the time estimates to the equipment distribution in the model units, the average monitoring requirement per source would be 2.9 man-minutes.

This number compares very favorably with the 3.4 man-minute number determined in the field, especially considering differences in the monitoring activities. The value determined in the field also includes time for instrument calibration, maintenance, etc.; these instrument-related items were considered in the instrument maintenance cost of $2700/yr and in the 40 percent overhead charge (see cost estimates Section 5 of AID). In addition, the average time determined in the field was for a research effort which required more data gathering and recording than routine monitoring will require. The researchers were required to obtain a numerical reading and record it, while routine monitoring would require only ascertaining whether the reading was on- or off-scale. Furthermore, the researchers were recording many extra data concerning valve type, process conditions, and ambient conditions which would not be required during routine monitoring. All of this extra effort is included in the 3.4 man-minute average. Considering these extra activities, the time estimates used for costing purposes are suitably conservative.

Another check on the validity of the time estimates can be made by comparing the actual time spent in the field with the time which would have been predicted by EPA's estimates in the BID. Table 4-5 shows such a comparison. EPA's estimates applied to the sampled units were again seen to be conservative.

Comment:

A commenter (IV-D-17) questioned the one minute estimate for valve monitoring time. He argued that it is not even possible to travel from one valve to another in one minute. He accused EPA of using the data provided by the industry out of context to come up with this estimate. The commenter argued that this figure was generated as a ballpark number for initial comparison purposes at the beginning of a fugitive emissions study a few

TABLE 4-5. ESTIMATED VERSUS ACTUAL MONITORING TIMES FOR VARIOUS SOCMI PROCESS UNITS[a]

| Unit Number | Chemical | Total Number of Sources Monitored | EPA-Estimated Monitoring Time (hours) | Actual Monitoring Time (hours) | Contractor |
|---|---|---|---|---|---|
| 1 | Vinyl Acetate | 1391 | 54 | 46 | Radian |
| 2 | Ethylene | 5078 | 176 | 110 | Radian |
| 3 | Vinyl Acetate | 2713 | 98 | 42 | Radian |
| 4 | Ethylene | 5278 | 182 | 132 | Radian |
| 5 | Cumene | 1025 | 36 | 15 | Radian |
| 6 | Cumene | 1573 | 55 | 26 | Radian |
| 11 | Ethylene | 3685 | 143 | 117 | TRW |
| 12 | Acetone/Phenol | 3207 | 128 | 171 | TRW |
| 20,21 | Ethylene Dichloride/ Vinyl Chloride | 2298 | 91 | 100 | PEDCo |
| 22 | Formaldehyde | 230 | 9 | 7 | PEDCo |
| 28,29 | Ethylene Dichloride/ Vinyl Chloride | 3363 | 123 | 90 | PEDCo |
| 31 | Methyl Ethyl Ketone | 585 | 22 | 16 | Acurex |
| 32 | Methyl Ethyl Ketone | 679 | 26 | 25 | Acurex |
| 33 | Acetaldehyde | 1148 | 44 | 23 | Acurex |
| 34 | Methyl Methacrylate | 2019 | 77 | 30 | Acurex |
| 35 | Adipic Acid | 1577 | 53 | 18 | Acurex |
| 60,61,62 | Chlorinated Ethanes | 3332 | 121 | 89 | PEDCo |
| 64 | Adipic Acid | 664 | 26 | 21 | PEDCo |
| 65 | Acrylonitrile | 1406 | 51 | 59 | PEDCo |
| 66 | Acrylonitrile | 1864 | 68 | 59 | PEDCo |
| | TOTALS | 43,115 | 1583 | 1196 | |

[a]From Frequency of Leak Occurrence for Fittings in Synthetic Organic Chemical Plant Process Units, by Radian Corp., for U.S. Environmental Protection Agency, Research Triangle Park, N.C., September 1980. (IV-A-11).

years ago. More recent detailed data show monitoring times of 3 to 4 minutes. In addition, the commenter cited an industry report which shows that monitoring time varies from a minimum of 3 minutes to a maximum of 12 minutes per valve depending upon the accessibility of the valve. He concluded that the overall average is 4 minutes.

Response:

The one minute per valve time estimate was taken from information provided by Exxon Company, USA (II-D-21). The data presented were presented as the results of "an in-depth study to determine the monitoring manpower requirements." A review of the letter, the data presented and its application to cost estimates failed to show that the data were used out of context or inappropriately.

The newer data referred to by the commenter is also contained in an Exxon document (II-D-72, Appendix B). The numbers cited by the commenter were inaccurately cited as manpower estimates per valve. The manpower requirements given were actually estimates of time which would be required to monitor pump seals, compressor seals, valves, drains, and pressure relief valves. As noted in the response to the previous comment, EPA's estimates allow more monitoring time for other types of equipment, so that the average time per source would be higher. Furthermore, Exxon's estimates also included manpower requirements for doing some minor valve maintenance, while EPA's estimates account for this manpower requirement separately.

The travel time for valve to valve is included in the monitoring time estimates. If valves were each distantly located from another, the travel time component would be larger. However, many valves are commonly found clustered together in one location, requiring no travel time between them.

Comment:

Another commenter (IV-D-18) wrote that the estimate of 16 man-hours per month to fulfill maintenance requirements is too low. He stated that since EPA did not provide a breakdown of time requirements, an evaluation could not be made of time estimated to service both readily accessible and inaccessible valves, nor was there an estimate of the number of valves and seals which would require service or replacement per month. The commenter further stated that the replacement of a single large valve alone could consume in excess of the allotted 16 man-hours.

Response:

EPA did provide estimates of time requirements for maintenance in the BID, p.8-8, and has reexamined these in the AID (III-B-2). While it is true that no distinction in time estimates is made between accessible and inaccessible valves, the total time estimate resulted from an assessment of maintenance requirements for valves, including inaccessible as well as accessible valves. The commenter is correct in saying that a single large valve may take as much as sixteen hours to replace. However, replacement of large valves is not expected to be a frequent occurrence. The average time for off-line repair of all sizes of valves used by EPA in its cost estimates has been estimated to be 4 hours per repair (see AID Section 5). The replacement of smaller valves is expected to take less than this allotted time for off-line maintenance, on the average.

The standards for inaccessible valves require annual monitoring and repair, compared to the monthly program for accessible valves. Considering an annual program for inaccessible valves, the repair requirements would be relatively infrequent.

4.2.3 Repair Requirements

Comment:

Several commenters (IV-F-1, No.1; IV-D-21; IV-D-26; IV-D-34) said that the requirement for repair at the next unit shutdown is too inflexible and ignores situations where replacement parts for leaking equipment may not be available until after the next shutdown. In two sets of these comments (IV-F-1, No.1; IV-D-21) it was stated that an extended shutdown could happen due to abnormal near term demand for replacement parts and for unforeseen manufacturer's or delivery delay. The third commenter (IV-D-26) also expressed concern that unscheduled outages, not related to maintenance could also create a situation where once the process unit was down it could not be restarted because of the inavailability of repair or replacement parts. He wrote that although this would not be a frequent occurrence, some provisions should be made to allow the process unit to start up again even though some unrepaired fugitive emission sources might still be leaking.

The same commenter cited another similar example involving custom-made equipment, e.g., a compressor built to certain design specifications that is not generally available. Due to the age of the unit, replacement seal parts may no longer be available and it may be necessary to replace the compressor with a new unit. The commenter suggested that if the existing unit does not present any occupational safety hazards, it should be allowed to continue operation during acquisition and fabrication of the new unit regardless of process shutdown.

Another commenter (IV-D-46) felt that there were significant points where back-up equipment could enable quick repair of leaks. Although not practical for all fugitive emission sources, the commenter said that some sources (control valves, block valves, pressure relief devices, pumps, compressors) could have back-up systems. The commenter continued, saying that back-up could be minimized by sharing between emission sources; for example, piping could be arranged so that a spare pump could serve as a back-up for more than one pump.

Response:

EPA agrees that there may be occasions when the lack of spare parts might prevent repair of all leaking valves during a unit shutdown. To allow for this eventuality, provisions have been made in the regulation to allow delay of repair beyond a shutdown if certain conditions are met. The conditions are that valve assembly replacement is necessary, valve assembly supplies have been sufficiently stocked, and the supplies have been deleted. Custom-order, unique parts should also be stocked to avoid delays of repair due to inavailability.

Spare parts, such as valve packing and pump seals, are items that are typically stocked and can be stocked without unreasonable burden. For example, assuming a unit maintains a stock of 8 spare pump seals, the annual cost of maintaining that stock is about $360. This value assumes $226/seal and an estimated carrying charge for the stock of 20 percent.

In allowing delays of repair, EPA recognizes that there may be instances where equipment cannot be repaired on-line. Although certain types of equipment are commonly spared in SOCMI, EPA determined it unreasonable to require spare equipment, where it is not the norm, so that leaks could be repaired quickly. The costs of requiring such redundancy would be prohibitive.

The delay of repair provisions are discussed in detail in Section 13 on Enforcement and Compliance Concerns.

Comment:

One commenter (IV-D-20) wrote that it would be almost impossible to inspect and repair units in 15 days.

Response:

The standards do not require that a unit be inspected and repaired in fifteen days. The standards require that all valves be monitored monthly but that nonleaking valves may be monitored quarterly. The fifteen-day requirement is for an individual valve not for a process unit. The requirement is that a valve found leaking must be repaired within 15 days of finding the leak, not within 15 days of the start date for monitoring in the process unit.

Comment:

In another set of comments (IV-D-17) the need for flexibility in scheduling repairs was stressed. The commenter said consuming an entire maintenance force to repair 10 percent of the components may result in allowing nonleaking equipment to deteriorate. He was concerned that the fifteen-day repair requirement might prevent timely maintenance on nonleaking equipment, thereby fostering a situation conducive to causing more leaks. Another commenter (IV-D-46), however, disagreed, stating that 15 days was too long a period. This commenter felt that 5 days would be adequate to effect repairs, since personnel and supplies should be at hand.

Response:

The fifteen days is considered adequate for repair of all but those valves which are critical and cannot be by-passed. The fifteen days provides sufficient time to schedule and effect on-line repairs that a shorter time period might not allow. Provisions have been made for delaying repair of those valves until the unit is shutdown.

EPA recognizes the fact that maintenance labor will be required for the implementation of this leak detection and repair program. The extra manpower required had been estimated and included in the cost estimates in Chapter 8 of the BID. These requirements were also included in the estimates presented in Chapter 5 of the AID (III-B-2). The additional maintenance manpower should allow efficient scheduling of preventive maintenance while the leak detection and repair program is underway.

Comment:

One set of comments (IV-D-17) expressed agreement with the estimates of ten minutes on-line and four hours off-line repair times. But the commenter expressed concern that EPA has not allowed any unit downtime for repair of valves which must be taken off-line for repair. The commenter pointed out that while many leaks can be repaired soon after they are found, and while the leaking equipment remains in service, it must be recognized that situations exist where quick repairs will, in fact, result in increased emissions. As an example, the commenter mentioned a situation where a critical component of a process unit is leaking. Repair of this critical component requires a special shutdown of the process unit. In order to safely shut down the unit, more emissions enter the atmosphere than would have been emitted from the leaking component. The commenter suggested that the proposed standard should not only allow, but strongly encourage the application of realistic judgement in these cases so that total emissions are reduced. He added that if EPA insists upon repair which requires unit shutdown, it must include a debit for lost production.

Another commenter (IV-D-32) said that some leaks are better left unrepaired. He explained that, to change a valve with a small leak, transfer lines would have to be purged. Even after purging, the line would contain enough material to pollute the atmosphere.

Response:

EPA recognizes the fact that it would be impractical to shutdown a process unit to repair a valve. The standard does not require that a unit be shutdown for repair. Allowance is made for repairing such critical valves at the next unit shutdown. In addition, those valves that can be isolated but would require considerable purging of VOC to the atmosphere would be exempted from repair until the next unit shutdown. Because shutdowns are not required, a debit for lost production is not necessary.

Comment:

One commenter (IV-D-46) was concerned that the focus of the standard appears to be on detecting and repairing leaks after they have occurred. He noted that the preamble devotes scant attention to preventive maintenance that could minimize development of leaks in the first place. For example, the commenter pointed out, EPA has apparently not considered the possibility of replacing the packing in valves at regular intervals, before it becomes brittle and subject to leakage. He suggested that automatic replacement at regular intervals may be justified.

Response:

Certainly the ideal way to eliminate fugitive VOC emissions is to prevent them from occurring altogether. Some of the equipment and performance requirements in the final standards provide for this where possible. One means of reducing leaks from valves is through scheduled preventative maintenance. Owners and operators have incentive under the standards to increase preventative maintenance efforts in order to reduce the number of valves found leaking. This procedure would reduce the monthly monitoring burden. This type of program would not, however, eliminate leaks from occurring due to the numerous variables affecting the valve leak occurrence rate. Although regular valve packing changes may reduce the leak occurrence rate, it would not eliminate leaks from occurring altogether; a leak detection and repair program would still be needed to find these other leaks.

As illustrated by the data collected on fugitive emissions, most valves do not leak. And in some instances, attempting repair of a nonleaking valve can result in creating a leaking source. Thus, there may not necessarily be a positive benefit for routine packing replacement in valves.

4.2.4 Accessibility

Comment:

Several commenters (IV-F-1, No.1, p.11; IV-D-5; IV-D-15; IV-D-17; IV-D-21; IV-D-23; IV-D-26; IV-D-29; IV-D-34; IV-D-43; IV-D-50) expressed concern about the inaccessibility of some valves in SOCMI units. Four sets of the comments (IV-F-1, No.1; IV-D-17; IV-D-21; IV-D-50) gave safety considerations, configuration, and elevation constraints as the possible reasons why a valve may be inaccessible for monitoring. Commenters said that many of these valves can be eliminated in an entirely new plant but become a problem when an older plant becomes subject to the regulations due to modifications. Two commenters (IV-D-21; IV-D-34) recommended that such inaccessible equipment be exempted or excluded from the proposed NSPS. Another commenter (IV-D-17) suggested that two new Sections 60.482(f)(7) and 60.482(f)(8) be added as follows:

> (7)(i) An owner or operator of a new or modified source subject to the requirements of §60.482(f)(1)-(6) may for valves that are routinely inaccessible for safety reasons monitor each inaccessible valve for leaks after a process unit overhaul prior to startup by pressuring with nitrogen to the system process pressure or 100 psig, whichever is less, and checking with a soap solution for bubbles, or other equivalent test method pursuant to §60.484.
>
> (ii) When a leak is detected, it shall be repaired as soon as practicable, but no later than the next scheduled shutdown, or consistent with §60.482(h).
>
> (iii) For purposes of §§60.483 or 60.484, inaccessible valves shall not be included.
>
> (8)(i) An owner or operator of a modified source subject to the requirements of §60.482(f)(1)-(6) may for valves that are routinely inaccessible because of elevation or configuration monitor each inaccessible valve annually using test methods pursuant to §60.485 or a soap solution for bubbles.
>
> (ii) When a leak is detected, it shall be repaired as soon as practicable, but no later than the next scheduled shutdown, or consistent with §60.482(h).

(iii) For purposes of §§60.483 or §60.484, inaccessible valves shall not be included.

Another commenter (IV-D-23) recommended either an exclusion or an alternative method of sampling for inaccessible valves. He referred to an alternate test procedure suggested by an industry group (IV-D-17). He stated that the costs would increase significantly if inaccessible valves were required to be sampled routinely.

One other commenter (IV-D-26) referred to EPA reports which indicated some accessibility problems experienced by the contractors during monitoring. The commenter expressed concern that despite this contractor experience, EPA wishes to impose on SOCMI such a frustrating and potentially hazardous task.

Response:

EPA recognizes that some valves may be difficult to monitor because access to the valve bonnet is restricted or the valves are located in elevated pipe racks. In addition, some valves may be unsafe to monitor because process conditions include extreme temperatures, pressures, or chemicals which could be explosive or hazardous. Difficult to monitor valves can be eliminated in new process units but may not be eliminated in existing process units. Therefore, the proposed standard has been amended to provide for these circumstances.

For process units that become affected by a modification or reconstruction, EPA is requiring an annual leak detection and repair program for valves which are difficult to monitor. Valves which are difficult to monitor are defined as valves which require safely elevating monitoring personnel more than two meters above any permanent available support surface. This means that ladders may be required to elevate monitoring personnel safely, but scaffolds will not be required.

Valves which are unsafe to monitor cannot be eliminated in new or existing units. These valves are required in certain process units and would be unsafe to monitor under certain process conditions. These valves can be monitored at times when the process conditions that indicate the unsafe conditions are not occurring. Owners or operators will be required to demonstrate that valves are unsafe to monitor on a routine basis and to prepare a plan for monitoring those valves which are unsafe to monitor routinely. Valves which are unsafe to monitor are defined as those valves which could, based on the judgement of the owner or operator, expose monitoring personnel to imminent hazards from temperature, pressure, or explosive process conditions. A plan is required that defines a leak detection and repair program conforming with the routine monitoring requirements of the proposed standards as much as possible given that monitoring should not occur when it is unsafe to monitor valves that would expose monitoring personnel to imminent hazards from temperature, pressure, or explosive process conditions.

### 4.2.5 Other Monitoring Methods

Comment:

One commenter (IV-D-24) suggested that in light of the high vapor pressure characteristics of the chemicals listed in Appendix E (§60.489) of the regulations, area monitoring of processes enclosed by buildings will suffice in determining the presence of a leak. He recommended that provisions for this special case should be included in the regulations.

Response:

As discussed in the BID in Appendix D, EPA performed a limited evaluation of fixed-point monitoring systems. The results of these tests indicated that fixed point systems were not capable of sensing all the leaks that were found by individual component testing. As a result, fixed-point area monitors were not incorporated in Reference Method 21.

The application suggested by the commenter, while it does not conform to Reference Method 21, may be useful to an owner or operator who has elected to comply with an alternative standard. It is possible that fixed-point monitors could be used for surveillance in addition to individual source monitoring.

Comment:

One commenter (IV-D-13) stated that application of any control resources other than visual inspection to equipment handling liquids in the vapor pressure range of concern would not be cost effective. He noted that almost any amount of leakage will occur in the liquid form. Evaporation rates are so slow that accumulation of liquid becomes readily evident long before serious impact upon the environment occurs.

Response:

Evaluations of monitoring methods were made in selecting the method of individual point monitoring with portable VOC analyzers. Visual inspections were discarded as being too subjective to be reliable. Experience in the field has shown that leaks are found with a portable VOC analyzer which would not be detected by visual, audible, or olfactory means. Therefore, the portable VOC analyzer was chosen as the monitoring method.

Comment:

In objecting to a leak detection and repair program, one commenter (IV-D-32) said that most large plants have safety and housekeeping inspection teams that perform maintenance checks for the kinds of leaks to be regulated by the proposed rule. He felt that only training and close supervision could correct sloppy operational practices.

Response:

While it may be true that some plants have safety and housekeeping inspection programs that detect visible leaks, this practice is not uniformly found in all SOCMI units. The leak detection and repair programs that are part of the final rule are intended to identify VOC leaks that may not be detected by visual, audible, or olfactory means which tend to be very subjective.

Comment:

One commenter (IV-D-1) wrote that data, currently not available, will show that leak frequency will vary with different types of valves. It would, therefore, be appropriate to group them into different categories according to leak frequency. He suggested that it would also be possible to have different inspection plans for the different groups. He added that it is also appropriate to vary the protection level depending on the toxicity or hazardous nature of the leaking chemical. According to the commenter, the effort should be focused where leaks occur most often.

Response:

The philosophy of focusing effort where leaks occur most frequently is a sound one which is endorsed by EPA. In fact, the standard for valves incorporates features resulting from the application of this philosophy. Several types of fugitive emission sources have been exempted from coverage because of low leak frequencies, e.g., flanges and heavy liquid equipment. Furthermore, the scheme of less frequent monitoring of valves which do not leak for two consecutive months is consistent with this philosophy.

Recent analyses of fugitive emissions data gathered by EPA in SOCMI units indicate several factors which may influence leak frequency, such as valve type, line pressure, primary material in the line, and chemical unit type. These factors may be useful to an owner or operator who chooses to develop his own plan to comply with an alternative standard. It would be impossible, however, to write the nonoptional valve standard (§60.482f) in a manner that allows for all of those factors. The resulting standard would be excessively complex and unmanageable.

Protecting people and the environment from toxic chemicals is certainly an important goal. EPA has determined that VOC compounds contribute to air pollution which may endanger man's health and welfare and that, therefore, all VOC should be prevented from entering the atmosphere, including those chemicals which are toxic.

4.2.6 Potential Monitoring Problems

Comment:

Two commenters (IV-D-15; IV-D-43) wrote that instrument calibration, operational reliability (an inventory of spare parts is needed), and difficulties encountered in the field appear to be major problems in monitoring VOC's in SOCMI plants. Chapter 4 of the BID notes "portable hydrocarbon detection instruments are the best method for identifying leaks of VOC from equipment components" (p.4-2). However, the commenter noted that there is no discussion in the BID of the many difficulties encountered during contractor sampling in SOCMI plants. The difficulties as detailed by the commenter are:

a. "Nuisance" malfunctions such as failure of the battery pack, preamplifier and readout meter. Hydrogen leaks also were frequently encountered in the monitoring equipment.

b. Another example of a "nuisance" malfunction occurred when excessive amounts of moisture or organic liquids were drawn into the probe of the hydrocarbon detector. The contractor's solution to the problem was to allow the instrument to run and dry out for several <u>hours</u> before reuse. This delay is distruptive and certainly is more than a "nuisance" when attempting to minimize sampling costs associated with compliance with this regulation.

c. The EPA contractor also observed that water, drawn into the instrument probe and internals during rainy weather or from icy surfaces, often produced random electrical signals and subsequent erratic behavior. Again, the contractor's solution to this problem was to allow the instrument to run and dry out for several hours.

d. With Century Systems' instruments the hydrogen flame was extinguished often when too rich (i.e., very high concentrations) compositions of VOC's were introduced into the instrument. This necessitates bringing the instrument to an area where safe ignition of the hydrogen can be made.

e. During EPA's survey of an adipic acid manufacturing plant, the sampling team used teflon tubing packed with glass-wool to prevent particulates and liquids from contaminating the OVA probe. In addition, it was reported "when cyclohexane contaminated the probe, we used an elaborate wash system to purge the OVA." (The use of the glass-wool and an "elaborate wash system" are not described in Reference Method 21.)

f. Instrument response to some organic compounds (phenol, for example) was very slow (10-30 seconds) and background zero was obtained only after 2 to 3 minutes. Thus, average sampling time/source can be adversely affected. The EPA contractor sampling team also noted that a very sluggish response to fugitive aromatic emissions (particularly cumene) was observed.

g. Apparently, adverse weather conditions, such as high winds, heavy rain or severe cold, hampered the screening efforts of the contractor at several process units. None of these problems was discussed in the BID. Further, the proposed regulation makes no allowance in the economics for sampling that is terminated because of inclement weather.

In summarizing his concerns, the commenter stated that the instrumentation used in VOC monitoring programs may not be reliable, and will result in significant additional manpower requirements not considered by EPA in developing the economics for each alternative.

Another commenter (IV-D-26) referred to the EPA contractor report "Frequency of Leak Occurrence for Fittings in Synthetic Organic Chemicals Plant Process Units." He stated that this report describes in considerable detail the delays in monitoring caused by instrument problems, failure of major parts, and slow repair. The commenter expressed the opinion that the OVA-108 does not seem to be really designed for rugged and continued use.

Response:

It is true that portable VOC monitors require some maintenance and care in their use. It is also true that a certain number of spare parts should be kept on hand to insure uninterrupted service. The instruments are certainly not perfect, but they are the best method for identifying leaks of VOC from equipment components, and it is expected that as more development work is done, the durability and reliability of the instrument will be improved. Alternatives to portable VOC monitors would be confined to expensive, nonportable analytical instruments not suited to field application, not explosion-proof and even more fragile than portable VOC analyzers. In other words, portable VOC analyzers are the only choice.

Recognizing that maintenance would be required for the portable VOC monitor, as it would for any analytical instrument, an allowance for maintenance was made in the cost analysis. The cost estimate for instrument maintenance including parts and labor was $2,700 per year. The estimate is shown in Tables 8-9, 8-10, 8-11, and 8-14 of the Background Document.

Some of the nuisance malfunctions mentioned by the first commenter can be avoided by careful operation of the instrument. Avoiding drawing liquids or particulates into the probe tip will eliminate the need to let the instrument run and dry out for several hours.

Contrary to the information presented in the first comment, extinguishing of the flame by VOC compositions which are too rich presents no problem to the Century System's instrument. The flame can be reignited safely within seconds without removing the instrument from the plant environment. (See the instrument manual for a description of its safety features.)

While it is true that use of glass-wool and an "elaborate wash system" are not given as part of Reference Method 21, these procedures were presented in the 24-Unit study (IV-A-11) as methods used to circumvent specific problems encountered during sampling by contractors. These procedures may not be necessary in all units, but there may be instances where the owner or operator deems it valuable to implement these procedures to avoid contamination of the probe by particulates or liquids.

In response to the comment concerning sluggish response to certain chemicals, it is true that sluggish response of an instrument to certain chemicals could affect monitoring time for an individual unit. However, the average monitoring time reported by EPA contractors incorporates those delayed response times. So, the average time reported is unaffected by sluggish response.

As the first commenter indicated, it is also true that inclement weather can delay or prevent monitoring with portable VOC monitors. However, an owner or operator of an affected facility will have much wider latitude in scheduling for inclement weather than contractors working under tight schedules. Interruption or termination of screening will not require starting over, merely resuming where the interruption occurred, so that no allowance was made for extra cost. Furthermore, scheduling of outdoor activities to meet weather conditions is an administrative problem frequently encountered and successfully solved in SOCMI.

The second commenter generally echoed the first commenter's complaints about portable VOC monitoring instruments. However, he also complained about slow repair service. Slow repair service by the factory was encountered as noted in the referenced report. However, as also noted in this report, a major contributing factor in the delayed repair service was the fact that the factory was being moved at the time. The report also noted that regional factory representatives did much to alleviate delays by providing access to back-up instruments.

Comment:

One commenter (IV-D-18) expressed concern that tightening the packing on certain types of valves may make emissions worse. He pointed out that, as mentioned in the preamble, overtightening will frequently cut or shear the packing. The commenter stated that overtightening will frequently result in increases in emissions, shorter valve life, and will be counter-productive to the intent of the regulation.

Response:

EPA recognizes the fact that some valves cannot be repaired on line. Overtightening is not advisable and is not encouraged. The regulation does not require that valves be overtightened. It allows for valves which cannot be repaired on-line to be repaired off-line at the next unit shutdown.

Comment:

One commenter (IV-D-32) stated that keeping track of numerous fugitive emission sources (250 in one unit, for example) would be impossible with limited program resources.

Response:

The final standards require maintaining records on only those fugitive emission sources found leaking. As part of its regulatory analysis, EPA considered reporting and recordkeeping requirements. As a result of this analysis the reporting requirements have been reduced in the final rule to semiannual reporting, in addition to the notifications required by the General Provisions and the regulation. Reporting and recordkeeping is addressed in detail in Section 11.

## 4.3 LEAK DEFINITION

Numerous comments were received regarding the selection of the leak definition for the valve leak detection and repair program. Most comments suggested that the leak definition be raised. A variety of reasons were cited for the increase including emissions reductions, maintenance reductions, and reasons related to the monitoring instrument. Comments on the leak definition for pumps were also received.

Comment:

A commenter (IV-D-17) wrote that it was his understanding that the 10,000 ppmv action level was chosen because it is the top of the scale on the Century Organic Vapor Analyzer. The commenter noted that apparently, EPA felt that 10,000 ppmv would make compliance monitoring easier for the chemical industry. He expressed significant disagreement with this assumption. He said that the scale on the Century instrument is a minor consideration. The commenter said that readings higher than 10,000 ppmv can be obtained readily with a dilution apparatus. In addition, he expressed confidence that equipment manufacturers will be able to supply instruments with direct scales to whatever level is required.

Response:

It is true that one consideration in selecting 10,000 ppmv as the leak definition for the SOCMI fugitive VOC emissions standards was the monitoring instrument characteristics. Data on which the standards are based were collected using common hydrocarbon detectors that are readily available. These instruments provide direct measurements of VOC up to 10,000 ppmv; in order to measure higher concentrations with the instruments most commonly used, additional care and calibration for devices such as dilution probes are required to obtain accurate results. As a result, additional costs are associated with measuring concentrations higher than 10,000 ppmv. Although instruments that directly measure higher VOC concentrations may be available in the future, the standards are based on the least complicated and best established portable hydrocarbon detection technique currently available.

Comment:

Several comments were received which said that the 10,000 ppmv action level could not be justified by the emission reductions achieved. One commenter (IV-F-1, No.3) called the choice of leak definition arbitrary. Another commenter (IV-D-17) argued that using a 20,000 ppmv action level instead of 10,000 ppmv would result in only 1 percent more emissions.

Comments were also received which stated that the SOCMI Maintenance Study data suggest a higher leak definition. One commenter (IV-D-7), using leak frequency/mass emissions data correlations developed in the Maintenance Study as his basis, wrote that if EPA set a leak definition on the basis of mass emissions equivalent to those defined in the refinery CTG, an appropriate leak definition would be 35,000 - 99,500 ppmv (based on methane). He added that using the leak definition as proposed by EPA with no consideration of its relationship to mass emission rates results in much wasted motion by attempting to correct leaks which are insignificant and unrepairable. The commenter suggested that EPA examine the SOCMI maintenance data to determine if it would support a higher leak definition and still effect a high percentage reduction of mass emissions. The first commenter (IV-D-17) said that recent SOCMI data point to a screening value of 40,000 ppmv. Furthermore, he stated that his preliminary analysis of the data shows that a majority of emissions could be controlled with a definition of 100,000 ppmv or higher.

The commenter went on to say that, if the leak rates from equipment in SOCMI were lower than originally predicted by EPA or if the leak frequency were lower, a lower percentage of mass emissions would be controllable for a given action level. Moreover, total uncontrolled emissions would be lower and control based on a low action level would not be justified.

In a later letter, the commenter (IV-D-50) recommended using an annual monitoring plan, a 100,000 ppmv screening value for valves in gas service, and a 10,000 ppmv screening value for other sources. He presented data (Table II, IV-D-50) to demonstrate control efficiencies of various plans. The commenter estimated that, under the recommended plan, NSPS emissions would be below 26 Gg/yr.

Response:

The leak definition of 10,000 ppmv was selected based on the results of testing on SOCMI sources. Table 4-6 presents a summary of the percent of sources screening above the action level (leak definition) for various action levels (an indication of the number of leaks) and percent of mass emissions attributable to these action levels. Analysis of the results of the SOCMI study (IV-A-14) demonstrates two important conclusions. First, between 4 and 10 percent less mass emissions, not an insignificant quantity, would be detected with an action level of 20,000 ppmv instead of 10,000 ppmv for the SOCMI sources tested. Secondly, the percentage of valves found leaking would be only 0.1 to 4 percent fewer. For a model unit B, this would mean a minor difference of one to 21 fewer valves found leaking initially, at an annualized cost difference of $4 to $84 for the initial repairs.

EPA has determined that, along with other reasons discussed in this section, the potential emissions reductions attributed to a leak definition of 10,000 ppmv warrant the small amount of additional work required to maintain the few extra leaks detected. The work required to monitor and repair the extra valves found leaking between 10,000 and over 20,000 ppmv was also not considered burdensome. An analysis of valve leak detection and repair programs for different leak definitions indicated that a leak detection and repair program based on 10,000 ppmv would result in a credit of $60/Mg of additional VOC recovered over a program based on 20,000 ppmv. Therefore, 10,000 ppmv was selected as the leak definition.

Comment:

Another commenter (IV-D-46), however, stated that EPA is not justified in exempting from the repair requirements all leaks below 10,000 ppmv. He quoted a passage from the proposed standards to demonstrate that EPA is not claiming that it knows that making repairs in 1,000-10,000 ppmv range will result in net increases in emissions. The commenter noted that EPA is only speculating that they will. He also pointed out that Table C-16 of the BID shows that most repaired leaks result in lower emission levels.

TABLE 4-6. SUMMARY OF PERCENT OF SOURCES DISTRIBUTION CURVES AND PERCENT OF MASS EMISSIONS CURVES AT VARIOUS ACTION LEVELS[a]

| | Percent of Sources Screening Above[b] | | | | Percent of Mass Emissions Attributable to Sources Screening Above[b,c] | | | |
|---|---|---|---|---|---|---|---|---|
| | 10,000 | 20,000 | 40,000 | 100,000 | 10,000 | 20,000 | 40,000 | 100,000 |
| Valves | | | | | | | | |
| Gas | | | | | | | | |
| Ethylene | 15 | 12 | 10 | 7 | 94 | 90 | 84 | 71 |
| Cumene | 16 | 13 | 10 | 6 | 94 | 89 | 83 | 69 |
| Vinyl Acetate | 3.7 | 2.8 | 2.0 | 1.2 | 90 | 84 | 77 | 62 |
| Light Liquid | | | | | | | | |
| Ethylene | 26 | 22 | 18 | 13 | 89 | 83 | 75 | 60 |
| Cumene | 12 | 9 | 6 | 4 | 80 | 71 | 61 | 45 |
| Vinyl Acetate | 0.2 | 0.1 | 0.1 | 0 | 25 | 16 | 10 | 4 |
| Pump Seals | | | | | | | | |
| Light Liquid | | | | | | | | |
| Ethylene | 30 | 24 | 18 | 12 | 96 | 92 | 86 | 73 |
| Cumene | 14 | 11 | 8 | 5 | 89 | 83 | 75 | 61 |
| Vinyl Acetate | 1.7 | 1.0 | 0.5 | 0.2 | 67 | 57 | 46 | 31 |

[a]Curves are based on models derived from data collected during 24-unit SOCMI study.

[b]Screening values are in ppmv.

[c]These values were based on the original leak rate/screening value correlations presented in the Maintenance Study and have not been changed to reflect the new correlations developed in the Technical Note on the revision of SOCMI emission factors. Based on a comparison of empirical data, these values are not expected to change significantly.

This commenter also wrote that even if the 1,000 ppmv level is inappropriate, EPA should have examined whether an intermediate cutoff (e.g. 8,000, 5,000, or 3,000 ppmv) would better maximize net reductions. Neither the BID nor the proposal discusses the possibility of different cutoff levels for different types of emission sources.

Response:

The commenter (IV-D-46) correctly pointed out that there would be only a potential for a net increase in emissions if an action level between 1,000 and 10,000 ppmv were selected. The potential increase in emissions that could result from attempted repair of a valve with a screening value between 1,000 and 10,000 ppmv. But it is unknown precisely at what action level maintenance efforts begin to result in increased emissions. Thus, EPA has determined to use the 10,000 ppmv leak definition as its lower bound for leak definition. Clearly, considerable emission reduction is achievable using a 10,000 ppmv leak definition, and the key criterion in selecting a leak definition is the mass emissions reduction achievable. Any leak definition chosen would only be an indicator of whether a source was emitting VOC in quantities large enough to warrant action (repair). A rise in the screening value above the leak definition is an indication that steps (such as repacking of valves or replacement of pump seals) must be taken to lower the screening value below the leak definition and, thus, reduce the emissions from the source. In this regard, certainly a leak definition of 10,000 ppmv accomplishes this goal and, based on the findings of the Maintenance Study, results in an overall 71 weight percent reduction of emissions using only simple on-line maintenance. Furthermore, the monitoring technique selected for the standards results in a leak or no leak determination and the leak definition should be easily implemented in this technique. The 10,000 ppmv definition fulfills this requirement. EPA has determined that using a lower leak definition would not increase emissions reduction significantly, and the potential net benefit of a lower leak definition is questionable. Therefore, a leak definition of 10,000 ppmv was selected instead of a lower level.

Comment:

One commenter (IV-D-17) said that raising the leak definition to 20,000 ppmv would decrease the maintenance required by 30 percent. He said that this factor is of major significance since Section 111 of the Clean Air Act requires the Administrator to take cost into consideration. The commenter had previously (IV-D-17) submitted data to show how he had arrived at his estimate which was based on valves in gas service. And in a later letter, the commenter (IV-D-50) reiterated that the proposed standards were not cost effective, citing as one reason the unreasonably low action level for leaks.

Response:

Under any assumed leak detection and repair program, the maintenance requirements would be directly related to the number of sources found leaking at the selected action level (leak definition). For all 24 units, only about 2 percent fewer gas valves were found leaking at a 20,000 ppmv action level than at an action level of 10,000 ppmv. Again, relating this to a model unit B used in the background document, only about 8 fewer gas valves would be identified as leaking if the higher action level were used. For valves in gas and light liquid service combined, about 21 percent fewer valves, or 16 valves in a model unit B, would be found leaking. This decreased number of valves represents a minor savings, as noted above, in maintenance costs attributed to the fewer hours associated with screening and repairing these valves. However, as noted in the previous response, the incremental cost effectiveness of using a 10,000 ppmv leak definition instead of 20,000 ppmv is a credit of about $60/Mg of additional VOC recovered. Therefore, EPA has determined the emissions reductions for a leak definition of 10,000 ppmv attainable at a reasonable cost (costs were discussed in detail in Chapter 5 of the AID).

Comment:

The same commenter (IV-D-17) wrote that the change in calibration gas from hexane to methane has effectively lowered the trigger point and recommended 20,000 ppmv as a leak definition. Another commenter (IV-D-7) objected to the change, noting that EPA's justification was that methane is available. He found this justification inadequate (See Section 12.1).

Response:

The final regulatory analysis for the SOCMI valve leak detection and repair program was based on SOCMI screening data measured with an instrument calibrated to methane. EPA's determinations regarding regulations for SOCMI fugitive emission sources were made based on these SOCMI data, not on other data obtained with another instrument calibrated to a different gas. Therefore, EPA sees no reason to alter the leak definition for differences in calibration gases.

The availability of methane was not the sole reason for its selection as the calibration gas for Reference Method 21 when used for SOCMI screening. It is true that methane is more readily available than hexane in the concentrations required for calibration. As discussed in Section 12.1 Test Methods, the SOCMI data gathered to support these standards were collected using methane as a calibration gas. Furthermore, as explained more fully in Section 12, the differences between the results obtained by the OVA*-methane system (used in SOCMI studies) and the TLV*-hexane system (used in refinery studies) are not really significant at the 10,000 ppmv action level. Therefore, data collected using either the OVA-methane system or the TLV-hexane system can be used interchangeably at the 10,000 ppmv action level.

For some types of monitoring instruments allowed in the Reference Method, however, methane cannot be used as the calibration gas. Photoionization instruments, for example, may be useful in certain SOCMI units, these instruments do not respond to methane. An alternative calibration gas has been added in the regulation to allow for this situation but is not restricted to a single type of analyzer. Based on the comparison presented above, hexane has been specified as the alternative calibration material. Moreover, one industry study (IV-A-17) indicates a comparable number of leaks determined using hexane and methane with the Century OVA* and Bacharach TLV.*

Comment:

Variation in repeat measurements of the same valve were also cited as the basis for raising the leak definition to 20,000 ppmv (IV-D-5; IV-F-1,

*Mention of trade names does not represent endorsement by EPA.

No.4). In a later letter, the commenter (IV-D-40) stated that the level should be high enough to allow for variations and still identify only significant leakers, if a single leak definition is to be set for the whole industry.

Another commenter (IV-D-46), while agreeing with a focus primarily on large leakers, expressed the belief that the cutoff levels should be lowered to include more leaks. He further stated that EPA has chosen the most cost-effective, sensible approach.

Response:

Repeat screening was addressed in a report filed in Docket Item No. IV-A-7. In this report, the variability in repeating precise screening values was given as X/5.6 to 5.6X. While this does represent a wide range of values, it relates to obtaining a discrete value. Reproducibility of leak/no leak determination is a more appropriate consideration when applying Reference Method 21 since a precise screening value need not be determined. In Docket Item No. II-B-24, reproducibility of leak/no leak determination at a 10,000 ppmv action level was given as 90 percent. In another research study (IV-A-30), reproducibility of leak/no leak determination at a 10,000 ppmv action level was given as greater than 94 percent. EPA, therefore, finds no basis for changing the leak definition for the SOCMI standards.

As discussed in response to previous comments, EPA has determined that lowering the leak definition is not warranted. The standards are based upon emission reduction achievable. The leak definition is only an indicator of whether a source is emitting VOC in quantities significant enough to require action. The utility of the 10,000 ppmv leak definition to this purpose has been thoroughly presented in this section. In lowering the leak definition, the emissions reduction achieved would probably not be increased much and the point may be approached that attempted repairs could even result in increasing emissions.

Comment:

Variability in response factors was also cited as supporting evidence that the leak definition should be raised (IV-D-7). The commenter objected to EPA's reasoning that a variability of 2 to 3 would not have a significant impact on the decision as to whether a leak exists when compared to the total number of potential leak sources. He said that the comparison should be made to the number of leaking sources and not the total number of potential leaking sources. He further stated that the variability in response is 0 to 571, not 2 to 3 as reported by EPA. He charged that EPA was aware of this variability before proposal because it was reported in September, 1980, in EPA Report No. 600/2-81-002. The commenter admitted that calibration of the instrument for each chemical involved would be impractical but suggested that an allowance should be made for the variability in response factors by defining leak concentrations on the basis of the type of unit surveyed.

Response:

The commenter accurately points out that a wide variation in response factors (0-571) was determined in laboratory testing of two portable VOC analyzers used for a number of organic chemicals. But it is important to point out that, even though this wide variation existed for all chemicals tested, 90 percent of these chemicals had response factors between 0.1 and 10 (IV-A-8). In addition, many of the chemicals falling outside of this range either are not SOCMI chemicals or are heavy liquids. And other monitoring instruments may demonstrate better response factors for specific chemicals that are to be monitored.

The monitoring requirements of Reference Method 21 result only in a determination of leak or no leak at an action level (leak definition), not a concentration measurement. As a result, the effect of response factor variation on percent leaking estimates is dampened since precise concentration measurements are not required. These effects were analyzed in the EPA report on the 24-Unit SOCMI study (IV-A-14). The conclusion of this analysis was that only a small reduction (approximately 3 percentage points) in the estimated leak frequencies was evident for gas valves in high leak service, while no distinguishable differences were seen in all other cases.

EPA, therefore, has determined that no allowances are needed in the leak definition to account for variation in response factors.

Comment:

One commenter (IV-D-17) wrote that EPA has defined a leak based simply on the ability to repair the leaking components. Although he commenter admitted that data may show that attempted repair of valves leaking at about 1,000 to 3,000 ppmv could result in an increase in emissions, it was impossible to understand how these data restrict the upper limit to 10,000 ppmv as proposed by EPA. The commenter suggested that it can be easily concluded from the present data that repairing leaks with screening values of 1,000 - 2,000 ppmv may not result in net reductions of emissions. On this basis, the commenter agreed that it is certainly important not to cause small leaks by requiring tightening of valves with a low-level leak definition. However, he also concluded from all available data that leaking valves could be defined as 1,000 - 20,000 ppmv which would significantly reduce the percent of unsuccessfully repaired valves and almost eliminate the increased emission rate of some attempted repairs. According to the commenter, there is no justification in these data to restrict the upper limit of a leak definition to 10,000 ppmv as proposed by EPA.

Response:

The standards are based on the emission reduction achievable, not on the ability to repair. The leak definition provides an indication of the significance of leaks in terms of mass emissions. Using a leak definition of 1000 ppmv, the emissions may actually increase as a result of attempted repair. This phenomenon was discussed earlier in this section. But, at a leak definition of 10,000 ppmv, simple on-line maintenance resulted in 71 weight percent reduction of emissions. For those valves that can be isolated, off-line maintenance will be done. For valves that cannot be repaired on-line and cannot be isolated, repair will be done at turnarounds (shutdowns). These efforts will result in a higher weight percent reduction. Therefore, EPA decided to use 10,000 ppmv as the leak definition.

Comment:

Comments were also received concerning the leak definition applied to pumps. One commenter (IV-D-15) argued that the proposed requirements to inspect dual seals for visible leakage of fluid and the assumption that any visual detection of liquid dripping will constitute a leak which must be repaired may result in significant expenditure of time and effort without any effect on VOC emissions. In most instances, leakage of the process fluid cannot occur across the inboard seal due to the higher pressure of the barrier fluid in the stuffing box, and liquid dripping from the outer seal will be only the barrier fluid. No light liquid VOC will be present and no fugitive emissions will occur. Therefore, the commenter stated, defining any visible dripping from the seal area as a leak is unjustified. Furthermore, since by their very nature all mechanical seals will leak some barrier fluid when in operation, the proposed definition of a leak would have most pumps in a perpetual state of leakage.

The commenter asked for a more specific definition of a leak. He suggested that specifying the number of drops per minute would be one method to avoid this situation. Rule 466 of the South Coast Air Quality Management District in California specifies a rate of 3 drops per minute as constituting a leak for pump seals. The commenter recommended that a similar provision should be included in the final standards. In addition, a suspected leak of VOC observed by visual inspection should be confirmed by monitoring prior to initiating repair work. He stated that if the VOC is below 10,000 ppmv, pump repairs should not be made.

Another commenter (IV-D-17) wrote that in many instances, the barrier fluid could be water, so there would be no reason to repair the seal where the barrier fluid pressure is higher than the pump pressure. He recommended rewording Section 60.482(a)(4) as follows:

> Each pump shall be checked by visual inspection each calendar week for indications of liquids dripping from the pump seals. If indications of liquids dripping from the pump are seen, the vapor emissions shall be monitored by the methods specified in 60.485. A vapor concentration containing greater than ten percent VOC at greater than 10,000 ppmv above background shall constitute a leak.

Response:

At proposal, the standards for pumps in light liquid service required the use of dual seals with a non-VOC barrier fluid systems. A weekly visual inspection of the pump seal was required to identify a leak. As discussed in Section 4.8 on Dual Seals, the final standards for light liquid pumps include a work practice standard in addition to the equipment standards presented at proposal. The work practice standard uses a leak definition of 10,000 ppmv to be determined in accordance with Reference Method 21.

Under the work practice standards pumps would be monitored monthly to detect leaks using a 10,000 ppmv action level (leak definition). Pumps screening above 10,000 ppmv would be defined as a leak, requiring repair as soon as practicable. The first attempt at repair would be made within five days of detection and repair would be required within 15 days. As an alternative to the work practice standard, the equipment requirements (dual seals, etc.) could be met.

A leak under the equipment standard for light liquid pumps is still defined as any visible leakage from the seal area. The "drops per minute" format was considered but was not chosen because leakage from pump seals is often in the form of spray or mist, or is exhibited by ice formation around the seal area.

Under the equipment standard, a leak is also detected upon failure of the seal system and/or the barrier fluid system which would be indicated by a sensor. Again, when a leak is detected, repair must be effected within 15 days of detection. Regardless of seal type/arrangement, visible leakage from the seal area is generally indicative of seal wear. To prevent excessive wear that could possibly result in catastrophic seal failure, the seal should be repaired soon after leakage is detected. Therefore, visible leakage from the seal area is defined as a leak under the standards for pumps.

## 4.4 SAFETY CONSIDERATIONS

Some of the comments received on the proposed standards dealt specifically with safety considerations of the control technologies presented in the support documents. The four areas commented on include closed vent systems and incinerators, rupture disk/pressure relief device installations, hazards during monitoring, and double valve requirements. Some other comments concerning safety considerations are included under the individual equipment types involved because the comments focus more on the control technology for specific equipment types than on the safety aspects.

Comment:

One commenter (IV-D-17) stated that, as presently drafted, the requirement for closed vent systems is potentially unsafe. The following reasons were given for these safety concerns.

First, the conveyance of explosive vapors or gases must be conducted under lean (<40 percent of the lower explosive limit) or rich (0 percent oxygen) conditions. Fugitive emissions from compressor and pump seals would not normally be present. The design of a sealed conveyance system which will not have hydrocarbon concentrations mixed with oxygen in the explosive range will be a difficult, if not impossible, engineering job. The engineering requirements for such a system include:

- either a sealed system without oxygen or a system which conveys vapor gas at <40 percent of the lower explosive limit at all times,
- the use of a water seal or equivalent to provide flashback protection between the conveyance system and the incinerator,
- the use of a blower/compressor to provide motive force to overcome seal and system pressure drop, and
- a turn-down capability in the order of magnitude range.

Secondly, the incinerator designed to burn the anticipated fugitive emissions efficiently will be unable to handle the volumes and pressures of volatile liquids and gases discharged under emergency conditions.

Thirdly, enclosed combustion devices are sensitive to conditions of feed. Under emergency conditions the system could see hot gases or cold (-150°F) liquids. An enclosed combustion device would have some difficulty meeting such operating requirements.

The commenter noted that the above concerns are best understood by considering an example. A chemical plant pumps liquid propylene at 400 psi. On occasion the pump seals blow, which triggers an automatic emergency pump shutdown. Under such conditions of emergency releases, an enclosed combustion device designed for fugitive emission loads is not believed to be able to handle the flow and pressure loads created by the above emergency situation. Such flow and pressure loads are said to be orders of magnitude higher than the design load for fugitive emissions.

Another commenter (IV-D-18) wrote that venting of emergency releases from rupture disks and emergency relief valves on larger tanks and vessels to incineration devices will create operational hazards due to design limitations.

Response:

The requirement of a closed vent system for fugitive emissions presents a difficult, but not insurmountable, design situation for safely conveying explosive vapors or gases if the system is used for transmission of fugitive emissions only. Balancing purge gas flowrates with anticipated releases (e.g., seal failures) must be done to avoid exceeding 40 percent of the lower explosive limit. This could potentially result in overdilution of "normal" fugitive emissions. But this same type design problem is encountered for any vent system where variable flows of explosive materials must be handled. Large variations in flowrates can typically be handled with flare systems which are now allowed, since these can achieve turndown ratios as high as 100:1.

Incinerators have limitations with regard to normal vent flows and flows experienced under emergency conditions. The equipment requirement is not for control of emergency flows; it is for disposal of low-volume fugitive emission streams. Incinerators, along with vapor recovery systems and properly designed and operated smokeless flares, are acceptable control devices for fugitive VOC emissions. VOC discharged under emergency conditions, such as overpressure relief, are not covered under the SOCMI fugitive VOC standards.

The safety and operational problems associated with incinerators cited by the comments relate to incinerators designed for control of fugitive emissions streams only. Incinerators are generally installed to control much larger streams than those expected for fugitive emissions sources. EPA believes that the incinerators designed for these larger streams, when available, will be used to control fugitive emissions streams as well. Since they would be designed for larger total flow, these incinerators would be capable of handling larger variations in stream characteristics resulting from process upsets. Therefore, it is unlikely that variations in the fugitive emissions streams will affect the operation of the incinerator. Even large changes in fugitive emissions streams would be small due to the small contribution of fugitive streams to the total flow. For example, the severe temperature changes referred to by one commenter would be dampened by dilution of the fugitive emissions stream into the main flow of the incinerator. Likewise, concentration differences and shifts in fugitive emissions will be dampened by the main incinerator stream so that incinerator operation will not be affected.

Comment:

One commenter (IV-D-6) stated that safety professionals at his organization strongly recommended against installing a rupture disk ahead of a relief valve. This combination increases the complexity of a relief system, reducing the reliability and increasing the probability of relief system failure. The commenter pointed out that a small leak in the rupture disk could lead to accumulation of pressure between the disk and the relief valves, causing the disk pressure to be increased significantly. A small leak of this type is believed to have contributed to the rupture of a nitroaniline reactor at one of the commenter's plants. The commenter further stated that safety audits of facilities which use rupture disk/relief device combinations often find full operating pressure downstream of the rupture disks.

Response:

The potential safety hazard resulting from leakage into the space between a rupture disk (RD) and a pressure relief device (PRD) can be minimized by proper installation of the disk assembly (ensuring the right seal without damaging the disk) and maintenance of the safety devices (ensuring that no leakage results from corrosion of the disk). Engineering codes (ASME and API) recommend as minimal requirements that safety indicators such as pressure indicators, petcock vent valves, etc., be installed between the RD and PRD to avoid this problem. An indicator of this type was included in the cost of RD/PRD installations in the background document. This issue is discussed in greater depth in Section 4.5 on pressure relief devices.

Moreover, the standards for pressure relief devices require that no detectable emissions be maintained. The standards do not specify how this level of emissions are to be met. Other means, such as piping to a flare, could be used as long as this level of emissions is met.

Comment:

One commenter (IV-D-26) noted that the EPA report "Frequency of Leak Occurrence for Fittings in Synthetic Organic Chemical Plant Process Units" points out that adverse weather, heavy rain, high winds, and extreme cold often delayed the monitoring studies at several process units. In addition, he said that each appendix of the report contains a section of sampling problems and the problems of instrument unreliability and the hazards of climbing up and down process units. The commenter wrote that with this contractor experience, he found it alarming that EPA wishes to impose on SOCMI such a frustrating and potentially hazardous task on a monthly (winter and summer) basis.

Another commenter (IV-D-48) stated that EPA has ignored the fundamental questions of worker safety and monitorability of valves in proposing the regulation. He wrote that for safety purposes, a valve should not be considered accessible if the valve cannot be reached safely from ground level or from a fixed platform. A valve should not be considered accessible for monitoring purposes if: (a) monitoring must be done from a movable ladder or "cherry picker," (b) it is located in high temperature and/or high pressure locations which are not routinely accessible for monitoring, (c) they are located in sealed or barricaded operating areas because of toxicity or explosive concerns, or (d) they are totally enclosed by insulation or drip covers to protect against corrosive leaks.

The commenter suggested an exemption to the periodic monitoring requirements for valves which are inaccessible for one or more of the reasons above. He said that, as an alternative to periodic testing, such inaccessible valves could be tested during shutdown periods by pressurizing the system with an appropriate gas to 100 psi, or to the process pressure, whichever is less, and checking the inaccessible valves for leaks by the appropriate leak detection procedure. However, such periodic checks of inaccessible valves should not be required more than once per quarter.

Response:

Contractor screening studies were conducted under time constraints that required sampling under adverse weather conditions. The timing of the periodic monitoring within a specific monitoring interval as required under the proposed standards, on the other hand, will be left to the discretion of the owner/operator. Plant personnel can schedule monitoring around unfavorable meterological conditions. Instrument reliability is attained through proper maintenance of the instrument and use of the correct sampling techniques. Training of personnel doing the monitoring will help achieve this result.

EPA recognizes that some valves are difficult to monitor, due to safety or access. Valves with difficult access can be virtually eliminated in new plants and, thus, would be subject to the leak detection and repair program given in the standards. But, for modified or reconstructed process units, EPA is requiring an annual leak detection and repair program for valves which are difficult to monitor. (See also Section 4.2.4.)

Valves which are unsafe to monitor will exist in new process units, as well as in modified or reconstructed units. For these valves a plan is required that defines a leak detection and repair program to conform as much as possible with the routine monitoring requirements, given that monitoring should not be undertaken under unsafe conditions. Valves that are unsafe to monitor are those, judged by the owner/operator, which could expose monitoring personnel to potential hazards from temperature, pressure, or explosive process conditions. (See also Section 4.2.4.)

Comment:

One commenter (IV-D-12) wrote that installation of double valves, which are required for open-ended vent valves that are not capped, would present severe safety complications in a major furfural step at his facility.

Another commenter (IV-D-17) stated that many processes used block-and-bleed techniques to avoid process contamination or where explosive or reactive mixtures are present. This commenter recommended a change to §60.482(e)(2) to exempt such bleed (vent) valves from the standards.

Response:

The first comment was made in the context of furfural production units, not other process units using furfural as a solvent in refining or distillation operations. The commenter (IV-B-8; IV-E-4) subsequently supplied further clarification, indicating that his concerns were the large discharge valves used to dump the waste solids remaining after completion of the batch reaction cycle. These valves were described by the commenter to be more like manhole covers than open-ended valves. Manhole covers and flanges are not regulated by the NSPS for SOCMI fugitive VOC emissions.

The block-and-bleed system described by the second commenter has been provided for in §60.482-6(a)(2). Where a block-and-bleed system is installed and in use, the bleed valve (second valve) must "seal the open end at all times except during operations requiring process fluid flow through the open-ended lines." The function of bleed valve of such a system is to vent the space between the two block valves; when venting this space, the bleed valve is "in service." Therefore, the bleed valve of a block-and-bleed system can remain open when it is venting the space between the block valves.

4.5 PRESSURE RELIEF DEVICES

Several comments were received concerning the proposed standards for pressure relief devices (PRD) in SOCMI. The five major areas receiving comments were: (1) the proposed standards and pressure relief system design, specifically relating to fragmentation of rupture disk (RD); (2) testing of inaccessible PRDs; (3) retrofitting a RD to a PRD; (4) increased costs due to RD installation; and (5) complexity of fugitive emissions control devices. Each of these areas is addressed separately.

Comment:

Several comments were received concerning rupture disks. One commenter (IV-D-24) wrote that the use of rupture disks upstream of pressure relief devices introduces the possibility of debris from a fractured disk preventing a relief device from properly reseating. Such an incident could increase VOC emissions, outweighing any advantage of a rupture disk. The commenter requested further study on this item.

Another commenter (IV-D-17) wrote that the chemical industry normally objects to the identification of rupture disks as the sole control device for limiting fugitive emissions from relief valves. While there are certain conditions which require installation of rupture disks under relief valves (corrosive service, for example), there are better solutions under most circumstances. Relief valve designs are available today which utilize an elastomeric O-ring seat as a backup to the conventional metal-to-metal seat. The high differential pressure which exists in many relief valve applications is still sealed primarily by the metal-to-metal seat while any leakage is controlled by the elastomeric O-ring seat. The elastomers of choice are expensive but do not appreciably add to the cost of new relief valves. There are conversion kits for retrofitting existing relief valves with O-ring seats which, although expensive, are an attractive alternative to the rupture disk approach. Relief valves with O-ring seats have been tested and found to be bubble tight up to over 95 percent of set pressure and reseat to this condition through several cycles. EPA has already accepted the O-ring design as an alternative design under the vinyl chloride regulation, and this concept should be recognized for control of fugitive hydrocarbon emissions in the BID.

One commenter (IV-D-18) further noted that a serious problem with the recommended use of rupture disks is that, due to corrosion or fatigue, rupture disks often fail prematurely. This will ultimately cause problems with downtime and associated costs, as well as the increase in VOC emissions due to the otherwise unnecessary opening of the vessel to replace the rupture disks. Based on the above considerations, the commenter recommended that pressure relief mechanisms be serviced during scheduled turnaround or downtime to minimize those emissions.

Two comment letters (IV-D-6; IV-D-17) disagreed with the assumption that the installation of a rupture disk beneath a relief valve eliminates leakage. The commenters' experience had indicated that this is not the case. They wrote that considerable leakage has occurred at the gaskets between the disk holder and the mating of the valve when using the manufacturer's instructions for maximum allowable torque on installation.

After flow testing it became worse because of loosening of assembly bolts due to forces transmitted from the valve thrusts. The commenters stated that the obvious answer is to ignore the manufacturer's recommendations and use higher torque to stop leakage. However, both commenters stated that this can cause deformation of the disk and affect bursting pressure.

On the other hand, another commenter (IV-D-2; IV-D-33) pointed out that new technology since 1966 allows the use of reverse buckling rupture disks under relief valves. These disks do not fragment as the tension loaded disks do. When using these disks, the piping changes to avoid fragmentation into the valve are unnecessary. In fact, it would be preferrable to have the rupture disk in a direct line with the relief valve to give the valve the opening. Furthermore, the flow coefficients are seen with the two directly in line and not offset.

One commenter (IV-D-6) was pleased that a performance standard has been proposed for safety/relief valves in place of the specification standard previously proposed. The commenter wrote that relief valve/rupture disks (in specific appropriate applications), vapor collection and control systems, and improved relief valve design should all be allowed. This flexibility is needed to meet the wide variety of process requirements in SOCMI facilities.

The commenter further wrote that the prevention of fugitive emissions from a relief valve needs to be achieved by proper design and maintenance of the valve. There are many equipment options including pilot operated valves, valves constructed of soft materials, and valves with elastomeric O-ring seats.

Response:

As presented in the preamble to the proposed standards, PRD's are one of the few fugitive VOC emissions sources for which a standard of performance can be established. There are various alternatives for complying with the "no detectable emissions" performance standard proposed for fugitive VOC emissions from PRD's in gas service in SOCMI. In proposing a performance standard, any alternatives (such as RD/PRD combinations and venting to a flare) may be used if they result in no detectable emissions. The particular equipment chosen is dependent upon the process and material being processed.

The use of a RD/PRD combination was used in the BID as an equipment specification for the regulatory analysis to evaluate the viability of a standard for PRD fugitive emissions. Other means also exist to eliminate fugitive emissions (leakage) from PRD's.

RD/PRD combinations have been commonly used in pressure relief systems. Two examples of RD/PRD applications are elimination of leaks of toxic substances and prevention of fouling of PRD internals in polymer processing units. But, as noted in one of the comments, existing PRDs could also be converted to soft-seat design, in some cases at considerably less cost than installing a RD assembly. These would be acceptable alternatives if they resulted in no detectable emissions.

From a safety standpoint, some RD designs may not be suitable for the RD/PRD arrangement. But newer RD technology (e.g., reverse buckling RD's) eliminates many of the potential problems of PRD malfunction due to RD fragmentation. Where other RD designs are used, vent piping may be modified to avoid the problems resulting from fragmentation. Offset piping was considered in the BID analysis.

Leakage may occur around the gaskets of an improperly installed RD or through pinholes in a RD resulting from corrosion. This results in a potential safety hazard since the bursting pressure of the RD is shifted. Leakage problems, however, can be minimized by proper installation and maintenance practices. Increases in pressure between the RD and PRD resulting from such leakage would be indicated by the devices suggested by ASME standards for RD/PRD installations. The ASME code requires that the space between RD and PRD be provided with a pressure gage, try cock, free vent, or suitable telltale indicator to permit detection of disk leakage or rupture.

Comment:

One commenter (IV-D-15) said pressure relief devices are frequently inaccessible. He showed data from contractor studies which showed how many were inaccessible during recent emissions testing. He said the proposed standards make no allowance for excluding inaccessible sources and the economic analysis did not address the extra cost incurred in monitoring these sources.

Another commenter (IV-D-18) agreed, writing that approximately 90 percent of all pressure relief devices are inaccessible and would require scaffolding to be constructed for sampling purposes. This represents an enormous cost consideration. Further, the commenter noted that requiring monitoring personnel to access pressure relief devices areas on a regular basis makes monitoring unnecessarily hazardous work. The low level of emission control achieved does not justify the hazards inherent to monitoring. This requirement should, therefore, be removed.

Another commenter (IV-D-17) suggested that EPA make it clear in the proposed standards that pressure relief devices which are tied into a closed flare header system do not need to be monitored for "no detectable emissions" levels after each discharge.

Response:

The standard for pressure relief devices in SOCMI requires a performance test (monitoring) on an annual basis only, in order to verify that the PRD is maintained at 500 ppmv or less. Annual performance testing is not considered to be so frequent that it is burdensome. Annual testing could be scheduled during periodic PRD inspections which are typical of many industry safety practices.

Additionally, PRDs must be checked within five days after each relief discharge to ensure that a condition of 500 ppmv or less is maintained. The outlet of the PRD does not have to be monitored if it is piped to a closed vent system. The definition of a closed vent system includes control systems such as enclosed combustion devices (incinerators, boilers, process heaters), vapor recovery systems, and elevated smokeless flares. Thus, pressure relief devices that are connected to a closed flare system are in compliance with the standards for pressure relief devices. For example, for RD/PRD combinations, since the RD would need replacing after such a relief, the PRD could be monitored when the system was put back in service. For a PRD alone, the PRD would have to be monitored after a relief to ensure that the valve is reseated properly. Monitoring of PRD's is not expected to be frequent. PRD's that are relieving frequently indicate improper PRD design or process operation too close to its limitations.

Comment:

A commenter (IV-D-17) wrote about the use of rupture disks. He said this practice can lead to problems which may not be readily apparent, especially on existing facilities. The solution to these problems is not straightforward nor simple. Significantly higher costs than projected by EPA will undoubtedly result. For example, the ASME pressure vessel code (Section VIII) requires one of the following two options in sizing relief valves for such cases:

1) The rated relieving capacity of the relief valve must be reduced to 80 percent, or
2) The combination rupture disk/relief valve shall be tested to establish the official "combination capacity factor."

If the use of rupture disks were required at existing facilities under Option 1, the capacity of the relief valve would be reduced by 20 percent. This would likely not be acceptable in many cases and would thus require a change to a new, larger relief valve.

Manufacturers are testing and developing the combination capacity factors, but since there are many such possible combinations, Option 2 is currently very limited in availability. Even if available, it would likely require a change in the relief valve. Furthermore, the commenter expressed the understanding that once a combination valve and disk has been installed, no substitution is allowed for either element of the combination since the combination factor is good for that particular combination of type and manufacturer. In either option, it is likely that relief valves with a capacity greater than that required would be installed. This may lead to chattering of the valve and extreme vibration of the piping leading to a flare or other control device. There have been cases where this vibration has led to failure of the piping. In order to resolve this, larger flare header piping could be required.

One commenter (IV-D-2; IV-D-33) pointed out that for retrofit applications, if a rupture disk/relief valve combination has been flow tested by the National Board of the ASME Code, a larger relief valve will not be required. Recent testing of flow coefficients for rupture disk/relief valve combinations have shown the coefficients to be between 0.95-0.99. For these combinations it would not be necessary to use a larger relief valve. For these combinations which have not been tested, it will be necessary to down rate it to 0.8.

The commenter also wrote that in retrofit cases, the user may have fixed piping upstream and downstream. The valves cannot be easily moved up several inches to allow the space for a rupture disk holder without thousands of dollars worth of piping changes. The recommended solution is a rupture disk welded into a flange that fits down in the piping and has only a minimal height of 1/8 to 1/4 inch. The price of this weld disk and holder is about half the price of a standard disk and holder.

The commenter also noted that it would be an excellent idea to reference the ASME code. In addition to requiring a monitor on the space between the rupture disk and relief valve, the ASME code requires the space to be vented to maintain safety, since the rupture disk is a pressure differential device.

Response:

These comments primarily focus on the regulatory analysis presented in the BID. One of the regulatory alternatives was based on use of RD/PRD combinations to eliminate fugitive VOC emissions from relief devices and was used to evaluate the feasibility of standards for relief valves in SOCMI. It is important to note, however, that the performance standard for relief devices is "no detectable emissions," providing the owner/operator the flexibility to choose the means to achieve that level.

The costs presented in the BID for retrofitting a rupture disk to an existing PRD included a new PRD. In addition, no credit was assumed for the old PRD that was replaced. As the second commenter noted above, however, a larger relief device may not be needed in all cases. Therefore, the costs presented in the BID are expected to be conservative.

Since proposal, the costs of new and retrofitted RD/PRD systems have been reevaluated. These costs, in last quarter 1978 dollars, were determined to be $3485/new system and $4025/retrofit system. Additional labor was required for retrofit applications. Details of the revised cost analysis were presented in the AID.

The comments also deal with rating of RD/PRD combinations with respect to relieving capacity. As noted by the commenter, ASME codes provide design criteria for relief systems that incorporate RD's and PRD's. If a larger PRD is required when retrofitting a RD to the system, the potential problems with valve chattering and pipe vibration attributable to the oversized PRD could be avoided through good overall design of the relief system. The ASME Code also provides other requirements for system design. Many of these requirements are current industry practice and many have been incorporated into the standard for pressure relief devices.

Comment:

Two comment letters (IV-D-6; IV-D-17) noted that rupture disks have been presented as cost savers because they allow testing of relief valves while they are in place. They stated that only one type of rupture disk can stand up to these pressures. This type of testing yields inadequate information because only the pressure at which leakage occurs is obtained and no information on relieving capacity is obtained. Testing in this manner is an unacceptable substitute. One comment letter (IV-D-17) added that, on this basis, industry will continue to test safety valves in shops from a safety standpoint, and therefore, the claim that rupture disks are cost saving installations is not supported by actual facts.

This commenter (IV-D-17) further stated that rupture disk installations, when used, are much more complex and expensive than systems that are usually presented in order to overcome adequately safety concerns. Tests have indicated that a pinhole leak through a rupture disk can equalize pressures on both sides of the disk and lead to vessel overpressure followed by greatly reduced relieving capacity when the disk finally ruptures. For this reason, at least one company requires all rupture disk-relief valve installations to include a pressure switch in the space between disk and relief valve along with a control room alarm when high pressure is sensed. To meet safety standards then, the rupture disk installation becomes much more expensive.

Another commenter (IV-D-2; IV-D-33) pointed out that the cost analysis is conservative. He said, in the BID, a block valve was assumed under a pressure relief device/disk combination. The commenter stated that, in practice, about half of all oil companies use block valves, while half do not. He went on to say that the cost of a new installation and retrofit should be similar since the safety relief valve will seldom need replacing in a retrofit, due to derating. In addition, a major cost to move or change downstream piping to accommodate a RD assembly in a retrofit can now be avoided with some RD designs that fit inside existing piping.

Response:

The proposed standard for PRD's requires a performance level of no detectable emissions. It is not an equipment requirement. In the BID, one control alternative (RD/PRD combination) for attaining this level of performance was presented to evaluate the relative benefits of NSPS for PRD fugitive emissions. In practice, any control techniques limiting emissions to less than 500 ppmv above background are acceptable.

Typical industry safety practices call for periodic inspection and testing of PRD's. These practices would be considered the baseline control level (current industry practice). When a RD is installed below a PRD, this testing will probably be done in a shop. This procedure could cost about $120/PRD for removal, inspection, and reinstallation of the PRD. Although probably more expensive than field testing, this cost is certainly affordable and would provide an opportunity for a more thorough maintenance check than possible under field test circumstances.

As discussed previously in the AID, the costs for RD/PRD systems (new and retrofit) were reevaluated after proposal. Both the BID estimates and the current cost estimates included indicators for the space between the RD and PRD, as required by ASME codes. The costs presented for RD/PRD combinations demonstrate the affordability of the performance standard for pressure relief devices. But it is not the only control option applicable to this source. Piping the discharge to a flare header is another alternative that could be used to meet the "no detectable emissions" limit.

Comment:

One commenter (IV-D-6) stated that design and use of incinerators and vapor collection systems are a complication for relief valves because of the wide range of flow which must be controlled. Further complexities are added in the need to minimize $O_2$ in the flare header.

Response:

Incinerators and vapor collection systems are not specifically required by the standard for fugitive VOC emissions from PRD's. The performance standard requires no detectable VOC emissions (less than 500 ppmv above background), leaving to the owner/operator the choice of method to use to attain this performance. In addition, the emergency relief conditions, which add complexity to control system design, are not covered by the standards for fugitive VOC emissions.

## 4.6 COMBUSTION DEVICE

The comments received concerning combustion devices focused mainly on the following areas: (1) incinerator operating specifications, (2) limited choices of control alternatives, (3) preclusion of catalytic incinerators, (4) bypass of control system, (5) incinerator design complexities, and (6) the choice of the 95 percent control level. The bulk of the comments relate to comments received on other technology areas including flares, pressure relief devices, and closed vent system.

Comment:

Three comments addressed the operating specifications for the combustion device. One commenter (IV-D-17) wrote that the EPA incinerator requirement is wasteful from an energy standpoint. He felt that the incinerator would probably require supplemental fuel to maintain temperature at minimal firing. The commenter also cited an inconsistency between the proposed residence time and those presented in the technical support document. Another commenter (IV-D-28) called the temperature-residence time specification for incinerators arbitrary since the standards apply to substances having a wide variety of thermal characteristics.

One commenter (IV-D-6) noted that the design specifications for incinerators are incorrect because they do not specify an excess air or oxygen concentration in the off-gas. The commenter suggested that the incinerator design specifications should be changed to a performance standard because the failure to set all necessary parameters can lead to installation of improper and ineffective control equipment. He further suggested that since the alternative to an incinerator is a vapor recovery system of 95 percent efficiency, the incinerator standard should be changed to 95 percent design efficiency.

Response:

The BID for fugitive VOC emissions from SOCMI sources reported the limited data available on VOC control efficiency for various combinations of temperatures and residence times. The temperature and residence time specified in the proposed regulation were based on data analyzed in an EPA memo "Thermal Incinerators and Flares," dated August 22, 1980 (II-B-31). The data base contained in this memo included Union Carbide laboratory studies, EPA and industry field tests, and 147 tests on existing incinerators in Los Angeles county. These data indicate that greater than 98 percent efficiency is attainable by incinerators operating at 1500°F (816°C) and 0.75 seconds residence time. The memo concludes that 98 percent efficiency, or less than 20 ppmv in the exhaust stream, is achievable in many situations at less than 1600°F (871°C) and 0.75 seconds residence time. And destruction efficiencies of better than 93 percent are possible for 1400°F (760°C) and 0.75 seconds residence time.

While thermal incinerators are proven control devices for destruction of VOC emissions, they are not the only enclosed combustion devices that could be used. In fact, boilers and process heaters already existing on-site are expected to be used for eliminating the small VOC streams covered by the standards. In order to ensure that these combustion systems achieve the requisite degree of control, temperature-residence time requirements for enclosed combustion devices have been retained in the final regulation.

Based on an analysis of the performance achievable by control devices examined for use, EPA decided to retain a control efficiency level of 95 percent for control devices used to comply with the standards. As an alternative to demonstrating that this performance level is met, an owner or operator can comply with the standards by maintaining temperature-residence time requirements. The requirements in the proposal [1500°F (816°C) and 0.75 seconds residence time] have been retained for the final standards. By meeting these operating requirements, a performance level well over the requisite 95 percent is ensured. Other temperature-residence time combinations may be used instead of these stated requirements if the owner or operator demonstrates that the alternative combination achieves the requisite 95 percent efficiency.

Other combustion systems, such as catalytic incinerators, are also applicable to the control of small VOC streams. Systems which employ catalysts, however, typically operate at lower temperatures and would not be able to meet these operating requirements. Therefore, the temperature-residence time requirements would not apply to combustion systems which employ catalysts. Such systems would need to meet the required destruction efficiency of 95 percent.

Comment:

Several commenters felt that the choices for control devices were restricted by the proposed standards. Two commenters cited costs of the control device. One of the commenters (IV-D-23) suggested that EPA not preclude the use of more cost effective devices that demonstrate equivalent emissions reduction. The other commenter (IV-D-21) wrote that the installation of a combustion device or vapor recovery system for a limited number of pumps is not cost effective and suggested that provisions for a variance be made where these alternatives are unreasonable due to the small VOC volumes involved.

Another commenter (IV-D-17) said the proposed standards exclude transporting fugitive emissions to other equivalent control devices or flares. This commenter also felt that §60.482(a)(7) was written on the assumption that seal leakage from pumps in liquid service is vapor. The commenter wrote that the major weight fraction of the leakage will be liquid and should be recovered in the process or disposed of safely. The vapors given off by these liquids can be ducted to destruction or capture devices. The commenter asked that room be made in Section 60.482(a)(7) to capture and treat VOC vapors by devices such as packed towers (water scrubbers). The commenter also noted that the captured vapors may, in some cases, not be recovered but treated as chemical waste in appropriate water treatment facilities.

Response:

EPA recognizes that alternative control systems should not be precluded from use where applicable. The equivalency provisions of §60.484 allows other control techniques to be used if they are adequately demonstrated. Any control technique allowed through equivalency must demonstrate at least 95 percent efficiency in eliminating VOC emissions. This efficiency is considered reasonable since it has been demonstrated by control technologies expected to be used in complying with the standards.

The use of packed towers (water scrubbers) for treating fugitive VOC emissions, therefore, would be allowed if equivalent control is adequately demonstrated. But the applicability of this technology to VOC control is expected to be limited by the solubility and vapor pressure of the VOC that must be controlled.

Normal pump seal leakage is expected to be gas or vapor. The presence of liquid seal leakage would probably indicate severe seal or barrier fluid system failures. This liquid seal leakage should be collected and disposed of properly.

The commenters pointed out that, for some applications, an enclosed combustion system as required by the proposed standards may not be the most cost-effective means of eliminating fugitive VOC emissions. As previously discussed in this section, temperature-residence time requirements (816°C or 1500°F; 0.75 seconds) for enclosed combustion devices have been retained in the final regulation as an alternative to ensure adequate destruction efficiency for various combustion systems (incinerator, boiler, process heater). But to provide the flexibility of using catalytic incinerators, these operating requirements are not mandatory for incinerators employing catalysts. In addition, EPA has decided to allow the use of smokeless flares operated under certain restrictions with a flame present as an alternative control device. The costs of emissions control options were presented in the AID.

Comment:

Another commenter (IV-D-17) wrote that, as presently drafted, catalytic incinerators were initially precluded from use for control of fugitive emissions from pumps unless their equivalency could be demonstrated. The commenter felt this process would be time-consuming and costly, especially since several companies have indicated that catalytic incinerators achieve equal or better control than the two systems presently recognized in §60.482(a)(3)(ii) and §60.482(a)(7).

Response:

As initially proposed, catalytic incineration units were inadvertently precluded from use by the temperature requirements for enclosed combustion devices. The specified temperature for incinerators (1500°F) was far above the maximum recommended operating temperature for catalytic units (1000 to 1200°F). As previously discussed, operating requirements (temperature and residence time) for combustion devices have been retained in the final rule as one compliance alternative. The main requirement for control devices is a demonstrated efficiency of 95 percent, which allows use of catalytic incinerators without equivalency determination. Moreover, the operating requirements will not apply to combustion units employing catalysts. This change will permit the use of catalytic combustion units for control of fugitive VOC emissions without an equivalency determination.

Comment:

Three comments (IV-D-17; IV-D-20; IV-D-50) were concerned with the requirement that all control systems for fugitive VOC emissions be operated at all times VOC emissions may occur. They felt that the provision would necessitate shutdown of the pump or process unit whenever the control system was being serviced or was experiencing an emergency outage. They noted that the process emissions resulting from process unit shutdown and startup would result in greater VOC emissions than the fugitive loss during a short-term outage of the control system. One commenter (IV-D-20) wrote that this requirement, specified in §60.482(a)(7), was not included in §60.482(a)(3)(ii) and should be deleted. The other comment letter (IV-D-17) recommended the following change to §60.482(a)(9) to allow a by-pass of the control system when this system is out of service for maintenance or during emergencies and when the net VOC emissions by-passed do not exceed emissions resulting from process unit shutdown and startup:

> A source, however, may bypass the applicable control device set forth in §§60.482(a)(3)(ii) and (iii) where emissions from an associated shutdown and start-up of the process unit would be greater than the emissions from the fugitive emission source(s).

Response:

The proposed standards require that the equipment installed to comply with the standards be operated at all times VOC emissions may occur. For example, this requirement is given in §§60.482(a)(7) and (9) for pumps (redesignated §§60.482-2 and -10). Control systems designed to handle only normal fugitive emission flow rates would probably be incapable of handling emergency venting situations such as seal failure. This would be especially true for enclosed combustion devices (incinerators) which have difficulty handling streams of widely varying compositions, flows, and temperatures. Thus, to protect the incinerator against damage due to excess loading, additional safety mechanisms are expected to be used for emergency venting situations. Such is not the situation where pressure relief devices are connected to a closed vent system, e.g., vented to a flare.

An example of this kind of arrangement would be an incinerator used to handle the normal flows expected connected to a seal drum that would release excess emergency-venting flow (or pressure) to a plant flare system. A system of this type would not be precluded from use under the standards.

The changes to §60.482(a)(9) [redesignated §60.482-10(f)] recommended by the commenters present no methods for determining those situations where process emissions from unit startup and shutdown are greater than the associated fugitive emissions. Without such a method, a regulation allowing for those situations is impossible. However, the control device requirements since proposal should allow a backup flare system to be used, so that outage or service shutdown of a control device should be no problem.

Comment:

One commenter (IV-D-6) wrote that an incinerator introduces a permanent ignition source and requires sophisticated control for reliable operation. Design and use of incinerators and vapor collection systems are also a complication for relief valves because of the wide range of flow which must be controlled. Further complexities are added in the need to minimize oxygen in the flare header. The commenter added that providing adequate combustion for widely varying flows entails complex design problems.

Response:

Design of an incineration system to handle properly the low and variable flow situations encountered in fugitive emissions control is difficult and has been addressed in other sections (4.1 Flares; 4.5 Safety Considerations; 4.6 Pressure Relief Devices). These standards are applicable to fugitive VOC emissions only and do not cover emergency vent situations. And even though the range of flow rates covered by the standards may be large, the final regulations allow more types of control devices to be used, i.e., enclosed combustion devices (incinerators, boilers, process heaters), vapor recovery systems (carbon adsorbers, condensation units), and smokeless flares. Moreover, other systems may be allowed if equivalency is demonstrated.

Comment:

One commenter (IV-D-16) stated that no supporting data were presented to justify the need for the arbitrarily selected 95 percent control level for control devices other than it is attainable by boiler furnaces, incinerators, process heaters, and carbon adsorption units. This is not an adequate basis for the definition of a control level, particularly when it results in the exclusion of a practical and effective control option such as flares.

Response:

Based on the data presented in the August 22, 1980 EPA memo on "Thermal Incinerators and Flares" (II-B-31), incinerator operating parameters of 1500°F (816°C) and 0.75 seconds residence time were selected as the basis of the proposed standards. An evaluation of three incinerator control levels was presented for an incinerator at similar conditions: 99 percent efficiency, or less than 10 ppmv in the exhaust stream (99/10); 98/20; and 95/30. The 98/20 level was considered to be the highest achievable control level for all new thermal incinerators, considering available technology, costs, and energy use.

The temperature-residence time requirements for a thermal incinerator to meet this control level, as required by the proposed standards, precluded the use of alternate combustion devices such as catalytic incinerators. These requirements, therefore, were dropped for combustion units employing catalysts but were retained to reflect the requisite control efficiency. In addition, EPA has decided to allow the use of smokeless flares operated under certain restrictions with a flame present (see Section 4.1).

Other control options determined to be applicable to control of fugitive VOC emissions include vapor recovery systems, such as carbon adsorbers and condensation units. These systems have demonstrated 95 percent efficiency in removing VOC. Therefore, to allow use of vapor recovery systems, the 95 percent efficient requirement was made for vapor recovery systems. This efficiency requirement is also applied to any control system considered under equivalency.

4.7 NO LEAK EQUIPMENT

Several comments were received concerning requirements of no leak equipment. The comments, presented below, specifically address leakless seal technology, canned pumps, and sealed bellows valves. A single response is provided for all of these comments.

Comment:

One commenter (IV-D-6) pointed out that the performance of zero leak equipment is cited as 100 percent when in fact this type of equipment contains static seals which will not permit 100 percent control.

Another commenter (IV-D-17) objected to the requirement in Section 60.482(a)(8)(i) that externally actuated shafts penetrating the pump housing cannot be considered leakless. This requirement was thought to preclude the future development of leakless seal technology. The commenter wrote that an individual operator or vendor should be allowed to demonstrate compliance with the leakless pump provisions using future leakless seal technology and, therefore, this provision should be deleted in any revision of the NSPS.

Comment:

The same commenter earlier (IV-D-17) had the following to say about sealless pumps.

A number of pumps are marketed today which fulfill the definition of a sealless pump, and they all have a broad application to process fluid handling problems. In most cases if the fluids being handled, the pump capabilities and design limitations, and the process requirements are compatible, then sealless pumps offer a good method for control of emissions. Unfortunately, the limitations and requirements are difficult to match.

Canned pumps have limitations in that the motor cooling function must be accomplished by the process fluid. For this reason, hot fluids and fluids that will degrade on heating (e.g., monomers) are not good candidates for application of canned pumps. Fluids that are flammable are also not recommended for use with canned pumps because of possible failure of the electrical insulation or power supply cord seal. The potential for a severe safety problem does not justify their use. The pumping of slurries is also not recommended because of the high potential for damage to the motor due to cooling problems caused by poor fluid circulation. The use of canned pumps in corrosive service may lead to high maintenance requirements and also to high emission and exposure concerns. Even for canned pumps which seem to handle clean, noncorrosive fluids, high emissions and/or exposures can result. The cleanout of the pump prior to disassembly is nearly impossible.

Chemical industry experience with sealless pumps is rather limited and in many instances unacceptable. Many pumps of standard vendor design are incapable of handling potentially destructive factors such as dirt in the process stream, or precipitation of harmful chemical elements at high rotor chamber temperature, or vacuum conditions. Canned pumps have been available for many years, but due to their high initial and operating cost they are seldom used. The largest pump currently available is 100 kW (135 hp) which is too small to satisfy many of the chemical industry requirements. In addition, all sealless pumps are, to various degrees, less efficient than conventional pumps, and are limited by low differential head.

Potentially troublesome areas associated with practices currently employed by vendors for design and fabrication of canned pumps are described in the following paragraphs. These specific areas are: bearing lubrication and design, motor rotor fabrication, stator liner material selection and fabrication, and balancing of axial thrust.

a. Bearing lubrication and design. Carbon bearings are most commonly used by the canned pump vendors. Although they are extremely susceptible to dirt in the lubricating fluid, a clean environment is not always provided. In applications where this problem is recognized, a thermal barrier separating the pump end from the motor is utilized to provide a clean operating condition for the carbon bearings. For lack of standards, "clean" fluid is assumed to have solid particles no more than one percent by weight and no longer than 10 mm.

b. Motor rotor fabrication. To protect the laminations and the core against corrosion and erosion of the pumped fluid, the rotor is enclosed in an airtight nonmagnetic can. In general, the rotor sleeve is in the neighborhood of 0.38 mm (0.015 in.) and the end covers are 1.6 to 3.2 mm (1/16 in. to 1/8 in.) thick, and are made of 316 stainless steel. To keep the air gap to a minimum, the sleeve is shrunk onto the rotor. End covers are welded on the shaft and sleeve by inert gas metal-arc welding. Prior to the final weld closure, the rotor is preheated to about 340°C (650°F) for about three hours to remove all traces of moisture. If moisture is not removed, the can will bulge and rub in service.

c. Stator liner material selection and fabrication. The liner which is normally 0.38 mm (0.015 in.) thick requires an extremely high quality control in fabrication and fitting because it must withstand relatively high pump design pressures. In some designs, the liner is field-removable for stator rewinding; in more efficient designs the liner is press-fitted in the vendor shop to reduce the air gap.

The stator liner is fabricated from nonmagnetic materials, such as 316 stainless steel, Carpenter-20, Monel, or various grades of Hastelloy, depending on the process fluid and the requirement of the users.

d. Balancing of axial thrust. The present method of balancing the axial thrust in canned pumps is not satisfactory for the wide range of process applications in the petrochemical industry. One of the existing designs manufactured in the U.S.A. has a thrust bearing to absorb the axial hydraulic forces. Some designs provide thrust collars with very limited load capacity, but they are mainly intended to absorb momentary forces generated during pump startup or shutdown. Consequently, the vendors are relying on hydraulically balanced impellers and on flow control orifices to position the rotor within the casting without producing an axial rub. Correct function of the balancing system depends on the cleanliness of the process fluid and maintenance of various clearances. This undesirable feature excludes the use of canned pumps in services containing abrasive particles.

Comment:

One commenter (IV-D-46) expressed concern that sealless pumps, which are extremely effective, are not required because, according to the proposal, they can be used only at a limited number of emission points. He suggested that sealless pumps be required wherever they can be used.

The commenter also noted that sealless compressors are not required because they are said not to be widely available. He said that if they were required for future plants, production of sealless compressors would increase and they would become more readily available. The commenter added that this is precisely the forcing of technology that Congress has mandated for new source performance standards.

Comment:

One commenter (IV-D-6) pointed out that although bellows valves have been used in blocking valve service in the nuclear industry, they have not been applied widely in the chemical industry. The commenter stated that concerns with corrosion and mechanical failure have yet to be resolved for many of the chemicals listed in Appendix E (§60.489).

Another commenter (IV-D-17) wrote that of all the suggested approaches to stopping fugitive losses, the use of the sealed bellows valves is by far the most effective. The commenter said that EPA has estimated that about 75 percent of all fugitive losses occur through valve leakage and only a small number of these valves (4%) account for 70 percent of the total fugitive emissions. Therefore, he concluded that the selected use of sealed bellows valves could have a significant impact on the reduction of fugitive losses.

The commenter continued by saying that sealed bellows valves are not necessarily impermeable. If the bellows are elastomer or fiber-reinforced elastomer materials, the bellows will allow permeation of vapors and will therefore leak. If the bellows are metal, their durability is highly questionable if the valve is operated frequently. When the bellows fail, bellows valves will result in significant emissions. For this reason they are not recommended for general service. They do offer good service in critical areas which are compatible with their limitations.

The commenter added that these types of valves do cost considerably more than conventional valves. In the smaller range (2 inches or less), the bellows valves are twice the cost of conventional valves ($100 vs. $50). In the larger size, the cost becomes somewhat more competitive, but is never closer than about $2,000 vs. $1,000 for a 6-inch valve. Not only do they cost more but they are not readily available in quantity (2 inch and below) and not available at all above six inches.

He said that the use of diaphragm valves should be discouraged. According to the commenter, it had been found that both temperature and process liquids tend to damage or destroy the diaphragm in the valve. In addition, operating pressures will reduce the application of this valve to mostly pumping and product storage facilities. These valves can be obtained with different bellows materials, but extreme care should be taken in the selection of the proper material.

Response:

EPA recognizes that leakless (no leak) equipment has limited application in the SOCMI. Because of the limited applicability, leakless equipment is not required by the regulations. But since leakless equipment demonstrates 500 ppmv or less, leakless equipment is allowed under the standards without equivalency determination. Furthermore, because of the equipment's low leak potential, it is exempted from the monitoring requirements by setting a performance standard of 500 ppmv or less with annual testing. It is important, however, to note that leakless equipment represents but one available control alternative under the standards. Other alternatives include equipment standards (dual seals, capture/conveyance/control systems) and work practice standards (such as leak detection and repair programs).

The provisions for leakless technology are presented in §60.482-2(e) for pumps. The provisions permit only pumps whose shafts do not penetrate the pump housing, i.e., sealless and canned pumps. These pumps are excluded only if operated with emissions less than 500 ppmv above background as measured by the methods set forth in the regulation. Similar provisions are given in §60.482-3(i) for compressors and §60.482-7(f) for valves in gas/vapor and light liquid service. Leakless seal technology is not precluded by these provisions. Other types of leakless seal technology that may be developed could become an accepted control alternative if adequately demonstrated through the equivalency provisions of §60.484.

4.8 DUAL SEALS

Several comments were received regarding the dual seal requirements for pumps and compressors. The majority of these comments dealt with the alledged stringency of uniformly requiring dual seals. Another large group of comments discussed barrier fluid systems, specifically focusing on potential chemical hazards and product contamination. Other areas of concern regarding dual seals included applicability of dual seals to reciprocating pumps and compressors, guidance on sensors to be used to indicate seal failure, and inconsistencies in wording of the proposed regulation.

Comment:

One commenter (IV-D-25) wrote that the requirement for dual mechanical seal systems with barrier fluids for pumps and barrier fluid systems for compressors appears to be unnecessarily stringent. Adequate control of emissions should be possible by requiring monthly monitoring of less elaborate sealing systems.

Another commenter (IV-D-17) also felt it inappropriate to require use of dual mechanical seals for pumps. This commenter was joined by another commenter (IV-D-26) in recommending that the requirement of dual mechanical seals for pumps be revised to permit the use of any properly designed dual seal, thus allowing other dual seal arrangements (e.g., tandem seals). One of these commenters (IV-D-17) stated that this change would allow the use of either pressure or level control devices to detect an inner seal failure.

This commenter (IV-D-17) stated that the general belief that a dual mechanical seal is better than a single seal is not always true. Depending on the specific requirements of the service, seal design becomes very complicated and costly and the efficiency cannot be generalized. The commenter disagreed with the statement in the proposal that dual mechanical seals will be 100% effective in controlling fugitive emissions. He further wrote that in the draft final "The Assessment of Environmental Emissions From Oil Refineries," February, 1980, Appendix B, no data is presented that would indicate any statistically significant difference for percent of leaks on packed vs. mechanical seals or single vs. dual seals. Thus, these data would not support the EPA position. The commenter suggested that, before such a significant investment in dual seals is required on such a questionable basis, a detailed technical review should be conducted to establish the data base for fugitive emission controls for pumps and compressors.

Another commenter (IV-D-15) wrote that in its evaluation of alternative control technologies for pumps, EPA had not compared and contrasted the relative merits of single mechanical seals versus dual mechanical seals. In the BID, data provided in Table 3-1 show emissions from single and double sealed pumps to be identical. The commenter, however, noted that the BID does not mention the condition under which the pumps surveyed were operating or whether a barrier fluid system was employed.

The commenter stated that although they are not commonly employed, single mechanical seals can be provided with a barrier fluid system and auxiliary stuffing box to reduce and even eliminate fugitive emissions from the pump seal. A barrier fluid system operating at a pressure higher than the process liquid would control emissions at the 100% efficiency level. The commenter concluded that since single seals can be more economical to install and maintain, EPA should have included them in its alternative control scenarios and provided justification for the choice of dual seals over single seals.

Another commenter (IV-D-51) agreed, citing a test that was conducted on over 20 pumps equipped with single mechanical seals that were in light liquid service in an acrylic acid process. The results showed that single mechanical seals provided effective control of fugitive emissions using the 10,000 ppm leak definition used for valves in light liquid service. The commenter recommended that a leak definition of 10,000 ppmv be established for pumps in light liquid service by adding a section to §60.482 that permits an inspection and maintenance plan using this definition. He also wrote that the inspection requirement should take into account a skip-period plan for pumps demonstrated by six successive measurements showing no leak. The commenter stated that semiannual leak measurement of qualified pumps is adequate to insure effective emissions control.

Response:

The proposed standards required that pumps be controlled with dual mechanical seal systems which included non-VOC barrier fluids and closed vents to control devices. If this equipment could not be installed, the owner or operator had the option of enclosing and venting the seal area to a control device. The control techniques involved were found to be technically feasible and the costs to control the model units (including control cost for pumps) were found reasonable.

Since proposal, the costs to control each fugitive emission source have been scrutinized more closely on an individual basis in the AID (III-B-2). In looking at the cost effectiveness for each fugitive emission source (Chapter 3), EPA determined that the costs associated with the equipment required for pumps may be unreasonable in some instances when compared to a leak detection and repair program. Based on this determination, the less stringent option of a leak detection and repair program has been added as an alternate standard for pumps. Leak detection and repair programs for pumps were discussed in Section 4 of the AID.

The final regulation requires a monthly leak detection and repair program using a 10,000 ppmv leak definition. No skip-period monitoring is used in the final regulation for pumps since the number of pumps that must be monitored is not large enough to justify such a program. As alternatives to the work practice standard, three choices remain: (1) installation of a properly designed dual mechanical seal system with an associated barrier fluid system as specified in §60.482-2(d), (2) installation of an enclosed capture/conveyance/control system as described in §60.482-2(f), and (3) use of leakless equipment as provided in §60.482-2(e).

However, some pumps in the 24-Unit Study did employ dual mechanical seals with barrier fluid systems. EPA believes if a pump is equipped with a dual mechanical seal/barrier fluid system that is operating properly with a non-VOC or heavy liquid VOC barrier fluid, emissions will be reduced.

The data collected during SOCMI screening studies on pump seal leak frequency are inconclusive with regard to seal type. No statistical differences were seen for seal type (single mechanical vs. double mechanical), either on-line or off-line. Off-line pumps, in general, leaked at about one-third the frequency of on-line pumps. The presence or type of barrier fluid associated with those seal systems screened was not recorded for all pumps during the pump seal screening studies conducted for the SOCMI and Petroleum Refinery Fugitive VOC emission programs. Thus, these inconclusive results should be considered carefully. For instance, if a VOC barrier fluid were used on a double seal, the seal would effectively be a single seal, and classified improperly for leak frequency evaluation. In addition, no significant effects of temperature and pressure could be seen from the screening results.

In some instances, a dual mechanical seal/barrier fluid system may be required to reduce emissions. For pumps that cannot be successfully repaired by routine maintenance, a monthly leak detection and repair program is ineffective in reducing emissions. Furthermore, since these pumps would be leaking on an almost continuous basis, the cost effectiveness of leak detection and repair is unreasonable ($3,000/Mg), while the cost effectiveness of using the required equipment is reasonable ($260/Mg - $430/Mg). Thus, a provision has been added to the standards for pumps that requires such pumps that cannot be repaired by repeated maintenance efforts to use the prescribed equipment to reduce emissions. A delay of repair provision was also added to permit an owner or operator the time (six months) to install the equipment on such pumps.

Comment:

Several comments were received regarding the barrier fluid requirements for dual seal systems. One commenter (IV-D-17) wrote that barrier fluid systems are not commercially available for many pumps and compressors on the market, especially for smaller sizes. In a previous letter, the commenter (IV-D-17) pointed out differences of understanding of requirements for a pressure reservoir sealing system. EPA did not include in its cost estimates: (1) a flushing oil pump/spare requirement, (2) strainers which are a critical component to ensure that foreign matter does not destroy the seals, and (3) instrumentation even though regulations clearly require such installations.

This commenter also stated that the requirement of a non-VOC barrier fluid is not technically feasible for many process applications within SOCMI. He cited, as an example, synthetic alcohol and alkylation processes (methyl ethyl ketone). Nonvolatile barrier fluids leaking across the seals would be converted to coke/tar solids resulting in possible seal damage and an acid sludge, thus creating hazardous waste disposal problems. Another commenter (IV-D-6) agreed, noting that dual seals with barrier fluid systems are not suitable for monomers such as acrylonitrile. Polymerization on the hot seal faces will cause failure, excess emissions, and increased maintenance.

One commenter (IV-D-41) wrote that the requirements for dual mechanical seal systems with barrier fluids for pumps and barrier fluid systems for compressors appear to be unnecessarily stringent. In addition, the commenter maintained that the requirement that a heavy fluid be utilized as the barrier fluid in dual mechanical seal systems seems excessive.

Several commenters (IV-D-7; IV-D-15; IV-D-17; IV-D-21; IV-D-26; IV-D-34; IV-D-37; IV-D-50) expressed concern over potential product contamination by leakage of barrier fluid into the pumped fluid. One commenter (IV-D-21) suggested a provision be made for a variance from the barrier fluid requirement where product requirements preclude use of a barrier fluid. Another commenter (IV-D-15) suggested that an equitable exemption from §60.482(a)(3)(i) be offered. The degassing reservoir - enclosed combustion device exemption given in §60.482(a)(7) was thought to be prohibitively expensive when there are only a few process pumps which must meet tight product purity specifications.

A commenter (IV-D-17) added that the use of non-VOC barrier fluids across the board, pursuant to EPA's requirements, is not possible. He stated that, since §60.482(a)(3)(ii) and (iii) require the barrier fluid reservoir to be connected to a closed vent system to recover or destroy VOC or to be purged back to the process, it seemed immaterial what barrier fluid was used since it would be controlled.

One of the commenters (IV-D-37) said process fluids, which are often light liquids, are generally used as barrier fluids to avoid product contamination or undesirable side effects. Although alternatives may be possible, they are not, in general, cost effective and product quality could suffer as a result. This commenter also felt that allowing more leeway with the "light liquid" requirement for barrier fluids would be a good application of the "bubble" philosphy, allowing industry to choose the degree of individual control to achieve an overall emission level while maintaining cost effectiveness. Another commenter (IV-D-7) wrote that unless it were feasible to allow the liquid to leak across the inner seal into the material being pumped, the barrier fluid itself could become contaminated to the point where it would be a light liquid and, thus, require replacement. The contaminated fluid would have to be moved somehow (presumably in another dual seal pump) to a process for cleanup or destruction.

Response:

As described in previous responses in this section, the standards for light liquid pumps have been revised since proposal. Under the proposed standards, fugitive VOC emissions would have been eliminated by installing equipment. This equipment was composed of a dual seal system with its associated non-VOC barrier fluid system vented to a suitable control device. The costs of installing such a system are discussed in Section 5 of the AID. As an alternative for pumps which could not use mechanical seals, the seal area was to be enclosed and vented to a suitable control device.

The final regulation, in addition to the equipment alternatives previously specified, allows the use of a work practice standard for pumps. This standard calls for a monthly leak detection and repair program with a leak definition of 10,000 ppmv, as determined by the leak detection monitoring specified in §60.482-2. The addition of the work practice standard for pumps allows the owner or operator to choose the best means of controlling emissions from pumps at his process unit. At higher leak frequencies, a program incorporating both alternatives could prove to be the most cost effective for any given process unit.

Also, for any given process unit, an owner or operator may choose to use equipment for some pumps that are chronic leakers and apply the work practice standard to the remaining pumps. If he chooses to use the equipment on a pump, he would not have to include that pump in a monthly leak detection and repair program.

Barrier fluid systems for the seals required under the proposed standards and allowed under the final standards can be of varying designs. The specific design of each system would be dictated by the particular application under consideration (pump/seal system). API Standard 610 (IV-M-21) presents several barrier system designs for various seal types. For smaller seal flow applications, an individual pressurized barrier fluid tank could be used instead of a pump/recirculation loop arrangement.

Some barrier fluid tanks may be as small as two or three gallons; replacement of barrier fluid contaminated by pumpage leaking across a failed inner seal would not present a major disposal problem. In addition, a properly designed barrier system would provide indicators (sensors) to indicate a seal failure so that severe contamination of the barrier fluid would probably be avoided. The type indicator is not specified, but, in most cases, it would be a pressure or level sensor.

The costs for double mechanical seal systems used in the BID included the double mechanical seal, pressurized barrier fluid system, and a barrier fluid cooler. These costs are considered adequate for the required seal applications and were not revised in the AID.

In the case of possible product contamination by barrier fluid, each case should be examined separately. There are too numerous product/barrier fluid combinations possible in the SOCMI to warrant examination of every combination. Specific compatibility determinations are expected to be made by the owner/operator on a case-by-case basis.

A non-VOC barrier fluid is required to comply with the dual seal equipment standard for pumps if an owner or operator chooses to install equipment in lieu of monitoring. If a VOC barrier fluid were used instead, the dual seal would effectively be only a single seal, in terms of sealing VOC from the atmosphere. Failure of the outer seal would result in VOC emissions.

Furthermore, the use of an inert material such as water is allowed under the standards. One commenter noted that dual seals could not be used for monomers such as acrylonitrile due to problems with polymerization on seal faces. Two acrylonitrile units were surveyed in the 24-Unit Study (IV-A-11); dual seals were being used successfully in one of these process units.

At proposal, EPA believed that barrier fluids for dual mechanical seal/barrier fluid systems were available that would effectively reduce VOC emissions from pump seals. Such barrier fluids would include heavy final products, heavy oils, water, etc. But comments received on the proposed standards pointed to a few limitations of barrier fluids. These comments were considered and the data from fugitive emissions studies were reviewed. As a result, EPA still maintains that barrier fluids are available that will serve the purpose of reducing emissions from pump seals when the fluid is judiciously selected and the system is properly operated.

The barrier fluid requirements for compressor seal barrier systems are not necessarily heavy liquids. The requirements prohibit the use of light liquid or gaseous VOC as barrier fluids. This requirement would not, however, prohibit the use of an inert material such as nitrogen or steam as the barrier fluid for such control systems.

Comment:

One commenter (IV-D-17) noted that the definition of "fugitive emission source" includes compressors and pumps. The commenter stated that, unfortunately, EPA has not included a definition as to the types of pumps and compressors not subject to the fugitive emissions standards. As a result of this oversight, reciprocating pumps and compressors are included in the regulatory program. According to the commenter, the potential problem with the inclusion of reciprocating pumps and compressors is their inability to accommodate dual seals, or any type of seal that EPA may ultimately require. He recommended that, in order to avoid sealing problems associated with reciprocating pumps and compressors, these equipment be expressly excluded from the definition of "fugitive emission sources."

Response:

Reciprocating pumps and compressors do present a more complex fugitive emissions control problem than centrifugal and rotary designs. Reciprocating equipment typically requires packed stuffing boxes for sealing, since mechanical seals are generally unusable. Under the proposed standards for SOCMI fugitive VOC emissions, reciprocating equipment and other equipment that cannot use mechanical seals would be required to have an enclosed seal area, with the captured gases vented to a suitable control system (smokeless flare, enclosed combustion device or vapor recovery system).

As the standards have been finalized, reciprocating pumps could comply with a monthly leak detection and repair program or the seal areas could be enclosed and vented. API standards covering the design of reciprocating equipment require that the distance piece (the piece separating the cylinder and the driver) be enclosed, sealed, and vented (IV-M-10). Since this piece is vented, it is technically feasible to vent the seal area of new reciprocating equipment. In a meeting with EPA, one industry group stated that for new equipment, venting is not only possible, but is general practice for some of its member companies. No specific venting arrangement has been adopted as a standard by their industry (IV-E-12).

Problems were noted, however, by this group for older existing reciprocating compressors. Older compressors may not have enclosed and vented distance pieces, making retrofitting difficult and expensive. The cost for compliance was estimated to be a new compressor in some cases. The number of reciprocating compressors that would be affected under the proposed standards is unknown. During the screening studies conducted in SOCMI process units, only three compressors with packed seals (assumed to be reciprocating compressors) were encountered out of the 22 compressors in VOC service. The impact of the equipment requirements for new reciprocating compressors is expected to be small since the compressors are built to accomodate venting systems. However, to alleviate potential problems associated with older existing reciprocating compressors, a restricted exemption from the equipment requirements for compressors has been made for existing compressors that come under the standards through the modification provisions. This is discussed in detail later in Section 4.12 on Reciprocating Pumps and Compressors.

Comment:

One commenter (IV-D-26) noted that the type of sensor required on the barrier fluid reservoir was not identified. He recommended that some guidance be given, since a pressure sensor might not be applicable when using a barrier fluid reservoir that is vented by a closed system to a combustion or recovery device.

Another commenter (IV-D-17) also indicated that different sensors would be needed to indicate seal failure for the different seal arrangements. The commenter cited the differences between two dual seal systems (double mechanical and tandem seals) and indicated that both systems should be allowed under the proposed standards. The double mechanical seal could require a pressure sensor to detect an inner seal failure, but a level control alarm would be better suited for a tandem seal.

Response:

As a requirement of Section 111(h) of the Clean Air Act, provisions must be made to ensure the proper operation and maintenance of control systems required by equipment standards. If an owner or operator chose to install equipment rather than comply with a work practice standard for pumps, outer seal failure would be noted through periodic visual inspections. But some form of indicator would be needed to indicate catastrophic failure of an inner seal of a dual seal arrangement. The choice of the type of sensor to be used would necessarily be based on engineering and design considerations and is, therefore, not specified in the regulation. By allowing any type of sensor, the owner or operator is afforded the flexibility of choosing one best suited to his situation.

As an example, consider a double mechanical seal, where the seal faces are mounted back to back forming a cavity in between. In this case, the barrier fluid flushed through the cavity is generally maintained at a pressure greater than the pump stuffing box pressure. With a failure of the inner seal, the barrier fluid would be flushed into the pumped fluid. Although no fugitive VOC emissions result from the inner seal failure, continued operation could result in total seal failure. And loss of barrier fluid would then result in VOC emissions. The initial loss of barrier fluid could be indicated by a low level alarm on the barrier fluid tank, thereby avoiding total seal failure and potential VOC emissions. A low pressure alarm may also be applicable to this system.

Another example is a tandem seal arrangement, where both seal faces are aligned in the same direction. For tandem seals, the pump stuffing box pressure is generally higher than the barrier fluid pressure. Therefore, failure of the inner seal would be more readily indicated by an increase in barrier system pressure, avoiding potential VOC emissions.

Comment:

One commenter (IV-D-26) pointed out that the words "stuffing box pressure" should be followed by the word "or" in the proposed Section 60.482(a)(3)(i).

Response:

The three provisions in the proposed §60.482(a)(3) for pumps and in the proposed §60.482(b)(3) for compressors are in series, using the conjunction "or" between the second and third items to indicate that only one of the three items (i, ii, or iii) would apply. Since this construction results in some confusion, the addition of "or" has been made between the first and second items to clarify the intent of exclusive alternatives. With the redesignation of section numbers for the regulation, these exclusive alternatives are found in §60.482-2(d) for pumps and in §60.482-3(b) for compressors.

Comment:

Another commenter (IV-D-17) pointed out one inconsistency in the compressor standards which should be clarified. Sections 60.482(b)(1) and (3) only require a seal system with certain characteristics to be used for all compressors. However, Section 60.482(b)(4) reverts to referring to dual mechanical seal systems.

Response:

The most commonly applied seals for compressors in SOCMI are labyrinth seals. Although the basic labyrinth seal and its more effective variations (staggered labyrinth, honeycomb labyrinth, rotating labyrinth) are considered mechanical seals, they are not dual seal systems, as described for pump applications. Therefore, this portion of §60.482(b)(4) [redesignated §60.482-3(d)] is being revised to read "seal system," not "dual mechanical seal system."

4.9 SAMPLING SYSTEMS

The comments received regarding requirements for sampling systems dealt primarily with four concerns: (1) emissions from closed-loop sampling systems, (2) the cost effectiveness of closed-loop sampling systems,

(3) potential safety risks of closed-loop sampling, and (4) alternatives to closed-loop sampling systems.

Comment:

One commenter (IV-D-26) wrote that the phrase "without VOC emissions to the atmosphere" in Section 60.482(d)(2) would preclude the removal of a sampling vessel from a closed purge system, since some VOC emissions would occur when the fittings are disconnected.

Another commenter (IV-D-17) also expressed the concern that providing the option of returning the fluid directly to the process line or collecting the purged process fluid for recycle or disposal without VOC emissions to the atmosphere amounts to a zero emissions requirement. In a previous letter, the commenter (IV-D-17) stated that closed-loop sampling, where the sample container is part of the flow path, is not an emission free system. The coupling points around the sample container will retain liquid when the container is isolated. Special equipment, vents and vacuum systems can be installed to remove this liquid, but these precautions only minimize exposure, not emissions.

Response:

In the Background Information Document, it is assumed that closed-purge sampling systems are approximately 100 percent effective in eliminating sampling purge emissions. But, as noted in the preamble of the proposed standards (46 FR 1145, January 5, 1981), some VOC could be emitted during sample transfer to a closed collection device. This was the reason a "no detectable emissions" or zero emissions limit was not considered feasible for sampling systems.

The potential for a small amount of VOC to be emitted during sampling procedures is recognized by EPA. The intent of the standard is to eliminate sample line purging to the atmosphere, ground, or sewer drain. A zero emissions limit is not intended, as noted by the establishment of an equipment standard instead of an emissions limit. To clarify this intent in the regulation, §60.482(d)(2) [redesignated §60.482-5(b)] has been revised to read:

(b) Each closed purge system as required in §60.482-5(a) shall:

(1) Return the purged process fluid directly to the process line without VOC emissions to the atmosphere, or

(2) Collect the purged process fluid for recycle or disposal without VOC emissions to the atmosphere; or

(3) Be designed and operated to capture and transport all the purged process fluid to a control device complying with the requirements of §60.482-10.

Comment:

One commenter (IV-D-6) pointed out that flow-through sampling systems may not be the most cost effective sampling procedure for all liquids. Another commenter (IV-D-13), however, noted that data show closed-loop sampling systems to be very cost effective and suggested that Alternative II be modified to include closed-loop sampling systems as the most appropriate control option.

Response:

Based on the costs estimated for carbon steel sampling systems presented in the BID, the cost effectiveness of closed purge sampling systems is approximately $890/Mg VOC. This value assumes 100 percent efficiency of VOC control using this sampling system. This cost effectiveness could be higher if stainless steel materials are necessary. The overall economic impact to SOCMI is expected to be overstated, however, since industry has stated that 75 percent of SOCMI sampling systems use some comparable sampling system currently (II-E-20). The costs of sampling systems are discussed in Section 5 of the AID.

The standards for fugitive VOC emissions from SOCMI sources are based on Alternative IV. The effectiveness of closed-purge sampling systems is adequately demonstrated by comparing reductions achieved in Regulatory Alternatives III and IV. Also, the costs of control were considered on a source by source basis in the AID. Therefore, there is no need to modify Alternative II to include closed-purge sampling systems.

Comment:

Three comments were received on the safety aspects of closed-loop sampling systems. One commenter (IV-D-6) said two concerns for liquid sampling systems were loss of liquid between valves and pressure at the valves. Another commenter (IV-D-17) noted a serious safety risk with closed-loop sampling by collecting "bomb" samples. He cited an example of a liquid-full sample container that ruptured due to volumetric expansion as the temperature increased. Another commenter (IV-D-32) said that a double valve sampling system cannot be used for materials in traced lines since, if both valves were closed, pressure increases would rupture the pipe.

Response:

The proposed BID recognizes that closed-loop sampling systems have limitations with respect to low pressure processes or tankage and, in some instances, safety requirements. The regulation, therefore, does not specify a "closed-loop sampling system," but does require a "closed purge system." In some cases, such as low pressure systems, a closed-loop sampling system would not permit sample collection. Under these circumstances, the sample and purge would be collected in containers separate from the process piping. Thus, a "closed purge system" would allow any system that collects all VOC purged during sampling and recycles or destroys the collected VOC in a control device. Sampling purge material is not to be discarded in the plant drain systems. Closed-loop sampling systems are used in the BID to evaluate the feasibility of controlling fugitive emissions from sampling systems.

Comment:

Another commenter (IV-D-17) noted that the technical support document does not support the proposed standard for sampling systems. He recommended the use of closed vent systems be included to minimize emissions from sampling systems by revising §60.482(d)(2) as follows:

> (2) Each closed purged system as required by §60.482(d)(1) shall return the purged process fluid directly to the process line, or shall collect the purged process fluid for recycle or disposal by means of a closed vent system.

In a previous letter, the commenter (IV-D-17) recommended a better system for use where line pressure drop is available. Partially evacuated sample containers are connected, and a sample of the flowing stream sucked into the sample container. Use of a partially evacuated sample container prevents the risk of "liquid filling." The commenter further stated that the most effective means of minimizing emissions and exposures is by sampling only the quantity of material needed. He referred to the description of various sampling systems presented in papers by Bruce C. Lovelace. According to the commenter, one commercial sampler allows sampling only the quantity desired and has no vented emissions. The vapor and gas displaced by the liquid are pumped back into the process.

Another commenter (IV-D-6) suggested that a better method would be the collection of the desired volume of liquid from a sampler that reduces sample pressure to atmospheric as it is collected. He expressed concern that under the proposed regulation these techniques would not be permitted. With a performance standard they could be used without extensive technical discussion, the commenter noted. He further recommended defining "closed purge systems" and "in-situ sampling systems."

Response:

Some of the concerns expressed by the commenters stem from the requirement that sampling be conducted "without VOC emissions to the atmosphere." The intent of the standard for sampling systems is not a zero emissions requirement. The intent is to minimize VOC emissions during sampling through improved system design practices. The systems described by Lovelace certainly provide safety for the individual collecting the samples and also lend themselves easily to the design practices intended by the proposed standards for minimizing VOC emissions.

The intent for sampling systems has been clarified in the final standard with the changes presented in response to other comments. By adding definitions for "closed purge systems" and "in-situ sampling systems," the proper equipment design criteria for sampling systems have been better described.

## 4.10 CLOSED VENT SYSTEM

Comment:

One commenter (IV-D-34) felt that the definition of "closed vent system" should not preclude the use of a flare as an acceptable control alternative. He gave as reasons for including flares previous experience with flare systems, as well as the inefficient, costly, and unsafe operation of closed incinerator systems.

Another commenter (IV-D-17) suggested that the definition of closed vent system be modified as follows:

> 'Closed Vent System' means a system which is not open to the atmosphere and which is composed of piping, connections, and, if necessary, flow inducing devices that transport gas or vapor from a fugitive emission source to an enclosed combustion device, vapor recovery system, a flare system, or an equivalent control device as determined by §60.484.

Response:

As discussed in Section 4.1, the final regulation allows elevated smokeless flares for control of fugitive VOC emissions from SOCMI if the flare is operated under certain restrictions with a smokeless flame present. Thus, some modification to the proposed definition of "closed vent system" has been made to reflect this decision. Another change has been made to incorporate a reference to equivalent control devices. Since some equivalency determinations made through provisions in §60.484 will be applicable to the industry as a whole, it is also appropriate to include some reference to these equivalency determinations in the definition of "closed vent system."

4.11 OPEN-ENDED LINES

Comment:

Two comments were received on the requirements for open-ended lines. One commenter (IV-D-12) wrote that installation of double valves, which are required in lieu of caps, plugs, or blinds, would present severe safety complications in a major furfural step at his facility. Another commenter (IV-D-17) stated that many processes use block-and-bleed techniques to avoid process contamination or where explosive or reactive mixtures are present. Two examples of such conditions were cited: (1) water removal systems using hot and cold dry gases and (2) fuel gas supply lines to combustion units.

To exempt these bleed (vent) valves from the standards, the commenter recommended the following change to §60.482(e)(2):

> (2). . . .through the open-ended valves, except where the open-ended valve or where the valve is vital to process safety or contamination.

<u>Response</u>:

With regard to the safety concerns of double valves in furfural production units, the commenter provided additional clarification (IV-B-8; IV-E-4). His concerns were the large discharge valves used to dump waste solids after completion of the batch reaction cycle. As the commenter described them, these valves are more like manhole covers than open-ended valves. In general, manhole covers and flanges, including blind flanges, are not regulated by these standards. Flanges are subject only to §60.482-8.

Currently, standard engineering codes do not cover open-ended lines and double valve installations, but there are instances where safety requirements might impact them. Provisions have been made in the standards for the block-and-bleed techniques described in the second comment. Section 60.482-6 requires:

(a)(1) Each open-ended valve or line shall be equipped with a cap, blind flange, plug, or a second valve.

(2) The cap, blind flange, plug, or second valve shall seal the open end at all times except during operations requiring process fluid flow through the open-ended valve or line.

(b) Each open-ended valve or line equipped with a second valve shall be operated in a manner such that the valve on the process fluid end is closed before the second valve is closed.

Where a block-and-bleed system is being used, the bleed valve (second valve) must "seal the open end at all times except during operations requiring process fluid flow through the open-ended line." The bleed valve, therefore, can remain open when venting the space between the two block valves.

4.12 RECIPROCATING PUMPS AND COMPRESSORS

Comment:

One comment letter (IV-D-17) noted that the definition of fugitive emission source includes compressors and pumps. It was viewed as unfortunate that the Agency had not included a definition of the types of pumps and compressors not subject to the proposed requirements. As a result, the comment letter continued, reciprocating pumps and compressors are included in the regulatory program. He was joined by another commenter (IV-D-34) in stating that their inclusion was seen as a problem because of their inability to accommodate double seals or any type of seal that EPA may ultimately require. Both commenters recommended expressly excluding reciprocating pumps and compressors from the definition of "fugitive emission source." In a later letter (IV-D-50), the first commenter expressed concern that the proposed standards were not cost effective for a variety of reasons including coverage of reciprocating pumps and compressors that are unable to accommodate the required controls.

Response:

Reciprocating equipment was intentionally included under coverage of this regulatory program. It should be noted that reciprocating equipment is not as common within this industry as within petroleum refineries and natural gas plants. In fact, surveys of SOCMI process units indicate that reciprocating pumps comprise between 5 and 9 percent of the total pump population in SOCMI and reciprocating compressors represent from 6 to 16 percent of the compressor population. The actual reciprocating compressor count, however, is small since the number of compressors (in comparison to pumps) in SOCMI is relatively small.

Because reciprocating equipment does exist in some units and may even be necessary in some applications, a provision was made in the proposed and final standards to allow enclosure of the seal area and venting of any emissions to a suitable control system (see Sections 4.1 Flares, 4.6 Combustion Device, and 4.11 Closed Vent Systems). This option is feasible for reciprocating pumps, as well as for most reciprocating compressors. New reciprocating equipment is provided with enclosed and vented seal areas, as required by API standards. This requirement was initiated by OSHA regulations governing allowable hydrogen sulfide levels in the workplace (an important consideration in petroleum refineries and gas plants). API representatives and compressor manufacturers have noted that, for new facilities, the seal area of reciprocating equipment can be vented. One manufacturer stated that venting the seal area to a flare is currently his company's practice for new reciprocating equipment (IV-B-9; IV-B-10; IV-E-12; IV-M-10.)

But these representatives further noted that there are technical problems associated with retrofitting a seal vent system to some existing reciprocating compressors. On older compressors, the distance piece between the cylinder and driver may not be enclosed and vented. In such cases, retrofitting a vent system to the compressor in order to comply with the standards could require recasting of the distance piece or even replacement of the compressor. The costs of new reciprocating compressors were determined to be excessive (up to $210,000 for a 2-stage 3000 CFM unit), especially in the light of the emission reductions that could be gained for reciprocating compressors. Therefore, EPA decided to examine two alternatives for reciprocating compressors: (1) exemption of some reciprocating compressors from modification requirements and (2) designation of compressors as a separate affected facility.

An exemption from modification provisions was considered for those existing reciprocating compressors whose distance pieces could not accommodate control equipment. Providing an exemption which is narrowly limited to such cases would mean that any new reciprocating compressors in units affected by the standards would be covered. But relief would be provided for those units affected by virtue of modification provisions which would encounter severe retrofit difficulties. One disadvantage to this approach is that it would require enforcement personnel to exercise some judgement concerning whether a reciprocating compressor meets the criteria for the exemption.

Since the compressor is a major piece of equipment and represents the major portion of the capital costs of the facilities considered under these standards, compressors could be designated as a separate affected facility. In doing so, some reciprocating compressors would probably be eliminated from coverage under the modification provisions. Providing an exemption for specific circumstances, however, also accomodates the problem of the high cost of controlling these specific compressors. Providing an exemption does not needlessly change the definition of the affected facility given at proposal.

Because of the necessity to eliminate coverage of existing compressors which cannot be retrofitted without replacement of the distance piece or compressor, EPA in the final regulation, has provided an exemption for reciprocating compressors which cannot accommodate vents within facilities which have become affected by virtue of modification. The exemption applies only to those specific instances where the seal area cannot be enclosed and vented without recasting the distance piece or replacing the compressor. Furthermore, at such time that the distance piece or compressor is replaced, the compressor will no longer be exempted from the standards.

# 5. APPLICABILITY OF STANDARDS

This section contains comments and responses concerning which fugitive emission sources, process units, and plants should be covered by the standards. Comments concerning applicability of the standards have been divided into ten subsections:

5.1 SOCMI List
5.2 Vapor Pressure Cutoff
5.3 Percent VOC Cutoff
5.4 Process Unit Definition
5.5 Small Manufacturers
5.6 VOC Definition
5.7 Pilot Plant and R&D Facilities
5.8 Flanges
5.9 Vacuum Service
5.10 Enclosed Buildings

## 5.1 SOCMI LIST

Comment:

Several comments were received which challenged the basis for the list of chemicals proposed as the definition of SOCMI in proposed Appendix E (promulgated §60.489). The comments focused on photochemical reactivity of listed chemicals, their degree of toxicity, and the applicability of a unit operations approach for regulating a wide variety of chemical processes.

Some commenters said that the list should logically have been compiled based on photochemical reactivity and potential to form ozone. They saw no evidence of this basis in the list (IV-D-17; IV-D-28). Another (IV-D-34) said that any control requirements for VOC should not include nonreactive hydrocarbons. A few chemicals were noted as being universally considered photochemically unreactive even by EPA and were, therefore, inappropriately placed on the list: methylene chloride (IV-D-26); chlorofluorocarbons (IV-D-26; IV-D-15); 1,1,1-trichloroethane (IV-D-26); methanol (IV-D-26;

IV-D-17); acetone (IV-D-26; IV-D-17); and acetylene (IV-D-26). Federal Register notices were cited in support of removing these chemicals from the list: 42 FR 35314, 45 FR 48941 (IV-D-26; IV-D-28). Still another commenter (IV-F-1, No.3) called decisions relating to the choice of substances to be included in SOCMI arbitrary.

One of the commenters pointed out (IV-D-28) that EPA was aware of differences in photochemical reactivity and differences in contribution to ozone formation with differences in chemical structure. He cited an EPA report; Fate of Toxic and Hazardous Materials in the Air Environment, 600/3-80-084, December 1980; and a Federal Register notice, 45 FR 48941. He also cited the transcript of the public hearing (pp. 52 and 70) as proof of the Agency's awareness of this fact. He went on to say that the Agency has compiled the list of SOCMI chemicals based on volume instead of photochemical reactivity even though they were aware of reactivity differences. He also said that the list was arbitrarily selected with no explanation about its compilation or why chemicals were or were not included.

One commenter (IV-D-11) said the different degrees of toxicity of the chemicals required tailoring the "operating and maintenance" procedures for the individual situation. Another (IV-D-6) wrote that a performance standard is needed instead of equipment standards because of the wide variety of chemicals involved having a wide variety of chemical, physical, and biological properties. The commenter added that a single solution for all of the chemicals listed is not sound technically.

Two other commenters (IV-D-38; IV-D-40) were also concerned with the selection of chemicals for the SOCMI list. Both commenters felt that SOCMI was comprised of a wide variety of chemical processes. They said EPA should evaluate the individual processes before including them in the standards. One commenter (IV-D-40) stated that, in taking a unit operations approach to regulations, EPA needed to ensure that the regulations were reasonable and technically sound for all members within the class. The other commenter (IV-D-38) pointed out that, of the 600 different processes within the category, EPA had evaluated only 27 processes as "the most likely candidates for NSPS or NESHAP coverage through generic standards."

Response:

Section 60.489 [Appendix E of the proposed regulation] is not a list of ozone-forming (photochemically reactive) chemicals although many chemicals on the list are photochemically reactive. The list consists of chemicals whose production requires equipment such as valves and pumps for processing photochemically reactive VOC. The photochemically reactive VOC may be products, reactants, additives, or intermediates. As explained in Docket Item No. IV-B-21 as of January 1983, EPA considers eleven organic compounds nonphotochemically reactive:

- methane
- ethane
- 1,1,1-trichloroethane
- methylene chloride
- trichlorofluoromethane
- dichlorodifluoromethane
- chlorodifluoromethane
- trifluoromethane
- trichlorotrifluoroethane
- dichlorotetrafluoroethane
- chloropentafluoroethane

As described in the BID for the proposed standards, the chemicals produced are the building block chemicals for many of the downstream industries producing synthetic products such as plastics, pharmaceuticals, textiles, and specialty chemicals with a wide variety of uses. This basis for selection of the SOCMI chemicals was explained at proposal (40 FR 1136, January 5, 1981). All other organic substances are considered VOC now.

As further explained in Docket Item No. IV-B-21, some of the chemicals cited by the commenters are photochemically nonreactive; however, their production requires fugitive emission sources to process photochemically reactive substances. For example, methylene chloride may be produced by the hydrochlorination of methanol, a VOC. Therefore, such chemicals remain on the list because photochemically reactive substances are used in their production processes. The criteria for their removal include not only whether the product is photochemically reactive, but also whether reactants, additives, or intermediates are photochemically reactive. Because the chemicals mentioned fail to meet all of the criteria, they remain on the list.

As the commenter (IV-D-28) pointed out, EPA is aware of differences in photochemical reactivity and differences in contribution to ozone formation with differences in chemical structures. However, the magnitude of these differences is not fully understood and depends on factors that are not fully understood. Therefore, it would be extremely difficult, and at least impractical, to establish regulations based on degree of photochemical reactivity. It should be noted that some photochemically reactive chemicals react quickly in the atmosphere to form ozone. Others take longer, but they are present in sufficient quantity and exist long enough in the atmosphere to contribute to ozone formation.

Similarly, it is not necessary to establish separate regulations based on degree of toxicity or chemical, physical, and biological properties. Other regulations such as National Emission Standards for Hazardous Air Pollutants (NESHAP) [Section 112 of the Clean Air Act] and OSHA regulations are aimed at regulating specific chemicals based on their serious toxic effects in humans.

The basis of the SOCMI list must be viewed in the context of the use of the list. The list defines the extent of coverage of standards of performance for fugitive emission sources of VOC. These standards of performance are designed to protect air quality by reducing emissions of VOC from equipment within SOCMI. In doing so, the environment is further protected against the toxic effects of some of the chemicals found in SOCMI. Physical and chemical properties of the chemicals have been considered in composing the SOCMI list. For example, vapor pressure distinctions have been established to eliminate routine requirements for equipment which has a low tendency to leak. As discussed in other portions of this section, EPA has established other limitations on the use of the list. The chemicals on the list or chemicals associated with their production participate in the formation of ozone, and equipment which has been shown to leak is used to process these chemicals. Therefore, their release to the atmosphere should be controlled.

To date, EPA has studied, in detail, fugitive emissions from about 20 chemical processes in SOCMI. In developing the model units for SOCMI, over 50 process units were surveyed to determine counts of fugitive emission sources. These process units included the 20 chemical processes studied in detail. The results of this work support the general technical judgments made in developing the standards for fugitive VOC from SOCMI. In another study (IV-A-11) EPA selected a cross section of units for study. The process units tested in SOCMI have provided sufficient information to confirm major conclusions concerning fugitive emission sources in VOC service. As other fugitive emissions data indicated, SOCMI fugitive emission sources leak. Just as expected, equipment in heavy-liquid service leaked less frequently with lower emission rates than equipment in light-liquid and gaseous service. Since process fluid vapor pressure (a factor common to all process units) is the overriding consideration in predicting leak frequencies and leak rates, testing all SOCMI units is unnecessary.

Economic data on SOCMI were also collected and examined in developing the economic impact to the industry. Economic and financial data on 100 chemical firms were studied to develop the models used to evaluate the cost and economic impact to the industry.

Comment:

Three commenters noticed that chlorofluorocarbons were being regulated for their tendency to destroy ozone in the upper atmosphere. (IV-F-1, No. 3; IV-D-15; IV-D-28). They thought it illogical to control a compound because it destroys ozone and because it creates ozone. One of the commenters (IV-D-28) referred to 45 FR 66776 as support for removing chlorofluorocarbons from SOCMI.

Response:

Chlorofluorocarbons (produced from such substances as perchloroethylene, carbon tetrachloride, and fluorinated derivatives of acetylene) are not being regulated because they form ozone but because they are produced from chemicals that form ozone in the troposphere. In any case, to the extent that chlorofluorocarbons are controlled, the standards will reduce the destruction of ozone in the stratosphere.

Comment:

In three sets of comments (IV-F-1, No. 5; IV-D-15; IV-D-9) it was suggested that urea should be withdrawn from the list of chemicals in Appendix E (§60.489) since the manufacture of urea does not involve VOC. The commenter said that urea is produced by reacting ammonia and carbon dioxide. This reaction produces ammonium carbonate which then decomposes to urea. The urea produced is very pure, containing only trace amounts of a co-product, biuret. Decomposition of urea yields biuret, ammonia, and cyanuric acid. Decomposition of biuret yields ammonia and cyanuric acid.

Response:

The process for manufacturing urea involves a combination of up to seven major unit operations. These major operations are:

(1) solution synthesis (solution formation)
(2) solution concentration
(3) solids formation
  - prilling
  - granulation
(4) solids cooling
(5) solids screening
(6) solids coating
(7) bagging and/or bulk shipping

The combinations of processing steps are determined by the desired end products. Plants producing urea solutions alone are comprised of only the first and seventh unit operations, solution formation and bulk shipping. Facilities producing solid urea employ these two operations and various combinations of the remaining five operations depending upon the specific end product.

Emissions from urea processes include particulate matter and ammonia. In addition, formaldehyde, a VOC, may also be emitted in some urea processes when the product is urea solids. Small amounts of formaldehyde are used as an additive to reduce dust emissions and to prevent solid urea product from caking during storage. In view of the potential for fugitive emissions of VOC, urea plants are appropriately covered.

Even though all urea plants produce an aqueous urea solution, not all plants would have a solids formation operation. Plants not producing urea solids have no formaldehyde addition step and, therefore, no potential for fugitive emissions of VOC. Thus, it would be appropriate to grant an exemption to urea plants that do not use formaldehyde. In addition, it would be appropriate to grant an exemption to any SOCMI unit that does not process VOC. Therefore, an owner or operator of a facility producing a chemical listed in §60.489 by a process in which no VOC are processed will be granted an exemption from the standards. An exemption for such situations is provided in §60.480 of the regulation (applicability and designation of affected facility).

Comment:

Two commenters (IV-D-19; IV-D-18) objected to including chemicals on the SOCMI list which were also covered by NESHAP. Vinyl chloride and benzene were cited as examples. One of the commenters (IV-D-18) felt that facilities which have established monitoring programs under NESHAP standards should be allowed to expand the program to those areas within the source to which VOC NSPS would apply. He said that this would eliminate the costs associated with having two separate redundant programs in effect for the source. He preferred the NESHAP program because the monitoring and record-keeping program afforded a greater level of control but is less burdensome. The other commenter (IV-D-19) also recommended that a change be made to exclude units covered by NESHAP's.

Another commenter (IV-D-48) stated that the inclusion of vinyl chloride as a VOC and the regulation of facilities which produce vinyl chloride by the proposed regulations is redundant and in conflict with EPA regulations currently in force. He added that the proposed regulation is in conflict with the NESHAP for vinyl chloride in that the NESHAP sets a lower maximum discharge concentration than the proposed regulation. The commenter pointed out that the NESHAP also sets standards for controlling fugitive emissions from loading and unloading lines, pumps, compressors, relief valves, and the opening of equipment. The NESHAP also contains provisions for leak detection and elimination. The commenter suggested deletion of vinyl chloride from Appendix E (§60.489).

Response:

The vinyl chloride and benzene NESHAP's and SOCMI NSPS are aimed at regulating emission sources for different purposes. For example, benzene fugitive emissions occur in the petroleum refining and chemical manufacturing industries as a result of the production and use of materials that contain benzene. The proposed benzene NESHAP would regulate only the components containing 10 or more percent by weight benzene (see proposed §61.111, 46 FR 1165). Fugitive emission sources containing more than 10 percent would be regulated by the benzene NESHAP only. Fugitive emission sources containing less than 10 percent benzene and located in an affected facility covered by the SOCMI standards for fugitive emission sources would be regulated only under the SOCMI (or refinery) VOC fugitive NSPS. It should be noted that at proposal both the benzene NESHAP for new sources and the SOCMI NSPS had the same requirements.

The SOCMI standards are applicable only to new vinyl chloride process units. There are no conflicting requirements in the two standards. For example, compressors are required by both standards to be equipped with seal systems. Similarly, an alternative permitted by both standards is the use of sealless pumps. Both standards have semiannual reporting requirements, but the requirements are not duplicative. Therefore, redundancy should not be a problem.

Comment:

One commenter (IV-D-4) said the list of chemicals in Appendix E (§60.489) should be confined to those processes which have been tested and shown to be significant contributors to air pollution. He suggested that the list could be amended as new test data became available.

Two commenters representing the same company (IV-D-4; IV-D-23) said adipic acid should be deleted from the list because test data showed no leaks in their adipic acid plant. Only four components of the 775 screened gave positive readings on the screening instrument. The readings were 32, 230, 580, and 2,000 ppmv.

One of the commenters (IV-D-23) said phenol should also be excluded from coverage because fugitive emissions were only detected in those parts of the phenol unit which were handling acetone.

Response:

As discussed in a response to a previous comment in this section, the fugitive emissions data collected in SOCMI units confirm the fact that fugitive emissions occur in SOCMI and that vapor pressure is the overriding consideration in predicting leak rates and leak frequencies. A cross section of high-leaking and low-leaking units was tested in SOCMI. The test results are sufficient to indicate that fugitive emission sources in SOCMI units do emit substantial quantities of VOC.

Fugitive emissions data show that there is considerable variation in the leak frequencies of different units of the same process type. Thus, it is not unexpected that an adipic acid unit could have leaks. It would be inappropriate to characterize a process as a low-leaking or high-leaking process based on the results of tests conducted on a limited number of units. The same argument holds for the case of the phenol unit where only a part of the unit had leaks. It is precisely because of the production of acetone and the use of VOC reactants that phenol is covered. One possible reason for the absence of leaks in some parts of the phenol and adipic acid units may be due to the fugitive emission sources being in heavy-liquid service only. In any case, not all phenol or adipic acid units would necessarily have the same characteristics. EPA has, therefore, concluded that the standards are appropriate for units producing the above chemicals.

However, EPA believes that incentives should be provided for process units which have very few leaks. For this reason, EPA has provided alternative standards for valves. The standards are based on maintaining a performance level of 2 percent or less of valves leaking within a process unit. These alternative standards are discussed in more detail in Chapter 14.

Comment:

Many of the appendix categories were called overly vague in one comment letter (IV-D-17). Acrylic acid and esters, ethanolamines, phenol sulfonic acids, polybutenes, tetrachloroethanes, toluene sulfonic acids, toluidines, and trichlorobenzenes were listed as examples. The commenter was joined by another commenter (IV-D-51) in recommending that each compound to be covered by the NSPS be listed separately. Another commenter (IV-D-35) pointed out that the list includes acrylic acid and esters as one entry, but gives separate entries for n-butyl acrylate and ethyl acrylate.

Response:

As suggested by the commenter, the duplication of the acrylic acid esters has been removed by removing the words "and esters" from the entry for acrylic acid. However, it should be noted that some entries include more than one chemical compound. For example, the entry for trichlorobenzenes indicates inclusion of all isomers, and EPA's intent is to include all isomers.

Comment:

One commenter (IV-D-28) objected to EPA's alleged selection of chemicals on the basis of production volume. However, another commenter (IV-D-7) argued that the list should be based on production volume and number of units. This commenter continued, saying that raw materials have little or no bearing on emissions and, therefore, should not be the basis for selection of the chemicals. He also noted that many of the chemicals on the list are produced in insignificant quantities and should be removed from the list. Another commenter (IV-D-35) questioned whether low-volume monomers such as hydroxypropyl acrylate would be covered by the rules.

Response:

The segment of the synthetic organic chemical industry covered by the proposed standards is a readily identifiable subgroup of the organic chemical industry. The products of this industry segment are derived from about ten basic petrochemical feedstocks and are used as feedstocks in a number of synthetic products industries. Many of these products are high-volume chemicals. Production volume alone is, however, not the basis for selection of these chemicals, as alleged by the commenter (IV-D-28). EPA studies of VOC fugitive emissions showed little or no predictable relationship between emissions and line size and capacity (II-A-9). The volatility and/or the phase of the process stream is the equipment or process variable which greatly influences fugitive emission rates. Unless data can be produced to the contrary, fugitive emissions cannot be assumed to be a function of production volume. All chemicals listed in §60.489 will, therefore, continue to be covered under the regulation, regardless of their production volume.

There are units, however, with production rates so small that emissions would also be very small. The cost to control a very small amount of emissions would be exorbitant when compared to the emission reduction achieved. Therefore, EPA has excluded units producing less than 1,000 Mg/yr from coverage. The production rate cutoff is explained in more detail in Section 5.7.

Even though EPA agrees with the commenter (IV-D-7) who stated that raw materials have little or no bearing on emissions, EPA believes that the raw materials that are processed in fugitive emission sources should be the basis for §60.489. Emission factors have been developed for each equipment type (valves, pumps, etc.) for each of the three kinds of service (gas, light liquid, and heavy liquid) by measuring emissions of the raw material(s) in the line. Moreover, the intent of standards is to reduce emissions of substances which are photochemically reactive and the substances emitted by these sources are the substances processed by the fugitive emission sources.

Comment:

One commenter (IV-D-12) noted that a very large fraction of the 400 to 500 chemicals on the list are also on the list in Table Z-1 of 1910.1000 of OSHA Law CFR29. He said these materials in air from all sources, including fugitive emission sources are enforced by OSHA at levels which are in most cases far below the present no effect levels and in all cases below the 10,000 ppmv level by several orders of magnitude. He commented that exemption of these duplicated chemicals from these standards would yield significant savings in capital expense and enforcement costs without compromising air quality in any significant way.

Response:

The above comments are based on a premise that the SOCMI NSPS and OSHA regulations are duplicative. The two regulations have different objectives and different approaches to emissions control (see Section 2.2). The standards, however, do provide sufficient flexibility so that units that have very few fugitive leaks due to compliance with OSHA can realize cost savings by choosing to comply with the several allowable alternative standards (see Chapter 14).

Comment:

One commenter (IV-D-12) said furfural plants were not like the oil refineries and petrochemical plants for which the proposed standards have been developed.

Other commenters (IV-D-48; IV-D-42) wrote that another chemical production process that EPA has unintentionally regulated is the production of ethanol (grain alcohol) via biological processes from grain feedstocks. They suggested that the proposed definition of "Synthetic Organic Chemicals Manufacturing Industry" be amended. They suggested, including a qualification to the SOCMI list, that the products be produced from petrochemical feedstocks. One of these commenters added that the beverage distilled spirits industry, which produces alcohol from natural food products by the natural process of fermentation, has never been thought of as part of the Synthetic Organic Chemicals Manufacturing Industry and does not produce synthetic alcohol. The commenter wrote that the EPA Draft Environmental Impact Statement (EIS) used to justify regulation of SOCMI establishes that fermentation alcohol cannot be regulated in this rulemaking. The commenter also claimed that the EIS is based upon studies of what is conventionally thought of as the chemical industry.

This commenter further stressed that fermentation alcohol is not a synthetic organic chemical. He wrote that synthetic alcohol typically is produced by a very complex process whereby ethylene (a VOC) is produced from a petrochemical feedstock and then is converted to alcohol by esterification-hydrolysis. The process requires complex equipment containing numerous valves, pumps, connections and other potential sources of VOC. By contrast, the production of alcohol fermented from grain and the like was said to be a relatively simple process involving few sources of potential VOC emissions. The commenter submitted process diagrams for synthetic and natural alcohol processes in support of his argument.

The commenter continued that the production of alcohol represents only a miniscule portion of the total chemical production EPA intends to regulate. Ethanol produced from grain, molasses, fruit and whey accounted for only 478.2 thousand Mg out of a total of 319,835 thousand Mg VOC produced in 1976. Thus, only 0.15 percent of the total was fermentation alcohol.

The commenter cited EPA studies to support his argument that EPA had previously recognized that alcohol evaporation as a result of the fermentation and distillation process is too small a factor to justify regulation. These EPA studies related to the whiskey distilling industry and whiskey warehousing. The commenter pointed out that EPA stated in those reports that the fugitive ethanol emissions from production were low. Also, in those reports EPA did not even consider any controls on beverage alcohol fermentation and distillation, but focused entirely on whether controls on aging warehouses were warranted.

Response:

The background information document for the proposed standards pointed out that SOCMI chemicals are produced from a variety of raw materials in a wide range of processes (over 600 for the industry). Although much of the data presented in the background document was for petrochemical process units, the conclusions drawn from the data in setting the standards are applicable to SOCMI in general. The standards have not been developed specifically for oil refineries or petrochemical plants. Nor have the standards been developed specifically for processes based on the criteria of whether a synthetic process is involved. The standards are aimed at plants producing certain products contained in the SOCMI list which involve the use and handling of VOC in the production process and have fugitive emission sources (e.g., pumps, compressors, valves, etc.) in VOC service. Synthetic organic chemicals are produced by physical, chemical, and biological processing methods which involve many operations including the handling of process fluids. As noted in the proposal BID, most of the synthetic organic chemicals produced in the United States are derived from crude petroleum and natural gas, with oil, shale, coal and biomass also serving as primary feedstocks. Furfural and grain alcohol processes use agricultural materials to produce, through biological synthesis, organic chemicals that are photochemically reactive. Operations in the processing plants contain process equipment types which are fugitive emission sources (e.g. pumps, valves, etc). The regulation, therefore, appropriately covers furfural and grain alcohol. However, as explained in Sections 8.1 and 8.2, these standards do not cover certain facilities in the whiskey distillation and beer manufacturing industries.

Comment:

Several comments (IV-D-20; IV-D-15; IV-D-16; IV-D-48) were received concerning potential application of the standards to refineries. It was noted that some process units in refineries would qualify as affected facilities under the proposed definition. One commenter (IV-D-16) requested that refineries be specifically excluded. Another (IV-D-20) said that it was inappropriate to cover such units because their primary purpose was not the manufacture of chemicals. He recommended that if they were covered under the proposed rules for SOCMI, they should be exempted from the refinery rule.

One commenter noted that refinery products are often used as feedstocks in SOCMI, and certain petroleum refineries produce only feedstock materials for SOCMI, and therefore by definition, are properly a part of SOCMI. However, the commenter objected to the fact that these regulations also apply to petroleum refineries whose principal products are motor fuels or related products. He said these facilities, by definition, are not part of SOCMI and should not be included in this regulation simply by virtue of the fact that one or more chemicals which are split as separate fractions during the processing of crude oil into gasoline are on the list. (Preamble at 46 FR 1461.)

He concluded that if the suggested exclusion is not granted to petroleum refineries whose principal products are motor fuels and related products, these regulations will have a significant economic impact upon this segment of the industry. By way of illustration, the commenter estimated that at one of his company's small refineries, producing slightly more than 50,000 BPD's of gasoline products, the initial capital expenditure will be $100,000 with annual operating and maintenance costs of a similar magnitude.

Response:

The primary purpose of most refineries is manufacture of petroleum products, such as motor oils. However, some refineries do produce organic chemicals. EPA is regulating process units that produce one or more of the chemicals on the SOCMI list. Because some refineries have sources of fugitive VOC emissions (such as pumps and valves) involved in producing one or more SOCMI chemicals, EPA believes that the standards appropriately apply to process units in these refineries that produce these chemicals. EPA has considered the impact on SOCMI units located in refineries as well as SOCMI units located in chemical plants. The impacts are not different, and as shown in Section 7.2 they are reasonable. In light of these facts, it is appropriate to regulate affected facilities located in refineries. However, to eliminate any potential redundancy or confusion, process units that are covered under the SOCMI standards would be exempted from refinery standards presently being developed.

Comment:

A commenter (IV-D-43) recommended that some chemicals be eliminated from the SOCMI list. He said some could be eliminated based on their vapor pressure. Others, he said, could be eliminated because they do not contribute to ozone formation.

Response:

Any chemicals that may be classified as heavy liquids, based on their vapor pressures, remain on the list because light liquid VOC are present in the process, as reactants, additives or by-products. Similarly, some chemicals that may not themselves contribute to ozone formation are on the list because they have ozone forming reactants, additives, or by-products in the production process. However, process units may be excluded if they process only heavy liquid VOC or non-VOC in producing chemicals on the list.

## 5.2 VAPOR PRESSURE CUTOFF

Comment:

One commenter (IV-D-6) said the proposed definition of light liquid service was not consistent with the test work referenced in the background information document. He did not cite any specific inconsistencies.

Response:

The background information document data classify a stream as light liquid if the following conditions apply:

(1) The vapor pressure of one or more of the components is greater than 0.3 kPa at 20°C.

(2) The total concentration of the pure components having a vapor pressure greater than 0.3 kPa at 20°C is equal to or greater than 20 percent by weight.

(3) The fluid is a liquid at operating conditions.

An emission source "in VOC service" was defined as a source containing a process fluid that is at least 10 percent VOC by weight. During the development of the regulations, several industry representatives called the two definitions confusing and suggested making the percent cutoff for light liquid and VOC the same. Therefore, at proposal the percent cutoff for light liquid was changed to 10 percent. As the commenter pointed out, this has caused an inconsistency between the proposed definition and the test data base. Because EPA considers it more appropriate to maintain consistency between this definition and its test data base than to reduce a potential confusion in another definition, the light liquid percent cutoff has been changed to 20 percent.

Comment:

One commenter (IV-D-6) objected to applying a vapor pressure cutoff developed on refinery plant streams to SOCMI streams. He said the majority of SOCMI processes utilize pure components to produce pure products, while the refining industry processes mixtures. He cited a model which he had developed for predicting evaporation of spills and emissions from pump seals as a function of temperature. He said the model shows significant differences between chemicals of concern in the refining industry and SOCMI. Another commenter (IV-D-19) argued against using the proposed vapor pressure cutoff because EPA had apparently used refinery data to derive the vapor pressure cutoff point. Noting that petroleum fractions are mixtures of compounds with widely varying vapor pressures, he said the data had been inappropriately interpreted. One other commenter (IV-F-1, No.3) called the definition of light liquid arbitrary.

Response:

Although the vapor pressure cutoff of 0.3 kPa was derived from petroleum refinery data, it does not represent misinterpretation of data. It should be noted in reference to the comment about differences between SOCMI and petroleum refineries that SOCMI streams can also be mixtures of compounds. On the other hand, several streams in refineries are pure chemicals. The differences between the industries are not as clearly defined as the commenter has indicated. However, an analysis of the vapor pressures and emission rates had shown that substances with vapor pressures of 0.3 kPa or higher had significant emission rates while those with lower vapor pressures did not. This represents the split between kerosene and naphtha (II-A-7) and is the criterion used by EPA to distinguish between light liquid and heavy liquid substances. This criterion was used in collecting the SOCMI data, and EPA is maintaining consistency by using the same criterion in the standards.

Comment:

The previous commenter (IV-D-6) argued further that there is only one study of fugitive emissions of pure components in the literature, a pump seal study by Summerfield. He said the study showed that for chemicals with boiling points above 20°C there was little in the way of emissions. The average for 20 tests was 2.8 g/hr. The data were further reported to show that 90 percent of the pumps tested with chemicals that boil at a temperature above 20°C had emission rates of less than 4 g/hr. He pointed out that this emission rate is 1/3 the emission rate reported by EPA for Alternative A.*

*Interpreted by EPA to mean Alternative I.

He recommended that the definition of light liquid service be changed to a stream having 20 percent or greater concentration of a component with vapor pressure greater than 760 mm Hg at operating temperature.

Response:

EPA made a thorough review of the data base for fugitive VOC emissions in the recently released AID (47 FR 19724, May 7, 1982). This review points out the limited usefulness of the Summerfield study with respect to applicability to actual SOCMI operating units. The review supports the decisions made by EPA in defining light liquid service.

Comment:

One commenter (IV-D-19) recommended a vapor pressure breakpoint of 3.5 kPa. He thought the 0.3 kPa criteria unreasonably stringent. He said regulations for VOC storage require floating roofs or equivalent control for tanks 75 $m^3$ or larger with liquids having vapor pressures greater than 3.5 kPa and less than 76.6 kPa.

Three commenters (IV-D-13; IV-D-18; IV-D-20) recommended a vapor pressure cutoff of 1.5 psi for light liquid service. One (IV-D-13) said the SIP's uniformly recognize 1.5 psi for purposes of establishing vapor controls on storage tanks and other units which are considered major sources of VOC emissions. He considered 1.5 psi a reasonable cutoff level and added that there were no data to justify a vapor pressure cutoff of 0.3 kPa for SOCMI fugitive sources.

Another commenter (IV-D-41) proposed that 10.3 kPa (1.5 psi) be used as the cutoff vapor pressure for the liquid required in dual mechanical seals. He wrote that as defined, a heavy liquid would have a vapor pressure of less than 0.3 kPa (0.04 psi) at 20°C which is 35 times more stringent than the 10.3 kPa specified for seals on floating roof storage tanks.

Response:

VOC in storage tanks are at ambient temperature and pressure conditions. VOC processed by fugitive emission sources, on the other hand, are at elevated temperature and pressure conditions. The storage tank criterion, therefore, has no bearing on the fugitive emissions standard. The vapor pressure cutoff for fugitive emission sources was established to eliminate requirements for sources which had low leak or emission potentials.

Comment:

A commenter (IV-D-19) said there were chemicals (cumene, normal propylbenzene, styrene, ethylbenzene) which are light liquids by the proposed definition but which would cause less than a 10,000 ppmv reading even if the air were saturated with them at 20°C. Another commenter (IV-D-18) said low vapor pressure materials would not register on a VOC detector.

Response:

As pointed out by the commenter, it may be true that certain chemicals which are light liquids by the proposed definition would cause less than a 10,000 ppmv reading even if the air were saturated with them at 20°C. However, not many streams in SOCMI are expected to be encountered at 20°C. At higher temperatures the chemicals mentioned by the commenter will show readings of 10,000 ppmv or greater. For example, the EPA 24 unit study (IV-A-11) included 2 cumene units. Several sources in both units were found leaking (i.e., 10,000 ppmv or greater reading). In fact, 16 percent of all gas valves and 14 percent of all pumps in these cumene units were found to have readings of 10,000 ppmv or greater.

Comment:

One commenter (IV-D-28) said the vapor pressure cutoff would classify water as a light liquid.

Response:

Water is not a VOC. The standards do not require equipment processing mostly water to be screened with the monitoring instruments.

Comment:

One commenter (IV-D-28) said the vapor pressure criteria have no health or environmental basis.

Response:

The SOCMI NSPS are technology based standards. They are aimed at prevention of degradation of air quality due to the emission of VOC by new, modified, and reconstructed sources. There is no need for the vapor pressure criterion to have a health basis. The purpose of the vapor pressure cutoff was to exempt heavy liquids from the regulation, since they had very little or no leakage.

Comment:

One commenter (IV-D-13) objected to using vapor pressure data for pure components in the line. He thought the vapor pressure criteria should be applied to actual conditions in the line. He said this approach would also avoid the problem of determining the percent of VOC that qualifies a mixture as a VOC.

Response:

The regulations define a source as being in light liquid service if:

(1) The vapor pressure of one or more of the components is greater than 0.3 kPa at 20°C.

(2) The total concentration of the pure components having a vapor pressure greater than 0.3 kPa at 20°C is equal to or greater than 20 percent by weight.

(3) The fluid is a liquid at operating conditions.

The above definition is consistent with the SOCMI NSPS data base. In addition, vapor pressures of pure components are easily available from standard reference texts (IV-A-6). Applying the vapor pressure criteria to the actual conditions in the line would cause unnecessary complications. For example, to determine the actual vapor pressure of the mixture in line, an owner or operator would have to conduct vapor pressure tests on all mixtures of chemicals in each line at the temperature conditions of the mixture. In EPA's judgement such complications are unwarranted, especially in light of the simple, yet reasonable approach of summing the concentrations of pure components.

Comment:

One commenter (IV-D-43) said EPA has not justified its present arbitrary criteria for dividing substances into light and heavy liquids. Another (IV-D-18) said 1.5 psi was the standard level for vapor pressure cutoff. He said that any effort to lower this level should be explained and justified. He called EPA's selection of 0.3 kPa completely arbitrary. A third commenter (IV-D-20) recommended that the level be adjusted to 1.5 psi RVP because that is the definition used by South Coast Air Quality Management District (SCAQMD). He said if it were kept at 0.3 kPa, it would include nearly every hydrocarbon stream in the plant.

Response:

As explained previously, the 0.3 kPa vapor pressure criterion was based on fugitive emission data gathered in petroleum refinery studies. Equipment processing VOC with vapor pressures above 0.3 kPa leaked at significantly higher rates and frequencies than equipment processing VOC with vapor pressures below 0.3 kPa. Therefore, EPA elected to exempt equipment processing lower vapor pressure VOC substances from the routine leak detection and repair requirements of the standards.

Available data do not show that if the cutoff were kept at 0.3 kPa it would include nearly every hydrocarbon stream in the plant. EPA's 24 unit SOCMI study shows several sources to be in heavy liquid service. For example, 13 percent of all pumps and about 17 percent of all liquid service valves screened were found to be in heavy liquid service. However, if all the equipment in a process unit is in light liquid service, the resulting higher leak frequency could provide further evidence that these emission sources should be controlled.

Comment:

One commenter (IV-D-19) challenged the concept of a vapor pressure cutoff. He said it was inappropriate to characterize the vapor pressure of a mixture by the vapor pressure of its least volatile component and then to imply that streams containing 10 percent or greater of this least volatile component should be treated like naphtha.

Response:

As discussed in an earlier response in this section, the vapor pressure of a stream is not characterized by the vapor pressure of its least volatile component. A stream containing 10 percent or more of liquids whose vapor pressure is 0.3 kPa or greater at 20°C is classified as a light liquid. The 0.3 kPa cutoff is based on fugitive emissions data gathered in petroleum refineries. The data show that fugitive emission sources processing VOC streams with vapor pressures lower than 0.3 kPa have low (but measureable) probabilities of leaking. The cutoff was established to eliminate those sources from some of the requirements of the standards.

5.3 IN VOC SERVICE

Comment:

One commenter (IV-D-20) suggested that EPA exempt streams containing less than 20 percent by weight VOC instead of 10 percent. He said the 20 percent figure was used by SCAQMD.

Another commenter (IV-D-46) stated that the 10 percent VOC cutoff should be conditioned to prevent evasion. He asked EPA to make provision for the possibility of plant designers diluting certain streams so as to avoid the need for controls. The commenter suggested that the rules should also make clear that where streams fluctuate above and below 10 percent VOC, the whole stream and its associated valves, seals, and pumps are subject to the control requirements of the standards.

Response:

The purpose of the 10 percent cutoff is to avoid covering those sources that have only small amounts of photochemically reactive substances in the line. In any case, very few sources are expected to have streams containing between 10 and 20 percent VOC. In view of the strict purity requirements of most chemicals, EPA does not consider dilution, for the purpose of evasion, to be a potential problem. However, the rules have been changed to make clear the fact that streams fluctuating above and below 10 percent VOC will be covered by the standards.

There has also been confusion over the compounds to be considered in computing the percent VOC. Volatile organic compounds (VOC) are defined as organic compounds that participate in atmospheric photochemical reactions. EPA considers several organic compounds to be nonphotochemically reactive (methane; ethane; 1,1,1-trichloroethane; methylene chloride; trichlorofluoromethane; dichlorodifluoromethane; chlorodifluoromethane; trifluoromethane; trichlorotrifluoroethane; dichlrotetrafluoroethane; chloropentafluoroethane). In determining the percent VOC in a process line (as a prerequisite to determining whether a piece of equipment is in VOC service), quantities of the nonphotochemically reactive compounds (these considered such by EPA)present in the line may be excluded from the total quantity of organic material.

## 5.4 PROCESS UNIT DEFINITION

Comment:

Five comment letters (IV-D-15; IV-D-17; IV-D-20; IV-D-14; IV-D-21) said that the definition of process unit was vague. Two of the commenters (IV-D-14; IV-D-21) cited potentially confusing situations in which the standard might be misapplied to solvent recovery operations. One (IV-D-21) recommended that the definition include the conditions that the chemical be produced by chemical synthesis.

Another commenter (IV-D-51) wrote that, as proposed, "process unit" means equipment assembled to produce, as intermediates or final products, one or more of the chemicals listed in Appendix E (§60.489). The key word of the definition in the context of the overall intent of the Subpart VV is the word "produce." The commenter added that as the Administrator explains in the preamble the applicability of Subpart VV is for facilities that produce the listed chemicals and not facilities that use them. He expressed concern that unless this point is clarified it may be interpreted that process units that purify or recover the listed chemicals are producing them. The commenter stressed that to produce a chemical means to convert raw materials by one or more reaction steps to the desired chemical which may be either an intermediate or a final product. He recommended that the following sentence be added to the definition of process unit: "Process units that handle, but do not form by chemical reactions, the chemicals listed in Appendix E (§60.489) are excluded from this subpart."

Another commenter (IV-D-14) recommended that a definition of intermediate products be included to avoid the potential misunderstanding.

Response:

Process unit is defined as equipment assembled to produce, as intermediate or final products, one or more of the SOCMI chemicals (listed in §60.489). A process unit can operate independently if supplied with sufficient feed or raw materials and sufficient storage facilities for the product.

The definition was drafted to provide a common sense, practical way to determine which equipment are included in an affected facility. There are no specific physical boundries or size criteria. The definition instead depends upon several operational factors, including chemical produced and the configuration of the processing equipment. The configuration of the processing equipment may be different for different producers of the same chemical, and, therefore, it may be fairly site-specific. However, in practice, the definition will implement the selection of a process unit basis as the "source" covered by the standards.

The intent of the standards is to cover process units that produce the chemicals listed in §60.489, either by chemical reaction or by other processing means, such as separation and purification techniques. EPA sees no justification in specifically excluding solvent recovery operations. VOC fugitive emissions occur from equipment in VOC service. Therefore, if there are any fugitive emission sources in VOC service in a process unit producing one of the chemicals listed in §60.489, they should be covered by the standards. These equipment components would be present in a process regardless of whether it is a chemical synthesis or separation process. It would, therefore, be inappropriate to define process unit by requiring that a chemical be produced by chemical synthesis or by a separation process.

Solvent recovery operations will be covered by the SOCMI standards if they are producing chemicals listed in §60.489. EPA has considered the impact on producers of all these chemicals. The impact on SOCMI units located in solvent recovery plants is no different from the impact on SOCMI units located in chemical plants.

Intermediate chemicals are typically those chemicals produced from raw materials which are then used captively to generate a final product(s). The equipment assembled to produce an intermediate chemical constitutes a process unit if it can be operated independently when provided sufficient storage for raw materials as well as the intermediate chemical itself. Thus, any process unit producing a chemical listed in §60.489 as an intermediate chemical would be covered by the standards.

Furthermore, chemicals listed in §60.489 that are produced as coproducts in a process unit would also result in coverage of that unit by the standards. Examples of coproducts are phenol and acetone. Chemicals listed in §60.489 produced as by-products, on the other hand, would not result in coverage of that unit. By-products are produced as a consequence of producing other chemicals and are not gathered together for any subsequent purpose. By-products may be found as trace contaminants in the final product of a chemical production process unit.

Comment:

Another commenter (IV-D-15) cited a potential problem in defining when an upstream process unit is an affected facility. He cited as an example a crude unit in a petroleum refinery which produces intermediate refinery streams which may contain 10 percent or more VOC per the proposed ASTM methods. These streams may feed a unit which will eventually produce a SOCMI chemical. In such instances it was not clear to the commenter which streams would be covered. He recommended that only the downstream unit be covered.

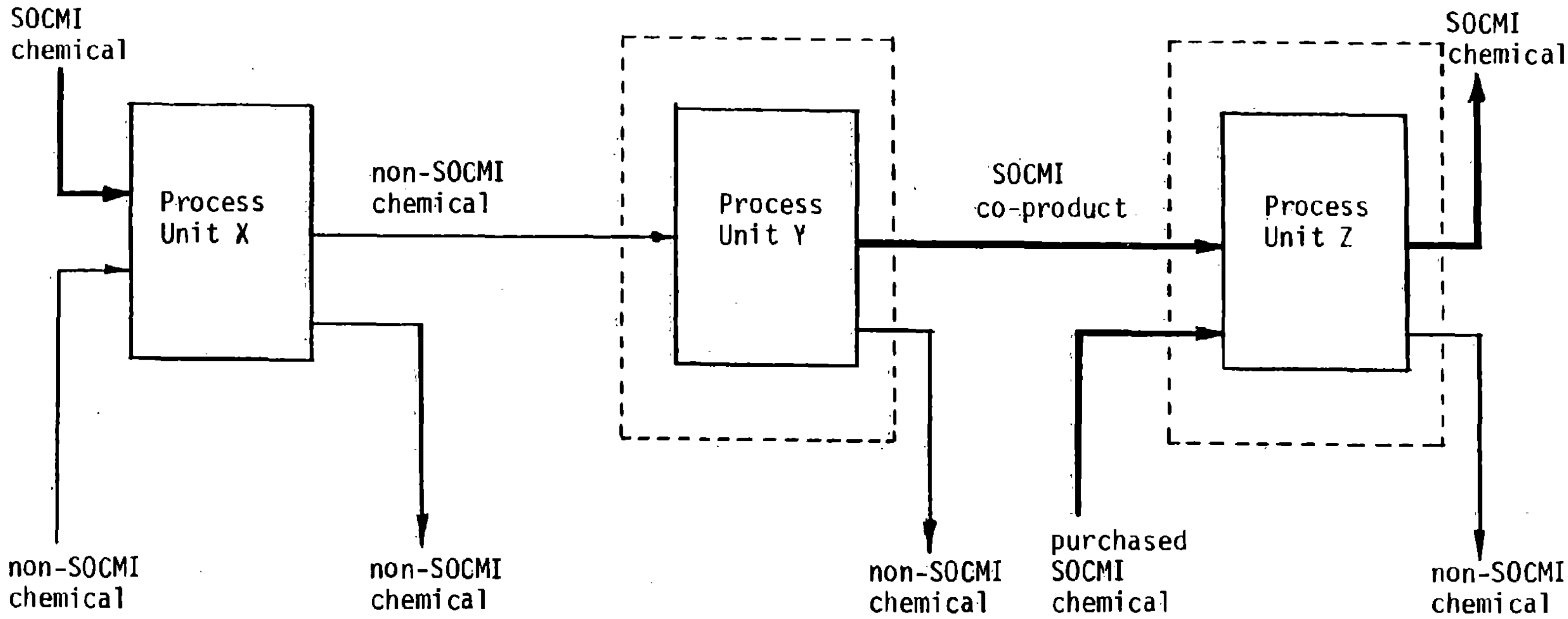
Response:

The SOCMI NSPS for fugitive VOC sources regulate process units that produce chemicals that are either photochemically reactive substances, use photochemically reactive chemicals as additives or reactants in the production process, or have photochemically reactive co-products. The chemicals covered by these standards are listed in §60.489. Therefore, if the intermediate product is one of the chemicals listed in §60.489, the unit producing it is covered by the standards. If the downstream unit also produces one or more chemicals on the list, it will also be covered by the standards.

The following example is offered for purposes of clarification. Figure 5-1 shows a configuration of a hypothetical petroleum refinery or chemical plant. In this hypothetical complex, there are three processes. Process X uses SOCMI and non-SOCMI raw materials to produce a non-SOCMI chemical and non-SOCMI co-products. Process unit X would not be covered by the final SOCMI standards because SOCMI chemicals are not produced.

Process unit Y uses non-SOCMI chemicals to produce another non-SOCMI chemical and a SOCMI chemical co-product.[a] Process unit Y would be covered

[a]If this production is less than 1,000 Mg/yr, the unit may be excluded under the lower production volume cutoff. See Section 5.7.




NOTE: Process units enclosed in dashed boxes would be affected facilities under the SOCMI standards.

Figure 5-1. Example for process unit definition.

by the standards because it produces a SOCMI chemical. There is an exception to this coverage, however. If the production of the SOCMI chemical co-product is less than 1,000 Mg/yr, the unit may be excluded under the lower production volume cutoff (see Section 5.7). And as discussed in the previous response, if the SOCMI chemical is a by-product (not a co-product) that is not collected for any purpose (such as product recovery) and remains in the final non-SOCMI chemical product in trace quantities as an impurity, the unit would not be covered by the standards (see previous response).

Process unit Z uses the SOCMI coproduct produced in Unit Y and purchased SOCMI materials to produce another SOCMI chemical and a non-SOCMI co-product. Process unit Z would be covered by the standards. However, the non-SOCMI co-product stream would not be covered after the point of removal from the reaction products.

Comment:

Another potential problem with the process unit definition was cited by one of the commenters (IV-D-20). He cited an example of an FCC unit which produces streams containing significant amounts of propylene. The major purpose of the unit is to produce gasoline. However, the propylene produced is fed directly into a polymer plant. He did not feel it appropriate to cover that plant by the proposed standards because the propylene is a transient intermediate which is not stored or sold as a finished product.

Response:

The fact that a product is not stored or sold as a finished product has no effect on fugitive emissions. A unit that produces propylene would be covered by the SOCMI fugitives NSPS unless none of the fugitive emission sources are "in VOC service."

In the example cited by the commenter, propylene is a co-product of the gasoline production operations. Under the final standards fugitive emission sources from the point of production of propylene to the point of raw material storage or reaction in the polymer unit would be covered if they are in VOC service.

## 5.5 SMALL MANUFACTURERS

Comment:

One commenter (IV-F-1, No.2) objected to small manufacturers being subject to the standards. He made three arguments in support of his objections:

1. He said the EPA's assumption that fugitive emissions are proportional to the number of fugitive emission sources is invalid. He stated that he believed that even relatively complex small plants will have fewer emissions than the larger ones.
2. Reductions in emissions from small plants would be insignificant.
3. The economic impact on small producers would be disproportionately large when compared to emission reductions. (See also Section 2.1).

Another comment letter (IV-D-3) said the record is lacking in data on small chemical manufacturers.

Another commenter (IV-D-12) said expenditures required by the standards would not be warranted for furfural units, considering the small size of the furfural business. He said the total added expenditures during the first year would be $109,375.00.

A commenter (IV-D-38), representing a group that had commented previously (IV-F-1, No.2), stated that additional comment on the proposed definitions of "small facilities" should be solicited. He used the term "small business" as defined in the rules issued under Section 8(a) of the Toxic Substances Control Act. He provided this definition in a subsequent comment (IV-D-38a).

This commenter stated that the data base for the proposed standards consisted primarily of large continuous-process petrochemical plants. These plants are not considered representative of the majority of the industry's manufacturing processes, such as small or batch process units. In addition, it is common for a batch process facility to manufacture a SOCMI chemical for a limited time, thereafter producing a non-SOCMI chemical. Despite the limited applicability of the NSPS to only a few products, such a manufacturer might incur substantial additional costs in monitoring, repairing, and recordkeeping. The commenter, therefore, felt EPA had not given adequate consideration to such problems in applying NSPS to all industry processes.

Response:

Data from fugitive emissions test work do not show any definite relationship between emissions and production volumes above some minimal qualities (see Section 5.1). Fugitive emissions are proportional to the number of sources in a plant rather than to the plant size or production rate. Emission reductions from small production volume plants would, therefore, be no smaller than those from larger ones. On the other hand, the cost analysis shows that the cost effectiveness for the least complex process units (model unit A) is $533/Mg VOC as compared to $252/Mg for the most complex units (model unit C). The difference is obviously not disproportionately burdensome even for the less complex process units. As discussed in Section 7.2, the economic impact of the standards does not have a significant adverse impact on small facilities.

However, there are some units (e.g., R&D facilities) which have production rates so small that their fugitive emissions are likely to be very small and the cost to control fugitive emissions from such a small unit would be unreasonably high compared to the emission reduction achievable. Therefore, EPA has excluded from coverage by the standards units producing less than 1,000 Mg/yr. The lower production rate cutoff is explained in detail in Section 5.7.

The record is not lacking data on small manufacturers as suggested by the commenter (IV-D-3). EPA has collected data on such statistics as total number of SOCMI product site locations, number of emission sources versus unit capacity, and cost estimates of installation of control devices for small units (II-C-30). All of this information was taken into account in the analysis of the economic impact on SOCMI. No unreasonable economic impact on small facilities was found. EPA feels that enough time was provided for public comment.

If a batch unit produces more than 1,000 Mg/yr of a SOCMI chemical, it will have VOC fugitive emissions and would be appropriately covered under the final standards. The costs for controlling fugitive emissions of VOC in such cases would not be any more than for a unit producing a SOCMI chemical on a continuing basis.

## 5.6 VOC DEFINITION

Comment:

Two commenters (IV-D-20; IV-D-6) said the definition of VOC should be clarified. One (IV-D-20) said it was not clear to him whether methane and ethane would be excluded as photochemically unreactive. He said a reference to EPA policies published in 42 FR 35314 would be helpful.

Another (IV-D-6) said the definition of VOC does not adequately reflect the capabilities of the reference method (see Section 12, Test Method). He further said that the definition is meaningless for those chemicals which participate in atmospheric photochemical reactions but cannot be measured by all instruments allowed by Reference Method 21. He recommended the following as a substitute for the definition of VOC:

> 'Volatile Organic Compounds' means any organic compound, which participates in atmospheric photochemical reactions and is measurable by the applicable test methods described in Reference Method 21 which can be calibrated by a saturated straight chain hydrocarbon.

Response:

Methane and ethane were not intended to be classified as photochemically reactive. The standards have been clarified to allow for the exclusion of substances not considered photochemically reactive by EPA when determining the percent VOC in the process fluid (i.e., determining whether a piece of equipment is in VOC service). The VOC content is to be determined by the referenced ASTM methods, not by Reference Method 21. As discussed in Section 5.3 on "In VOC Service," some compounds may be excluded from the total quantity of organic compounds contained in a process line. These compounds are the eleven organic compounds considered at this time by EPA to be nonphotochemically reactive.

As the commenter (IV-D-6) pointed out, no single monitoring instrument will measure all photochemically reactive chemicals. However, each chemical can be measured by at least one instrument. Therefore, the selection of the monitoring instrument will depend partly on the chemicals in the line.

The intent of the standards is to reduce emissions of VOC. In selecting the basis for the standards -- that is, in selecting the best system of continuous emission reduction (considering costs and other impacts) (BDT), EPA considered VOC emission reductions and costs for three emission reductions. However, in implementing the controls represented by BDT, EPA only used the quantity of VOC to determine whether a piece of equipment should be covered by the standards, as discussed in Section 5.3.

In contrast, the leak definition (10,000 ppmv), the criteria for control devices, and other criteria are based on total organic compounds. This is done to ensure that the standards reflect BDT. The data used in selecting BDT are based on total organic compounds. Thus, while methane and ethane are considered nonreactive but are measured by the leak detection monitor, they can not be subtracted from the criteria such as the 10,000 ppmv leak definition. To do so would not be consistent with reflecting BDT.

## 5.7 PILOT PLANT AND R&D FACILITIES

Comment:

One set of comments (IV-D-17) recommended that research and development facilities be exempted from applicability of the proposed regulations. The reasoning presented was that operation of such facilities and their contribution of VOC are *de minimis* in nature.

Response:

Under Section 111, EPA may exempt units where the costs of the standards are unreasonably high in comparison to the minimal emissions reduction achievable. Thus, any exemption would be based on a cost versus emission reduction analysis. Such an analysis indicates that units producing less than 1,000 Mg/yr have such low fugitive emissions that the resulting control is unreasonably high. For this reason, EPA has exempted process units producing less than 1,000 Mg/yr.

To implement an exemption on this basis, this potential emission reduction would have to be translated into a usable format. Two approaches to an exemption cutoff were considered: (1) processing rate and (2) production rate.

An exemption based on processing rate would be hard to determine. The processing rate for a process unit is the amount of materials that move through the process within a year, including raw materials, finished products, intermediate materials and by-products. As a result, this rate is not only difficult to establish but also may vary greatly.

A production rate cutoff is specified during the design of the process unit. It is much easier to determine since the production rate is merely the amount of material moving out of a process in a year. The production rate is less apt to change greatly as well. Because it provides the most easily applied cutoff, exemption based on low production rate was chosen.

An analysis of the cost effectiveness of the standards was made with particular emphasis on units with a low number of fugitive emission sources (IV-B-20). At low equipment counts, low emission reductions are achieved and the cost effectiveness of the standards becomes unreasonably high. A product of this analysis was Figure 5-2, which presents the cost effectiveness of the standards (considering valves only) as a function of production rate for low production volumes. The cost effectiveness of the standards becomes unreasonable at production rates between 600 and 800 Mg/yr. There is some uncertainty in the computations, however. Thus, EPA decided to set a lower production rate cutoff of 1,000 Mg/yr.

The result of providing such a cutoff is to exempt smaller research facilities directed toward research and development alone. At the same time, those facilities that are producing chemicals on a scale that would be considered semicommercial or commercial would be covered by the standards.

## 5.8 FLANGES

Comment:

One comment letter (IV-D-17) said the term "other connector" in the phrase "flange or other connector" is excessively vague. It was said to be impossible to tell from this term what EPA proposed to regulate. It was requested that EPA define "other connector" more precisely or exclude the phrase from the regulation.

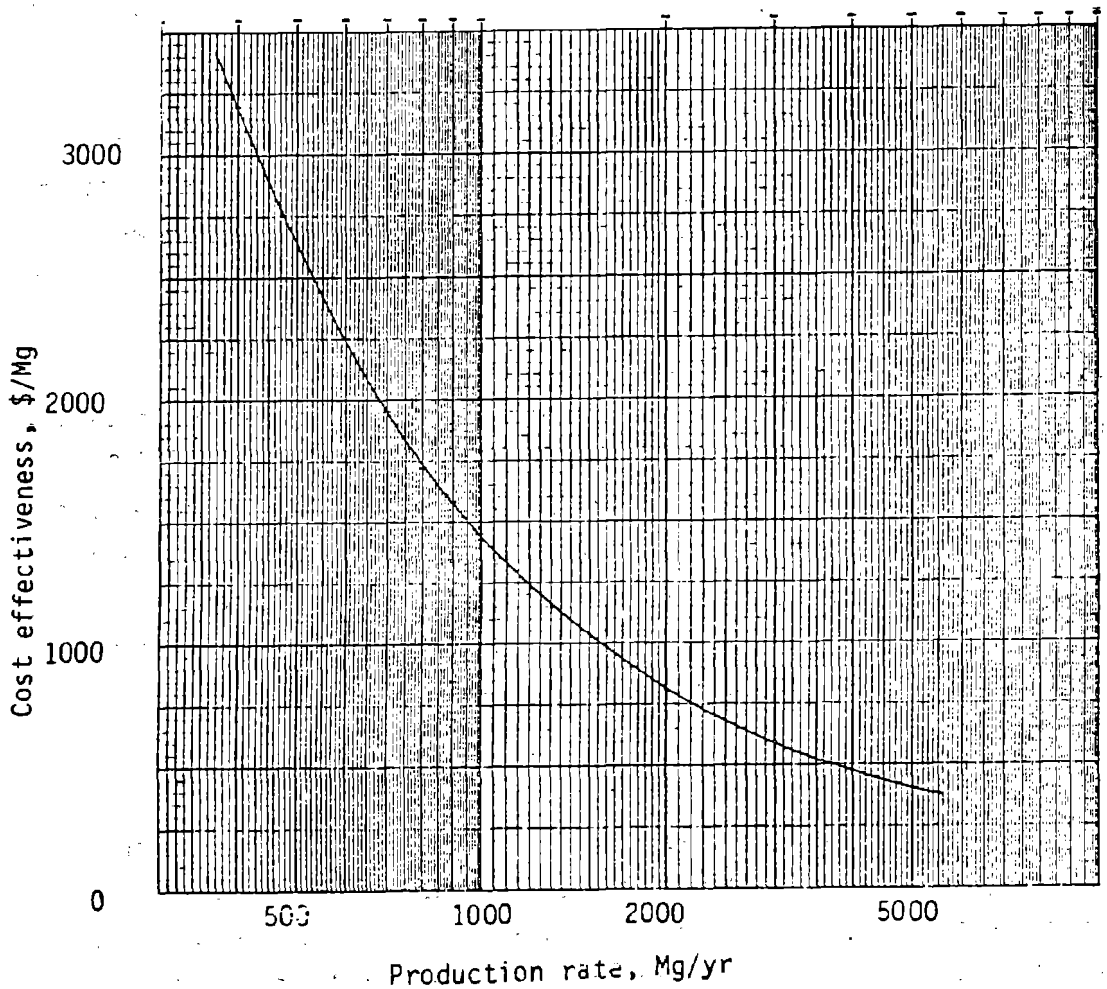



Figure 5-2. Cost effectiveness for low volume SOCMI production units assuming valve standards only (IV-B-20).

Response:

Connectors are such items as flanged, screwed, or welded connections or any other connectors used to connect two pipe lines or a pipe line and a piece of equipment. This explanation has been included in the regulation [§60.482(-8)].

Comment:

A commenter (IV-D-43) said flanges were underrepresented in the sampling reported in EPA-600/2-81-003. He said an effort was made to test only 20 percent of the total and even this goal could not be achieved primarily because of inaccessibility. Thus, the problems of real life in a chemical plant were demonstrated.

Response:

It is precisely because of the large number of flanges in a facility, some of which may be difficult to access, that flanges are generally excluded from specific coverage under the standards. EPA has made every attempt to take into consideration such problems in an effort to make the regulation as reasonable as possible. There is, however, limited coverage of flanges under §60.482-8 of the standards that requires monitoring and repair if evidence of a potential leak is found.

## 5.9 VACUUM SERVICE

Comment:

In one comment letter (IV-D-17) it was stated that the criteria for determining vacuum service (100 kPa) was obviously not intended. The proposed definition was interpreted to mean that when the ambient pressure, (barometer) is below 100 kPa, atmospheric vented tanks are in vacuum service. It was recommended that a better definition would be when a fugitive emission source is operating at an internal pressure which is continuously 200 kPa or more below ambient pressure.

Response:

The proposed regulation defines a source to be in vacuum service if it is operating at an internal pressure which is continuously less than 100 kPa. It should be noted that 1 atmosphere equals about 100 kPa. Many sources may be operating at a pressure below 100 kPa. However, if the source's internal pressure is less than 200 kPa below the ambient pressure, it will not be classified as being in vacuum service by the commenter's recommended definition. That, in EPA's judgement, would be inappropriate because vessels operating even at a slight vacuum would have little if any potential to emit VOC. When asked for a clarification of the above comment, the commenter indicated that his comment was in error and that he had not realized that 100 kPa is atmospheric pressure. Therefore, to avoid any further misunderstanding about the standard, the definition for vacuum service has been changed as follows:

> 'In vacuum service' means that a fugitive emission source is operating at an internal pressure which is at least 5 kPa below ambient pressure.

5.10 ENCLOSED BUILDINGS

Comment:

One commenter (IV-D-51) wrote that OSHA regulates fugitive emissions released inside totally enclosed buildings by stipulating the maximum exposures permitted in the workplace. The act also calls for engineering controls to correct problems of overexposure. Breathing apparatus is only permitted as a corrective measure if engineering controls are not feasible. The commenter stated that additional regulations to control fugitive emissions within the workplace are unnecessary.

Response:

The OSHA and NSPS regulations do not have identical objectives. However, the SOCMI NSPS does not impose any duplicative requirements. They only supplement the OSHA standards. As such it would be improper to exclude enclosed buildings. The respective coverage of OSHA and NSPS regulations is discussed in greater detail in Section 2 on the Basis of the Standards and in Section 5.1 on the SOCMI list.

# 6. ENVIRONMENTAL IMPACT

Many comments on the proposed standards for VOC fugitive emissions from SOCMI addressed emissions estimates and emission reductions achievable under the standards. Such comments appear throughout this document. EPA's analysis of emissions and emission reductions achievable under the final standards are presented in this section.

The development of emission factors and model units, as discussed in Chapter 3, was detailed in the Additional Information Document (AID) for fugitive VOC emissions (III-B-2). Also presented in the AID was an analysis of emission reductions achievable under various control options (e.g., installation of equipment or implementation of work practices such as leak detection and repair programs). Discussion and responses to comments received on the AID are presented in Appendix A of this document.

The analyses presented in Chapter 3 and in the AID were made for individual fugitive emission sources (single equipment components) only. In this section the emissions analyses aggregate fugitive emission sources into model units (see Section 3.2) and examine the overall impact of the standards on process unit-wide fugitive emissions. Model unit emissions are then extrapolated to the national level to estimate national impacts.

## 6.1 EMISSIONS ANALYSIS

Two parallel analyses of SOCMI fugitive emissions are presented in this section. One analysis presents estimates of emissions and estimates of emission reductions under the standards using the model units, emission factors, and estimated control efficiencies presented in the AID. The other analysis estimates emissions and emission reductions achievable for three types of SOCMI units tested (ethylene, cumene, vinyl acetate) during the Maintenance Study (IV-A-10).

Estimating the impact of the standards on emissions from SOCMI units and from SOCMI nationwide requires the following steps:

(1) development of emission factors for fugitive emission sources (see Section 3.1 of this document and Section 2 of the AID);

(2) development of model units (see Section 3.2 of this document and Section 3 of the AID);

(3) evaluation of the effectiveness of control techniques (see Section 3.3 of this document and Section 4 of the AID);

(4) aggregation of emissions (with and without standards) by model unit;

(5) projection of model unit emissions (with and without standards) to the anticipated growth in the industry.

The development of emission factors for fugitive emission sources in SOCMI was detailed in the AID. Briefly, the technique uses emission factors generated in petroleum refining and SOCMI studies for leaking and non-leaking equipment and the leak frequency determined for each type of equipment during SOCMI screening studies. For the purposes of the parallel analysis of emissions from the three types of SOCMI units tested, the emission factors generated for three equipment types (gas valves, light liquid valves, light liquid pumps) in the SOCMI studies were used. Emission factors for the remaining fugitive emission sources were estimated using the approach detailed in the AID. The emission factors are shown in Table 6-1.

The model units used to describe SOCMI were also presented in the AID. The equipment counts for the model units have not been changed since proposal, but some revisions have been made to clarify some confusion and to account for the current level of control in SOCMI. These equipment counts are presented for model units A, B, and C in Table 6-2. Also presented in this table are the average equipment counts found in the ethylene units, cumene units, and vinyl acetate units tested. These average equipment counts are used in developing estimates in the parallel analysis of the SOCMI units tested.

Estimates of emissions from model units are merely the aggregation of the emissions due to the various equipment components in a process unit. These estimates are generated by applying the emission factor for a single component to the total equipment counts and extrapolating emissions to a

## TABLE 6-1. EMISSION FACTORS FOR SOCMI EMISSIONS ANALYSES

| Emissions Source | SOCMI | | Ethylene | | Cumene | | Vinyl Acetate | |
|---|---|---|---|---|---|---|---|---|
| | Leak Frequency, % | Emission Factor, kg/hr | Leak Frequency, % | Emission Factor, kg/hr | Leak Frequency, % | Emission Factor, kg/hr | Leak Frequency, % | Emission Factor, kg/hr |
| Pump Seals | | | | | | | | |
| Light liquid | 8.8 | 0.0494 | * | 0.058[a] | * | 0.018[a] | * | 0.002[a] |
| Heavy liquid | 2.1 | 0.0214 | 0 | 0.0135 | 0 | 0.0135 | 0 | 0.0135 |
| Valves | | | | | | | | |
| Gas | 11.4 | 0.0056 | * | 0.0086[a] | * | 0.007[a] | * | 0.0014[a] |
| Light liquid | 6.5 | 0.0070 | * | 0.018[a] | * | 0.006[a] | * | 0.00023[a] |
| Heavy liquid | 0.4 | 0.00023 | 1.1 | 0.00023 | 0 | 0.00023 | 0 | 0.00023 |
| Pressure Relief Devices | | | | | | | | |
| Gas | 3.6 | 0.1040 | 3.9 | 0.1092 | (3.6)[b] | 0.1040 | (3.6)[b] | 0.1040 |
| Open-ended lines | 3.9 | 0.0017 | 12.8 | 0.0028 | 9.1 | 0.0025 | 3.7 | 0.0019 |
| Compressors | 9.1 | 0.228 | 5.9 | 0.179 | (9.1)[b] | 0.228 | 0 | 0.0894 |
| Sampling connections | --- | 0.0150 | --- | 0.0150 | --- | 0.0150 | --- | 0.0150 |
| Flanges | 2.1 | 0.00083 | 5.7 | 0.0022 | 2.9 | 0.0011 | 1.0 | 0.00043 |

[a]Emission factors determined from results of 6-unit SOCMI Maintenance Study.

[b]Twenty-four unit leak frequency assumed where insufficient or biased data existed.

TABLE 6-2. EQUIPMENT COUNTS USED IN ESTIMATING SOCMI UNIT EMISSIONS

| Emissions Source | Unit Equipment Counts | | | | | |
|---|---|---|---|---|---|---|
| | A[a] | B[a] | C[a] | Ethylene[b] | Cumene[b] | Vinyl Acetate[b] |
| Pumps | | | | | | |
| Light Liquid | 8 | 29 | 91 | 29 | 13 | 47 |
| Heavy Liquid | 7 | 30 | 93 | 8 | 2 | 3 |
| Valves | | | | | | |
| Gas | 99 | 402 | 1232 | 2494 | 273 | 625 |
| Light Liquid | 131 | 524 | 1618 | 1854 | 464 | 1179 |
| Heavy Liquid | 132 | 524 | 1618 | 683 | 124 | 64 |
| Pressure Relief Devices | | | | | | |
| Gas | 3[c] | 11[c] | 33[c] | 16[c] | 3[c] | 5[c] |
| Open-ended Lines | 104 | 415 | 1277 | 165 | 11 | 278 |
| Compressors | 1 | 2 | 8 | 5 | 1 | 4 |
| Sampling Connections | 7 | 26 | 80 | 41 | 3 | 70 |
| Flanges | 600 | 2400 | 7400 | 10660 | 1933 | 1685 |

[a]SOCMI model units as presented in the SOCMI AID.

[b]Average equipment counts of the units tested in the Maintenance Study by process type.

[c]The seventy-five percent of safety/relief valves in gas service EPA assumed to be controlled at baseline (tied into flare header) are not included in these numbers.

[d]All open-ended lines assumed to be controlled in the absence of standards.

full year (8760 hours). An example of this procedure is shown in Table 6-3. A summary of unit emissions for the three model units (A, B, and C) and for the three SOCMI unit types tested (ethylene, cumene, and vinyl acetate) are presented in Table 6-4.

Emissions reduction estimates have been previously discussed in Section 3 of this document and in Section 4 of the AID. The efficiency estimated for each type of equipment depends upon the type of standard applicable to that type of equipment. For instance, the equipment standards for sampling connections, compressor seals,* and open-ended lines are assumed to be 100 percent effective in eliminating fugitive VOC. Leak detection and repair programs are more cost-effective alternatives for other fugitive emission sources (such as valves and pumps), but have lower efficiencies associated with them. The efficiencies used in evaluating the overall effectiveness of standards are summarized in Table 6-5.

These efficiencies are applied to the emissions estimated for SOCMI sources in the absence of any fugitive emissions program. Baseline emissions, emissions under the standards, and emissions reductions are summarized for the SOCMI model units in Table 6-6. The overall percent reduction in fugitive VOC emissions is about 56 percent when computed on a model unit basis.

The nationwide impact of the standards in the fifth year after proposal was determined by applying the growth projection for SOCMI to the model units. The same model unit projections presented in the BID, based on a 5.9 percent growth rate and replacement based on a 20-year equipment life, were used in this analysis of nationwide impacts. The same percentages of model units (52% A, 33% B, 15% C) that were used before proposal were applied to the 831 new, modified, or reconstructed units for this analysis. As shown in Table 6-7, the total VOC emission reduction estimated for the fifth year after implementation of the standards is about 46 gigagrams.

*Seals can achieve at least 95 percent emission reduction and the control device can achieve greater than 95 percent efficiency, for a combined efficiency of at least 99.7 percent. In addition, compressor seals are typically vented back to suction. Considering all these factors, an assumed efficiency of 100 percent for compressor seals is reasonable.

TABLE 6-3. EXAMPLE OF EMISSIONS ESTIMATED FOR MODEL UNIT B IN ABSENCE OF STANDARDS

| Emissions Source | Number of Sources | Emission Factor, kg/hr/source | Annual Emissions, Mg/yr[a] |
|---|---|---|---|
| Pump seals | | | |
| Light Liquid | 29 | 0.0494 | 12.55 |
| Heavy Liquid | 30 | 0.0214 | 5.62 |
| Valves | | | |
| Gas | 402 | 0.0056 | 19.72 |
| Light Liquid | 524 | 0.0070 | 32.59 |
| Heavy Liquid | 524 | 0.00023 | 1.06 |
| Pressure Relief Devices | | | |
| Gas | 11 | 0.1040 | 10.02 |
| Open-ended lines | 415 | 0.0017 | 6.91 |
| Compressors | 2 | 0.228 | 3.99 |
| Sampling connections | 26 | 0.0150 | 3.42 |
| Flanges | 2400 | 0.00083 | 17.45 |
| Total | | | 106.42 |

[a]For estimating purposes, one operating year was assumed to be 8760 hours.

TABLE 6-4. SUMMARY OF ESTIMATED EMISSIONS IN THE ABSENCE OF STANDARDS BY SOCMI UNIT

| Emissions Source | Unit Emissions Estimates, Mg/yr[a] | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| | A | B | C | Vinyl Acetate | Cumene | Ethylene |
| Pump seals | | | | | | |
| Light Liquid | 3.46 | 12.55 | 39.38 | 0.82 | 2.05 | 14.73 |
| Heavy Liquid | 1.31 | 5.62 | 17.43 | 0.35 | 0.24 | 0.95 |
| Valves | | | | | | |
| Gas | 4.86 | 19.72 | 60.44 | 7.67 | 16.74 | 187.89 |
| Light Liquid | 8.15 | 32.59 | 100.63 | 2.38 | 24.39 | 292.34 |
| Heavy Liquid | 0.27 | 1.06 | 3.26 | 0.13 | 0.25 | 1.38 |
| Pressure Relief Devices | | | | | | |
| Gas | 2.73 | 10.02 | 30.06 | 4.56 | 2.73 | 15.31 |
| Open-ended lines | 0[b] | 0[b] | 0[b] | 4.63[c] | 0.24[c] | 4.05[c] |
| Compressors | 2.00 | 3.99 | 15.98 | 3.13 | 2.00 | 7.84 |
| Sampling connections[d] | 0.92 | 3.42 | 10.51 | 9.20 | 0.39 | 5.39 |
| Flanges | 4.36 | 17.45 | 53.80 | 6.35 | 18.63 | 205.44 |
| Total | 28.06 | 106.42 | 331.49 | 39.22 | 67.66 | 735.32 |

[a]For estimating purposes, one operating year was assumed to be 8760 hours.

[b]Nearly all open-ended lines were assumed controlled at baseline for the model units.

[c]Emissions estimates are based on no control in the absence of standards.

[d]The equipment count for sampling connections is taken as 25 percent of the open-ended line count.

TABLE 6-5. SUMMARY OF STANDARDS AND ESTIMATED EFFICIENCIES FOR NEW SOURCES OF FUGITIVE VOC EMISSIONS IN SOCMI

| Equipment | Type of Standard | Estimated Efficiency |
|---|---|---|
| Pumps - Light Liquid | Work Practice[a] | 0.61 |
| | Equipment[b] | 1.0 |
| Valves - Gas | Work Practice[a] | 0.73 |
| - Light Liquid | Work Practice[a] | 0.59 |
| Pressure Relief Devices | Performance[c] | 1.0 |
| Open-ended Lines | Equipment | 1.0 |
| Sampling Connections | Equipment | 1.0 |
| Compressors | Equipment[b] | 1.0 |

[a]The work practice standards are monthly leak detection and repair programs. Efficiencies were computed using the LDAR model described in IV-A-22.

[b]Seals can attain 95 percent efficiency and the control device can attain at least 95 percent efficiency, for a combined efficiency of at least 99.7 percent. Thus, the efficiency for the combination was assumed to be 1.0.

[c]The performance level for safety/relief valves is no detectable emissions and the estimated efficiency of 1.0 is based on equipment (e.g., rupture disks) being used.

## TABLE 6-6. SUMMARY OF EMISSIONS ESTIMATES FOR AVERAGE SOCMI UNITS IN MG/YR

| Source | Regulated By | Baseline Emissions A | Baseline Emissions B | Baseline Emissions C | Control Efficiency | Controlled Emissions A | Controlled Emissions B | Controlled Emissions C | Emissions Reduction A | Emissions Reduction B | Emissions Reduction C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pumps | | | | | | | | | | | |
| Light Liquid | Work Practice | 3.46 | 12.55 | 39.38 | 0.61 | 1.36 | 4.92 | 15.44 | 2.10 | 7.63 | 23.94 |
| Heavy Liquid | --- | 1.31 | 5.62 | 17.43 | --- | 1.31 | 5.62 | 17.43 | 0 | 0 | 0 |
| Valves | | | | | | | | | | | |
| Gas | Work Practice | 4.86 | 19.72 | 60.44 | 0.73 | 1.31 | 5.32 | 16.32 | 3.55 | 14.40 | 44.12 |
| Light Liquid | Work Practice | 8.15 | 32.59 | 100.63 | 0.59 | 3.34 | 13.36 | 41.26 | 4.81 | 19.23 | 59.37 |
| Heavy Liquid | --- | 0.27 | 1.06 | 3.26 | --- | 0.27 | 1.06 | 3.26 | 0 | 0 | 0 |
| Pressure Relief Devices | | | | | | | | | | | |
| Gas[a] | Performance | 2.73 | 10.02 | 30.06 | 1.0 | 0 | 0 | 0 | 2.73 | 10.02 | 30.06 |
| Open-ended lines[b] | Equipment | 0 | 0 | 0 | 1.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Flanges | --- | 4.36 | 17.45 | 53.80 | --- | 4.36 | 17.45 | 53.80 | 0 | 0 | 0 |
| Sampling connections | Equipment | 0.92 | 3.42 | 10.51 | 1.0 | 0 | 0 | 0 | 0.92 | 3.42 | 10.51 |
| Compressors | Equipment | 2.00 | 3.99 | 15.98 | 1.0 | 0 | 0 | 0 | 2.00 | 3.99 | 15.98 |
| TOTAL | | 28.06 | 106.42 | 331.49 | | 11.95 | 47.73 | 147.51 | 16.11 | 58.69 | 183.98 |
| % Reduction | | | | | | | | | 57 | 55 | 56 |

[a]This estimate assumes 75 percent of the pressure relief devices (gas service) are controlled (e.g., tied into a flare header) in the absence of standards.

[b]As discussed in the AID and in Section 3 of this document, nearly all open-ended lines are assumed to be controlled at baseline. If 90 percent of the open-ended lines are assumed to be controlled at baseline, the baseline emissions (and emission reductions) in Mg/yr would be as follows: A, 0.15; B, 0.61; 1.91.

TABLE 6-7. NATIONWIDE IMPACT OF SOCMI NEW SOURCE STANDARDS FOR FUGITIVE VOC EMISSIONS IN THE FIFTH YEAR

| Model Unit | Number of Units | Emission Reductions, Mg/yr Per Unit | Emission Reductions, Mg/yr Total |
|---|---|---|---|
| A | 432 | 16.1 | 6,960 |
| B | 274 | 58.7 | 16,081 |
| C | 125 | 184.0 | 22,998 |
| | 831 | | 46,039 |

6.2 ENVIRONMENTAL IMPACT:

Several comments were received regarding the environmental impacts of the standards in general. The comments ranged from concern over estimates of fugitive VOC emissions in SOCMI and the potential benefits of achievable emissions reductions to questioning the impacts of other regulatory programs, such as SIP, PSD, and LAER. Overlapping coverage of standards, such as RCRA incinerator requirements, also received comment.

Comment:

Several commenters objected to the estimation of emissions from SOCMI made by EPA, based on emission rates from petroleum refinery equipment. One commenter (IV-D-7) said this estimation method was not justified since studies have now been completed for SOCMI. Another (IV-D-6) said emission rates are lower than expected from application of refinery data. Another (IV-D-28) said the background document has no data on emissions for sources except equipment data from petroleum refiners. He said fugitive emissions estimates for SOCMI based on petroleum refineries were wrong because the refining industry is not a proper model for SOCMI.

Response:

EPA's approach to quantifying fugitive VOC emissions from SOCMI is to use the best fugitive emissions data available. At the time of proposal, the best available data for SOCMI fugitive emissions were data from petroleum refineries. As noted in Section 6.1 and explained in the AID, the estimates of environmental impacts of the standards have been revised. The previous estimate of 200 Gg/yr uncontrolled emissions from SOCMI facilities which will become affected by the standards through 1985 has been revised to 83 Gg/yr.

Comment:

There was disagreement among the commenters concerning the percentage of VOC emissions contributed by SOCMI fugitives. Two commenters (IV-D-17; IV-D-48) cited information from the Background Information Document which indicated that SOCMI fugitives contributed 2 percent of stationary VOC emissions. One of these two commenters (IV-D-17) indicated some confusion over the numbers and said the percentage should actually be 1 percent.

Another estimate of 5 percent was quoted from the preamble to the proposed regulations (IV-D-21). The estimate was also said to be 0.5 percent (IV-D-17; IV-D-48) because of an apparent error on EPA's part. The commenters said that EPA had estimated that fugitive emissions from 1000 existing plants total 200 Gg/yr and that 800 new plants would contribute 200 Gg/yr. The commenters saw this as an obvious error and concluded that estimates of current contributions of fugitive emissions were obviously overstated by a factor of 2.

Response:

Percentages can often be confusing because they require consideration of the number being compared as well as the base to which it is being compared. The most recently available total for VOC emissions from stationary sources is 17,000 Gg/yr (IV-A-26). A recent estimate for VOC emissions from SOCMI (all sources) is 540 Gg/yr with fugitive emissions contributing about 35 percent of the total or about 190 Gg/yr (IV-B-24).[a] Comparing the fugitive emission contribution to VOC emissions from stationary sources yields roughly 2 percent. Comparing VOC emissions from all SOCMI sources to total stationary source VOC emissions yields roughly 5 percent.

Another confusing aspect of percentages of emissions is the fact that the numbers are not static. Emissions change from year to year, most recently in a downward trend. The numbers presented at proposal were based on earlier emissions estimates of 19,000 Gg/yr VOC emissions from all stationary sources, 1000 Gg/yr VOC emissions from SOCMI, and 400 Gg/yr from fugitive emission sources in SOCMI. Comparisons of these numbers yielded roughly a 5 percent contribution of SOCMI VOC emissions to stationary source emissions of VOC and a 2 percent contribution of SOCMI fugitive emissions of VOC to total stationary source emissions of VOC. Even though the numbers have changed somewhat since proposal, the percentages have remained essentially constant.

[a] Previous estimates were based on petroleum refinery emission factors (IV-A-19). Using the refinery emission factors, fugitive emissions from SOCMI were estimated to be about 320 Gg/yr, or about 40 percent of the total 800 Gg/yr estimated for all sources in SOCMI.

The source of the error pointed out by two of the commenters came from two industry-wide equipment estimates presented in a draft survey document of fugitive emissions from SOCMI. One of the estimates presented in the draft document was based on a direct industry scale-up of equipment counts. This scale-up of equipment counts resulted in estimated emissions of 200 Gg/yr; the estimate was discarded since the scale-up was performed incorrectly and was, therefore, removed from the final document. The other estimate (400 Gg/yr) was based on the same model unit approach employed in the BID and AID analyses to estimate number of pieces of equipment. This approach in estimating emissions is retained in the final document.

Comment:

One commenter (IV-D-28) expressed some confusion over what the SOCMI VOC emissions estimates made by EPA actually are. He said the preamble gives total annual stationary source VOC emissions as 19,000 Gg and those from SOCMI as 1,000 Gg, or about 1 million tons, for some unspecified year. He cited another EPA report "Cost and Economic Impact Assessment for Alternative Levels of the NAAQS for Ozone" (June 1978 draft), which shows in Table 3-1 a total of 18.6 million tons from 90 nonattainment ACQR's for 1975 with chemical manufacturing responsible for 0.43 million tons. Environmental Outlook 1980 does not list the chemical industry in Table 4-8 of "Principal Sources of Net Hydrocarbon Emissions" for 1975 with a total of 13.5 million tons. "Other sources" have a value of 3.5 million tons. Report EPA 600/8-78-004 gives in Table 5-10 a total for 1975 of 28 million tons, and chemicals as 1.5. Industrial processes total 3.2. Report OPA 48/8, June 1979, agrees that the total is 28 million tons, but industrial processes are responsible for 10.1, or 36 percent. Table 6-3 of "Facts and Issues Associated with the Need for a Hydrocarbon Criteria Document," February 1980 External Review Draft, agrees with a total of 28.3, and industrial contribution of 10.1, but puts the chemical industry at 2.7 million tons/yr. Thus, he said that he had some problem with determining the Agency position on the amount of emissions under consideration.

Response:

The commenter is correct in stating that several different estimates appear in the literature. These different estimates are largely due to EPA's frequent updates using emissions data. They are also in some measure due to different calculation or modeling methods. It should also be kept in mind that the numbers are estimates, not absolute measurements.

The numbers cited in the preamble were from an EPA report on the chemical industry (II-A-22). The total VOC emissions number has since been revised downward to 800 Gg/yr in a subsequent edition of the report.[a] This number compares very closely with the latest published estimates (1977) cited by the commenter.

Two of the references cited by the commenter present the same 1977 estimates of VOC emissions: Cleaning the Air (OPA 48/8) and Facts and Issues Associated With the Need for a Hydrocarbon Criteria Document (External Review Draft). These are the most current of the estimates cited and are probably the most reflective of today's emission levels. It should be noted that SOCMI is only a part of the chemical industry classification listed in these references.

Environmental Outlook 1980 contains earlier projections of emissions made by the SEAS model. The report explains on page 99 that a major discrepancy exists between these projections and those made by NEDS. The report states that the SEAS estimates are about one-third the NEDS estimates. It goes on to explain that the single most important contributor to this difference is the fact that SEAS does not account for evaporative losses of solvent. The report states, "as a result of these discrepancies, forecasts of hydrocarbon emissions by SEAS are probably low in each projection year."

[a]The estimates of total VOC emissions from sources in SOCMI have been revised recently according to the best information available from the various standards development programs. The new estimate is about 540 Gg/yr for 6 source groups in SOCMI (IV-B-24).

The estimates presented in Air Quality Criteria for Ozone and Other Photochemical Oxidants (EPA-600/8-78-004) are slightly older estimates for 1974 and 1975 and, therefore, are not considered as valid as the more recent ones.

The estimates contained in Cost and Economic Impact Assessment for Alternative Levels of the National Ambient Air Quality Standards for Ozone (EPA-450/5-79-002), as the commenter pointed out, are estimates for 90 AQCRs and are, therefore, not comparable to national estimates.

Comment:

EPA's estimates of fugitive emissions of VOC contributed by SOCMI were said to be overstated (IV-F-1, No.1; IV-D-23; IV-D-21; IV-D-17; IV-D-7; IV-D-50; IV-D-38; IV-D-24; IV-D-15). Several commenters said more recent SOCMI data indicate a more realistic percentage of stationary source VOC of 0.25-0.33 percent (IV-D-17; IV-D-21; IV-D-23; IV-D-50; IV-D-20). Another commenter (IV-D-38) said the VOC emissions from SOCMI were actually 45 percent of the estimate EPA made at proposal. Two of the commenters (IV-D-50; IV-D-24) said the emissions estimates are still further overstated because they are based on existing units. He said that for regulatory and economic reasons, new plants have lower emissions than the existing units sampled.

Response:

EPA's estimate of fugitive emissions of VOC contributed by newly constructed, reconstructed, or modified process units within SOCMI at proposal was 200 Gg/yr. This number has been revised to 83 Gg/yr (see Section 6.1).

The more recent SOCMI data referred to by the commenters is assumed to consist of the SOCMI maintenance report (IV-A-10) and the SOCMI 24-Unit Study (IV-A-11). The basis for their percentages is unclear, but it is probable that the commenters are comparing leak frequencies or emission factors to those presented in the BID (III-B-1). EPA's latest estimate of 83 Gg/yr reflects this new SOCMI data and represents a decrease of 79 percent over the original estimate. (See Section 3.1 and the AID for a discussion of comparisons of petroleum refinery and SOCMI data.)

Hopefully, the commenter is correct in stating that the emissions are overstated because they are based on existing units and new units will be cleaner. Unfortunately, it is not possible to measure emissions from units which have not yet been built. Data from existing units represents the best data available. These data were collected during the recent testing program at SOCMI process units. Thus, the data should reflect the impact of current regulations and economic environments.

Comment:

Another comment received concerned emission reduction estimates made by EPA. One commenter (IV-D-15) wrote that the overriding concern with the proposed standards concerns the doubtful validity of the emission reductions and economic benefits which are claimed. He said EPA had taken uncontrolled fugitive hydrocarbon emissions estimates which were originally derived from a survey of similar process equipment used in refineries, applied "guesstimated" reduction factors relating to the effectiveness of either specific control equipment or monitoring and maintenance programs, and predicted that these will result in an 87 percent reduction in fugitive VOC emissions from new and modified units. The commenter stated that the claim that the standards will reduce the total emissions from 200,000 metric tons to 26,000 metric tons over the next five years in questionable. He asserted that at this point no quantitative fugitive emission source data exist to make such claims. Another commenter (IV-D-7) said the reduction in emissions will be less than that assumed by EPA.

Response:

The commenters are critical of the methods and results obtained in making estimates of emission reductions for SOCMI under the standards. They have not offered a better method, however. The data and methods used to develop estimates of emission reductions achievable under the standards are described in the AID and in Docket Item No. IV-A-22.

Comment:

One commenter (IV-D-18) alleged that insufficient development and study has gone into the regulatory package as proposed. He questioned whether the regulation in present form will provide any significant environmental benefit. The commenter indicated that increases in emissions will result from:

A. Purging of lines so that a valve may be accessed. (It is physically impossible to purge all lines to a combustion device.) Replacement of valves during a non-turnaround period will cause emissions which are likely to exceed any benefit achieved.

B. Closed sampling systems will require at least four valves to operate in most instances. The emissions from these valves will exceed the emissions from the sampling system, according to the emission factors.

C. Damage to valves will occur due to overtightening, shearing, or otherwise destroying the packing. In a typical chemical facility, if replacement of the valve would mean a process shutdown and the leakage from the valve does not present a hazard, the valve would be allowed to remain in operation, thereby increasing emissions. Several "unrepairable" valves could conceivably negate any benefit the proposed regulation could have had.

Response:

As shown in Section 6.1, the final regulations for SOCMI fugitive VOC emissions will indeed result in significant environmental benefit. The commenter, however, presented three comments for why emissions could increase as a result of the new source standards, as proposed. Each comment is addressed separately below.

The proposed standards for valves required that repair be made to a leaking valve that could be isolated without process unit shutdown. EPA recognized that some valves, although capable of being isolated, may cause emissions resulting from purging that could outweigh the benefits of repair to that valve. Therefore, a specific exemption was added to the standards to allow valves that could be isolated but that would require purging to the extent that resultant emissions would exceed benefits of repair to delay repair until the next shutdown. Prior to repairing such valves at the shutdown, the purged material from preparing the valves for repair must be "controlled" in that the purged material must be collected and disposed of properly in a control device. The purged material (gas or liquid) should be collected in a suitable container for transport to the control device or should be conveyed through piping or ductwork to the control device for disposal. Such practices may include hooding ("bagging") of the equipment component(s) being purged for repair.

There will be cases where the valve can be isolated and repair effected without the extensive purging and emissions increases described above. An example of this situation would be the addition of a packing ring to a valve while it is in place. In these cases, the exemption would not apply and repair must be effected as prescribed in the standards.

Emissions from an uncontrolled sampling apparatus were estimated based on the potential purge taken before extracting the sample. The analysis of emissions, therefore, considered the sampling apparatus alone; any valves that might be associated with a sampling system were considered in the total valve count, not as part of the sampling apparatus. If a closed purge sampling system is used, there may be four valves associated with the sampling system, but only two of the valves are considered to be in VOC service. For usual sampling systems, a single valve is considered to be in VOC service. Thus, only one additional valve in VOC service would be needed to comply with the standards. The uncontrolled emissions from a single valve (0.0056 kg/hr for a gas valve; 0.0071 kg/hr for a light liquid valve) are less than the captured purge from sampling (0.015 kg/hr). Furthermore, the additional valves in VOC service associated with closed-purge sampling systems would be subject to the standards for valves (achieving some degree of emissions reduction) and would represent lower mass emissions than those for uncontrolled valves. Controlled emissions per valve are estimated to be 0.0015 kg/hr for gas valves and 0.0029 kg/hr for light liquid valves under a monthly leak detection and repair program.

The emissions increase associated with "unrepairable" valves was not directly accounted for in the original emissions estimates. It was indirectly accounted for in the B-factor estimate used in the ABCD model. Unrepairable valves are not necessarily valves that would cause operating or safety problems due to high leakage or failure. Such valves would probably be repaired without the standards. Unrepairable valves, rather, are valves for which attempted repair as defined in the standards repeatedly fails. The results of the Maintenance Study (IV-A-10) show that even with unsuccessful repair (repair attempts failed to reduce the screening value below 10,000 ppmv), emissions from valves were reduced by 63 percent from the uncontrolled level. These emissions were included in the analysis presented in Section 6.1. The standards were shown to demonstrate an emissions reduction of 64 percent or greater for valves only, and about 56 percent for the model unit overall even when unrepairable valves were included.

Comment:

One commenter (IV-D-17) was concerned that the achievable emissions reductions were based on maintenance frequency, emission rates, and leak occurrence/recurrence rates. Changes in these rates for SOCMI will impact emissions reduction and cost effectiveness analyses. The commenter also pointed out that no assessment was made of mass emissions from equipment that could not be repaired within a given interval.

Response:

The analysis presented at proposal was based on assumptions and data available at that time. The analysis has been reconsidered using data collected on SOCMI units during screening and maintenance studies (IV-A-10; IV-A-11; IV-A-14). The results of this revised analysis, as detailed in Section 6.1, indicated an overall emissions reduction of about 56 percent. This analysis estimated the efficiency of leak detection and repair programs for valves and pumps, in accordance with the final standards. Emissions from valves which could not be repaired on-line were included in the original estimates presented at proposal. These emissions were also included in the latest emissions analysis. Also, where a repair interval is specified in the regulation, half of the interval was assumed as the time during which emissions occurred.

Comment:

Two commenters (IV-D-17; IV-D-18) disliked the assumptions that EPA made for predicting the effects of a leak detection and repair program for valves. The assumptions the commenters disagreed with or thought illogical include the leak occurrence/recurrence rate (IV-D-17), the monitoring time requirements (IV-D-18), and the ABCD factors for the valve model printed in the BID (IV-D-17).

Response:

The technical substance of this comment is treated in detail in the AID (III-B-2).

Comment:

One commenter (IV-D-28) wrote that the impact on the air quality has not been spelled out. He noted that no estimate is given for reduction in ozone generation. The only reference is that an 87 percent emission reduction will be obtained from new and modified sources compared to emissions which would occur in the absence of the regulation. The commenter added that this estimate is incorrect because it does not consider LAER, BACT, or SIP.

Response:

The concept of controlling VOC emissions to control ozone generation has been addressed previously in Chapter 2. VOC emissions have been identified as precursors to the formation of ozone and other oxidants which result in adverse impacts on health and welfare (IV-A-17). At no point in this standards-setting process has EPA attempted to relate quantitatively the emissions of VOC which would be affected to the resultant air quality. Under Section 111, it is sufficient for the purposes of new source standards to aim at preventing degradation of air by new sources by controlling VOC to the level achievable by the best demonstrated technology, knowing that VOC emissions contribute to oxidant formation.

At proposal, an estimated 87 percent reduction in VOC emissions was presented for SOCMI under the regulations. Based on the final regulations, and considering SOCMI data, the SOCMI standards resulted in an estimated 56 percent reduction in fugitive VOC emissions.

The emissions and emissions reductions achievable by the standards do consider the effects of other factors, including other regulations. The benefits of other regulations were considered in establishing the baseline level of control, or the actual level of control existing in the industry.

Regulatory circumstances, such as SIP (for facilities in nonattainment areas), NESHAP (for facilities processing vinyl chloride and benzene), and OSHA, already affect the levels of emissions control practiced in the industry. These other regulatory programs are discussed further in Chapter 2. Other circumstances also have an effect on the levels of control in the industry. These include the provisions of insurance policies for fire and explosion protection and the economics of recovering products made more valuable by increases in prices for petroleum-derived products. EPA has considered these circumstances in establishing baseline emission estimates.

Comment:

One commenter (IV-D-26) said EPA's Office of Solid Waste's incinerator standards (40 CFR 264 Subpart O) may well apply to "enclosed combustion devices" such as those required in the proposed NSPS. The permitting requirements, he said, would also apply, as would required test burns and the achievement of a destruction and removal efficiency of 99.99 percent. The application of RCRA requirements to combustion devices and similar units under other air quality regulations were said to be most detrimental to placing such equipment in service. He urged OAQPS to seek a general class exemption for this type of equipment.

Response:

The commenter appropriately pointed out a potential overlap in the standards. Some compounds on the SOCMI list are also designated as hazardous materials under RCRA (Resource Conservation and Recovery Act). RCRA covers hazardous materials up to their final disposal, and, where an incinerator is used, a destruction and removal efficiency of 99.99 percent must be met for all principal organic hazardous constituents.

An example of overlap would be coverage of discarded commercial chemical products, off-specification species, and container residues by RCRA; in some instances, material collected during sampling could be considered under both RCRA and SOCMI standards. In this case, the requirements for sampling systems under SOCMI standards might result in a small total quantity of hazardous material that might need to be disposed of in compliance with the requirements of RCRA. When this overlap occurs, compliance with RCRA requirements will already be needed. Thus, the addition of a small quantity of material for disposal would not be unreasonable. By meeting the disposal requirements of RCRA, particularly by incineration, the requirements of the SOCMI standards would also be met and even surpassed.

# 7. ECONOMICS

This section discusses the comments received on the cost and economic analyses conducted in support of the standards. The cost methodology and cost estimates by piece of equipment were discussed in detail in the AID and are summarized here in Section 7.1. Comments on the AID and EPA's responses to those comments are presented in Appendix A. Comments related to the economics methodology are presented in Section 7.2. The economic impact of the standards is presented in Section 7.3. Comments on the cost benefit considerations are addressed in Section 7.3 and in Section 3.1 (Selection of Final Standards).

## 7.1 COST ESTIMATES

Several comments[a] were received concerning various aspects of the estimated costs of the control options for SOCMI. These comments concerned the general methodology, the results of the analysis, and specific input data used to evaluate the control techniques considered in selecting the proposed standards. EPA reviewed these factors and made changes in certain circumstances as explained in the AID.

In the AID, EPA reviewed the cost estimating techniques (cost methodology) used in the BID and found them valid. After reviewing comments on the AID, EPA continues to conclude that the general cost methodology used in the BID is valid. In the AID, EPA also reviewed specific input data for the various control techniques. EPA concluded that, while most of the data contained in the BID was correct, some cost input data should be revised to reflect comments on the BID and data gathered during the SOCMI 24-Unit Screening Study and the SOCMI Maintenance Study. These input data were changed accordingly and are discussed in detail in Section 5 of the AID for each emission source.

Emission source costs are aggregated into model unit costs by using the equipment counts for each model unit (IV-B-31). Model units are presented

[a] IV-D-1; IV-D-2; IV-D-6; IV-D-13; IV-D-15; IV-D-17; IV-D-18; IV-D-20; IV-D-28; IV-D-46; IV-D-50; II-E-20.

in Section 3.3. Table 7-1 presents a summary of the estimated capital costs of the standards for the model units. Table 7-2 presents a breakdown of the annualized cost estimates by model unit. Using the growth projections presented in the BID and used in Section 6 to project nationwide emissions reductions, capital and annualized costs to the industry were projected for the fifth year. The cumulative capital costs and the annualized costs in the fifth year are summarized in Table 7-3.

## 7.2 GENERAL ECONOMIC ISSUES

Comment:

Commenters (IV-D-17; IV-D-48) expressed the belief that EPA has, in its industry growth projections, failed to account adequately for current economic trends such as the effects of foreign competition on the growth of SOCMI. The commenters stated that the domestic SOCMI industry had previously enjoyed some technological advantage and, in the recent past, had the advantage of raw material and energy costs that are lower than those of producers in Europe or Japan. They felt that EPA's 5.9 percent growth factor is apparently an extension of the historic 6-percent factor and does not adequately address current economic trends. They felt that external forces deserve further consideration because they will decrease the projected number of units affected by the standards and, therefore, decrease the projected increase in VOC emissions.

Response:

The growth projection presented in the background information document (BID) is 5.9 percent annually as estimated by McGraw-Hill (IV-M-35). The McGraw-Hill projection was selected primarily because it was calculated for a group of chemicals that closely corresponds to the SOCMI chemicals and because the projection methodology was appropriate. In response to these comments, a review of the literature was conducted to determine the availability of other projections for synthetic organic chemical production. It was found that the U.S. Department of Commerce has projected a 6-percent growth rate for the synthetic organic chemicals industry (IV-M-39). However, both this projection and those in the BID are now somewhat dated.

TABLE 7-1. SUMMARY OF CAPITAL COST ESTIMATES OF SOCMI STANDARDS, 1978$

| | Model Unit | | |
|---|---|---|---|
| Emission Source | A | B | C |
| Pump seals, light liquid[a] | 320 | 1,170 | 3,590 |
| Valves, gas and light liquid[a] | 470 | 1,900 | 5,830 |
| Safety/relief valves, gas[b] | 7,820 | 28,680 | 86,050 |
| Compressor seals[c] | 1,590 | 3,170 | 12,690 |
| Sampling connections | 3,220 | 11,960 | 36,800 |
| Monitoring instruments | 8,500 | 8,500 | 8,500 |
| | 21,910 | 55,380 | 153,460 |

[a]These are the amortized costs of initial start-up of the leak detection and repair program (initial repair of leaks).

[b]Assumes a 50/50 split between systems using 3-way valves and systems using block valves.

[c]Assumes a 50/50 split between systems tied to an enclosed combustion device and systems tied to a flare; also assumes 60 percent of the compressors in the industry are already controlled.

TABLE 7-2. ANNUALIZED COST ESTIMATES OF SOCMI STANDARDS, 1978$

| Emission Source | Model Unit A | Model Unit B | Model Unit C |
|---|---|---|---|
| Pump seals, light liquid | | | |
| Annualized capital cost | 50 | 190 | 590 |
| Annual operating cost | 1,890 | 6,770 | 21,290 |
| Valves, gas and light liquid | | | |
| Annualized capital cost | 80 | 310 | 950 |
| Annual operating cost | 2,970 | 11,970 | 36,840 |
| Safety/relief valves, gas | | | |
| Annualized capital cost | 1,520 | 5,570 | 16,700 |
| Annual operating cost | 700 | 2,580 | 7,750 |
| Compressor seals | | | |
| Annualized capital cost | 260 | 520 | 2,060 |
| Annual operating cost | 140 | 280 | 1,140 |
| Sampling connections | | | |
| Annualized capital cost | 530 | 1,950 | 6,000 |
| Annual operating cost | 290 | 1,070 | 3,280 |
| Monitoring instruments | | | |
| Annualized capital cost | 1,960 | 1,960 | 1,960 |
| Annual operating cost | 3,040 | 3,040 | 3,040 |
| Total annualized costs | 13,430 | 36,210 | 101,600 |
| Product recovery credit[a] | (4,830)[b] | (17,610)[b] | (55,200)[b] |
| Net annualized costs | 8,600 | 18,600 | 46,400 |

[a] Product recovery credit is based on \$300/Mg of VOC recovered or saved as a result of the controls implemented.

[b] Parentheses indicate credits due to the saved/recovered product.

TABLE 7-3. CAPITAL AND ANNUALIZED COST SUMMARIES: NATIONWIDE PROJECTIONS

Capital Costs

| Model Unit | Cost per Unit, $1000 | Number of Units | Total, $Million |
|---|---|---|---|
| A | 21.9 | 432 | 9.5 |
| B | 55.4 | 274 | 15.2 |
| C | 153.5 | 125 | 19.2 |
| | Total | 831 | 43.9 |

Annualized Costs

| Model Unit | Cost per Unit, $1000 | Number of Units | Total, $Million |
|---|---|---|---|
| A | 8.6 | 432 | 3.7 |
| B | 18.6 | 274 | 5.1 |
| C | 46.4 | 125 | 5.8 |
| | Total | 831 | 14.6 |

Since their publication, it appears that the growth opportunities in the synthetic organic industry may have decreased somewhat. Retention of the original growth rate is, however, warranted for several reasons.

First, to develop a more current industry output projection would require an elaborate study, which could be justified only if the projection played a significant role in deciding either (1) whether there should be standards or (2) which standards should be adopted. As discussed in Section 2.1 of this document, plants that would be affected by the standards would be significant contributors to air pollution. EPA has selected standards with reasonable control costs. Thus, even if the growth rate projection is high, EPA has still met the major criterion used to decide whether a standard is needed and is reasonable within the context of Section 111 of the Clean Air Act. Secondly, use of a high growth rate results in a projection of higher industry compliance cost than would result from use of a lower rate. A higher growth rate projection tends to represent a worst-case result in terms of the total fifth-year cost to society. Thirdly, reduction in the industry growth projection would have the same proportional effect on compliance costs and on the potential benefits of the regulation. That is, any projection of the ratio of benefits to costs or cost to effectiveness for the standards would be left unchanged. Therefore, because these points indicate that there is insufficient reason to adjust the growth projections, EPA has retained the original growth rate projection.

Retaining the growth rate projection used in the BID for the proposed standards is consistent with recent revisions to the Priority List (40 CFR 60.16). As expressed in revisions to the Priority List of source categories (47 FR 950), Congress did not intend, in EPA's judgment, that source categories showing insignificant growth should be listed under the significant contributor list of Section 111(b)(1)(A) of the Clean Air Act. In the context of the Priority List, EPA considers insignificant growth to be indicated by one or no newly constructed, modified, or reconstructed plants within the next 5 or 10 years. In the context of SOCMI fugitive emission sources, EPA considers the growth rate projection--including the new information associated with current trends in this industry--to be significant and clearly in excess of the criteria used for the Priority List.

Comment:

EPA, according to a commenter (IV-D-17), stated that both the degree of control and the cost of control are not the primary basis for setting standards; he stated that EPA considers reasonableness the primary basis. The commenter claimed that the standards are based on reasonableness. He stated that even though higher costs might not change EPA's decision to issue an NSPS, the NSPS would have a large effect on industry. The commenter pointed out that one company calculated a compliance cost of more than $4.5 million per year for 36 capital projects scheduled for completion between 1981 and 1985. When EPA estimates are used to determine the costs for these same projects, a net savings of more than $100,000 per year results. The commenter stated that, if these standards could be implemented at a net savings for these projects, there would be no need for the standards.

Response:

EPA considers costs and achievable degrees of control and then applies reason to select a standard. In particular, the commenter questioned the accuracy and reasonableness of the cost estimates and the product recovery credits. EPA believes that its final cost estimates are reasonable and that its estimates of product recovery credits are based on realistic estimates of the average value of the recovered materials. Details were not provided on the compliance costs of $4.5 million annually that the commenters indicated would be incurred. Therefore, it is not possible to review this estimate.

The commenter also contends that, given EPA estimates, the producers of synthetic organic chemicals would have already installed the control equipment prescribed by standards that result in net benefits. However, there are several reasons that a firm might not invest in cost-saving technology.

First, a firm may not know about the technology. Secondly, if the firm is aware of the technology, potential cost savings may not be perceived as significant enough to tempt the company to introduce the technology, especially if, for specific firms, the management is unfamiliar with the technology. Thirdly, a firm may currently be using equipment that would be too costly to scrap and replace by a new technology in the immediate future. However, when the time comes to scrap the firm's old equipment, it could choose to replace outmoded plant equipment with the previously unavailable and less costly pollution control equipment. Fourthly, on occasion, investments in cost-saving pollution control equipment may have too low a return to be considered worthwhile. Accordingly, the fact that SOCMI existing plants have not adopted the recommended technology does not prove that the estimates of savings are incorrect. These savings may not have been available or perceived when existing plants were constructed. Even new plants would not necessarily use the recommended technology if owners or operators are uncertain about potential savings because they lack experience with the new technology.

Comment:

One commenter (IV-D-28) stated that cost estimates should not be for the first 5 years only. He said this is an inadequate time frame. The commenter said this rule would not end on the fifth year, but would continue in perpetuity, and that these costs would continue to rise forever.

Response:

The 5-year time horizon used in the environmental and economic impact analyses is the typical time horizon over which impacts are calculated for most regulatory actions. The 5-year time horizon facilitates comparison of the costs and associated emission reductions with those of other standards affecting both the SOCMI and other industries. EPA recognizes that costs and benefits associated with the standards accrue over longer time horizons and that these costs and benefits could be examined in addition to those accruing over the 5-year period. However, it must be recognized that, although annualized costs increase over time as a result of the standards (in the long run, at approximately the same rate as industry output), benefits also increase proportionately. Because of the relatively small cost of the standards and the constraints imposed by the need to develop timely standards, additional effects were not investigated. The 5-year time horizon may in fact be most appropriate for the assessment of cost and benefits for these standard because, within the 5-year time horizon, a relatively large number of existing facilities may be required to comply with the standards through modifications or reconstruction. Consequently, a longer time horizon for impact assessments would not likely alter the implications of the regulatory analyses because both costs and benefits would be increasing.

Comment:

One commenter (IV-D-28) noted that most of the calculations show the after-tax cost to industry. He argued that, if a tax rate of 50 percent is assumed, the pre-tax cost is twice that shown and that the pre-tax cost is the true cost to society. The commenter said industry pays half of this cost and society pays the other half in foregone taxes. If the tax rate is lower, society pays a smaller portion.

The commenter added that the statement that no significant price increases are to be expected from this proposal is naive; all costs of all regulations are paid eventually by society as a whole as price increases, foregone profits (lost dividends or capital accumulation), or foregone taxes. Thus, society will pay all of those costs in the long run, in addition to suffering an inflationary impact from unproductive expenditures.

Response:

There is an important distinction to be made between industry impacts and social impacts. Industry impacts will result from firms' responses to the standards. Examples of industry impacts include changes in the market price for the industry's output, changes in firm and industry output levels, and changes in firm and industry profit levels. In formulating decisions, individual firms consider the after-tax costs of standards. It is after-tax profit that is available to stockholders, and stockholder wealth maximization is the goal of the firm. Thus, when impacts on industry output, market price, and certain other variables are computed, after-tax calculations are in fact relevant.

In the "full cost pass through" study, the price of synthetic organic chemicals is assumed to increase by an amount equal to the compliance cost increase. Thus, an affected firm's taxable income will not decline as a result of the standard. Corporate shareholders will not suffer a loss in wealth, and the government will not lose tax revenue. The entire cost of the regulation will be paid by chemical users in the form of higher prices.

An alternative estimate would assume full cost absorption. Affected firms would incur the added cost of compliance but would receive no higher price for their chemicals. If a 50-percent tax rate is assumed, half of the cost would be paid by shareholders in the form of a loss in profits and half would be paid by taxpayers in the form of foregone tax revenue. No cost would be paid by chemical users through higher prices. The total cost so calculated would be very close to the total cost calculated based on full-cost pricing. Either is an estimate of the real resource cost of compliance. However, full cost absorption is generally not a reasonable assumption for standards of performance. Investors will not undertake the construction of a new facility unless the market price is at a level that will permit recovery of all costs.

Comment:

One commenter (IV-D-28) expressed concern over the use of 1978 dollars for cost estimates. He stated that inflation has already increased the costs by nearly 50 percent and will, by 1985, have caused an increase of 100 percent. Thus, all costs are underestimated. He added that the true annualized costs by 1985 will be well over $100 million annually when the effects of the current inflation and the total cost to society are considered. He stated that the initial capital costs for 1985 will be over $125 million. Another commenter (IV-D-15) made a similar statement regarding the cost of capital. He suggested that the cost estimates be escalated to reflect current capital costs.

Response:

The cost and impact analyses were conducted in constant dollars as opposed to current dollars. Current dollar values differ from constant dollars in that current dollars include the effects of inflation. Constant dollars are corrected for inflation. The correction involves stating dollar values for any time period in terms of some base year dollar's purchasing power. The base year for this analysis is 1978. Thus, all monetary impacts are expressed in constant, 1978 dollars.

The use of constant dollars provides a standard of reference for evaluating the real resource costs of the standards when such costs will be incurred at different points of time. However, even with a doubling of the current dollar value of the costs as suggested by the commenter, the compliance costs would still not reach $100 million annually by the fifth year. This is partially due to the fact that product recovery credits are included in the cost estimate. If costs are inflated, the product recovery credits would also be inflated.

When performing discounting operations, e.g., annualizing capital costs, the discount rate (interest rate) and the flow of costs and revenues to be discounted must reflect the same assumptions. In particular, if cost and revenue streams are in constant (real) dollars, a real interest rate must be used. A nominal interest rate (including inflation) is appropriate only if nominal dollars are used to estimate cost and revenue streams. Since real dollar values were used to analyze the economic impact of the standards, a real interest rate was used also. The methodology employed to estimate this real interest rate is outlined in Appendix A of the AID.

In summary, the real economic costs of the standard are needed to assess the economic impacts of the standards. The appropriate way to compute costs is to (1) allow all costs, revenues, and any recovery credits to increase over time with expected inflation or (2) remove the effects of inflation from the estimate. The method typically employed and the one used here is the latter.

Comment:

One commenter (IV-D-24) charged that EPA considers capital availability to be unlimited. He stressed that it is not.

Another commenter (IV-D-15) wrote that the 10-percent interest rate used to determine capital recovery costs is significantly low. He recommended that a more realistic value of 15 percent should be used in a reassessment of the economic analysis.

Response:

The use of a positive interest rate reflects the scarcity of capital. Two interest rates are used in the analysis. One is used to compute the cost of capital to the SOCMI. This rate is 10.8 percent and is based on an analysis of the real cost of capital to the industry. It is assumed in the analysis that the price of the chemicals will increase sufficiently to cover all compliance costs plus earn a normal return (10.8 percent) on compliance capital expenditures.

The second interest rate employed is 10 percent. It is used to compute the social cost of the standard. It is also taken to represent a real value of either the social rate of time preference or the social opportunity cost of capital. The use of this rate is strongly recommended by the Office of Management and Budget.

Both interest rates appear low compared to current rates. However, when constant dollar values are used to estimate cost, as is the case in the analysis, a real interest rate must be used (as discussed in the previous response). As real rates, both 10 percent and 10.8 percent are quite conservative and lead to a worst-case estimate for product price increases and annualized compliance costs.

Comment:

One commenter (IV-D-15) felt that the economic analysis was severely distorted by amortizing the labor costs incurred during the initial year of monitoring over a 10-year period. He suggested that EPA did this to make the overall calculation easier because there is no sound basis for this manipulation of figures. The commenter said labor costs are incurred during the year in which the work is performed. Therefore, by spreading out these costs, the economics for the first year of operation become very favorable.

Response:

The commenter has apparently confused the treatment of one-time labor costs and recurring labor costs. In the analysis for the proposed standards, labor costs are included in the year incurred. All costs are then discounted to the present and annualized. EPA assumed that the labor cost associated with the initial investment is paid along with all other investment costs. As part of the initial investment outlay, it is thus recovered over the entire life of the project at the appropriate discount rate. This amortization procedure is appropriate and is used in investment-type analyses.

However, the procedure used to estimate the labor cost has been changed; Section 5 of the AID contains a discussion of the new procedure. The procedure was changed because EPA is now using a Leak Detection and Repair (LDAR) Model to estimate the amount of labor needed and, therefore, labor costs.

Comment:

Two comment letters (IV-D-24; IV-D-17) objected to an economic analysis that does not consider the cost of all environmental regulations on the SOCMI. One commenter (IV-D-24) said EPA has not considered the effects of NPDES, pretreatment, RCRA, Superfund, TSCA, etc. The commenter said when all costs are summed, the number becomes very significant. The second comment letter (IV-D-17) said the only meaningful economic analysis is one of the total impact of all EPA regulations on an industry. This commenter estimated that the economic impact of the standards to be about 0.25¢/kg on average for a new SOCMI plant. Since fugitives are about 20 percent of total VOC emissions, total regulation at the same cost per unit of pollutant would be 1.25¢/kg of product. The commenter noted from Table 8-18 in the BID that Clean Air Act costs are about 29 percent of total air, water, and solid waste costs. He, therefore, calculated the total regulatory costs to be on the order of 4.4¢/kg. The commenter pointed out that this is twice the 6 percent, or 2.2¢/kg, annual profit margin of the chemical industry and is a significant adverse impact.

The commenters said the technological and input cost advantages that SOCMI previously enjoyed are now largely dissipated and that the domestic SOCMI is at a turning point. They referred to news items that reported multimillion dollar projects to make synthetic organic chemicals in Saudi Arabia. They argued that, in addition to underestimating this new competition, EPA has failed to assess fully the inhibiting effects of this and other standards on the modification of existing units.

Response:

The purpose of this study is not to provide a comprehensive, cumulative assessment of the costs of environmental regulations. The purpose of developing the compliance cost estimates is to provide estimates of the additional costs due to these standards on an affected industry. Various economic impact indicators, including the potential impacts of the costs on product prices, are reviewed. In addition, the cost of retrofit is considered for existing sources that become affected by the standards. Further, in examining the impact of these standards it is not relevant that firms have already incurred costs to meet other government regulations. The key issue is whether the additional costs industry would incur due to these standards are outweighed by the environmental benefits. In EPA's judgment the benefits outweigh the costs.

Comment:

One commenter (IV-D-38) was concerned with the impact of the standards on small facilities and companies. The commenter claimed that the proposed standards did not permit a direct evaluation of the costs and benefits of regulating smaller facilities. He was particularly concerned that the cost impact on smaller companies and facilities would be considerably greater than on larger companies and that EPA had not adequately assessed these impacts. He cited EPA's findings that Model Unit A, the least complex plant, would incur a compliance cost of $520/Mg; Model Unit B, $445/Mg; and Model Unit C, the most complex plant, $443/Mg; and further, recovery credits for all three units would be $360/Mg. Thus, the smaller, less complex plant suffers a relatively larger impact than does the larger, more complex plant. This commenter also stated that compliance requirements could possibly require hiring additional employees or result in decreased productivity, especially for small companies. He presented one estimate for the annual operating cost of compliance of about $40 for each valve or fitting affected. He said the reduction in VOC emissions would be small, the loss of productivity would be high, and, hence, the social costs would be great, especially for smaller firms. This commenter requested that EPA withdraw the standards so that resources could be expended for greater benefits at reasonable costs in other areas. This commenter felt the standards, if not withdrawn, should exclude small facilities, since these facilities have fewer emissions than do larger plants.

Response:

SOCMI fugitive emission standards are standards of performance established pursuant to Section 111 of the Clean Air Act and hence would apply to all new, modified, and reconstructed sources. Only firms that plan to build new facilities or modify or reconstruct their existing facilities would be affected by the standards. The Regulatory Flexibility Act (Public Law 96-354, September 19, 1980) requires that special consideration be given to the impacts of proposed regulations on "small" entities. As a criterion for extending loans and related assistance, the Small Business Administration defines a "small" business in the synthetic organic chemicals industry as one that employs fewer than 1,000 workers (13 CFR Part 121, Schedule A). (For some chemicals a smaller number is used.) The Regulatory Flexibility Act also applies to small organizations and small governments. However, there is none that would be affected by the SOCMI NSPS.

The major basis for the commenter's contention that small businesses would be disproportionately affected is the difference in Model Unit A (small size) and Model Units B and C (medium and large sizes) cost effectiveness. There is no known relationship between model unit type and small businesses. Thus, the commenter's comparison is not likely to be relevant. Even if the comparison is relevant, the differences in cost effectiveness cited by the commenter do not convince EPA that the impacts on small businesses are unreasonable. However, because of the concern over the small business impacts of governmental regulations, this issue was subsequently examined by EPA.

A two-step approach has been used to develop insights regarding the possible impacts of the standards on small businesses. First, data on the capacity of existing plants and employment of their parent firms were used to identify the chemicals produced in plants owned by small businesses with plant capacities small enough that production costs would be increased by more than 2 percent by the standards. Second, trade publications were reviewed to determine the plant sizes actually scheduled for construction over the last several years for the identified chemicals. This review was made to see if new plants producing the identified chemicals would be in fact small enough to have an increase in unit costs of 2 percent. The methodology and findings are presented below.

Compliance costs for a combination of chemical prices and plant capacities were estimated for each type of model unit (A, B, and C). The minimum capacity levels and product prices for each model unit that could represent a 2-percent increase in average total cost (which is assumed to equal the change in product price) are shown in Figure 7-1 for Model Units A, B, and C. Product price-plant capacities falling to the left of these curves would have a cost increase of more than 2 percent due to the standards.

Data on organic chemical producers from the Organic Chemical Producers Data Base, 1976 (IV-A-33) were then examined to see if existing small businesses are producing chemicals with a plant size and product price that fall in the area bounded by the price and capacity axes and the 2-percent curves in Figure 7-1. In essence, existing sources were assumed to represent possible new sources. This assumption was made because of the uncertain nature of any projection of new facilities and their ownership. To the

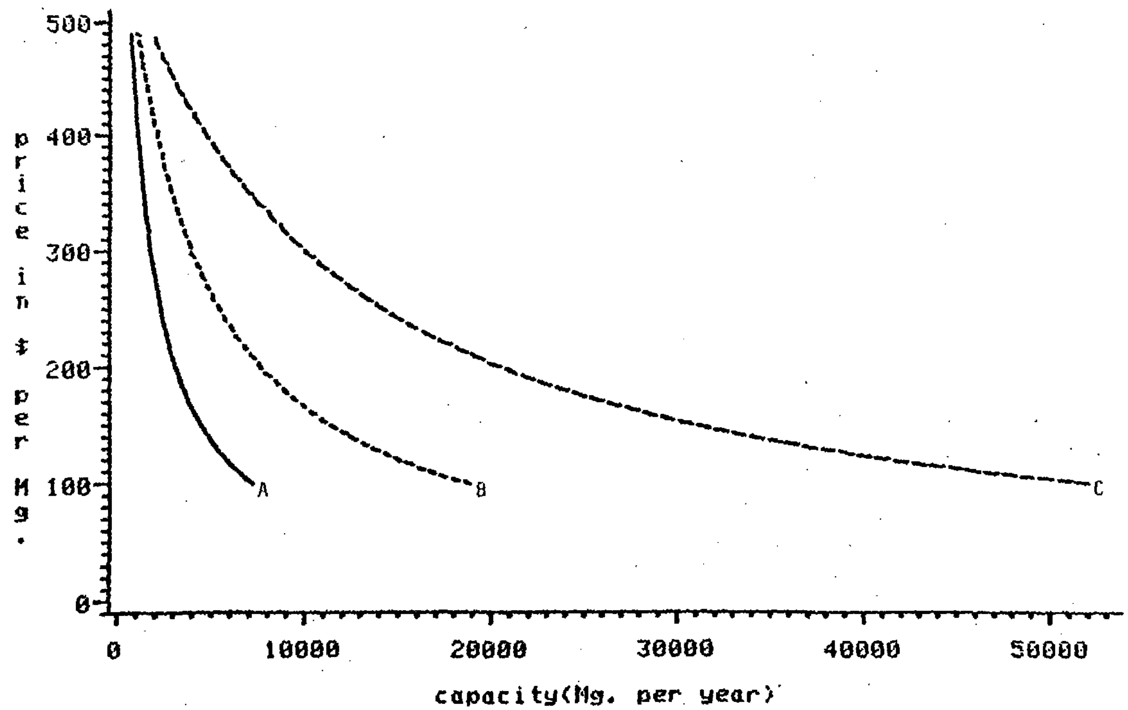



Figure 7-1. Minimum price and capacity combinations.

extent that new plants and firms are like current ones, data for current plants can provide some insight into the possible impacts of the standards on new plants and firms.

The data base contains information on 138 chemicals produced in 1,020 SOCMI plants by 69 firms. Of these, 30 chemicals were produced in 138 plants, which, if Model Unit C were employed, could have a unit cost increase greater than 2 percent. However, at least 54 of the 69 firms employ more than 1,000 workers. Thus, they would not be classified as small businesses. Employment data are not available for the remaining 15 firms, so, in a worst-case situation, all could be small businesses. Ten chemicals are produced by these 15 firms. These 10 chemicals, their 1978 market price, the threshold capacity below which the standards would increase the average total cost of production by more than 2 percent, and the capacity of the smallest existing plant producing each chemical are all provided in Table 7-4.

Information is available on the sizes of process units used to produce most of the 10 chemicals shown in Table 7-4. Information concerning the sizes of process units (equipment counts) is contained in a series of documents concerning organic chemical manufacturing (IV-A-19) and in the background information document for proposed standards for petroleum refineries (IV-A-34). This information indicates that none of these chemicals would be produced as the sole product from a Model Unit C. Thus, based on existing minimum capacities and the expected size of model units, only two chemicals, methanol and toluene, might experience more than a 2 percent increase in the cost of production. It seems reasonable to conclude that if new facilities were constructed that mirrored the current facilities in capacity and chemicals produced, the impacts on small firms would be minimal. Only two chemicals might be impacted by a price increase (cost of production) of more than 2 percent, and it is unlikely that even these two would be significantly affected unless firms constructed Model Unit C (which is unlikely) to produce those chemicals.

This initial review focused on the existing chemical plants and identified 10 chemicals that might be affected by the standard. However,

Table 7-4. Threshold Plant Capacities of Chemicals Potentially Produced by Small Firms at Current Prices

| Chemical | 1978 Market Price ($/Mg) | Threshold Capacity by Model Unit Type* ($10^3$ Mg/yr) | | | Existing Minimum Capacities ($10^3$ Mg/yr) |
|---|---|---|---|---|---|
| | | A | B | C | |
| Acetaldehyde | 420 | 1.0 | 1.8 | 4.0 | 2.3 |
| Benzene | 220 | 2.7 | 6.6 | 17.6 | 10.0 |
| Cyclohexane | 250 | 2.3 | 5.4 | 14.2 | 10.0 |
| Formaldehyde | 110 | 6.5 | 16.8 | 46.3 | 36.3 |
| Isobutylene | 240 | 2.4 | 5.8 | 15.2 | 6.8 |
| Methanol | 130 | 5.3 | 13.6 | 37.5 | 3.6 |
| Phosgene | 370 | 1.2 | 2.5 | 6.0 | 3.6 |
| Propylene | 210 | 2.9 | 7.1 | 19.0 | 11.3 |
| Toluene | 170 | 3.8 | 9.6 | 16.0 | 3.6 |
| Urea | 300 | 1.8 | 3.9 | 10.0 | 4.5 |

*The threshold capacity of a model unit is the capacity where the increase in average total cost is exactly equal to 2 percent.

another perspective can be gained by examining the types and production sizes of plants for these 10 chemicals that are actually being constructed. Such an examination provides additional insight into the characteristics of plants that would be affected by the standards and the possible economic implications of the standards.

Data from Chemical Engineering (IV-M-28 to 53) and the Directory of Chemical Producers (IV-M-54) were used to determine the capacities of plants scheduled for construction over the 1975-1981 period for the 10 chemicals identified in Table 7-4. The new capacity of the chemical and threshold capacity of the affected chemicals are shown in Table 7-5 for comparison. As shown in Table 7-5, new plant construction was not reported for acetaldehyde, isobutylene, or phosgene. This lack of information is not a problem because these chemicals are not likely to be produced in a Model Unit C. Except for formaldehyde, the new plant capacities are several times the existing minimum capacities of the respective chemicals. Thus, because expected new plant capacities for methanol and toluene are considerable longer than their "threshold capacities," a price increase of more than 2 percent is not likely for these chemicals. To the extent that new plants are representative of future industry construction patterns, these results support the conclusion that the impacts on the industry in general and on small firms in particular are likely to be quite small, i.e., price increases will be less than 2 percent in all cases and, based on a review of the costs for all chemicals, will average less than 0.25 percent for the industry.

Comment:

One commenter (IV-D-17) said the product recovery credit was overstated. He said the average market value of $360/Mg was based upon very pure finished products and that a more realistic estimate is $110/Mg. Emission reductions will occur on raw material and semifinished streams, which have a lower product value.

Table 7-5. Comparison of New Plant and Threshold Plant Capacities of Chemicals Potentially Produced by Small Firms

| Chemical | Existing Minimum Capacities ($10^3$ Mg/yr) | Smallest New Plant Capacity Reported* ($10^3$ Mg/yr) | Threshold Capacity by Model Unit Type** ($10^3$ Mg/yr) A | B | C |
|---|---|---|---|---|---|
| Acetaldehyde | 2.3 | NA | 1.0 | 1.8 | 4.0 |
| Benzene | 10.0 | 65 | 2.7 | 6.6 | 17.6 |
| Cyclohexane | 10.0 | 376 | 2.3 | 5.4 | 14.2 |
| Formaldehyde | 36.3 | 32 | 6.5 | 16.8 | 46.3 |
| Isobutylene | 6.8 | NA | 2.4 | 5.8 | 15.2 |
| Methanol | 3.6 | 299 | 5.3 | 13.6 | 37.5 |
| Phosgene | 3.6 | NA | 1.2 | 2.5 | 6.0 |
| Propylene | 11.3 | 136 | 2.9 | 7.1 | 19.0 |
| Toluene | 3.6 | 38 | 3.8 | 9.6 | 16.0 |
| Urea | 4.5 | 70 | 1.8 | 3.9 | 10.0 |

*These are the smallest plants built during the 1975-1981 period.

**The threshold capacity of a model unit is the capacity where the increase in average total cost is exactly equal to 2 percent.

Note: The symbol 'NA' means that no new plants were built during the 1975-1981 period.

Response:

The average market value of SOCMI chemicals was reestimated using primary, intermediate, and final products, and the price has been subsequently revised to $300/Mg. This value is an average product value and reflects the average value of the materials conserved by the standard. Some chemicals will have a value exceeding the average; others will be below it. The methodology and data sources used to estimate the price are included in Appendix A of the AID.

Comment:

One commenter (IV-D-28) provided the data presented in Table 7-6 in response to a request by EPA for information on change in prices to his customers over the past 3 years. The domestic price index shown in the table is a weighted average of all domestic sales, adjusted for the annual sales index, and is based on 1974 = 100.

However, the commenter also added that price indices are not a proper measure of the profitability of an organization in times of spiraling inflation such as these. Table 7-6 also shows that the operating income of the chemicals group--which he said was the sector more heavily affected by existing EPA rules and would be the area most affected by this proposal--fell nearly 22 percent as a share of sales and that operating income as a percentage of invested capital fell even more, by over 25 percent. He added that the capital investment to meet environmental regulations in this group had risen to about 13 percent of all new invested capital in 1980 and that the added operating costs because of these rules was now about 12 percent of total operating costs, excluding raw materials and energy. These incremental operating costs due to environmental regulations amounted to 35 percent of the operating income of the chemicals group in fiscal year 1980.

Response:

The commenter claims that his firm has not been able to recover the costs of environmental regulations and other inflationary forces by price increases to customers, and he implies that the same situation is likely to

Table 7-6. Product Price and Profitability Data, 1978-1980

| Year | 1978 | 1979 | 1980 | % Change |
|---|---|---|---|---|
| Domestic Price Index* All Products, 1974 = 100 | 148 | 156 | 176 | +18.9 |
| Consumers Price Index 1967 = 100 | 195.4 | 217.4 | 246.8 | +26.3 |
| Producers Price Index 1967 = 100 | 194.6 | 215.9 | 244.8 | +25.8 |
| Chemicals Group Operating Income as % of Sales* | 9.6 | 7.7 | 7.5 | -21.9 |
| Operating Income as % of Assets* | 12.5 | 10.7 | 9.3 | -25.6 |

*These data relate to the commenter's firm.

hold for these fugitive emission standards. There is not enough information in the comment letter to verify either the claim or the implication. Fluctuations in costs, revenues, and profits are a normal feature of most industries. Furthermore, accounting procedures used in measuring impacts of environmental regulations vary widely. For example, it sometimes happens that costs incurred for non-environmental reasons are listed as costs of environmental regulations, and it also happens that some costs are counted twice if they are incurred to comply with two different environmental regulations. These are legitimate accounting procedures in some situations, but they would be inappropriate here. Also, unlike these fugitive emission standards, some environmental regulations the commenter may be referring to are applied to all existing facilities, and some regulations affect only certain parts of the country; the costs of such regulations cannot be recovered easily by price increases when there is a buyer's market.

Notwithstanding these considerations, it is EPA's position that the net increase in costs attributed to the standards will be very small, averaging less than 0.25 percent, and that the costs will be recoverable in the market. The costs apply only to facilities that are new, reconstructed, or substantially modified. Normally, a firm will delay the construction of a new plant, or the modification or reconstruction of existing facilities, until the market price enables recoupment of all applicable costs, including a normal return on compliance capital expenditures.

## 7.3 COST-BENEFIT EVALUATION

Comment:

Two commenters (IV-D-34; IV-D-38) considered the impacts of the proposed program to be overly demanding in terms of dollars, manpower, and time. Another commenter (IV-D-17) also said the standards would have a significant adverse impact on SOCMI. He estimated that it will cost SOCMI $80 million in 1981 to $100 million in 1985, or greater than $475 million over the 5-year period, to meet the standards. He estimated that the emission reductions in 5 years due to the standards would not exceed 50 Gg and that the net annualized cost, after credit for the recovered emissions, would vary from $10 million in 1981 to $35 million by 1985, or approximately $135 million over a 5-year period. Considering that less than 1 percent of the total national VOC emissions were being addressed, the commenter called the costs excessive, inflationary, and unjustified. Another commenter (IV-D-13) wrote that EPA's statement that control costs are insignificant compared to the annual operating cost of the process unit itself fails to recognize that all costs are significant and that each added increment of expense in providing a product is an addition to inflationary pressures.

Addressing the overall cost/benefit of the standards, a group of commenters (IV-D-17; IV-D-28; IV-D-47; IV-D-48; IV-D-19) said they did not see any need for the standards nor did they see any discernible benefit. They said that the standards are counter to the spirit of Executive Order 12291, the purpose of which is to eliminate wasteful and unnecessary regulations that place undue burdens on industry and the economy. They concluded that the small impact on air quality of the standards does not justify what they felt were the extreme costs of implementation.

Response:

The annualized compliance costs for each model unit have been estimated and presented in Section 7.1 of this document for the standards summarized in Section 1.1., also of this document:

| Model unit | Compliance cost ($/yr) |
|---|---|
| A | 8,600 |
| B | 18,600 |
| C | 46,400 |

Multiplying the total number of new units of each type projected over the 5-year period 1981-86 by the cost per unit presented above gives the following fifth-year annualized compliance costs:

| Model Unit | Projected New Units | Compliance Cost ($10^6$ $/yr) |
|---|---|---|
| A | 432 | 3.7 |
| B | 274 | 5.1 |
| C | 125 | 5.8 |
| Totals | 831 | 14.6 |

The 831 new units include 274 replacement units, which encompass both modifications and reconstructions. The costs of retrofitting some equipment in facilities that are being modified is greater than the same equipment in new and reconstructed facilities. The difference between retrofit and ordinary compliance costs is small and even though retrofit costs were considered in establishing the standards, this difference is not accounted for here.

Executive Order 12291 specifies that a regulatory action, to the extent permitted by law, must not be undertaken unless the potential benefits to society from the regulation outweigh the potential costs to society. An exhaustive benefit-cost analysis is not appropriate here due to the small cost of the standards. However, a simple comparison of the costs and benefits of the standards is presented below.

The standards would benefit society by reducing the release of VOC's to the atmosphere. The following emission reductions, which are equal to the amount of recovered material, are for each model unit and for the industry in the fifth year:

| Model Unit | Emission Reductions (Mg/yr) per Unit | Industry Emissions Reductions ($10^3$ Mg/yr) |
|---|---|---|
| A | 16.1 | 7.0 |
| B | 58.7 | 16.0 |
| C | 184.0 | 23.0 |
| Total | | 46.0 |

The compliance cost per Mg of VOC emissions reductions is therefore:

$$\frac{14.6 \times 10^6}{46.0 \times 10^3} = \$317/\text{Mg}$$

This analysis is quite straightforward and ignores some complexities that could be included. However, the basic implications would remain. In view of the damages to the environment caused by VOC emissions and the compliance cost estimates, EPA believes that implementation of these standards is justified. VOC emissions are a precursor to ozone formation in the atmosphere. Section 2.1 of this document provides a discussion of the benefits of ozone reductions.

# 8. LEGAL

This section contains comments concerning EPA's regulatory actions in light of policies and rules established by the Clean Air Act, recent court decisions, and executive orders on regulation. The comments have been divided into nine major subject areas:

8.1 EPA's Regulatory Responsibility
8.2 Priority List
8.3 Executive Orders
8.4 Court Decisions
8.5 Unit Operation Standards
8.6 States Authority
8.7 Requests for Withdrawal or Delay
8.8 Statutory Time Requirement for Proposal
8.9 Technology-Forcing Standards

## 8.1 EPA'S REGULATORY RESPONSIBILITY

Comment:

Several commenters (IV-F-1, No.3; IV-D-24; IV-D-28; IV-D-19; IV-D-17) concluded that EPA had not complied with requirements of the Clean Air Act for setting new source standards. They argued that EPA had not made the necessary considerations nor presented adequate justification for setting a standard. According to the commenters, EPA failed to demonstrate that fugitive VOC emissions from SOCMI could reasonably be anticipated to endanger public health or welfare. They also noted that no effort was made to evaluate the potential health effects which would result from the standard.

One commenter (IV-F-1, No.3; IV-D-28) continued, saying that he believed that any decision to regulate a substance as a significant contributor to pollution which may endanger health should include consideration of at least these criteria:

(1) Is health being endangered? Is the national standard being exceeded for that pollutant?

(2) If it is, are the substances being considered contributing a significant amount to the concentration of that pollutant in the areas exceeding the standard?

(3) If health is being endangered by VOC emissions, which of these emissions makes a significant contribution to that risk, and how can they best be controlled?

(4) Are there other current regulatory activities which will have an effect on this potential problem, and, if so, what will their effect be?

He asserted that the Agency had not evaluated these questions. He did not believe that the Agency could be justified in controlling a substance simply because it is there.

Response:

The Administrator clearly documented the need to regulate VOC in order to protect public health and welfare in the EPA publication "Air Quality Criteria for Ozone and Other Photochemical Oxidants" (EPA-600/8-78-004, April 1978). VOC emissions are precursors to the formation of ozone and other oxidants. Photochemical oxidants result in a variety of adverse impacts on health and welfare, including impaired respiratory function, eye irritation, necrosis of plant tissues, and the deterioration of selected synthetic materials such as rubber. Since there are estimated to be over 600 process units in SOCMI in the aggregate that have the potential to emit a significant quantity of VOC, SOCMI was included on the priority list for which new source performance standards (NSPS) are to be investigated. The proposed standards will reduce VOC emission by 46 Gg/yr in the fifth year after implementation.

The commenter's list of criteria indicates some confusion over the difference between National Ambient Air Quality Standards (NAAQS) and Standards of Performance for New Stationary Sources (NSPS). NAAQS are set for certain criteria pollutants. Criteria air pollutants are those substances in the air which are reasonably anticipated to endanger public health or welfare and which are released by numerous or diverse sources.

SIP standards aimed at attaining the NAAQS in a particular area differ from standards of performance which limit emissions from specific categories of sources regardless of their locations. Standards of performance reflect the best technology for controlling a particular source and are not directly designed to achieve any ambient air quality or public health or welfare goals. Therefore, the commenter's first two criteria are not appropriate except for the fact that NSPS are developed for sources of emissions which may endanger public health or welfare.

The commenter's third criterion has been met. All VOC endanger public health and welfare. Section 111(f) requires that EPA set standards of performance for new stationary sources of VOC (within listed source categories) for which the best demonstrated technology (considering cost, energy and nonair environmental impacts) can be identified.

With regard to the commenter's fourth criterion, there are basically four types of environmental regulations (NAAQS, SIP's, NSPS, NESHAP's) and some occupational health and safety standards which have the potential to affect VOC emissions. As explained in Section 2.1, each of these statutory programs plays a uniquely different role in meeting the goals of the Clean Air Act and the Occupational Safety and Health Act. None of these statutory programs negates the needs for standards of performance for fugitive emissions from new SOCMI units.

Comment:

EPA was said to have given no thought to the geographical distribution of the industry, that is, whether the industry is located in attainment or nonattainment areas or in rural or urban areas (IV-F-1, No.3).

Response:

In setting new source performance standards, location of the industry in attainment or nonattainment areas is not relevant. Location of an industry in an attainment or nonattainment area is relevant to achieving the national ambient air quality standards (NAAQS) under Section 109 of the Clean Air Act. The intent of Congress in establishing NSPS was to establish a single minimum level of stringency for all state limits, thereby preventing States from soliciting industry with lenient air pollution requirements and causing increased air pollution from new sources.

Comment:

EPA was charged with failing to address the relationship of the emissions from the industry to other similar man-made and natural emissions (IV-F-1, No.3: IV-D-19).

Response:

EPA has determined that emissions from SOCMI are significant (540 Gg/yr), that emissions may endanger public health and welfare (EPA-600/8-78-004), and that the emissions can be controlled at reasonable costs. This is sufficient basis for establishing an NSPS.

In the development of a NSPS, EPA is not charged with examining the relationship of the emissions from the industry to other similar man-made or natural emissions in the area. This type of consideration is necessary for the Prevention of Significant Deterioration (PSD) or nonattainment area permitting process.

Comment:

A commenter (IV-D-17) said the standard was being proposed out of the proper sequence. He felt that the more logical sequence is to establish RACT and then evaluate the effectiveness of NSPS against the RACT control baseline. He also noted that it is unreasonable to go from an "uncontrolled baseline" to an NSPS control alternative and evaluate the cost effectiveness of the NSPS against this "uncontrolled basis." The commenter believe that RACT will achieve almost all of the reductions being proposed by EPA under the NSPS and that the cost to achieve the additional NSPS control would be unreasonable.

Response:

In the development of a NSPS the baseline level represents the level of control in the absence of any standards of performance. Since there were not Federal fugitive emission regulations for SOCMI and since the South Coast Air Quality Management District in California was the only area of the country that had developed such regulations, the assumed baseline for SOCMI was uncontrolled. If several States had had time to develop RACT prior to the development of the proposed standards, RACT might have been used as the baseline.

Where RACT-level control is already in place, however, the impact of NSPS will be smaller than calculated. RACT and the systems chosen as best demonstrated technology for this industry's standards of performance for new stationary sources are not conflicting types of control; therefore, where RACT already applies, the standards of performance will supplement RACT-level control. EPA has determined that existing RACT-level facilities that become subject to the standards of performance (e.g., through modification) can achieve the additional reduction required at a reasonable cost.

Comment:

One commenter (IV-D-42) wrote that Appendix A of the EIS, "Evolution of the Proposed Standards," cites testing at the information received from Stauffer Chemical Company, Phillips Petroleum, Exxon Chemical Company, Shell Oil Company, Vulcan Materials Company, American Cyanamid, B.F. Goodrich, Atlantic Richfield, DuPont, Chevron, and Dow Chemical Company, among others. Trade associations consulted were the Chemical Manufacturers Association and the Texas Chemical Council.

The commenter noted that no beverage distilling companies or trade associations representing them were studied or consulted, nor were any background information documents sent to them (such documents were mailed on 7 November 1979 according to Appendix A of the EIS).

Response:

EPA attempted to get several SOCMI representatives involved early in the development of the standards with review and comment of preliminary documents including those mailed on November 7, 1979. Later in the process of developing the standards, the Agency sent the Federal Register notice of the proposed standards (46 FR 1136, January 5, 1981) to additional SOCMI representatives as well. This notification was made to ensure that all industries which might include affected facilities had been notified and were given ample opportunity for review and comment.

Although the beverage distilling industry was not involved in the preliminary review of the Background Information Document (BID), Volume 1, this industry did have the opportunity to participate in the public comment period following proposal. All comments received during the public comment period after proposal of the standards are considered by EPA in the final rulemaking. Both the public notification, the individual notification of various industry groups, and commenting period have provided ample opportunity for all interested parties to comment on the proposed regulations.

Comment:

One commenter (IV-D-42) wrote that Section 111(f)(1) of the Clean Air Act, 42 U.S.C. 7411(f)(1), required the Administrator to publish a priority list of stationary VOC sources to be regulated. That list as published on August 21, 1979, did not include the distilling industry process units in source categories.

SOCMI was included on the priority list on the basis of the Administrator's determination that:

> Sources within this industry contribute significantly to air pollution which may reasonably be anticipated to endanger public health or welfare (46 Fed. Reg. 1152).

The commenter pointed out that no such determination was made for the production of fermentation alcohol. He said that in the August 21, 1979 priority list EPA specifically stated that fermentation alcohol was not being included in the sources to be regulated because:

> Beer manufacture has a much lower emission level than had been assumed in the background report, and whiskey manufacture was deleted due to a lack of any demonstrated control technology (44 Fed. Reg. 49224).

In addition, in Section III, in studies conducted prior to 1979 EPA has concluded that emissions from fermentation, distillation and other production facilities were so low that they did not warrant regulation. Thus, the commenter concluded, it could not have been reasonably expected that EPA intended to regulate this industry when it listed SOCMI in the August 21, 1979 priority list.

One commenter (IV-D-42) wrote that the EIS cited the following factors studied as a basis for regulating SOCMI and other emission sources, none of which have been considered in connection with fermentation alcohol: projections of growth and replacement of existing facilities, estimated incremental amount of air pollution that could be prevented in future years, cost of compliance, potential inflationary or recessionary effects of regulation, effects on small businesses with respect to competition effects on consumer costs, effects on energy use, and a thorough study of the profitability and price-setting mechanisms of the industry (EIS, pp. 2-10). The commenter stressed that fermentation alcohol plants, the structure of the industry, its finances, the nature of the markets, its competitive position with respect to foreign producers, and the economic impact of the regulation on the industry bear no resemblance to the studies and conclusions about the chemical industry discussed in the EIS.

He added that it is clear from the list of companies consulted, (Appendix A of the EIS) and from a careful examination of the entire EIS, that at no time did EPA ever consider distilleries producing alcohol from grain, molasses, fruit or other agricultural food products in the analyses leading to this rulemaking. Not even the description of the industry to be regulated bears any resemblance to the fermentation alcohol industry; it does not even mention the production of products which can be consumed as food (EIS, pp.3-1 through 3-3).

The commenter concluded that since EPA did not consider the fermentation alcohol industry in the EIS, as required by law, it cannot be regulated under the January 5, 1981 notice.

Response:

The promulgated priority list (45 FR 49225, August 21, 1979) excluded beer and whiskey manufacture source categories. However, the list included the SOCMI category which was identified in the listing notices and the background information as including 600 processes producing a wide variety of chemicals. Some of these chemicals can be produced by fermentation processes used in beer and whiskey manufacturing plants. While the listing notices did not define beer and whiskey manufacturers, under the most straightforward reading, those terms include only the processes used to produce the fermented beverages, beer and whiskey, for human consumption.

The draft background study entitled "Fermented Beverage Industry" confirms the fact that this definition was intended by EPA. That study addresses only the fermentation and distillation of fermented beverages produced for human consumption; it does not treat the production of chemicals from fermentation processes.

After reviewing the promulgated priority list and draft background study, EPA has concluded that process units within beer and whiskey plants that are producing fermented beverages solely for human consumption were not included on the priority list within SOCMI or another source category. Therefore, they are not covered by the standards. However, any process units in beer or whiskey plants that are not used for beer or whiskey manufacture but rather to manufacture nonbeverage fermented products will be subject to the standards.

There are several reasons to consider regulating nonbeverage fermented products that are produced in beer or whiskey plants. First, the purpose of the proposed standards is to reduce VOC emissions which are precursors to ozone. Currently, there are readily available work practice procedures, equipment standards, and performance standards that would reduce these emissions. Therefore, not regulating these sources may be contrary to the intent of the Clean Air Act. Secondly, EPA has concluded that the effectiveness of the standards and the cost and energy impacts are equitable. Finally, it is not necessary to regulate the fermented beverage industry as a whole. Only those process units in a beer or whiskey plant that produce one of the chemicals listed in 40 CFR 60.489 as final products could be regulated.

The analysis of emissions, emission reductions, and costs presented in the BID for proposal are applicable to fermentation alcohol units. Furthermore, the economic analysis performed for SOCMI units included units which produce chemicals from biomass, as discussed in Chapter 9 of the BID. The inclusion of fermentation alcohol processes and other processes using biomass as a raw material is further documented in II-A-12 and II-A-8.

## 8.2 PRIORITY LIST

Comment:

The priority list was said to be preliminary and not final, meaning that the decision to list the various industries was made without public comment and without justification or generation of support that the industries listed affect the public health and welfare (IV-F-1, No.3).

The same commenter, in another set of comments (IV-D-28) said there was no evidence of a further consideration of the preliminary assessment. He also saw no support that the preliminary assessment was a proper final conclusion.

Response:

While the priority listing included a preliminary screening of source categories, it is a comprehensive screening, forming the basis for the Administrator's official determination under §111(b)4(f); it is not a preliminary list. The final priority list was promulgated at 45 FR 49225 on August 21, 1979, after full notice and comment on the proposed priority list. This list reflects the Administrator's determination that, based on preliminary assessments, emissions from the listed source categories contribute significantly to air pollution which may endanger public health or welfare. As mandated under Section 111(f)(3) of the Clean Air Act, the Administrator consulted with Governors and State air pollution control agencies and conducted a public hearing in order to discuss the proposed priority list. The public hearing was held on September 29, 1978. While new information has led EPA to delete 12 categories from the list and further information may lead to deleting other categories, nothing EPA has learned since promulgation of the priority list suggests that SOCMI does not belong on the list.

Comment:

One commenter (IV-D-28) said the priority list ranking was improper. He said the "potential to emit" criteria was used instead of considering the effectiveness of abatement devices which are in place. This error was said to have occurred because the study was completed before the Alabama Power decision.

Response:

The commenter suggests that EPA misinterpreted the phrase "emits, or has the potential to emit" in the Section 302(j) definition of "major stationary source" that applies to the standards through Section 111(f)(1). However, even if EPA had considered existing control levels in deciding which industries are "major stationary source" categories for purposes of the Priority List (40 CFR 60.16), SOCMI would have remained a "major source category" under the Section 302(j) 100-ton cutoff. More importantly, if EPA had used the commenter's interpretation and if SOCMI had become a "minor" source category as a result, that would not change EPA's finding under Section 111(b)(1) that SOCMI "contributes significantly" to ozone pollution. Because SOCMI has been listed as a significant contributor, EPA must promulgate an NSPS, regardless of whether SOCMI is one of the numbered "major stationary source" categories on the category list at 40 CFR 60.16. See Priority List promulgation, 44 FR 49223-49224 (August 21, 1979) (discussing EPA's decision to list three categories not considered "major" under EPA's analysis). Thus, the commenter's interpretation of "emits, or has the potential to emit" under Section 302(j) would not have exempted SOCMI from regulation under Section 111.

Beyond that, EPA disagrees with the commenter's interpretation of Alabama Power Co. v. Costle, 636 F.2d 323, 352 (D.C. Cir. 1979). In that case, the Court did hold that EPA must consider the level of emissions with pollution controls operating when calculating whether a source "emit[s], or has the potential to emit," 100 tons per year, under the definition of "major emitting facility" in Section 169(1). That decision, however, addresses only the question of which sources are subject to new source review requirements under the prevention of significant deterioration (PSD) program established in Part D of the Act. The Court based its decision largely on its view of the intent of the PSD program. The Court has not addressed whether EPA has properly focused on uncontrolled emissions levels for the very different purpose of determining categories of "major stationary sources" subject to inclusion on the NSPS Priority List, 60 CFR 60.16. See 43 FR 38874 (August 31, 1978).

Although the definition of "major stationary source" that applies to the NSPS program is similar to the definition of "major emitting facility" used for PSD purposes, EPA believes that the two definitions may be interpreted differently, in light of the different purposes of the two programs. In EPA's judgment, focusing on uncontrolled emissions levels rather than emissions levels with pollution controls operating is consistent with the intent of the NSPS program. In contrast to the relatively cumbersome and uncertain case-by-case PSD review requirements, NSPS's set minimum standards applicable to broad categories of sources. Congress intended PSD requirements to apply only to a portion of sources intended to be covered by minimum NSPS requirements.*/ A focus on uncontrolled emissions for NSPS listing purposes serves this intent.

Moreover, the Court in Alabama Power recognized, as EPA had in that rulemaking, that focusing on uncontrolled emissions for PSD applicability purposes would place an intolerable burden on both EPA and all but the very largest sources. 636 F.2d at 354. Neither the Court nor EPA has found that focusing on uncontrolled emissions for purposes of the NSPS Priority list will impose similar burdens. Nor did any party raise this issue in commenting on or petitioning for judicial review of EPA's use of uncontrolled emissions in developing the Priority List.**/

*/The Alabama Power decision itself suggests this difference in applicability. The Court cited NSPS's when it noted that, since Congress was aware that many major sources were already operating pollution controls pursuant to legal requirements, it must not have intended all such sources to be brought under PSD requirements by virtue of EPA's ignoring these existing controls. 636 F.2d at 353. This implies the view that at least some sources that should be covered by NSPS's should not be covered by PSD review under the Section 169(1) "major emitting facility" definition.

**/The Agency notes in this regard that the commenter did not comment or present a judicial challenge on this point. The initial Alabama Power decision, 606 F.2d 1068 (1979), established the D.C. Circuit's preliminary view on the definition of "major emitting facility". The Court issued that opinion before EPA promulgated the Priority List. This permitted the commenter ample opportunity to cite the decision in support of a timely comment or judicial petition. See Section 307(b); Oljato Chapter of Navajo Tribes v. Train, 515 F.2d 654 (D.C. Cir. 1975).

It is also important to note that EPA did consider the level of emissions with existing controls operating in ranking the source categories included on the Priority List. Section 111(f) establishes three criteria EPA was required to use in that ranking. As described in the Priority List proposal, supra, in the listing rulemaking EPA represented the first criterion, quantity of emissions, as the emissions an NSPS would prevent after being in effect for a specified period of time (in this case, 10 years). Emissions for 1990 were calculated first, assuming that the 1980 level of control continued to be applied to new sources. EPA termed this level $T_S$. Next, EPA calculated 1990 emissions assuming that a best level of control, representative of an NSPS, were applied to all new sources constructed between 1980 and 1990; this 1990 emission level was termed $T_N$. The "potential" emissions that could be prevented by an NSPS over the span of 10 years equaled the difference between $T_S$ and $T_N$. Based on this emissions level, as well as the potential impact of VOC emissions on public health and welfare and the mobility and competitive nature of this source category, EPA properly ranked SOCMI first on the Priority List.

Comment:

Another commenter (IV-D-24) was concerned that EPA has a list of sources and once it establishes an NSPS for one, it just continues on down the list ad infinitum contrary to the intention of the Clean Air Act.

Response:

Section 111(f) of the Clean Air Act required the Administrator to publish a list of categories of stationary sources for which NSPS are to be promulgated. These source categories represent sources of pollutants that in the judgment of the Administrator cause, or contribute significantly to, air pollution which may reasonably be anticipated to endanger public health and welfare.

Section 111(f) requires EPA to promulgate standards of performance for all categories on the list. In doing so, EPA analyzes in detail the alternative levels of control achievable for each industry before setting standards for that industry. The process does not constitute blindly establishing regulations. In fact, EPA has deleted categories when new information has suggested that deletion would be in keeping with the intent of the Clean Air Act.

Comment:

One commenter (IV-D-38) said the proposed NSPS should be withdrawn and the source category removed from the priority list since the NSPS would have an insignificant effect on emissions. He cited, as support for this request, the provisions in 44 FR 49222-23 (August 21, 1979) that said:

> [I]f further study indicates that an NSPS would have little or no effect on emissions, or that an NSPS would be impractical, a source category would be given a lower priority or removed from the list.

Response:

Neither this commenter nor any other submitted information demonstrating that the contribution of SOCMI sources to harmful air pollution is significant. For example, projected growth obviously affects the significance of the contribution a category of new sources makes to harmful air pollution. If further study had indicated that NSPS's for the SOCMI category would have little effect on emissions because there would be no new SOCMI sources in the foreseeable future, this source category could have been removed from the list. However, EPA has concluded that the emissions contribution from both existing and projected new sources in this industry are significant. Therefore, SOCMI remains on the priority list. Furthermore, EPA has identified at least one system of control that will achieve additional emission reduction from the fugitive emissions subcategory of SOCMI at a reasonable cost. For this reason, EPA is required to promulgate these standards.

8.3 EXECUTIVE ORDERS

Comment:

One commenter (IV-D-38) considered the proposed NSPS to be contrary to cost-effective regulation pursuant to Executive Order 12291. He summarized the requirements of the Executive Order as follows:

(1) Regulations should be based upon adequate information concerning the need for and consequences of proposed government action;

(2) Regulatory action should not be undertaken unless the potential benefits to society outweigh the potential costs;

(3) Alternatives should be chosen so that the net benefits to society are maximized and the net costs are minimized;

(4) Priorities should be set so as to maximize net benefits, taking into account the condition of the economy and other contemplated regulatory actions.

Two other commenters (IV-F-1, No.3; IV-D-28) said the real cost of the proposed program in current dollars will be far more than the hundred million dollar threshold for a regulatory analysis by 1985 or, perhaps, earlier, and therefore, a regulatory analysis must be performed. The commenter (IV-F-1, No.3) also said the proposal must be classified as a major rule under the recent E.O. 12291 and must, therefore, be reevaluated and reproposed to be in compliance with that order.

Response:

Executive Order (E.O.) 12291 requires that a regulatory impact analysis, thoroughly examining costs and benefits of a rule, be prepared in connection with every major rule. A major rule is any regulation which is likely to result in:

(1) An annual effect on the economy of $100 million or more;

(2) A major increase in costs or prices for consumers, individual industries, Federal, State, or local government agencies, or geographic regions; or

(3) Significant adverse effects on competition, employment, investment, productivity, innovation, or on the ability of United States-based enterprises to compete with foreign-based enterprises in domestic or export markets.

An economic analysis of this standard was prepared. Economic impact estimates presented in the Background Information Document, Volume I, and summarized in the preamble to the proposed regulation (46 FR 1136; January 5, 1981) showed that no unreasonable economic impacts are expected. Since proposal, changes in the standards have caused the economic impacts to be reduced; thus, the discussion in Section 7 also shows no unreasonable economic impacts. Because no unreasonable economic impacts are expected and the criteria for a major rule have not been met, no additional regulatory impact analysis has been prepared.

Comment:

The same commenter (IV-D-28) said Executive Order (E.O.) 12044 required consideration of the effectiveness of alternative levels of control. This requirement was said to have been reemphasized by E.O. 12291. E.O. 12291 was also said to require that the lowest cost alternative be chosen. The commenter said that EPA had failed to comply with these mandates by not considering health data for the alternatives and by not providing an adequate explanation for the choice of the most stringent alternative.

Response:

Alternatives were considered during the development of the SOCMI regulation. They are discussed in the preamble to the proposed standards and in the Background Information Document (BID), Volume I. In selecting the final standards EPA considered alternative levels of control for each fugitive emission source covered by the standards.

Health factors are considered prior to the decision to regulate the source, indicating whether a pollutant endangers public health and welfare and whether a particular source category's contribution of that pollutant is significant. In development of an NSPS, EPA is not specifically required to analyze health data for each alternative. Each alternative control level is evaluated in terms of emission reduction, impacts on water quality and solid waste, secondary environmental impacts, energy requirements, and economic impacts.

Comment:

In another set of comments (IV-D-17) EPA was urged to allow the use of flares as control devices to be consistent with the spirit, if not the express language of E.O. 12291. It was said that EPA should not preclude technically sound and cost-effective regulatory options unless the Agency establishes a record clearly documenting that the options will offset a significant environmental benefit that could otherwise result.

Response:

For the reasons described in Section 4.1, the regulation has been revised to allow the use of smokeless flares that are designed and operated within the exit velocity and heat content criteria established for the following three flare types: steam-assisted flares, air-assisted flares, and nonassisted flares.

Comment:

A commenter (IV-D-43) said that E.O. 12291 requires that emissions be calculated on a substance-by-substance basis in order to evaluate the benefit of various alternatives. In addition, this type of analysis is needed to determine the incremental cost of ozone to the local burden, and to estimate the results in terms of human health.

Response:

This commenter asserts that the emissions from the chemicals listed in 40 CFR 60.489 must be individually calculated to meet the requirement of E.O. 12291, and that based on these calculations, adverse effects of each chemical on public health and welfare must be based on local burden not on a nationwide burden.

E.O. 12291 requires that potential societal benefits of a regulation outweigh potential costs. This executive order does not require emissions to be calculated on a substance-by-substance basis in order to evaluate the benefit of various alternatives. Rather, the aggregate cost and resulting benefits must be considered. Therefore, individual calculations for each chemical are not necessary for these standards. As discussed in Section 5.1, the chemicals listed in 40 CFR 60.489 are chemicals whose production requires the use of fugitive emission sources to process VOC. All of the processes represented have the potential to emit VOC which result in photochemical ozone formation. The VOC may be contributed from raw materials, additives, products, or co-products. The chemicals contribute to ozone in varying rates and in different amounts depending not only on the chemical's reactivity but also on meteorological conditions and the mix of pollutants in the atmosphere.

For purposes of setting an NSPS, it is sufficient to know that the processes emit significant quantities of VOC which have the potential to form ozone. The purpose of the NSPS is to control emissions of VOC from new, modified, and reconstructed sources to prevent ozone levels from becoming higher. Section 111 does not require that EPA establish standards of performance according to the direct effect a given amount of VOC emitted from the regulated source will have on the public health and welfare.

In response to the commenter's second point, NSPS are developed to set a nationwide level of control which will keep air pollution problems from worsening due to industrial growth, not to control VOC emissions on a local level. Other parts of the Clean Air Act such as Section 110, State Implementation Plans, define programs for local regulation of industries keyed to air quality in the immediate area.

8.4 COURT DECISIONS

Comment:

One commenter (IV-F-1, No.3; IV-D-28) argued that the proposal was in sharp conflict with existing case law. Specifically, the commenter said that EPA's action is contrary to the Supreme Court's decision in IUD v. API, 100 S.Ct. 2844 (1980). He noted that in IUD, which involved an Occupational Safety and Health Agency (OSHA) benzene standard, the Court ruled that before setting such standards OSHA must make a threshold determination that the workplace currently poses a significant health risk and that a new, more stringent standard is reasonably necessary or appropriate to provide safety or to preserve the health of those affected. He commented further that the Court rejected the idea that if there were some risk at one workplace exposure level, it was proper for OSHA to regulate to a lower workplace exposure level simply on the assumption that the risk also would be lowered thereby.

The commenter noted the Court's holding that OSHA's action, by not resting on a determination of significant existing risk and predicted benefit, would unlawfully impose enormous costs that might produce little, if any, discernible benefit. He also cited a concurring opinion by Chief Justice Burger stating that OSHA must show something more than a de minimis relationship between cause and effect, and also cited Alabama Power v. Costle, 636 F.2d 323 (D.C. Cir. 1979).

The commenter suggested that even though the OSHA benzene case involved a statutory provision different from Section 111 of the Clean Air Act, the basic requirements are the same and have not been fulfilled in EPA's establishment of this NSPS.

Response:

EPA does not agree that the legal requirements for establishing NSPS's are the same as those governing OSHA standards. The statute at issue in the OSHA benzene case states, among other things, that OSHA may establish standards "reasonably necessary and appropriate to provide safe and healthful employment." (Occupational Safety and Health Act, §3(8)). Standards involving harmful materials, in particular, also have to "assure[], to the extent feasible, . . . . that no employee will suffer material impairment of health or functional capacity." (Id., §6(b)(5)). The Court invalidated the benzene standard OSHA promulgated under these provisions. A plurality of the Justices held that to comply with §3(8) -- as required in setting §6(b)(5) standards -- OSHA must first determine that workplaces in compliance with existing standards are not "safe." The plurality held that this in turn must mean that the workplaces pose a "significant risk" of harm to the employee. The plurality ruled that, having made that finding, OSHA may then set standards only if it shows that such standards will eliminate or lessen that risk.

The legal standard under Section 111 of the Clean Air Act is quite different from the standard at issue in the OSHA benzene case. Section 111 requires EPA to identify categories of sources that "contribute[] significantly to[] air pollution which may reasonably be anticipated to endanger public health or welfare." (Section 111(b)(1)(A)). For sources within such "significant contributor" categories, the Agency must establish NSPS's that other factors the Administrator determines has been adequately demonstrated." (Section 111(a)(1)). Thus, in contrast to OSHA standards, each NSPS is predicated, not on the Administrator's finding of a specific level of existing harm caused by the affected source and the effect of more stringent standards on that level, but rather on the findings that (1) the source category in which the affected sources fall "contributes significantly" to the pollution found harmful under the Section 111(b)(1)(A) standard discussed above and (2) the selected standard of performance reflects the performance of the best demonstrated technology. Section 111 simply does not require NSPS's to reflect the degree of control shown necessary to avoid directly a particular level of harm that the Administrator has found to be significant.

Contrary to the commenter's statements, EPA has complied with the requirement in Section 111. First, EPA made the general finding that ozone "may reasonably be anticipated to endanger public health and welfare." EPA has found that ozone causes a variety of adverse impacts on health and welfare, including impaired respiratory function, eye irritation, necrosis of plant tissues, and the deterioration of selected synthetic material, such as rubber. EPA clearly documented these adverse effects when it promulgated the national ambient air quality standard (NAAQS) for ozone. (See "Air Quality Criteria for Ozone and Other Photochemical Oxidants," EPA-600/8-78-004.) EPA has also documented the finding that VOC, the pollutant regulated by this NSPS, is a precursor to the formation of ozone. (Id.) The ozone NAAQS has been upheld by the D.C. Circuit. (665 F.2d 1176 (D.C. Cir. 1981), cert. denied, 102 S.Ct. 1737 (1982)). Next, through a separate rulemaking, the Administrator identified SOCMI as a "significant contributor" source category. (NSPS Priority List, 40 CFR 60.16). As explained in an earlier response, that listing was adequately documented and was not challenged in court. */ Finally, through today's final NSPS rulemaking, EPA is selecting the standard of performance reflecting the application of the best demonstrated technology for the equipment leaks subcategory of SOCMI. In sum, contrary to the commenter's claim, EPA is meeting the applicable requirements in promulgating this NSPS.

*/ Moreover, no new facts have arisen to suggest that the SOCMI category is no longer a "significant contributor" to ozone.

The commenter also incorrectly suggests that this NSPS unlawfully constitutes de minimis regulation. In the case cited by the commenter, Alabama Power Co. v. Costle, 636 F.2d 323, 400 (1979), the D.C. Circuit stated that:

> EPA does have discretion, in administering the statute's "modification" provision, to exempt from PSD review some emission increases on grounds of de minimis or administrative necessity.

As this language shows, the Court was simply noting the Agency's discretion to avoid de minimis regulation in defining the term "modification" for PSD applicability purposes. The Court did not require EPA to avoid de minimis regulation in the PSD area. Nor did the decision address whether such regulation might be effected under other provisions of the Clean Air Act, such as Section 111. Thus, Alabama Power simply has no bearing on EPA's promulgation of the NSPS for SOCMI equipment leaks.

Moreover, even if EPA were prohibited from promulgating an NSPS having only de minimis effects, this NSPS would meet the applicable requirements. As stated earlier in this document, these standards will reduce fugitive emissions of VOC from process units constructed, modified, or reconstructed between 1981 and 1985 from about 83,000 Mg/yr to about 46,000 Mg/yr. This reduction will in turn reduce ozone levels from what they would be, absent this NSPS. In the Agency's judgment, this is not a de minimis effect.

## 8.5 UNIT OPERATION STANDARDS

Comment:

One commenter in two comment letters (IV-D-28; IV-D-43) questioned the Agency's authority to set unit operation standards. It was clear to him that EPA could regulate in this fashion only if each substance or process within the scope of such a regulation is shown by scientific evidence to present a significant risk of that hazard which causes the Agency to act. He could not see that the Agency had presented such evidence.

This same commenter, in a second letter, questioned the Administrator's authority to set unit operations standards. In support of his statement, the commenter cited the Proposed Revocation Notice for the National Ambient

Air Quality Standards (NAAQS) for hydrocarbons (46 FR 25665, May 8, 1981) which says: (1) that class standards cannot be set simply because members of that class are suspect, and (2) that a case-by-case study of the need for and benefits from any regulation must be performed prior to action.

Response:

Section 111(b)(2) of the Clean Air Act gives the Administrator the authority to establish unit operation new source performance standards for a class of facilities, provided those standards reflect best demonstrated technology for that class. EPA has concluded that it can develop a unit operation standard reflecting best demonstrated technology for over 600 SOCMI process units. This results in a substantial savings to the industries being regulated as well as to the taxpayer.

As previously explained in this section, all of the processes represented have the potential to emit VOC which result in ozone formation. The VOC may be contributed from raw materials, additives, products, or by-products. The chemicals contribute to ozone at varying rates and in different amounts depending not only on the chemical's reactivity but also on meteorological conditions and the mix of pollutants in the atmosphere.

For purposes of setting an NSPS, it is sufficient to know that SOCMI sources emit significant quantities of VOC which have the potential to form ozone. The purpose of the NSPS is to control emissions of VOC from new, modified, and reconstructed process unit fugitive emission sources to prevent ozone levels from becoming higher as a result of industrial growth.

The Proposed Revocation Notice for the hydrocarbon (HC) NAAQS does not directly affect the development of this NSPS. As explained in that notice, the NAAQS for HC were intended only as a guide in the development of state implementation plans to attain the original NAAQS for photochemical oxidants (Recast as NAAQS for ozone in 1979). The revocation of the NAAQS for HC was proposed because EPA determined that there is no single, universally applicable relationship between HC and ozone and that HC as a class apparently do not produce any health or welfare effects in or near ambient levels. However, the proposed revocation was in no way intended to restrict EPA or state authority to limit VOC emissions, including HC as a class, where necessary to limit the formation of ozone or particularly HC that are found to pose a threat to health and welfare. Since VOC are precursors to ozone and ozone has been determined harmful to the public health and welfare, significant sources of VOC are subject to regulation under Section 111 of the Clean Air Act (46 FR 25656; May 8, 1981).

8.6 STATES AUTHORITY

Comment:

One commenter (IV-D-22) said the promulgation of the standard would be contrary to Section 101(a)(3) of the Clean Air Act which places primary responsibility for prevention and control of air pollution at its source with State and Local governments.

Response:

The Clean Air Act requires the Federal government and State governments to work together in controlling air pollution. With the 1970 Clean Air Act, the Federal Environmental Protection Agency (EPA) was created and was congressionally mandated to establish national air quality and regulatory goals. In addition, the Act gave State and Local governments primary authority for all regulatory efforts needed to achieve the national air quality and regulatory goals.

Section 101(a)(4) of the Clean Air Act acknowledges the need for Federal financial assistance and leadership in the development of cooperative Federal, State, regional, and local programs to prevent and control air pollution. In the case of new source performance standards, EPA is mandated to establish national standards of performance for new, modified, and reconstructed stationary sources. However, as delineated in Section 111(c)(1) of the Clean Air Act, a State may develop and submit to the Administrator a procedure for implementing and enforcing standards of performance for the new source located in that State. Federal standards are important because they set the minimum requirements for new sources.

8.7 REQUEST FOR WITHDRAWAL OR DELAY

Comment:

Three commenters (IV-D-38; IV-D-43; IV-D-50) requested that the proposed standards be withdrawn. All three commenters claimed that the proposed standards would be costly with an insignificant effect on emissions. One of the commenters said that based on SOCMI data, the uncontrolled emissions approach the level of control proposed in the regulation. The estimated uncontrolled emissions, presented by the commenter, are 55 Gg/yr, compared to the 200 Gg/yr based upon refinery data presented in the Background Information Document (BID), Volume I.

One of these commenters urged the Agency to withdraw the proposal until EPA can supply the public with the relevant documents so that informed public comment can be made.

Response:

EPA finds no logical or legal basis for withdrawing or delaying the proposed NSPS for SOCMI. EPA has concluded that, as Section 111 requires, the proposed standards reflect application of technology that will achieve the most additional reduction at reasonable cost. The emissions reduction based on SOCMI data are discussed in Section 3.4, and Section 7.2 discusses the cost effectiveness of these standards.

The reports referenced in the FEDERAL REGISTER (46 FR 21789; April 14, 1981) provide an analysis of SOCMI fugitive emissions data. Although EPA was unable to fill all the requests for these reports, the reports are in the docket in Washington and available for public review. In addition, complete reports were sent to and made available through the Chemical Manufacturers Association, the Texas Chemical Council, the American Petroleum Institute, and the Synthetic Organic Chemical Manufacturers Association. Furthermore, the AID was prepared and submitted to the public for comment. Comments on the AID will be considered in preparing the final standards.

Comment:

One commenter (IV-D-5) said promulgation should be deferred until questions relating to the ozone standard are resolved. He said certain questions relating to the ozone standard are currently before the U.S. Court of Appeals for the District of Columbia Circuit. He also commented that the number of allowable exceedances of the ambient standard is under review by the Administration's Task Force for Regulatory Reform. He added that the

National commission on Air Quality has recommended that the dates for achievement of the ambient standard be lifted from the Clean Air Act.

Response:

This comment is not relevant to developing new source performance standards. Section 111 requires EPA to set standards of performance for new sources in source categories contributing significantly to harmful air pollution. EPA has already determined that ozone is harmful to the public health and welfare. Based on this finding and the judgment that SOCMI's contribution of VOC, precursors to ozone, is significant, EPA is now setting these standards (see Section 111(f)). Section 111 requires that standards of performance for new stationary sources reflect the "best demonstrated technology," not the technology that will achieve a particular level of pollutants in the ambient air. For this reason, the exact level of the ozone NAAQS will not affect the level of stringency of any NSPS aimed at controlling VOC emissions.

Comment:

Another commenter (IV-D-28; IV-F-1, No.3) said the proposal should be withdrawn or reclassified as an advance notice of proposed rulemaking. He thought that it should be revised and reissued after serious procedural and factual errors had been corrected.

Response:

EPA is unaware of any procedural or factual errors made during the rulemaking process. In addition, the purpose of an advance notice of proposed rulemaking for new source performance standards is to announce the development of a standard. Both the proposed priority list (43 FR 38876; August 31, 1981) and the promulgated priority list (44 FR 49222; August 21, 1979) were advance notices of proposed rulemaking for all new source performance standards (NSPS). The proposed standards resulted from EPA's detailed study of emissions, control technology, and control costs for SOCMI fugitive emission sources. The proposal provided adequate notice of the standards that EPA is promulgating in this action. It, therefore, served the purposes of a notice of proposed rulemaking, not merely an advance notice.

## 8.8 STATUTORY TIME REQUIREMENTS FOR PROPOSAL

Comment:

Two commenters (IV-D-28; IV-D-46) noted that the Administrator was late in proposing the standards. One of the commenters said the Administrator is required by Section 111(b)(1) of the Clean Air Act to make the judgment that a category of stationary sources may reasonably be anticipated to endanger public health or welfare. He reported that the Administrator made that determination, on a preliminary basis, at 44 FR 49222 on August 21, 1979. The commenter noted that the Administrator failed the statutory requirement for proposal within 120 days. Publication of the proposal occurred about 500 days later. The second commenter questioned why NSPS had not been developed sooner for the SOCMI industry, the number one source on the priority list.

Response:

The source categories identified on the priority list are not subject to the provisions of Section 111(b)(1)(B) of the Clean Air Act which would require proposal of new source performance standards (NSPS) within 120 days of adoption of the priority list. The promulgation of NSPS for sources on the priority list is to follow the time schedule prescribed in Section 111(f)(1) of the Clean Air Act (44 FR 49225; August 21, 1979). EPA is endeavoring to adhere to this schedule. As discussed in a previous comment and response, the priority list ranking does not indicate the order in which standards will be promulgated.

## 8.9 TECHNOLOGY-FORCING STANDARDS

Comment:

One commenter (IV-D-46) wrote that the technology-forcing requirements of Section 111 bear special emphasis. The law requires the NSPS to reflect the performance (or in certain cases, the design, equipment, work practices, or operational measures) determined to be "achievable" by the best adequately demonstrated controls. The commenter emphasized that what is achievable is not the same as what had been achieved by the plants designed and built years ago. The law requires new installations to apply knowledge gained from past installations, not just to initiate the status quo of old designs. Otherwise, the standards would be perpetually out of date.

The commenter cited National Lime Association v. EPA where the court explicitly reiterated the technology-forcing authority of EPA. He concluded that if any doubt remained, it was dispelled by the subsequent power plant (Sierra Club v. Costle) and diesel auto cases, which make it absolutely clear that EPA is supposed to set technology-forcing NSPS.

Response:

This comment raises the issue of whether this standard has gone far enough in requiring the SOCMI industry to develop and adopt the best technology for the control of VOC emissions from new sources.

Although Section 111 of the Clean Air Act is technology-forcing to the extent that it requires new, modified, and reconstructed facilities to comply with a standard based on application of the best demonstrated control technology, the setting of that standard and the selection of that best demonstrated technology are constrained by the provisions of the Act.

As discussed in Essex Chemical v. Ruckelshaus, EPA's determination of what contributes the best demonstrated technology must be based on solid technical data. Pure speculation or prediction concerning the performance of technologies which are not currently in use anywhere within an industry cannot be used as the basis of the standard. Under this rule, technologies or procedures which are not currently in use anywhere within the industry can be considered demonstrated only if the available data show clearly that they are capable of being successfully transferred from one application to an industry being addressed by an NSPS. Although innovative or untried technologies may in some cases form the basis for an NSPS, in many cases a technology can only be demonstrated as a result of actual application and experience somewhere within an industry. Therefore, to be consistent with both National Lime and Sierra Club, technology-forcing under this standard, and many others, can only be construed to extend to the application of the best technologies and procedures currently available, not to untried or developing technologies whose performance is unproven.

In the development of this standard, a wide range of technologies and procedures were reviewed to determine their availability and performance, including both those currently practiced within the SOCMI industry and those which are developing. Based on the terms of Section 111, and considering demonstrated performance, availability, cost, energy impacts, and environmental costs and benefits, the work practices and procedures which comprise the basis of this standard, the equipment standards and the performance standards were determined to constitute the most effective application of control technology consistent with the requirements and constraints of the Act. Should other technologies or practices be developed which surpass these in effectiveness, costs, and benefits, they may be included in the subsequent 4-year review of this standard.

The diesel auto cases referred to by this commenter are not applicable to new source performance standards, but rather apply to the Vehicle Emission Standards under Title II, Part A of the Clean Air Act.

# 9. MODIFICATION AND RECONSTRUCTION

Comments received concerning modification and reconstruction provisions (40 CFR 60.14 and 60.15) as they apply to the standards have been divided into six main subject areas: (1) Clarification,(2) Suggestions for Emission Criteria for Modifications, (3) Suggestions for Changes in the Affected Facility Definition for Modifications, (4) Technical Problems with Retrofit; (5) The Capital Expenditure Criterion; (6) Coverage of Reconstructions.

## 9.1 CLARIFICATION

Comment:

Several commenters requested clarification of the modification and reconstruction provisions. (IV-D-26; IV-F-1, No.9; IV-F-1, No.6)

Response:

Section 111 of the Clean Air Act directs the Administrator to establish standards of performance for any new stationary source which causes or contributes significantly to air pollution which may reasonably be anticipated to endanger public health or welfare. Under Section 111(a)(2) and 40 CFR 60.14 and 60.15 a new source is defined as any stationary source, the new construction, reconstruction or modification of which is commenced after the date of proposal of the standards (January 5, 1981). For purposes of these standards, the stationary source is the group of fugitive emission sources within a SOCMI process unit. Each such group of fugitive emission sources on which new construction, reconstruction, or modification commences after proposal is subject to the standards, i.e. is an affected facility. An existing facility is the group of fugitive emission sources within a SOCMI process unit on which construction has not commenced after proposal.

The General Provisions (40 CFR Part 60, Subpart A) outline the procedures for implementing the Act, including the rules governing modification and reconstruction (40 CFR 60.14 and 60.15). With some exceptions, a modification is defined as any physical or operational change to an existing facility which results in an increase in emissions from that facility. The exceptions include changes such as routine maintenance, repair, and replacement; an increase in production rate accomplished without a capital expenditure; and an increase in the hours of operation. The preamble to the proposed standards pointed out that these standards are not intended to cover existing process units making routine and minor additions. The standards (40 CFR 60 Supart VV) exclude such process improvements. Such routine changes and additions at existing SOCMI units would not cause an existing facility to become an affected facility if the changes and additions are made without incurring a capital expenditure. The General Provisions define "capital expenditure" (40 CFR 60.2); the capital expenditure criterion is discussed in a subsequent comment and response.

Section 60.15 defines reconstruction as replacement of components of an existing facility to such an extent that the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost that would be required to construct a comparable entirely new facility. It must also be determined that compliance is technologically and economically feasible. The General Provisions allow for the Administrator's case-by-case determination of whether proposed replacements constitute reconstruction.

Both of these provisions apply to existing facilities that would, if affected by these provisions, become affected facilities. Increases in emissions will be determined based, in general, on the number of fugitive emission sources; if the number of fugitive emission sources increases, emissions increase unless an owner or operator takes specific actions to offset the increase due to the additional fugitive emission sources. The capital costs associated with replacing an existing facility is limited to the costs associated with replacing the fugitive emission sources only. Emissions and capital costs associated with other sources, such as process vent emissions, are not considered when evaluating the applicability of these provisions.

Comment:

One commenter (IV-D-51) wrote that the proposed NSPS is unique in the NSPS subparts because it applies not to a process but rather to equipment within a category of processes. Because of this unique difference, the commenter said it is difficult to connect the content of 40 CFR 60.14 in the General Provisions with the proposed rules. He recommended the following addition to §60.480:

> Modification of a process unit accomplished with no net increase in emissions from the group of fugitive emission sources within the process unit shall not be considered a modification under this subpart.

Response:

The commenter is correct in his interpretation of the modification provisions. A change must indeed increase emissions to be considered a modification. By definition, if a change is accomplished without an emissions increase, it is not a modification. Certain changes must also require a capital expenditure to be considered a modification.

The affected facility regulated by the standards is the group of fugitive emission sources within a SOCMI process unit. The definition of the affected facility is clearly stated in the regulation [§60.480(a)]. The General Provisions (40 CFR 60.14) use the same term, "affected facility," (and the corresponding term, "existing facility") in explaining the provisions for modification. Therefore, EPA has concluded that there is no need to clarify the modification provisions specifically in Subpart VV.

Comment:

While supporting the provision in the proposed rules that process improvements achieved without a capital expenditure are not considered modifications, one commenter (IV-D-51) offered one suggestion to improve this provision. He asked that the definition of Capital Expenditure in the General Provisions be restated in the proposed subpart with changes to make it clear for this subpart. The commenter expressed the understanding that a facility's basis used to calculate the modification investment limit [sic, "capital expenditure"] is only the affected facility and not the entire process unit. He said the present definition of "capital expenditure" in the General Provisions only fits cases where the affected facility is the same as the entire facility.

Response:

The function of the General Provisions is to define terms and list requirements that are common to all new source performance standards. The standards use the definition of "capital expenditure" as intended in the General Provisions and, therefore, it is neither necessary nor appropriate to redefine that term in Subpart VV. The definition of "capital expenditure" in the General Provisions uses the term "existing facility" and does not imply that, in the case of Subpart VV, this term means the entire process unit, and it is this facility to which the capital expenditure criterion would be applied. Subpart VV defines a "facility" (which is either an affected facility or an existing facility) as the group of all fugitive emission sources within a SOCMI unit. Thus, the General Provisions definition of "capital expenditure" fits the case of fugitive emission sources within SOCMI. A comment related to this one concerning capital availability is presented in Section 7.3.

9.2 EMISSION CRITERIA FOR MODIFICATION

Comment:

EPA was urged in three sets of comments (IV-D-7; IV-D-17; IV-F-1, No.1, p.12) to consider an allowance for a de minimis emissions increase criterion in its revisions of the proposed regulations. It was suggested that it would be reasonable to exempt sources increasing emissions by 10-20 tons per year from coverage under the modification provisions. The 10-20 tons per year cutoff was said to be supported by data contained in an EPA contractor study: Impact of Proposed and Alternative De Minimis Levels for Criteria Pollutants, June, 1980. One commenter recommended setting the cutoff at either 10 tons per year or 10 percent of the baseline emissions, whichever is greater. In one of the sets of comments (IV-D-17) further arguments for establishing an emission increase criterion were given. PSD and nonattainment reviews for permits were said to provide ample opportunity for stringent control of modified sources. According to the comment, all net increases in emissions from existing major sources must be accumulated. Then, when a 40 tons per year level is reached, a review for a permit is required. The commenter continued, saying that either BACT or LAER would be required on the last changed unit triggering review. This commenter and another commenter (IV-D-15) basically requested that EPA consider an emissions increase criterion as a possible solution to the problem of covering plants making small changes.

Response:

Under the definition in Section 111(a)(4), any physical or operational change resulting in an increase in emissions constitutes a "modification." EPA has exempted certain small emissions increases from consideration in deciding whether there has been an increase in emissions constituting a "modification" for purposes of PSD applicability (40 CFR 52.21(b)(2) and (b)(231)). This action followed the decision in Alabama Power Co. v. Costle, 636 F.2d 323 (D.C. Cir. 1979), in which the D.C. Circuit held that EPA has authority to interpret the definition of "modification" so as to exempt sources with small emissions increases from PSD review on grounds of administrative necessity (Id. at 400).

As explained in a previous response, the Alabama Power decision does not require EPA to provide a de minimis exemption from application of the "modification" definition for NSPS applicability purposes. Nor has EPA's experience in implementing the NSPS program suggested an administrative need for relieving existing sources from NSPS applicability when they undergo changes resulting in only a small increase in emissions. This differs somewhat from EPA's implementation of the definition of "modification" for PSD applicability purposes. In that area, the Agency has determined that the administrative burden of applying the full preconstruction review process to a source with only a small emissions increase may be unreasonable (45 Federal Register 52705 (Aug. 7, 1980)). The administrative burden associated with the NSPS program, however, is relatively minimal. In contrast to PSD requirements, NSPS's are categorically applicable technology-based requirements only; they do not involve an assessment of ambient effects and do not require case-by-case review.

Furthermore, EPA believes that the current straightforward application of the "modification" definition for NSPS purposes best serves Section 111's intent. One key purpose of the NSPS program is to prevent new pollution problems from arising. One way that the statute seeks to achieve this is by requiring application of the best demonstrated technology at, and thereby minimizing emissions from, existing facilities with increased emissions. The current NSPS approach of not providing an exemption from the "modification" provision based on the size of the emissions sources are not intended to cover existing plants making routine and minor additions. The "modification" provisions in the General Provisions of 40 CFR Part 60 exempt changes such as additions made to increase production rate (if they can be accomplished without capital expenditure, as defined in the General Provisions) and routine replacements (40 CFR 60.14(e)). In addition, these standards would exempt additions made for process improvements if they are made without incurring a capital expenditure.

## 9.3 AFFECTED FACILITY DEFINITION FOR MODIFIED SOURCES

Comment:

One commenter (IV-D-15) was concerned that the financial guidelines provided by EPA to define a capital expenditure could result in inappropriate application of performance standards. The commenter thought this might especially be a problem for small production facilities with limited assets. He cited an example. If a distillation column were added to an existing unit, the entire unit and all associated equipment would be subject to the NSPS. The situation appeared unreasonable to him in view of the fact that the fugitive emissions sources associated with the new column would contribute only a small incremental increase in the overall VOC emissions from the unit. He further commented that upgrading and retrofitting all the fugitive emission sources within the unit would substantially increase the capital required for the project and could possibly result in abandoning it altogether. As a solution, the commenter suggested limiting the scope of the affected facility to individual equipment being added or replaced for modified facilities. He offered another alternative: an emissions increase criterion (see Section 9.2).

Response:

The Clean Air Act requires that standards of performance be applied to existing sources which increase emissions. EPA has carefully analyzed the modification and reconstruction provisions which might apply to existing SOCMI units. The Agency has concluded that the provisions offer sufficient flexibility for continued productive operation and reasonable protection against inappropriate coverage of existing facilities within the context of the Clean Air Act. In developing the standards, EPA considered retrofit costs which would be incurred if an existing unit were covered under modification provisions. In selecting the final standards, EPA selected standards based on cost-effectiveness considerations. Furthermore, the economic analysis for this regulation showed no capital availability problem, nor did it show any unreasonable economic impact.

The commenter's example and interpretation of the modification and reconstruction provisions which would apply shows some confusion about the provisions themselves and the affected facility to which they apply. Because the determination of a capital expenditure is based on a percentage of the purchase price of the existing facility, small and large production facilities should be affected equally. The commenter may be referring to a production facility owned by a small business instead of a small production facility. Still, as shown in Section 7.3, the economic analysis showed no adverse impact on small businesses.

Furthermore, the affected facility to which the standards apply is the group of all fugitive emission sources (pumps, compressors, sampling connections, safety/relief valves and open-ended lines) within a process unit. If a new distillation column were added to an existing process unit, the cost basis used to determine whether a capital expenditure had been made is the cost of the added fugitive emission sources compared to the cost of the existing fugitive emission sources. The cost basis does not include the cost of the column or the entire process unit.

The existing modification provisions in 40 CFR 60.14 and the process improvement exemption in the SOCMI standards prevent small increases in emissions due to routine activities from causing modification to occur. Finally, it is important to note that to be considered a modification, a change made must increase emissions from the existing facility. If a change is made that would increase emissions, but that potential emissions increase is offset so there is no net increase, then the change is not considered a modification.

The preamble to the proposed regulation (40 CFR 1136, January 5, 1981) explained that the commenter's suggestion of limiting the scope of the affected facility to the individual equipment being added or replaced was considered. However, such a designation would mean that replaced equipment components in existing units would be subject to the new source standards, while adjacent components would not be subject to the standards. Determining which components were subject to the requirements of the standard would be impracticable for the owner/operator and for EPA. Therefore, the individual equipment definition was not selected for the affected facility.

The commenter's suggestion of an emissions increase criterion was also considered at proposal. This issue is discussed in Section 9.2.

9.4 TECHNICAL PROBLEMS WITH RETROFIT

Comment:

One commenter (IV-D-24) wrote that some existing SOCMI plants might be subject to the rule by virtue of modification or reconstruction. In these cases an enclosed combustion device would be required. For safety reasons, the combustion device should be located at a distance from the process area. However, the commenter said there might not be enough space to install a combustion device in an appropriate location. For this reason, he said modified and reconstructed facilities should be relieved of the requirement to install a combustion device.

Another commenter (IV-D-15) cited the same problem of space limitations. He said existing plants often would not have room for barrier fluid systems and combustion devices. He added that locating these pieces of equipment at a distance from pumps and compressors would increase construction and operating costs by requiring more piping to interconnect the systems and increasing the energy costs to run the system.

Response:

Regardless of whether a unit is a new or existing unit, EPA expects that an existing control device will be used. The control device need not be a combustion device. Furthermore, since proposal, some of the provisions which would have required a control device have been changed. The changes effectively mean that a control device is not necessarily required; in fact, most units will not require a control device.

The proposed standards required that pumps and compressors be controlled with a barrier fluid/dual seal system. The vent streams from this system were to be destroyed in an enclosed combustion device or 95 percent efficiency vapor recovery system. However, the final standards allow an owner or operator of an affected facility to choose among several methods for compliance with the final standards for pumps and compressors. First, the final standards for pumps do not require a control device. An owner/operator may choose to comply with a work practice standard for pumps instead of the equipment standard as originally proposed. The work practice standard eliminates the need for a control device. The standards allow vent streams from pump and compressor barrier fluid systems to be controlled by flares, enclosed combustion devices, or any other control device designed and operated for 95 percent efficiency. The provision for allowing flares means that if a control device is required, additional options are available to the owner or operator. The provision for allowing flares also means that a control device will most assuredly be present in all SOCMI process units. As discussed in Section 4.1, smokeless flares are only allowed if they are operated within certain exit velocity and gas heat content criteria.

Another change in the standards was made specifically to avoid retrofit problems with existing compressors. If an existing compressor becomes subject to the rules by virtue of modification and reconstruction and it cannot be vented because vents cannot be provided in the existing hardware surrounding the seal area, it is exempt from complying with the compressor standards. This provision is discussed more fully in Section 4.12.

Comment:

One commenter (IV-D-15) gave another example of a retrofit problem with rupture disks. He said the increased bulk and weight of the new pressure control system may exceed the stress limits of existing tower welds and connections. Increasing the strength of these new connections would be costly and would require additional downtime for installation.

Another commenter (IV-D-2) offered some solutions to retrofit problems for pressure relief devices. He said if a combination rupture disc/relief valve that had been flow-tested by the National Board of the ASME code were selected, a larger relief device would not be required. He also offered a solution to the problem of having fixed piping upstream and downstream of the relief device. This situation prevents the device from being moved up several inches to allow space for a rupture disc. He recommended a rupture disc welded into a flange that fits down in the piping and has only a minimal height of 1/8 to 1/4 inch. The price of the welded disk and holder is about half the price of a standard disk and holder.

Response:

The standards do not require rupture disks as a control device. The standards require "no detectable emissions" (defined as no higher a concentration than 500 ppmv measured by a portable VOC monitor) from safety/relief valves except during emergency venting. This standard may be met in any way which results in no detectable emissions. Two ways, for example, would be by using rupture disks or by piping to a flare header. If rupture disks are chosen as the method of control, there are some new methods for overcoming some of the retrofit problems as described by the commenter in IV-D-2.

The problem posed by the commenter regarding strengthening tower welds would be an unusual circumstance from an engineering point of view. However, if bracing or supporting is required, it can be done while the unit is undergoing modification or reconstruction. No additional downtime would be required. EPA recognizes that in retrofit situations more complicated installation procedures may be required. These expected complications have been accounted for in retrofit installation costs which are higher than costs for new installations.

9.5 CAPITAL EXPENDITURE CRITERION

Comment:

One commenter (IV-D-7) described some problems with the capital expenditure criterion applied to determine modifications. He said such a criterion would be difficult to administer. He commented that a company's records may not be detailed enough to reflect the cost basis under Internal

Revenue Code 1012. An even bigger complication was seen in the fact that the concept of "annual asset guideline repair allowance percentage" is a part of the Asset Depreciation Range System (ADR) under the Internal Revenue Code. According to the commenter, President Reagan's tax proposals would repeal the ADR for property placed in service in 1981 and later years. Other proposals would make the ADR optional. However, under any of the new proposals, a company would have to maintain additional records for post-1980 assets, solely for the purpose of the proposed regulation.

Response:

This comment describes two possible problems with using a capital investment criterion to determine exemptions from the standards for routine replacement and additions made to increase the production rate. The first problem is that a company may not have kept accounting records that are in sufficient detail to reflect the cost basis of the existing facility. This cost is necessary to determine if a particular expenditure constitutes a capital investment. It is true that this difficulty may be a larger problem for the SOCMI fugitive VOC regulation than for many other new source standards. The difficulty arises in the fact that the affected facility is the group of fugitive emission sources within the process unit rather than the entire unit so that the total cost is composed of many small cost items. However, there are ways to handle this problem. For example, one way to estimate the cost of emission sources would be to prorate costs, based on the present ratio of fugitive emission source costs to total costs. The use of replacement costs with an appropriate adjustment to reflect original costs would be considered by EPA. Therefore, because estimation methods can provide a sufficiently accurate cost estimate of the existing sources, EPA sees no reason to make the suggested change.

The second problem discussed in this comment with the capital investment criterion is the tax reform which changes the depreciation rules for new facilities . The annual asset guideline repair allowance percentage, referenced by the General Provisions (40 CFR 60.2) for the purpose of defining a capital investment remains in effect for existing units. It was included in IRS Publication 534 for 1981 tax returns. Existing units can still use the allowable percentage for determination of whether a capital expenditure has occurred.

SOCMI units built in the future will use the accelerated depreciation system for which there is no allowable repair percentage; however, they will be covered by the standards in any case. EPA is currently considering changes to the General Provisions which would solve the potential problems which would arise with facilities which would become subject to NSPS in future years.

Comment:

Another comment letter (IV-D-17) stated that the commenter's understanding was that process improvements costing up to 12.5 percent annually of the original investment would not by themselves be considered a modification.

Response:

The commenter's statement is correct with some qualifications. The figure of 12.5 percent of the original investment for fugitive emissions sources represents the maximum expenditure that could be made annually for routine replacement and minor additions without triggering application of the modification provisions.

The calculation of this limit is explained in the definition "capital expenditure" in 40 CFR 60.2. It is the product of the applicable "annual asset guideline repair allowance percentage" specified in the latest edition of Internal Revenue Service (IRS) Publication 534 and the existing facility's basis. For 1980 and 1981, the annual asset guideline repair percentage was 12.5 percent; however, this is subject to change annually. In 1979, for example, the repair percentage was 5.5.

It is important to note that an increase in emissions is the primary test for determining if some physical or operational change to an existing facility constitutes a modification. Moreover, changes made for process improvements [and other changes as described in 40 CFR 60.14(e)] which increase emissions would not be considered a modification if the capital expenditure limit has not been exceeded. For example, an owner or operator might add a control loop consisting of about 5-10 valves for purposes of improved process efficiency. If the cost of these valves did not exceed the 12.5 percent allowance of the original fugitive emission source costs, the change would not be considered a modification.

Comment:

One commenter (IV-D-34) agreed with EPA's expression that "NSPS for SOCMI sources are not intended to cover existing plants making routine and minor additions." He further agreed that exemptions should apply for routine replacement and for additions made for production rate increases if such increases can be accomplished without capital expenditures.

Response:

The provisions for exempting production rate increases made without capital expenditures may be found in 40 CFR 60, Subpart A.

Comment:

Another commenter (IV-D-26) favored allowing capital expenditures if there were no emissions increase. He said that eliminating the capital expenditure criterion would allow updating of existing facilities while limiting VOC emissions. Unless some provision is made for capital expenditures, he added, older existing plants may not be upgraded into more efficient facilities which incorporate current technologies.

Response:

Capital expenditures are allowed to some extent under modification and reconstruction provisions. Existing facilities may spend up to 50 percent of the cost of a comparable new facility and not be covered by the standards if emissions are not increased. However, if emissions are increased and a capital expenditure is made (i.e., is greater than the product of the applicable annual asset guideline repair allowance percentage and the existing facility's basis), then the facility becomes a modified facility. The intent of the Modification and Reconstruction Provisions is discussed in a previous comment in Section 9.1.

## 9.6 COVERAGE OF RECONSTRUCTIONS

Comment:

One set of comments (IV-D-17) said that EPA should revise 40 CFR 60.15 to limit the applicability of the proposed NSPS requirements to reconstructions. Reconstructions are essentially more comprehensive modifications and to be consistent with the definition of modification, should not be subject to NSPS unless there is an increase in net emissions at the process unit. The comment cited a brief, filed by the steel industry in nonattainment litigation, which demonstrates that the Clean Air Act would not require application of NSPS to reconstructions where no emission increases occur. The comment said that, in apparent recognition of the reasonableness and legal support for industry's position, EPA proposed to exclude reconstructions from nonattainment area new source review (46 FR 16280). This argument continued that it is completely within EPA's authority to limit the applicability for reconstruction of existing facilities from any new source review requirements. The comment said this change would offer the benefit of permitting full use of the bubble concept at the process unit without any undue restrictions based on air quality.

Another commenter (IV-D-48) wrote that the definition of "reconstruction" at 40 CFR 60.15(b) is ambiguous in light of the statement of applicability of 40 CFR 60.480(a) and the definition of "process unit" at 40 CFR 60.481.

He argued that, as these definitions are written in the proposal, it is possible for a facility, over a period of years, to reach the 50 percent of capital cost of construction of a new facility and thus become an affected facility. Accordingly, the definition of "reconstruction" at 40 CFR 15(b)(I) is inadequate and should be amended to prevent this occurrence. The commenter proposed that one or more of the following suggestions be implemented to accomplish this amendment:

(I) Provide for a specified time limit during which accrual of capital expenditures should occur. This time limit would have to be of sufficient duration, e.g., two years, to prevent stretching such repairs to avoid coverage.

(2) Amend the definition to provide that, for purposes of determining whether or not the 50 percent test is met, the cost of equipment which is accrued be a single piece of process equipment and directly related support equipment, e.g., pumps. Where such support equipment is shared in common by two or more pieces of process equipment, the capital replacement cost of the support piece could be apportioned either equally or according to pro rata usage among the various pieces of process equipment served.

(3) Amend the definition to provide that a repair qualifies as a reconstruction only where there is a net increase in emissions from the process unit.

This third approach was said to be, by far, the most desirable approach since it provides a measure of pollution control which is unaffected by external forces, such as inflation.

Response:

Since in enacting Section 111 Congress did not define the term "construction," the question arose whether NSPS would apply to facilities being rebuilt. Noncoverage of such facilities would have produced the incongruity that NSPS would apply to completely new facilities, but not to facilities that were essentially new because they had undergone reconstruction of much of their component equipment. This would have undermined Congress's intent under Section 111 to require strict control of emissions as the Nation's industrial base is replaced.

EPA promulgated the reconstruction provisions in 1975, after notice and opportunity for public comment (40 FR 58420, December 16, 1975), to fulfill this intent of Congress. Since this turnover in the industrial base may occur independently of whether emissions from the rebuilt sources have increased, the reconstruction provisions do not focus on whether the changes that render a source essentially new also result in increased emissions.

Congress did not attempt to overrule EPA's previous promulgation of Section 60.15 in passing the Clean Air Act Amendments of 1977. This indicates that Congress viewed the reconstruction provisions' focus on component replacement, rather than emissions level, as consistent with

Section 111. See, e.g., Red Lion Broadcasting Co. v. FCC, 395 U.S. 367 (1969); NLRB v. Bell Aerospace Division, 416 U.S. 267 (1974). Nor has any Court questioned the Agency's authority to subject reconstructed sources to new source performance standards. In fact, in ASARCo v. EPA, 578 F.2d 319, 328 n.31 (D.C. Cir. 1978), the D.C. Circuit suggested that the reconstructed provisions may not go far enough toward preventing possible abuses by owners seeking to avoid NSPS by perpetuating the useful lives of their existing facilities indefinitely. Failure to cover facilities that have undergone extensive component replacement over a long period of time similarly postpones the enhancement of air quality Congress sought under Section 111. The D.C. Circuit recognized this when it expressed concern in the ASARCo case that, absent a provision for aggregating replacement expenditures "over the years," owners could evade the reconstruction provisions by continually replacing obsolete or worn-out equipment, [578 F.2d 319, 328 n.31 (D.C. Cir. 1978)].

Section 60.15 currently defines "reconstruction" as the replacement of components of an existing facility to such an extent that "the fixed capital cost of the new components" exceeds 50 percent of the "fixed capital cost" that would be required to construct a comparable entirely new facility and EPA determines that it is technologically and economically feasible to meet the applicable NSPS. Subsection (d) indicates that the "new components" whose cost would be counted toward the 50 percent threshold include those components the owner "proposes to replace." It is unclear under this wording whether a reconstruction has occurred in the case of an owner who first seeks to replace components of an existing facility as a cost equal to 30 percent of the cost of an entirely new facility and then, shortly after commencing or completing those replacements, seeks to replace an additional 30 percent. Specifically, it is uncertain whether the owner should be deemed to have made two distinct proposals, or instead a single proposal. If EPA would take the former view, owners could avoid NSPS coverage under Section 60.15 simply by characterizing their replacement projects as distinct proposals, even where the component replacement is completed within a relatively short period of time.

EPA did not intend, in promulgating the reconstruction provisions, that the term "propose" exclude from NSPS coverage facilities undergoing this type of extensive component replacement. Failure to cover these sources serves to undermine Congress's intent that air quality be enhanced over the long term by applying best demonstrated technology with the turnover in the Nation's industrial base.

To eliminate the ambiguity in the current wording of Section 60.15 and to further the intent underlying Section 111 (as described above), the Administrator is interpreting proposed replacement components to include all replacements which are required by programs of construction of alteration which commence (but are not necessarily completed) during any 2-year period for determinations of reconstruction. Stated differently, the Agency will count toward the 50 percent reconstruction threshold the fixed capital cost of all depreciable components (except those described below and elsewhere in this document) required for replacement in all continuous programs of reconstruction which commence within any 2-year period following December 17, 1980. In the Administrator's judgment, the 2-year period provides for this industry a reasonable, objective method of determining whether an owner is actually proposing extensive component replacement, within the Agency's original intent in promulgating Section 60.15.

The Administrator must decide on a case-by-case basis if proposed replacements constitute reconstruction. This decision is based on the following: (1) fixed capital cost of replacement and estimated life of the facility after replacement compared to the cost and life of a comparable entirely new facility, (2) the extent to which the components being replaced cause or contribute to emissions from the facility, and (3) economic or technical limitations on compliance inherent in the proposed replacements.

The brief and the Federal Register notice cited in one of the comments both deal with nonattainment provisions rather than NSPS. The Federal Register citation (46 FR 16280, March 12, 1981) proposed to standardize the definitions of "source" for new source review in attainment and nonattainment areas. Among other changes, the proposal seeks to drop the requirement that reconstructions be subject to nonattainment new source review.

However, as part of the rationale for dropping reconstructions from this review, EPA stated that NSPS would assure the use of the most up-to-date pollution control techniques, regardless of the applicability of nonattainment area new source review. Thus, it is consistent with the brief and the Federal Register notice to continue reconstruction as is for these standards.

# 10. EQUIVALENCY

Three commenters (IV-F-1, No. 4; IV-D-17; IV-D-18) were concerned with equivalency provisions in the proposed standards. Two comments referenced the equivalency provisions of standards already promulgated. The other comments involved equivalency for test methods and equivalency demonstrated by vendors.

Comment:

According to one commenter (IV-F-1, No. 4), although the proposed equivalency procedures are detailed, they are not specific enough to insure that, having met the requirements, equivalency is virtually automatic. The commenter said the approach taken in the regulations for storage vessels for petroleum liquids constructed after May 18, 1978 was simpler and more straightforward and would be preferred over the present proposal.

Response:

The equivalency provisions for storage vessels for petroleum liquids constructed after May 18, 1978 (40 CFR 60.114a) provide that the Administrator may approve the use of equipment and/or procedures that have been demonstrated to his or her satisfaction to be equivalent in terms of reducing VOC emissions to that level required by the standards. The following four items must be provided in the written application for equivalency by the owner/operator: (1) emissions data, including a description of the measurement method; (2) design specifications and estimated emissions reduction capability of the control equipment; (3) an operation and maintenance plan for the control equipment; and (4) any additional information that would aid in evaluating equivalency.

Section 60.484 allows an owner or operator to apply to the Administrator for determination of equivalency for any alternative means of emission limitation that achieves a reduction in emissions of VOC at least equivalent to the reduction achieved by the required controls. Guidelines for application for equivalency are also presented in Section 60.484. The requirements are essentially the same as those for petroleum storage vessels. The guidelines are more extensive and detailed for the SOCMI standards because several different sources are regulated by different formats. Guidelines are presented for equivalency to equipment standards, as well as for work practice standards.

After reviewing the equivalency provisions of the proposed standards, EPA concluded that the detail included in the equivalency provisions is necessary to provide an understanding of what an owner or operator will have to demonstrate to obtain equivalency. It was also concluded that the proposed provisions were explicit enough to convey what was needed without being so explicit as to limit options of an owner/operator applying for equivalency. Therefore, after these considerations were made, EPA decided to promulgate the equivalency provisions as proposed except for the addition of a provision for allowing manufacturers and vendors to apply for equivalency. This addition is discussed in a later comment in this section.

Comment:

Two comments were made concerning equivalency and monitoring. One commenter (IV-D-18) said monitoring systems which are equivalent to those required by the vinyl chloride NESHAP (40 CFR 61.55(b)(8)) are equivalent to the monitoring requirements for the NSPS. He felt that these equivalent monitoring systems should be written into the final regulations as alternatives.

Response:

Section 61.65(b)(8) of the vinyl chloride NESHAP addresses "leak detection and elimination" of fugitive emissions from ethylene dichloride, vinyl chloride (VC) and polyvinyl chloride plants. This section calls for VC emissions "to be minimized by instituting and implementing a formal leak detection and elimination program." The program, developed by the owner/operator and subject to the approval of the Administrator, must incorporate the following features:

(1) A VC monitoring system (fixed point monitors) for detection of major leaks and identification of the general area of the plant where a leak is located;

(2) A portable hydrocarbon detector to be used routinely to find small leaks and to pinpoint the major leaks indicated by the fixed point system. The sensitivity of such a device must be at least 10 ppmv;

(3) A calibration and maintenance schedule for the items in (1) and (2).

The specific requirements of each program must be appropriate for the individual plant. That is, the definition of leak is made based on background concentration measurements and the features of the overall monitoring program (location and number of fixed points, as well as frequency of monitoring) depend upon the size, layout, etc. of the plant.

In choosing a monitoring system/procedure for the SOCMI fugitive emissions standards, several alternative approaches were considered. One such system was the same system specified by the vinyl chloride NESHAP. This system, however, was not selected for the SOCMI NSPS since monitoring with a portable VOC detection instrument would be required in both cases and the fixed point/portable monitoring system was more capital intensive. Moreover, EPA believes the fixed point system is less efficient in detecting leaks due to possible meteorological interference. Thus, the monitoring system may not be equivalent to that required by the SOCMI NSPS.

EPA has recently reviewed the programs developed by polyvinyl chloride and vinyl chloride manufacturers. The portable monitoring programs vary considerably among the owners and process units affected by the vinyl chloride standard. Large variations are seen in leak definition, repair interval, and monitoring interval. Some of the variations are so large that equivalency to the SOCMI NSPS is questionable. EPA believes that this large variation should be minimized. Therefore, EPA is considering clarifying the vinyl chloride standards to include specific monitoring requirements. In general, the VC Standard is more restrictive than the SOCMI NSPS. However, as mentioned above, some aspects of the VC standard may not have been adequately implemented. Where the VC standard is more restrictive, the SOCMI NSPS provides automatic equivalency within the standards. For example, double mechanical seals are required for pumps in the VC standard, even though monthly monitoring generally is required in the SOCMI NSPS, double mechanical seals are explicitly allowed, and if used monthly monitoring is not required in the SOCMI NSPS. Where the VC standard is unclean or less restrictive than the SOCMI NSPS, the additional clarity or emission reductions are warranted. Thus, based on these considerations, EPA decided not to remove VC from the SOCMI list or draft the VC monitoring procedure into the NSPS as alternatives. If a plant has a good system in place, that plant could apply for permission to use an alternative plan.

Comment:

In another comment letter (IV-D-17) equivalency provisions were requested for test methods and procedures, as well as for control techniques. The commenter's concern was that the regulations do not provide the necessary flexibility to approve in the future the use of new instruments that may use different calibration systems which may provide equivalent or more accurate results.

Response:

Equivalency determinations are allowed for performance tests and monitoring by the General Provisions (40 CFR Sections 60.8 and 60.13). Also, Reference Method 21 gives specifications for the monitoring instrument that are general enough so as to allow new analytical developments. Therefore, new instruments using different calibration procedures would be allowed when the results of the equivalent method have been demonstrated to be at least as accurate as the results obtained by the required methods.

Comment:

Another commenter (IV-D-17) requested that vendors and manufacturers be allowed to apply for equivalency. The commenter said that in the real world context few companies would purchase an innovative control system unless the manufacturer stated that EPA had approved the system.

Response:

The equivalency provisions of the proposed standards (§60.484) did not directly allow a vendor or manufacturer to apply for equivalency. Since proposal, the proposed equivalency provisions have been changed to allow a vendor or manufacturer to apply for equivalency. However, it should be remembered that efficiency of some control techniques can only be shown to be equivalent by the owner or operator. For those, EPA will not grant equivalency determinations to vendors or manufacturers. The ultimate responsibility for insuring the equivalency of alternate methods is on the owner or operator, not on the vendor or manufacturer.

# 11. RECORDKEEPING AND REPORTING

Comments were received on the recordkeeping and reporting provisions of the proposed standards. They fall roughly into four areas. The first area of comments concerns the burden of recordkeeping and reporting provisions. Another area concerns specific recordkeeping provisions, mainly centering on the requirement for having records readily accessible. The other two areas concern tagging requirements and provisions for delaying repair past 15 days.

## 11.1 REPORTING BURDEN

Comment:

Several commenters (IV-F-1, No.4; IV-D-24; IV-D-5; IV-D-17; IV-D-20; IV-D-22; IV-D-7; IV-D-34; IV-D-32) said the proposed reporting requirements were excessive and burdensome. One commenter (IV-D-24) said quarterly reporting should be reduced to annual reporting. He noted that annual reports were the precedent at both State and Federal levels. He further cited dual advantages to this recommended change: a reduction in manpower required at the plant and a reduction in the size of the bureaucracy needed to review the reports. Another commenter (IV-D-20) suggested that reports be eliminated. He said that records were required and that they were available at any time to EPA personnel. He argued that reporting would do nothing to further compliance.

Three comment letters (IV-D-17; IV-F-1, No.1; IV-D-22) said State reporting requirements overlapped with the proposed reporting requirements for the new source standard. It was suggested (IV-D-17; IV-D-22) that reports be submitted to the States; EPA could then request information from the States.

One commenter (IV-D-21) said that requiring certification of the quarterly reports by the owner or operator is excessively burdensome and inconsistent with other new source performance standards (NSPS) reporting requirements. He cited as an example the fact that industrial boiler NSPS excess emission reports do not require owner or operator certification. He argued that such statements were more properly signed by an authorized representative or designate.

Two provisions were suggested as additions to the proposed requirements (IV-D-17). One suggested addition was a provision for reporting the number of leaking sources not repaired at shutdown. The other suggested addition was a provision for reporting the number of pump and compressor leaks not repaired within 15 days.

Response:

The proposed standards included reporting provisions requiring periodic reports of leak detection and repair efforts within a process unit. The reported information was regarded by EPA as a good way to judge how diligently the required leak detection and repair program had been implemented. The reporting requirements were considered a means of reducing in-plant inspections. The costs of reporting were assessed and judged reasonable.

EPA continues to believe that reporting requirements would reduce in-plant inspections as a means of determining compliance. But the quarterly reporting requirements in the proposed standards have been reduced to semiannual reporting in the final standards. The semiannual reports may be waived for process units in States with the delegated authority to enforce the standards provided (1) EPA approves the reporting requirements or an alternative means of compliance surveillance adopted by the State and (2) the process unit complies with the requirements established by the State. The one-time notification requirements given in the General Provisions, however, have not been eliminated from the final standards. Therefore, any reporting overlap (notifications, etc.) between State and Federal requirements can be determined when the States request information.

As explained at proposal, three alternatives were considered for reporting requirements. The three alternatives represented trade-offs between varying amounts of in-plant inspections and report preparation for enforcement. The first alternative required minimum reporting and relied on inspections for enforcement. The third alternative relied almost totally on reports and would require a minimum of inspections to judge compliance. The second alternative, the one selected for proposal, represented a compromise with some reporting and some inspections required. However, EPA has concluded that periodic reporting requirements are necessary and has included semiannual reporting requirements in the final standards. The reporting requirements have been streamlined to reporting of data on leak detection and repair of pumps, valves, and other equipment types only. In addition, the requirement of certification of periodic reports has been eliminated. This alternative requires an intermediate amount of reporting and relies also on in-plant inspections for assessing compliance with the standards. However, the semiannual reporting requirements may be waived for process units in any State that is delegated authority to enforce these standards provided certain criteria of reporting requirements are met.

In addition to periodic reporting, the following reports are required for compliance with the final regulation:

(1) Notification of construction [40 CFR 60.7(a)(1)] or reconstruction [40 CFR 60.15];

(2) Notification of anticipated startup [40 CFR 60.7(a)(2)];

(3) Notification of initial startup of affected facilities [40 CFR 60.7(a)(3)];

(4) Notification of physical operational changes in equipment specifications [40 CFR 60.7(a)(4)].

If an owner or operator opts for compliance with an alternative standard, the following additional reports may be required, depending on the standard selected:

(1) Notification of intent to comply with an alternative standard [§60.487(b)];

(2) Performance test results [40 CFR 60.8 except as noted in §60.487(c)].

Comment:

Several commenters felt that some or all of the data requirements of the proposed reporting provisions are irrelevant for determining compliance (IV-F-1, No.4; IV-D-17; IV-D-21; IV-D-23; IV-D-7). Specifically cited as irrelevant for compliance purposes, and therefore unnecessary, were the number of valves repaired (IV-D-17; IV-D-23); the number of valves in the process unit (IV-D-17; IV-D-7); the number of valves, pumps, and compressors found leaking (IV-D-17; IV-D-21); and the number of leakless valves (IV-D-21). Three of the commenters interpreted the proposed reporting requirements as being devised solely for data collection and enforcement (IV-F-1, No.1; IV-D-17).

Section 114 of the Clean Air Act was cited by one commenter (IV-D-17; IV-D-50) in speaking of reporting requirements. This commenter said that if data/information required by the proposed reporting provisions were not relevant to ascertaining a source's compliance, the Agency will have exceeded its authority under Section 114.

Response:

The commenters are concerned that the information required in periodic reports was irrelevant to determining compliance and, therefore, exceeded EPA's authority of collecting data under Section 114 of the Clean Air Act. Section 114 established EPA's authority to gather information to enforce regulations. This authority applies to enforcing promulgated standards, as well as to gathering information on which standards will be based and later enforced. Therefore, EPA's authority under Section 114 would not be exceeded by their required data since EPA deemed that data necessary for determining compliance with the standards.

As noted in the previous response, however, the routine periodic reporting requirements have been reduced to semiannual reporting in the final standards. The data that must be reported in the semiannual reports must also be maintained as part of the recordkeeping requirements. Inspection of records will also be used to determine compliance with work practice standards.

Comment:

The meaning of §60.487(a) was said to be unclear and duplicative of the sections that followed (IV-D-17). Deletion of this section was recommended.

Response:

Section 60.487(a) of the proposed standards required that reports contain the information recorded under §60.486. The meaning of this section was neither unclear nor duplicative. The information required to be reported in the semiannual reports that are part of the final standards has been streamlined. Moreover, those data that must be reported are clearly defined in §60.487(b) for the initial semiannual report and in §60.487(c) for the subsequent semiannual reports. The data required in the routine reports include information summarized from records on leak detection and repair of pumps, valves, and other equipment.

Comment:

Another commenter (IV-D-22) thought that the recordkeeping and reporting requirements were not in concert with the Paper Work Reduction Act of 1980 (44 CFR Chapter 35).

Response:

The recordkeeping and reporting requirements for compliance with the new source standards have been reviewed and approved by the Office of Management and Budget as required by the Paper Work Reduction Act of 1980 (44 USC 35). As stated previously, quarterly reporting has been reduced to semiannual reporting in the final standards. This reduction is consistent with the intent of the Paperwork Reduction Act of 1980. As explained below, records documenting the performance of the work practices are also necessary for judgement of compliance and are, therefore, required by the standards.

Comment:

Two comment letters (IV-D-17, IV-D-23) said that a single certification statement should be allowed for those plants containing more than one affected facility.

Response:

Certification of a process unit's full compliance with the standards is not required under the promulgated standards. However, if States or EPA Regional Offices request reports under Section 114 of the Clean Air Act, a single certification would be allowed.

## 11.2 RECORDKEEPING

Comment:

Several commenters (IV-D-7; IV-D-17; IV-D-21; IV-D-48) objected to the proposed requirement for keeping records, technical data, and logs available for EPA inspection at the manufacturing site. One commenter (IV-D-17) went on to refer to Section 114 of the Clean Air Act saying that the Administrator has exceeded his authority by requiring records to be kept on-site and available for EPA scrutiny. According to the commenter, these data are not commonly kept on-site, but may be housed at some central corporate location. The industry was willing to make applicable records available upon request by EPA. One commenter noted that, for the purposes of demonstrating compliance, it is not necessary to keep the required data together at one location. Another of the commenters (IV-D-48) asked that the requirements be modified to allow an owner/operator to supply the information within a reasonable period of time. He went on to say that EPA had not demonstrated that the failure to keep such information in the manner proposed will frustrate the purpose and intent of the Clean Air Act.

Response:

Section 114 provides that, with respect to determining whether any person is in violation of a standard, EPA may require any person who owns or operates any emission source or who is subject to any requirement of the Clean Air Act [other than a manufacturer subject to the provisions of section 206(c) or 208] to establish and maintain records; to make reports; to install, use, and maintain monitoring equipment or methods; to sample emissions (in accordance with methods, locations, and intervals prescribed by the Administrator); and to provide other information EPA may reasonably require. Section 114 further provides that EPA shall have a right of entry to, upon, or through any premises owned or operated by persons subject to requirements of the Clean Air Act or to premises in which records required to be maintained are located. EPA may at reasonable times have access to and copy any records, inspect any monitoring equipment and methods required and sample any emissions which an owner or operator is required to sample. EPA has determined that records are necessary to determine compliance with the standards. The standards state (§60.486) that the required records must be kept in a readily accessible location. Section 114 gives the Administrator authority to require and inspect such records at the site and the General Provisions (§60.7(d)) require that the records must be recorded in a permanent form, suitable for inspection. EPA's intention in calling for a readily accessible location is to facilitate plant inspections by having records which can be used to judge compliance on the plant site. After consideration of the burden associated with these records, EPA concluded that the recordkeeping requirements are reasonable.

Information needed to document compliance with the final standards consists of various sets of information, depending upon the type of standard. For equipment and design standards, detailed information of system design and design changes must be maintained to ensure that the desired design criteria are met. For equipment standards such in §60.486(e), criteria for barrier system failure must be recorded and updated if that criteria changed. Recording the required information for work practice standards (leak detection and repair programs) in particular, is not burdensome because the manager of such programs needs this information to manage the program effectively.

Keeping the records at the plant site does not represent a hardship because the information must be generated at the plant. This does not mean that the records must be maintained within the process unit, but they should be readily available for review during an unannounced inspection. If the records are to be stored at another facility in another location, they would have to be shipped there from the plant for storage and would not be available at such an inspection.

Comment:

Another commenter (IV-D-24) preferred recordkeeping as a method of measuring compliance instead of reporting. He said that rather than EPA specifying reporting requirements, each plant should be allowed leeway to formulate its own recordkeeping methods to assure compliance with the regulation.

Response:

As discussed in the previous section on reporting, the periodic reporting requirements have been reduced to semiannual reporting in the promulgated regulation.

As authorized under Section 114 of the Clean Air Act, Section 60.486 of the standards specifies the information that must be recorded in order to determine compliance. The information to be recorded is information that would be required by the manager of the leak detection and repair program in administering it. Furthermore, this information is needed for enforcement personnel to determine compliance with work practice standards. These records serve as the primary tool to prepare the semiannual reports upon which to base a compliance determination. While the information to be recorded is specified, the standards do not prescribe a format for recording this information. The required information may be recorded in any useful form.

Comment:

Another commenter (IV-D-7) said that EPA's need to review records should not be a continuing requirement and that EPA should request information under Section 114 of the Act.

Response:

Compliance with work practice standards is determined by inspection and review of records. Thus, to judge compliance, EPA will need to review the records. Section 114 of the Clean Air Act gives the Administrator authority, beyond requesting information, to inspect the required records at any time. The required recordkeeping is a continuous process and, as explained in the response to the previous comment, EPA would inspect the records when performing a plant inspection. Contrary to the apparent belief of the commenter, EPA has no reason to believe that information would be recorded if it is not required by the standards.

Comment:

Records pertaining to equipment installed for compliance with equipment standards were considered unnecessary by one commenter (IV-D-17). This commenter recommended that inspection of equipment for proper operation is all that is necessary to ensure compliance. He said that the equipment records would be an additional cost to industry and would result in no decrease of fugitive emissions.

Response:

It is not clear to what recordkeeping provisions the commenter is referring. The only recording requirements associated with equipment standards is in §60.486(g) [§60.486(e) of the proposed standards] which requires that the criterion for failure of a barrier fluid system be recorded and any changes in that criterion noted. The commenter may have been referring to the recordkeeping provisions [§60.486(d); §60.486(c) of the proposed standards] for design standards which require detailed schematics, design specifications, and piping and instrumentation diagrams for closed vent systems, enclosed combustion devices, and vapor recovery systems.

As required by both sections, the records document how the equipment will achieve the required design level and describe any design changes. The records are necessary since compliance cannot be determined without them. For example, the specific design arrangements of a dual seal system cannot be established without a shutdown of equipment; thus, without the information on the seal system design, compliance cannot be determined. Therefore, these records are necessary for EPA to determine whether the equipment is in compliance with the standards.

Comment:

One commenter (IV-D-48) wrote that, since the purpose of the proposed standards is to control fugitive VOC emissions, he failed to understand the logic or the necessity for requiring data recording beyond information about the date of testing for monitored sources which do not leak.

Response:

It appears that the commenter is referring to the recordkeeping provisions for leak detection and repair programs. The final standards require recordkeeping for only those sources found leaking under a leak detection and repair program. For those sources complying with equipment standards, inspection reports would be unnecessary; therefore, routine recordkeeping requirements like those for work practices are not required for sources complying with equipment standards.

11.3 TAGGING

Comment:

Two commenters (IV-D-17; IV-D-25; IV-D-50) objected to the tagging requirements in the proposed standards. Two of the comment letters (IV-D-17; IV-D-50) from the same commenter recommended tagging only for those valves which were not repaired immediately upon detection of a leak. The commenter also objected to logging that valve as a leaker. The other commenter (IV-D-25) thought that tagging was altogether unnecessary, preferring to rely on records to insure that leaking sources receive the required attention.

Response:

Tagging is not specifically required by the standards, as proposed; any form of weatherproof and readily visible identification is acceptable. This identification is required to allow ready location of leaking sources by the plant personnel or by EPA inspectors. Identification of leaking sources is an integral part of an inspection program. Without identification it would be very difficult to locate each valve which requires follow-up monitoring. It would also be difficult to find valves which are leaking but awaiting shutdown for repair. Tagging appears to be a useful method of identification, and tags have been used in leak detection and repair programs, but any form of weatherproof and readily visible identification is acceptable.

If a process unit has a system of identifying markings on valves and a diagram is available which allows easy location of the marked valves, the system would be acceptable.

11.4 OTHER PROVISIONS

Comment:

The provision for requesting permission to delay a repair past 15 days was said to be unreasonable (IV-D-17). The paper work to be processed was estimated to be unmanageable. The commenter suggested that records of reasons for unsuccessful repair, date of detection, and expected repair date would serve to insure compliance.

Response:

There is no provision requiring the plant owner or operator to request permission to delay a repair past 15 days. However, the standards require that "repair delayed" be recorded in the log for that particular fugitive emission source if the repair is delayed beyond 15 calendar days after the date of detection. These records would be needed to assess compliance with the work practice standards.

## 11.5 BURDEN ESTIMATES

Based on analyses of industry projections and current methods of operation, an estimated 166 new respondents per year will be required to submit reports and begin maintaining records. The annual average number of respondents for 1983 and 1984 will be 581. The average annual labor requirement for 1983 and 1984 will be about 65 person-years. Costs to the Federal government are expected to be $565,342.

The Information Collection Request, SF-83, and Supporting Statement submitted to OMB are filed in IV-H-2.

# 12. TEST METHOD

The comments received regarding the proposed test method were concerned with three major areas: selection of calibration gas, instrumentation, and instrument responses to different chemicals. In addition to these principal areas, comments were received on equivalency for test methods, leak definition, detection methods, and screening methods.

## 12.1 CALIBRATION GAS

Comment:

Two commenters (IV-D-6; IV-D-7) objected to the use of methane as the calibration gas for Reference Method 21. One commenter (IV-D-6) said that, since the refinery studies on which the proposed SOCMI studies were based had been conducted using hexane, hexane should also be the basis of the SOCMI standards. This commenter said the use of methane would result in more leaks than would the use of hexane. Another commenter (IV-D-17) agreed and suggested that the leak definition should be revised to compensate for the difference. According to one commenter (IV-D-21), the calibration gas/instrument differences between the petroleum refinery and SOCMI studies, added to the lower leak frequencies found in SOCMI units, clearly show fundamental differences between the two industries.

Response:

The SOCMI fugitive emissions standards are based on data collected on SOCMI units (see Section 3.2). These data were collected using an instrument (OVA) calibrated with methane. The final regulatory analysis was based on SOCMI screening data measured with an instrument calibrated to methane. This analysis supplements the preliminary one based on refinery screening data measured with an instrument (TLV) calibrated to hexane. Since EPA's final determinations were made based on data gathered in SOCMI using methane as the calibration gas for an OVA, no compensation in leak frequency or leak definition is necessary.

Ultimately, however, the differences are not significant. The variability seen in repeat sampling of the same source was 23 percent (IV-A-7). This variability is in the same range as the 30 percent difference seen in response between the TLV-hexane system and the OVA- methane systems at the 10,000 ppmv action level (IV-A-8). Because the variability in repeat sampling is so similar to the differences in response at 10,000 ppmv, the data can be used interchangeably within ±30 percent at the action level. Accordingly, EPA has added hexane as an alternate calibrant.

Comment:

One commenter (IV-D-6) said that VOC definition does not adequately reflect the capabilities of the reference method. He said the method allows the use of photoionization devices which will not respond to the calibration gases specified in the method. He continued his argument saying that, if an instrument cannot be calibrated, it should not be used to measure emissions.

Response:

The reference method has been written to be applied to fugitive emission source screening in general, with specific application requirements being established in each regulation. The method states only that photoionization instruments might meet the requirements, but it does not state categorically that photoionization instruments may be used. However, since this type analyzer may be useful in certain SOCMI process units, and it does not respond to methane, an alternate calibration material has been added in the regulation.

As discussed in the previous comment response, the variability in response between a hexane-calibrated instrument and a methane-calibrated instrument is similar to the variability in repeat sampling of the same source. Data gathered using either systems were determined to be interchangeable. Furthermore, hexane is an appropriate calibrant for photoionization analyzers since they will respond to hexane at an ionization potential of 11.7 - 11.8 μeV. Therefore, adding hexane as a specified alternate calibration material allows calibration of photoionization instruments.

The use of the alternate calibration material is not limited to a single type of analyzer. The owner or operator may choose to use either calibrant with any allowable instrument. But in any performance test by EPA or a State agency, methane may be used as the calibrant even if it is different from the one selected by the owner or operator.

Comment:

Another commenter (IV-D-27) suggested that the gas specification section be amended to include a turnover of calibration gas standards every 3 months since calibration gases can deteriorate significantly over time.

Response:

Calibration gas mixtures could be subject to deterioration with time. Good analytical procedures would dictate periodic checks of gas concentrations and changing or turn-over of the calibration gases when necessary to assure the quality (integrity) of the monitoring. Since proposal, a provision has been added to Reference Method 21 which addresses shelf-life of calibration gases and procedures to follow to ensure that calibration gas concentrations are accurate.

## 12.2 INSTRUMENTATION

Comment:

Two comments (IV-D-15; IV-D-17) concerned the instrumentation requirements of Reference Method 21. One commenter (IV-D-17) stated that only two instruments on the market today could be considered, and neither one would meet the specifications of the reference method entirely: the first instrument fails the calibration accuracy and the second instrument does not meet the response time requirements. The commenter further stated that, considering pros and cons, the first instrument is better suited to finding fugitive leaks, resulting in five percent more leaks than the second. The commenters considered this difference in detection capability to be more important in determining overall efficiency than leak definition or inspection interval.

Response:

Since proposal, the instrument specifications have been revised. The instrument specifications given in the revised Reference Method 21 are based on performance during SOCMI screening studies and on comments received by EPA during the development of the method. The maximum instrument response time is 30 seconds, and the calibration precision must be less than or equal to 10 percent of the calibration gas value. This means that the instruments referenced by the commenters can achieve the specifications.

As discussed above, in Section 3 and in the AID, the standards are based on data collected on SOCMI emission sources using the OVA. But any instrument which meets the requirements discussed by the commenter should provide adequate leak detection when used in accordance with Reference Method 21.

Comment:

Another commenter (IV-D-15) stated that 20 percent of the time during screening studies was devoted to calibration and maintenance of the instrument. The potential instrument problems indicated by such high time utilization were not discussed in the BID or in the reference method.

Response:

The data presented in the referenced problem-oriented report, "Frequency of Leak Occurrence for Fittings in Synthetic Organic Chemical Process Plant Units," indicated that from 1 to 1-1/2 hours per day were required for calibration and maintenance of the monitoring instrument. Based on the number of sources that were screened in each unit, this calibration time amounted to 16-25 percent of the total time for screening.

The calibration time during the EPA studies was expected to be longer than for screening alone since concentration measurements were being recorded that would be used in further analysis. This necessitated calibration with more than one standard concentration on a more frequent basis (2-3 times daily). Also, because concentrations up to 100,000 ppmv were being measured, a dilution probe had to be calibrated several times daily. Routine screening would require calibration with only one standard, one time per day. Also, a dilution probe would not be required. Calibration time for routine screening is estimated to require about 10 to 25 percent of that required during EPA tests, or about 2 to 6 percent of the total time for screening.

The referenced problem-oriented report also listed a number of problems, equipment-related and procedure-related, encountered during the SOCMI 24-Unit Study. Procedure- related problems, as well as equipment problems, to a large extent were due to performing work in the field which was remotely located from laboratories and repair facilities. Problems with instruments in the field take longer to fix because of shipping delays. Furthermore, many inefficiencies were encountered because the personnel performing the studies were research staff who spend only short periods of time on projects of this type, thereby lacking the experience necessary for troubleshooting.

Time lost due to equipment failure is expected to be minimized by maintaining the critical spare instrument parts (including readout meter, battery pack, regulator repair kit, pressure gauges, hydrogen flow valves, and filters) identified during the 24-unit study. Additionally, personnel familiar with troubleshooting procedures should facilitate instrument operation and repair. The proximity of instrument shops and labs should also improve routine screening efficiency.

The cost estimates in the BID include costs for two instruments, one of which was considered a spare. Having a spare should decrease instrument downtime. Moreover, an ample allowance of time was made for calibration and maintenance of instruments. The 40% administrative and overhead charge allotted includes time for calibration, and an additional $3,000 per year was allotted for instrument maintenance. In view of these differences between research field studies and routine screening activities, the calibration and maintenance costs allotted in the BID are reasonable and no adjustments have been made.

## 12.3 VARIABLE RESPONSE TO DIFFERENT CHEMICALS

Comment:

Several commenters (IV-D-6; IV-D-7; IV-D-17) noted that the instruments used during screening studies responded differently for different chemicals. One commenter (IV-D-6) stated that the actual response factor was poorly related to the theoretical response factor and cited inconsistent responses for nonane and decane, as well as no response for some chemicals, to support his claims. Another commenter (IV-D-7) suggested that the leak concentration for the standards should vary according to the unit since such wide variability (0-571) in response factors have been determined for the industry. He disagreed with EPA's use of a response factor of 2-3 applied to potential leaking sources. Any comparison should be made to the number of leaking sources, not potential leaking sources. Another commenter (IV-D-17) stated that aromatic compounds such as benzene, toluene, and xylene demonstrate a non-linear response close to 10,000 ppmv.

Response:

Reference Method 21 gives specifications for the instrument to be used in monitoring fugitive VOC emission sources. The technique is intended to classify leaks only, not to provide a rigorous analytical concentrations of VOC. A specific statement has, therefore, been added to Reference Method 21 to clarify the intention to classify leaks only.

The variation in response factor, due to compound or instrument, is not expected to affect significantly the number of leaks determined through screening because screening values are usually greater than 10,000 ppmv for leaks and much less than 10,000 ppmv for non-leaks. Two industry commenters concur with EPA in this position (IV-D-17; II-D-72). However, to remove some of the wide variability, a definition, specification, and test procedure for response factors has been added to Reference Method 21.

Laboratory experiments using two VOC analyzers indicated a wide variation in response factors for a number of organic chemicals. The range as indicated by the commenter was 0-571. However, 90 percent of the chemicals tested had responses between 0.1 and 10 (IV-A-8; IV-A-12; IV-A-15). Most of the remaining 10 percent are solids or heavy liquids. Differences were also seen between the two types of analyzers tested. When considered in analyzing leak frequencies (IV-A-14), the response factor variation, however, did not produce significant changes in the percent leaking estimates resulting from the SOCMI 24-Unit Study (II-A-21). Although a small reduction in the estimated leak frequencies is indicated for gas valves in high leak service, the estimates in all other cases were almost indistinguishable from the unadjusted estimate. Furthermore, the differences when present were in the same range as the variation in reproducibility described in IV-A-7. Table 12-1, reproduced from the analysis report (IV-A-14), illustrates the effects of response factor variation on leak frequency.

## 12.4 OTHER COMMENTS

Comment:

One comment letter (IV-D-17) expressed concern that no provision was made for the use of new instruments or calibration procedures which would provide equivalent or more accurate results. They asked that equivalency provisions be added for test methods and procedures.

Response:

Reference Method 21 gives specifications for the monitoring instrument that are general enough so as not to preclude new analytical developments. In addition, the General Provisions (40 CFR Part 60, Subpart A) allow for equivalent methods and procedures to be used for performance testing and monitoring when the results of the equivalent method have been demonstrated to be at least as accurate as results obtained by the required methods.

Comment:

One commenter (IV-D-27) suggested that use of a windscreen upwind of the component being screened would prevent meteorological effects on the instrument readings.

Response:

The selection of a measurement location at the surface of the source was made to minimize meteorological effects. During the data collection efforts, no further provisions were found necessary to obtain repeatable screening values. Therefore, all of the field data were collected without a windscreen. In view of these facts it is unnecessary to require that a windscreen be used while monitoring.

Comment:

One comment letter (IV-D-17) cited wide variability in repeat screening values from an EPA Report (contract #68-03-2776) as justification for raising the leak definition. The commenter said that the trigger point should be set high enough to insure isolating only the bad leakers.

TABLE 12-1. COMPARABLE ESTIMATES FOR PERCENT LEAKING (VALVES)
(24 SOCMI Process Units)

| Process Stream | Number Streened[1] | Percent Leaking Based on OVA Readings | Percent Leaking Based on Method 1 Adjustments[2] | Percent Leaking Based on Method 2 Adjustments[3] | Percent Leaking Based on Method 3 Adjustments[4] |
|---|---|---|---|---|---|
| Gas | 9374 | 11.3 | 10.1 | 10.2 | 10.3 |
| Light Liquid | 18133 | 6.1 | 5.3 | 5.6 | 5.5 |

Reference: Analysis of SOCMI VOC Fugitive Emissions Data, EPA-600/2-81-111 (IV-A-14).

[1] 119 sources with screening valves taken to be 10,001 ppmv were excluded.

[2] Method 1 is the adjustment to the OVA Reading based on the response of the primary chemical in the line.

[3] Method 2 is the mixed chemical-weighted logarithmic average technique for the primary and secondary chemicals in the line (IV-A-15).

[4] Method 3 is the mixed chemical-weighted average technique for the primary and secondary chemicals in the line (IV-A-15).

Response:

The commenter is referring to a report on maintenance for control of fugitive VOC emissions filed in IV-A-7. Quality Control/Quality Assurance procedures and measures for the study are reported in Appendix C of the report. The statistical measures generated for repeatability of screening values are measures of repeatability of precise screening values ($\frac{X}{5.6}$ to 5.6X). However, a more relevant measure of repeatability is one which measures the reproducibility of an on-off (leak-no leak) measurement, not one which measures reproducibility of a precise number. This reproducibility was quantified and reported in a memo filed in II-B-24. The information presented in this docket entry shows a 90% repeatability of a leak-no leak determination at a 10,000 ppmv action level. In a recent study of fugitive emission sources in the South Coast Air Quality Management District in California, greater than 94 percent repeatability of leak-no leak determination was found for duplicate screening. Thus, EPA finds no basis for raising the leak definition because of the test method. The issue of leak definition is addressed in more detail in Section 4.3.

Comment:

One commenter (IV-D-29) submitted several comments about fixed-point area monitors. He described his plant's fixed-point area monitoring system as a fugitive emissions detection device which protects their people and their environment. He explained that the alarm points are based on TLV's which should reflect exposure levels below which no harm results.

The commenter disagreed with EPA's conclusions about fixed-point area monitors. He objected to the analysis of testing data for fixed-point monitors gathered in his plant. He said one problem existed in the fact that the study was conducted over a short period of time. Therefore, the area monitors were not subjected to significant wind shifts. The system depends on periodic wind shifts to detect small leaks such as the ones under consideration.

The commenter voiced a strong objection to EPA's conclusions that the area monitoring system did not pick up leaks detected on the walk-through survey. He said that this was misleading because the walk-through did not pick up some leaks detected by the area monitors. He thought that this situation existed because the survey was done at ground level. He pointed out that there were fugitive emission sources on structures and columns which were not accessible without scaffolding.

Response:

EPA's evaluation of a fixed-point area monitoring system is filed in a test report on fugitive emissions from chloromethanes production (IV-A-5). Three monitoring methods were evaluated in the tests described: individual component survey, walk-through, and fixed-point area monitoring. The report clearly confirms the commenter's statement that since some equipment items were not readily accessible, the fixed monitors might indicate leaks where individual component testing could not detect them. Nevertheless, the report also indicates that out of 22 leaks identified by the individual component survey, only 4 were detected by the area monitors. As indicated in the report, the low leak detection effectiveness may have been due in part to the use of TLV's as alarm points; setting the alarms at lower concentrations may have increased the effectiveness.

This decreased leak detection effectiveness was only part of the reasoning for not selecting fixed point area monitors as the test method for use in detecting fugitive emissions. As explained in the BID, the reasons that area monitors were not selected included meteorological influences, the expense of the equipment, and the necessity of also performing individual equipment surveys. Furthermore, it was impossible to specify a system which would effectively detect leaks in all equipment configurations and under all meteorological conditions found in the industry.

This does not mean that area monitors have no place in the determination of fugitive emissions. There may be cases in which area monitors may be effective emission detection devices because they continuously monitor for high concentrations. An owner/operator may find a system of fixed point area monitors especially useful in combination with other fugitive emission control measures if he chooses to comply with an alternative.

The walk-through survey mentioned by the commenter was also considered as a test method, but as explained in the BID, it was not selected. The results obtained in walk-through surveys were mixed, and are affected by meteorological conditions (IV-A-18). Furthermore, an individual equipment survey is required when a high concentration is indicated. However, as is the case with fixed-point monitors, a walk-through survey system may be a useful complement to other leak detection methods if an owner/operator chooses to comply with an alternative.

Comment:

The same commenter (IV-D-29) said that screening data was in no way related to exposure data. Screening data, he said, was literally a sample taken in direct contact with a leak. The commenter did not see how a screening value determination could be extrapolated to effect on the environment.

Response:

Screening values have been shown to be accurate indicators of leakage of VOC from equipment. On an average basis, mass emission rates can be correlated with screening values. If the proportion of sources with screening values in excess of the leak definition can be reduced, then it follows that reductions in mass emissions will be achieved. Reductions in mass emission rates are used to determine best-demonstrated technology (considering cost), which is the basis for the Standards of Performance.

# 13. ENFORCEMENT AND COMPLIANCE CONCERNS

Several commenters expressed interests in enforcement and compliance concerns. Basically, three areas of comment were presented: (1) resource requirements for local enforcement, (2) compliance with the standards for pressure relief devices, and (3) delay of repair provisions. Three facets of the delay of repair provisions received comment: unavailable spare parts, technically infeasible situations, and out of service spare equipment.

Comment:

One commenter (IV-D-11) stated that local enforcement of the regulation would require a more intensive use of resources than envisioned.

Response:

In assessing the relative impacts of reporting alternatives, both industry and enforcement agency requirements were evaluated. The background information presented in the Federal Register with the proposed standards (46 FR 1136) gave the industry requirements for reporting as 53 man-years in 1985 (the fifth year) for 830 affected facilities. The corresponding requirements for enforcement agency review in 1985 were estimated at less than 4 man-years, or about 7 percent of the estimated requirement for industry. This estimate included 8 man-hours annually for review of the quarterly reports submitted for each affected facility. These figures were filed in the Docket in the Reports Impact Analysis (II-A-30).

Since proposal, however, the reporting requirements for the SOCMI fugitive VOC NSPS have been reduced. Records must still be maintained to the extent necessary to demonstrate compliance with the standards. These revised recordkeeping and reporting requirements have been estimated at an average of 65 person-years annually for 1983 and 1984. Even with the reduction in reporting requirements, however, local enforcement activities such as on-site inspections may not increase. Thus, no additional burden is expected to be placed on local enforcement. The burden calculations for VOC fugitive emissions in SOCMI are filed in the Docket (IV-H-2).

Comment:

One commenter (IV-D-17) stated that there was a loophole in the standard for pressure relief devices. As proposed, the standard requires each pressure relief device in gas/vapor service to return to a state of "no detectable emissions" no later than five days after an emergency release. The commenter pointed out that if a process unit is down five days after the release, the relief device, by definition, will be in compliance. The regulation should say that the pressure relief device should be returned to "no detectable emissions" five days from resumption of normal operation after each episode of pressure release.

Response:

The standards for pressure relief devices (§60.482-4) are:

(a) Except during pressure releases, each pressure relief device in gas/vapor service shall be operated with no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background, as determined by the methods specified in §60.485(c).

(b) (1) After each pressure release, the pressure relief device shall be returned to a condition of no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background, as soon as practicable, but no later than 5 calendar days after the pressure release, except as provided in §60.482-9.

(2) No later than 5 calendar days after the pressure release, the pressure relief device shall be monitored to confirm the conditions of no detectable emissions, as indicated by an instrument reading of less than 500 ppmv above background, by the methods specified in §60.485(c).

(c) Any pressure relief device that is equipped with a closed vent system capable of capturing and transporting leakage through the pressure relief device to a control device as described in §60.482-10 is exempted from the requirements of §60.482-4(a) and (b).

The pressure relief device has the potential to emit VOC whether the unit in which it is located is in operation or not, because the equipment and lines may still contain VOC. Therefore, if the process unit is down five days after the release, the pressure relief device may well be in compliance with the regulation. But even if the unit is down, the potential still exists for a pressure relief device to emit VOC in excess of 500 ppmv above the background.

The standards state that the pressure relief device shall be returned to a state of no detectable emissions after each pressure release as soon as practicable. Clearly, this requirement is intended whether the unit has been down or continued to operate after the release. For example, if the unit has been down for several days after an incident of pressure release, the pressure relief device must still meet the requirements of no detectable emissions when the unit starts up. The pressure relief device must always achieve the 500 ppmv limit except for the time (no greater than 5 days) required to return the pressure relief device to less than 500 ppmv after a release. Of course, if a unit is scheduled to be down for a long period of time, an owner or operator could elect to remove the device from VOC service.

Comment:

Several commenters (IV-D-17; IV-D-48; IV-D-50; IV-D-51; IV-D-34) were concerned that the proposed standards do not allow repairs to be delayed past a shutdown. Their concerns related to delayed repairs due to unavailable replacement parts and technically infeasible situations and on the repair requirements for spare equipment.

They recommended a limited extension provision to avoid those limited instances where replacement of leaking equipment might not be possible until after a process unit shutdown. The consequences of not including such a provision, they said, would be unanticipated and costly continuances of shutdown or risk of criminal or civil penalties for resuming operation without repairing all leaks.

Several reasons for occasional necessary delays were offered by commenters. One reason cited was the delay associated with obtaining custom-made or unique parts (IV-D-51; IV-D-48; IV-D-17). Another (IV-D-51; IV-D-48; IV-D-17) was unforeseen depletion of inventoried parts just prior to a shutdown. Still another (IV-D-48; IV-D-51) was the occurrence of unscheduled and unforeseen shutdowns of a duration too short to allow the opportunity for repairs. One commenter (IV-D-51) pointed out that repairs normally require the process be cooled, emptied, and inspected to permit safe working conditions. He said that these procedures can require 24 or more hours to complete.

Since extensions are allowed for situations qualifying as technically infeasible, two commenters (IV-D-17; IV-D-48) recommended that a definition of "technically infeasible" be included to minimize uncertainties and to reduce unwarranted enforcement proceedings resulting from ambiguities in the regulations. They recommended that the following definition be added:

> For purposes of §60.482(h), technically infeasible shall mean where a repair within 15 days of leak detection would constitute an unsafe practice, could result in premature total process failure, could cause an unscheduled complete or partial process unit shutdown or if the temporary emission resulting from the repair would exceed the emissions from the continued leak.

Another commenter (IV-D-51) recommended the following amendment to the proposed §60.482(h):

> Delay of repair will not be allowed beyond the first scheduled process unit shutdown unless bonafide attempts to secure spare parts in time for the scheduled shutdown have failed.

In a related matter one of the commenters (IV-D-17; IV-D-50) in two comment letters said that if a leak is detected in a pump or compressor with an installed spare, the five day-fifteen day repair requirements should not apply to the pump or compressor taken out of service, if the equipment is properly purged and isolated from the process. They recommended that for this case the regulation should simply state that the equipment be repaired prior to coming on-line and be tested within fifteen days of startup.

Response:

The intent of the standards is to reduce fugitive VOC emissions. To meet this end, all available approaches for repair of leaking sources should be used. EPA recognizes that, in a few cases, repair of leaking sources may have to be delayed beyond a process unit shutdown. Several provisions have been added to the standards to accommodate those cases.

The first provision allows delay of repair where repair is technically or physically infeasible without a process unit shutdown. Technically or physically infeasible means that all safe repair procedures short of shutting down the unit have been tried and the valve is still leaking. An example of such a situation would be a leaking valve that could not be isolated from the process stream to replace internal parts that would likely repair the valve. In this case, the process unit would have to be shutdown to effect repairs on the valve, since the valve could not be physically isolated from the process stream. Once the process unit is shut down for any reason, the valve must be replaced.

The second provision was added to clarify EPA's intent for spare equipment that is out of service. This provision would be applicable only to those pieces of equipment that have been isolated from VOC service and properly purged. Delay of repair would not be allowed for spare equipment that was pressurized and prepared to be placed on-line; such equipment is considered to be in (VOC) service.

A third provision was added for those situations in which it is possible to isolate a valve from the process for repair, but doing so would cause higher emissions than allowing the leak to continue. An owner or operator, to delay repair under this provision, must demonstrate that emissions of purged material resulting from immediate repair are greater than the fugitive emissions that are likely to result from delay of repair. Furthermore, when repair procedures are effected, the purged material must be collected and diverted to a control device.

Provisions have also been added for delay of repair for pumps operating under work practice standards. In a case in which replacement of mechanical seals does not "repair" the pump, the only way to repair it is to install equipment (dual seals with barrier fluid systems or vented seal areas). Six months is a reasonable length of time for installation of such equipment (IV-B-29); therefore, the standards allow for a 6-month delay in installing equipment necessary to "repair" the pump.

A final provision has been made for delay in limited instances due to the lack of spare valve assemblies. It is not, however, the intent of the standards to permit delays resulting from poor administrative practices. Two such practices that are not sufficient to substantiate a delay of repair are unavailable maintenance personnel and the lack of readily available valve assemblies that were not sufficiently stocked. Custom order or unique valve assemblies must be sufficiently stocked to avoid delays due to their inavailability. The additional cost of keeping a sufficient stock of readily available spare parts is not unreasonable because the additional stock of spare parts needed for this standard are small in comparison to the stocks of spare parts commonly stored within this industry. Stocking or contracting for "quick" supply of unique parts is an economic necessity within this industry. Even though EPA believes that this delay of repair provision would be appropriate only under unusual circumstances, the commenters' concerns are valid and the provisions have been added. In addition, if spare valve assemblies are not in stock, they must be obtained and must be used at the next process unit shutdown which occurs 6 months after the initial delay of repair (IV-B-30).

To make allowance for delay of repairs beyond an unscheduled shutdown in the case of shutdowns of too short a duration to effect repairs, a process unit shutdown has been defined as longer than 24 hours.

> "Process unit shutdown" means a work practice or operational procedure that stops production from a process unit or part of a process unit. An unscheduled work practice or operational procedure that stops production from a process unit or part of a process unit for less than 24 hours is not a shutdown. The use of spare equipment and technically feasible bypassing of equipment without stopping production are not process unit shutdowns.

In cases of unscheduled shutdowns of shorter than 24 hour duration, repair of leaking equipment would be required at the next scheduled process unit shutdown.

# 14. ALTERNATIVE STANDARDS

Several sets of comments were received which addressed the alternative standards for valves in gas/vapor and light liquid service. The comments fall into basically three categories: (1) clarification of the provisions and requirements of the alternative standards, (2) procedures for determining and demonstrating equivalency, and (3) skip-period monitoring.

Comment:

Two commenters (IV-D-17; IV-D-23) asked that the criteria for approval or disapproval of a request for an alternative standard be made clear in the regulation. In a previous letter, one of the commenters (IV-D-17) stressed that these guidelines be specific so that approval decisions would not be open to interpretations. The commenter said difficulties had been experienced in the past when EPA Regional office decisions required interpretation. This same commenter (IV-D-17) requested clarification in the regulation concerning what constitutes a violation of an alternative standard and recommended specific language to be added to §60.483 to provide the clarification.

The commenter also noted that, for any number of reasons, at some time it may no longer be cost effective for a source to comply with an alternative standard. He pointed out that a mechanism should be provided to allow a source to return to the valve standard given in §60.482(f) by notifying the Administrator in writing. One comment (IV-D-17) stated that inaccessible valves create problems in calculating meaningful percentages of valves leaking and, therefore, should be regulated under another provision.

The same commenter stated that a monthly average was the wrong measure for judging equivalency. He recommended a 95 percent confidence bound, determined during the year-long data collection program, as the measure of equivalency. Without such a provision, equivalency would not be possible. The commenter also said that, since the BID acknowledges differences between annual and monthly numbers, a correction factor should be provided in order to determine equivalency from annual monitoring data. He suggested the annual average be divided by 12 to compare with the monthly allowable average.

In a subsequent letter, the same commenter (IV-D-50) recommended reduced monitoring requirements for plants demonstrating consistent attainment of leak rates of 2 percent or less. In so doing, incentives would be provided for the adoption of more cost-effective alternative good-performance levels and low-leak plant designs.

Several comments were received on statistical approaches to leak detection programs. Many of the commenters (IV-F-1, No. 4; IV-D-1; IV-D-17; IV-D-28; IV-D-47) suggested that statistical inspection plans, such as skip-period monitoring plans, be considered. These programs have been demonstrated to be effective quality control techniques and would provide adequate protection against leaks. The commenters also said skip-period plans would minimize costs by reducing inspections when good performance was achieved and demonstrated.

Several of these commenters (IV-F-1, No. 3; IV-F-1, No. 4; IV-D-17; IV-D-47) pointed out that quality in reducing emissions from a unit is obtained through good design. And they felt that leak detection and repair programs were a disincentive to designing and installing low-leak units. Two of these commenters (IV-F-1, No. 4; IV-D-17) noted that the currently proposed alternative standards would be more difficult for current low-leak units to meet, since the standards call for improving current performance levels.

One commenter recommended adding a third alternative standard for valves based on papers presented at the NAPCTAC meeting. These papers indicated that a 2 percent good performance level was adequate to ensure low levels of emissions. In another letter, the commenter (IV-D-47) suggested skip-period plans be considered for SOCMI since they had been included in the NAPCTAC package for petroleum refineries (June 2-3, 1981).

Two sets of comments were concerned with various aspects of determining equivalency with the alternative standards.

Response:

At proposal, two alternative standards were presented for valves in gas/vapor and light liquid service. Both of these alternatives called for one year of monthly monitoring to obtain data on which to base the alternative standard. Section 60.483(a) in the proposed standards was a performance standard based on an allowable percentage of valves leaking. Since an industry-wide allowable leak percentage was not possible due to variability of leak frequency among process units, an allowable percentage of valves leaking was to be determined for that unit based on data collected on that unit. The allowable percentage was to be the sum of the monthly baseline percentage and the monthly incremental percentage. A minimum of one performance test was required annually. Section §60.483(b) in the proposed standards allowed the development of work practices that would achieve the same result as the proposed leak detection and repair program for valves. This alternative would allow a unit to vary the monitoring interval and to use valves with a low probability of leaking in order to achieve an overall goal of emissions reductions.

Based on comments received on the proposed alternative standards and on analysis of the results from SOCMI screening and maintenance studies (IV-A-10; IV-A-11; IV-A-14), the alternative standards for valves were reexamined. As a result, these standards were changed and refined in response to comments and to reflect the information gathered on SOCMI units.

The first alternative standard was reconsidered by (1) looking at the cost effectiveness of a monthly leak detection and repair program (see Section 4.2 for a detailed discussion on monitoring interval selection) as a function of the percentage of valves leaking initially (IV-B-26) and (2) comparing the leak frequencies for gas/vapor and light liquid valves determined in the 24-Unit Study (IV-A-11). Figure 14-1 presents the results of the first analysis for an average SOCMI unit. Table 14-1 presents the overall leak frequencies (excluding inaccessible valves) for gas/vapor and light liquid valves for the 24 SOCMI units screened. As shown in this table, fifteen of the 24 units demonstrated overall leak frequencies for valves of less than 2 percent. Whereas shown in Figure 14-1, the cost

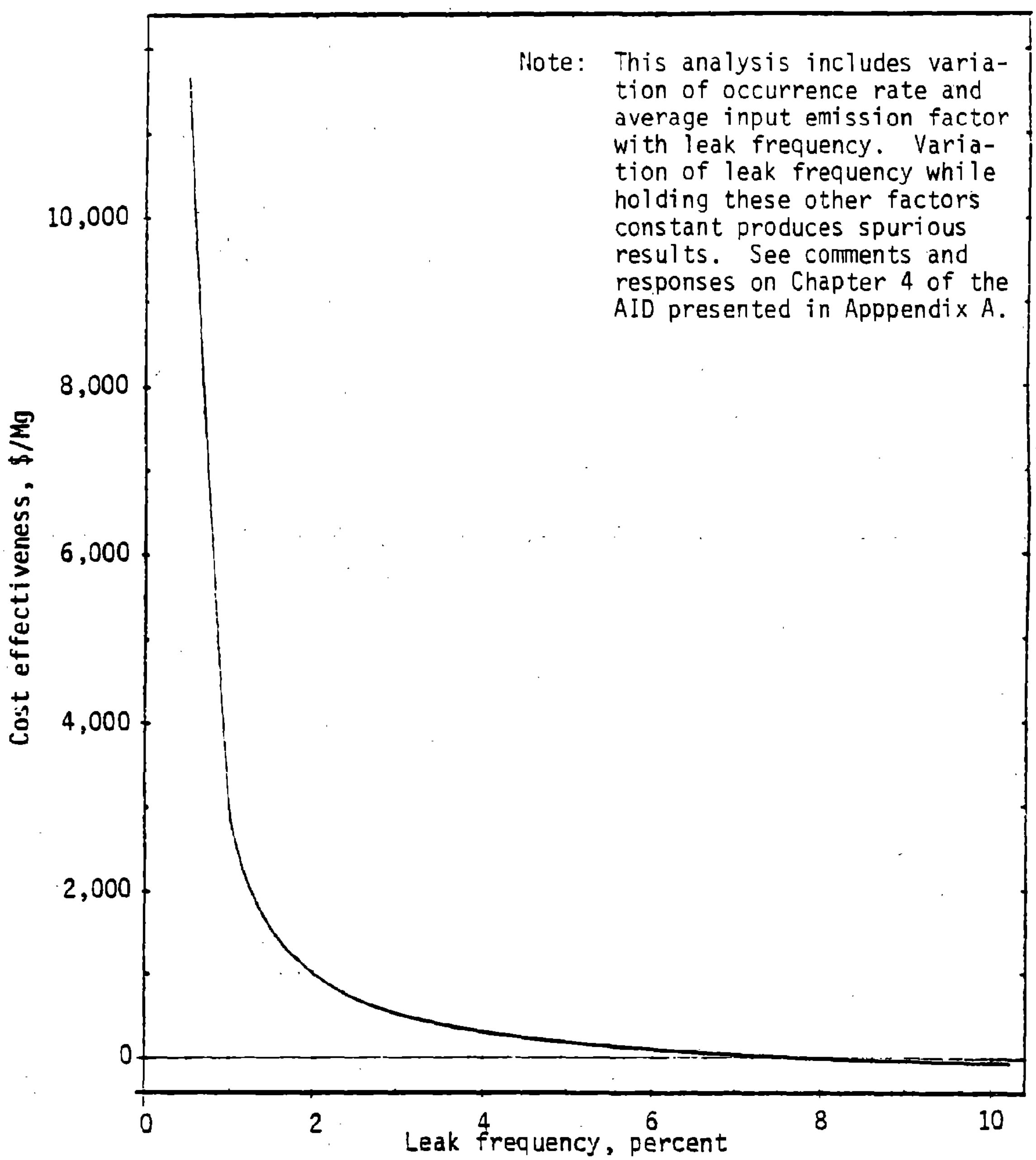



Figure 14-1. Cost effectiveness as a function of leak frequency for monthly leak detection and repair programs for valves in SOCMI units.

TABLE 14-1. OVERALL LEAK FREQUENCIES FOR VALVES IN THE SOCMI 24-UNIT STUDY

| Unit | Process | Percent Leaking of Valves Screened: Gas and Light Liquid[a] | Percent Leaking of Valves Screened: Gas, Light and Heavy Liquid[b] |
|---|---|---|---|
| 1 | Vinyl acetate | 1.2 | 1.1 |
| 2 | Ethylene | 18.8 | 14.2 |
| 3 | Vinyl acetate | 1.5 | 1.4 |
| 4 | Ethylene | 22.1 | 21.9 |
| 5 | Cumene | 9.4 | 8.2 |
| 6 | Cumene | 13.1 | 11.2 |
| 11 | Ethylene | 12.6 | 12.5 |
| 12 | Acetone/phenol | 0.3 | 0.3 |
| 20 | Ethylene dichloride | 0.9 | 0.9[c] |
| 21 | Vinyl chloride monomer | 0 | 0[c] |
| 22 | Formaldehyde | 0.6 | 0.6[c] |
| 28 | Ethylene dichloride | 5.8 | 5.8[c] |
| 29 | Vinyl chloride monomer | 1.5 | 1.5[c] |
| 31 | Methyl ethyl ketone | 8.0 | 8.0[c] |
| 32 | Methyl ethyl ketone | 4.4 | 4.4[c] |
| 33 | Acetaldehyde | 1.5 | 1.5[c] |
| 34 | Methylmethacrylate | 0.1 | 0.1[c] |
| 35 | Adipic acid | 0 | 0 |
| 60 | Tri- and perchloroethylene | 0.1 | 0.1[c] |
| 61 | 1,1,1-trichloroethane | 1.1 | 1.1[c] |
| 62 | Ethylene dichloride | 0 | 0[c] |
| 64 | Adipic acid | 0 | 0 |
| 65 | Acrylonitrile | 3.0 | 2.7 |
| 66 | Acrylonitrile | 1.2 | 1.2[c] |

[a]Percent is percent leaking of light liquid and gas valves only.

[b]Percent is percent leaking of light liquid, heavy liquid, and gas valves.

[c]No heavy liquid valves screened in this unit.

effectiveness of a monthly leak detection and repair program begins to increase rapidly for overall valve leak frequencies of one percent or less. Considering the variability inherent in determining leak frequencies, a 2 percent maximum allowable percentage of valves leaking was determined. As one commenter suggested, this provided an owner or operator a risk of less than 5 percent that an average of 1 percent was being exceeded.

Therefore, Section 60.483(a) (renumbered §60.483-1) was simplified to a 2 percent limitation as the maximum percent of valves leaking within a process unit, determined by a minimum of one performance test annually. This will provide a standard for valves where the costs of monthly monitoring would be unreasonable. It would also provide a cost-effective incentive to maintaining a good performance level and promote low-leak unit design as was indicated by one commenter. Inaccessible valves, that would not be monitored on a routine basis under §60.482-7, would be included in the annual test since an annual test of these valves is not considered burdensome. By incorporating some of the features of the proposed §60.483(b), this standard (§60.483-1) provides the flexibility of a performance level that could be met by implementing any type of leak detection and repair program and engineering controls chosen at the discretion of the owner or operator. Even though an industry-wide allowable leak percentage was not possible for valves, this alternative standard would allow an affected facility to comply with an allowable percentage of valves leaking without having to determine a specific performance level by a year-long monthly monitoring program. If the results of a performance test show a percentage of valves leaking higher than 2 percent, however, the process unit would be in violation of the alternative valve standard. Finally, if an owner or operator determines that he no longer wishes to comply with this alternative standard, he can submit a notification in writing to the Administrator stating that he will comply with the work practice standard in §60.482-7.

EPA also recognizes benefits which may be derived from statistically-based skip-period leak detection and repair programs. Under skip-period leak detection, an owner or operator could skip from routine monitoring (monthly) to less frequent monitoring after completing a number of successful sequential monitoring intervals with the prescribed performance level achieved for each interval within 90 percent certainty. Two options were considered for an alternative standard based on skip-period monitoring: (1) a mathematically presented skip-period plan which sophisticated owners or operators could use for their process units and (2) two readily understood, but specified skip-period programs that conform to the established performance criteria. Only one of the two set skip-period programs may be selected for any given process unit and the selection must be made in a notification of intent to the Administrator prior to implementation of the alternative standard.

The first skip-period monitoring option provides maximum flexibility when applied to the widely different process units throughout SOCMI. Equations have been developed (IV-B-28), based on common skip-lot quality control plans, that allow a straightforward determination of a monitoring schedule that incorporates skip-period features. By applying these equations, an owner or operator can optimize the monitoring schedule (a combination of consecutive periods monitored and skipped periods allowed) to suit the particular requirements of his process unit.

In addition, this option allows for a variable performance level that must be maintained. Since the performance level is based on an inverse relationship of valve count, a higher performance level would be allowed for process units with low valve counts. A fixed performance level, on the other hand, favors the unit with a large number of valves. A disadvantage to this option, however, is the increased burden on enforcement personnel in maintaining records on process units with variable skip-period monitoring plans.

This disadvantage of the first option is eliminated under the second option. A single performance level would be selected and two set programs would be presented to conform to the selected performance level. The reference leak detection and repair program for skipping is monthly/quarterly leak detection as allowed by the standards. This means that monitoring of valves would be the same as required in §60.482-7 but that, once skipping begins, monitoring would be based on skipping quarterly periods. When the performance level is not achieved, however, the monthly/ quarterly program would be reinstituted. In addition, monitoring of inaccessible valves would be handled as under the reference program required by §60.482-7. Inaccessible valves would not be counted toward determining the percent of valves leaking under §60.483-2.

Based on less than 2 percent leaking with clearly greater than 90 percent certainty that in all periods less than 2 percent are leaking, the following set of consecutive periods and fraction of periods skipped were determined for SOCMI units:

(1) two consecutive quarterly periods achieved to skip to semiannual monitoring, and

(2) four consecutive quarterly periods achieved to skip to annual monitoring.

By providing only two specific programs, some of the flexibility afforded by tailoring a program to the specific process unit is lost. Another disadvantage to this approach is the establishment of a single performance level, regardless of the number of valves in the process unit.

However, because of the difficulties which EPA would face in keeping track of many different skip-period programs and the difficulties in determining which programs are appropriate for control of leaking valves, EPA decided to provide two set skip-period plans with a single performance level of 2 percent leaking as its second alternative standard (§60.483-2) for gas/vapor and light liquid valves. This alternative (§60.483-2) would provide two choices and would thereby provide flexibility while decreasing the potential confusion for enforcement personnel. The standard also requires that, if a process unit does not meet the prescribed performance level, it must revert to the monthly leak detection and repair program that is specified in §60.482-7. Compliance with this work practice standard would be determined by inspection and/or records.

While two set skip-period programs are provided as an alternative standard for valves in gas and light liquid service, there is no provision for skipping from semiannual leak detection to annual leak detection. If such a change is desired, the owner or operator must submit a notification of intent to the Administrator and demonstrate compliance with 5 consecutive leak detection intervals (quarters) at a performance level of 2 percent leaking or less.

Comment:

One commenter (IV-D-51) had recommended a leak detection and repair program for pumps in light liquid service based on the good performance of single mechanical seals in an acrylic acid unit. He further recommended a skip-period approach for such a program that would allow semiannual monitoring after six successive periods of finding no leaks.

Response:

As discussed in Section 4.8, the standards for pumps in light liquid service have been revised to allow implementation of work practices (leak detection and repair programs) as well as using the equipment required in the proposed standards. Although statistical sampling techniques such as skip-period sampling are useful tools in alleviating some of the monitoring burden for valves, the number of pumps per process unit prohibits the reasonable use of these techniques because there are too few pumps to use these techniques. And the amount of monitoring is reasonable considering the amount of leakage from the leaking pump and the cost of monitoring. Therefore, skip-period monitoring was not included as an alternative to the standards for pumps given in §60.482-2.

## 15. MISCELLANEOUS

Several comments were received that were not related to the other topic areas presented in the previous sections. These comments are discussed in this section. They include comments on EPA's bubble policy and on an apparent omission from Appendix A of the Background Information Document.

Comment:

Several comments were received which referred to EPA's bubble policy. The comments reflect a good deal of confusion about the bubble policy and its application to new source performance standards.

Several commenters (IV-D-6; IV-D-17; IV-D-26; IV-D-34; IV-D-37; IV-D-38) said that they supported the use of the "bubble" concept for the SOCMI standards. One of the commenters (IV-D-37) cited page 1139 of the SOCMI preamble which said that in most cases fugitive emissions could be controlled from some other fugitive emission sources within an existing facility to keep the (overall) fugitive emissions to the original level. This same commenter said that allowing more leeway with the light liquid requirement is one application of the bubble concept that would help industry maintain cost effectiveness and make the proposed NSPS more realistic.

Three commenters (IV-D-17; IV-D-26; IV-D-34) supported the application of the "bubble" concept to modified facilities within a SOCMI plant. One of the commenters (IV-D-26) said that the application of the bubble concept to a process unit would avoid having to apply the fugitive VOC emission NSPS to the entire process unit. This commenter requested that the bubble concept also be applied to modifications.

Another commenter (IV-D-17) said that he supported the proposed application of the modification definition, which would allow combining emissions from fugitive sources within the process unit to avoid a net increase in emissions and thereby avoid having to apply the subject NSPS to the entire process unit.

One commenter (IV-D-38) said that the proposed requirements are inconsistent with the trend toward more flexible, cost effective emissions control. He felt that extensions of the "bubble" concept to cover fugitive emissions could provide adequate limitations for entire plants or individual facilities. He said that this approach is consistent with Section 111 of the Clean Air Act.

Another commenter (IV-D-6) strongly recommended setting a performance standard as the minimum regulation for the SOCMI NSPS. He went on to say that as a performance standard the VOC regulations would be compatible with OSHA actions and prevent duplication of federal activities and duplicate costs for industry. A performance standard would also be consistent with the "bubble" concept of VOC emission controls.

Response:

The bubble concept is a fairly new emission reduction option that was recommended by EPA at 44 FR 71780 on December 19, 1979, and is currently implemented under Section 110 and/or Part D of State implementation plan (SIP).

The bubble policy allows an existing plant to decrease emission reductions from an affected facility with high control costs while simultaneously increasing an equal amount of emission reductions from an other affected facility in the same defined area with a relatively low control cost. The end result is a zero net increase in total emissions within that defined area.

EPA is considering the application of a similar bubble policy in implementing Section 111 of the Clean Air Act. At this time, EPA has not endorsed the application of a bubble policy to new source standards. If the decision is made to incorporate a bubble policy in the implementation of Section 111, the potential would exist for applying it to SOCMI facilities covered by these standards even after the standards are promulgated. However, EPA does not know how a bubble policy would be implemented for work practice standards. It would be difficult, if not impossible, to implement a bubble policy within the format of work practice standards.

A number of commenters have confused the modification and reconstruction provisions for NSPS with EPA's bubble policy. Under the SOCMI standards an affected facility is defined as a process unit which includes numerous fugitive emission sources that are assembled to produce one or more of the chemicals listed in 40 CFR 60.489. In order to avoid routine changes being considered as a modification and subjecting the facility to the standards, the owner or operator may "balance out" an emission increase from a routine change or addition to one of the fugitive emission sources within an affected facility by simultaneously decreasing the fugitive emissions from another source within that same affected facility. This is not an application of the bubble policy because the balancing of emissions is within the same affected facility, not between separate plants, although the concept is similar.

The commenter's relating the "light liquid requirement" (assumed to mean the vapor pressure cutoff for the definition of light liquid) to the bubble concept does not seem logical. The vapor pressure cutoff was devised to eliminate those sources which do not have a tendency to leak (heavy liquid) from routine monitoring requirements. The vapor pressure definition would remain the same for different units trying to bubble emissions.

It is also difficult to understand the commenter's point about a performance standard's being consistent with the bubble concept. A performance standard is not a prerequisite for applying the bubble policy. It should be noted that a performance standard has been provided as an alternative for valves in gas and light liquid service.

Comment:

One commenter (IV-D-17) noted that a letter from the Texas Chemical Council to Walter Barber regarding a meeting held on July 18, 1980 with EPA had been omitted from Appendix A of the Background Document.

Response:

The July 28, and 20, 1980 letters from the Texas Chemical Council to Mr. Walter Barber regarding the July 18, 1980 EPA meeting arrived after the Background Information Document (BID) was printed. That is why these letters were not included in Appendix A of the BID. However, both of these letters as well as the minutes of the July 18, 1980 meeting have been considered in developing the regulation and were entered into the docket. The docket entries for the July 29 and the July 30 letters are II-D-78 and II-D-79, respectively. The docket number for the minutes of the meeting is II-E-20.

# APPENDIX A

# RESPONSES TO COMMENTS ON THE ADDITIONAL INFORMATION DOCUMENT

## APPENDIX A

## RESPONSES TO COMMENTS ON THE ADDITIONAL INFORMATION DOCUMENT

### Executive Summary

In a Federal Register notice on May 7, 1982 (47 FR 19724), the Environmental Protection Agency (EPA) announced the availability of Fugitive Emission Sources of Organic Compounds - Additional Information on Emissions, Emission Reductions, and Costs (EPA-450/3-82-010) and requested comment on the technical content of this Additional Information Document (AID). The AID is part of the background information considered in selecting the standards. The 14 comment letters received on the AID were all from industry representatives of companies and associations. A list of commenters, their affiliations, and the EPA docket number assigned to their correspondence is given in Table A-1.

After review of the comments on the technical content of the AID, EPA has concluded that the procedures (presented in the AID) for estimating emissions, emission reductions and costs are appropriate. Many of the comments on the AID were based on intuitive evaluations of fugitive emission sources. EPA has attempted to understand these intuitive evaluations and has prepared more detailed analysis in order to determine the appropriateness of the commenters' suggestions. In some cases, these detailed analyses have led EPA to change the standards since proposal. A few commenters presented detailed analyses. These analyses were evaluated by EPA and considered in selecting the procedure for estimating emissions, emission reductions and costs.

EPA considered carefully the comments on the proposed standards and on the technical judgments presented in the AID, particularly when determining the best demonstrated technology (BDT) for fugitive emission sources of VOC in SOCMI. For example, EPA has set alternative standards to reflect BDT for process units using low leak techniques. Process units with less than 2 percent of their valves leaking may opt for an annual performance test

TABLE A-1. LIST OF COMMENTERS ON THE ADDITIONAL INFORMATION DOCUMENT FOR FUGITIVE VOC EMISSION SOURCES

| Commenter and Affiliation | Docket Item No. |
|---|---|
| Mr. Ronald A. Lang<br>Executive Director<br>Synthetic Organic Chemical Manufacturers Association<br>1612 K Street, N.W., Suite 308<br>Washington, D.C. 20006 | IV-N-1, IV-N-6 |
| Mr. Charles P. Blahous, Vice President<br>Environment, Health, and Safety<br>PPG Industries, Inc.<br>One Gateway Center<br>Pittsburgh, Pennsylvania 15222 | IV-N-2 |
| Ms. Geraldine V. Cox, Vice President<br>Chemical Manufacturers Association<br>2501 M Street, N.W.<br>Washington, D.C. 20037 | IV-N-3, IV-N-9 |
| Mr. C. D. Malloch<br>Regulatory Management Director<br>Monsanto Company<br>800 N. Lindbergh Boulevard<br>St. Louis, Missouri 63166 | IV-N-4, IV-N-13 |
| Mr. Richard H. Smith<br>Environmental Specialist<br>El Paso Products Company<br>P.O. Box 3986<br>Odessa, Texas 79760 | IV-N-5 |
| Ms. Judith A. Feldman<br>Government Affairs Coordinator<br>Chevron Chemical Company<br>P.O. Box 3883<br>San Francisco, California 94119 | IV-N-7 |
| Mr. A. H. Nickolaus<br>Texas Chemical Council<br>1000 Brazos, Suite 200<br>Austin, Texas 78701 | IV-N-8 |

TABLE A-1. LIST OF COMMENTERS ON THE ADDITIONAL INFORMATION DOCUMENT FOR FUGITIVE VOC EMISSION SOURCES (CONTINUED)

| Commenter and Affiliation | Docket Item No. |
|---|---|
| Mr. T. A. Kittleman<br>Senior Engineer<br>E. I. DuPont de Nemours & Company<br>Wilmington, Delaware 19898 | IV-N-10 |
| Mr. Milton J. Rhoad, Managing Director<br>International Institute of Synthetic Rubber Producers, Inc.<br>2077 South Gessner Road, Suite 133<br>Houston, Texas 77063 | IV-N-11 |
| Mr. C. T. Seay<br>Chairman, Air Conservation Committee<br>Texas Chemical Council<br>1000 Brazos, Suite 200<br>Austin, Texas 78701 | IV-N-12 |
| Mr. William P. Gulledge<br>Manager, Environmental/Scientific Programs<br>Chemical Manufacturers Association<br>2501 M Street, N.W.<br>Washington, D.C. 20037 | IV-N-14 |

rather than monthly leak detection and repair. It is important to note that even though EPA's consideration of these comments focused on their technical aspects, EPA attempted to understand and analyze the underlying concerns presented in the comments.

This appendix presents summaries of the comments received and the responses to those comments. The comments and responses are grouped according to the topic area referred to in the AID. Section A.1 addresses comments on emission factors and emission factor development that was discussed in Chapter 2 of the AID. Section A.2 presents comments and responses on model units (Chapter 3 of the AID). Comments on the Leak Detection and Repair (LDAR) model and other emission control techniques are discussed in Section A.3, and comments on the costing methodology presented in Chapter 5 of the AID are discussed in Section A.4. Section A.5 contains responses to the comments on the economics data given in Appendix A of the AID.

A number of comments were received on material that was not addressed in the AID. The responses to these comments appear in Section A.6. Finally, there were many comments received that had been submitted previously on the proposed standards and background document. These comments are already addressed in various chapters of this Background Information Document. Thus, the responses are not repeated in this appendix. Section A.7, however, presents a listing of comment summary, docket item number of comment correspondence, and a reference listing of the portions of the BID that address the comment.

## A.1 EMISSION FACTORS

<u>Comment</u>: Several commenters asserted that SOCMI data is preferable to data from petroleum refineries and should be used wherever possible (IV-N-8; IV-N-4; IV-N-3; IV-N-1). One commenter referred to the Maintenance Study, saying (1) that petroleum refinery data indicate higher mass emission rates at a given screening value than do SOCMI data; (2) that for valves in gas service, even the 95 percent confidence intervals do not overlap; and

(3) that the number of leaking light liquid valves and pump seals in SOCMI are lower than those in petroleum refineries. He further argued that emission factors for all three processes in the Maintenance Study are lower than those from the Refinery Study.

Response: The commenter is correct in his assertion that the data from the Maintenance Study exhibit some differences from the data collected in the petroleum refinery studies. As explained in the AID, EPA recognized that fact, and accordingly, changed the estimates of emissions, emission reductions, and costs used to evaluate the standards. EPA has made the changes implicitly requested by the commenters.

As further explained in the AID, the reasons for the differences are not fully understood and could not be explained conclusively. Even though the Maintenance Study data may be the most complete set of data, all the data are not necessarily high quality, nor are the data complete. Thus, some of the data used to evaluate the standards originated from studies of refinery equipment. But in EPA's judgment, the data selected in the AID can be used to reflect the impact of the standards.

To summarize the analysis presented in the AID, EPA concluded that the best method for arriving at a complete set of emission factors was by using leak frequencies determined for SOCMI units in the 24-Unit Study (IV-A-11) to weight the emission factors determined in the petroleum refinery study. These studies were the two most comprehensive sets of fugitive emissions data available at that time. The refinery study represents the best available data on fugitive emissions rates (emission factors) from different equipment types. The 24-Unit SOCMI Study represents the best data available on leak frequencies for different types of equipment in SOCMI.

The emission factors resulting from combining these data sets were compared to the factors generated from Maintenance Study data. Only the emission factor generated for valves in gas service appeared to be abnormally high, as noted by the commenter. Further analysis led to the use of the leaking and nonleaking emission factors found for gas valves in three SOCMI process types. This resulting emission factor for gas valves fell within the range described by the gas valve emission factors found for the three SOCMI process types.

The emission factor data from the Maintenance Study were not chosen as emission factors for SOCMI because the study was designed to evaluate the effects of maintenance on emission characteristics of pumps and valves in VOC service; establishing emission factors for these equipment types was not the primary goal of the study. Furthermore, the average of emission factors from three unit types were not representative of an average for SOCMI and the emission factors generated were for only three types of equipment.

Comment: One commenter (IV-N-8) took issue with the criteria EPA used to choose data for estimating SOCMI fugitive emissions. About the first criterion, "relevance to estimating fugitive emissions from SOCMI," the commenter said that the SOCMI Screening and Maintenance studies (along with the analysis report) are the only data of unquestioned applicability and unquestioned validity collected specifically for this purpose. He asserted that all other data sets require assumptions, adjustments, or transformations to be applicable. He said that the SOCMI studies provide a body of high quality data which were taken by the same procedures and instruments the EPA has proposed for use in the SOCMI standards.

Concerning EPA's second criterion, "validity of testing and analytical methods used," the commenter said that the data from petroleum refineries were taken with different instruments, different calibrants and, in some cases, different monitoring methods. He cited an example of the Exxon Cyclohexane study which used soap solutions for leak detection.

The third criterion, "comparability to other work," the commenter called the antithesis of scientific investigation since it insures that original errors and inaccuracies are never resolved. He said that the real concern should not be comparability but applicability to SOCMI. The commenter did not understand why SOCMI data must be comparable to refining data nor why they must support EPA's assumption that all refinery data are applicable to the chemical industry. The commenter said he could understand EPA's wanting a single approach to both petroleum refining and SOCMI, but he said there are large differences between the two and the differences mean that portions of the refinery approach are not correct for SOCMI.

Response: The commenter presented a strong preference for the data in the Maintenance Study and the 24-Unit Study. However, where the commenter disagreed with EPA's judgment, the commenter did not present an objective rationale for the validity of doing so. In contrast, EPA evaluated each study and set of data and presented this analysis in the AID.

This evaluation presented in the AID makes it clear that the data contained in the Maintenance Study and 24-Unit Study are not the highest quality, best available data on fugitive VOC emissions, nor are they the sole source of data on fugitive emissions. Numerous studies have been conducted and these were reviewed in the AID, pointing out both strengths and weaknesses associated with each study. To gain maximum utility of the data from these studies, interpretation of the data is required, drawing upon the strong points of a study while considering its weaknesses. This evaluation and interpretation of the data was done in the context of the whole base of fugitive emissions work; it was not done just for isolated studies. Based upon this review and analysis, it was determined that the relevant data from widely different studies had to be merged and transformed into a useful means of estimating emissions.

A thorough evaluation of all the available studies on fugitive emissions provided a good basis for selecting the relevant data for estimation of emission factors. An example of this evaluation procedure is the Maintenance Study. The goal of the Maintenance Study was the determination of the effectiveness (success rate and emission reduction) of maintenance techniques in reducing fugitive emissions from valves and pumps in VOC service. Its purpose was not to generate emission factors for equipment in SOCMI. However, since the generation of emission factors was a secondary objective of the study, these factors were used as a guide to evaluate the emission factor estimation procedure.

The data used in developing emission factors had to be not only relevant to this fugitive VOC emissions work, but also valid with respect to acceptable testing procedures. Thus, another part of the data evaluation procedure involved the examination of sampling/testing procedures as a test of their validity. EPA agrees with the commenter that it is important to consider the differences between both testing and analytical techniques used in compiling the reported data. For instance, in comparing the reported emission factors, some important items to evaluate include (1) how the samples are collected, (2) how the measurements are made (field or laboratory determination), and (3) what type of equipment does the reported emission factor represent (e.g., only leaking equipment, complete distribution of equipment, etc.).

The same sort of comparisons were made for the various screening studies. Of particular importance for these kinds of studies was the method of determining leaks (soaping or instrument screening) and the leak definition used (bubble count or ppmv level). Soaping data were evaluated in a qualitative manner with instrument screening data. Analysis of data collected using two different monitoring instruments with different calibrants (TLV-hexane and OVA-methane) indicated that the differences are not relevant to the determination of leak frequency (see Chapter 12).

Comparability of the studies is not, as suggested by the commenter, the antithesis of scientific investigation. The various studies considered must be of a basis common enough to allow comparison of the results of the studies. Otherwise, no valid comparison of the studies can be made, and differences (including errors, etc.) cannot be determined. For example, the SOCMI and refinery studies could not be justly evaluated against one another if the data collected were not comparable. While comparability is an important criterion for evaluating fugitive emissions data, the primary criterion used is applicability, i.e., relevance, of the studies to VOC emissions from equipment in SOCMI. This criterion was discussed earlier in this section.

Comment: One commenter (IV-N-10) said the emission factors reported in Revision of Emission Factors for Nonmethane Hydrocarbons from Valves and Pump Seals in SOCMI Processes were in reasonable agreement with emission factors he had calculated independently from the same data. The same commenter continued, saying that the best estimators for industry-wide emissions from SOCMI are the average factors he calculated independently from Maintenance Study data:

EMISSION FACTORS (KG/HR/SOURCE) FOR VALVES:*
CALCULATED FROM EPA'S MAINTENANCE STUDY DATA

| | Gas Valves | | Light Liquid Valves | |
|---|---|---|---|---|
| Plant No. | Leaking | Nonleaking | Leaking | Nonleaking |
| 3 | 0.0468 | 0.00009 | 0.0282 | 0.00009 |
| 4 | 0.0391 | 0.00034 | 0.0253 | 0.00180 |
| 6 | 0.9561 | 0.00045 | 0.0265 | 0.00170 |
| 5 | 0.0698 | 0.00017 | 0.0249 | 0.00125 |
| 2 | 0.0375 | 0.00019 | 0.0321 | 0.00138 |
| Average | 0.0498 | 0.00025 | 0.0274 | 0.00124 |

*Emission factors were reported in lbs/hr/source and converted to kg/hr/source.

Another commenter (IV-N-8) recommended the following set of emission factors:

| | Leaker Rate (kg/hr/Source) | NonLeaker Rate (kg/hr/Source) |
|---|---|---|
| Gas Valves | 0.0497 | 0.000247 |
| Liquid Valves | 0.0273 | 0.00124 |
| Pumps | 0.0772 | 0.0070 |

Response: EPA acknowledges the commenter's verification (IV-N-10) of the revised emission factors reported in Docket Item No. IV-A-29. EPA does not agree, however, with the contention of both commenters that averaged emission factors based on the results of the Maintenance Study are the best estimators for industry-wide emissions from SOCMI. In the AID, EPA developed emission factors for different types of equipment in SOCMI. The rationale and support for the development procedure were clearly presented in that document.

EPA analyzed the available data on fugitive VOC emissions from SOCMI and other industries. It was determined that the SOCMI 24-Unit data were appropriate for establishing the percent of equipment components leaking. However, it was not the purpose of the Maintenance Study to develop emission factors. Consequently, the emission factors which can be derived from the Maintenance Study are not the best. EPA believes, as detailed in the AID, that data collected for equipment in petroleum refineries are more accurate and, in most cases, appropriate for determining the quantity of mass emissions from equipment components that leak, except in the case of valves in gas service. Based on this, emission factors for equipment in SOCMI were developed and used to estimate emissions for equipment types and services. An additional, although less important, consideration in this discussion is that the factors reported in Docket Item No. IV-A-29 described a range of emissions for gas valves, light liquid valves, and light liquid pumps. An arbitrary method of aggregating these emissions estimates would have been needed in determining nationwide impacts. Furthermore, emission factors determined in the SOCMI studies were limited to three types of equipment. Emission factors would have had to be generated for those sources not represented in IV-A-29 from the refinery data in any case.

Comment: Two commenters (IV-N-9; IV-N-10) said a source's leak rate is constant for all leak frequencies.

Response: As stated by the commenters, the emission factors for leaking equipment appear to remain fairly constant with varying leak frequency. Data from fugitive VOC emission studies tend to support this observation. This constancy of values for leaking component emission factors provides the basis for the approach used by EPA in developing the average emission factors. EPA's approach was presented in the AID in Chapter 2.

Comment: Three commenters (IV-N-8; IV-N-1; IV-N-14) took issue with the assumption of the distribution of units in SOCMI. Two of the commenters (IV-N-8; IV-N-14) said the distribution is weighted too heavily with high leak-rate ethylene plants. One commenter (IV-N-1) said the 15 process types were not selected as a representative sample of the true distribution. Another (IV-N-8) said 37 percent of the valves screened were from ethylene plants.

The commenter recommended that a more reasonable way to arrive at a distribution would be to average the 15 processes, giving equal weight to each process. He showed a comparison of this method with EPA's method.

| | EPA Method | Equal-Weight Method |
|---|---|---|
| Ethylene Plant Weighting in Averages Below | 37% | 6.7% |
| Average % Leaking | | |
| Gas Valves | 11.4 | 4.2% |
| Light Liquid Valves | 6.5 | 2.9% |
| Pump Seals | 8.8 | 7.7% |

Response: The commenters are in disagreement with EPA over how to determine the leak frequency that is assumed to represent the behavior of equipment in SOCMI. In the absence of more definitive information, EPA assumed that the total number of equipment components in the 24-Unit Study is applicable for the estimation of emission factors for the industry. This assumption and its known weaknesses were noted in the AID. EPA believes these assumptions to be reasonable. The relatively high proportion of valves in ethylene units represented in the sample is not considered inconsistent with the number of large, complex ethylene units that supply the majority of input chemicals for the rest of SOCMI.

The commenters' recommended procedure also entails the acceptance of some assumptions. The assumption of equal weight throughout SOCMI for the 15 process types represented in the 24-Unit Study is no more realistic than the assumptions EPA has made. The assumption of equal weighting may, in fact, be less accurate due to the prevalence of large complex ethylene units in SOCMI.

Comment: One of the same commenters (IV-N-8) said EPA should have obtained data to characterize the distribution of leak rates in SOCMI from contractor studies such as the Hydroscience report. He said the Hydroscience report shows less than 15 percent of valves in ethylene plus propylene service.

Response: The leak frequencies determined for the total equipment counts in the 24-Unit Study represent a cross-section of SOCMI. The assumption was made (as discussed in the previous response) that the 24-Unit Study represented the distribution of leaking and nonleaking equipment components in SOCMI. These data do not characterize the distribution of leak rates in SOCMI; they relate to the number of equipment components found leaking or not leaking. Furthermore, leak rates are characterized for equipment in specific VOC services (e.g., valves in gas service, pumps in light liquid service, etc.), not for industries.

The version of the Hydroscience report referenced by the commenter was a draft report; the data cited by the commenter were not incorporated in the final report. The proportion of valves in ethylene units in the Hydroscience surveys is a gross underestimate of valves in ethylene units. Using the draft report, approximately 1013 valves per unit were estimated for ethylene units from P&ID diagrams. However, based on the 24-Unit Study in which actual physical counts were made, an average of over 4800 valves were found in each ethylene unit.

If the valve counts reported in the Hydroscience study were adjusted using the average valve count found in the 24-Unit Study for the 15 process types, valves in ethylene units would comprise about 34 percent of the total count for the 415 units in the Hydroscience study. This is the same percentage attributed to valves in ethylene units in the 24-Unit Study (see Table A-2).

Comment: The validity of EPA's data base on fugitive emissions was called questionable by one commenter (IV-N-4). The commenter said that his concerns about the data were highlighted by Table 2-20 and by the use of

TABLE A-2. COMPARISON OF EQUIPMENT COUNTS FOR SOCMI PROCESS UNITS

| | | Valves in VOC Service[a] | | | |
|---|---|---|---|---|---|
| Chemicals(s) | Number Of Plant Sites (Hydroscience) | Average Number Per Unit (24-Unit Study) | Total Number As Orginally Reported By Hydroscience | Total Number With Revisions From 24-Unit Study | Total Number In 24-Unit Study |
| Acetaldehyde | 4 | 1,080 | 7,098 | 4,320 | 1,080 |
| Acetic acid | 9 | | 6,199 | 6,199 | |
| Acetic anhydride | 6 | | 4,000 | 4,000 | |
| Acetone cyanohydrin | 3 | | 1,263 | 1,263 | |
| Acrolein/glycerin | 4 | | 8,000 | 8,000 | |
| Acrylic acid | 3 | | 3,156 | 3,156 | |
| Acrylic acid esters | 5 | | 7,796 | 7,796 | |
| Acrylonitrile | 6 | 1,604 | 7,101 | 9,624 | 3,208 |
| Adipic acid | 5 | 1,030 | 4,734 | 5,153 | 2,061 |
| Aniline/nitrobenzene | 7 | | 6,629 | 6,629 | |
| Benzene | 14 | | 5,779 | 5,779 | |
| Butadiene | 20 | | 33,941 | 33,941 | |
| Caprolactam | 3 | | 17,713 | 17,713 | |
| Chlorobenzenes | 6 | | 5,657 | 5,657 | |
| Chloromethanes | 17 | 1,468 | 17,000 | 24,965 | 2,937 |
| Cumene | 14 | 855 | 12,765 | 12,397 | 1,771 |
| Cyclohexane | 11 | | 3,245 | 3,245 | |
| Cyclohexanone/cyclohexanol | 8 | | 8,626 | 8,626 | |
| Dimethyl terephthalate | 6 | | 15,428 | 15,428 | |
| Ethyl acetate | 8 | | 2,140 | 2,140 | |
| Ethylbenzene/styrene | 19 | | 8,087 | 8,087 | |
| Ethylene/propylene | 37 | 4,842 | 52,690 | 179,166 | 14,527 |
| Ethylene dichloride | 17 | 1,212 | 18,778 | 20,604 | 2,424 |
| Ethylene oxide | 16 | | 10,635 | 10,635 | |
| Formaldehyde | 53 | 230 | 11,953 | 12,190 | 230 |
| Glycol ethers | 9 | | 2,574 | 2,574 | |
| Linear alkyl benzene | 4 | | 10,042 | 10,042 | |
| Maleic anhydride | 9 | | 3,724 | 3,724 | |
| Methanol | 12 | | 6,616 | 6,616 | |
| Methyl methacrylate | 5 | 1,844 | 3,236 | 9,220 | 1,844 |
| Phenol/acetone/methyl styrene | 11 | 3,337 | 11,207 | 36,707 | 3,337 |
| Terephthalic acid | 3 | | 2,055 | 2,055 | |
| Urea | 40 | | 2,685 | 2,685 | |
| Vinyl acetate | 7 | 2,176 | 12,732 | 15,236 | 4,353 |
| Vinyl chloride | 14 | 1,862 | 22,750 | 26,075 | 3,725 |
| Other Units | | | | | 1,285 |
| Total | 415 | | 358,034 | 528,705 | 42,782 |

[a]Valves includes pressure relief devices, open-ended valves, and in-line valves.

ambient temperature vapor pressure data to characterize chemicals which will result in VOC leaks. He said that according to the AID, cumene has the same leak frequency as ethylene, but no data are provided on processing conditions involved in the processes tested. He said that the cumene processes had to have been high temperature operations or the loss of cumene to the workplace would not have been detected. According to the commenter, at 10,000 ppmv, the vapor pressure of cumene would have to be 7.6 mm Hg or greater. Processing temperatures would have to be above ambient (97.3°F or 33.5°C) for this to occur, he said. He compared these temperatures to those for ethylene at 7.6 mm Hg vapor pressure (-103.9°C) and concluded that ethylene leaks would be detected at temperatures below ethylene's boiling point.

Response: Studies of fugitive VOC emissions (II-A-26; IV-A-14) have shown that the major factor affecting the percent of leaks detected (or leak frequency) for any equipment type is the vapor pressure of the substance in the line. This finding forms the basis for separation of different types of equipment by service (gas, light liquid, heavy liquid). The substance in the line does not necessarily mean the substance produced as the final product. In the example cited by the commenter, the leaks found in the cumene process units were not identified as cumene; there are other substances involved in the manufacture of cumene, notably benzene. The vapor pressure of these other compounds must be considered if they are the substances contained in the line being tested.

The commenter also stressed the importance of temperature on leak frequency. The effect of temperature (in-line and ambient) on leak frequency was also examined in Docket Item No. IV-A-14. Temperature was found to have little effect on leak frequency. Where any effects were noted, they proved to be inconsistent.

At atmospheric pressure (760 mm Hg), a vapor pressure of 7.6 mm Hg for any substance would result in a concentration of 10,000 ppmv. Boiling points are defined as the temperature at which the vapor pressure of a substance is equal to the atmospheric pressure (i.e., vapor pressure equals

760 mm Hg). The temperature at which a substance has a vapor pressure of 7.6 mm Hg, therefore, will always be less than its normal boiling point where its vapor pressure will be about 760 mm Hg.

Comment: One commenter (IV-N-4) found EPA's using emission rate data from another industry which does not face the same control practices hard to understand. This commenter said that the correction of the emission rate data for differences in leak frequencies is not an acceptable alternative to the use of SOCMI emission rate data. He continued, saying that EPA's proposal to use leak rate data from petroleum refinery studies instead of actual SOCMI data penalizes facilities which have achieved low emission rates.

Response: Techniques for controlling fugitive emissions were designed for control of emissions from equipment in VOC service. They are not specific to a given industry such as SOCMI or petroleum refining. In any case, refineries are subject to as strict control practices as chemical plants. As stated above and in the AID, mass emissions data for equipment in VOC service in petroleum refineries represent the best available data for establishing mass emissions from VOC-emitting equipment. When combined with leak frequency data from the 24-Unit Study, these data, in general, provide estimates of emission factors that are bounded by the range of values found in SOCMI studies (IV-A-29). The notable exception was valves in gas service; data from SOCMI studies led to the development of an emission factor for this equipment type and service that is also bounded by the emission factors generated for three SOCMI process types.

EPA's use of emission rate data from petroleum refining studies has resulted in emission factors that are similar to the values found for three types of equipment in SOCMI units. Units that achieve low emission rates are not penalized as suggested by the commenter. Process units that have low leak frequencies (indicating low leak rates) have been provided for in the standards with alternative standards for valves (see Chapter 14). These alternative standards allow reduced monitoring efforts for units that meet certain low leak frequency criteria.

Comment: Another commenter (IV-N-1) said that the original proposal was premised on the assumption that emissions from petroleum refineries are similar to emissions from SOCMI units and that data showing the need for control in petroleum refineries would support the need for controls in chemical plants. This commenter contended that the data presented in the AID refuted this assumption. He said the effort to extrapolate from refinery data to SOCMI fails to produce realistic emission factors for SOCMI. Another commenter (IV-N-3) said data referenced in Section 2 further substantiated his position that SOCMI fugitive emissions are significantly less than those encountered in the petroleum refining industry.

Response: It is not assumed that the emissions from the two industries are similar. Rather, the standards are premised on an analysis of data related to the substances processed and the equipment used, regardless of the industry in which the equipment is being used. Similarly, the need for the standards, as discussed in Chapter 2, is not based on an assumption that SOCMI and refinery emissions are similar. The need for fugitive VOC emission standards for equipment in SOCMI is determined independently from the need for standards in the refining industry as discussed in Chapter 2. Control technologies for equipment leaks in the petroleum refining and SOCMI industries are similar because equipment used and substances processed are similar. EPA believes the data in the AID support rather than refute the basis of the standards.

As detailed in the AID and discussed above, the emission factors used to estimate emissions from equipment in SOCMI are considered by EPA to be the most realistic factors available to date. They are the result of a reasoned examination and analysis of available fugitive emissions studies.

Comment: One commenter (IV-N-1) contended that emission factors from batch processes used by small producers are different from emission factors for continuous processes. He said that a single set of emission factors could not describe differences in production methods.

Response: This same commenter made this statement in an earlier set of comments (IV-D-38) submitted on the proposed standards. As is noted in Section 5.5 on "Small Manufacturers," the data base includes information on small manufacturers. EPA has used these data in developing the model units emission characteristics, and has found no reason to believe that emissions from leaking equipment in small batch units would be any different from the same emissions in other units. The equipment processing VOC is performing the same function in both types of processes.

EPA has provided a low production volume (1,000 Mg/yr) exemption for small facilities. If a unit produces more than this quantity of chemicals, on either a continuous or batch basis, it will have fugitive emissions that can be controlled at a reasonable cost. Furthermore, since batch operated units are, by design, shutdown on a more frequent basis than continuous units, effective repairs can be made more quickly. This would tend to increase the emissions reduction achievable since unrepairable equipment would not accumulate for longer periods as in a continuous unit.

Comment: Two commenters (IV-N-8; IV-N-1) objected to SOCMI's characterization by a single average unit. The commenters said a single unit failed to capture the variability in the industry. One of the commenters (IV-N-1) said the use of a single average unit leads to serious distortions of emissions from individual processes.

As support for this perceived distortion he referenced a chart distributed at the APCA meeting in June 1982. The commenter said the average unit is not representative of the processes that make up the industry because leak rates for some processes are overstated, while leak rates for other processes are understated. He further stated that data in the AID show that "average units do not characterize the industry because of differences in the characteristics of the substances produced." He cited variations in volatility, safety considerations, odor considerations, and OSHA regulations.

The commenter cited two passages in the AID as support for his contention that an average unit cannot represent SOCMI:

> There are no mass emissions data which can be considered representative of emission factors for SOCMI as an industry. (AID at 2-51)
>
> Reviewing the available studies of fugitive emissions from SOCMI units, no studies were found that resulted in a full set of emission factors applicable to SOCMI in general. Furthermore, no study had been designed to establish a single set of emission factors for SOCMI fugitive emission sources. (AID at 2-58)

He objected to the fact that despite these acknowledged data limitations, the AID attempts to extrapolate from the petroleum refinery data to estimate emission factors for SOCMI.

The other commenter (IV-N-8) said SOCMI cannot be characterized by a single average leak frequency for the purpose of determining monitoring frequency. He said that use of a single average leak frequency leads to absurd results for low-leak plants. He gave as an example vinyl acetate plants which would have to monitor every two weeks just to maintain their initial or uncontrolled emission levels.

Response: In developing standards and assessing impacts, several types of emission factors are required. One average emission factor is needed to determine the industry-wide effect of the standards, and a second more detailed set of emission factors is required to evaluate the effect of controls on categories of facilities affected by the standards.

EPA has acknowledged that there is no average SOCMI unit which can serve as a predictor of the performance of individual process units. However, the concept of industry averages is appropriate and has been used historically by EPA to estimate the impacts of control alternatives on the industry as a whole. Furthermore, the task of compiling estimates, which would be a formidable and impractical undertaking, is unnecessary.

In preparing emission estimates for the industry, EPA is not predicting emissions for any given process unit. Rather, the average values are used with the knowledge that there are units with emissions lower than the average, and units with emissions greater than the average. EPA's average emission factors fall within the range determined for some equipment types in three SOCMI process types (IV-A-29). Averaging techniques are applied as a straightforward means of arriving at industry-wide emissions estimates. The results of these estimating procedures give a reasonable approximation of fugitive emissions from SOCMI.

In evaluating the effects of alternative control approaches on individual categories of facilities affected by the standards, the limitations of the available data on fugitive emissions must be carefully assessed. This need was clearly acknowledged in the AID. Categorization of factors is unnecessary. The commenter has quoted two passages from the AID without giving the same qualifications presented in that document. While it is true that there are limitations on SOCMI fugitive emission data, and on fugitive emission data in general, these limitations were considered in determining which data were applicable to establishing a set of average emission factors for SOCMI. It was due to these limitations that judgments concerning the data had to be made. The limitations of fugitive emissions data were restricted to estimating emissions; they did not relate to the achievability of the fugitive emission control techniques being applied. Based on the studies of fugitive VOC emissions, it is obvious that fugitive emissions do occur and that control techniques are available that effectively reduce them.

As discussed in the AID, the study of fugitive emissions from petroleum refining was specifically designed to generate emission factors for different types of equipment. The Maintenance Study on the other hand focused on the effects of maintenance in reducing emissions; establishing emission factors was not a primary goal. When differences in the two sets of emission factors were noted, and after noticing that leaking emission factors remain remarkably constant among units, EPA used the leak frequencies found in the 24-Unit Study to adjust the emission factors from the refining work for the differences and another comparison was made. The only average emission factor falling outside of the range described for selected SOCMI equipment types (IV-A-29) was for gas valves. Upon closer examination of the data, differences in the leaking and nonleaking emission factors from gas valves in the SOCMI units were found to be markedly different and to have tighter confidence bands. Therefore, they were used as the basis for determining the average emission factor for gas valves in SOCMI. The resulting factor was verified since it is within the range described in Docket Item No. IV-A-29.

The use of average emission factors is typically used in estimating impacts of standards. The technique has been found to yield reasonable approximations. But in establishing standards, variability of data is also considered. Variability of leak frequency, emission factor, and leak occurrence rate, among other things, has been considered in setting standards for SOCMI fugitive emitting equipment. For example, the standards provide for less frequent monitoring (monthly/quarterly leak detection and repair, and other alternative standards) should low leak status be maintained.

Comment: One commenter (IV-N-8) thought EPA's rationale for using a single average unit was not convincing. The commenter said that estimation of national impacts does not have to be done by extrapolating emissions from a single typical unit to the entire U.S. population of units in SOCMI. He said national impacts could be determined from the sum of any number of subsets instead. Referring to EPA's rationale in the AID, the commenter said the situation in SOCMI is not similar to the refining industry because of the wide variation in SOCMI products. He said the fact that EPA used a single set of emission factors for estimating impacts in the petroleum refining industry was not a reason; it was simply what EPA did. He said data in Table 2-2 and the 24-Unit Study showed much more variability in SOCMI than in petroleum refineries. As an example the commenter said the leak frequencies for gas valves were 5.6 to 27.3 percent in refineries, a factor of 4.9; while in SOCMI, leak frequencies were 1.0 to 14.8 percent, a factor of 14.8. Another commenter (IV-N-1) said the effort to extrapolate from a fictional average refinery unit to a fictional average SOCMI unit fails to produce realistic emission factors for SOCMI.

Response: The estimation of national impacts does not have to rely on the extrapolation of a single typical unit to the expected population. It is true that estimates can be based on an aggregation of subsets different from the current model unit concept. (The method used currently, however, is appropriate and reasonable.)

EPA has defined its subsets as three model units, which describe three degrees of process unit complexity. Each model unit is composed of various numbers of equipment components (valves, pumps, compressors, etc.) in different services (gas, light liquid, heavy liquid) based on the vapor pressure of the substances being handled. In previous studies, vapor pressure of the substance in the line was found to be the major factor affecting leak characteristics (i.e., leak frequency). Therefore, equipment types were considered by service, and emission factors were developed accordingly. Emissions estimates were then based on aggregated emissions for three model units and extrapolated to the projected number of model units. While the commenters suggest other methods for defining subsets for determining emissions impacts, they do not present their methodology nor the results of their recommended procedure. Additional discussion of emissions aggregation methods is presented in the comments and responses to Chapter 3 (Model Units) of the AID.

The comparison of ranges of leak frequencies for petroleum refinery data and SOCMI data made by the commenter is inappropriate. The factors presented by the commenter are affected by the absolute value of the lower bound of leak frequency. Since the lower bound for SOCMI data was less than the lower bound for petroleum refining data, the range factor for SOCMI computed by the commenter appears to be much larger. The appropriate comparative ranges of leak frequencies would have been 21.7 percent and 13.8 percent for refineries and SOCMI, respectively. This comparison does not necessarily indicate a higher degree of variability associated with emissions from SOCMI equipment.

As discussed previously in this section, the emission factors developed for estimating emissions from SOCMI were based upon a reasoned examination of the available studies of fugitive emissions. They are not a mere extrapolation from an average refinery unit to an average SOCMI unit. In fact, the emission factors developed for SOCMI equipment do provide appropriate estimates for nationwide emissions.

## A.2 MODEL UNITS

Comment: One commenter (IV-N-8) maintained that model units should be based on low, medium, and ethylene leak rates instead of on process complexity. He said that basing model units on process complexity does not lead to meaningful consequences because all three model units have the same cost per component monitored, the same emission reduction per component monitored, and the same cost per Mg VOC emission reduction. He said the thing that does make a difference in costs per component and cost effectiveness is leak rate. The commenter included some calculations for Model B units under quarterly monitoring of valves with low, medium, and ethylene leak frequencies. He concluded that leak frequency is the thing that makes a difference in costs and cost effectiveness per component, and, therefore, the model units should be based on varying leak frequencies.

Response: By following the commenter's recommendation, it would be possible to define a large and complex set of model units. Although the commenter's analysis was confined to varying leak frequencies for valves, several leak frequencies for each type of equipment could be modeled for several units of varying complexity. The model units could also include different trends in leak frequency for different types of equipment. It is easy to see that this type of analysis would very quickly result in a large matrix of model units. However, adding all of this complexity would result in little benefit in terms of estimating regulatory impacts. Obtaining estimates of impacts would still require averaging. The same can be said for adding the complexity required to model three different leak frequencies for valves as suggested by the commenter. The result would be an expansion of the number of model units from three to nine, and estimating impacts would still require averaging. The added complexity would not improve the analysis used in establishing the standards; therefore, for purposes of estimating impacts of the standards, EPA has assumed average leak frequencies for each of the different types of equipment and three levels of complexity.

Variations in leak frequency are important and have been considered in the formulation of the standards, however. Notable examples of this type of consideration are the alternative standards for valves. These alternative standards address the leak frequency variation of valves pointed out by the commenter, providing less costly options for owners or operators with low leak frequencies. (See comments in Miscellaneous for other examples of options for compliance.)

Finally, the commenter is correct in his assertion that leak frequency affects costs on a per component basis. However, costs and emissions for process units depend on the number and kinds of fugitive emission sources present as well as on leak frequencies.

Comment: The same commenter (IV-N-8) said EPA's reasons for not using different leak rate models were unconvincing. The commenter responded to EPA's assertion that it was impractical because there was no distribution of the number of units in each leak category. He said that EPA had assumed a distribution based on the 24-Unit Study to get the proposed average industry emission rates, a distribution he thought poor (see Section 2). The commenter said that EPA had thought it impracticable to do a cost analysis for model plants based on leak frequencies, but that he had been able to perform a cost analysis on a hand calculator. To the objection EPA raised concerning the impracticality of categorizing all the process units, the commenter said he was not asking EPA to categorize all the processes. He was simply stating that SOCMI processes have a wide range of leak frequencies and was requesting that EPA's regulations be reasonably appropriate for all units in SOCMI. He finally responded to EPA's reasoning that the complexity introduced was unwarranted because of leak rates varying among different components and with time. He said that these complexities were associated with the real world and that EPA's responsibility was to develop regulations applicable to the real world, not some hypothetical case.

Response: The first issue raised by the commenter concerning the distribution assumed for SOCMI is addressed in Section 2 as noted in the comment. Turning to the issue of practicability of construction of varying leak frequency model units, the commenter claims to have performed the analysis on a hand calculator. However, it should be noted that the commenter's calculations included varying leak frequencies for valves only. His analysis does not indicate how the varying leak frequencies would be aggregated. EPA has performed an analysis similar to the commenter's but not within the context of model units. As EPA has noted, modeling varying leak rates for different types of equipment would constitute a much more complex problem, complexity which could not be justified with respect to the results achieved.

The problem of categorizing SOCMI units was dismissed by the commenter as unnecessary for such an analysis. However, he did not offer any solution to the problem of assigning units to categories. It is difficult to see how an analysis such as the one requested by the commenter could be performed otherwise. The approach used by EPA avoids the problem and achieves the result of defining appropriate standards which account for ranges of leak frequencies, as the commenter requests. Variability in the industry has been taken into account in arriving at reasonable standards, applicable to all of SOCMI. Evidence of these considerations may be found in Chapter 14 (Alternative Standards) and in the Miscellaneous Section of this Appendix.

EPA realizes that there is an obligation to develop real world standards. EPA has accepted that responsibility and believes this responsibility has been met. Complexities associated with standards for equipment in SOCMI that emit fugitive VOC have been analyzed thoroughly and standards have been developed to provide for those complexities.

Comment: The same commenter (IV-N-8) recommended that regulatory scenarios be analyzed for occurrence rates of 0.2, 1, and 2 percent per month.

Response: As in similar comments submitted by this same commenter, his recommendation concerns valves only. The commenter has apparently overlooked the fact that varying occurrence rates for different types of equipment would result in a very complex analysis which is not justified by the end result. Therefore, as explained in the preceding comments and responses, EPA has not incorporated varying leak frequencies and occurrence rates in the model units.

However, an analysis of varying leak frequency and occurrence rate for valves has been performed. It is included in Chapter 14. This analysis was used in developing standards for valves which are reasonable and appropriate for low leak frequency units as well as high leak frequency units.

Comment: Another commenter (IV-N-1) said that model units should be based on such items as unit size, system pressure, system temperatures, volatility, odor threshold, existing control measures, and size of producer.

Response: Construction of model units for this long list of parameters would result in an extremely complex set of model units. As stated previously, this type of complexity is unnecessary. The variations, if added to the analysis, would add an undue amount of complexity which would then be averaged out in aggregating the impact estimates. Furthermore, of the parameters listed by the commenter, only volatility has been shown to have a significant effect on leak frequency. It would be inappropriate to define model units by varying parameters which have not been shown to have a large effect on fugitive emissions. To the extent the commenter was suggesting that EPA tailor the standards to model units with various items (as mentioned above), EPA has done so where data indicate a need to do so.

Comment: A commenter (IV-N-1) said that EPA's models fail to present an accurate portrayal of the industry.

Response: Analysis of all of the information available to EPA indicates that the model units present an accurate picture in aggregate. (See AID for review of available data.) That is, the national averages for emissions and costs are reasonably accurate insofar as accuracy can be determined. The only means to a more accurate estimate would be by sampling every unit in SOCMI, an unreasonably expensive undertaking. EPA's information covers batch, continuous, simple, complex, hazardous, benign, and malodorous chemicals.

EPA realizes that, just as in the case with averages of any kind, some units will have higher leak frequencies and some will have lower leak frequencies; some will have more equipment, and some will have less equipment. However, averages are useful tools, and they are necessary in aggregating total impacts of the standards. With any average it is important to keep the range represented by the average in mind. EPA recognizes this fact, and the standards have been written to allow for differences in units represented by the model units.

In summary, the model units appropriately represent the range of units in SOCMI. Furthermore, they reflect variations in the main factor which influences costs, emissions, and emission reductions, i.e., number of equipment components.

## A.3 EMISSION REDUCTIONS

### A.3.1 The LDAR Model

Comment: Several commenters (IV-N-10; IV-N-9; IV-N-11; IV-N-8) favored using the LDAR model, although they said it needed further work. Commenters felt that the LDAR represented an improvement over the ABCD model which they recommended be dropped from consideration.

Response: The selection of the LDAR model in the AID as an evaluation tool indicates EPA's agreement with the commenters that the LDAR model represents an improvement over the ABCD model. Comment on the LDAR model was requested with release of the AID for public review. Suggestions for improvement have been considered. Although the LDAR model does represent an improvement over the ABCD model, its proper implementation requires more data than the ABCD model. As a result, the ABCD model may still be the only mode of evaluating leak detection and repair programs for equipment for which only limited data (of certain kinds) are available.

For example, sufficient data were not available to use the LDAR model to evaluate leak detection and repair programs for pressure relief devices. Therefore, the ABCD model was used to make this estimate. The ABCD results were adjusted, however, based on LDAR model results for other equipment (see Section 4.3 of the AID). Since the results of the LDAR model for gas valves indicated a lower effectiveness than estimated by the ABCD model for gas valves, a ratio of these two results was used to adjust the ABCD model results for pressure relief devices in gas service (IV-B-19). Thus, where the LDAR model is not readily applicable, the ABCD model still provides a means of evaluating leak detection and repair programs. In some cases, the ABCD approach can be supplemented with information generated by the LDAR model for other equipment types.

Comment: Two commenters (IV-N-10; IV-N-8) said that the model results should be reported and evaluated in terms of mass emissions rather than fractional reduction. Both commenters made the point that a small fractional reduction may give a large emission reduction and vice versa. One (IV-N-10) added further arguments, saying that since emission rate is the value of interest, it would be more appropriately reported, and that emission rate figures are not likely to cover up apparent anomalies in the model (as discussed in the previous comment).

Response: The LDAR model, as presented in Docket Item No. IV-A-22, provides sufficient information for the computation of mass emissions and mass emissions reduction. In the summary tables in the computer output, both the mean emission factor and fractional emissions reduction associated with the LDAR program are presented. Either value can be used to compute the controlled emissions rate and the emissions reduction when coupled with the number of equipment components considered and the average input emission factor. Furthermore, the computer programming can be modified by the user to print out these results in any format that may be desired.

The commenters are correct in pointing out that fractions and percentages should be used with caution. It is good practice to present both the fractional values and the actual computed emissions levels since both of these numbers are important. Both values are presented in the AID in Table 4-15 for valves and in Table 4-20 for pumps in light liquid service.

Comment: One commenter (IV-N-10) agreed with the gist of EPA's discussion of "assumed baseline levels" and "uncontrolled levels" of emissions. He said he recognized the difficulties inherent in developing a good basis for comparison of emissions results for the NSPS. The commenter saw that both contained major uncertainties for typifying the industry. However, the commenter went on to say that he saw a definite advantage to the "uncontrolled" level basis for comparing costs and effectiveness of various regulatory strategies. The advantage the commenter saw was that the occurrence rate appears directly in the comparison basis. The commenter said this was not the case with the assumed baseline level basis. He said using an assumed baseline level basis apparently avoids assumptions about typical SOCMI occurrence rates. However, since an occurrence rate is assumed in the LDAR model for regulated plant emission rate calculations, it is likely that an occurrence rate is implicitly involved in the baseline level.

Response: There are problems associated with comparison of one level of control (e.g., monthly leak detection and repair) to some other level, whether that level be an "assumed baseline level" or an "uncontrolled emissions level." Any comparisons among levels of control will be based on some degree of uncertainty because data collected to compare levels of control with the LDAR model are collected either in different plants or at different times.* However, when comparisons of different levels of control are based on appropriate data, relevant comparisons can be made.

*The feasibility of obtaining truly uncontrolled data within an operating unit is questionable. An operating unit's primary purpose is to produce chemicals. Interference or interruption of normal operating and maintenance practices to collect truly uncontrolled occurrence rate data may inhibit production and, thus, would not be reasonable.

When using the LDAR model, it is appropriate to use information and data collected during the Maintenance Study unless better information and data are available. The occurrence and recurrence rate data are the most relevant and useful data from the Maintenance Study; they have been used in executing the LDAR model. Furthermore, analysis of the impacts of various levels of control using these data (and data outlined in the AID) is an appropriate means of selecting the level of control required by these standards. The comparisons used in selection of the standards included a comparison to the level of control that would be evident in the absence of the standards and comparisons to incrementally more and less restrictive levels of control. The comparisons used in selecting the standards are on a common basis.

Comment: Three commenters (IV-N-9; IV-N-8; IV-N-10) said that the equation used in the LDAR to correlate mass emission rates and leak frequencies is inappropriate. One commenter (IV-N-8) said he understood that the model splits a fixed emission factor with 98 percent to leakers and 2 percent to nonleakers, regardless of leak frequency. The commenter recommended that the model be corrected to reflect the concept presented in Section 2 of the AID; that is, that leakers have a certain emission rate per source and that nonleakers also have a certain emission rate per source.

Another of the three commenters (IV-N-10) described the model's workings, saying that instead of using a constant emission factor for each valve category, the LDAR calculates different emission factors, as an intermediate step, for each category and application. He said the model assumes average emissions for each valve category based on the number of valves initially in the category. The commenter described four valve categories defined by the model as leaking gas valves, leaking light liquid valves, nonleaking gas valves, and nonleaking light liquid valves. He provided emission factors he calculated from the Maintenance Study data as shown in Table A-3.

TABLE A-3. EMISSION FACTORS (KG/HR/SOURCE) FOR VALVES: CALCULATED FROM EPA'S MAINTENANCE STUDY DATA*

| | Gas Valves | | Light Liquid Valves | |
|---|---|---|---|---|
| Plant No. | Leaking | Nonleaking | Leaking | Nonleaking |
| 3 | 0.0468 | 0.00009 | 0.0282 | 0.00009 |
| 4 | 0.0390 | 0.00034 | 0.0253 | 0.00180 |
| 6 | 0.0561 | 0.00045 | 0.0265 | 0.00170 |
| 5 | 0.0698 | 0.00017 | 0.0249 | 0.00125 |
| 2 | 0.0375 | 0.00019 | 0.0321 | 0.00138 |
| Average | 0.0498 | 0.00025 | 0.0274 | 0.00125 |

*Values were reported by commenter in lbs/hr/source and converted to kg/hr/source.

He said that, overall, these data show little difference among units in spite of the fact that the leak frequencies ranged from 1 percent to more than 25 percent.

The commenter contrasted these emission factor calculations with the procedure used in the LDAR model. He said that the model calculates emission factors for each of the four valve categories described in Table A-3 based on the initial leak frequency of the valves. He then presented a graphical analysis, Figures A-1 and A-2, showing his understanding of the LDAR emission factor calculation method superimposed on the emission factors presented in Table A-3. He concluded that the relationship used in the LDAR model is not supported by the Maintenance Study data.

Response: The commenters have misunderstood several aspects of the LDAR model mechanics and the way EPA used the model to arrive at estimates of impacts. First, the categories defined by the LDAR model are not those given by one of the commenters (IV-N-10). They are, rather

(1) Nonleaking sources (sources screening < action level),

(2) Leaking sources (sources screening ≥ action level),

(3) Leaking sources which cannot be repaired on-line and are awaiting a shutdown for repair, and

(4) Repaired sources with early leak recurrence,

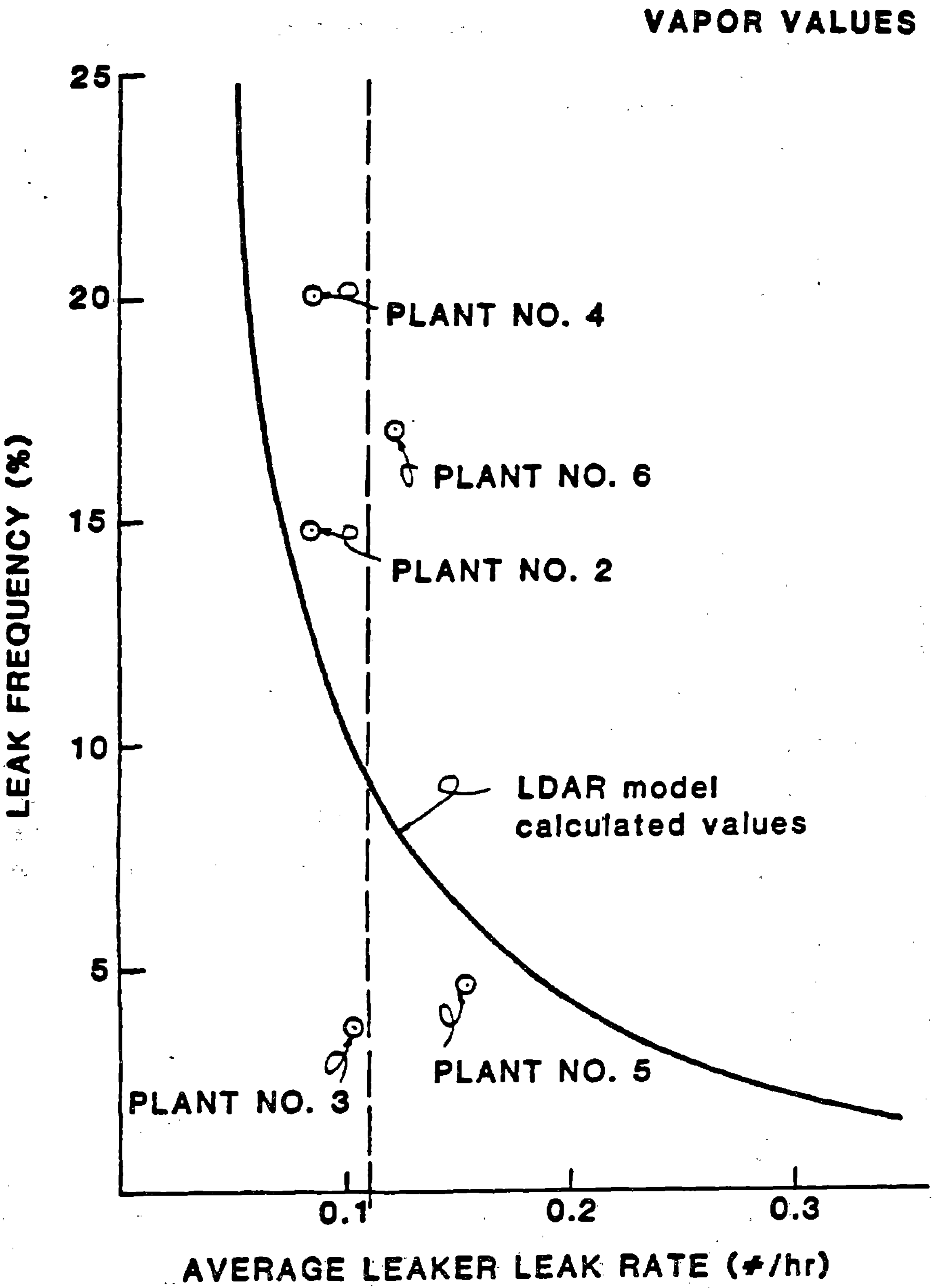



Figure A-1. Emission factor for leaking valves in gas service as a function of leak frequency (IV-N-10).

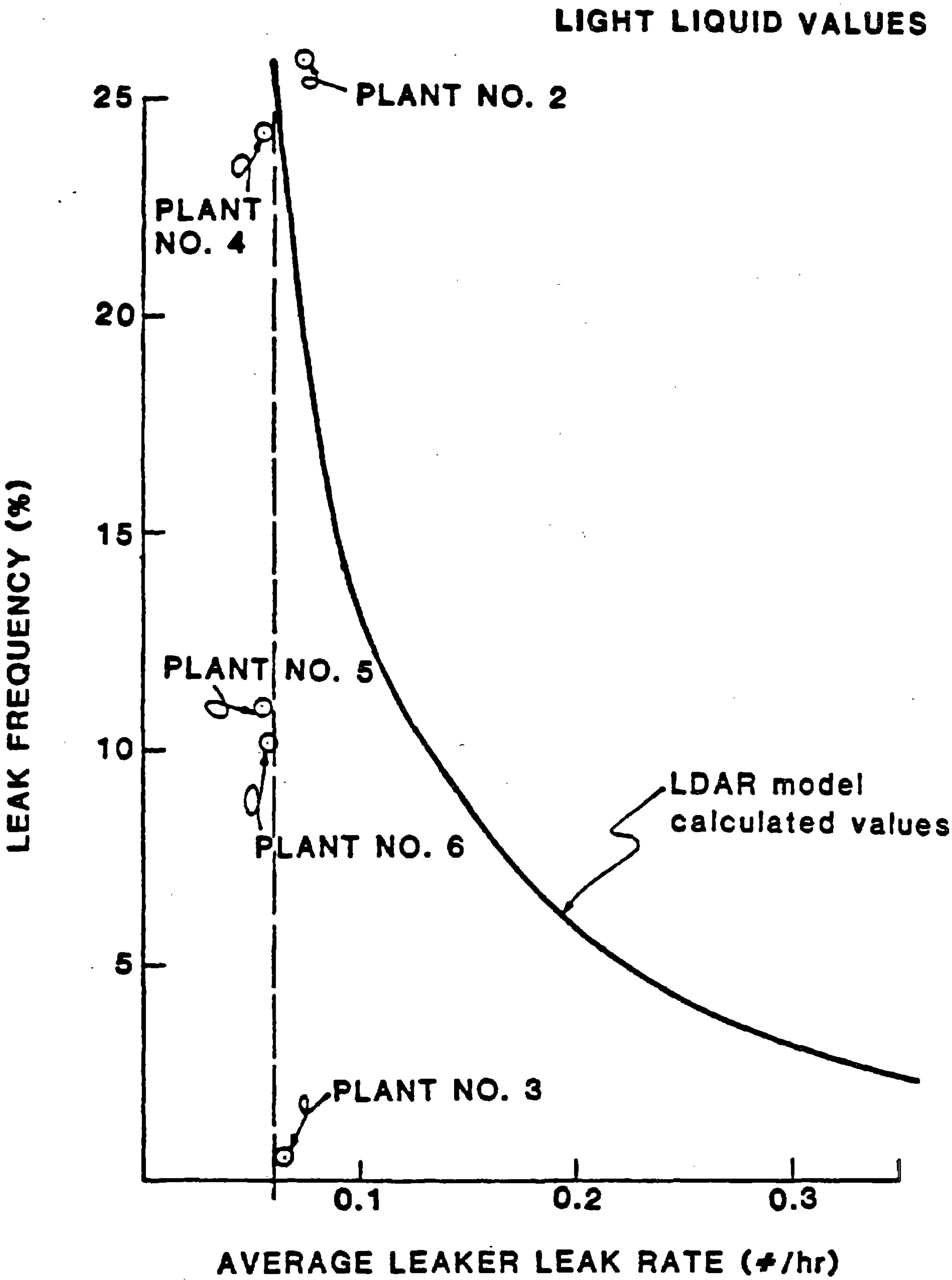



Figure A-2. Emission factor for leaking valves in light liquid service as a function of leak frequency (IV-N-10).

as given on page 3 of Model for Evaluating Effects of Leak Detection and Repair Programs on Fugitive Emissions (IV-A-22).

Furthermore, the commenters have misunderstood the mechanics of the LDAR model used in partitioning emissions among the four categories. The model does not arbitrarily split an emission factor with 98 percent to components that leak and 2 percent to components that do not leak regardless of the leak frequency, as one commenter (IV-N-8) suggested. In the LDAR model, emissions per component for leaking and nonleaking components are calculated, based on the average input emission factor for all components and the initial leak frequency of the components:

$$(IFL)(E_L) + (1 - IFL)(E_P) = E_I,$$

where: IFL is the initial leak frequency;
$E_L$ is the emission factor leaking components;
$E_P$ is the emission factor for nonleaking components; and
$E_I$ is the average input emission factor for all components.

The emission factors are all on a per component basis.

The derivation of $E_L$ and $E_P$ is detailed in Docket Item No. IV-A-22 on page 9. Another emission factor, $E_E$, is also defined on that page. This emission factor is for components exhibiting early leak recurrence and for components which cannot be repaired. In this way, the LDAR model assigns emission factors to the four defined categories (two categories having the same emission factor) prior to initiating the model simulation. These three emission factors, $E_L$, $E_P$, and $E_E$, are applied to the number of components assigned to each category as a result of initial leak frequency, occurrence rate, recurrence rate, and maintenance effectiveness, both for normal and turnaround maintenance efforts.

One commenter (IV-A-10) has misinterpreted the results of the LDAR model through the use of improper (inconsistent) inputs to the model. He used a constant average input emission factor, $E_I$, with varying leak frequencies. By holding the average input emission factor constant, regardless of the leak frequency, he produced the curves in Figures A-1 and

A-2 showing the emission factor for leaking components as a function of leak frequency. The commenter called the illustrated relationships unreasonable, especially in view of the constant emission factors he had determined for leaking components.

EPA agrees that the emission factor for leaking components remains relatively constant with changing leak frequency as the commenter shows. In fact, this is the premise for generating average input emission factors for all components that is presented in Chapter 2 of the AID. Therefore, in the analysis presented by the commenter, the average input emission factor, $E_I$, should have depended upon the leak frequency as given in that chapter.

The LDAR model's approximation of a constant emission factor for leaking components is shown in Figures A-3 and A-4 for valves in gas and light liquid service. Each figure presents three curves for the emission factor for leaking components determined by different methods. Curve "A" is the constant emission factor used in the development of average input emission factors. This is the value presented in Chapter 2 of the AID. Curve "B" represents the LDAR model approximation of the emission factor for leaking components assuming a constant average input emission factor. This curve is similar to the one presented by one of the commenters (IV-N-10) in Figures A-1 and A-2. Finally, curve "C" is the LDAR model approximation of the constant emission factor for leaking components. The average input emission factors used in generating this curve were determined by the method presented in Chapter 2 of the AID, based on a constant emission factor for leaking components (Curve "A") and a leak frequency.

In comparing curves "A" and "C" there is a small deviation from linearity noted for curve "C." The deviation is the result of the relationship between the emission factor for leaking components and the emission factor for nonleaking components assumed in the LDAR model. As seen in the figures, however, this simplifying assumption is justified since the resulting emission factors for leaking components are a close approximation of those used to generate the average input emission factors.

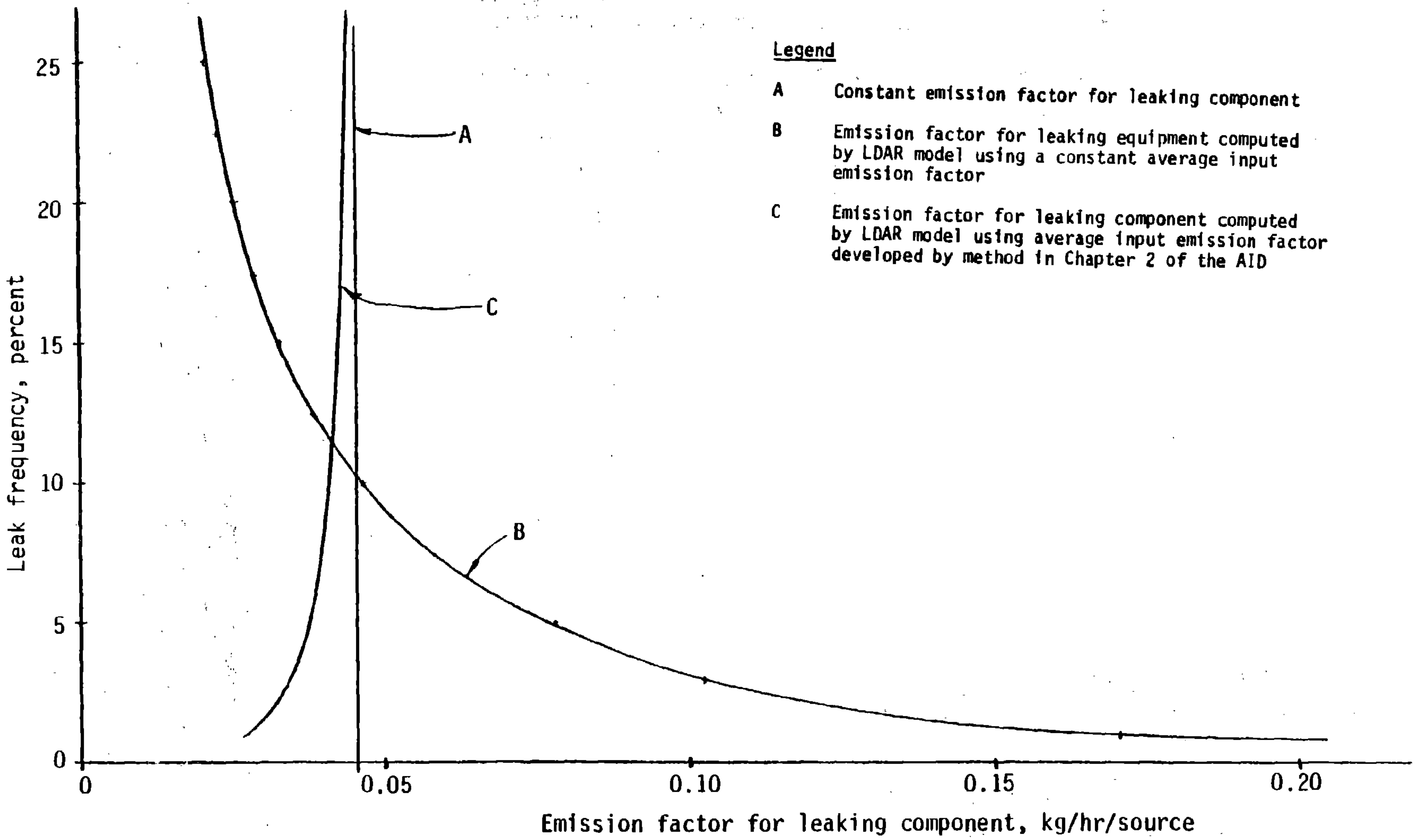



Figure A-3. Comparison of emission factors computed for leaking valves in gas service.

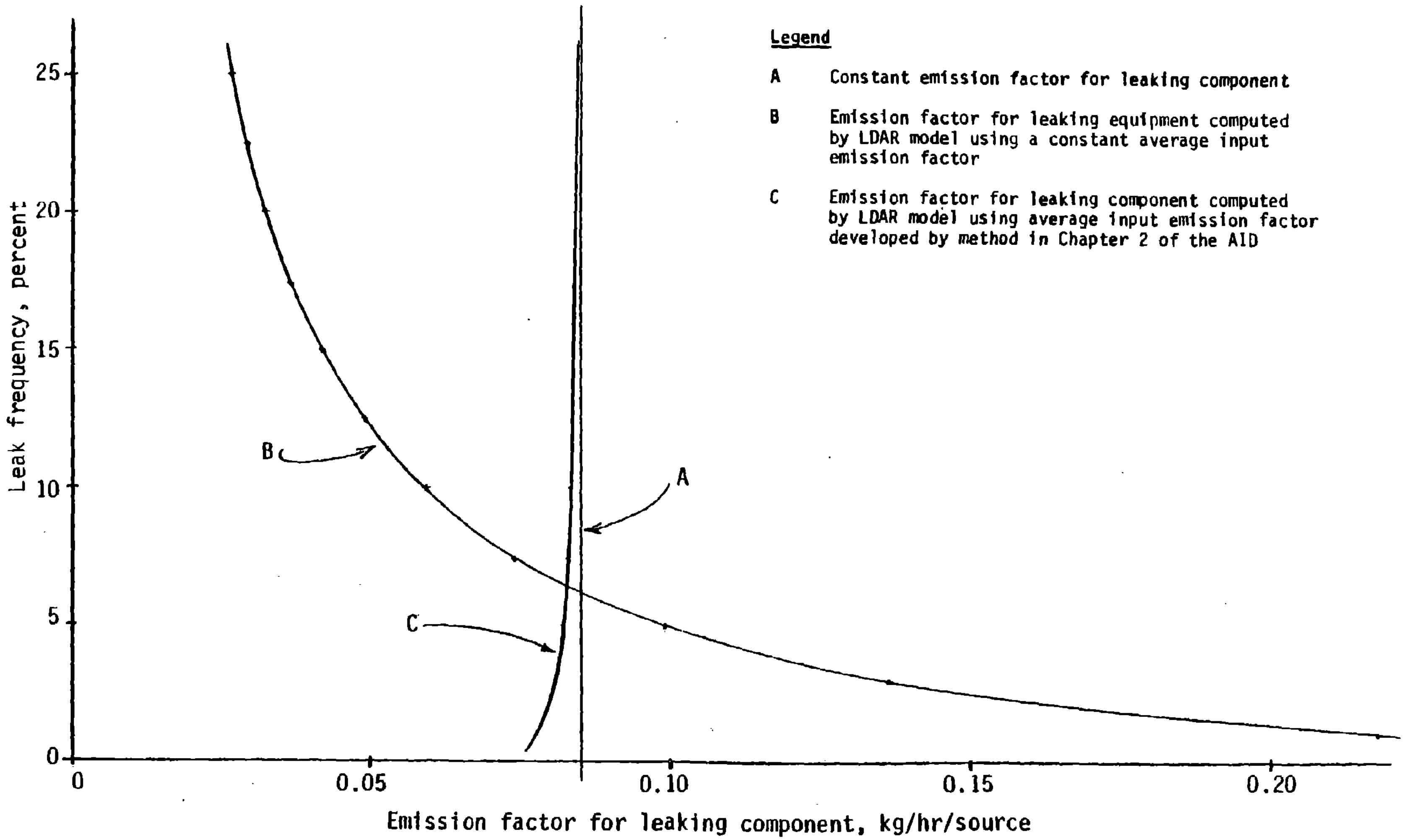



Figure A-4. Comparison of emission factors computed for leaking valves in light liquid service.

Comment: Two commenters (IV-N-9; IV-N-10) objected to the comparison of the LDAR model results to the ABCD and modified-ABCD model results. One (IV-N-9) called the comparison an apples and oranges comparison. The other (IV-N-10) said that, instead, the validity of the LDAR assumptions, inputs, and results should be investigated separately.

Response: EPA agrees that there are differences between the ABCD, modified-ABCD, and LDAR models. These differences stem primarily from the assumptions made in their development and the data required to implement them. The comparisons presented in the AID were not intended as a validation or discrediting of one method or another. The comparisons were presented as an aid in understanding how each model was applied. EPA agrees that each method should be validated on its own merits. In Chapter 4 of the AID, EPA has examined the assumptions, inputs, and results of the LDAR model separately from the other models for evaluating leak detection and repair programs.

Comment: One commenter (IV-N-10) felt it essential that the model be able to evaluate regulatory impacts on industry segments. The commenter said that this capability is necessary for development of a standard that avoids gross inequities and insures real emission reductions.

Response: The LDAR model is not constrained by industry segmenting. With it, any particular case can be examined, given the appropriate input values. If analysis of any aggregate is desired, the LDAR model is capable of evaluating the effects of leak detection and repair programs based on the input values.

As discussed in Chapter 2 of the AID and in the responses to comments on that chapter, segmenting of an industry as diverse as SOCMI is not practical. Instead of segmenting the industry, input values were varied to analyze various situations in examining regulatory alternatives for the standards. This analysis of the LDAR model input parameters provided the support for standards with reasonable costs per unit emission reduction. An example of this approach is given in Chapter 14 which discusses alternative standards for valves.

Comment: One commenter's (IV-N-10) analysis showed occurrence rate to be one of the few parameters to which the LDAR model is sensitive. The commenter asserted that most emissions come from new leaks occurring between inspections.

Response: Many of the input parameters to the LDAR model have an impact on the results of the model. Since input parameters can have different degrees of effect on the model results, sensitivity analyses were performed by varying many of the input parameters of the LDAR model, including:

- monitoring interval
- unsuccessful repair rate for normal maintenance
- unsuccessful repair rate for turnaround maintenance
- percent emissions reduction associated with unsuccessful repair
- turnaround frequency
- early recurrence rate

Most of the listed parameters (in fact, all but monitoring interval) show little effect on the model results. All of these parameters were examined in the classical sense for sensitivity (i.e., all other parameters were held constant while only the parameter of interest was varied). The results of these tests are presented in Docket Item No. IV-B-22. The results of a sensitivity analysis on the effect of monitoring interval indicated a larger effect on model results than the other parameters listed above; the results are detailed in Section 4.2 on "Leak Detection and Repair Programs."

The effects of occurrence rate changes on LDAR model results were also examined in a sensitivity analysis. As the commenter noted, the occurrence rate was found to be one of the few parameters that appear to have a noticeable impact on the results of the LDAR model. The analysis of the model's sensitivity to occurrence rate, however, is complicated by the relationship of occurrence rate to two other model input parameters, leak frequency and emission factor. As a result, the classical approach to a sensitivity analysis cannot be used for occurrence rate.

In a physical, real world sense, occurrence rate and leak frequency are related, i.e., one parameter affects the other. Most likely, the occurrence rate significantly influences the relative level of leak frequency measured in the field. For instance, in the absence of any maintenance efforts, a high occurrence rate will result in a high leak frequency measurement. Indeed, this trend appears to be substantiated by the data presented in Figure A-5. These data are from the Maintenance Study (IV-A-10) and the 24-Unit Study (IV-A-11). They represent occurrence rate/leak frequency data for all valves in three process types and in the composite data set. The line shown in the figure is the result of a linear regression of the four data points. Although this regression is not a rigorously developed relationship for all SOCMI units, it was used to examine the relationship between model results and occurrence rate.

In the LDAR model, there is a derived relationship between the emission factors for various categories (defined within the model), the average input emission factor, and the leak frequency. This relationship was discussed in detail in response to the first comment on the LDAR model. Furthermore, as discussed in Chapter 2 of the AID, the average input emission factor used as an input to the LDAR model is dependent upon the leak frequency that is used, since an average emissions rate can be viewed as being composed of emissions from equipment that is leaking and of emissions from equipment that is not leaking. As discussed previously in the comment and response on the LDAR model, different average input emission factors (generated using leak frequency) must be used as inputs when the LDAR model is executed using different leak frequencies. The average input emission factors (for valves) used in this sensitivity analysis were, therefore, varied according to leak frequency. Furthermore, since an average SOCMI unit with hypothetical leak frequencies for all valves was considered, a single average input emission factor was used for gas and light liquid valves combined. This factor represents the relative distribution of valves by service in the model units (43 percent in gas service; 57 percent in light liquid service).

As described in the preceding paragraphs, the analysis of the LDAR model sensitivity to occurrence rate involves variation of occurrence rate,

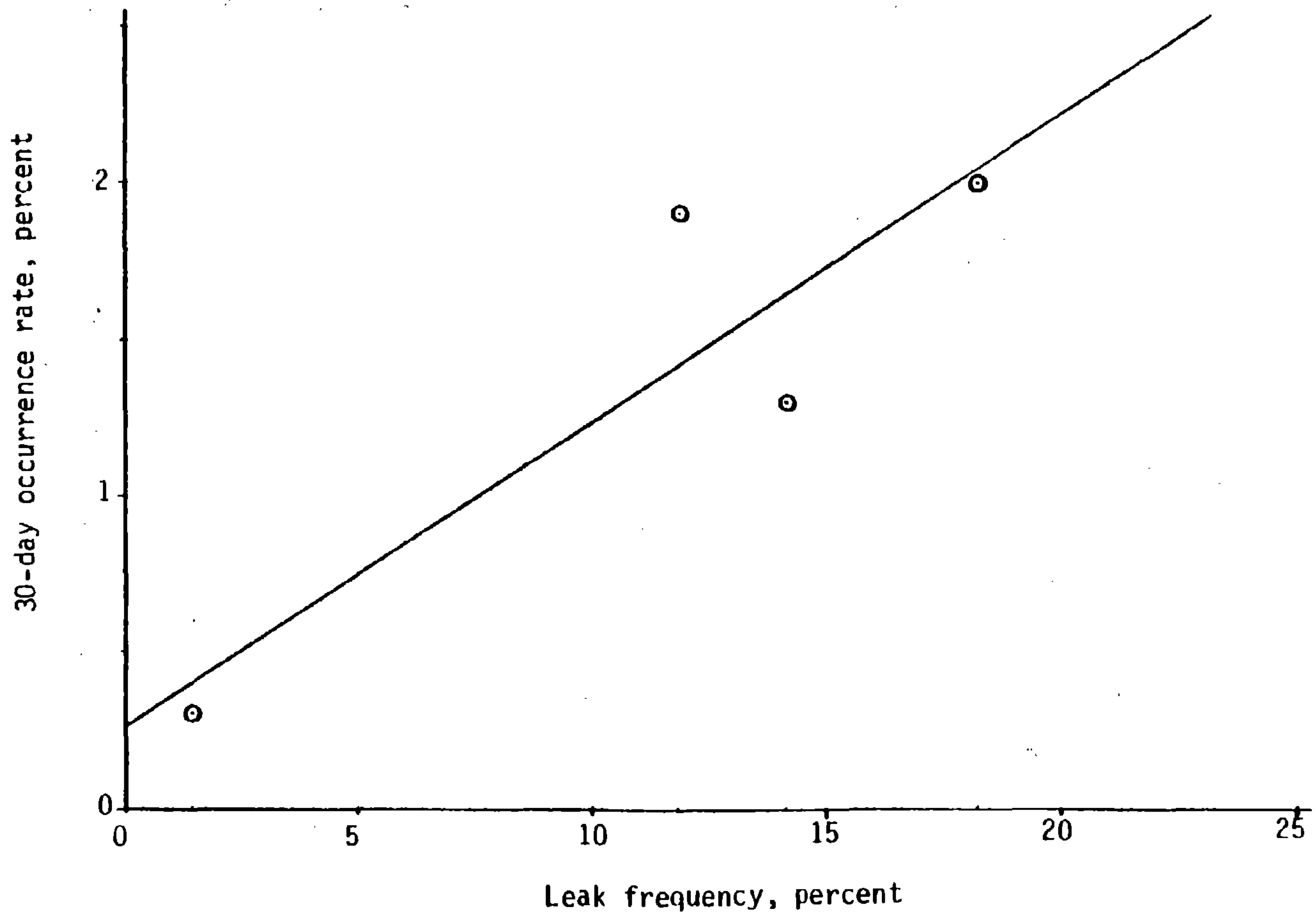



Figure A-5. Thirty-day occurrence rate as a function of leak frequency for valves in gas and light liquid service.

leak frequency, and average input emission factor due to the interrelation of these three parameters. Table A-4 presents the inputs and results of the LDAR model executed for this test of sensitivity. The results for monthly leak detection and repair are presented for a model unit B containing 926 valves in gas and light liquid service. Several observations are apparent from the results presented in the table:

(1) The fraction of valves screened remains relatively constant for the inputs tested;

(2) The fraction of valves maintained decreases with decreasing occurrence rate since fewer leaks appear with lower occurrence rate;

(3) The cost of the leak detection and repair program decreases with decreasing occurrence rate largely as a function of the maintenance required;

(4) The cost of the leak detection and repair program begins to stabilize at low occurrence rates since the amount of maintenance required becomes small at these low occurrence rates;

(5) The effectiveness of the leak detection and repair program declines rapidly with decreasing occurrence rate, illustrating a strong relationship between these two variables;

(6) The emissions reduction achievable also decreases markedly with decreasing occurrence rate, due to the strong dependence of effectiveness on occurrence rate and the relationship between average input emission factor and leak frequency.

Cost effectiveness (i.e., cost per unit VOC controlled) usually provides a good means of comparing control options, regulatory alternatives, and even the sensitivity of model input values. The net cost effectiveness, which accounts for product recovery credits resulting from the program being examined, is also used to compare results. As seen in Table A-4, the emissions reduction achievable has the largest effect on net cost effectiveness since a relatively small variation in gross annualized costs is noted for the range of inputs analyzed. The net cost effectiveness of monthly

TABLE A-4. SUMMARY OF INPUTS AND RESULTS OF LDAR MODEL SENSITIVITY TO OCCURRENCE RATE, LEAK FREQUENCY, AND EMISSION FACTOR FOR VALVES IN AN AVERAGE MODEL UNIT B

| Case | Quarterly Occurrence Rate[a], Percent | Leak Frequency, Percent | Average Input Emission Factor[b], kg/hr/valve | Fraction of Valves Screened | Fraction of Valves Maintained | Reduction Effectiveness | Emissions Reduction[c], Mg/yr | Gross Annualized Cost[c], $/yr | Net Cost Effectiveness[d], $/Mg |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 3.72 | 10 | 0.00787 | 11.7988 | 0.1706 | 0.705 | 45.0 | 11760 | (39)[e] |
| 2 | 1.96 | 4 | 0.00385 | 11.8935 | 0.0906 | 0.522 | 16.3 | 9840 | 304 |
| 3 | 1.30 | 2 | 0.0025 | 11.9251 | 0.0639 | 0.349 | 7.08 | 9210 | 1000 |
| 4 | 1.08 | 1 | 0.00183 | 11.9414 | 0.0500 | 0.186 | 2.76 | 8880 | 2910 |
| 5 | 0.938 | 0.5 | 0.0015 | 11.9492 | 0.0435 | 0.061 | 0.74 | 8720 | 11450 |

[a]Occurrence rate (30-day) taken as a function of leak frequency: OCC = 0.0976 (LF) + 0.264; Quarterly rate taken as three times the 30-day rate.

[b]Average input emission factor taken as a function of leak frequency (using emission factors for leaking valves and for nonleaking valves from Chapter 2 of the AID) and based on the 43/57 split between gas and light liquid valves in the model units:

Average input emission factor = [LEF - NLEF](LF) + [NLEF]
where: LEF = 0.0683 kg/hr/valve
NLEF = 0.00116 kg/hr/valve

[c]Emissions reduction and gross annualized costs based on 926 valves (gas and light liquid) in model unit B.

[d]Net cost effectiveness includes a credit of $300/Mg of VOC reduced.

[e]Parentheses indicate an overall credit of the program due to recovered or saved product.

leak detection and repair of valves increases with decreasing occurrence rate. Again, this change is a result of changing all three input parameters (occurrence rate, leak frequency, and average input emission factor), not just a single parameter.

Since all of these parameters act together, EPA considered how these results should be evaluated in selecting the standards. Of the three choices for the independent variable, the leak frequency would be of the most utility. Certainly, the results in Table A-4 indicate the importance of occurrence rate in establishing the number of leaks in a unit and the purpose of any leak detection and repair program is to reduce the number of leaks, thereby reducing emissions. But measuring occurrence rate is time-consuming and costly. While they provide an accurate measure of emissions, mass emission rates (emission factors), too, are costly to establish. Leak frequency, on the other hand, is a quantity readily measurable in any process unit. It provides an indicator of occurrence rate and can be used to approximate emission factors (as described in Chapter 2 of the AID). Therefore, leak frequency was selected as the independent variable against which the cost effectiveness should be presented.

Figure A-6 presents the net cost effectiveness for the cases (presented in Table A-4) as a function of leak frequency. As illustrated in the figure, the net cost effectiveness of monthly leak detection and repair of valves increases dramatically as the leak frequency decreases below about 1 percent. This relationship lends support to establishing alternative standards for valves as discussed in Chapter 14.

Increases in emissions from inspection to inspection also are affected by various parameters. Emissions increases resulting from leak occurrences may in some cases (as stated by the commenter) comprise the largest portion of emissions from equipment. This is, in general, reasonable since the emission factor for equipment which leaks is much larger than the emission factor for nonleaking equipment. There may, however, be other factors which can result in large portions of emissions being attributed to other equipment categories. For example, if a high rate of unsuccessful repair is

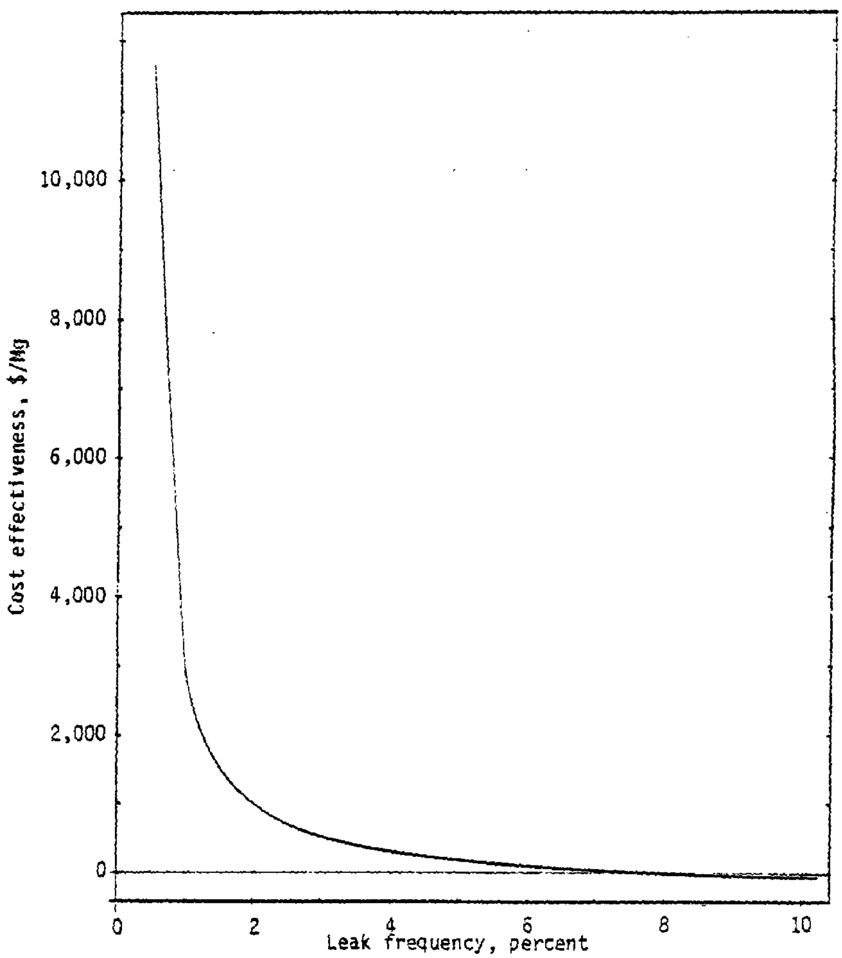


Figure A-6. Cost effectiveness as a function of leak frequency for monthly leak detection and repair programs for valves in SOCMI units.

considered, a significant number of unrepairable components can accumulate prior to turnaround repair. In this case, the emissions associated with unrepairable components can account for the larger share of total emissions. Identification of which category of equipment components account for the greatest portion of emissions aids the operator in determining specific improvements for his leak detection and repair program. But this identification should not overshadow the fact that all of these factors contribute to increases in VOC emissions. Leak detection and repair programs are effective in reducing both the number of leaks and the total mass emissions. Improving repair effectiveness also results in enhanced emissions reduction.

Comment: The same commenter (IV-N-10) concluded that emissions carried over from inspection to inspection are small because the model provides that emissions are substantially reduced at each inspection.

Response: It is true that under certain conditions the emissions, estimated by the LDAR model, that are carried over from inspection to inspection can be small. But this is not a function of the model itself. Rather it is dependent upon the values selected as input parameters for the specific cases evaluated. For instance, the amount of emissions carried over from inspection to inspection is affected by the number of equipment components that cannot be repaired on-line successfully and by the proximity of the inspection period to turnaround. If there are large numbers of unsuccessfully repaired equipment components, then the emissions carried over can be relatively large since these components will continue to emit VOC at a given rate. The model assumes no change in emission rate for unrepairables at each subsequent inspection prior to turnaround.

Comment: A commenter (IV-N-10) recommended that leaks which recur immediately (i.e., early recurrences) should be treated as unsuccessful repairs. The commenter said that applying the same repetitive emission reduction to leaks which recur is inappropriate.

Response: The LDAR model does, in some ways treat early recurrences like unsuccessful repairs. It assigns the same emission factor to these two categories. However, EPA makes a distinction between the categories. Early recurrences are pieces of equipment found leaking, repaired, and found leaking again shortly thereafter. Unsuccessful repairs are pieces of equipment for which repair attempts failed to reduce the screening value below 10,000 ppmv. Since it is possible to repair early recurrences, it is important (in reducing VOC emissions) to locate them and attempt repair again.

EPA has no reason to believe that emission reductions achievable through maintenance on early leak recurrences are any different from emission reductions achievable through maintenance attempts on unsuccessful repairs. Therefore, the same emission factor is assigned to both categories. The emission factor represents a 63 percent reduction over the emission factor for uncontrolled equipment components. As explained in the AID, this emission reduction is based on the Maintenance Study (IV-A-10).

The 63 percent reduction is not applied repetitively as indicated by the commenter. The model computes emission factors for four categories (leaking, nonleaking, early recurrences, and unrepairable) and assigns equipment components to each category. If a valve, for example, exhibited early recurrence for two inspection periods, it would be assigned to the same category with the same emission factor; its emission factor would not change. These emission factors for each category are then applied to the fraction of the population of valves in each category. The resulting products are summed to yield the average controlled emission factor for valves operating under the leak detection and repair program.

Comment: One commenter (IV-N-8) generally agreed with EPA concerning uncertainties in determining uncontrolled emission rates, such as why they vary from process to process, and why some regulatory scenarios give negative results. This commenter thought that the differences were caused less by cyclic maintenance than by differences in leak occurrence, maintenance practices, and repair effectiveness, however.

The negative results obtained for some monitoring intervals caused another commenter (IV-N-7) to doubt that the model could be used in a meaningful way.

Response: There are many variables that affect the emission level of a process unit. All the items cited by the commenter (IV-N-8) contribute to this level. Differences in these factors from unit to unit contribute to the differences seen in the levels of various units. The uncertainties associated with determining uncontrolled emission rates are further complicated by the interrelation of these factors. Admittedly, this makes understanding negative results difficult. While some technical questions (such as uncontrolled emissions levels) are not fully answered, the LDAR model does represent EPA's most current understanding of fugitive emissions behavior and incorporates the most reliable information on fugitive emissions and effectiveness of maintenance in reducing emissions.

The technical problems involved in fine-tuning the baseline level of emissions do not alter the facts that fugitive emissions of VOC do exist in SOCMI and that maintenance reduces those emissions.

Comment: A commenter (IV-N-8) questioned the assumption that repaired leakers experiencing early failure have the same probability of repair as initial leakers.

Response: The studies of fugitive VOC emissions and maintenance effects on these emissions do not specifically address the repair efficiency for early recurrences. This phenomenon of early recurrence for valves was noted in the Maintenance Study (IV-A-10) and was found to constitute 14 percent of the valves on which repairs were attempted. The number of valves exhibiting early recurrence during this study was small (about 22 of the 155 attempted repairs).

EPA has no reason to believe that the successful repair rate and emissions reduction for early recurring leaks are any different from these valves for occuring leaks. Therefore, a simplifying assumption was made in the development of the model to assign the same repair effectiveness to leaks which occur and recur and to those which recur early. The value used for emissions reduction associated with successful repair is based on data from the Maintenance Study (IV-A-10), including occurrences, recurrences, and early recurrences.

The LDAR model was also used to look at the effect of the fraction of equipment exhibiting early leak recurrence. Based on the LDAR results for a single model unit B operating under a monthly leak detection and repair program, only two valves are found to exhibit early recurrence when 14 percent recurrence is used. Furthermore, there is less than three percent difference in the emissions reduction for the leak detection and repair programs where 14 and zero percent early recurrence are used.

Comment: One commenter (IV-N-3) asked for clarification of how shutdown repair efficiency is handled in the LDAR. He said information concerning shutdown repair efficiency was not provided in the AID.

Response: The repair efficiency of equipment at turnaround is assumed to be 100 percent in the LDAR model. On page 4-22 of the AID, this is indicated as "all unrepaired sources [equipment designated as unrepaired] are repaired at the turnaround." Repair at turnaround is expected to be more comprehensive than normal repair, but the effectiveness is not expected to be exactly 100 percent. The LDAR model does have the capability of examining other values for turnaround repair effectiveness. In varying the turnaround repair effectiveness from 100 percent to 90 percent, only a three percent drop in emissions reduction is seen for a model unit B using a monthly leak detection and repair program for valves. At 95 percent turnaround repair effectiveness, there is only a one percent difference in emissions reduction. Since turnaround repair effectiveness is expected to be higher than 95 percent, the emissions reduction presented for the 100 percent case is indicative of that expected for a unit operating under a rule.

Comment: One commenter in two comment letters (IV-N-3; IV-N-9) requested that confidence intervals which the LDAR is capable of generating be published with the modeling results. The commenter said that the end points of the confidence intervals should be considered in formulating a regulatory strategy and that they should be used to distinguish between various regulatory options.

Response: The use of confidence intervals in distinguishing between various regulatory options is addressed in a memorandum filed at Docket Item No. IV-B-27. The memorandum explains that the use of confidence intervals generated by the LDAR model in this manner is inappropriate. The confidence intervals generated quantify uncertainty in individual output variables. They are useful in examining the output properties for cases that employ completely independent inputs, such as Plant A vs. Plant B. But these confidence intervals do not represent the uncertainty of differences between cases using common inputs. Since the comparison of the regulatory options (monitoring intervals) involves the use of common inputs, the use of confidence intervals generated by the LDAR model to examine differences between the regulatory options is inappropriate.

Comment: One commenter (IV-N-7) felt that the main problem with the model is in the assumption for occurrence and recurrence rates. The rate appeared unrealistically high to the commenter who felt that the rates should not be extrapolated linearly. He found the assumption of the same number of leaks occurring in the first and twelfth months unrealistic. He attributed the negative efficiencies associated with annual programs to the assumption of linearity.

Response: The occurrence and recurrence rates used in the AID for valves were developed in the Maintenance Study (IV-A-10). An exponential model was fit to the experimental data to develop the estimates. The results of this procedure for valves are compared to a linear extrapolation of the quarterly occurrence rate in Figure A-7. (The rates used in the LDAR model producing

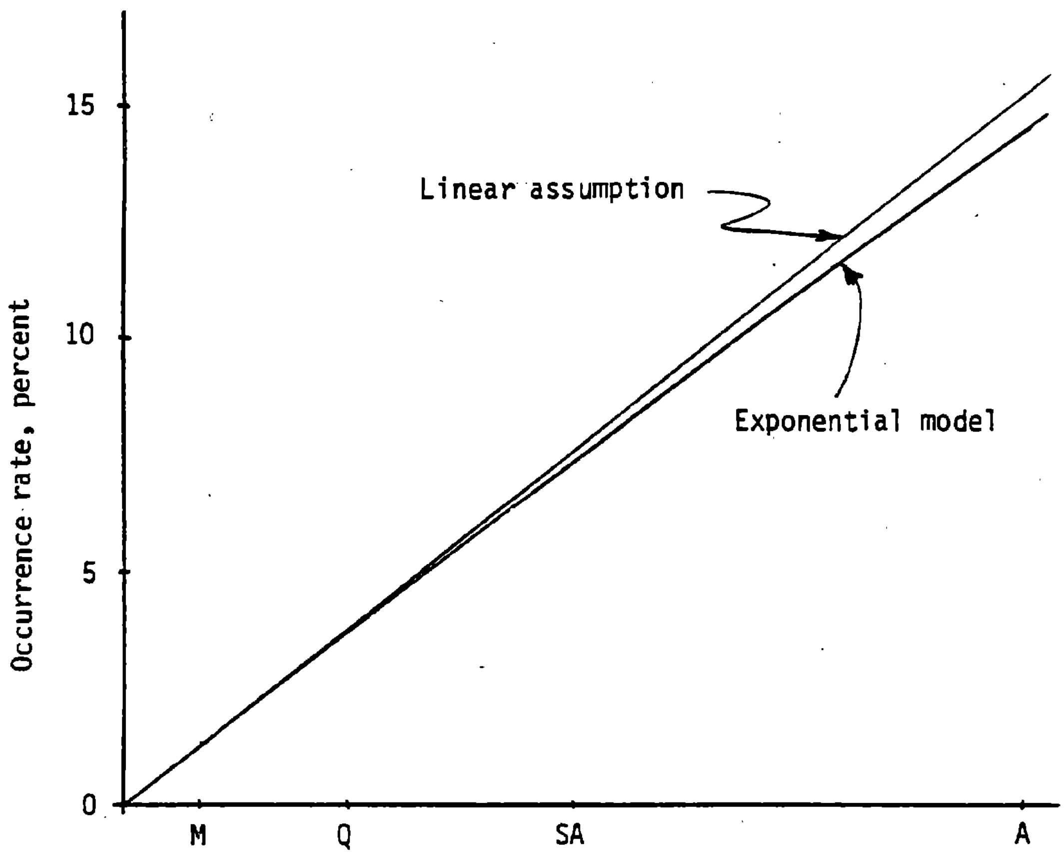



Figure A-7. Comparison of valve occurrence rates assuming a linear relationship and an exponential model.

the results in the AID were linearly approximated from the quarterly rate.) As noted by the small difference between the estimates, even at an annual monitoring interval, an assumption of linearity for valves is a close approximation of the modeled occurrence rate. Based on this small difference, an assumption of linearity for the valve leak occurrence rate is not the reason for the negative efficiencies associated with annual monitoring programs. In fact when the LDAR model was reexecuted using the corrected occurrence rate for annual monitoring, a negative efficiency still resulted for valves in light liquid service (IV-B-23).

In analyzing data on leak occurrences for valves, it was found that leaks occur randomly. This concept formed the basis for estimating leak occurrence rates from the data. Since leaks do occur in a random fashion, the probability of a leak occurring in any given month will be equal and independent from the probability of leaks occurring in other months.

Comment: A commenter (IV-N-9) objected to subjecting the population of valves maintained at turnaround to the 14 percent probability of leak recurrence.

Response: The question of leak recurrence after turnaround maintenance has not been answered by the available studies on fugitive VOC emissions. There is, however, no reason to believe that early leak recurrence after turnaround maintenance does not happen. The best indicator (currently available) of the rate of recurrence is 14 percent. The importance of the assumption of 14 percent leak recurrence after turnaround can be addressed, however, by analyzing the magnitude of the assumption. The recurrence rate is applied to only a small population of equipment (previous early recurrences and occurrences), resulting in a smaller number of leak recurrences after turnaround. For example, for a typical model unit B operating under a monthly leak detection and repair program, 12 valve leaks would occur and seven valve leaks would recur compared to a total of 926 valves in the unit.

Furthermore, under this assumption, the cost and emission reductions computed are conservative. By applying a 14 percent recurrence rate at turnaround, more maintenance is performed; thus, the costs are overestimated

Since the sources that experience early leak recurrence do not return to the higher leaker emission rate, the emission reductions are underestimated.

Comment: The same commenter (IV-N-9) said the basis for comparing controlled and uncontrolled regulatory programs is inappropriate for predicting emission reductions for leak detection and repair programs applied to new sources. The commenter explained that EPA has chosen to calculate fugitive emissions from present uncontrolled model plants and emission reductions over a one-year fugitive emission control program. Mass emissions before and after the one-year period are then used to calculate the emission reductions achieved. The commenter called this method inappropriate and said that a better method consisted of comparing emission reductions before and after a turnaround.

Response: The commenter has apparently misunderstood how the emissions and emission reductions are computed by the LDAR model. The model does average the emissions and reductions over the turnaround period, and includes the impact of turnaround repair. The comparison made in the model is the time-averaged value over the turnaround period compared to the pre-program level (the initial, field-measured conditions). This is the comparison presented by EPA in the AID. The data used to calculate emissions are from plants which represent a cross-section of SOCMI and, thus, should reflect the emissions expected from new plants in the absence of standards.

The LDAR model presents another comparison to the pre-program level. This other comparison is by monitoring interval. It permits evaluation of a LDAR program performance with time.

A.3.2 Model Input Parameters

Comment: The use of a single industry-wide occurrence rate was considered unsupported by the SOCMI data (IV-N-9; IV-N-10). One of the commenters (IV-N-10) stressed the importance of treating the occurrence rate parameter appropriately because it is one of the most important parameters in the model. The commenter asserted that using a single occurrence rate could lead to meaningless results. He said the maintenance study showed a wide range of occurrence rates, 0.2 to 4.1 percent per month. The differences were said to have persisted for the length of the study and were reported by the commenters to be significant at the 95 percent confidence level. The other commenter (IV-N-9) recommended that a range of leak occurrence rates be used to examine emission reductions achievable from alternative leak detection and repair programs.

Another commenter (IV-N-14) said the 1.3 percent per month occurrence rate is too high for the industry as a whole because it was determined from high leak plants.

Response: Certainly, the occurrence rate is one input parameter that has a large impact on the cost and effectiveness of leak detection and repair programs, as evaluated by the LDAR model. A single occurrence rate estimate for all valves was used in the analyses since it incorporated all of the occurrence rate data collected for valves and, thus, represented the best overall estimate.

The commenter is correct in pointing out that a range of occurrence rate estimates was described for the different process types included in the Maintenance Study (IV-A-10). In recognizing the variation of occurrence rates throughout the industry, EPA has further examined the cost and effectiveness of leak detection and repair programs for valves with varying occurrence rates. The LDAR results of this analysis are shown in Chapter 14 which discusses alternative standards. (See Section A.1 for discussion of the distribution of plant leak levels in SOCMI.)

Comment: Commenters (IV-N-10; IV-N-8; IV-N-3; IV-N-9) disagreed with EPA's selection of values for repair effectiveness and emission reductions achievable by maintenance on nonrepaired valves. The commenters favored using 29 percent repair effectiveness and a 63 percent emission reduction for unsuccessful repairs. The commenters contended that if 10 percent are unrepaired instead of 71 percent as found in the Maintenance Study, it is likely that 63 percent emission reduction might not be achievable for the 10 percent unrepaired. One commenter (IV-N-10) speculated that the unrepaired valves might even have emission rates greater than average leakers. Another commenter (IV-N-8) recommended 29 percent repair effectiveness be used because that number came from the only complete data which are consistent within themselves. The commenter found it inconsistent to use SOCMI data for everything else and then use a successful repair number of 90 percent from petroleum refining data.

Another of the commenters (IV-N-3) contended the data used to arrive at 90 percent repair effectiveness were not valid. The commenter referred to Table 4-11, saying that the Shell, Union, and Refinery Maintenance data should not be considered. He said differences in monitoring methods and instruments made comparisons invalid. He was disappointed that the selection was based entirely on petroleum refinery data. The commenter favored using 29 percent repair effectiveness instead of 90 percent because none of the tests listed in Table 4-11 were designed to develop an average leak repair as was done in the EPA Maintenance Study. He believed that use of higher repair efficiencies is inappropriate, as the valves studied were repaired or removed from service. He called this practice atypical, and said that it tended to bias repair efficiency data. The commenter challenged EPA's use of 90 percent repair effectiveness (because he said it forced a conclusion) that quarterly monitoring is desirable for emission reductions and cost effectiveness.

Response: The values selected as inputs to the LDAR model for repair effectiveness and emission reduction due to unsuccessful repair were based on an examination of all available data. These values resulted from a reasoned extrapolation of these data to the conditions expected under a regulation; they are not merely averages of the available data. Moreover, they are not values based on petroleum refinery data. The data used in establishing the input values for the LDAR model are data from equipment in VOC service.

The commenters suggest that a 90 percent repair effectiveness is high, especially in view of the 29 percent effectiveness determined in the Maintenance Study (IV-A-10). However, as discussed further below, the state of California has regulations in place governing fugitive emissions from valves. The experience in California is that better than 90 percent repair effectiveness (essentially 100 percent for valves) is possible for process units operating under a regulation. Furthermore, the 29 percent repair effectiveness determined in the Maintenance Study was for simple on-line maintenance only. It does not reflect the effectiveness of a process unit operating under standards which require more than simple on-line maintenance.

The 63 percent emission reduction used for unsuccessfully repaired valves is at present the best value available. There are no data or other bases for considering that this value is affected by the effectiveness of repair. Thus, it is reasonable to assume that the 63 percent reduction is appropriate for a repair effectiveness of 90 percent, 50 percent, or 29 percent. The only valves that can remain unrepaired are those valves that necessitate a shutdown for repair. There is no reason to believe that the unsuccessful repair of these valves would be any less effective in reducing emissions than unsuccessful repair of valves in general. Therefore, 63 percent reduction is appropriate to use in estimating impacts of leak detection and repair programs.

The data used to arrive at the 90 percent repair effectiveness are for valves in VOC service. The data used in arriving at this value include data from process units in California which operate under a regulation governing fugitive emissions. One of the commenters (IV-N-3) expressed concern over the handling of the repair effectiveness data from one of the process units in California. He felt that these data did not reflect the real repair efficiency for the unit since some valves (those that were not repairable and those requiring off-line repair) were not included in the repair effectiveness value. As noted in Table 4-11 of the AID, only those valves for which simple on-line repairs were attempted were included in the data. The remaining valves that the commenter is concerned about were removed from consideration since they were subjected to more elaborate repair procedures (that would expectedly result in a higher degree of repair effectiveness). The effect of removing these valves from the data was to lower the overall repair effectiveness for all valves, not increase it, since off-line repairs had a higher rate of success (in fact, 100 percent effectiveness) than on-line repairs.

The data on valves that were repaired off-line were excluded from Table 4-11, to provide consistency and allow comparison with other data on maintenance effectiveness. The data in the table represent the success rate of simple on-line maintenance attempts only; off-line repair is expected to be more successful. Removal and off-line repair of valves may be atypical in an uncontrolled process unit. It will, however, be common practice under a fugitive emissions regulation.

Finally, EPA did not select data to prove a certain result, as suggested by one of the commenters. The inputs selected for use in the LDAR model were based on a reasoned examination of all available fugitive emission studies. The results obtained from the analysis do not indicate that a quarterly leak detection and repair program should be used for valves. They show that monthly monitoring, as proposed, achieves a high degree of emission reduction at a reasonable cost (see Chapter 4).

Comment: In a slightly different view, one commenter (IV-N-8) said the emission reductions from unsuccessful repair parameter is assumed to remain constant with time. He said this assumption is apparently based on Section 3.3 of the Maintenance Study where immediate reductions from maintenance held up over a six-month period. The commenter admitted to being puzzled about the data since emissions from a companion control group of 60 nonleaking, nonmaintained valves actually decreased over a median 77-day period. This behavior he called contrary to his theories. However, he said, based on present information, he had no option but to agree with EPA's assumption.

Response: The assumption of a constant emissions reduction for unsuccessfully repaired equipment reflects EPA's best understanding of fugitive emissions at this time. The use of this assumption in the LDAR model is reasonable since it reflects how the leak detection and repair programs should be implemented under a rule.

Comment: With respect to input parameters for pumps, one commenter (IV-N-8) said that with the exception of the emission factor, the input parameters given in the AID, Table 4-18, are satisfactory.

Response: EPA has examined the available data on pumps in developing the inputs used in the LDAR model. Emission factor development is discussed separately in the comments on Chapter 2 (Emission Factors) of the AID.

Comment: Two commenters (IV-N-9; IV-N-10) said that 63 percent emission reduction should not be used for recurring leaks. The commenters said subsequent unsuccessful repair attempts would result in little, if any, emission reduction. The commenters recommended that recurring leaks be treated as unsuccessful repairs.

Response: The 63 percent emission reduction used for unsuccessfully repaired valves is based on the results of the Maintenance Study (IV-A-10). This figure was derived from the data collected on all unsuccessfully repaired valves, whether they were originally leak occurrences or recurrences. As discussed in response to a similar comment on the LDAR model, the same emission reduction was applied to unsuccessfully repaired valves that had experienced early leak recurrence.

The fractional emission reductions associated with successful repair and with unsuccessful repair are not applied repetitively for each monitoring/repair interval as suggested by the commenters. Instead, these factors are used to determine emission factors which are assigned to specific categories (leaking equipment, equipment which exhibits early leak recurrence, equipment which cannot be repaired, and nonleaking equipment). The same emission factor would apply to recurring leaks found in sequential monitoring intervals. The same emission factor is used for equipment which cannot be repaired and equipment which exhibits early leak recurrence; the emission factor is determined from the leaking emission factor and the fractional emission reduction for unsuccessful repair. The resulting emission factor is then applied to that fraction of the components determined to be unrepairable or early recurring leaks.

Early recurring leaks, as mentioned above, are treated in some respects like unsuccessful repairs in the LDAR model. However, leaks that can be repaired, technically, are cost-effective to repair, whether they have recurred or occurred. Thus, it would not be logical to consider a valve which had been repaired and then began to leak again (i.e., recurred) to be a valve which could not be repaired.

Comment: Several commenters (IV-N-9; IV-N-10) discussed "effective" occurrence rates versus "unmaintained" occurrence rates. An "effective" occurrence rate was defined as the rate of occurrence of leaks for valves operating under a plant's usual maintenance practices. Referring to the Maintenance Study, the commenters said that the occurrence rates determined were based on valves for which normal maintenance was not allowed during the test period. This occurrence rate was called an "unmaintained" occurrence rate which the commenters said could be quite different from an "effective" occurrence rate. They said that EPA has used an "unmaintained" occurrence rate which is inappropriate for representing SOCMI. The commenters asserted that appropriate "effective" occurrence rates must be used.

Response: The differences between "effective" and "uncontrolled" occurrence rates, as inputs for the LDAR model, are not expected to be large. In the Maintenance Study (IV-A-10) of fugitive emission equipment, occurrence rate data were collected in the most effective manner possible within existing, operating units. The data collection plan was set up to cause the least amount of interruption to normal plant operations. For valves, it is unlikely that any additional maintenance would have been performed since only extremely large leaks and improperly operating valves would be repaired under current industry practices. Given these practices and the large degree of variability in leak occurrence rate from process unit to unit, the use of the occurrence rate from the Maintenance Study is appropriate for analyzing the impacts of leak detection and repair programs on SOCMI.

Moreover, leak detection and repair programs for valves using various occurrence rates were examined as part of the analysis of alternative standards for valves (see Chapter 14).

Comment: According to two commenters (IV-N-8; IV-N-10), the real world is probably better represented by less than 100 percent repair efficiency at turnaround. One of the commenters (IV-N-8) said that it is not normal to fix any but the obviously malfunctioning valves during turnaround. Therefore, the commenters said that turnaround maintenance in the sense contemplated by the proposed regulation does not exist for fugitive emissions in uncontrolled plants.

Response: EPA recognizes that in existing uncontrolled process units the effectiveness of turnaround maintenance is less than 100 percent. In uncontrolled units, only those large leaks or malfunctioning valves (especially those critical to process operation) would be maintained at turnaround. New process units, however, would be subject to standards. Under the standards, new process units are expected to achieve close to 100 percent turnaround repair effectiveness on equipment that was previously unsuccessfully repaired.

A.3.3 Modeling Results

Comment: One commenter (IV-N-7) said that negative modeling results indicate that faulty data could have been used in the model. The same commenter suggested that negative results may have arisen because the units tested actually had programs in place which were better than the program being evaluated. Another potential reason for negative results provided by the commenter is that the baseline leak level was measured at a point when emissions were at a low point in the maintenance cycle.

Response: The possible causes of negative results of the LDAR model can be examined with an understanding of the parameters used in defining the model. EPA examined all available data on fugitive VOC emissions carefully in deriving the inputs used for the LDAR model. The best available data were selected for use in the LDAR model analysis, and they appear consistent and reasonable with the current understanding of fugitive emissions. The analysis and conclusions drawn were presented in the AID.

Some ideas on the causes of negative results of the LDAR model were presented briefly in the AID (pp. 4-23, 4-24). The commenter presents two possible reasons for the negative results. Another related reason is the level to which the performance of a leak detection and repair program is compared. For instance, a program can be compared to the baseline level (represented by the measured leak frequency). Alternatively, it can be compared to an uncontrolled level where leaks accumulate without any action taken.

The fact that negative modeling results occur does not preclude the use of the LDAR model. First, no decisions have been based on any negative modeling results obtained using the LDAR model. Secondly, the standards are based on comparisons between levels of control rather than on the absolute values obtained from the model. Thus, even though some results are negative, the LDAR model is used in an appropriate manner in selecting the standards.

Comment: Two commenters (IV-N-11; IV-N-10) concluded that the success of any leak prevention strategy will be highly dependent on what happens to a plant's effective leak occurrence rate. The commenters stressed that there are ways other than mandated inspections to achieve low effective occurrence rates.

Response: At present, there are limited demonstrated means for achieving low effective occurrence rates. Apart from the use of leakless equipment, no other control methods have been demonstrated to eliminate leak occurrences. Under the standards, however, other methods that will effectively lower the leak occurrence rate, such as installation of better equipment (e.g., valves with improved packing), may be used. In fact, process units choosing this course of action and effectively reducing their leak frequency may comply with one of the alternative standards and thereby avoid monthly monitoring.

Comment: The same two commenters (IV-N-11; IV-N-10) said reliance on mandated inspections to lower effective occurrence rates will increase costs and emissions because there is no incentive for design and operating practices to minimize effective occurrence rates. The commenters emphasized the desirability of formulating flexible standards that encourage building and operating plants to achieve low effective occurrence rates.

Response: Based on the LDAR analysis presented in the AID, the leak detection and repair programs required under the proposed standards result in lowering the cumulative number of leaks in a process unit. This is evidenced by the emissions reduction achieved by the program. But the standards also allow alternative methods for achieving reductions in fugitive emissions. These methods include the use of leakless equipment (Chapter 4) and alternative standards for valves (Chapter 14). These provisions allow owners or operators to avoid the mandated leak detection and repair program if they design and operate process units with low effective occurrence rates. Owners and operators have complete flexibility in choosing any such approach which effectively achieves low leak frequencies.

The standards are based on the leak detection and repair programs described in the AID because these are methods that are currently being used and can be used by all SOCMI units to reduce fugitive VOC emissions. Other methods may be applicable to a given segment of the industry but may not be applicable universally and, therefore, would not be appropriate for standards. Moreover, arriving at cost estimates for control techniques which have not been demonstrated would not be possible.

Comment: One commenter (IV-N-10) recommended that improving turnaround repair efficiencies be evaluated as a regulatory strategy.

Response: Improving turnaround repair efficiency would lead to a reduction in fugitive VOC emissions. This is part of EPA's regulatory strategy, as evidenced by the standards. The standards require the use of all possible repair efforts at turnaround to remedy those leaks that could not be repaired on-line or in-place during normal unit operation. As discussed in Chapter 13, only valves which require valve assembly replacement and for which replacement parts are not available can remain unrepaired after shutdown.

Comment: A commenter looking at the LDAR modeling results (IV-N-10) concluded that if initial percent leaking differences resulted from different operating and design characteristics, the effective occurrence rates must also differ, and the emissions for the same inspection period must be different.

Response: The commenter's conclusion is logical. Many of the characteristics used to describe fugitive emissions are interrelated, making it difficult to determine which characteristics actually affect the other measurable characteristics. Supporting evidence for the commenter's thesis is found in the data for the different process units presented in the Maintenance Study (IV-A-10) and the Analysis Report (IV-A-14). Each process type exhibited different leak frequencies and the occurrence rates reported for each process type also differed.

Regardless of which factor causes the emissions characteristics to differ, the number of leaks in a process unit will depend on the occurrence rate for that unit. If occurrence rates differ, the number of leaks will differ. Furthermore, the emissions will differ as well, since the total emissions for a process unit depend on the number of equipment components in each category (leaking equipment, nonleaking equipment, unrepairable equipment, and equipment exhibiting early leak recurrence). (The emissions associated with each category of equipment were discussed earlier in this section in response to comments on the LDAR model.)

An analysis incorporating some of these ideas is presented in evaluation of alternative standards for valves (Chapter 14). The analysis considers the cost effectiveness of leak detection and repair programs for one model unit size over a range of leak frequencies and associated occurrence rates.

Comment: Negative modeling results were attributed to low occurrence rates by one commenter (IV-N-8). The same commenter also said that low-leak plants cannot be explained on the basis of maintenance cycles or maintenance efficiency. An explanation which seemed more reasonable to the commenter is that the occurrence rate is low.

Response: As discussed in response to previous comments in the section, there are several reasons why the LDAR model yields negative results for some leak detection and repair programs. A low occurrence rate of leaks is one possible explanation. Based on the mechanics of the LDAR model, negative effectiveness values for leak detection and repair programs can result from an occurrence rate estimate that is low in relation to the leak frequency measured for the process unit. But an important question is does the low occurrence rate happen naturally or do other factors involved result in the low occurrence rate. There are several possible explanations of how low occurrence rates might be measured.

Two factors, relating to field measurements, that could result in low occurrence rates are (1) too short a period sampled for adequate occurrence rate determination and (2) interim maintenance being performed on the source population being sampled. For at least one of the plants sampled during the

Maintenance Study (IV-A-10), premaintenance and interim maintenance may have impacted the results. Other explanations of low occurrence rates/negative results include low or no leak equipment, high maintenance efficiency, and the position in time of the maintenance study relative to maintenance activities. The potential impact of the position in the maintenance cycle was mentioned in Chapter 4 of the AID.

Comment: A commenter (IV-N-8) compared emissions reductions for two cases by assuming constant controlled emission rates applied to different uncontrolled emission levels. Using this method, he obtained large differences in the emissions reductions obtained using his estimates when compared to the emissions reductions obtained using EPA's estimates.

Response: The comparative analysis of a quarterly leak detection and repair program for light liquid valves presented by the commenter is complicated by his assumption of an emission factor and leak frequency that are vastly different from those presented in the AID. In his estimates, the controlled emissions from light liquid valves are apparently taken to be controlled emissions using EPA estimates, even though his uncontrolled emissions are almost 40 percent less than the EPA estimate. EPA does not agree with the analysis presented by the commenter. The controlled emissions level is not constant as apparently assumed by the commenter. It is dependent upon many factors, including leak frequency and average emission factor.

### A.3.4 Control Device

Comment: Two commenters (IV-N-3; IV-N-8) stated they were not convinced that local burnout efficiencies were not as acceptable a measure of flare efficiency as an overall or global efficiency measurement. One of the commenters pointed out that Siegel sampled a planar array of measurement points above the flame plume. This commenter also pointed out that there is no EPA approved calculation methodology to estimate flare efficiencies.

Response: EPA has not specifically discounted the use of local burnout measurement to characterize flare efficiency. In the Siegel study, there was no evidence to show that flare efficiency decreased as the edge of the plume was approached. Siegel's results support the use of a single point local burnout as a reasonable measure of flare efficiency. Also, even a single local burnout sampling point represents an integrated sample since the plume moves considerably underneath it during sampling even in a light wind. At the present time, there is no method for determining global efficiency of flares operated under normal field circumstances. Therefore, flare efficiency based upon local burnout measurement is the only practicable method that can be used to measure flare efficiency under actual field conditions without making the sampling methodology prohibitively expensive.

An EPA research study presently being conducted will utilize an experimental method that will allow determination of overall global efficiency. The commenters agreed that global efficiency measurement is an appropriate objective of the EPA research project.

EPA does not plan to develop a method for estimating flare efficiency. The CMA-EPA study (IV-A-32) has provided sufficient data under conditions representative of chemical industry operations to allow specification of conditions that will assure 98 percent or greater combustion efficiency. Therefore, the need for an estimation method does not exist.

Comment: Two commenters (IV-N-3; IV-N-8) questioned an EPA statement that flares used for fugitive emission control might be better represented by a lower flow region than the turbulent region investigated in the DuPont study.

Response: The CMA-EPA flare test (IV-A-32) that was completed recently investigated a very wide range of flow conditions from very low to a high of 18 m/sec (60 ft/sec). For steam-assisted flares, air-assisted, or flares operating without assist, flare efficiencies in excess of 98 percent were measured over this entire range of flow conditions.

Comment: Two commenters (IV-N-3; IV-N-8) disagreed with the EPA's statement that the results from the Siegel study were of questionable utility and applicability to flares used for fugitives control. The limitations of the Siegel study elicited by the EPA were: (1) a flare tip design allowing air-fuel premixing atypical for the majority of chemical industry flares in the U.S. and (2) high concentrations of hydrogen/low concentrations of VOC and relatively high Btu content (greater than 1,000 Btu/scf), characteristics not typical of flare gases found in the chemical industry.

Response: Results from the CMA-EPA flare test (IV-A-32) have become available since the AID (III-B-2) was published. A flare tip without provision for air-fuel premixing was operated with and without steam assist; very high efficiencies in the range from 98 to 99+ percent were measured under the conditions of the test series. One of the commenters (IV-N-3) also cited these efficiency results in a later comment letter (IV-N-14).

Also during the CMA-EPA flare test, a range of flare gas heat contents, compositions, and exit velocities were investigated. These characteristics of the streams are judged to be more representative of flare gases found in the chemical industry than those tested by Siegel. There were consistently high efficiencies measured; the only result observed less than 98 percent occurred at a heat content less than 200 Btu/scf for flare operation without assist.

Comment: Two commenters (IV-N-3; IV-N-8) made the following points concerning the EPA position that plant flares may not achieve 95 percent efficiency:

(1) The CMA-EPA study will provide data on flaring of low Btu gases;

(2) There are no data to show that large flares are not as effective as small flares;

(3) There are no data to quantify effect of maintenance on flare performance;

(4) One company has reported to a trade association that flare maintenance needs are low while durability of flare tips is high.

Response: The CMA-EPA study (IV-A-32) did investigate the flaring of low Btu gas. Data from this test series did show that high flare efficiencies (i.e., greater than 98 percent) are achievable on streams down to 300 Btu/scf when operated with steam assist and down to 200 Btu/scf when operated without assist.

At the present time, EPA does not have any data that shows that larger flares are not as effective as smaller flares in combusting flare gases. This question will be addressed in the EPA flare research project to determine if there is any relationship between flare size and combustion efficiency.

EPA is not aware of any data to quantify the effect of flare maintenance on flare efficiency. However, flares maintained as required by the 40 CFR Part 60 General Provisions, operated smokelessly with a flare flame present, and operated with an exit velocity less than 18 m/sec (60 ft/sec) [with flare gas heat content greater than 300 Btu/scf for steam assisted flares or with flare gas heat content greater than 200 Btu/scf for flares operated without assist] will obtain at least a 98 percent combustion efficiency. Air-assisted flares will also obtain 98 percent combustion efficiency on streams with heat contents greater than 300 Btu/scf that meet certain maximum exit velocity criteria.

Comment: One commenter (IV-N-8) stated that EPA had been hostile to the use of flares compared to other control devices. This commenter indicated that EPA should judge flares by the same criteria used for boilers and incinerators. While admitting that flare efficiency is not readily measured, this commenter thought the most important test of a control device should be its cost effectiveness and efficiency, not ease of enforcement.

Response: EPA agrees that control equipment should be evaluated objectively in terms of performance and cost. However, it is also important that means be available both to owners or operators and to EPA to assure reasonably that the expected performance is continuously achieved. In the case of flares where performance tests are not possible at this time (except in costly research projects), it is particularly important that performance be fully characterized before their installation or use is encouraged.

EPA has been aware for some time that flares under some conditions demonstrate very high measured efficiencies, i.e., as high as 99+ percent. Older studies have shown much lower efficiencies. However, the CMA-EPA study (IV-A-32) made available for the first time efficiency measurements for conditions of flare gas composition, flare gas heat content, and exit velocity that are representative of the conditions found in the chemical industry. This study has been instrumental in the adoption of EPA's position that steam assisted flares, air-assisted flares, or flares operated without assist achieve at least 98 percent combustion efficiency when operated smokelessly and within flare gas heat content and exit velocity specifications.

## A.4 COSTS

Comment: One commenter (IV-N-8) recommended that EPA use vendor prices for estimating monitoring costs. He maintained that EPA's monitoring costs were too low. The commenter said that monitoring is now offered on a contract basis by such firms as Espy-Huston and Radian Corporation. He quoted their monitoring price at $2 per source and up.

Response: EPA contacted both Espy-Huston (IV-E-13) and Radian Corporation (IV-E-14) regarding the prices quoted by the commenter. Neither organization offers services on a per valve basis. Both companies only bid on an overall job. Furthermore, they frequently offer more than screening services. Both companies offer data analysis, program design, and other services in addition to routine screening. EPA has thoroughly checked the cost basis presented in the BID and the AID and believe it to be the best cost estimate available.

Comment: The same commenter (IV-N-8) said that EPA's overhead and administrative charges are too low. He provided monitoring labor cost estimates with all benefits and nonproductive time factored in at $1.05 per valve as opposed to EPA's estimate of $0.70 per valve. The commenter's figures included 1.8 hours per day of nonproductive time and 35 days of leave per year.

Response: The commenter in his calculations has inappropriately charged all nonproductive time charges associated with one workeryear to valve leak detection activities. It is highly unlikely that valve leak detection activities in a SOCMI process unit will require an entire worker year of productive effort. For a process unit similar to a model C unit, 1,140 hours (28.5 workweeks) of productive monitoring time would be required for monthly monitoring of valves in one year. Allowances for nonproductive time like those cited by the commenter would reduce the total productive hours available to 1,440 hours per work year. The total monitoring time estimated for valves in a model C unit would, therefore, amount to 79 percent of the total productive time available in one worker year. Adding 79 percent of the nonproductive labor charges to the direct labor requirements for monitoring results in a cost of $0.72 per valve. This estimate is close to the estimate of $0.70 per valve for direct and indirect labor charges calculated by applying a factor of 1.4 to the direct labor requirement.

Comment: The commenter (IV-N-8) cited another reason he felt EPA's monitoring costs were too low. He said that 2 man-minutes per valve is optimistic for the average industrial worker. He attributed the low estimate to the fact that EPA's data were obtained under special test conditions or by contractors paid on a piece work basis who were, therefore, motivated to complete the job as soon as possible.

He cited data from other SOCMI companies monitoring in petroleum refineries. He said their monitoring rates range from 100 valves per day including on-line maintenance to as high as 350 per day without maintenance.

He cited an average (based on limited data) of between 200 and 300 valves per day without on-line maintenance.

Response: The basis for the estimates submitted by the commenter is not clear. The monitoring time estimates made by EPA are clearly documented in the BID and the AID. Those estimates were verified by actual field studies made by EPA. As previously pointed out, the time estimates are very liberal because they include time spent in collecting data which are not required of owners or operators complying with the standards.

Comment: The cost relationships between monthly/quarterly and quarterly monitoring intervals were questioned (IV-N-3). The commenter asked for clarification of the assumptions used and the cost numbers presented.

Response: Since the cost basis, assumptions, and methodology for calculating costs were set forth in the BID and in the AID, the commenter is apparently requesting that EPA provide another example calculation for monthly/quarterly monitoring like the one provided for monthly monitoring in the AID. Accordingly, tables similar to Tables 5-3 through 5-6 of the AID have been assembled and presented here in Tables A-5 through A-8 for monthly/quarterly monitoring.

Comment: One commenter (IV-N-3) judged the cost effectiveness of quarterly monitoring prohibitive if 29 percent repair efficiency is assumed.

Response: As the sensitivity analysis (IV-B-22) shows, varying repair efficiency has little effect on the results of the LDAR model. The cost for quarterly monitoring using 29 percent repair efficiency is hardly prohibitive at $452/Mg, nor is the cost of monthly monitoring prohibitive at $589/Mg.

Comment: One commenter (IV-N-2) stated that the cost of a control device should be included in the cost analysis. Along similar lines, another

TABLE A-5. INITIAL LEAK REPAIR LABOR-HOURS REQUIREMENT FOR VALVES BY MODEL UNIT

| No. of Valves Per Model Unit | | | Initial Leak Frequency | Estimated No. Of Initial Leaks | | | Repair Time, Man-Hours[a] | Labor Hours Required | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A | B | C | | A | B | C | | A | B | C |
| 99 | 402 | 1232(G) | 0.114 | 11.3 | 45.8 | 140.4 | 1.13 | 12.8 | 51.8 | 158.7 |
| 131 | 524 | 1618(LL) | 0.065 | 8.5 | 34.1 | 105.2 | 1.13 | 9.6 | 38.5 | 118.9 |
| | | | | | | | | 22.4 | 90.3 | 277.6 |

[a]Based on 75 percent valves repaired on-line in 10 man-minutes and 25 percent repaired off-line in 4 man-hours.

TABLE A-6 . TOTAL COSTS FOR INITIAL LEAK REPAIR FOR VALVES BY MODEL UNIT

| | A | B | C |
|---|---|---|---|
| Initial Leak Repair Labor Charges ($15/hour) | $336 | 1355 | 4164 |
| Admin. & Support Costs (0.4 x labor charges) | 134 | 542 | 1666 |
| Total Costs | $470 | 1897 | 5830 |
| Annualized charges for initial leak repair (0.163 x total costs)[a] | $77 | 309 | 950 |

[a]Initial leak repair costs amortized over 10 years at 10 percent interest (CRF = 0.163).

TABLE A-7. ANNUAL MONITORING AND LEAK REPAIR LABOR REQUIREMENTS
(Monthly/Quarterly Leak Detection and Repair Program for Valves)

| No. of Valves Per Model Unit A | B | C | Type of Monitoring | Monitoring Time Man-Min[a] | Times Monitored Per Year[c] | Monitoring Labor-Hours Required A | B | C | No. of Leaks Per Year[b] A | B | C | Repair Time, Man-hours | Leak Repair Labor-Hours Required A | B | C |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 99 | 402 | 1232(G) | Instrument | 2 | 4.24 | 14.0 | 56.8 | 174.1 | 18.6 | 75.5 | 231.4 | 1.13 | 21.0 | 85.3 | 261.4 |
| 131 | 524 | 1618(LL) | Instrument | 2 | 4.23 | 18.5 | 74.0 | 228.3 | 24.5 | 98.2 | 303.2 | 1.13 | 27.7 | 111.0 | 342.6 |
| | | | | | | 32.5 | 130.8 | 402.4 | | | | | 48.7 | 196.3 | 604.0 |

[a] Instrument monitoring time is 1 minutes for a 2 man team.

[b] Average number of leaks found over turnaround 2 from the LDAR model, based on monthly occurrence rate of 1.3 percent.

[c] From LDAR modeling results.

TABLE A-8. ANNUAL MONITORING AND LEAK REPAIR COSTS FOR MONTHLY/QUARTERLY MONITORING OF VALVES BY MODEL UNIT

| | A | B | C |
|---|---|---|---|
| Monitoring labor-hours | 32.48 | 130.75 | 402.41 |
| Repair labor hours | 48.75 | 196.27 | 604.08 |
| Total labor-hours (Monitoring & Repair) | 81.23 | 327.02 | 1006.49 |
| Labor charges ($15 x total labor-hours) | $1218 | 4905 | 15097 |
| Admin. & support costs (0.4 x labor charges) | 487 | 1962 | 6039 |
| Annualized charge for initial leak repair | 77 | 309 | 950 |
| Total costs ($/year) | $1782 | 7176 | 22086 |
| Product recovery credit[a] ($/year) | (2070) | (8240) | (25300) |
| Net annualized costs ($/year) | ($290) | (1060) | (3200) |

[a]Product recovery credit is calculated at $300/Mg. The emission reductions are shown in Section 4 of the AID.

Note: Figures in parentheses indicate credits.

commenter (IV-N-8) stated that a utility allowance is necessary for the control device.

Response: As discussed in the AID (III-B-2), the costs associated with operation of a control device are not included in the costs estimated for the standards. For instance, where an owner or operator chooses to use equipment to comply with the standards for pumps in light liquid service, the costs of the standards include the dual seals, the barrier fluid/degassing reservoir system, and the piping required to connect the degassing reservoir with the combustion device on vapor recovery system. The combustion system (especially considering that smokeless flares are included in the standards) are assumed to be available in the process unit.

## A.5 ECONOMICS

Comment: One commenter (IV-N-2) alleged that the analysis did not treat each chemical as a profit center within the corporation as a whole as should have been done. He stated that the analysis equated the economic impact on a particular chemical as equaling the impact on the corporation as a whole.

Response: Two related issues are addressed by the commenter. The first is that the analysis focuses on chemicals and not firms. The second is that the financial and management structure of each firm influences how it would react to new air pollution standards, but corporate structure was not expressly considered in evaluating the economic impact of the standard. The first issue relates to the way EPA develops the cost estimates; the second, how it evaluates the size of the costs.

The compliance costs for the proposed regulation have been developed based on an analysis of industry practices and production technology. Where necessary and appropriate, worst-case scenarios are formulated and the compliance costs estimated. If significant impacts are projected under such scenarios, then the impacted chemicals are reviewed in further detail. This involves an examination of existing facilities and their operating characteristics and usually results in the refinement of the initial conservative assumptions. Because most of this effort focuses on chemicals, and not on corporations, it is easy to get the incorrect impression that EPA assumes, as the commenter suggests, that economic impacts on a particular chemical equal the impact on the corporation as a whole. EPA assumes only that a chemical is not likely to be produced unless all costs, including compliance costs, are covered. If product prices are sufficient to cover all costs, including a normal return on investment, then no corporation producing that chemical should be adversely affected.

As regards the second issue, EPA analyzes the potential economic impacts of standards on a model unit that can be built and operated independently, and that, therefore, represents a single investment decision. Such an approach is completely compatible with the profit center concept mentioned by the commenter. The only time the size of the corporation enters the analysis is to determine whether an affected facility would be operated by a small business. EPA accepts the Small Business Administration's definition of a small business for the purpose of analyzing the potential economic impacts on small businesses. However, this does not detract from the compatability of the economic analysis with the corporate structure mentioned by the commenter.

Comment: A commenter (IV-N-1) has asserted that the costs of compliance for small producers are likely to be high because they are unlikely to have excess labor to devote to VOC emission controls. Further, he also asserts that controls on small facilities will have low VOC recovery. He concludes by suggesting that new or modified small facilities be excluded from the proposed regulation.

Response: Monitoring and repair costs for each model unit have been estimated and are included in the annualized cost of the standards. EPA estimates that the annual leak detection and repair labor-hours requirements for each model unit will be:

Model Unit A: 214
Model Unit B: 829
Model Unit C: 2,569

These estimates are believed to be reasonable.

The commenter asserts that small producers, presumably as compared to large producers, have relatively few excess man-hours to devote to this activity. This comment implies that such excess man-hours are, in essence, free and could be used to comply with the proposed regulation. EPA has not treated any of the resource requirements, including labor, that are necessary to comply with the proposed standard, as being free. In all cases, the requirements and their associated costs have been estimated. To the extent that any facility has underemployed resources that could be applied to meeting the standard, then the compliance costs would be lower. However, EPA has made no such assumption in developing the compliance cost estimates. Finally, the commenter has not provided any evidence why he expects that the financial burden on small companies would be great.

The commenter has also proposed a facility size cutoff for the proposed regulation although he has provided no accompanying data why such a cutoff is reasonable. It is anticipated, of course, that small facilities will have smaller reductions in emissions than larger facilities from applying the controls. EPA is proposing that facilities with an annual capacity of 1,000 Mg or less be exempted from compliance with the proposed regulation.

## A.6 COMMENTS ON SUBJECTS NOT COVERED IN THE AID

Comment: Commenters (IV-N-8; IV-N-9; IV-N-3) recommended that EPA adopt a standard of annual/turnaround monitoring instead of the monthly monitoring proposed for valves. The commenters maintained that an annual/turnaround monitoring program would be a cost-effective approach. They predicted that control efficiencies would exceed 90 percent. In a later letter (IV-N-12) one of the commenters clarified his comments. The program was seen as an annual leak detection and repair program combined with screening before shutdown, attempted repair, and repair of all remaining leakers during shutdown. The commenter stressed that he did not mean that every process should be shutdown once a year; although, the industry average for shutdowns is once a year. The commenter also explained his basis for 90 percent control efficiency. He said that on-line repair followed by immediate off-line repair (at shutdown) would approach 100 percent repair efficiency.

Response: EPA estimates for an annual monitoring program coupled with an annual turnaround show 1.93 Mg/yr reduction in VOC emissions from a model unit B, a decrease of 3 percent over uncontrolled (baseline) emissions. Estimates for annual monitoring coupled with a two-year turnaround show a 1 percent decrease in emissions over uncontrolled (baseline). This low level of emissions reduction yields high cost effectiveness ratios: $1900 and $6700 per Mg for annual monitoring with one- and two-year turnarounds, respectively. EPA does not consider either of these programs reasonable alternatives to the standards.

The commenter's estimate of 90 percent control efficiency is actually an estimate of repair efficiency. EPA agrees that repair efficiency when repair is attempted should exceed 90 percent. That is, 90 percent of the valves found leaking should be repairable to a no-leak status. However, 90 percent repair does not mean 90 percent emission reduction (control efficiency). The control efficiency numbers presented by EPA are comparisons of emissions for one year under a leak detection and repair program with emissions which would occur if the program were not in effect.

Comment: A commenter (IV-N-8), referring to previous submittals, asked that the percent leaking alternative standard for valves be clarified with respect to what constitutes a violation. He also asked for a mechanism through which low-leak plants could be dropped out of the program.

Response: If an owner or operator elects to comply with the percent leaking alternative standard for valves, a violation would occur when more than 2 percent of the valves in light liquid and gas service within an affected facility leak. A leak is defined as a concentration at or above 10,000 ppmv as measured by Reference Method 21. Affected facilities with a low percentage of valves leaking (plants with leak frequencies maintained at a level lower than 2 percent) need only monitor valves for leaks once a year to determine compliance with this alternative standard. Additional compliance tests may be required by the Administrator. Repair must be attempted on valve leaks detected at the annual monitoring or at any other time leaks are detected. Thus, while valves in affected facilities having low percentages of valves leaking are not exempted from the standards, the leak detection and repair effort for valves is substantially reduced for them.

Dropping process units with low frequencies of valve leaks from coverage would not be justified for several reasons. First, there would be no way for either the owner or operator or for EPA to insure that the valves in the affected facility were maintained at a low leak frequency without continuing requirements for low leak frequency maintenance and periodic verification. Furthermore, other fugitive emission sources are affected by the standards, not just valves. It would be unreasonable to drop a unit from coverage based on valve leak frequency when emissions from other fugitive emission sources may be significant. However, there is provision for waiving the annual performance test (40 CFR 60.8(b)(4)) by demonstrating by other means to the Administrator that the affected facility is in compliance with the standards.

Comment: A commenter (IV-N-8) asked that the determination of percent leaking be changed. He said that the percent leaking should be determined by dividing the number of valves leaking by the number of accessible valves in the unit.

Response: It is not clear why the commenter requested this change since its effect would be to make the percentage of leaking valves in a process unit higher, thereby making compliance with the alternative standard more difficult. Inaccessible valves are part of the affected facility and must be monitored annually, or, in the case of unsafe to monitor valves, as often as safety practices allow. Thus, all light liquid and gas valves should be included in the total number of valves with the exception of leakless valves complying with the performance standard of no detectable emissions.

Comment: A commenter (IV-N-8) asked that provisions be made for a soap bubble type test to be used for inaccessible valves.

Response: Reference Method 21 when promulgated will allow soaping (not soap scoring) as a method of leak detection for accessible as well as inaccessible valves. Therefore, soaping may be used for inaccessible valves as appropriate.

Comment: A commenter (IV-N-8) disliking EPA's monthly/quarterly monitoring strategy requested that EPA use the LDAR model to evaluate whether it is worth the cost and nuisance entailed.

Response: The standard for valves is monthly leak detection and repair. EPA has provided owners and operators of affected facilities the flexibility of minimizing the time and resources involved in monthly monitoring by concentrating monitoring effort on leaking valves, i.e., monthly/quarterly monitoring. However, implementation in this manner is not required. Monthly monitoring of all valves is acceptable. Also acceptable is compliance with one of the two alternative standards for valves.

Implementation of a monthly leak detection and repair program by concentrating on leaking valves has been evaluated. Results of the evaluation were published in the AID. Costs of various monitoring intervals for valves were presented in Table 5-7. The costs indicate that monthly monitoring of all valves in light liquid and gaseous service has reasonable costs. Therefore, EPA believes that quarterly monitoring of all valves in light liquid or gaseous VOC service is not an appropriate basis for the standard. However, EPA believes that implementation of monthly monitoring by screening demonstrated leakers is effective and also has reasonable costs because it allows effort to be concentrated on those valves that leak. In allowing implementation of monthly monitoring in this way, EPA is recognizing that some valves leak infrequently. However, it is not EPA's intention to implement quarterly monitoring of all valves in light liquid or gaseous VOC service.

Comment: A commenter (IV-N-8) said that anyone using cost effectiveness numbers and especially incremental cost effectiveness numbers should keep in mind the uncertainties in the data used to make the estimates. He cited differences in EPA's and his estimates of emissions and costs as evidence of variability. He presented cost effectiveness estimates for light liquid valves in a Model Unit B performing quarterly leak detection and repair. His estimate was $1,286/Mg which he compared to an EPA estimated credit of $55/Mg.

Response: The commenter is correct in his assertion that estimates should always be treated with good judgement, and variability in data and in physical processes represented by data should be considered when estimates are used. EPA has followed this philosophy.

Estimates of emissions and costs for SOCMI were developed to assess the impact of the standards on SOCMI. But the analysis did not stop there. In developing standards, EPA has also considered the variability within SOCMI. The standards provide for control of fugitive emissions with reasonable costs in all situations in SOCMI of which EPA is aware. Providing this reasonable cost effectiveness for all parts of SOCMI has resulted in providing many options from which an owner or operator may select to comply with the standards.

The issue raised by the commenter is not a variability issue. Instead, the issue raised by the commenter is how emissions, emission reductions, and costs should be calculated. EPA disagrees with the commenter's method of arriving at a percentage of valves leaking and emission factors as discussed in Section A.1. EPA also disagrees with his method of arriving at controlled emission levels as discussed in Section A.3.

Comment: One commenter (IV-N-8) concluded from reviewing the confidence intervals associated with the petroleum refinery emission factors that there is a sizeable unexplained variance in EPA's correlation of refinery data. The commenter said that EPA should be trying to rationalize the differences to insure that their petroleum refining fugitive emission standards are technically sound.

Response: It is not clear just what variability the commenter is referring to. A variance component analysis was performed on the petroleum refinery data. The analysis is presented in Docket Item No. II-A-26. Large portions of the variability in screening values were found to be due to the effect of data for pumps and valves. For valves, large portions of the variability were seen to be due to individual valves. Similarly, an analysis of variability was performed on SOCMI data (II-A-7). Again, large portions of the total variation in valve screening values were seen to be due to variations between valves and day-to-day variations.

Rationalizing this variability as the commenter requests would in this case be technically infeasible and inappropriate because the variability is inherent in the valve and its operation. Because the commenter referred to confidence intervals, he may have been referring to uncertainty attached to estimates of emission factors. This type of uncertainty arises in any case where a mean or other statistical estimator is extrapolated from a sample to a population.

Both the SOCMI and petroleum refining fugitive emission standards are based on technically sound data collection and analysis methods. Neither uncertainty attached to estimates nor variability in a data set prevent the use of that data in developing standards as long as the uncertainty and variability are considered. These considerations have been made in development of the petroleum refinery fugitive emission standards in much the same manner as the considerations have been made for the SOCMI standards.

Comment: A commenter (IV-N-8) recommended a regulatory approach which differed from the one proposed by EPA. Instead of a fixed monitoring period, the commenter recommended that EPA evaluate a variable monitoring frequency to maintain a fixed percentage of valves leaking. The commenter suggested annual, semiannual, quarterly, and monthly monitoring intervals. He said an owner/operator would start monitoring on some frequency and if the number of new leaks exceed some "X" percent for two consecutive times, he would go to the next more frequent period until he met the "X" percent leaking figure or reached monthly monitoring. Conversely, if the unit were below "X" percent leaking for two consecutive times he would drop to the next longer monitoring period.

The commenter said that such an approach would insure that all affected facilities maintained an average of X/2 repairable leaks. According to the commenter, the system would make monitoring frequency a function of leak rate so that low-leak plants would monitor less frequently than high-leak units, and it would encourage owners/operators to make engineering changes to reduce emissions and reward those that did so. He called this approach a rare feature in federal regulations.

Two commenters (IV-N-8; IV-N-14) said that an equitable basis for controlling chemical industry emissions would be to have controlled emission rates comparable to those obtained by the NSPS for the petroleum refining industry. One of the commenters (IV-N-8) judged that the most equitable basis for setting an allowable percent leaking would be to set "X" percent leaking times the emission factor equal to mass emissions which would result from 2 percent leaking in a petroleum refinery. The commenter computed the allowable percent leaking which would result using SOCMI emission factors which he recommended (see Section A.1). The resulting allowable percentages were 14 percent for gas valves and 9.6 percent for light liquid valves. He said that these values for leak frequency are in the range of unregulated SOCMI units, and, therefore, the standards are unnecessary.

Response: The commenter's recommended approach incorporates some good ideas. In fact, many of the aspects of his recommended program have been incorporated in EPA's alternative standards for valves. One of the alternative standards incorporates a varying monitoring interval. The other incorporates a fixed percentage of valve leaks not to be exceeded. (See Chapter 14 for a discussion of alternative standards.) The alternative standards do, as the commenter requested, encourage owners or operators to reduce emissions and to reward those who succeed in doing so.

It should be remembered that the objective of valve standards is to reduce emissions to the lowest level which can be attained with reasonable costs. This objective has dictated an important difference in the two approaches. Instead of starting with a monitoring interval and shortening it as recommended by the commenter, the variable monitoring interval incorporated in the alternative standard has been implemented by starting with the shortest monitoring interval, lengthening the interval as the target is successfully met. There is another difference in the percentage of valves leaking standard. In the context of a single standard (as opposed to an alternative or optional standard), it would be inappropriate to set a fixed percentage leaking target for all affected facilities because of variability in the industry. The fixed percentage in the alternative standard is a minimum level below which a leak detection and repair program would not have reasonable costs. It is not a percentage set by a predetermined emission level as recommended by the commenter.

The attempted normalization of emissions from SOCMI to those from petroleum refineries is not a valid concept within the standard-setting context. The objective is to achieve the lowest emissions attainable with reasonable costs, not to achieve the same level of emissions in all industries. Impacts of the standards for both industries were evaluated independently. Costs and impacts for best demonstrated technology for both industries are reasonable. Comments concerning the need for the standards are addressed in Chapter 2.

Comment: A commenter (IV-N-8) said that many difficulties he had noted in the proposed standards for SOCMI fugitive emission sources would be eased or eliminated if the standards were revised to be similar to those for petroleum refinery fugitive emission sources presented at the July 1981 meeting of the National Air Pollution Control Techniques Advisory Committee.

He recommended that the appropriate changes be made to make the SOCMI standard similar to the refinery standards.

Response: Several revisions to the SOCMI fugitive standards have been made since proposal. The SOCMI fugitive emission standards as well as the petroleum refining fugitive emission standards represent EPA's best understanding of fugitive emissions of VOC. The similarities between the two sets of standards are not surprising since they affect similar equipment in similar services. Best demonstrated control techniques are understandably similar.

Comment: According to a commenter (IV-N-8), EPA seems preoccupied with methods for estimating industry-wide impacts. He contrasted this concern with industry's major concern, saying that industry's major concern is for technically sound, reasonable and equitable standards.

Response: EPA is concerned with technically sound and reasonable standards as well as their industry-wide impacts. The standards are technically sound and reasonable and at the same time, they are cost-effective and affordable for the industry. Since these same criteria are applied when standards are developed for other source categories, the standards are equitable.

Comment: A commenter (IV-N-8) emphasized the fact that in taking a unit operations approach, EPA has the obligation to see that the standards are reasonable for all members of a class.

Response: EPA agrees with this comment. EPA is obligated to develop standards consistent with Section 111 of the Clean Air Act for new, modified, and reconstructed stationary sources. EPA has fulfilled this responsibility by developing standards for fugitive emissions of VOC from SOCMI which reflect best demonstrated technology taking into consideration costs, nonair environmental impacts, and energy requirements. Inherent in this is the need to assure that the standards are reasonable for all members of a class. In considering the impacts on SOCMI, EPA has evaluated the impact on all members of SOCMI, and, as appropriate, adjustments have been made in the standards for all SOCMI members to assure that there are not unreasonable impacts. For example, an exclusion has been made for units with production rates so low that compliance with the standards would not be cost effective. For units with less than 2 percent of their valves leaking, an option has been provided for eliminating routine leak detection and repair requirements. Pumps may comply with one of several options, e.g., leak detection and repair, barrier fluid systems, or enclosed seal areas. Related comments and responses concerning applicability of the standards to SOCMI members have been addressed in Chapters 5 and 7.

Comment: A commenter (IV-N-4) complained that the AID did not address some technical comments he had submitted previously. He said that his comments concerning vapor pressure/temperature relationships had been ignored.

Response: The comments presented previously by the same commenter have not been ignored. EPA considers and responds to all comments submitted. Only a part of the comments were included in the AID, i.e., those which dealt specifically with methods and data to be used in calculating impacts. The scope of the AID was clearly defined in the Federal Register Notice of Availability (IV-I-2) and did not include the topic of vapor pressure/temperature relationships. The remaining comments are included in the background document and the comment which the commenter felt was excluded is discussed in Section 5.2 of of this background document.

Comment: A commenter (IV-N-4) referring to the AID, said the Agency's statement that, "For reasons only partially understandable, the SOCMI fugitive emissions data showed a difference in the number of leaking and non-leaking sources (leak frequency) when compared to the data derived from petroleum refineries," illustrates a lack of technical expertise in the field of workplace exposure control and limited willingness by EPA to learn.

He asserted that the Agency needs to develop or contract for the expertise needed to attain full understanding.

Response: The commenter has a totally incorrect perspective of EPA desires, interests and technical expertise. EPA has led the efforts to characterize the extent of and control approaches for fugitive emissions. Prior to this activity which has been carried out over the past 5- to 6-years, fugitive emission rates had not been adequately evaluated and were significantly underestimated as was the utility and effectiveness of well-designed leak detection and repair programs. Throughout this period EPA has sought to raise the level of understanding in this area and has done so in close cooperation with the affected industries.

More specifically, EPA has a long history of research in the field of fugitive emissions. The chronology of work on the development of standards for fugitive emissions of VOC from SOCMI was presented in Appendix A of the Background Information Document (III-B-1) for the proposed standards. Work began on development of these standards in December 1978 and continued until the present time (promulgation). EPA studies of fugitive VOC emissions referenced in the AID include:

- Petroleum Refinery Study (II-A-26)
- Four Unit EPA Study (II-B-34)
- EPA 6-Unit Study (II-A-23, 24, 25, 28; IV-A-1; IV-A-5)
- EPA 24-Unit Study (IV-A-11)
- Maintenance Study (IV-A-10)
- Analysis Report (IV-A-14)
- Analysis of Allied HDPE Unit Data (IV-A-16)
- SCAQMD Study (IV-A-30)
- Coke Oven By-product Recovery Plant Study (IV-A-31)
- Gas Plant Study (IV-A-28)
- Revision of Emission Factors for Non-Methane Hydrocarbons from Valves and Pump Seals in SOCMI Processes (IV-A-29)

Furthermore, the docket includes information concerning fugitive emissions of VOC collected as early as 1957 (II-I-2).

Other studies performed by EPA include:

- Response factors for VOC analyzers (II-A-20; IV-A-8; IV-A-12; IV-A-15)
- Emission Control Options for the Synthetic Organic Chemical Industry (II-A-22)
- Vapor Pressure Distribution of Selected Chemicals (IV-A-6)
- Evaluation of Walkthrough Survey (IV-A-18)

This history of research in the area of fugitive emissions does not indicate an unwillingness to learn about fugitive emissions and their control. Although the thrust of the experimental efforts has been protection of the environment, control of fugitive emissions has an associated benefit of reducing workplace exposure and saving both money and energy. Collaboration between EPA and OSHA in control of emissions is evidenced by the NIOSH document Control of Emissions from Seals and Fittings in Chemical Process Industries (IV-M-3). In this document, fugitive emissions data collected by EPA were applied to the subject of workplace exposure. The report says that EPA's standards should be considered minimum requirements for areas where workers may be exposed to highly toxic or carcinogenic VOC fugitive emissions. The report recommends that in these cases additional equipment, which EPA considers technically feasible but not sufficiently cost-effective from an environmental point of view, should be incorporated based on worker exposure considerations.

Comment: A commenter (IV-N-1) asserted that leak frequency is undoubtedly influenced by vapor pressure. He said that highly volatile compounds are more likely to leak than are compounds with low volatility. He referred to Tables 2-12 and 2-19 of the AID as support for his statement. The commenter said that a comparison of the tables showed that compounds with lower vapor pressures have lower leak frequencies than compounds with higher vapor pressures. He presented a table of normal boiling points and vapor pressures at 25°C for ethylene, vinyl acetate, and cumene. He said that EPA had used the leak rates for these substances with very different vapor pressures to derive average unit emission factors.

The commenter further asserted that the differences would be much greater if they were evaluated at their operating temperatures. Another commenter (IV-N-4) expressed the same view and maintained that the definition of light liquid should be changed to reflect vapor pressures at actual operating temperatures. He said that fugitive emissions will be minimized for highly volatile organics operating at low temperatures and for low volatility substances processed at high temperatures. He said the standards should apply only to those processes likely to have significant emissions. He recommended the following definition of light liquid: a fugitive emission source is in light liquid service if the following conditions apply:

(1) The vapor pressure of one or more components, present in concentrations greater than 20 percent by weight, is greater than 760 mm Hg at operating temperature. Vapor pressure may be obtained from standard reference texts or may be determined by ASTM Method D-2879.

(2) The fluid is a liquid at operating temperature.

Response: The first commenter (IV-N-1) is correct in his assertion that highly volatile compounds are more likely to leak than are compounds with low volatility. Fugitive emissions data indicate that vapor pressure is the most important factor influencing the frequency of leaks. However, the commenter is apparently confused concerning the derivation of emission factors. The quantity of mass emissions were derived from the petroleum refining study except in the case of gas valves. Furthermore, the emission factors used were leaking emission factors and nonleaking emission factors. (See analysis in AID and in Docket Item No. IV-N-10.) This consistency supports the use of leaking and nonleaking average emission factors to characterize SOCMI.

Although a correlation of leak frequency with operating temperature seems reasonable, that hypothesis, suggested by both commenters, is not supported by the data (II-A-26; IV-A-14). These data show that the effect of operating temperature was not consistent and was significant in only a few cases. Based on these data, the standards were designed to eliminate those sources which tend to leak infrequently (heavy liquid sources) regardless of operating temperature, and EPA has not been provided any data nor found any support for changing the standards.

Comment: A commenter (IV-N-9) requested that the model runs used to select and evaluate the proposed regulatory options be placed in the public docket for inspection.

Response: The computer print out used in preparation of the final standards is archived in the docket (IV-B-23).

Comment: A commenter (IV-N-3) complained that Tables 4-12 and 5-7 are difficult to understand. The commenter concluded that some data were missing, especially data relating to monthly/quarterly and quarterly monitoring intervals.

Response: EPA tried to make very clear the methods and data used to arrive at the estimates in the BID. It is true that the subject of fugitive emissions is highly complex, and reproducing the estimates presented in the AID requires some time and effort. The computer print-out generated in making the estimates in the AID has been placed in the docket (IV-B-23). Thus, as requested, any numbers the commenter was having difficulty reproducing are available.

It is not clear just what data the commenter felt were missing with regard to monthly and monthly/quarterly monitoring intervals. It could be that they are referring to blank spaces in Table 4-12. There are entries left blank in Table 4-12 for the monthly/quarterly monitoring intervals because the ABCD and modified ABCD models cannot evaluate that monitoring scheme. However, the numbers used in the estimates are shown in the column labeled "LDAR." With that exception the same information was presented for all the monitoring intervals considered. Another possibility is that the commenter is requesting an example of cost calculations for the monthly/quarterly program. An example of the cost calculations for a monthly/quarterly leak detection and repair program for valves is provided in Section A.4.

Comment: A commenter (IV-N-3) complained that the AID failed to provide enough information to analyze fully and to critique the LDAR model. He, therefore, requested an extension in the comment period. He further complained that the technical note describing the LDAR model was of such poor printing quality that it could not be used to reproduce the computer runs.

Response: An extension in the comment period was granted. As previously noted, EPA recognizes the complexity of the subject of fugitive emissions and realizes that analysis requires some time and effort. EPA made every effort to make the necessary information available to the public for review and comment. A very legible copy of "Model for Evaluating the Effects of Leak Detection and Repair Programs on Fugitive Emissions" has been placed in the docket (IV-A-22). In addition, a copy of the document was sent to those commenters requesting it. It should be noted that another commenter (IV-N-10) was able to run the LDAR model (computer program) while this commenter was having difficulty.

Comment: The same commenter (IV-N-3) protested that the LDAR technical note did not use the same input data as that used in the AID.

Response: The technical note (IV-A-22) is a description of the LDAR model and the software designed to implement it. The input data shown in the technical note were used for illustrative purposes. The model and software can be implemented with any input data. To evaluate impacts of the standards, EPA has chosen input data which are the most reasonable for that purpose. These selections of input data are detailed in the AID.

Comment: A commenter (IV-N-1) submitted that data presented in the AID confirm the fact that uniform application of control measures in an industry as diverse as SOCMI is not supported. He said that the regulatory approach must be sufficiently flexible to reflect differences in substances regulated, processes used, and sizes of units.

Response: The commenter's vague reference to data presented in the AID makes it difficult to know just what data he is referring to. EPA is aware that variability exists within SOCMI due to different processes, different chemical substances, and different levels of unit complexity. EPA is also aware that such variability required consideration when establishing the standards. As a result, the standards accommodate this variability. For example, an owner or operator may elect to comply with a fixed percentage of valves leaking or an alternative work practice standard instead of a monthly leak detection and repair program according to which plan best suits his unit's operations. Additionally, control device requirements allow the use of several different types of control devices, including elevated smokeless flares.

EPA has evaluated each fugitive emission source in terms of variability in the industry. The standards accommodate all of the variability EPA is aware of. All control techniques known to be equivalent have been included in the standards. Also, equivalency provisions have been provided so that new control techniques may be used as they are demonstrated.

Comment: A commenter (IV-N-6) submitted a copy of a draft report, "Frequency of Leak Occurrence in the Specialty Organic Chemical Manufacturing Industry" prepared by $S^3$, as evidence that there is no fugitive emissions problem among specialty chemical producers. He further commented that the proposed NSPS for SOCMI "is based on data that do not accurately characterize this industry." The commenter referred to the five process units studied as a representative cross-section of the specialty chemicals industry. He said that the results showed a negligible frequency of leaks.

Response: For several reasons the $S^3$ report and the comments received do not contain information which is relevant or useful for the SOCMI fugitive emission standards.

First, the industry for which the $S^3$ study was designed is the specialty organic chemical manufacturing industry (SPOCMI), not SOCMI. There is no indication that any of the five processes screened are SOCMI processes. Furthermore, the basis for comparison of the two industries is not clear and is made even more difficult to understand by the fact that SPOCMI has not been well-defined.

A serious limitation on the data itself is the large proportion of heavy liquid equipment screened. Even though previous fugitive emission studies have shown negligible emissions from heavy liquid sources, four of the five process units screened in the $S^3$ study were heavy liquid processes. It is not surprising that few leaks were detected; 86 percent of the fugitive emission sources screened were in heavy liquid service. The fact that few leaks were found merely affirms the previously determined fact that fugitive emission sources in heavy liquid service leak infrequently.

It should also be noted that the $S^3$ study was a small sampling effort. Only five process units were screened. Furthermore, of the 1034 fugitive emission sources screened, only 149 were in light liquid service and only 82 would be affected by fugitive emission standards if they were in process units affected by fugitive emission standards. Table A-9 presents a comparison of leak frequencies for equipment in light liquid service in SOCMI (Analysis Report, Docket Item No. IV-A-14) and SPOCMI ($S^3$ Report, Docket Item No. IV-N-6). The large confidence intervals noted for pumps and flanges in light liquid service in SPOCMI reflect the small number of these equipment that was sampled.

TABLE A-9. COMPARISON OF LEAK FREQUENCIES FOR EQUIPMENT IN LIGHT LIQUID SERVICE IN SOCMI AND SPOCMI

| | SOCMI Results (Docket Item No. IV-A-14) | | SPOCMI Results (Docket Item No. IV-N-6) | |
|---|---|---|---|---|
| | Leaking | 95% Confidence Interval | Percent Leaking | 95% Confidence Interval |
| Valves | 6.5 | (6.1, 6.9) | 1.1 | (0.3, 6.1) |
| Pumps | 8.8 | (6.4, 11.0) | 0 | (0, 70.8) |
| Flanges | 1.3 | (0.9, 1.7) | 0 | (0, 12.3) |

Finally, the report is a draft contractor report which has not been released to the public. The report is deficient is several respects and will be substantially revised before it is completed.

EPA recognizes that low-leak units do exist and they will be subject to the standards. For such low-leak units, alternative standards have been allowed. These alternative standards would result in no unreasonable impact on low-leak units.

Comment: One commenter (IV-N-1) objected to the burden the standards place on small companies. He requested a 10 million pound annual capacity cutoff to relieve the burden.

Response: An exemption for low production rate units has been provided. The standards exempt process units producing less than 1,000 Mg/yr of SOCMI chemicals. EPA's production rate cutoff differs from the commenter's recommended cutoff level. The commenter's recommendation of 10 million pounds per year is equivalent to 4,500 Mg/yr. The commenter's basis for choosing this number is not clear nor did he provide any convincing indication of an unreasonable burden. EPA's choice of 1,000 Mg/yr is based on an analysis of cost effectiveness and is presented in Section 5.5 of this background document.

Comment: A commenter (IV-N-5) submitted data from his plant to show that greater than 90 percent control of fugitive emissions can be achieved by capping and plugging open-ended lines and valves. The commenter said that the regulatory approach of capping open-ended lines and valves has been overlooked by EPA.

Response: The commenter's calculations apparently reflect an inordinately large number of open-ended lines in his process unit, although it was difficult to discern just how many from his calculations. The commenter's uncontrolled emissions estimates show 60 percent of the total uncontrolled fugitive emissions from open-ended lines. In contrast, uncontrolled emission estimates for EPA's model units include 6 percent from open ends only, or 40 percent from open-ended lines and associated valves.

EPA realizes that covering open-ended lines is important in reducing fugitive emissions of VOC from SOCMI units. Covering open-ended lines has been made a part of the standards. However, EPA does not agree that plugging and capping open-ended lines is enough. Control of other fugitive emission sources is also important in significantly reducing fugitive emissions of VOC. Furthermore, industry representatives have said that plugging open ends is now standard practice in new plants. In that regard, covering open-ended lines is a part of the baseline control level. As shown in Chapter 6, since capping open ends is a part of the baseline level of control, no emission reductions are assumed.

Comment: A commenter (IV-N-10) emphasized the desirability of formulating flexible regulations that encourage building and operating plants to achieve low "effective" occurrence rates. The commenter said that plants can either keep "effective" occurrence rates low by good design and maintenance practices or allow high "effective" occurrence rates and monitor frequently. He said that frequent monitoring is analogous to treating symptoms, whereas lowering the "effective" occurrence rate treats the disease.

Response: EPA agrees and has incorporated the commenter's suggestion. The commenter is expressing good ideas in his recommendations for concentrating control strategies on occurrence rates (rates at which leaks occur over time). However, his strict use of occurrence rates has practical limitations. There are two major problems with developing control strategies which reduce occurrence rates. First, to date, the technology for reducing occurrence rates, while possible, has not been demonstrated, and it is unlikely that equipment substitution or changes in operating procedures could be applied throughout SOCMI. The second problem is one of measurement. Measuring occurrence rates is an expensive proposition, requiring several months of intensive work to arrive at a satisfactory estimate. The cost of requiring such measurements would be unjustifiably high, just as it would be unreasonable to expect an owner or operator to bag all of his fugitive emission sources to estimate his emissions.

For practical reasons, the control strategy embodied in the standards uses the easily measurable manifestation of the occurrence rate, or leak frequency, as an indicator of leak rate. Also included in the strategy is the demonstrated control technology of maintenance for reducing emission rates. This approach is reasonable in cost effectiveness terms and can be applied throughout SOCMI. However, the standards achieve the purposes sought by the commenter of allowing those units that can reduce their occurrence rates to a level, as indicated by a low frequency of leaks, to comply with an alternative standard. The alternative standards allow units with low occurrence rates (and, therefore, low leak frequencies) to reduce the amount of leak detection required. Equivalency provisions are also available to any owner or operator who can demonstrate control by any other method as effective as the method provided in the standards.

Comment: A commenter (IV-N-4) disagreed with EPA's judgement that the Four-Unit study should be eliminated from consideration. He said that the data had been reviewed and found valid in a review by Jones, et al., in 1982.

Response: EPA has reviewed the paper referred to by the commenter, Jones, Alan, Sydney Lipton, and Jeremiah Lynch. "Critical Review of Fugitive Emission Data." Presented at AICHE meeting in Orlando, Florida. February 28 - March 3, 1982.

The paper (IV-M-55) includes the four-unit study in the review of fugitive emissions data. However, EPA could find no evaluative judgements in the paper concerning the validity of the four-unit study.

Comment: The same commenter voiced concerns about the validity of EPA's data in three letters (IV-D-6; IV-N-4; IV-N-13). He had two major concerns: (1) the K-factor used in the petroleum refinery studies and (2) the statistical distribution model used in analyzing fugitive emissions data. He cited the following two references in support of his objections:

> Jones, A. L., Lipton, Sydney, and Lynch, Jeremiah, "Critical Review of Fugitive Emission Data," AICHE meeting, March 3, 1982, Orlando, Florida.
>
> Harvey, P. A., and Jones, A. L., "Fugitive Emission Data: Statistical Treatment," UK Health and Safety Executive and Esso Europe Inc. (Received as Private Communication from B. C. Davis, Exxon Chemical Co.)

Specifically, the commenter said that the paper by Jones, et al. reinforced questions about the handling of refinery data previously raised in his earlier comments. He used the Harvey and Jones paper to support his contention that the statistical analysis was not satisfactory and that a better statistical distribution could be found.

Response: EPA has responded to the commenter's previously submitted comments concerning the confusion over published K-factors. His questions about the validity of the data base apparently center on a typographical error in the K-factor generated in the petroleum refinery studies. (See Chapter 3 for a response to his comment.) A letter explaining the discrepancy noted by the commenter has been filed in the docket (IV-B-7). Furthermore, copies of this letter have been sent to the commenter on two separate occasions. The reasons for the commenter's remaining concerns are unclear in the face of actions taken by EPA to respond to his concerns.

EPA requested a copy of the Harvey and Jones paper from the commenter (IV-C-78). In one of his letters, the commenter informed EPA that he did not have permission to release this paper and that the paper would have to be obtained from the originating company. He subsequently arranged to have a copy of the Harvey and Jones work sent to EPA (IV-D-55).

EPA reviewed the paper; the three main points made by Harvey and Jones were:

- The methods used by EPA usually fit the data quite well.
- The lognormal distribution, used by the EPA to derive fugitive emission factors, is not the only distribution function which can be used to describe the fugitive emission data.
- The Gamma distribution and other distribution functions can also be used to fit fugitive emission data.
- Preliminary work indicates that a better prediction of fugitive emission factors may be obtained for some types of fugitive emission sources using the Gamma distribution rather than the lognormal distribution.

While other distributions may also be applicable in certain cases, the lognormal distribution was chosen for describing fugitive emissions in the Petroleum Refining studies since it was the simplest distribution that adequately described the data and it was the only distribution that allowed a closed form expression to be written. In Appendix C of the Petroleum Refining studies, this selection was documented. Furthermore, it was noted that only three of the twelve data sets examined failed a test for normality using this assumed distribution. The commenter draws the conclusion from the paper that the gamma distribution better describes fugitive emissions data, but he does not present any comparison of the two distributions, even though such a comparison is possible.

Though the two papers referenced by the commenter do review and discuss fugitive emissions data and analysis procedures, it is important to note the emphasis of these particular papers. Both Harvey and Jones, and Jones, et al. address workplace exposure and industrial hygiene. The papers are written from the standpoint of using fugitive emissions data collected for environmental purposes to study industrial hygiene. These different applications require different data analysis techniques in some instances.

Comment: The commenter (IV-N-4; IV-N-13) demanded that EPA audit the data collection and analysis performed by Radian Corporation, a contractor for EPA. He said that he had requested an audit previously, and it had yet to be performed.

Response: EPA continuously audits all contractor work as it is performed as well as when it is finalized. In addition, EPA work is open to public scrutiny. An additional EPA audit is not warranted.

## A.7 PREVIOUSLY SUBMITTED COMMENTS

A number of comments were received in the correspondence pertaining to the AID that had been submitted previously on the background documents and proposed standards. The comment summaries are listed in Table A-10 along with the docket entry number of the correspondence containing the comment and the section in this document that responds to the comment.

TABLE A-10. CROSS-REFERENCE OF COMMENT AND SECTION CONTAINING RESPONSE

| COMMENTER | | COMMENT SUMMARY | CHAPTER/SECTION CONTAINING RESPONSE |
|---|---|---|---|
| IV-N-1 | 1. | The standards are disproportionately burdensome for small producers. | 5.5 |
| IV-N-3 | 2. | Flares that have been properly designed and maintained are an acceptable control technology for reducing VOC fugitive emissions. | 4.1 |
| IV-N-8, IV-N-9 | 3. | The regulation should be reproposed based on a rewritten BID. | 8.7 |
| IV-N-8, IV-N-9, IV-N-1 | 4. | Modification should be limited to increases in emissions of more than 10-20 tons/yr. | 9.2 |
| IV-N-8, IV-N-9 | 5. | Reconstruction should be limited to cases of increased emissions. | 9.6 |
| IV-N-8 | 6. | The definition of fugitive emission source includes reciprocating pumps and compressors which cannot be fitted with double seal technology. | 4.8, 4.12 |
| IV-N-8 | 7. | Categories of chemicals in the SOCMI list are overly vague. Specific compounds should be listed. | 5.1 |
| IV-N-8 | 8. | The leak definition should be higher than 10,000 ppm. The recommended figure is 20,000 ppm. | 4.3 |
| IV-N-8 | 9. | Commenters object to requiring mechanical seals on pumps and compressors. | 4.8, 4.12 |
| IV-N-8 | 10. | The requirements for action when liquid is dripping from seal should be changed. Since the liquid may be a non-VOC, the requirments should be changed to require monitoring by instrument for VOC concentrations when a visual leak is detected. | 4.3 |
| IV-N-8 | 11. | Pressure relief device requirements should be that the pressure relief device is returned to no detectable emissions within 5 calendar days after resumption of normal operation after each episode of pressure release. | 4.5, 13 |
| IV-N-8, IV-N-9 | 12. | The phrase "without VOC emissions to the atmosphere" implies a zero emissions requirement. The standard should be changed to include "by means of a closed vent system." | 4.9 |
| IV-N-8, IV-N-9 | 13. | Commenters recommended exclusions for inaccessible valves due to safety reasons and due to restricted physical access. | 4.2.4, 4.4 |
| IV-N-8, IV-N-9 | 14. | Delay for repair due to technical infeasibility should be clearly defined. | 4.2.3, 13 |
| IV-N-8, IV-N-9 | 15. | The repair time requirements should not apply to equipment taken out of service. | 4.2.3, 13 |
| IV-N-8, IV-N-9 | 16. | Commenters requested a provision for delay of repair beyond shutdown for lack of parts for all fugitive emission sources. | 4.2.3, 13 |

TABLE A-10. CROSS-REFERENCE OF COMMENT AND SECTION CONTAINING RESPONSE (CONTINUED)

| COMMENTER | | COMMENT SUMMARY | CHAPTER/SECTION CONTAINING RESPONSE |
|---|---|---|---|
| IV-N-8, IV-N-9 | 17. | Vendors and manufacturers should be able to obtain equivalency rulings. | 10 |
| IV-N-8, IV-N-9 | 18. | The definition of "connector" is unclear. | 5.8 |
| IV-N-8 | 19. | Model units should be low, medium, and high leak occurrence rates. | 3.3 |
| IV-N-8 | 20. | EPA should develop standards that account for variability in SOCMI. | 3.5, 14 |
| IV-N-8 | 21. | In side-by-side measurements a TLV calibrated to hexane gives measurements different from those obtained with an OVA calibrated to methane. | 12.1 |
| IV-N-4 IV-N-1 | 22. | SOCMI is already regulated by OSHA, so there is no need for the standards. | 2.2 |
| IV-N-1 | 23. | Safety, odor, and toxicity problems associated with SOCMI chemicals dictate stringent control measures. | 2.2, 5.1 |
| IV-N-1 | 24. | Small producers are not represented in the data base. | 5.5 |
| IV-N-1 | 25. | Commenters request implementation of the bubble policy for new source standards. | 15 |
| IV-N-1, IV-N-8 | 26. | Emissions from SOCMI are insignificant, so there is no need for the standards | 2.1, 8.2, 8.7 |
| IV-N-2 | 27. | The vapor pressure cutoff should be changed to 1.5 psi to be consistent with State SIP's. | 5.2 |
| IV-N-2 | 28. | The selection of 0.3 kPa is arbitrary. | 5.2 |
| IV-N-7 | 29. | Commenters prefer performance standards to equipment standards. | 3.5 |
| IV-N-7 | 30. | Retrofit may not be feasible for existing reciprocating compressors. | 4.8, 4.12, 9.4 |

# APPENDIX B

# MONITORING METHODS

## APPENDIX B
## MONITORING METHODS

The standards require that some fugitive emission vent streams be vented through a closed vent system to a control device (that is designed and operated for greater than 95 percent control), such as an incinerator, flare, boiler, or process heater. The standards also require that the control device be monitored to ensure that it is properly operated and maintained. This appendix presents methods for monitoring control devices: incinerators, boilers and process heaters, flares, or product recovery equipment, such as condensers or carbon adsorbers.

### Incinerators

Incinerators must be maintained and operated properly if the standard is to be achieved on a continuous basis. The operating parameters that affect performance are temperature, type of compound being incinerated, residence time, inlet concentration, and flow regime. Of these variables, the last two have the smallest effect on the performance of an incinerator. Residence time is a design criterion and is not easily altered after the incinerator is constructed, unless, of course, the vent stream flowrate is changed. At temperatures above 760°C, the type of compound being burned has little effect on the efficiency of combustion.

Continuous monitoring of the incinerator inlet and outlet would be preferred because it would provide a continuous, direct measurement of actual emissions and destruction efficiency. However, EPA is aware of no continuous monitor being used to measure total VOC at incinerators which control fugitive vent streams, probably because each of the many different compounds would have to be identified separately and their concentrations determined. Such a monitoring system would be extremely complex for the determination of individual component concentration and mass flow rates. Moreover, it would be relatively expensive since both inlet and outlet monitors are required to verify that a certain destruction efficiency is maintained.

Monitoring of the incinerator operating temperature provides a reliable measure of the efficiency of the incinerator in destroying organic compounds. Both theoretical calculations and results of monitoring or performance tests show that lower incinerator operating temperatures can cause a significant decrease in VOC destruction efficiency. Temperature recorders are relatively inexpensive, costing less than $5,000 installed. They are easily and cheaply operated. Given the large effect of temperature on efficiency and the reasonable cost of temperature monitors, EPA believes that temperature is clearly easy to monitor and would provide some measure of the uniformity of the operation of the incinerator.

Where a combustion device is used to incinerate only waste VOC streams (and not multiple waste streams from the process unit), flowrate can also be an indirect indication of changes in destruction efficiency since it relates directly to residence time in the combustion device. Flowrates of fugitive emission vent streams are typically small and thus would probably be ducted with other larger streams to the same incinerator. Under these circumstances, the vent stream flowrate (for fugitive emissions) may not always give a reliable indication of the residence time of the fugitive emission vent stream in the incinerator. Simple indication of fugitive emission vent stream flowrate to the incinerator does, however, provide verification that VOC is being routed to the incinerator. Flow recorders, at an estimated installed cost of less than $2,000, are inexpensive and require little maintenance. Therefore, since flow recorders provide verification that organics-laden streams are being routed to the incinerator for destruction and they are inexpensive, flowrate is also a reasonable parameter to monitor the constancy of performance of an incinerator. Flow recorders should be installed, calibrated, maintained, and operated according to the manufacturer's specifications.

Boilers

If a fugitive emissions vent is piped to the flame zone of a boiler (or process heater), it is only necessary to know that the boiler (or heater) is operating and that the waste gas is flowing to the boiler (or heater). Records presently maintained for plant operation, such as steam production records, would indicate operation. Flow recorders could be installed to verify flow of the vent stream to the boiler (or heater). For smaller heat producing units (less than 44 MW (150 million Btu/hr heat input)), combustion temperature should also be recorded to enable verification of optimum operation. Boilers (or heaters) with heat input design capacities greater than 44 MW would not be required to install temperature recorders. These larger units always operate at high temperatures (>1100°C) and stable flowrates to avoid upsets and to maximize steam generation rates. Records that indicate onstream time would be sufficient for these larger boilers (or heaters).

Flares

Because flares are not enclosed combustion devices, it is not practically feasible to measure combustion parameters continuously. Temperatures and residence times are more variable throughout the combustion zone for flares than for enclosed devices and, therefore, such measurements would not necessarily provide a good indicator of flare performance even if measurable. Monitoring of flow rate to the flare is generally unacceptable from a safety point of view since the flow measurement would present an obstruction in an emergency vent line. As a result, flare operation is usually verified by examination of more prominent characteristics.

The typical method of verifying continuous operation of a flare is visual inspection. However, if a flare is operating smokelessly, it can be difficult to determine if a flame is present, and it may take several hours to discover. The presence of a flame can be determined through the use of a heat sensing device, such as a thermocouple or ultra-violet (U-V) beam sensor on a flare's pilot flame. The loss or absence of a flame would be indicated by a low temperature measurement. The cost of available thermocouple sensors ranges in price from $800 to $3,000 per pilot. (The more expensive sensors in this price range have elaborate automatic relight and alarm systems.) Thermocouples used on flares may, however, burn out if not installed properly. The cost of a U-V sensor is approximately $2,000. A U-V system is not as accurate as a thermocouple in indicating the presence of a flame. The U-V beam is influenced by ambient infrared radiation that could affect the accuracy. Furthermore, interference between different U-V beams makes it difficult to monitor flares with multiple pilots. By design, U-V sensors are primarily used to verify the existence of flames within enclosed combustion devices. Therefore, based on cost and applicability, EPA believes thermocouples provide adequate verification of flare operation.

Product Recovery Equipment

Three types of product recovery equipment which might be used in controlling fugitive emissions vents are absorbers, condensers, and carbon adsorbers.

Two operating parameters are the primary determinants of product recovery device operation for an absorber: the temperature and specific gravity of the absorbing liquid. Facilities which have installed an absorber to recover product which otherwise would be lost will generally monitor a parameter which indicates the degree of saturation of the absorbing liquid with respect to the product. Specific gravity is commonly used for this purpose. Devices for measuring the temperature and specific gravity are available at reasonable cost. The estimated one-time combined capital investment for such equipment is $8,000. It is considered reasonable for an operator of a process unit to install, calibrate, maintain, and operate according to manufacturer's specifications the requisite devices to monitoring continuously temperature and specific gravity or such alternate parameters which would indicate the degree of saturation of the absorbing liquid.

In constrast, the exit temperature of the offgas is the primary determinant of the efficiency of a condenser. Again, suitable temperature recorders are available at a reasonable cost. The estimated one-time capital investment is $3,000. A record of the outlet temperature would verify that the condenser is properly operated and maintained. EPA believes an operator can install, operate, calibrate and maintain according to the manufacturer's specifications a temperature recorder to verify proper operation of a condenser.

The operation of a carbon adsorber can be monitored by the carbon bed temperature and the amount of steam used to regenerate the bed. Steam flow meters and temperature recorders are available at reasonable cost. The estimated one-time capital investment for such equipment is $10,000. These parameters could be monitored to reflect whether the carbon adsorption unit has been consistently operated and properly maintained. Therefore, EPA believes that an operator of a carbon adsorber used as a pollution control or product recovery device could install, calibrate, maintain, and operate according to manufacturer's specifications an integrating steam flow recorder and a carbon bed temperature recorder. Some operators may install vent stream analyzers to aid in maximizing the recovery of organic compounds. No widely accepted performance specifications have been developed for such analyzers. If an analyzer is installed without a recorder, the vent stream should be sampled at the end of the adsorption cycle (at least once during every 4 hours of operation) and the concentration recorded as a means of verifying that operational modes remain consistent with the conditions under which the performance test was conducted.