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Part II

Environmental Protection Agency

40 CFR Part 61
National Emission Standards for
Hazardous Air Pollutants; Standards for
Inorganic Arsenic; Final Rule

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 61

[AD-FRL-2779-3]

National Emission Standards For Hazardous Air Pollutants; Standards For Inorganic Arsenic

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: On June 5, 1980, EPA listed inorganic arsenic as a hazardous air pollutant under section 112 of the Clean Air Act (48 FR 37886). Standards were subsequently proposed for inorganic arsenic emissions from high-arsenic primary copper smelters, low-arsenic primary copper smelters, and glass manufacturing plants on July 20, 1983 (48 FR 33112). Additional control measures for high-arsenic primary copper smelters and associated arsenic plants were proposed in a December 16, 1983, Federal Register notice (48 FR 55880) and additional control options for glass manufacturing plants were proposed in a March 20, 1984, Federal Register notice (49 FR 10278). This Federal Register notice reaffirms the Administrator's decision that inorganic arsenic is a hazardous air pollutant and responds to comments on and promulgates standards for inorganic arsenic emissions from primary copper smelters, glass manufacturing plants, and arsenic plants.

Six other categories of sources emitting inorganic arsenic were also identified and discussed in the July 20, 1983, Federal Register notice: primary lead smelters, secondary lead smelters, primary zinc smelters, zinc oxide plants, cotton gins, and arsenic chemical manufacturing plants. This Federal Register notice responds to comments on the decision that standards for these sources were not warranted and reaffirms the Administrator's decision not to regulate these sources.

EFFECTIVE DATE: August 4, 1986. Under section 307(b)(1) of the Clean Air Act, judicial review of the actions taken by this notice is available only by filing a petition for review in the United States Court of Appeals for the District of Columbia circuit within 60 days of today's publication of this notice. Under section 307(b)(2) of the Clean Air Act, the requirements that are the subject of today's notice may not be challenged later in civil or criminal proceedings brought by EPA to enforce these requirements.

ADDRESSES: *Background Information Documents.* The background information documents (BID's) may be obtained from the U.S. EPA Library (MD-35), Research Triangle Park, North Carolina 27711, telephone number (919) 541-2777. Please specify:

EPA-450/3-83-010b Inorganic Arsenic Emissions from Primary Copper Smelters and Arsenic Plants— Background Information for Promulgated Standards.

EPA-450/3-83-011b Inorganic Arsenic Emissions From Glass Manufacturing Plants—Background Information for Promulgated Standards.

EPA-450/5-85-001 Inorganic Arsenic NESHAP: Responses to Public Comments on Health, Risk Assessment, and Risk Management.

EPA-450/5-85-002 Inorganic Arsenic Risk Assessment for Primary and Secondary Lead Smelters, Primary Zinc Smelters, Zinc Oxide Plants, Cotton Gins, and Arsenic Chemical Plants.

The BID's for the promulgated standards each contain: (1) A summary of all public comments on the proposed standard, including comments that are not discussed in this preamble, and EPA's responses to these comments; (2) a summary of changes to the standard since proposal; and (3) the final environmental impact statement (EIS), which summarizes the impacts of the standard.

For background information on the health effects and carcinogenicity of inorganic arsenic, please refer to "Health Assessment Document for Inorganic Arsenic," EPA-600/8-83-021F. This document also may be obtained at the above address.

Dockets. Dockets containing supporting information considered in developing the promulgated standards are available for public inspection and copying between 8:00 a.m. and 4:00 p.m. Monday through Friday, at EPA's Central Docket Section, West Tower Lobby, Gallery 1, Waterside Mall, 401 M Street, SW., Washington, DC 20460. A reasonable fee may be charged for copying. The following dockets are available.

OAQPS-79-8 Listing of arsenic as a hazardous pollutant
A-80-40 High-arsenic and low-arsenic copper smelters
A-83-8 Glass manufacturing plants
A-83-9 Secondary lead
A-83-10 Cotton gins
A-83-11 Zinc oxide plants
A-83-23 Primary zinc, primary lead, arsenic chemical manufacturing.

FOR FURTHER INFORMATION CONTACT: For further information concerning the background technical information

supporting the promulgated standards, contact Dr. James Crowder, Industrial Studies Branch, MD-13, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, telephone (919) 541-5601. For information on the regulation of inorganic arsenic emissions and the promulgated standards, contact Mr. Robert L. Ajax, Standards Development Branch, MD-13, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711, telephone (919) 541-5578. For information concerning the listing of inorganic arsenic as a hazardous air pollutant, contact Mr. Robert Kellam, Pollutant Assessment Branch, MD-12, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711, telephone (919) 541-5645.

SUPPLEMENTARY INFORMATION: The discussion of the promulgated standards and their basis and the decision not to regulate certain source categories is organized as follows:

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The Overview section presents a brief summary of the basis for the standards and a summary of the standards, while the sections on the standards present more detailed discussions. The discussion of the risk management policy and health issues presented in the second part of this preamble is limited to issues generally applicable to the actions. Policy and health issues specific to individual source categories are presented as part of the specific discussion on the standard.

I. Overview

Background

In 1977, Congress amended the Clean Air Act (the Act) to address airborne emissions of arsenic. Section 122 of the Act required the Administrator of EPA to determine whether or not emissions of arsenic into the ambient air will cause, or contribute to, air pollution which may reasonably be anticipated to endanger public health. On June 5, 1980, EPA published a Federal Register notice listing inorganic arsenic as a hazardous air pollutant under section 112 of the Act (44 FR 37886).

Concurrent with the decision to list inorganic arsenic as a hazardous air pollutant, EPA began a series of studies of the sources of inorganic arsenic emissions. The purpose of the earliest studies in the series was to identify which types of sources merited more detailed study toward possible regulation, and the purpose of the final studies in the series was to develop the detailed information needed to support the proposal of standards. The EPA Administrator was sued by the State of New York, and was subsequently ordered on January 12, 1983, by the United States District Court for the Southern District of New York, to publish proposed emission standards for inorganic arsenic by July 11, 1983, *New York* v. *Gorsuch*, 554 F. Supp. 1060, 1066 (S.D.N.Y. 1983).

On July 11, 1983, EPA proposed standards (48 FR 33112, July 20, 1983) for inorganic arsenic emissions from the following source categories: High-arsenic primary copper smelters, low-arsenic primary copper smelters, and glass manufacturing plants. The EPA also identified other categories of sources which emitted inorganic arsenic; but, after careful study, determined that proposal of standards for these source

categories was not warranted. These sources are primary lead smelters, secondary lead smelters, primary zinc smelters, zinc oxide plants, cotton gins, and arsenic chemical manufacturing plants. During the consideration of public comments on the proposed actions, new information on emissions and costs as well as new regulatory approaches were published for public comment. Specifically, on December 16, 1983, EPA proposed in the **Federal Register** (48 FR 55880) for comment additional controls for fugitive emission sources at high-arsenic primary copper smelters and any associated arsenic plant. The comment period for the proposed standard on glass manufacturing plants was reopened on March 20, 1984, (49 FR 10278) to take public comment on proposed options for controlling emissions from furnaces producing soda-lime glass and the method for calculating zero production offsets. On September 20, 1984, the public comment period was reopened to take comments on the revised cost and emission estimates for low-arsenic primary copper smelters (49 FR 36877). The public comment period on this last **Federal Register** notice closed on November 5, 1984.

At the time of proposal, the standard proposed for high-arsenic primary copper smelters affected only the smelter owned and operated by ASARCO, Incorporated, located in Tacoma, Washington. On June 27, 1984, ASARCO announced plans to close its primary copper smelting operations at Tacoma, Washington, by June 30, 1985; and subsequently ceased copper smelting operations at Tacoma. Because of ASARCO's action, EPA is withholding further action on the proposed standard for existing high-arsenic primary copper smelters. The EPA will continue to monitor ASARCO's actions and will reconsider the need for a separate standard applicable to existing high-arsenic smelters if there is evidence that ASARCO-Tacoma will resume copper smelting operations. However, even in the absence of a specific high-arsenic smelter standard, the standard being promulgated today would apply to the Tacoma smelter if copper smelting operations were to resume. Today's standard is applicable to all existing and any new primary copper smelters.

In the announcement of closure of the primary copper smelter at Tacoma, ASARCO also stated that it will continue to operate the arsenic trioxide and metallic arsenic plants at the site. ASARCO also indicated that the operations at the arsenic plants would be modified to reduce emissions

significantly, but the actual configuration of the facilities was not specified. Therefore, EPA is promulgating the proposed standard for fugitive emission sources at arsenic plants. This standard is being established as Subpart P. The only existing arsenic plant is the ASARCO arsenic plant at Tacoma, Washington.

Public Participation

To provide interested persons an opportunity to comment on the proposed standards, public hearings were held on November 2, 3, and 4, 1983, in Tacoma, Washington, and on November 8, 1983, in Washington, DC. Both hearings were open to the public, and each attendee was given an opportunity to comment on the proposed standards and the negative determinations. During the various public comment periods, about 800 letters were received on the proposed standards for high-and low-arsenic primary copper smelters, 24 letters were received on the proposed standard for glass plants, and 11 letters were received on the listing of inorganic arsenic and the negative determinations. Most of the commenters made multiple comments, and many repeated comments made in other letters or by other commenters. All comments were carefully considered and, where determined to be appropriate by EPA, have served as the basis for changes made to the proposed standards. (Comments received on the proposed standard for high-arsenic primary copper smelters that are also pertinent to the proposed standard for low-arsenic smelters were considered in the development of the final standard for primary copper smelters.) Major comments and EPA's consideration of the issues presented for each standard are discussed in the appropriate section of this preamble. Additional comments and the detailed analyses conducted for responses to some issues are presented in the BID's for the promulgated standards (see Addresses section). All commenters on the proposed standards are identified in the appropriate BID's.

Basis For Promulgated Standards

Risk Management Approach

For carcinogenic hazardous pollutants, including inorganic arsenic, health effects thresholds have not been clearly demonstrated and, in the view of a number of researchers, may not exist. The absence of identifiable thresholds suggests that for carcinogens any level of control short of an absolute ban on emissions may pose finite health risks. For many of the substances considered

for regulation under section 112, such a ban would produce severe economic disruption if not closure of the emitting industries.

Section 112 of the Act requires EPA to establish emission standards for hazardous air pollutants that protect public health with an "ample margin of safety." In interpreting this language for the purposes of regulatory development, EPA does not believe that the word "safety" implies a total absence of risk. Many activities involve some risk, but are not considered "unsafe." In the Administrator's view, standards under section 112 should protect against significant public health risks. See *Industrial Union Department, AFL-CIO v. American Petroleum Institute*, 448 U.S 607, 642 (1980); *Ethyl Corp.* v. *EPA*, 541 F. 2d 1 (D.C. Cir. 1976), *cert. den.* 426 U.S. 941 (1976); H.R. Rep. No. 95–294, 95th Congress, 1st Sess. 43–51 (1977).

In establishing an appropriate level of control for carcinogens, the Administrator views the objective as a judgment of the extent to which the estimated health risks must be reduced before the degree of control can be considered amply protective. Two choices are available: either the emission standards must be set at zero to eliminate the attributable health risks or some residual risk must be permitted. In the absence of specific direction on this choice in section 112 and in recognition of the drastic economic consequences that could follow a requirement to eliminate all risk from hazardous pollutant emissions, the EPA believes that it is not the intent of this section to eliminate totally all risks and that section 112 standards which permit some level of residual risk can be considered to provide an ample margin of safety to protect public health.

The EPA's strategy for risk management under section 112 first provides for the identification of source categories that may pose significant risks to public health as a result of air emissions. Next, the Agency performs an assessment of candidate source categories to evaluate current control levels and associated health risks, future or ongoing emissions reductions from other regulatory activities (e.g., State Implementation Plans (SIP's) and Occupational Safety and Health Administration [OSHA] standards), the availability of more stringent options such as further controls or process modifications, and the costs and economic impacts associated with each option. Based on this assessment, the Administrator selects a level of control which, in his judgment, reduces the health risks to the greatest extent that

can reasonably be expected after considering the uncertainties in the analysis, the residual risks remaining after the application of the selected control level, the costs of further control, and the societal and other environmental impacts of the regulation. In the consideration of the factors, no one factor is consistently overriding and the deciding factor will vary among source categories. In summary, there is no rigid formula to decide whether to regulate a source category or decide the appropriate level of control; rather, a more flexible approach is used to weigh the effects of regulation in a given situation. The Administrator believes that this flexibility is necessary to establish the appropriate level of control.

Risk Assessment Methodology

In reaching a decision on the ample margin of safety required by section 112 of the Act, the Administrator considers the nature and relative magnitude of the health hazards posed by the pollutant in question. The EPA has estimated public health risks as a result of population exposure to inorganic arsenic emissions from a number of source categories. Although uncertainties are associated with the data and the estimating procedure, the Administrator believes that these quantitative expressions of risk serve a purpose as a health-based measurement tool facilitating comparison of pollutants, sources, and emission controls, and that when used appropriately, such quantitative expressions of risk play an important role in decisionmaking.

In developing the exposure/risk relationship for inorganic arsenic, EPA has assumed that a linear, nonthreshold model appropriately describes the relationship between inorganic arsenic exposure and the risk of contracting lung cancer. This relationship, calculated from studies of occupationally exposed workers who have been subjected to relatively high exposures, is also assumed to describe mathematically the exposure/risk relationship at lower levels more characteristic of public exposure. The nonthreshold assumption implies that any nonzero exposure to inorganic arsenic poses some finite cancer risk. As described more fully in Part II, Risk Management Policy and General Health Issues, of this preamble, EPA has concluded that the assumptions of linearity and the absence of thresholds are reasonable and prudent for the protection of public health in light of presently available information.

The numerical constant that defines the exposure/risk relationship used by

EPA in the linear, nonthreshold model is called the unit risk factor. The unit risk factor for an air pollutant is defined as the excess cancer risk associated with a lifetime of exposure (70 years) to an average concentration of 1 microgram per cubic meter (1 $\mu g/m^3$) of the pollutant in the air. For inorganic arsenic, the unit risk estimate is based on EPA's analysis of five sets of the latest smelter worker epidemiological data collected by four researchers at two smelters. Based on this analysis, EPA has revised the unit risk estimate used in the proposed regulations from 0.00295 to 0.00429 per $\mu g/m^3$, a 40-percent increase. The linear nonthreshold risk extrapolation model is believed to produce plausible upper-bound estimates of risk since other plausible risk models give lower risk estimates. When the projected lifetime public exposure to inorganic arsenic approaches 1 $\mu g/m^3$, the public exposure also approaches the range of occupational exposure as measured by some epidemiological studies. In this high range of exposure, the difference between models is less and the risk estimate is more accurate. At lower levels of inorganic arsenic concentrations where most of the public exposure occurs, the Agency believes that the risk model generally produces upper-bound but plausible risk estimates, if the exposure is accurately known.

The unit risk factor is one of two elements required in the estimation of public health risks. The second required element is the estimation of public exposure, i.e., the number of people exposed and the concentrations of inorganic arsenic to which they are exposed. To estimate public exposure, EPA uses computer models that calculate: (1) Nearby ambient concentration profiles that occur due to the source's emissions, and (2) the location and number of people exposed to the arsenic concentrations. Arsenic concentration profiles are estimated through the use of atmospheric dispersion models. Plants are located by latitude and longitude, and then estimated or measured emissions data are supplied along with other plant parameters and local prevailing weather patterns as inputs to the computer model to estimate ambient air concentrations within a specified distance from the source. When data are available and where feasible, the Agency compares the predicted concentrations to the measured concentrations, and adjustments are made in the exposure estimates to reflect more closely the measured

concentrations. The number and location of people exposed are derived from 1980 census data broken down into clusters called individual block group and enumeration districts that are located within the assessment area.

By combining the population data with predicted concentrations, the computer model estimates exposure at selected distances from the source and sums the exposure estimates. As used in this notice, the term "exposure" refers to the product of the estimated ambient air concentration of inorganic arsenic and the estimated number of people exposed to that concentration. Exposure is expressed in units of "people-μg/m^3."

The modeled concentrations and exposure estimates are combined to produce two measures of health risk: "annual incidence" and "maximum lifetime risk." "Annual incidence" represents the aggregate number of cancer cases that may occur in the population residing within a specified distance from plant or plants. This risk reflects the average number of cases that would be expected each year in the exposed population based on predicted exposure. "Maximum lifetime risk" represents the probability of contracting cancer for those individuals assumed to be exposed for a lifetime to the highest measured or predicted average concentration.

Due to the highly complex interactions between individuals and airborne arsenic, EPA has made a number of simplifying assumptions in estimating inorganic arsenic health risks. Major assumptions of the exposure model are that individuals remain in the vicinity of their residences for a lifetime, are exposed for that period to the predicted concentrations, and are equally as susceptible to contracting cancer as occupationally exposed individuals. Also, site-specific factors such as the plant's emissions are, for calculation purposes, assumed to remain constant over a lifetime. In addition, two simplifying assumptions generally have been used in the air dispersion modeling analysis: That the readily available meteorological data at the site nearest the plant are representative of the local meteorology and that the terrain surrounding the plant is relatively flat.

There are also numerous uncertainties in the analysis. For example, scientific uncertainties not resolved to date include the amount of overestimation of the true risk in the use of the linear nonthreshold model in extrapolating from high-dose occupational exposure to low-dose public exposure at ambient air concentrations. There also is uncertainty with exposure estimates because of difficulty in obtaining precise

data on emission rates; atmospheric dispersion patterns and population concentrations around individual sources; and lack of information on short-term and long-term movement (migration) of people and indoor versus outdoor toxic air pollutant concentration patterns. Finally, there are uncertainties concerning possible additive effects of multiple sources or pollutants, synergistic or antagonistic health effects, and heightened susceptibilities to some cancers by some population groups.

In view of this, EPA took a number of actions. Where better data were available and more detailed study was feasible, EPA performed a limited number of more sophisticated site-specific air dispersion analyses that consider local meteorology and terrain features. Also, EPA used measured ambient arsenic data to confirm the concentration profiles predicted by the air dispersion analysis and reviewed community epidemiology studies to check the risk assessment projections.

The Administrator has considered the uncertainties of the analysis and the risk assessment methodology and has concluded that the calculated risks for inorganic arsenic exposure represent the best estimates of the actual health risks that the Agency can generate within the available resources.

Summary of Standards and Actions

Primary Copper Smelters

The standard applies to all existing and new primary copper smelters. The standard requires monitoring, recordkeeping, and reporting of the average annual inorganic arsenic feed rate to converters. For all affected primary copper smelters with average annual arsenic feed rates to the converters greater than 75 kilograms per hour (kg/h) (164 pounds/h [lb/h]), the standard requires capture and collection of secondary inorganic arsenic emissions from converters. The standard is expressed in terms of equipment and design specifications and work practices for the capture system and a maximum allowable particulate emission limit for the control device. The required equipment consists of a secondary hood system, the principal components of which are a hood enclosure, a horizontal air curtain, fans, and auxiliary equipment. The standard limits emissions from the control device to 11.6 milligrams of particulate per dry standard cubic meter of exhaust gas (mg/dscm) (0.005 grains per dry standard cubic foot of exhaust gas [gr/dscf]).

Compliance with the particulate matter emission limit will be determined using EPA Reference Method 5. The average annual arsenic charging rate to the converters will be determined using monthly average weight percent arsenic in feed materials and the charging rates. The weight percent arsenic in feed materials will be determined using Method 108A. Continuous monitoring of the opacity of gases exiting the control device and of the airflow through the converter secondary hood is required to ensure proper operation and maintenance of the system. The reporting requirements of the standard include: (1) Annual reports of average inorganic arsenic charging rate to the converters; (2) quarterly reports of airflows less than 80 percent of the reference flow rate; and (3) quarterly reports of excess opacity levels.

Glass Manufacturing Plants

The standard applies to each glass manufacturing furnace that uses commercial arsenic as a raw material. The standard for existing glass manufacturing furnaces requires the owner or operator to either: (1) Limit uncontrolled arsenic emissions to 2.5 megagrams (Mg) (2.75 tons) per year, or less, or (2) reduce total arsenic emissions by 85 percent. New or modified glass furnaces must keep uncontrolled arsenic emissions below 0.4 Mg (0.44 tons) per year or reduce emissions by 85 percent.

Compliance with the emission limit will be determined using Method 108 unless the furnace is exempted. Existing furnaces are exempt from the emission test requirement if less than 8.0 Mg (8.8 tons) of arsenic is added to the furnace annually, and new or modified furnaces are exempt if less than 1.0 Mg (1.1 tons) of arsenic is added annually; and the owner or operator can demonstrate through a material balance that the applicable emission limit is being met. The standard also requires continuous monitoring of the temperature of the gas entering the control device and of the opacity of the gas discharged to the atmosphere from the control device. The reporting requirements of the standard include: (1) Semiannual reports of occurrences of excess opacity at facilities subject to the 85 percent reduction emission limit, and (2) semiannual reports of occurrences of uncontrolled emission rates greater than 2.5 Mg (2.75 tons) per year at existing furnaces and greater than 0.4 Mg (0.44 tons) per year at new or modified furnaces at facilities subject to those limits.

Arsenic Trioxide and Metallic Arsenic Plants

The standard applies to facilities recovering arsenic trioxide from low grade arsenic bearing materials by a roasting-condensation process and to metallic arsenic plants. The standard requires the owner or operator to develop a detailed inspection, maintenance, and housekeeping plan that will be used to minimize fugitive emissions; to take steps to minimize emissions during malfunctions and upsets; and to monitor ambient concentrations of inorganic arsenic near the plants.

Compliance with the standard will be determined by the development of an approvable plan and implementation of that plan. Continuous monitoring of the opacity of gases exiting from the control device is required to ensure proper operation and maintenance of the control device. The regulation also requires continued operation and maintenance of existing ambient monitoring systems for arsenic in the vicinity of the arsenic plants. Reporting requirements of the standard include: (1) Quarterly reports of occurrences of excess opacity; (2) quarterly reports of ambient concentrations of arsenic monitored near the facility; and (3) semiannual reports on pilot plant studies on alternative arsenic trioxide production technologies.

Negative Determinations

At proposal, EPA identified several inorganic arsenic source categories for which standards were not warranted. After consideration of public comments on these negative determinations, the Administrator is reaffirming his decision not to regulate these sources at this time. The primary reasons for this decision are that the estimated health risks are small; and additional emission reduction either can be achieved only through closure or will impose control costs that are likely to result in closure, or are excessive compared to any small possible health benefit that might result.

II. Risk Management Policy and General Health Issues

This part of the preamble presents a discussion of comments on health effects of inorganic arsenic and the risk management policy that apply to all categories considered in the July 20, 1983, notice. Health and risk issues that pertain only to one source category are presented in the discussion on the specific source category.

Health Effects and the Listing of Inorganic Arsenic

A fundamental element in this rulemaking is the Administrator's conclusion that inorganic arsenic is a hazardous air pollutant and the decision on June 5, 1980, to list inorganic arsenic under section 112 of the Act (45 FR 37885). After a substance is listed as a hazardous air pollutant, section 112 requires the Administrator to subject the listing decision to public review following the proposal of the emission standards to determine if "such pollutant is clearly not a hazardous air pollutant" (section 112(b)(1)(B)). Thus, in the July 20, 1983, proposal the Agency specifically requested comments on the listing decision and the Administrator's judgment that inorganic arsenic is a hazardous air pollutant. Of those who responded to this request, the majority of commenters expressed support for EPA's decision to list inorganic arsenic as a hazardous air pollutant and to require standards to protect public health. However, there were a number of commenters who disagreed with the listing decision. Most of their arguments fell into the following two categories.

One group of commenters called for the Administrator to act under section 112 only when there is an absolute certainty that inorganic arsenic is a human carcinogen and when there is a clear association between inorganic arsenic emissions and lung cancer. For instance, these commenters noted that inorganic arsenic is not a proven animal carcinogen, and in fact, low levels of inorganic arsenic appear to be a nutritional requirement for certain animals. Also, several commenters stated that the mutagenic potency of inorganic arsenic is weak or negligible when compared to other known metal mutagens and that this, therefore, casts some doubt on inorganic arsenic being classified as a human carcinogen. There also were flaws, a few commenters said, in the occupational studies on which EPA's listing decision was based.

Another set of commenters felt that a reasonable link had been established between the high levels of inorganic arsenic exposure and increased lung cancer rates. But, they pointed out that certain studies, such as those of Higgins, *et al.*, indicate the existence of a cancer threshold, i.e., a certain level of inorganic arsenic exposure below which no carcinogenic effect was observed in those exposed. Furthermore, they noted that the apparent inorganic arsenic threshold level (as suggested by Higgins, *et al.*) is well above the measured or estimated public exposure levels near any of the inorganic arsenic sources.

Also referenced by these commenters were several community studies, such as Frost, *et al.*, that did not detect any increases of lung cancer in the community near the ASARCO primary copper smelter in Tacoma, Washington. These commenters agreed with the Administrator's finding that there is a high probability that inorganic arsenic is carcinogenic to humans at high levels of exposure, but they felt that there are either no risks or insignificant risks associated with the lower levels of public exposure to inorganic arsenic emissions.

The Administrator stated at the time of proposal, and many commenters agreed, that there are uncertainties in the health data base and EPA's risk assessment and that a significant public health risk in the general community has not been absolutely proven. But, neither the Act nor prudent public health protection policy requires absolute proof of health risks before the Agency invokes its authority to act under section 112.

When the decision to propose inorganic arsenic standards was made, the Administrator was aware, via an extensively updated draft document entitled "Health Assessment Document for Inorganic Arsenic" (EPA–600/8–83–021), of the issues and the data subsequently presented by many of the dissenting commenters. This draft document presented, on balance, a strong case for inorganic arsenic being a human carcinogen. In September 1983, the Science Advisory Board (SAB), an advisory group of nationally prominent scientists from outside EPA, reviewed the document in a public meeting. The SAB subsequently concurred with the report's conclusion that the weight of evidence places inorganic arsenic in a group of pollutants that are characterized as "carcinogenic to humans." This conclusion is based on two general observations. First, associations between cancer and inorganic arsenic exposure have been demonstrated in several different occupational settings, such as copper smelters, pesticide manufacturing, and agricultural work, and in nonoccupational populations using arsenical drugs on consuming arsenic-contaminated drinking water and/or food. Second, the results from several human studies have consistently demonstrated the same study findings, that is, the same high relative risks, and specificity of tumor sites (skin and lungs). The EPA has now published these conclusions in the final health document (EPA–600/8–83–021F), which can be obtained from EPA at the

address given in the Addresses section of this preamble.

Others have made similar findings regarding inorganic arsenic's carcinogenicity. Widely respected scientific groups such as the National Cancer Institute (NCI), the National Academy of Sciences (NAS), and the International Agency for Research on Cancer (IARC) have concluded that there is sufficient evidence to conclude that inorganic arsenic is carcinogenic to humans. In addition, the OSHA also recently reviewed the substantial body of evidence and concluded that inorganic arsenic "is clearly a human carcinogen" (43 FR 19584).

The EPA health document indicates that consistent demonstration of inorganic arsenic as an animal carcinogen, using different chemical forms, routes of exposure, and various experimental species, has not been observed. However, recent data indicate that lung tumorigenicity and possibly carcinogenicity can be demonstrated in animals if the retention of inorganic arsenic in the lung is increased. The additional observations reported from two laboratories that calcium arsenate is only slowly cleared from the lung suggest that this agent may be carcinogenic. Upon review of the available data and the public comments, the Administrator has concluded that the data do not clearly demonstrate the lack of carcinogenicity of inorganic arsenic in animals.

The possible nutritional value of inorganic arsenic was mentioned by commenters in support of the idea that at low levels inorganic arsenic is beneficial to humans. That inorganic arsenic appears to be an essential element in small quantities in certain animal species is based on a number of detrimental effects noted by several researchers when administering arsenic-deprived diets to rats, goats, chicks, and guinea pigs. However, EPA's review of the literature and the public comments found no data which support the view that inorganic arsenic is beneficial to such animals when inhaled or deposited in the trachea, and EPA is unaware of any data that demonstrate the essentiality of inorganic arsenic in man.

Many researchers have noted that a number of probable carcinogens have also been shown to be probable mutagens as well, and have linked the two responses together. Commenters, in applying this association in reverse, pointed to inorganic arsenic's weakness in producing mutagenic responses in numerous test systems as supporting a conclusion that inorganic arsenic is not carcinogenic. The EPA's final health assessment document points out that

various inorganic compounds of arsenic have been tested for mutagenicity in a variety of systems ranging in complexity from bacteria to lymphocytes in the blood of exposed human beings. Although much of the data are contradictory, the weight of evidence supports the following conclusions:

1. Arsenic is either inactive or extremely weak for the induction of gene mutations in cell cultures.

2. Arsenic causes chromosomal breakage and induces sister chromatid exchanges, an indicator of chromosomal damage, in a variety of cell types, including human cell cultures.

3. Arsenic does not appear to induce chromosome aberrations in experimental animals (one available study).

4. Several studies suggest that human beings exposed to arsenic demonstrate higher frequencies of sister chromatid exchanges and chromosomal aberrations in blood lymphocytes; however, the quality of these studies is generally poor.

5. Arsenic may affect DNA by the inhibition of DNA repair processes or by its occasional substitution for phosphorus in the DNA structure. Although the data do not present a clear picture, inorganic arsenic may be a weak or inactive gene mutagen with the potential to cause chromosomal changes in human beings. The Administrator cannot conclude, based on the available data, that inorganic arsenic is clearly a nonmutagen in humans, as some commenters have suggested.

The information the commenters have presented is indirect evidence for the case of inorganic arsenic not being a human carcinogen, and when closely studied is inconclusive as evidence to refute the Administrator's findings. On the other hand, a number of independent occupational studies provide direct evidence of inorganic arsenic's carcinogenicity in humans. As commenters pointed out, each study contains flaws and EPA carefully reviewed the comments regarding those flaws. But, the collective documentation in the human health data base, which demonstrates in several different occupational settings the same study findings, the same high relative risks, and the same specificity of tumor sites, overwhelms the flaws in each individual occupational study and the inconclusive, indirect data from the animal studies. On balance, the Administrator concludes, after reviewing the public comments and the available data, that inorganic arsenic is a human carcinogen.

The second set of commenters, although agreeing with the Administrator's findings regarding the

carcinogenicity of inorganic arsenic, questioned the assumption that inorganic arsenic poses some finite lung cancer risk at low levels of exposure. They felt that several scientific studies had shown that there was a threshold or level of exposure below which increased cancer risks are nonexistent. The EPA recognized at the time of listing that epidemiological studies had not proven that exposure to inorganic arsenic at ambient levels causes cancers. Epidemiological methods that have successfully revealed associations between occupational exposure and cancer for inorganic arsenic are not as easily applied to the public sector, with its increased number of confounding variables, much more diverse and mobile exposed population, lack of consolidated medical records, much lower exposures, and almost total absence of historical exposure data. Given the above characteristics, EPA considers it improbable that any community epidemiological association with arsenic exposure, short of very large increases in cancer or very unusual pathology, can be detected with any reasonable certainty. The NAS noted that in considering the possibility of thresholds for carcinogenesis, it is important to understand that there is no agent, chemical or physical, that induces a form of cancer in man that does not occur in the absence of that agent. In other words.

. . . . when there is exposure to a material, we are not starting at an origin of zero cancers. Nor are we starting at an origin of zero carcinogenic agents in our environment. Thus, it is likely that any carcinogenic agent added to the environment will act by a particular mechanism on a particular cell population that is already being acted on by the same mechanism to induce cancer.

In discussing experimental dose-response curves, the NAS observed that most information on carcinogenesis is derived from studies on ionizing radiation with experimental animals and with humans, which indicate a linear, nonthreshold dose-response relationship at low doses. They added that although some evidence exists for thresholds in some animal tissues, by and large thresholds have not been established for most tissues. The NAS concluded that establishing such low-dose thresholds would require large-scale experiments and recognized that the U.S. population is a genetically heterogeneous group exposed to a large variety of toxic agents. This fact, coupled with the known genetic variability to carcinogenesis and the predisposition of some individuals to some form of cancer, makes it extremely

difficult, if not impossible, to identify a threshold.

For these reasons, EPA has taken the position, shared by other Federal regulatory agencies, that in the absence of sound scientific evidence to the contrary, carcinogens should be considered to pose some cancer risk at any exposure level. This nonthreshold assumption is based on the view that as little as one molecule of a carcinogenic substance may be sufficient to transform a normal cell into a cancer cell. Evidence is available from both the human and animal health literature that cancers may arise from a single transformed cell. Mutation research with ionizing radiation in cell cultures indicates that such a transformation can occur as the result of interaction with as little as a single cluster of ion pairs. In reviewing the available data and the public comments regarding carcinogenicity, EPA found no compelling scientific reason to abandon the nonthreshold presumption for inorganic arsenic.

In support for the existence of an inorganic arsenic threshold, several commenters cited community studies that did not demonstrate a link between increased lung cancer risks and arsenic exposure. For instance, Dr. Frost of the Washington State Department of Social and Health Services (DSHS) forwarded to EPA a recently completed community study that provided new data on women who have died in Pierce County from 1935 through 1969. The Frost, *et al.*, analysis showed that all three study areas near the ASARCO primary copper smelter in Tacoma, Washington had mortality rates that were slightly less than the U.S. white-female lung cancer rates, even though these women were living near a very large inorganic arsenic source in the U.S. Unfortunately, this kind of study cannot directly quantify the female lung cancer rates for people who had lived in the study areas without inorganic arsenic exposure (i.e., there is no control group) and, therefore, such studies do not provide a clear demonstration of the absence of increased cancer risks in an exposed population in relation to a similar but unexposed population. However, the Frost, *et al.*, study does provide an indication that the ASARCO emissions have not been causing an epidemic of lung cancers in the communities surrounding the smelter and that EPA has not grossly underestimated public risks.

Several other community studies with both "positive" and "negative" results were mentioned by commenters. Except for the Frost, *et al.*, study which was

completed during the public comment period, many of these studies identified by the respondents were already mentioned in EPA's draft health assessment document and had been considered by the Agency. The following section provides a summary of the known community studies that consider arsenic exposure.

1. *Blot and Fraumeni, 1975* Lung cancer mortality was shown to be significantly higher among males and females in 36 U.S. counties with copper, lead, and zinc smelters and refineries than in the rest of the U.S. counties. The increase, corrected for demographic variables, was 17 percent for males and 15 percent for females over the years 1950–1969.

2. *Lyon, et al., 1977* Using a population based cancer registry, addresses at diagnosis of lung cancer cases were compared to malignant lymphoma controls to assess the possible carcinogenic effect of the Salt Lake City copper smelter. The distribution of distances from the smelter of lung cancer cases and lymphoma controls was similar.

3. *Rom, et al., 1982* Using the same methodology as Lyon, *et al.*, lung cancer cases around the El Paso, Texas, smelter were shown to have the same distance distribution from the smelter as breast and prostate cancer controls.

4. *Greaves, et al., 1981* Greaves, using the same methods as Lyon, *et al.* and Rom, *et al.*, studied the distances of residences at diagnosis, or death, of lung cancer cases and controls (prostate, colon, and breast cancers) from the ten primary copper smelters and one lead-zinc smelter. The distance distribution of lung cancer was not significantly different from the distribution of the control cancers in any of the areas studied.

5. *Pershagen, et al., 1977* Mortality in the region around the Ronnskar smelter in northern Sweden was studied. The population residing within 15 kilometers (km) (9 miles) of the smelter was compared to the population residing 200 km (124 miles) away. The lung cancer mortality in the exposed population (<15 km) was significantly different in comparison to national rates. When the occupationally exposed cases are removed, the lung cancer standard mortality ratio was reduced and was no longer statistically significantly different than the comparison population.

6. *Matinoski, et al., 1976* Cancer mortality reported on death certificates was studied in census tracts in Baltimore around a chemical plant producing calcium and lead arsenate, arsenic acid, cupric aceto-arsenite (Paris

green), and sodium arsenite. An increase in lung cancer was seen in the census tract containing the plant in the years 1966–1974 in males only. No increase was seen in an earlier time period (1958–1962). Removing plant workers from the high lung cancer census tract did not eliminate the high male lung cancer mortality rate.

7. *Polissar, et al., 1979* Lung cancer mortality by census tract was examined around the Tacoma, Washington, copper smelter. The distance of the census tract from the smelter, and the concentration of sulfur dioxide over background for each census tract were used as a surrogate for arsenic exposure data. There was no excess risk of lung cancer for persons living near the smelter.

8. *Hartley, et al., 1982* Lung cancer mortality in the 35 census tracts in Tacoma, Washington, was examined for the 21 years 1950–1970, using the death certificate address for assignment to census tract. Lung cancer mortality was no higher in the census tracts near the smelter than in those farther away.

9. *Milham, et al., 1982* Class rosters of children enrolled at the Ruston elementary school (91m [100 yards] from the Tacoma, Washington, smelter) were examined. A cohort of 283 children who were enrolled for three or more years during the years 1900–1919 was developed. Surviving cohort members were contacted and death records were obtained for decedent members. Using life table comparisons, mortality of men in this cohort was shown to be favorable (more survivors to 1980 than expected). It also did not appear that lung cancer was increased in the male cohort (1 lung cancer death among 20 for whom death certificates were obtained). Forty percent of the men in this cohort were employed at the smelter at some time.

10. *Newman, et al., 1976* Although this was primarily a study of lung cancer cell type in two Montana copper mining and smelting counties, it demonstrated an increase in lung cancer incidence in both men and women in the towns of Butte and Anaconda, but the same increase was not seen in the counties as a whole.

In addition, there were a number of community morbidity studies referenced by commenters.

1. *Milham and Strong, 1974* In the population around the Tacoma smelter, children were shown to have increased levels of arsenic in hair and urine. Urinary arsenic decreased with distance from the smelter. Mean urinary arsenic for children living within 0.8 km (0.5) miles of the smelter was 0.30 ppm (parts per million) (normal 0.014). Vacuum

cleaner dust and attic dust contained over 1000 ppm of arsenic.

2. *Morse, et al., 1979* Children exposed to arsenic in air and drinking water in Ajo, Arizona, near a copper mine and smelter were studied. Hair and urinary arsenic were elevated in children and decreased with distance from the smelter. No clinical or hematologic abnormalities attributable to arsenic were found.

3. *Baker, et al., 1977* In 19 U.S. towns with primary nonferrous smelters, 1-to 5-year-old children were studied for arsenic, lead, and cadmium absorption. Urine arsenic was elevated near 10 of 11 copper smelters.

4. *Milham, 1977* Hearing, hematological status, and school attendance of children living in Ruston, Washington (near the Tacoma smelter), were the same as children living further away from the smelter. The Ruston children had increased levels of urinary and hair arsenic.

5. *Nordstrom, et al., 1978* Frequencies of congenital malformations were studied in offspring of female employees of the Ronnskar smelter and in the population living near the smelter. In the offspring of the employees, the frequency of multiple malformations was increased. However, there was no increase in total frequency of malformations or in type of malformations in the population around the smelter.

6. *Nordstrom, et al., 1978* Frequency of spontaneous abortion and birthweight distributions in female smelter employees and women who lived near the Ronnskar smelter were examined. Women working at the smelter had an increased frequency of spontaneous abortion and low birthweight infants. Women living near the smelter showed no increase in spontaneous abortions, but had a tendency to have infants slightly lighter than women who lived at a distance from the smelter.

Such community studies generally suffer from two shortcomings: They lack a well-defined control group and they lack the necessary statistical power to detect the predicted number of increased lung cancer cases.

A control group is a number of people who are not exposed to inorganic arsenic yet who live in the same or a similar area, have similar life styles, and are similarly exposed to other carcinogenic agents. National data indicate significantly different lung cancer rates between states and even cities; thus, the ideal control group would live in the same city or area; but would remain unexposed to arsenic. Obviously, such a group of any useful size does not exist.

The second shortcoming of community studies is that negative study results do not conclusively prove that there is no increased risk in the community due to exposure. The ability of a study to detect an excess risk that truly exists, or the probability of not missing a true excess risk, is quantified by a statistical parameter called "power." In a community epidemiological study, the research may not have the statistical power or be able to detect excesses in lung cancer rates when, in fact, such excesses are actually occurring. Key factors that determine the study's power are the number of expected lung cancer cases in the study group and the relative magnitude of the excess risk in relation to expected risk.

For inorganic arsenic, EPA's assessment estimated that the increase in lung cancer risk due to the inorganic arsenic source categories is for most of the exposed population a small fraction of the expected community lung cancer risk. Considering the above, it is not reasonable to expect the referenced community studies to detect the increased lung cancers predicted by the Agency.

In particular, the Nordstrom, *et al.*, studies were not designated specifically to study the effects of arsenic but rather to study the effects, in general, of the smelter works pollutants on neighboring populations; the diverse agents involved preclude making conclusive statements about the specific effects of inorganic arsenic. In 1981, the Swedish National Health Board Expert Committee published a report that discredited or questioned almost every finding that would be suitable for making determinations regarding the potential human reproductive effects caused by inorganic arsenic exposure.

These community studies have provided the Administrator with very little new information regarding the risks associated with inorganic arsenic emissions other than that increased cancer risks are not likely to be substantially greater than EPA's estimates and could be substantially less than estimated. Such studies also have not clearly proven the existence of an inorganic arsenic threshold.

The Administrator, upon review of the available data and the public comments, reaffirms his position stated in the proposal that inorganic arsenic emissions pose significant risks to the public health.

Public Exposure and Health Risk Estimates

A number of commenters were concerned that specific portions of the exposure and health risk models

represented sources of uncertainty. A few commenters recommended that 1980 census data or recent maps of the areas near sources, rather than 1970 census data, be used to estimate the exposed populations. Also, EPA's simplifying assumption that individuals are exposed to the same arsenic concentration continuously over 70 years was questioned by several commenters.

Other commenters noted that EPA's models did not consider such factors as risks to sensitive subpopulations, exposure to arsenic at places other than a person's residence, and risks to people residing beyond 20 km (12 miles) from sources.

Another group of commenters questioned the usefulness of the quantitative exposure and risk model results in decisionmaking. For instance, several commenters expressed opinions about the degree of conservatism of the models. Most felt that EPA's risk estimates were overly conservative, representing an extreme worst-case estimate of risk. In particular, some thought the linear, nonthreshold model used to calculate risk from exposure estimates was too conservative, although a few supported use of this model. Others thought that the linear, nonthreshold model was moderate, and might underestimate health risk. Also, several commenters questioned the need for the Agency to use exposure and/or health risk models at all. Instead, they suggested that the Agency should use direct measurements of public health effects and lung cancer rates instead of mathematical models. Others suggested that urinary arsenic content or measured ambient arsenic concentrations rather than dispersion model estimates be used to estimate public exposure.

In the Overview—Basis for Promulgated Standards section of this preamble, EPA has briefly described the public exposure/risk methodology and a more detailed explanation can be found in each BID for the inorganic arsenic source categories (see **ADDRESSES** section of this preamble). Basically, there are four phases of the risk assessment process: (1) Emission and emission parameter estimation; (2) air quality dispersion modeling; (3) public exposure estimation; and (4) risk evaluation. The first two phases are discussed elsewhere in this notice, while the following discussion focuses on comments pertaining to the third and fourth phases.

Changes in the exposure estimation methodology (the third phase) were made in response to public comments and the Agency's desire to improve the model. At the time of proposal, EPA

used 1970 U.S. Census Bureau population data which EPA extrapolated to 1980 by using 1977 U.S. Census Bureau county growth factors. These population data have been replaced with 1980 U.S. Census Bureau population data recently made available to the Agency.

At proposal, exposure and risk were estimated for people residing within 20 km (12 miles) of a source. Some commenters pointed out that since people beyond 20 km are exposed to some level of arsenic due to the source emissions, EPA's proposal analysis underestimates the total exposure and risk. EPA agrees with this comment and has expanded its analysis to 50 km (31 miles); the risk assessment results presented in today's notice reflect this change. There are several reasons for EPA to extend its analysis out to 50 km. The EPA's guidelines for use of air quality models recommend that, because of the increasing uncertainty of estimates with distance from the modeled source and because of the paucity of validation studies at larger distances, the impact analysis should generally be limited to a downwind distance of 50 km from the source. Such site-specific factors as terrain features (complex or flat), the objectives of the modeling exercise, and the distance to which the model has been validated will determine the appropriate distance (whether greater or less than the guideline distance) over which the Agency should apply the model.

Unless there are special overriding technical considerations, EPA has decided to extend the hazardous air pollutant dispersion modeling out to 50 km (31 miles). The Administrator believes that the potential to identify additional significant public exposure outweighs the increased inaccuracies of applying the models beyond the previously accepted 20-km radius.

For the exposure model, it is assumed that people stay at the same location and are exposed to the same concentration for 70 years. The complexity of human mobility in today's society makes this assumption somewhat unrealistic. However, long-term individual mobility and concurrent changes in inorganic arsenic exposure are difficult to model with any amount of certainty. For example, it is unknown how long various portions of the population remain in an area and to what concentrations of inorganic arsenic they may have been exposed in other places they have lived. Thus, the simplifying assumption of a 70-year residence in one location has been made. On a smaller scale, the exposure

model also assumes that people are continuously exposed to the average ambient arsenic concentration at their residence. In reality, people travel daily within and beyond the local area and they are exposed to different concentrations at their workplaces, schools, shopping centers, etc. However, it would be extremely difficult to model local travel and indoor and outdoor exposures, and any result would be highly uncertain. For instance, even if it were possible for EPA to collect this information over one particular time period, it may not be representative of population activities in times past or in the future. It is not known if this approach over- or underestimates actual exposures.

Moreover, the Agency believes that there is merit to using the simplifying assumption of 70-year resident immobility. When estimating risk, the Agency is concerned about both the public exposure that is occurring and that could potentially occur. That group of people being exposed to the highest predicted pollutant concentrations may include individuals, who for a variety of reasons, may spend a large majority of their lifetime at a single residence. Presently, the Agency does not have detailed information on those individuals that live near the inorganic arsenic sources, nor does it intend to collect routinely those kinds of specific data. Such data would not allow the Agency to predict the exposure patterns that high exposure groups may experience in the future. Since the purpose of estimating maximum individual exposure is to anticipate a reasonable worst-case scenario, EPA regards this assumption as appropriate.

In calculating aggregate risk, the estimates of annual cancer incidence are independent of population mobility as long as there is no net change in population of each exposure subgroup and no net change in the total population in the study area (see Overview—Risk Assessment Methodology for a description of EPA's exposure model). This conclusion is based on EPA's risk model which mathematically describes cancer risk that varies in direct proportion to cumulative lifetime exposure. For example, application of EPA's risk model produces the same estimate of total cancer incidence for a certain number of people exposed for a lifetime to a particular concentration as for a group twice that number being exposed for half a lifetime to the same concentration. It is possible for communities to remain rather stable in number and location of residents despite

significant migration of individuals into and from the area. For this reason, the individual exposure assumption does not impact the estimation of aggregate population risk, i.e., the annual incidence.

Another problem is that emission sources do not emit at a constant annual level for 70 years. Many sources have reduced emissions over the past decade. To the extent that this trend continues, EPA's estimates may overstate risks. Similarly, the EPA assumes that the number of people that are exposed remains constant. These uncertainties are considered to the extent possible in interpreting and applying modeled risk estimates.

One commenter noted that EPA assumed that indoor air concentrations equaled the ambient concentration near the house and that assumption probably causes overestimation of exposure and risk. When developing inorganic arsenic exposure estimates, the Agency considered this possibility. If there are no sources or sinks for inorganic arsenic in the homes, the long-term concentrations in the home should equal the concentrations measured just outside the house. However, this may not be true for many homes. For example, homes that have a filtered air handling system for heating and cooling would tend to have lower indoor inorganic arsenic concentrations. Little study has been made of the relationship between indoor and outdoor inorganic arsenic concentrations. The limited available data on particulate matter indicate that the indoor concentrations are somewhat lower than ambient concentrations but the difference is not substantial; the indoor particulate matter levels are about 10 to 30 percent lower than the outdoor air. Whether this ratio applies to homes near arsenic sources is unknown. Since people spend part of their time on their property outside the house and since the available data do not indicate that a correction for indoor inorganic arsenic concentrations is required, the assumption of equal inorganic arsenic concentrations for both indoor and outdoor air over a long term is reasonable. The EPA has not made any revisions in its current analysis to account for this factor.

The distribution of individual susceptibility to lung cancer is unknown, so risk to sensitive subpopulations or individuals could not be considered quantitatively in EPA's model. Commenters correctly indicated that the unit risk estimate is based on the study of healthy males exposed in the workplace and the application of the

unit risk estimate assumes that the exposed community has the same cancer susceptibility as the exposed workers. As stated in the background documents, this is one of the uncertainties that may cause the risks calculated by EPA to be underestimated. The EPA, in its decisionmaking, is aware of the possible risk to sensitive individuals and to the extent possible considers this in its selection of the appropriate control option.

Several commenters suggested that EPA use approaches, such as direct monitoring, other than modeled exposure estimates. While appealing, it is not feasible to directly measure exposure to ambient arsenic. In a heavily populated area such as El Paso or Tacoma, a large number of monitors would be necessary. Perhaps as many as 50 to 100 monitors within 50 km (31 miles) of the plant would be needed to determine the concentrations to which persons living near a source are exposed, since exposure will vary with distance and direction from the plant. Furthermore, air quality monitors cannot predict potential ambient concentration reductions due to a certain control option, or past or future concentrations. Conversely, dispersion models can be used to estimate time variations in exposure and to predict exposure under any emission control scenario.

Based on the Agency's present level of knowledge, EPA also has rejected the use of urinary arsenic concentrations as a measure of public exposure to smelter emissions or lung cancer risks and for developing Section 112 regulations. The primary reason is that urinary arsenic levels and how they relate to adverse effects such as cancer are not well understood, although we do know they reflect many factors in addition to the inhalation of arsenic. Arsenic in food and drinking water can account for increases and decreases in urinary arsenic concentrations. Individual metabolism and age also can cause variations in the amount of arsenic excreted. Thus, at low dose levels urinary arsenic levels cannot be used to estimate exposure to air emission sources only, because other sources of exposure contribute in unknown degrees to arsenic concentrations in urine.

Furthermore, an attempt to determine exposure to the population within 50 km (31 miles) of an inorganic arsenic source using urinary arsenic measurements would not be feasible. The analysis procedure would be relatively expensive and time consuming; to get a good "map" of exposure, one would have to measure urinary arsenic levels in many individuals living at many different

locations at different times of the year under a variety of meteorological conditions. Dispersion and exposure modeling, despite its drawbacks, is a much more practical approach.

As discussed earlier, increased health risk to residents in an area surrounding a source cannot be measured directly either. Epidemiological studies have revealed an association between occupational exposure to ambient arsenic and lung cancer, but such associations are not readily measured in the general public because of the presence of many confounding factors. These include the public's greater diversity and mobility, the lack of consolidated medical records, lack of historical exposure data over each individual's lifetime, public exposure to many carcinogens besides inorganic arsenic, and the long latency period of cancer. Because of such factors, increases in cancer observed in the public can rarely be assigned to a specific chemical or emission source. Therefore, public risk is estimated by using an exposure/risk relationship developed from epidemiology studies. The Human Exposure Model (HEM) uses air dispersion and population models to estimate exposure, and then applies the exposure risk relationship to calculate risks. These assessment procedures are the only tools currently available to EPA for making such estimates.

Risks from other potential inorganic arsenic-related health effects were not modeled. For example, skin cancer also has been associated with inorganic arsenic when exposure occurred through ingestion or dermal contact. Health effects other than cancer which could result from chronic, low-level exposure to inorganic arsenic have not been well documented. These effects have not been consistently observed where exposure/risk relationships can be established. For this reason, health risks other than lung cancer cannot be quantitatively estimated or modeled. The potential for risks of other unknown health effects is considered by EPA to the extent possible during the decisionmaking procedure. It is not clear that these other effects are occurring at workplace exposure levels and, as best as can be determined, they do not occur at levels of public exposure.

Although a number of commenters had assumed that measured ambient arsenic concentration data provided the best means of calculating exposure, the Natural Resources Defense Council (NRDC) and the Attorney General's Office of New York questioned the reliability of either EPA's Or ASARCO's

ambient data. The NRDC mentioned that the ASARCO monitoring program had a number of uncertainties such as the untested correspondence between the ASARCO air sampler (low-volume filtration) and EPA's air sampler (high-volume filtration), and the lack of a quality assurance program. New York questioned the reasons for changes in the measurement technique used by EPA for establishing mass of the collected arsenic and thought that the Agency's analysis was designed for measuring only certain inorganic arsenic compounds and not all arsenic compounds.

To measure the atmospheric concentrations, the Agency first collects or "captures" arsenic onto or into some medium from which analytical techniques can determine the mass of the collected arsenic. Both ASARCO and EPA use devices that draw the air through a filter to capture the ambient particulate matter and then analyze the amount of arsenic in the filtrate. The concentration of arsenic is calculated by dividing the measured mass of the pollutant of the filter by the measured volume of air that passed through the filter. Portions of the commenters' concerns centered on one of the two phases of atmospheric measurement (sampling or analysis) described above.

In the early 1970's, limited research indicated that some if not a substantial amount of arsenic was not being collected by either the high- or the low-volume sampler's filters. More recently, ASARCO conducted a more extensive test of their low-volume air sampler's collection efficency. The collection efficiency test was performed by adding arsenic gas phase collection devices behind the filter. The EPA and the Puget Sound Air Pollution Control Agency (PSAPCA) reviewed the study results and determined that the data provided evidence of the reliability of the low-volume sampler to collect arsenic. Although the data showed that the device was not 100 percent efficient (no collection device can be), generally more than 90 percent of the airborne arsenic was collected by the filter and consequently, less than 10 percent of the arsenic was collected by the impingers.

However, some of the arsenic data used in the risk assessment was collected using high-volume samplers. In addition to the impinger studies, ASARCO, in conjunction with the State of Montana, conducted a comparison study between the low-volume and the high-volume air samplers. This study indicated that the two devices provided measurements that were highly correlated. the concentrations measured

by low-volume air samplers were about 18 percent higher than those measured using high-volume samplers; the low-volume samplers' data ranged from 4 to 33 percent higher than the high-volume sampler's data. The two sampling techniques are statistically different at the 90 percent level. Thus, the combination of the two studies, the ASARCO/Montana study and the ASARCO impinger study, provide evidence to the Agency that for purposes of the inorganic arsenic risk assessment the high-volume air sampler data have adequately measured the amount of arsenic in the atmosphere.

Regarding the second phase of measurement (analysis), EPA has changed the analytical techniques used over the years. The objective of switching techniques was to improve sensitivity and accuracy, and the Agency has generally been successful in doing so. However, the commenters should note that both the Agency's and ASARCO's routine analyses measure elemental arsenic; it is more difficult to provide analyses on individual species of arsenic compounds such as arsenic trioxide or the trivalent arsenic compounds than the elemental concentrations. Also, when measuring total elemental arsenic, the Agency uses a quality control/quality assurance program to assure the best data possible.

Based on the available company data and some limited monitoring data collected at nearby sites, the Agency believes that both ASARCO and EPA arsenic data have some measure of uncertainty, but may provide more reliable information than the air dispersion modeling. For these reasons, the Agency followed through on the commenters' suggestion to check air dispersion predictions against available air quality data and this has been done where the data would provide meaningful comparisons.

Risk Management

Risk Management Approach

Several comments focused on whether the proposed inorganic arsenic standards provide an ample margin of safety as required by Section 112. These comments either directly or indirectly address the Agency's position that a Section 112 regulation can permit some level of residual risk and still provide an ample margin of safety to protect public health (see the Overview—Basis for Promulgated Standards section of this preamble for the full statement of the Agency's position). A significant number of those who commented on this issue felt that the proposed standards were

entirely inadequate to provide this "ample margin of saftey." Opposing views were held by other who felt that the proposed standards were adequate to protect the health of the citizens living in the local communities.

According to several commenters, the Agency should establish a level of health risk resulting from exposure to hazardous pollutants that it considers to be acceptable. For instance, commenters felt that maximum individual risks above 1 in 1,000 were unacceptable. Some felt that risk levels below 1 in 100,000 or 1 in 1,000,000 could be considered negligible. In addition, many commenters felt that the emission standards for arsenic should be set at a zero level or at a level which would result in no deaths (zero risk); however, other commenters felt that a zero-risk standard was not possible or needed. Some said it would be difficult or impossible to determine an acceptable level of risk, while others said that EPA should determine an unacceptable level of risk before promulgating a regulation.

Many commenters sought a framework for determining the acceptabilty of the estimated risks. They suggested that comparisons of risk levels to those associated with other societal and environmental factors might be appropriate. Both voluntary risks (such as those associated with smoking) and involuntary risks (such as the risk of being struck by lightning) were suggested as a basis of comparison.

Many of these commenters, in effect, are advocating that EPA establish a target, or maximum permissible, risk level for setting standards under Section 112. Under this approach, a fixed numerical risk or expected cancer incidence rate target could be used in determining the degree of control required for carcinogens. Although EPA finds the concept of an established "acceptable" risk level appealing, it suffers, from several drawbacks. First, the Agency perceives there would be substantial difficulty in determining such levels. This perception was borne out by the wide range of opinions on what constituted acceptability in the minds of the commenters. Second, although current quantitative risk assessment techniques for chemical carcinogens are useful decisionmaking tools, considerable uncertainties are associated with these techniques at their current stage of development. Consequently, the Administrator believes that in using quantitative risk assessments, he should generally be free to consider that actual cancer risks may be significantly above or below those

predicted by the estimated procedures, and not bound by a fixed target. Third, a fixed target level fails to provide the flexibility necessary for an appropriate response. For example, where risks could be reduced beyond the target without significant costs, that should be permitted. Likewise, where attainment of the risk-based goal would eliminate a highly beneficial or necessary activity, the decisionmaker should be able to consider less stringent standards. The EPA agrees with those commenters who perceived that specific acceptable risk levels are very difficult to set and are not reasonable as a basis for regulation. After reflecting on the various points presented, the Administrator supports the concept of reducing public risks to the extent possible considering the uncertainties and technical feasibility, and the environmental, economic, energy, and other impacts on society and industry. (See Basis for Standard sections of this preamble for a discussion of how these factors were specifically used to select the level of control in the final standards.)

The EPA understands the desire of the public to seek a reference for relating to the estimated risk levels associated with inorganic arsenic source categories. The EPA believes that comparing the estimated increased lung cancer risk associated with inorganic arsenic source categories, as seen in other sections of this notice, to national lung cancer rates provides a useful perspective (see Table II–1).

TABLE II–1.—NATIONAL CANCER AND LUNG CANCER RATES—ALL AGES (1982)ᵃ

	Annual deaths per 100,000ᵇ·ᶜ	Percent of total deathsᵇ
Malignant neoplasms of respiratory and intrathoracic organs......................	50.2	5.8
Malignant neoplasms, including neoplasms of lymphatic and hematopoietic tissues (cancer—all forms)......	188.1	21.9

ᵃ Source: "Monthly Vital Statistics Report," National Center for Health Statistics, Vol. 31, No. 13, October 5, 1983.
ᵇ Based on a 10 percent sample of deaths.
ᶜ Rates are not age-adjusted.

Basis for Proposed Standards

Many commenters objected to EPA's setting standards based on "best available technology" (BAT). Commenters felt that basing standards on BAT placed too much emphasis on nonhealth issues such as technology, economics, and affordability. They stated that under section 112 the protection of public health, not costs or the availability of technology, is the primary consideration in developing standards. A few commenters objected

to the BAT approach because it provided no incentive on the part of industry to develop improved control technology. On the other hand, several commenters favored basing a standard on BAT, calling it a reasonable, logical approach. They felt it was a reasonable approach when considering uncertainties associated with estimating public health risks. They also felt that economic data are important and must be considered in setting standards under section 112. Some commenters noted that basing standards on BAT may allow for continued improvement. As a new technology becomes available and economically feasible, commenters thought it appropriate to require that technology for control of emissions.

Comments received on the risk management approach described in the July 20, 1983, notice of proposal suggested that many do not believe that the approach sufficiently considers protection of public health. Evidently, some commenters saw the selection of BAT as the final step in the decisionmaking process. Also, there seemed to be some level of misunderstanding as to what BAT represented and some confusion between BAT and similar terms used in other EPA programs, such as "best available control technology" (BACT) found in the Prevention of Significant Deterioration program and "best available technology" (BAT) in the water program.

Several commenters either interpreted the meaning of BAT in terms of a level of control that would force further development of control technology or desired the Agency to adopt this definition. This perception is not, however, consistent with EPA's proposed definition of BAT applied to inorganic arsenic control. Under EPA's definition at proposal, BAT was an available, feasible, and affordable technology. An option which would be technology-forcing and which might require plant closure if the technology does not evolve was defined as beyond BAT. However, commenters who are concerned that technology improvements will bypass EPA's regulation are reminded that the Agency's activities do not stop with the promulgation of standards; EPA will periodically review today's regulations and revise them appropriately in light of improved control technologies.

In addition, several commenters responded to EPA's suggestions regarding alternative strategies for using exposure/risk information to determine best available technology (BAT) for low-arsenic primary copper smelters. The

BAT policy upon which the proposed decision was based gave limited weight to exposure and risk information and substantial weight to the economic feasibility of installing technologically available emission controls. The Agency sought public comment on the degree to which exposure and risk information should be used to establish BAT and, in doing so, presented two alternative strategies. Under the first alternative, called the population density approach, EPA would subdivide the source category on the basis of population density (a surrogate for public exposure) near each source before determining BAT. Sources would be put into a "high" or "low" population density category and BAT would be determined for each subcategory of sources. Under the second alternative, the risk-based approach, EPA would place sources into "high" or "low" risk categories based on consideration of the combination of estimated maximum individual risk and the annual incidence estimates. Again, BAT would be determined for each source group.

One commenter felt that under both of EPA's alternative approaches for determining BAT for low-arsenic copper smelters, EPA was making the protection that an individual deserves a function of the number of people at the same level of exposure. He, along with three other commenters, said that the population density approach had the potential for causing people in sparsely populated areas to be exposed to higher risk than people in cities. Under the risk-based approach he said a person could be exposed to shockingly high risks unless there are many people in a similar situation. He stated that the Clean Air Act does not authorize such inequitable distinctions.

Two commenters rejected both alternatives by saying that, although the cost factors associated with regulation may be excessive for smaller sources, EPA should establish required controls for the entire industry to regulate more effectively environmental pollutants. One suggested that if such an approach was going to drive somebody out of business, that individual should petition Congress and let Congress decide whether that is an unacceptable tradeoff between risk reduction and the cost of compliance. Another said that once a standard is set, penalties should be imposed for violations that are stiff enough to make compliance economically worthwhile.

Although they wanted risk information to be used in a more significant way in determining BAT, the Office of Management and Budget

(OMB) was not supportive of either alternative approach presented by the Agency and said that the stepwise process of classifying sources (based on risk or exposure data) into subcategories and then determining BAT (based on technology and costs) produces inconsistent results. The OMB argued that one of the most important factors, risk reduction, could not be considered in the subcategorization process, and plants may be required to apply controls that are "too little" or "too much" in light of the reduction in public risks. Thus, for each plant, EPA would be unable to balance the effectiveness of all control options in light of likely public health gains and costs of achieving further control. The OMB went on to suggest that EPA should establish BAT in one step where the decision criteria, reduction in public health risks and costs of further controls, can be considered and balanced at the same time. If exposure and risk were considered in the process of subdividing the source category for purposes of establishing different levels of BAT, then the selection of BAT based on cost effectiveness of reducing emissions would serve as a reasonable estimate of the cost effectiveness of reducing public exposure and risk. Another commenter agreed with this basic concept, but suggested that EPA discontinue the BAT approach and use the one step that considers risk, risk reduction, available controls, and costs when making decisions to regulate each source category.

Two commenters supported EPA's proposal to subdivide low-arsenic primary copper smelters based on cancer incidence and health risk data. One felt that a more uniform risk criterion should be established for regulating each source category and preferably for each carcinogen. In fact, the commenter said, in the case of inorganic arsenic abundant risk information is available, providing confidence that safe levels can be prescribed. Risk information should play a more significant role in establishing BAT.

Three commenters disagreed with EPA's cancer incidence and health risk based approach as an alternative strategy. One felt that this approach would be based on unreliable risk estimates. Two other commenters shared his concern and stated that this regulatory alternative also suffers from other serious problems, such as the intentionally conservative assumptions in calculating risk which distort and exaggerate the risk estimates. The high risk etimates place sources in the high

risk category when, in actuality, they do not need further controls.

The OMB noted that most of the public health gains projected from the proposed rules would result from control of emissions at a distinct subset of plants. For example, control of secondary emissions from converter operations at three smelters accounts for 88 percent of the total cancer reduction for low-arsenic copper smelters but only 34 percent of the total control costs. The commenter pointed out that an alternative regulatory strategy that emphasizes the effectiveness of further controls on a particular subcategory of sources could achieve most of the health gains at a substantially lower cost.

One commenter suggested modifying the BAT approach to include a graduated risk approach for regulating existing sources. Under this approach, the lowest achievable emission rate (LAER) would be required for sources with risk levels exceeding 1,000 in one million; BAT would be required for sources with risks between 1,000 in a million and 1 in a million; and no NESHAP regulation would be required for sources with risks less than 1 in a million. The commenter also said that if EPA does not have the confidence in its risk assessment figures to set such risk levels as firm standards, then acceptable risk levels should be set as goals to be considered in the regulatory decisionmaking process.

The Agency carefully considered the above comments. Generally, there was not a strong support for either of EPA's suggested alternative approaches, and the variety of other approaches offered indicated that the public perceived major flaws in the Agency's proposed BAT subcategorization approach as well as the suggested alternatives. Based on EPA's experiences with benzene and now inorganic arsenic, the Administrator agrees that the BAT approach and its stepwise procedures are inflexible and make it difficult to weigh all the important factors at the appropriate point in the decisionmaking process.

When the Agency began formal dialogue with the public on many of these issues by proposing the air carcinogen policy in 1979 (49 FR 58642), the BAT concept was the keystone to EPA's strategy. The Agency realized that it was necessary to have a technical portion of the decisionmaking process that considered what control technologies were available and could reasonably be applied to the source category being considered for regulation. The Agency was desirous of applying a similar control requirement for most or all of the sources within the

category. However, as EPA reviewed the public comments on the carcinogen policy and gained more experience with specific pollutants such as inorganic arsenic and benzene, the shortcomings of the BAT approach became more apparent.

As highlighted by the wide range of estimated risks, existing controls, and affordability for individual plants in the primary copper smelter category, the proposed and the suggested BAT approaches would in certain cases place individual sources into subcategories that, on balance, would be inappropriate. There were several reasons for this. Each of the step-wise approaches tended to downplay at least one significant piece of information. For example, the commenters pointed out their concern that a small number of people being subjected to very large unacceptable risks were not going to be appropriately protected. With the risk-based alternative regulatory strategy, a hypothetical source with very high individual risks and very low annual incidence would not be regulated.

Also, the process of selecting a cutoff, that is, an emission, risk, cost or other parameter that would separate sources into one subcategory or the other, places a large burden on the Agency when there are a number of sources near the cutoff value. Uncertainties in EPA's analysis (which may be considerable) makes the task difficult to reasonably separate sources into two subcategories. An example would be a source that narrowly fell into the low risk category but could easily afford to substantially reduce its emissions and risk. It may be reasonable, upon further scrutiny of the risk information, to regulate this source, although a straightforward application of the BAT decisionmaking routine would not require further controls. For these reasons and the reasons given in the discussion of the current approach, the Administrator has come to the conclusion that the Agency cannot, at this time, establish a mathematical formula that will accommodate all the relevant factors of managing public risk.

Therefore, the Administrator has decided to move away from the BAT approach and refine the decisional procedure into a simple one-step process designed to reduce unacceptable risks with as little social or economic disruption as possible.

As can be seen when comparing the risk management description in today's promulgation to the one given in the proposal, the term "BAT" has been removed. This change reflects more than just a revision in terms; it is a refined approach used in selecting the final control option as a basis for the Section

112 regulation. Instead of the previous multi-step process, this approach incorporates an amalgam of elements of the BAT residual risk approach combined with elements of the two risk-based alternatives set forth in the proposal. Under each control option, the residual risks were considered along with other important factors such as risk assessment uncertainties, economic and environmental impacts, and affordability. With this approach, there is no separate step for determining BAT or for examining the reasonableness of the residual risks. Rather, these are combined into a single selection process which involves considering possible control options and the technical, economic, public health, and other implications of each option. This refinement, the Administrator believes, is both rational and consistent with the intent of section 112, and it responds to many concerns of the commenters.

There are certain factors that must be evaluated, and they will remain in any process for selecting the appropriate control option. For instance, has the control technology been demonstrated at other installations as a means to reduce emissions? If required, can the control device actually be used safely on the process or the stack gases? Will the control technology create new problems such as increased pollution in another medium such as the water or land? Is the control technology so expensive that its application will shut down a large portion of the plants within the source category? In summary, there is no one consistently overriding factor in the evaluation of whether to regulate a given source category or sources within the category; rather, a more flexible approach is used to weigh the effects of regulation in a given situation. Under both the proposed BAT approach and the current risk management approach, EPA has considered and will continue to consider these technical and economic factors as part of the selection of the appropriate level of control.

Consideration of the OSHA Standard

A number of commenters compared measured or predicted ambient inorganic arsenic concentrations to the OSHA permissible exposure limit of 10 $\mu g/m^3$ in an attempt to show that exposure to ambient inorganic arsenic concentrations below 10 $\mu g/m^3$ would cause insignificant health effects. However, EPA believes that it is inappropriate to make such comparisons for several reasons.

For example, there is a difference in the averaging times of the concentration

values used by OSHA and EPA. The OSHA standard is based on an 8 hour time-weighted average for occupational exposure, while EPA's concerns are with long term average (lifetime) community exposures. For instance, a 10 $\mu g/m^3$ exposure for 8 hours per day, 5 days per week, 50 weeks per year and 45 years over a lifetime equates to a continuous lifetime exposure of less than 1.5 $\mu g/m^3$. This example demonstrates that on a technical basis, direct comparisons cannot be made between EPA's estimated long term pollutant concentrations and the OSHA standard.

In addition, OSHA did not conclude that the 10 $\mu g/m^3$ level it set left only an insignificant risk. Rather, OSHA concluded that the level it set was the lowest feasible level, and that a significant risk remained to employees at that level. It stated:

OSHA also concludes, based on the estimates from the risk assessments and the dose-response demonstrated in many of the epidemiology studies, that a 10 $\mu g/m^3$ exposure limit, *the lowest level feasible*, together with the industrial hygiene provisions in the arsenic standard are necessary and appropriate to significantly reduce the health risk . . . . :

Finally, OSHA concludes that the new inorganic arsenic standard setting exposures at 10 $\mu g/m^3$ does not reduce the risk of the exposure to inorganic arsenic below the level of significance. (48 FR 1867, January 14, 1983). OSHA added,

The linear model estimates a risk level of 7.7 to 10 excess cases of cancer per 1000 exposed workers at the 10 $\mu g/m^3$ limit. OSHA's preliminary conclusion is that significant risk is not eliminated at this risk level and that a reasonable person would take steps to reduce it if feasible (48 FR 1902).

OSHA has clearly stated their judgment that the risk level associated with their 10 $\mu g/m^3$ standard is significant and that their standard is based on the limit to which feasible engineering and work practice controls can reduce the workplace concentrations. For these reasons, the use of the OSHA standard as a reference or target concentration for the protection of public health under the Clean Air Act is inappropriate.

III. Primary Copper Smelters

As indicated in the Overview section of this preamble, on July 20, 1983, EPA proposed standards in the Federal Register (48 FR 33112) for inorganic arsenic emissions from low- and high-, arsenic primary copper smelters. The public comment period for the proposed standards, which was extended twice at the request of members of the public, ended on January 31, 1984. The public

comment period was later reopened on September 20, 1984, to allow comment on EPA's analysis of new information on emissions and costs for low-arsenic smelters. This comment period ended on November 5, 1984.

At the time of proposal, the low-arsenic smelter category included 14 smelters and it was estimated that the proposed standard would affect six of the smelters. The high-arsenic smelter category only included and affected the smelter owned and operated by ASARCO, Incorporated, located in Tacoma, Washington. On June 27, 1984, ASARCO announced plans to close its primary copper smelting operations at Tacoma, Washington, by June 20, 1985; and subsequently ceased copper smelting operations at Tacoma. Because of this, EPA is withholding further action on the proposed standard for existing high-arsenic primary copper smelters. The EPA will continue to monitor ASARCO's actions and will reconsider the need for a separate standard applicable to existing high-arsenic smelters if there is evidence that ASARCO-Tacoma will resume copper smelting operations. However, even in the absence of a specific high-arsenic smelter standard, the standard being promulgated today would apply to the Tacoma smelter if copper smelting operations were to resume. Today's standard is applicable to all existing and any new primary copper smelters.

This part of the preamble presents the final standard, its basis, and a discussion of public comments on the proposed standards. The discussion of comments includes comments made on the proposed standard for high-arsenic smelters that are also pertinent to the proposed standard for low-arsenic smelters, as well as comments made on the proposed standard for low-arsenic smelters.

Summary of Promulgated Standard

Applicability

The standard that is being promulgated today applies to each existing and new primary copper smelter. For all copper smelters, the standard requires monitoring, recordkeeping, and a reporting of average annual inorganic arsenic feed rate to the converters. For all copper smelters with average annual arsenic feed rates to the converters greater than 75 kg/h (164 lb/h), the standard requires control of secondary emissions for the converters. These facilities also are required by the standard to minimize excess emissions during malfunctions and process upsets, to monitor emissions; to maintain specific records,

and to report all occurrences of excess emissions.

Standard for Converter Operations

The standard for converter operations remains the same as proposed. The standard requires capture and collection of secondary inorganic arsenic emissions from converter charging, blowing, skimming, holding, and pouring operations. The standard is expressed in terms of equipment and design specifications and work practices for the capture system, and a maximum allowable particulate emission limit for the control device. Equipment and design specifications described in the regulation are intended to ensure that the secondary hood system achieves its maximum capture efficiency. The secondary hood system specifications include: (1) The configuration and dimensions of the hood enclosure must be sized so that the converter mouth, charging ladles, skimming ladles, and other material transfer vessels are housed within the confines or influence of the hood during each mode of converter operation; (2) the back of the hood enclosure must be fully enclosed and sealed against the primary hood; (3) the edges of the hood enclosure side-walls in contact with the converter vessel must remain sealed during each mode of converter operation; (4) the size of the opening at the top and front of the hood enclosure necessary for the entry and egress of ladles and crane apparatus must be minimized to the fullest extent practicable; (5) the hood enclosure must be fabricated in such a manner and of materials of sufficient strength to withstand incidental contact with ladles and crane apparatus with no significant damage; and (6) one side-wall of the enclosure must be equipped with a horizontal-slotted plenum along the top, and the opposite side-wall must be equipped with an exhaust hood.

The standard specifies that the horizontal-slotted plenum shall be connected to a fan and the air curtain fan be sized to deliver a minimum of 22,370 watts (30 air horsepower) at the slot. In addition, the converter and the air curtain secondary hood system must be operated at conditions optimum for the capture of secondary inorganic arsenic emissions. The owner or operator must visually inspect the components of the system at least once every month and maintain each converter and associated secondary hood system in a manner consistent with minimizing inorganic arsenic emissions.

Particulate emissions from the collection device may not exceed 11.6 mg/dscm (0.005 gr/dscf).

Requirements for Periods of Excess Emissions

At all times, including periods of startup, shutdown, and malfunction, the standard requires plant personnel to minimize emissions of inorganic arsenic from the converters and associated control devices to the greatest extent possible. The standard requires the owner or operator to submit a plan for control of emissions during startup, shutdown, and malfunctions of converter and associated emission control equipment. The plan shall include: (1) A systematic procedure for identifying malfunctions and for reporting them immediately to supervisory personnel; and (2) procedures that will be followed to ensure that equipment or process breakdowns due to poor maintenance or other preventable conditions do not occur.

Compliance Provisions

The Standard requires compliance within 90 days of today's date, unless a waiver of compliance is obtained from the Administrator. Waivers can be granted for a period of time needed to install controls to comply with the standard, not to exceed 2 years from today's date. Each smelter that has an average arsenic feed rate to the converters greater than 75 kg/h (164 1b/h), must have installed the required controls within 90 days of today's date to be in compliance, unless a waiver is requested and granted. Most smelters already monitor the arsenic content of feed materials throughout the smelting process and, based on historical data, should know whether they will be affected by the requirement for secondary converter controls. Should any additional smelter in the future have an annual arsenic feed rate to the converters greater than 75 kg/h, the owner or operator of that source must install the required controls within 90 days of the determination, unless a waiver is requested and granted.

The average annual arsenic charging rate to the converters shall be determined each month using the monthly average weight percent of arsenic in feed materials and charging rates to the converters for a 12-month period. The weight percent of arsenic in feed materials will be determined using Method 108A. Compliance with the particulate emission limit for copper converter control devices will be determined using EPA Reference Methods 1 through 5 in Appendix A of 40 CFR Part 60.

Continuous Monitoring

Owners or operators of facilities that must capture and control converter secondary emissions must continuously monitor the opacity of converter secondary emission streams that exit from a control device. The standard requires that reference opacity levels be established for each converter operating mode based on the highest 1-hour average opacity level monitored during a 36-hour evaluation period. Thereafter, occurrences of average opacity levels above the respective reference levels must be reported as exceedances to Administrator along with information describing the cause of the exceedances.

Continuous monitoring of air flow through the converter air curtain secondary hood system's horizontal-slotted plenum and exhaust hood is also required to ensure that the hood system is being properly operated and maintained. Occurrences of air flow rates less than 80 percent of the reference air flow rates must be reported as exceedances along with information on the causes of the exceedances.

Recordkeeping and Reporting Requirments

Owners or operators of source covered by the standard are subject to the reporting and recordkeeping requirements of the standard as well as those prescribed in the General Provisions (Subpart A) of 40 CFR Part 61. Specific reporting requirements of the promulgated standard include: (1) An initial report and subsequent annual reports of the average inorganic arsenic charging rate to the converters at each affected smelter; (2) reports of emission test results to demonstrate compliance with the particulate emission limit for control devices treating converter secondary emissions; (3) for the converter secondary hood systems, quarterly reports of occurrences of air flows less than 80 percent of the corresponding reference flow rate for any converter operating mode; and (4) for converter secondary emission collection devices, quarterly reports of excess opacity readings and the reference opacity levels set at the time the collection device demonstrated compliance. In addition, the owner or operator shall submit a report documenting the evaluation of the opacity monitoring system and the establishment of the reference opacity level.

Records of supporting data for the reports described above must be maintained at the source for a period of 2 years and made available to the Administrator upon request. These records will include the monthly arsenic charging rate to converters in existing and new smelters, and all continuous monitoring data.

Summary of Environmental, Health, Energy, and Economic Impacts

The standard being established today affects existing and new primary copper smelters. It is estimated that only one existing domestic primary copper smelter, the ASARCO smelter at El Paso, Texas, will be required to install control equipment to comply with the standard. No new domestic copper smelters are projected to be built in the next 5 years. This projection is based on EPA's conclusion that in the next 5 years annual copper industry growth in the U.S. will be accomplished by existing primary copper smelting capacity.

The standard will reduce secondary inorganic arsenic emissions from the affected smelter by about 1 to 4 Mg per year (1.1 to 4.4 tons per year). As a result of this reduction in inorganic arsenic emissions, it is estimated that the number of incidences per year of lung cancer due to inorganic arsenic exposure for persons residing within 50 km of the affected smelter would be reduced from 0.38 to 0.29 case per year. The standard would reduce the estimated maximum lifetime risk from exposure to airborne inorganic arsenic at the affected smelter from 1×10^{-3} to 8×10^{-4}. The estimated maximum lifetime risk represents the probability of a person contracting cancer who has been exposed continuously during a 70-year period to the estimated maximum long-term inorganic arsenic concentration due to emissions from the smelter. These estimated health impacts were calculated based on a number of assumptions and contain uncertainty as discussed in Appendix C of the BID for the promulgated standard (EPA-450/3-83-010b).

Application of the controls required would slightly increase the amount of solid waste handled by the smelter. The additional solid waste can be easily handled by ASARCO-El Paso. The standard also does not create any direct water pollution impacts, since the control system used at ASARCO-El Paso is a dry system (a fabric filter collector). The standard will increase electrical energy consumption by approximately 2000 MW, or approximately 0.1 percent above plant energy requirements without the standards.

Capital and annualized costs of complying with the standard are estimated to be about $1.85 million and $379,000, respectively. The primary economic impacts associated with the standard are projected decreases in profitability for the ASARCO-El Paso smelter if costs cannot be passed through. If the costs are passed forward in the form of a price increase, it is estimated that the final standard would result in a 0.3 percent increase in the price of copper. No plant closures are anticipated to result from this standard.

Significant Changes Since Proposal

Since proposal of the standard, a number of major and minor changes have been made. Significant changes have been made to the applicability of the standard, the opacity monitoring requirements, and the requirements for control of matte and slag tapping emissions. In addition, requirements for control of excess emissions during malfunctions and upsets have been added. The bases for these changes are discussed in the Basis for Standard and Discussion of Comments sections of this part of the preamble. The changes are summarized below.

Applicability of Standard. The standard is now applicable to new and existing primary copper smelters. The proposed standard was applicable to new and existing low-arsenic primary copper smelters, and a separate standard was proposed for high-arsenic smelters. The standard for converter secondary emissions now applies to all converters where the average annual arsenic feed rate to the converters is 75 kg/h (164 lb/h), or greater; the proposed level was 6.5 kg/h (14 lb/h). At proposal, it was estimated that six smelters would be required to install controls to comply with the standard. The final standard is expected to affect only one existing smelter in this manner.

Control Requirements for Matte and Slag Tapping Emissions. The standard no longer includes provisions requiring application of emission control to matte and slag tapping operations.

Requirements for Periods of Excess Emissions. Provisions have been added to the standard that require steps to be taken to minimize emissions during malfunctions and upsets and that require operation and maintenance of converters and associated air pollution control equipment in a manner that avoids preventable malfunctions.

Test Methods and Procedures. The equation for calculation of the converter arsenic charging rate was revised to clarify that all converters operating at a smelter are considered in the calculation of the arsenic charging rate and that

applicability is not determined for each converter separately. This revision was made to clarify the calculation method and the basis for the cutoff, and does not represent a substantive change in the method of determining applicability. The revised equation calculates converter arsenic charging rates in a manner that is consistent with the method used to calculate the rates presented in Table III–1, given later in this notice.

Opacity Monitoring. The proposed standard required reporting of all 6-minute average opacity levels greater than the 97.5 percent upper confidence level of a normal or log-normal distribution of the 6-minute average opacity levels monitored during the emission test. This requirement has been revised to require establishment of reference opacity levels based on the highest 1-hour average opacity level monitored during a 36-hour evaluation period. The evaluation period will include the time period during which the emission test for the control device is conducted. Occurrences of 1-hour average opacity levels above the reference level must be reported as excess emissions.

Recordkeeping and Reporting. The proposed requirements were redrafted to clarify some requirements, to improve the organization of the sections, and to add additional requirements. New recordkeeping and reporting requirements added include maintenance of a record of malfunctions and all actions taken to reduce emissions until the problem is corrected; and reporting of any changes in the operating conditions of the emission capture system, control device, or the building housing the converters that might increase emissions. In addition, exceedances of opacity and air flow rate reference values are now to be reported quarterly instead of semiannually.

Additional Analyses

Because of public comments, EPA has conducted additional analyses to ensure that the final rule is based on the most complete and accurate information available. These additional analyses include revision of emission estimates, revision of dispersion modeling and risk assessments, and additional cost and economic impact analyses. The scope of these additional analyses is summarized in the paragraphs below. The conclusions are presented in the Discussion of Comments section of the preamble and are discussed in detail in the BID for the promulgated standard.

Emission Estimates

Since proposal, EPA has refined its estimates of process and fugitive emissions for the 14 primary copper smelters. These revised estimates are based either on additional information on the emission inventory or on refinements in emission estimates.

Analysis of additional information provided by copper companies for eight smelters concerning arsenic inputs, distribution, emissions, and baseline controls resulted in significant revisions to converter secondary emission estimates at seven smelters. Comments that prompted the additional analyses of emission information for these eight smelters and EPA's detailed responses are included in the BID for the promulgated standard (EPA–450/3–83–010b) along with comments received on the revised emission estimates. These comments and responses also are summarized in the Discussion of Comments—Emission Estimates section of this preamble.

The EPA also reviewed the emission estimates for the remaining low-arsenic smelters and made minor adjustments as necessary. These adjustments primarily reflected refinements in assumptions and calculations concerning distribution of arsenic between primary and secondary emission sources. These revised emission estimates are also presented in the BID for the promulgated standard.

Dispersion Modeling

At the time of proposal, EPA recognized that the estimates of public exposure to inorganic arsenic emissions from the 14 low-arsenic copper smelters needed improvement. In particular, it was known that uncertainties in emission estimates, particularly the estimates of fugitive emissions and other information used in dispersion modeling, could contribute to significant errors in estimates of ambient concentrations. Because of the recognized uncertainties in the information used in the dispersion modeling studies, EPA undertook to improve the dispersion modeling results. The EPA reviewed emission sources and quantities used as inputs to the HEM at proposal to make quantitative estimates of public exposure, current risk, and probable risk reduction resulting from application of controls. Input parameters for each smelter were revised based on results of the reanalysis of emission estimates and upon best available meteorological data for each site. The model was applied to the revised set of input parameters for each low-arsenic throughput smelter and new arsenic

dispersion estimates were obtained. The revised modeling results predicted ambient concentrations at distances up to 50 km (31 miles) from the smelter. The procedure used to estimate health risk is described in Part I of this preamble, Risk Management. Further, more sophisticated modeling of arsenic dispersion was performed for two of the smelters, as discussed below.

At the plant sites of Douglas, Arizona (Phelps Dodge), and El Paso, Texas (ASARCO), EPA performed more detailed, site-specific analyses which included the use of plant meteorological data, consideration of terrain features, and the use of more sophisticated air dispersion models. These two sites were selected because of the availability of on-site or nearby meteorological data. At the other primary copper smelter sites, similar data were not reasonably available.

In its original risk assessment, EPA did not consider terrain effects or the effect of buoyancy of the fugitive emissions escaping from the furnace buildings. Additional dispersion analyses were performed for the El Paso and Douglas sites to examine the combined effect of terrain, downwash, and buoyancy on airborne arsenic concentrations. These analyses are described in Appendix C of the BID and in a report, entitled "Atmospheric Dispersion Modeling of Long-Term Average Arsenic Concentrations in the Vicinities of Four Industrial Plants" (A-80-40/IV-A-12).

The concentration profiles predicted by both the more sophisticated model and by HEM were compared to available ambient data near the El Paso smelter to confirm the model's abilities to provide reasonable estimates of ambient arsenic concentrations. Both air dispersion models generally underpredicted the ambient concentrations at the El Paso site. The EPA expects that the dispersion models could tend to slightly underpredict ambient concentrations since the ambient monitors collect arsenic due to other nearby sources including arsenic that naturally occurs in the soil and from reentrainment of past smelter emissions. These comparisons indicate that the HEM can provide reasonable estimates of ambient concentration profiles and is suitable for estimating concentration of ambient arsenic at the remaining primary copper smelter sites at which the more sophisticated analyses were not used.

At smelter sites other than El Paso, Texas, EPA has compared its HEM predictions of ambient concentrations to available ambient data. Such comparisons were attempted at the

Douglas, Ajo, Hayden, San Manuel, and Morenci copper smelter sites. For a number of technical reasons, including a lack of a significant quantity of data, the EPA was unable to make meaningful comparisons except at two sites—El Paso and Hayden. Although the model both over- and underpredicted measured concentrations, generally HEM provided reasonable, for the purpose of risk assessment, estimates of the inorganic arsenic concentrations to which people are being exposed. (The final risk estimates for each plant are listed in Table III-3, presented in the Consideration of Risks discussion.) In addition to the above, EPA meteorologists searched for more representative weather data for each of the smelter sites. For the Garfield, Utah, site, such data were identified and used in subsequent analysis. These analyses are presented in detail in Appendix C of the BID (EPA-450/3-83-010b).

Costs and Economic Analyses

Since proposal, EPA has revised its estimates of the cost and economic impacts to primary copper smelters of applying controls required by the proposed standard. For six of these smelters, copper companies supplied information concerning equipment and costs necessary for compliance with the proposed standard. The EPA reviewed the cost information supplied by the companies and analyzed the differences between these estimates and those made by EPA at proposal. For each of these smelters, EPA reviewed the reasonableness of the assumptions and reevaluated the control costs. The EPA also reviewed the comments of these copper companies on EPA's reanalysis of the control costs. The final estimates of control costs reflect consideration of all comments received throughout the public comment period.

Because of this reanalysis, the control cost estimates for converter operations and matte and slag tapping operations generally were increased over the estimates presented at proposal. Also, an economic analysis was performed for the 14 copper smelters using the revised cost and emission estimates to determine whether the standard would be affordable.

Basis for Standard

As discussed in Part I of this preamble, the risk management approach provides for a comprehensive assessment of candidate source categories, including an evaluation of current and applicable emission control alternatives, as well as the associated health risks, risk reductions, and associated costs and economic impacts.

This section describes the application of this approach in the development of the standard for primary copper smelters and the rationale for extension of the standard to any new smelters. The factors considered in the development are discussed under two areas: (1) application of risk management approach including consideration of risks and control options; and (2) selection of final standard.

Application of Risk Management Approach

The standard that is being established today is based on the technology that, in the Administrator's judgment, provides the maximum reduction in risk to public health and is available and can be applied without causing widespread plant closure or imposing costs that far exceed any public health benefit. Accordingly, the Administrator considered a number of factors in selecting the final standard. The factors that were considered included the estimated emission reduction and remaining public exposure to inorganic arsenic, the level of the estimated health risks and uncertainties in these estimates, and the economic impacts of closure. The following sections describe the principal factors considered in this decision.

Consideration of Control Options. There is a range of potential control options that are applicable to low-arsenic primary copper smelters. These potential options are: (1) Converter fugitive emission controls; (2) matte and slag tapping fugitive emission controls; and (3) control of emissions during malfunctions. The evaluations of the potential control options are summarized below.

1. *Converter fugitive emission controls:* The standard proposed on July 20, 1983, would have required installation of converter secondary hoods consisting of horizontal air curtains and exhaust plenum, specific work practices to ensure effective capture by the hoods of converter secondary emissions, and venting of the captured secondary emissions to a control device for collection. A prototype air-curtain secondary hood already installed on the No. 4 converter at ASARCO-Tacoma has been evaluated and found to achieve an overall average capture efficiency of about 94 percent. Based on these test results, EPA estimates that the converter fugitive controls will reduce converter fugitive emissions by 90 percent (if captured emissions are controlled by a collection device with 96 percent efficiency (i.e., 90 percent = 94 percent

× 96 percent)). The potential emission reductions, in Mg per year, for existing copper smelters are summarized in Table III-1. The estimated annualized costs for the converter secondary controls at each of the existing smelters also are given in Table III-1. The estimated cost effectiveness ($/Mg) ranges from about $100,000 to $8 million per Mg at the 14 smelters.

TABLE III-1.—REVISED ENVIRONMENTAL AND COST IMPACTS ASSOCIATED WITH SECONDARY INORGANIC ARSENIC EMISSION CONTROL SYSTEMS FOR CONVERTER OPERATIONS

Smelter	Arsenic content of feed, percent	Arsenic feed rate to converters, kilogram per hour	Potential secondary arsenic emission, milligrams per year	Baseline secondary arsenic emissions, milligrams per year	Predicted secondary arsenic emission reduction, milligrams per year	Annualized control costs, $1,000	Cost per unit emission reduction, dollars per milligram as
ASARCO—El Paso: [1]							
(1)	0.5	98.9	98.3	13.3	[2]3.7	379	102,430
(2)	0.5	98.9	24.6	3.4	[2]1.0	379	379,000
ASARCO—Hayden	0.42	63.4	10.2	5.4	4.4	798	181,365
Kennecott McGill	0.033	9.3	10.1	10.1	9.2	2,201	239,240
Kennecott—Hayden	0.015	7.2	6.5	6.5	5.9	2,140	362,710
Phelps Dodge—Douglas	0.03	4.2	4.1	4.1	3.7	2,943	795,405
Inspiration—Miami	0.033	5.7	1.9	1.9	1.7	2,943	1,731,000
Phelps Dodge—Morenci	0.006	1.9	1.9	1.9	1.7	3,432	2,019,000
Kennecott—Utah (Garfield)	0.144	14.7	1.5	1.5	1.4	2,028	1,449,000
Phelps Dodge—Hidalgo	0.003	0.4	0.2	0.2	0.18	1,745	9,694,000
Tennesee Chemical—Copperhill	0.0004	0.7	0.65	0.65	0.58	1,278	2,203,000
Magma—San Manuel	0.006	0.6	0.55	0.55	0.50	3,979	7,958,000
Phelps Dodge—Ajo	0.015	0.8	0.52	0.52	0.47	1,562	3,323,000
Kennecott—Hurley	0.0005	0.8	0.46	0.46	0.42	2,296	5,467,000
Copper Range—While Pine	0.008	0.5	0.30	0.30	0.27	1,278	4,733,000
Total							

[1] El Paso figures represent secondary arsenic emissions based (1) on an emission factor for uncontrolled converter fugitive emissions of 15% of the arsenic contained in the primary converter process gases and, (2) on a 3.75% emission factor. These figures are estimated by EPA to represent the upper and lower bounds of uncontrolled converter fugitive emissions at ASARCO—El Paso.

[2] Emission reduction estimates calculated assuming no additinal control by the building evacuation system (BES) of emissions escaping the converter secondary hoods. Some control of these emissions by the BES may occur although the amount of control cannot be determined. To the extent that emissions escaping the converter secondary hoods are controlled by the BES, these emission reductions are understated.

2. Matte and slag tapping fugitive emission controls: The standard proposed on July 20, 1983, also would have required capture and control of matte and slag tapping secondary emissions from smelting furnaces with arsenic tapping rates greater than 40 kg/h (88 lb/h). All three smelters above this cutoff have installed localized hoods over matte and slag tapping operations and two have also installed efficient control devices to control the particulate matter emissions. The potential emission reductions and the costs to control the captured emissions at the smelters that are not currently controlling them are summarized in Table III-2. The cost effectiveness of these controls ranges from $330,000 to $7,300,000 per Mg for the 14 primary copper smelters.

concentrations have been monitored at the plant boundary for the past eight years. These monitoring data have shown that arsenic concentrations dramatically increased when increased fugitive emissions were released during upsets of the copper converters and when malfunctions of control equipment resulted in an increase in emissions. Therefore, EPA believes that all reasonably available control measures should be utilized to reduce the impact of malfunctions and process upsets on inorganic arsenic emissions.

The Administrator recognizes that malfunctions cannot be completely prevented. However, there are measures that can be taken to reduce emission rates significantly and to minimize the time during which increased emissions occur due to malfunctions and process upsets. Measures that can be taken to reduce emissions during startups, shutdowns, and malfunctions include repair of malfunctioning or damaged equipment as soon as possible and regular maintenance of potential sources of inorganic arsenic emissions to ensure that preventable breakdowns do not occur.

The emission reduction obtained by using such measures cannot be estimated. Furthermore, the control costs will vary depending on the nature of the malfunctions, specific equipment, and frequency of occurrence of

TABLE III-2.—REVISED ENVIRONMENTAL AND COST IMPACTS ASSOCIATED WITH SECONDARY INORGANIC ARSENIC EMISSION CONTROL SYSTEMS FOR MATTE AND SLAG TAPPING OPERATIONS

Smelter	Arsenic process rate kilograms perhour	Potential Arsenic Emissions milligrams per year	Baseline Arsenic Emissions milligrams per year	Predicted Arsenic Emission Reduction milligrams per year	Annualized Control Costs $1,000	Cost per Unit Emission Reduction dollars per milligram as
ASARCO—Hayden	98.2	8.5	1.1	0	0	
ASARCO—El Paso	102.1	6.7	0.8	0	0	
Kennecott—Utah (Garfield)	40.4	2.0	2.0	1.7	1,914	1,126,000
Kennecott—Hayden	9.4	0.9	0.9	0.78	257	329,490
Inspiration—Miami	19.8	0.8	0.8	0.69	261	378,260
Phelps Dodge—Douglas	10.4	0.6	0.4	0.32	514	1,606,000
Kennecott—McGill	5.6	0.3	0.3	0.26	257	988,460
Phelps Dodge—Morenci	5.0	0.3	0.3	0.26	514	1,977,000
Phelps Dodge—Hidalgo	0.8	0.05	0.05	0.04	257	6,425,000
Phelps Dodge—Ajo	1.8	0.1	0.1	0.09	257	2,856,000
Kennecott—Hurley	1.6	0.1	0.1	0.09	265	2,944,000
Tennessee Chemical—Copperhill	1.1	0.09	0.09	0.08	257	3,213,000
Magma—San Manuel	1.0	0.08	0.08	0.07	514	7,343,000
Copper Range—White Pine	0.6	0.06	0.06	0.05	257	5,140,000

3. Control of emissions during malfunctions: Primary copper smelting operations can experience equipment malfunctions and process upsets that result in increased inorganic arsenic emissions. The effect of process upsets and equipment malfunctions on ambient arsenic concentrations has been demonstrated at the ASARCO-Tacoma smelter, where ambient arsenic

malfunctions and upsets. However, it is estimated that the costs of a program will be negligible.

Consideration of Risks. In reaching the decision on the standard, the Administrator considered of particular importance the magnitude of the estimated risks and the degree to which estimated risks can be reduced by available control measures. In addition, the Administrator also considered the general public comments on the reasonableness of risks to be an important element in consideration of risks.

Estimated Risk—Current estimated risks and the risks remaining after the application of available control technology for converter secondary emissions are summarized in Table III–3. These calculated risk estimates were developed using the procedure described in Part I of this notice, and a unit risk factor of $4.29 \times 10^{-3}/\mu g^{-m3}$. As shown in Table III-3 for each smelter,

estimated maximum lifetime risks before application of controls range from 1.3×10^{-3} to 5.0×10^{-6} and the estimated annual incidence ranges from 0.38 to 0.0001 cases per year. In general, these estimates of risk are lower than those presented at proposal because of revisions to inorganic arsenic emission rate estimates resulting from public comments (for basis of revisions see Discussion of Comments—Emission Estimates).

TABLE III–3.—RISK ESTIMATES FOR PRIMARY COPPER SMELTERS

Maximum lifetime risk	Smelter[2]			Annual Incidence, cases per year		
	Baseline × 10⁻⁴	Converter Control[1] × 10⁻⁴	Reduction × 10⁻⁴	Baseline	Converter Control[1]	Reduction
ASARCO—El Paso:						
(1)	10	[1]8	2	0.38	[4]0.29	0.09
(2)	6	[4]5	1	0.20	[4]0.18	0.02
	[3]10	[3][4]9	[3]1	[3]0.18	[3][4]0.16	0.02
ASARCO—Hayden	13	12	1	0.06	0.05	0.01
Kennecott—Garfield (Utah)	0.6	0.6	0	0.14	0.14	0
Kennecott—Hayden	3	0.5	2.5	0.016	0.0054	0.0106
Inspiration—Miami	1.9	1.0	0.9	0.0069	0.0034	0.0035
Phelps Dodge—Douglas	12	2	10	0.022	0.0081	0.0139
	[5]0.8	[5]0.7	[5]0.1	[5]0.025	[5]0.013	[5]0.012
Kennecott—McGill	4	0.6	3.4	0.006	0.0015	0.0045
Phelps Dodge—Hidalgo	0.05	0.03	0.02	0.0001	0.0001	0
Phelps Dodge—Morenci	0.8	0.2	0.6	0.0028	0.0009	0.0019
Phelps Dodge—Ajo	2	1.7	0.3	0.0045	0.0038	0.0007
Kennecott—Hurley	1.2	0.5	0.7	0.0008	0.0003	0.0005
Tennessee Copper—Copperhill	0.6	0.1	0.5	0.003	0.0006	0.0027
Magma—San Manual	1.6	0.4	1.2	0.0026	0.0017	0.0009
Copper Range—White Pine	1.1	0.15	0.95	0.0004	0.0002	0.0002

[1] Control of converter fugitive emissions by a system consisting of a secondary hood with 94 percent collection efficiency.
[2] El Paso figures represent secondary arsenic emissions based: (1) on an emission factor for uncontrolled converter fugitive emissions of 15% of the arsenic contained in the primary converter process gases, and (2) on a 3.75% emission factor. These figures are estimated by EPA to represent the upper and lower bounds of uncontrolled converter fugitive emissions at ASARCO–El Paso.
[3] Risk estimates calculated using site-specific analyses (ISCLT/Valley model) and 3.75% emission factor.
[4] Risk estimates calculated assuming no additional control by the building evacuation system (BES) of emissions escaping the converter secondary hoods. Some control of these emissions by the BES may occur although the amount of control can not be determined. To the extent that emissions escaping the converter secondary hoods are controlled by the BES, these risk estimates are overstated.
[5] Risk estimates calculated using site-specific analyses (ISCLT/Valley model).

Effect of Control Options.—As described in the discussion on *Consideration of Control Options,* reductions in fugitive emission rates can be achieved with the air-curtain hoods for converter secondary emissions and controls on matte and slag tapping emissions. (Emission reductions for a malfunction and upset control program cannot be estimated.) Applying controls for converter secondary emissions would reduce the range of estimated maximum risks to between 1.2×10^{-3} and 3.0×10^{-6} from a range of 1.3×10^{-3} to 5.0×10^{-6}. The estimated annual incidence of lung cancer would be reduced to levels ranging from 0.29 to 0.0001 with application of converter secondary controls. (Before application of controls, the estimates of annual incidence ranged from 0.38 to 0.0001.) The application of controls to matte and slag tapping secondary emissions would achieve only negligible reductions in risk. Specifically, application of matte and slag tapping controls in addition to converter controls would not result in

any additional reduction in maximum lifetime risk and would reduce the estimated annual incidence of lung cancer to levels ranging from 0.29 to 0.0001 (i.e. essentially no reduction).

Accuracy of Risk Estimates.— Although EPA believes that the use of quantitative risk estimates is an important element of the risk management process, the Agency recognizes and has attempted to make clear throughout this rulemaking that any such estimates contains inherent uncertainties. A part of this uncertainty arises from gaps in the health and technical data bases that (1) Cannot ever be filled; or (2) cannot be filled within the time and resource allocations available. Another part of this uncertainty derives from the simplifying assumptions that must be made to reduce the scope and detail of the analysis to manageable terms. The assumptions necessary to estimate inorganic arsenic health risks and the underlying uncertainties have led some commenters to suggest that the use of

risk estimates is inappropriate in regulatory decisionmaking. Although the Agency acknowledges the potential for error in these estimates, EPA believes that, on balance, they are best estimates that the Agency can reasonably provide. Whether the risk estimates are higher or lower than the true risks to the public is unknown; although, in general, many of the assumptions which have been made tend to be conservative and, therefore, tend to ensure that the estimates are not significantly understated.

Selection of Standard

The EPA interprets the requirement of section 112 to establish emission standards at a level which "provides an ample margin of safety" as not implying that these standards must ensure that there is no remaining level of risk. Consequently, the standard being adopted today requires the use of control equipment and work practices that will reduce arsenic emissions and hence risks to the practical minimum. Equipment and work practices

requirements for the capture of converter secondary emissions are being established instead of an emission standard owing to the infeasibility of accurately measuring these emissions (see 49 FR 33132 for discussion of selection of format of the standard).

The standard reflects consideration of the magnitude of the risks, the costs and availability of further controls and associated risk reduction potential, and the potential societal impacts of regulatory alternatives. The consideration of the impacts, in particular, weighed the estimated risks achieved by and remaining after application of controls and their uncertainties against the costs to achieve the emission reduction and the potential for widespread closure. These considerations were described earlier and are summarized below.

The EPA assessed the need for the proposed converter secondary control requirements using the risk estimates and control cost estimates presented in Tables III-1 and III-3. For five of the six smelters that the proposed standard would have affected, EPA concluded that the costs were disproportionate to the risk reductions that could be obtained. Furthermore, the revised economic analysis showed that for two of these five smelters the control costs were likely to result in the smelters remaining permanently closed. The analysis of the converter control requirement also indicated for the sixth facility, ASARCO-EL Paso, that risk reduction could be obtained at a cost that does not present unreasonable economic and social effects. An additional factor considered in the assessment was that secondary hoods will be installed on all converters at ASARCO-EL Paso to comply with requirements in the Texas SIP for attainment of the NAAQS for lead. Since the costs of the controls are reasonable and the control can be implemented now, it is the Administrator's judgment that these controls should be applied at ASARCO-El Paso. Consequently, EPA revised the cutoff to distinguish between primary copper smelters where additional emission control is reasonable and those where additional emission control imposes costs that far exceed any public health benefit. The final standard, thus, requires installation and operation of the air-curtain secondary hoods and the use of work practices to ensure maximum capture of fugitive emissions at facilities where the converter arsenic feed rate is 75 kg/h (164 1b/h) or greater. Based on available information, this cutoff requires application of converter

secondary controls only at the ASARCO-El Paso smelter.

The Administrator also concluded that it is appropriate to apply the standard to any new primary cooper smelters having average annual arsenic feed rates to the converters of 75 kg/h, or greater. Although no new smelters are projected to be built in the next 5 years, the standard is being applied to new smelters to ensure that any such sources are controlled. Should any new smelter be constructed, EPA will also evaluate the need for additional emission controls.

The EPA's assessment of the risk reduction achievable through application of controls on matte and slag tapping secondary emissions showed that reductions in annual incidence were less than 0.001 and that essentially no reduction in maximum lifetime risk would be obtained. The negligible reductions in risk are largely a result of the current low emission rates (less than 1-2 Mg per year). In addition, controls on matte and slag tapping operations are required by the Tripartite Agreement for ASARCO-El Paso, and no additional emission reduction would be achieved with a NESHAP requirement. Moreover, it is the Administrator's judgment that controls on matte and slag tapping operations at the remaining facilities would impose costs that are greatly disproportionate to the risk reduction achieved. Therefore, the proposed control requirement for matte and slag tapping operations is not included in the final standard.

The need for requirements to minimize emissions during process upsets and equipment malfunctions was not evaluated using a risk management analysis. Rather, the need was determined considering the availability of preventative measures and the potential for elevated ambient arsenic concentrations during such periods. Since EPA inspections of primary copper smelters identified areas where increased attention to maintenance and operations could minimize emissions due to equipment malfunctions, it is the Administrator's judgment that control measures are available and can be reasonably applied. Because the inclusion of a comprehensive list of all potential malfunctions in a regulation is impractical, the Adminstrator concluded that it would be more effective if the owner or operator were to identify potential malfunctions and upsets and the steps it would take to minimize emissions when they occur. Therefore, the final standard requires each affected smelter to submit a plan for EPA approval that outlines the specific steps

that can and will be taken to reduce emissions from converter upsets and control equipment malfunctions. For the purpose of this standard, a malfunction is defined as any sudden failure of process or air pollution control equipment or of a process to operate normally that results in increased emissions of arsenic. A failure of equipment or a process upset caused entirely or in part by poor maintenance, careless operation, or other preventable upset condition or equipment breakdown, would be considered improper operation and maintenance. Improper operation and maintenance is a violation of the standard. The provisions pertaining to malfunctions that are discussed above do not excuse such violations.

Discussion of Comments

Comments on the proposed standard were received from copper companies, State and local air pollution control agencies, Federal agencies, environmental groups, the United Steelworkers of America (USWA), and private citizens. A detailed discussion of these comments and EPA's responses can be found in the BID, which is referred to in the ADDRESSES section of this preamble.

In comment letters and hearing testimony, general and specific comments were made on EPA's emission estimates, cost estimates, ambient exposure modeling and risk estimation, achievability of the standard and various technical aspects of the proposed standard. For discussion purposes, the comments have been grouped into the following areas: risk management approach, legal and policy, application of risk management approach, emission estimates, health effects, public exposure and health risk estimates, control technology, costs and economic impacts, monitoring requirements, and compliance provisions.

Risk Management Approach

Comments on the risk management approach include general comments on the methodolgy and BAT approach as well as comments on alternative risk management strategies considered for low-arsenic primary copper smelters. The comments on risk management and BAT approach, and alternative risk management strategies are considered in Part II of this notice, and will not be repeated here.

Legal and Policy

A few commenters argued that the proposed standard attempts to

circumvent Section 112 of the Clean Air Act; and that the regulation should not exempt emissions during startup, shutdown, and malfunctions from the control requirements. The commenters further argued that the regulation should encourage compliance, not provide a means and incentive for circumvention. The regulation has been revised as it applies to emissions during startups, shutdowns, and malfunctions. The final regulation includes maintenance requirements and timely repair of malfunctioning converters and pollution control equipment. The regulation also now explicitly requires that emissions of inorganic arsenic be minimized at all times.

The Sierra Club, State of New Mexico, and NRDC took issue with EPA's reliance on control measures required by SIP's, consent decrees growing out of violations of SIP requirements, and OSHA standards. The commenters thought these requirements were an inadequate substitute for Section 112 standards since the requirements can be amended and have greater flexibility in their enforcement. The Administrator believes that where standards established under separate authorities are effective in reducing emissions, redundant standards need not be established by EPA. The EPA establishes separate standards when there is evidence that either the control measures are not likely to remain in place or are unlikely to be properly operated and maintained. In the case of primary copper smelters, EPA reviewed the SIP requirements, the applicable OSHA standards and agreements, and the emission reductions achieved under these requirements. Based on this review, the Agency has concluded that adoption of redundant EPA standards would result in no emission reduction or other public health benefit beyound that which is occurring (or will occur). The EPA will continue to monitor controls and emissions at the smelters, and the standard can be later revised should this assessment prove to be incorrect.

The Sierra Club also recommended that EPA consider requiring capital investment set-asides that would be available for smelter capital improvements when EPA reviews the standard after 5 years. This would provide smelters that otherwise could not afford controls with a means of affording controls on their operations. The NRDC suggested that some form of financial relief be established to assist communities that are at particular risk from smelter inorganic arsenic emissions. Section 112 of the Act requires EPA to adopt standards that

are protective of public health and places the obligation for controlling emissions on the source. The Administrator believes that requirements of capital investment set-asides and financial relief are not authorized by Section 112 of the Act and are beyond the scope of this rulemaking. Furthermore, EPA believes that since historical fluctuations in the price of copper was considered in the analysis of the affordability of controls, such a requirement is not necessary.

In their comments on the revised emission and cost estimates published for comment in the September 20, 1984, **Federal Register** notice, ASARCO, Phelps Dodge, and Kennecott requested that EPA also publish the revised risk estimates for comment. The Administrator considered this request, the extent to which the estimates have changed since proposal, and the potential effect of these changes on the final decision, and concluded that publication of the revised risk estimates for comment is not necessary. Moreover, the Administrator thought that the additional delay in issuance of the standard this would entail would not be in the public interest. Instead, to keep the public informed, EPA placed the revised estimates in the public docket (Docket No. A-80-40) and provided these commenters with copies of the revised estimates and their supporting documentation. The Administrator believes that adequate opportunity for public review of the risk estimates has been provided.

Application of Risk Management Approach

ASARCO and Kennecott commented that EPA's selection of smelters to be regulated at proposal was arbitrary and capricious since different cost-effectiveness cutoffs were used at different facilities. At proposal, smelters were selected for regulation of either converter fugitive emissions or matte and slag tapping emissions based on potential emissions and the costs to achieve the emission reduction. As discussed in Part II of this notice, several difficulties were encountered with this approach and the basis for selection of the appropriate level of control has been revised. Decisions on the level of control are now based on consideration of the risk reduction that can be obtained as well as the costs to achieve that reduction and the economic impacts of the control requirement. The Agency believes that the present risk management approach is consistent with the intent of Section 112, and it responds to many concerns of commenters.

Emission Estimates

On two occasions during the public comment period, EPA published estimates of arsenic emission rates for the low-arsenic smelters. Comments were received from several copper companies on the two estimates. The copper companies' comments on the emission estimates presented in the July 20, 1983, **Federal Register** notice were that EPA had overestimated arsenic emissions from several of their smelters. Comments of this nature were received regarding ASARCO's El Paso and Hayden smelters, Kennecott's Hayden, McGill, and Garfield (Utah) smelters, and Phelps Dodge's Morenci and Ajo smelters.

For each of these smelters, EPA reviewed the information on which the proposal emission estimates were based in light of the comments submitted. Where judged appropriate, revisions to the proposal estimates were made. These revised estimates were presented for public comment in the September 20, 1984, **Federal Register** notice (49 FR 36877). Additional comments were received regarding these revised emission estimates. In general, the copper companies thought that EPA's estimates still overstated the total amount of arsenic being emitted or the amount emitted from the converter building. The EPA reviewed these additional comments and determined that with the exception of Phelps Dodge-Hidalgo, additional revisions to the estimates were not warranted. The final emission estimates for the low-arsenic smelters are given in Tables III-1 and III-2. All of the final estimates of inorganic arsenic emissions are lower than the proposed estimates with the exception of the Kennecott-Hayden estimates, which are unchanged. The primary basis for revision of the estimates is summarized below for each smelter and discussed in detail in the BID for the promulgated standard (EPA-450/3-83-010b).

ASARCO-El Paso: The EPA concluded from a review of comments and supporting documentation that the estimated capture efficiencies for the building evacuation system at El Paso should be increased to 90 percent (from 75 percent) and that less converter secondary emissions may be generated than previously estimated due to use of a computerized gas management system; however, the amount of emission reduction is unknown. Therefore, a range of emission estimates was developed for this smelter, assuming 90 percent capture efficiency and converter secondary emission factors of 3.75 and

15 percent of the converter primary emissions, and was published in the September 20, 1984, **Federal Register** notice. ASARCO's comments on the range of emission estimates did not provide any information on the effect of the computerized damper system on fugitive emissions. Therefore, EPA continues to believe that the range of emission estimates best characterizes converter secondary emissions at ASARCO-El Paso.

ASARCO-Hayden: Based on a review of comments and material submitted regarding the estimates presented in the July 20, 1983, **Federal Register** notice, EPA determined that its estimate of the smelting furnace arsenic volatilization rate should be increased (from 49 to 78 percent), and converter secondary emissions decreased (from 15 to 3.75 percent of the primary converter process emissions). The revised percent arsenic volatilization rate falls within the range of values reported in the literature and is the rate predicted by the furnace designer (INCO) for feed materials used at the Hayden smelter. Additionally, the converter fugitive emission factor was revised to reflect the performance of high-draft primary hoods such as the hoods on the No. 1 and No. 2 converters at ASARCO-Tacoma, which the primary hoods for the converter operations at Hayden closely resemble. Since ASARCO did not provide any rationale for its estimates of 75 to 80 percent capture efficiency for the existing secondary hoods, the original estimate of 50 percent efficiency based on EPA observations was retained.

In their comments on the revised emission estimates, ASARCO disagreed with EPA's assessment of emissions escaping capture by the primary hoods, the capture efficiencies achieved by the existing secondary hoods, and the capture efficiencies air curtain secondary hoods would attain at this smelter. The EPA considered these comments and concluded that to revise the emission estimates further would require inspection of the facility and additional information. Because EPA believes that further reductions in the emission estimates achievable would not affect the standard, EPA decided this effort would not be a productive use of resources and the estimates should not be revised. If EPA were to consider revising the standard so as to cover this facility, the capture efficiency achieved by the existing secondary hoods would be re-evaluated and the specific factors that might reduce the capture efficiency of air curtain secondary hoods would be evaluated.

Kennecott-Hayden: After consideration of Kennecott's comments on the emission estimate for this smelter, EPA has not made any significant changes to the arsenic material balance. The overall arsenic material balance information provided by Kennecott was very similar to the mass balance used by EPA at proposal, with the exception of the estimates of stack emission rates and fugitive emission rates from smelter equipment. Since Kennecott did not identify the basis for their estimated stack emission rate of 0.23 kg/h (0.5 lb/h) and EPA's estimate is derived from emission test data for control devices similar to the device used at this smelter, EPA retained its estimated stack emission rate of 3.2 kg/h (7 lb/h). Further, since the potential reduction in fugitive inorganic arsenic emissions was not quantified by Kennecott, EPA has no basis for estimating the effects of the smelter improvements on fugitive emissions of inorganic arsenic. This smelter is currently closed.

Kennecott-McGill: In response to comments that the proposal arsenic balance was based on atypical concentrates that will not be smelted at this facility in the future, EPA revised the arsenic balance to reflect use of concentrates used by other low-arsenic throughput toll smelters. In comments on the revised estimates, Kennecott reiterated its belief that planned controls for converter fugitive emissions should be considered in determining emissions. The EPA considered this comment and concluded that the planned controls should not be included in the estimate of baseline emissions. Specifically, EPA believes that since the anticipated controls are not included in a Federally enforceable requirement and these controls are not yet firmly enough established to be assumed operational before application of this NESHAP, the control should not be considered in estimating baseline emissions. This smelter is currently closed.

Kennecott-Utah: The arsenic material balance was revised to reflect changes in process operations and more accurate material assays. The smelter arsenic material flow information used by EPA at proposal for developing the arsenic balance was obtained directly from information submitted by Kennecott in 1978 and 1983. In its comments on the estimate presented in the July 20, 1983, notice of proposal, Kennecott supplied a revised balance for the Utah smelter that reflected small changes in process operations and more accurate material assays. In these comments Kennecott also stated that in-house testing

demonstrated that the capture efficiency of the converter secondary hoods is more than 90 percent, indicating EPA's estimate of 50 percent capture efficiency is too low. This comment was restated in Kennecott's comments on the revised emission estimates. The final emission estimate for this smelter only reflects the basic changes to the balance suggested by Kennecott. The final arsenic balance and emission estimate retains EPA's estimate of 50 percent capture efficiency by the converter secondary hoods. Kennecott's claim of greater capture efficiency for the converter secondary hoods was not accepted because the analysis failed to consider the other points in the hot metal building housing the converters where emissions could escape to the atmosphere, such as the roof monitor on the hot metal side of the building and windows and doors in the building. The EPA also considered that even if the existing converter secondary hoods were to achieve 90 percent capture efficiency, the difference in the estimate of low-level fugitive emissions would result only in small changes in risk estimates, and would not affect the promulgated standard.

Phelps Dodge-Morenci: The EPA revised the arsenic material balance for this smelter using information submitted by the company after proposal. The revised arsenic distribution is based on recent sampling at the smelter, while the balance presented at proposal was based on a theoretical distribution provided by the company. Consequently, the basic changes were accepted by EPA as more accurately predicting inorganic arsenic emissions and were incorporated into the arsenic balance.

Phelps Dodge-Hidalgo: The EPA revised the arsenic material balance for this smelter using information submitted by the company in their comments on the September 20, 1984, **Federal Register** notice. The revised arsenic distribution is based on the arsenic content of copper concentrates now being processed at the smelter (now 0.005 percent arsenic, or less). Consequently, EPA revised the arsenic balance based on this new information. The revised emission estimate is lower than the estimate presented at proposal.

Phelps Dodge-Ajo: The arsenic balance was revised to reflect the arsenic content of feed materials expected to be smelted in the future and the use of an unmodified reverberatory furnace instead of an oxy-sprinkle modified furnace. These changes were made because of information provided by the company and because of changes

in the consent decree affecting this smelter. The company also thought that the arsenic balance should reflect the fugitive emission controls on matte and slag tapping operations at the Ajo smelter. The EPA did not revise the arsenic balance regarding matte and slag tapping operations for two reasons. First, the fugitive emission controls consist of only an emission capture system (no collection or removal system), so no emission reduction is achieved. Second, the risk modeling already considered the height of release of these emissions.

Other comments on emission estimates were made by the USWA. In its comments, the USWA suggested that no set of emission estimates should be considered final and definitive. The regulation should provide for a continuing examination of inorganic arsenic emissions from all sources at the smelters, in order to identify opportunities for additional control. In particular, the USWA thought that attention should be given to intermittent operations and to process upsets. The EPA agrees that estimations of emissions from a source should not be considered final, and that continuing examinations, as circumstances warrant, should be carried out in order to have up-to-date and accurate emission information on record. It was for this reason that the Agency's estimates at proposal were re-evaluated after receipt of public comments and the revised estimates were published for public comment. Several emission estimates were revised to reflect new information on feed inorganic arsenic concentrations, smelter configurations, and process data. The final regulation was issued after considering the best information available. The regulation will be periodically reviewed after promulgation and changes made as appropriate to account for any new information relating to arsenic emission sources at smelters in this source category. In addition, the final regulation includes provisions that require steps to be taken to minimize emissions during converter upsets and emission control equipment malfunctions.

Health Effects

Phelps Dodge, Kennecott, and ASARCO stated that Section 112 was intended to apply only when emissions pose a significant risk of increased mortality or serious irreversible, or incapacitating reversible illness. Phelps Dodge felt that the evidence presented to EPA has established that inorganic arsenic emissions from U.S. primary copper smelters do not present significant risks. The evidence that the

companies presented in support of their position included both (1) community and certain occupational studies that did not detect lung cancer risks associated with exposure levels at or greater than those occurring near primary copper smelters, and (2) evidence that predicted concentrations near the smelter are less than those found in some cities in the U.S.

As discussed in Part II, Risk Management Policy and General Health Issues, of this preamble, this evidence has not proven to the Agency that primary copper smelters pose insignificant or nonexistent risks to the exposed public. (The commenters did not debate that inorganic arsenic exposure was occurring.) The community and occupational studies generally do not have the statistical power to detect significant increases in lung cancer at the exposure levels that are predicted by the Agency's models. Although they did not detect increases in risk, such studies could not conclude with a high degree of statistical confidence that risk increases were not present. By applying the best information available and using a scientifically creditable exposure/risk relationship that was based on occupational data, EPA has estimated increased lung cancer risk to the public surrounding the smelters.

These three commenters also compared the ambient arsenic concentrations caused by the smelter's emissions to the highest arsenic concentrations measured in other places in the U.S. According to EPA's estimates and ambient monitoring data, the maximum concentrations of arsenic to which people may be exposed near smelters ranges from 0.003 to 0.3 $\mu g/m^3$ and the highest annual concentrations reliably reported in areas not affected by smelters occurred in Ohio and Atlanta, Georgia, where concentrations are about 0.01 $\mu g/m^3$. The comparison indicates that arsenic concentrations in most areas are well below the predicted and measured concentrations near copper smelters.

In the Administrator's judgment, primary copper smelters are posing significant risks, but in light of the level of the estimated risks and the impacts requiring further controls, most of those risks are not unreasonable.

Public Exposure and Health Risk Estimates

Commenters on the proposed standards for high- and low-arsenic primary copper smelters expressed both general and specific concerns regarding the exposure and risk estimates for primary copper smelters. The general

comments included comments on the linear nonthreshold assumption, the 70-year residence assumption, the air quality modeling out to distances of 20 km (12 miles), and the failure to consider health effects other than lung cancer. The EPA's consideration of these general comments is discussed in Part II, Risk Management Policy and General Health Issues, of this preamble. The responses to specific comments on risk estimates for primary copper smelters are given in this section.

Two commenters who had carefully studied EPA's risk assessment results criticized the fact that the computerized exposure model positioned portions of exposed populations at points where people could not possibly live. For instance, in the Phelps Dodge-Ajo smelter analysis, people had been assigned to uninhabited areas near the smelter such as tailings ponds, slag heaps and waste dumps. The EPA is aware that the computer model may assign exposed people to unlikely places near the smelter. This results from the format of the census data. Of necessity, the census data are provided to EPA in a summarized form so that the data base will not overload computer storage capability. Instead of providing records on the location of each family dwelling, the U.S. Census Bureau gathers a number of people (up to 2,000 people) and locates this group of people at one point called a population centroid. Of course, most if not all of the people in the group do not acutally dwell at this population centroid. Therefore, the computer program, when calculating exposure, considers that groups of people do not live at a single point and, using a preselected formula that more realistically reflects the actual population distribution, assigns people to nearby points on the concentration profile grid. Generally, this approach causes the model's risk estimate for the most exposed person to increase since "spreading" out the population over a broader area increases the likelihood of people being placed nearer points of maximum concentrations. After the risk estimates are calculated, EPA staff review the computer printouts to ensure that the estimation of the risk to, and the location of, the most exposed individual is reasonable. This judgment is based on a study of small-scale U.S. Geological Survey (USGS) maps and discussions with Agency personnel who have visited the plants. For calculating annual incidence or aggregate risk for a large number of nearby people, such careful checking becomes very difficult to perform. When the Agency has attempted to make such corrections in

the modeling, the results have not significantly changed. The computer program simply assigns people in a more reasonable spot where the concentrations may be larger or smaller than at the centroid location. With larger populations, the corrections result in about equal positive and negative changes to the estimated risks and thus balance out. With smaller populations, the Agency reviews the reasonableness of the exposure results and where deemed necessary, makes corrections by hand calculations. The Administrator believes that the risk assessment techniques used as a basis for today's rulemaking produce reasonable exposure and risk estimates given all the other uncertainties that are associated with the risk assessment process.

Phelps Dodge commented that the location coordinates for the Ajo smelter that EPA presented in the background document for the proposed standard are inaccurate. In response, EPA checked its location data on a small-scale USGS map and has made the location correction (less than a kilometer shift in position). The current risk assessment is based on the new location data.

Several of the primary copper smelter companies said EPA should present a table for each smelter that provides the distribution of levels of exposure. (The EPA only showed this information for all smelters as a group, not for individual smelters.) They said that without this information, the public is not able to replicate or check the accuracy of EPA's exposure assessment. Therefore, EPA has expanded its risk assessment portion in the BID for primary copper smelters (and the other source categories as well) and has included in the docket (Docket No. A–80–40) copies of the exposure assessment computer printouts.

Two commenters criticized the appropriateness of meteorologic date EPA used in dispersion modeling. One commenter stated that EPA did not use accurate meteorological data. A representative of Phelps Dodge commented that the Tucson meteorologic data used to model Phelps-Dodge smelters in Ajo and Morenci, Arizona, were from a location over 160 km (100 miles) from these smelters, and the data are not representative of conditions at the smelters. He suggested that local meteorologic data should be used. Another commenter said the model, based on Tucson data, estimates the highest concentrations to the northwest and west northwest of the smelter. The commenter noted that meteorological data show Ajo's winds

are primarily from the the south so the highest concentrations should be directly north of the smelter. We claimed areas north of the smelter are largely uninhabited. These two commenters believed using the Tucson data caused overestimation of exposure. One also believed assumptions about atmospheric stability should be avoided, and soundings should be taken at different heights to measure stability.

ASARCO also claimed that the Tucson data were not representative of metorological conditions near its smelter at Hayden. ASARCO commented that Tucson was over 100 km (60 miles) from Hyden, and is in a broad valley; whereas Hayden is mountainous with a narrow valley, so wind patterns would be different. ASARCO also commented that the El Paso smelter is on the other side of a ridge from the meteorologic station EPA used to model that smelter, so the data are not representative. It also cautioned that meteorologic conditions at the elevation of a tall stack may be different from those at ground level. Kennecott commented that the Tucson airport was located too far from their Hayden smelter for the meteorologic data to be representative.

As discussed under the section entitled Additional Analyses, EPA made several efforts to improve the Agency's estimates of risks near primary copper smelters. However, the analysis at only three plant sites (El Paso, Douglas, Garfield) were affected by the improvements. At other primary copper smelter sites, the Agency was unable to obtain more representative meteorological data in a format that could be used by EPA's computer models. These other smelters are generally located in rather sparsely populated areas and are not near a National Weather Service station that would collect and record the necessary surface weather observations. As the commenters point out, the selected surface weather observation (meteorological data) may not be representative of the smelter area. In this case, the Agency must use the best available information to perform its analysis. Therefore, since more representative meteorological data were not available for some smelter sites, EPA tried to obtain ambient arsenic concentrations data for comparison with the modeled exposure estimates. The following discussion explains the basis of the final exposure estimates.

The commenters suggested that the estimated risks at sites where the Agency may be using unrepresentative meteorological data are overstated. When applying the more local or

representative meteorological data, EPA's experience has shown that the risk estimates may increase or decrease and because of the complexity of the dispersion and exposure models, the changes are difficult to predict in advance of completing the new analysis.

Several commenters believed the dispersion model overestimates ambient arsenic concentrations. Some commenters said EPA should have measured background arsenic present when smelters were not operating and compared this with ambient arsenic concentrations measured when the smelters were operating to determine the extent to which smelters contribute to ambient arsenic levels. These commenters and others felt EPA should base its exposure estimates on measured ambient concentrations rather than dispersion modeling results.

Some commenters presented ambient monitoring data and compared it to the dispersion model predictions in an attempt to show that the dispersion model is inaccurate. Phelps-Dodge submitted ambient arsenic concentration data obtained using a high-volume air sampler for two periods: January through April 1982 and January through April 1983. Measurements were taken at the Ajo town plaza. During the first period the Ajo smelter was operating normally. During the second period, the smelter was closed. These data were used to arrive at an estimate of 0.0014 $\mu g/m^3$ as the level of ambient arsenic concentration caused by the smelter at the plaza. Phelps-Dodge commented that EPA's model estimated maximum ambient concentrations 150 times greater, and average exposures 40 times greater than these measured concentrations.

Some commenters claimed ambient arsenic levels in Morenci are 10 percent of the levels reported by EPA in the proposed notice. ASARCO submitted quarterly concentrations of arsenic measured using ASARCO's low-volume air sampling network around El Paso and Hayden in 1982 and 1983. The commenters said the mean measured concentration at the Hayden fire station (near the town's population center) is 0.14 $\mu g/m^3$. According to ASARCO, this measurement can be multiplied by 1.67 to yield an estimate similar to that which would be obtained using a high-volume air sampler. ASARCO concluded that EPA's dispersion model estimates a concentration of about 0.417 $\mu g/m^3$ for this location, which is twice the measured concentration.

Some commenters criticized EPA's dispersion model because it does not consider terrain. They said terrain is not

level around copper smelters, in particular Phelps Dodge's Ajo smelter, ASARCO's Hayden smelter, and ASARCO's El Paso smelter. One commenter added that EPA's background document for the proposed standard states that failure of the model to consider terrain will result in underestimation of exposure in areas with uneven terrain. The commenter said this is not always the case. He said measured concentrations in Hayden were lower than modeled concentrations.

As mentioned in the section entitled Additional Analyses, EPA has made serveral changes to improve or check the exposure and risk estimates. (See Appendix C of the BID [EPA-450/3-83-010b] for a detailed presentation of the risk assessment.) In addition to significantly reducing some of the smelter's emission estimates used in the exposure model, comparisons between predicted and measured values have been made to demonstrate the exposure model's potential for estimating ambient arsenic concentrations. Because it generally does not provide a site-specific analysis that accounts for local terrain features and meteorology and because there are other sources that emit arsenic into the atmosphere, EPA expects that exposure model to both over- and underpredict measured concentrations; but, on the average, the model should slightly underpredict the measured values. As a result of a computer data base search, limited ambient arsenic data near the ASARCO-Hayden, Inspiration-Miami, Magma-San Manuel, Phelps Dodge-Ajo, Phelps Dodge-Morenci, and Phelps Dodge-Douglas sites were identified, while at the ASARCO-El Paso site, the Agency located a number of arsenic monitoring sites operated by the State Agency and ASARCO.

For El Paso, EPA's computer exposure model consistently underpredicted concentrations at 20 monitoring sites (included six company sites). At eight of these sites, the predicted concentrations were within a factor of two of the measured data and all but one of the remaining estimates were within a factor of ten of the measured data. At the one remaining site, EPA has underestimated the arsenic concentration by a factor of 40. (However, the data at this one site were collected in one year only and did not meet the air quality guidelines for calculating a representative annual average.) The amount by which EPA's exposure model underpredicted the measured concentration was higher than what EPA would consider a natural

background concentration. In an attempt to improve the correlation between predicted and measured concentrations, EPA also performed a site-specific analysis of El Paso. This site-specific analysis used on-site meteorology and considered terrain features. However, the site-specific analysis also provided predicted concentrations that were lower than the measured concentrations. There are three possible explanations for this underprediction. First, as the commenters have suggested, there is some fraction of the arsenic concentration that comes from other sources, such as naturally occurring arsenic in the local soil. Second, studies have shown that pollution from past plant emissions has increased pollutant concentrations in the surrounding soil and this condition allows the reentrainment of arsenic into the atmosphere. Third, the Agency may have underestimated emissions from the plant. Some combination of reentrainment of local soil and underestimation of the plant's emissions is the suspected but undocumented cause of the underpredictions.

At the ASARCO-Hayden and Phelps Dodge-Douglas primary copper smelter sites, EPA's analysis indicated that the exposure model both over- and underpredicted the measured concentrations at those monitoring sites where meaningful comparisons could be made between predicted and measured concentrations. However, at the State-operated monitors near the smelters, the calculated long-term concentrations were based often on individual measurements that were below the minimum detectable level (MDL) of the analysis technique. Rather than record zeros, EPA assumed that the actual concentration is one-half the MDL and used that value in the analysis. Thus, when there are a number of measured concentrations below the MDL in the data base, the calculated long-term concentration become more uncertain. When considering this uncertainty of the available ambient data at the Phelps Dodge-Douglas and the ASARCO-Hayden sites, it appeared that on balance the exposure model was making reasonable if not somewhat of an overprediction of the ambient concentrations.

At those remaining primary copper smelter sites (Inspiration-Miami, Phelps Dodge-Ajo, Phelps Dodge-Morenic, and Magma-San Manuel), much of the ambient data showed concentrations below the MDL and at best, provided only a qualitative comparison to confirm the model's predicted concentrations. At the Phelps Dodge-Douglas site, EPA

performed an additional site-specific analysis that was similar to that performed at the ASARCO-El Paso site. Although the Agency believes that the site-specific analysis will generally produce at any site the best estimate of ambient concentrations that occur as a result of a source's emissions, EPA's human exposure model provides ambient concentration estimates that are very similar to the site-specific analysis results and the available ambient data. (See Appendix C of the BID of a detailed discussion of the modelling.)

There were several primary copper smelter sites for which no nearby ambient data could be found. When considering the results of the model confirmation efforts described above, the Administrator believes that the ambient concentration estimates as generated by HEM are reasonable and represent the best estimates that can be provided within the limited resources available.

Several commenters said that some populations are exposed to emissions from two or more smelters. They reasoned that since the model does not consider the combined effects of the emissions from plants with overlapping emissions, exposure and risk are underestimated. This possibility, as identified by the commenters, could occur in the Hayden area since two primary cooper smelters are located in this town. The EPA agrees that in this case, there is a potential for the risk assessment to underestimate the maximum individual risk to the population exposed to both smelter's emissions. Because the ASARCO-Hayden facility emissions dominate the concentrations, the additional risk (concentration) from Kennecott-Hayden has been shown to be small, about 16 percent of the ASARCO-Hayden maximum individual risk. The commenter has made a valid point, but the maximum individual risk estimates that account for the overlapping of the ambient concentrations are essentially the same as the maximum individual risk based on only concentrations resulting from the ASARCO-Hayden emissions. To confirm this result, EPA modified the exposure model and performed as assessment that considered the combination of the two plants. The results substantiated the earlier estimates. For the annual incidence, the combined smelter exposure assessment indicated that the town of Hayden's annual incidence is simply the sum of the annual incidence associated with each plant's operations.

Some commenters said that primary cooper smelter risks were overestimated because EPA has applied a number of conservative assumptions that lead to worst case risk estimates. The EPA agrees with the commenters that some of the Agency's assumptions are conservative (e.g., the exposed people remain at their residences for a lifetime). However, in several cases, the assumptions are generally not conservative. For example, the assumption of flat terrain may result in under-prediction of ambient concentrations for those located in areas with local terrain features elevated above the source.

Upon review of the assumptions and their associated uncertainties, which are discussed in Part II of this notice, the Agency cannot demonstrate that the analysis provides an overestimate, a best estimate, or an underestimate of actual risks. Although not able to quantify all the uncertainties, the Agency believes that its risk assessment

provides reasonable if not somewhat conservative estimates and is the best estimate that the Agency can reasonable make. A number of commenters have made suggestions for improving the risk estimates, as mentioned in earlier sections. The EPA has followed their suggestions where feasible (e.g, use of nearby ambient data to confirm the exposure model's prediction).

Two smelter companies made their own risk calculations, which they believed to be more accurate than those EPA presented in the BID for the proposed standard (EPA 450/3–83–010a). Their results are summarized in Table III–4. At two sites (Hayden and McGill) EPA's estimated risks are every similar to those estimated by the company. At the two remaining sites (Garfield and Ajo), there was substantially less agreement. The footnotes provide possible reasons for the differences in results. Since the standard does not regulate any of these four smelters, the companies' lower risk estimates have no effect on the Administrator's decisions.

smelting operations on both sides of the border. Arsenic emissions from the smelters may be considered by the technical study group.

Control Technology

Numerical emission limit. The American Lung Association (ALA) and NRDC commented that the proposed emission limit of 11.6 mg/dscm (0.005 gr/dscf) for the control device treating converter secondary emissions or smelting furnace tapping emissions does not reflect the control levels achievable by best available technology. Hence, the commenters thought the standard would allow application of less than best systems. The NRDC further commented that the emission limit should be established considering the best control efficiencies achieved by well-designed and -operated systems, not the worst efficiencies, and that EPA had not explained why the emission limit was based on the highest emission rate rather than the average. In contrast to NRDC's and ALA's position, ASARCO and Phelps Dodge argued that the emission rate had not been demonstrated to be achievable and the standard should be 50 mg/dscm (0.022 gr/dscf) to allow use of existing electrostatic precipitators and fabric filter collectors. ASARCO cited test data for other smelters and a retest of the El Paso converter building fabric filter collector to support its argument. The average outlet particulate matter concentration for these tests varied from 0.2 to 126 mg/dscm (0.001 to 0.05 gr/dscf). Phelps Dodge also cited EPA and company emission test data showing average particulate matter concentrations greater than 11.6 mg/dscm.

The Administrator does not agree with the commenters that the standards are either too lenient or so restrictive as to be unachievable. As explained at the time of proposal, to select the emission limit, EPA reviewed the particulate matter source test results for the control devices judged to represent best technology. The available source test data for systems used to treat converter secondary emissions consisted of one series of three test runs conducted on the fabric filter collector treating emissions from the El Paso converter building. The particulate matter emissions from the control device outlet ranged from 1.1 to 11.6 mg/dscm. The average value for the three runs was 5.1 mg/dscm (0.002 gr/dscf). The EPA believes that because an emission level of 11.6 mg/dscm (0.005 gr/dscf) is not an unexpected result during an emission test of this technology, this is the

TABLE III–4—COMPARISON OF RISK ESTIMATES AS MADE BY THE SMELTER COMPANIES AND THE EPA

Smelter	Baseline—maximum individual lifetime risk		Baseline—annual incidence individual risk (cases/yr)	
	Company	EPA	Company	EPA
Phelp Dodge-Ajo (ᵃ)	0–6×10⁻⁶	2×10⁻⁴	0–0.00044	0.0045
Kennecott-Utah (ᵇ)	0.8–5×10⁻⁶	6×10⁻⁵	0.0006–0.003	0.14
Kennecott-Hayden	4.5–27×10⁻⁶	3×10⁻⁴	0.0017–0.025	0.016
Kennecott-McGill	1.7–13×10⁻⁵	4×10⁻⁴	0.005–0.1	0.006

(a) Phelps Dodge's analysis was based on limited sampling data collected over 3 months at one site that was located approximately 1 km from the plant. The EPA's analysis was based on air dispersion models that estimate long-term (over several years) concentrations.

(b) The EPA's risk analysis considered population exposure out to 50 km, while Kennecott's analysis went out to 20 km. There was a significant number of people that lived between 20 and 50 km of the plant. This factor may account for the difference in EPA's and Kennecott's estimates of annual incidence.

Consideration of Transboundary Air Pollution. Two commenters noted that EPA's risk assessment did not consider any Mexican populations that are being exposed to emissions from U.S. primary copper smelters located near the Mexican border. Also, commenters noted that EPA's analysis did not consider U.S. public exposure to emissions from the Mexican primary copper smelters located near the border. In regard to the first comment, the Administrator has considered the potential exposure to Mexican citizens from the U.S. smelters (El Paso and Douglas) in his decisionmaking. At the present time, the Agency does not have any Mexican census data in a form similar to that supplied by the U.S. Census Bureau, so the Agency was unable to perform its standard exposure analysis to evaluate exposures in Mexico. Based on the very limited data available, the Agency did attempt a

crude estimate of Mexican exposure near the Douglas smelter and found, based on this initial calculation, that exposure was small enough so as to not significantly change the risk assessment results presented in this notice. Similar estimation techniques indicated that the Mexican population exposure due to emissions from the ASARCO-El Paso smelter is more substantial, but not great enough to justify any tightening of the standard.

In regard to U.S. public exposure to emissions from Mexican smelters, the Administrator notes that he lacks authority to regulate these emissions. However, the United States and Mexico have entered into an "Agreement on the Environment in the Border Area" (signed August 14, 1983; entered into force February 16, 1984). Under this agreement, delegations from the two countries have formed a technical study group on air quality that will deal with

appropriate level for the standard which is not to be exceeded. It is EPA's judgment that the 11.6 mg/dscm (0.005 gr/dscf) emission limit requires a well-designed, -operated, and -maintained control device and does not allow use of less effective control devices.

The level at which a standard should be set is a matter of judgment. As discussed above, the numerical emission limit for converter secondary emissions is based on the test results for only one control device. Because of the limited amount of data, it is EPA's judgment that a standard reflecting the lowest level or even the average level measured would not allow any margin for differences among facilities and control devices or for sampling and analytical errors in measurement of emissions. To provide this margin, the standard is based on the highest outlet concentration that was measured.

The Administrator considered the data and arguments presented by ASARCO and Phelps Dodge and concluded that it would not be appropriate to establish an emission limit of 50 mg/dscm (0.022 gr/dscf) as suggested. In reaching this conclusion, the data base for the standard, the data cited by both companies, and data for other source categories which have emissions comparable to converter secondary emissions were reviewed. This review is summarized here and presented in the BID for the promulgated standard (EPA-450/3-83-010b). Emission test data for the ASARCO-Tacoma smelter and other facilities show that uncontrolled converter secondary emissions contain less than 50 mg/dscm (0.022 gr/dscf) particulate matter. Thus, an emission limit of 50 mg/dscm (0.022 gr/dscf) would likely require no control of converter secondary emissions.

Review of the test data submitted by ASARCO and cited by Phelps Dodge showed that the data do not demonstrate that the proposed emission limit is unachievable. Specifically, with the exception of the test conducted on the El Paso converter building control device, the data were for emission streams which are not comparable to converter secondary emissions (e.g., higher inlet concentrations and significantly different particle size distributions) and for control devices with different design specifications. Therefore, the performance of these control devices is not considered to be indicative of the expected performance of a well-designed and -operated best system of emission reduction controlling converter secondary emissions. ASARCO's August 1983 test of the El

Paso converter building fabric filter collector also does not demonstrate the unachievability of the emission limit. The EPA's review of this test report found that the condition of the control device was not reported. In addition, the concentration measured at the outlet of the control device exceeded the concentration measured at the inlet during EPA's test program in 1978. Combined, all of these factors suggest that the system tested by ASARCO in 1983 differed significantly from the system tested by EPA in 1978, and that at the time of ASARCO's tests the control system probably was not properly maintained or operated.

The EPA believes that the emission limit of 11.6 mg/dscm (0.005 gr/dscf) is further demonstrated to be achievable by the test data available from other source categories which have emissions similar to converter secondary emissions and use comparable control devices. Electric arc furnaces (EAF's) in the steel industry have particulate emissions with size distributions and concentrations similar to those of converter secondary emissions. Emission test data for well-controlled EAF's show that emission rates of less than 11.6 mg/dscm (0.005 gr/dscf) are consistently achieved (EPA-450/3-82-002a). Consequently, EPA has established an emission of 12 mg/dscm (0.0052 gr/dscf) in the new source performance standard for EAF's in the steel industry.

An additional ASARCO comment on the achievability of the 11 mg/dscm (0.005 gr/dscf) standard for converter secondary emissions was that it is invalid to argue that the standard is achievable merely because the concentration of the inlet fugitive emission gas stream is low since there is no direct relationship between the inlet and outlet concentrations of arsenic-containing particulate matter. To support this comment, ASARCO cited emission data for the arsenic plant fabric filter collector at the Tacoma smelter that seemed to show that the highest outlet concentrations were associated with the lowest inlet concentrations. The Administrator considers the low inlet concentration to be relevant to selection of the emission limit for several reasons. Inlet concentration is considered along with desired emission rate and other gas stream parameters in the design of a control device. Although particulate control devices do not tend to operate with constant efficiency over the entire design range of conditions, they will achieve a minimum collection efficiency when operated within the design range

of conditions. Vendor guarantees of performance for control devices do include consideration of the expected minimum efficiency over the expected range of operating conditions. ASARCO's argument regarding the lack of any relationship between inlet and outlet arsenic concentrations is flawed. The data cited included one inlet test that was reported to be biased low owing to loss of part of the sample during analysis. When this test series is excluded from the data set, the remaining three inlet tests only vary by about 20 percent. The measured collection efficiencies varied from 99.95 to 99.97 percent. Thus, the data only show small random variations and do not support ASARCO's argument.

Converter work practices. Several comments were received from ASARCO and Phelps Dodge on the proposed converter work practices. (No substantive comments on the converter work practices were received from other commenters.) ASARCO commented that, since a rolled-out converter never ceases fuming, the wording of proposed § 61.182(a)(2)(ii)(B) should be changed to require the converter to be held in an idle position until fuming is minimized. The EPA agrees with the commenter that converters do not cease fuming entirely. The intent of this requirement was not to require zero fuming before skimming but to require sufficient idling of the converter to minimize the quantity of secondary emissions generated during skimming. Consequently, the language of this requirement has been revised as suggested (now § 61.172(b)(2)(i)(B)).

ASARCO and Phelps Dodge also commented that the proposed requirement in § 60.172(a)(2)(ii)(C) to position the ladle as close to the converter as possible to minimize the drop distance would reduce the effectiveness of the air curtain, decrease productivity, and increase safety hazards. The commenters hypothesized that the hood capture efficiency would be adversely affected because holding the ladle off the ground will place the crane cable in the air curtain jet during the skim. ASARCO and Phelps Dodge argued that productivity would be decreased because: (1) coordination of smelter operations serviced by the crane is difficult due to the unpredictable nature of smelting; (2) the crane would not be available to perform other duties and it would block the converter aisle, thus preventing part of the aisle from being serviced by other cranes; and (3) at most smelters only one crane is available during the daily maintenance period, thus the requirement would

hinder production during these periods. ASARCO argued that the requirement would create safety hazards because the secondary hood channels the heat toward the crane aisle, increasing the heat burden on the crane block, cables, and cab. As support for this comment, ASARCO stated that it has had to install additional heat shields on the crane cab at Tacoma and to replace wiring with special heat-resistant materials.

The proposed requirements are based on EPA personnel's observations of converter operations at the ASARCO-Tacoma smelter. Over a 1-week period, EPA personnel observed the operation of the prototype air curtain secondary hood during all converter operating modes. Work practices used by crane and converter operators varied significantly from operator to operator. The work practices observed included the proposed practice of holding the ladle close to the converter and slow pouring rates during skimming as well as placing the ladle on the ground and rapid skimming rates. The EPA personnel observed that better capture efficiencies were achieved when the ladle was held close to the converter than when the ladle was placed on the ground, and better capture was obtained with slow skimming of the converter than with rapid skimming. Thus, EPA personnel did not observe that the crane cables adversely affected the secondary hood's capture efficiency. The EPA personnel, however, observed that the crane block did affect the capture of emissions when it was placed in the air curtain path. To achieve effective emission capture, the crane block must be placed above or below the air curtain during skimming, and the final regulation requires this.

The EPA reviewed the comments on the effects of the proposed ladle-holding requirements on productivity considering the range of typical converter operations at copper smelters. A converter generally completes a cycle in 8 to 24 hours, with slag blowing comprising 70 to 75 percent of the cycle. The remainder of the cycle is spent in charging and skimming operations, and holding due to normal process fluctuations within a smelter. At the end of each slag blowing period, slag is skimmed off the bath and returned to the reverberatory furnace. Typically, the ladle is filled 4 or 5 times during each slag skimming which lasts less than 30 minutes. Except for skimming into the first ladle (which may be done when the crane is not in the area), the crane is typically committed to skimming a particular converter and is not available for other activities regardless of the

ladle-holding practice used. Thus, it is EPA's conclusion that the requirement that the ladle be held close to the converter during skimming could at worst decrease productivity only slightly.

The EPA reviewed the comments on the safety hazard presented by the proposed work practices considering available information on the practices. Basically, the proposed practices were observed in operation at the ASARCO-Tacoma smelter and appeared to be routine operating procedure for some crane operators. The question of safety hazards presented by the practice was also discussed with the USWA industrial hygienist. It was the industrial hygienist's impression from talking with the local union that in the past some crane operators at the ASARCO-Tacoma smelter routinely held the ladle close to the converter. Consequently, EPA concluded that, in spite of these comments, ASARCO has not judged the practice to be sufficiently dangerous to ban its use. The EPA also considered ASARCO's remarks on the potential hazard of additional heat stress applied to the crane block, cables, and cab. Important considerations in the assessment of any additional heat stress from the requirement were (1) the fact the requirements reflect ASARCO's operating practice at one smelter and (2) the fact that to the extent that a company concludes that the extra heat burden may affect crane cables and blocks, it appears safety can be assured by increasing the frequency of inspection of crane cables and upgrading the maintenance program for the cranes.

Moreover, it should be noted that Section 112(e)(3) allows use of alternative equipment or operation practices upon demonstration that equivalent capture efficiency is achieved. The addition of doors to the air curtain hood is one specific example of equipment which would preclude the need to hold the ladle close to the converter.

ASARCO and Phelps Dodge also commented that EPA has not estimated the extent to which any of the proposed work practices would reduce emissions and has not considered that some smelter feed causes more fuming than other feed. Hence, fuming will vary from time to time. (However, the commenters did not argue that this variation in fuming makes the standard unachievable.) The EPA's assessment of the effect of work practices on emission reduction consisted of evaluation of the effect on capture efficiency of the secondary hood. During the test program

to evaluate the performance of the prototype hood, two visible emission observers usually evaluated the hood's capture effectiveness. The observations are presented in "Evaluation of an Air Curtain Hooding System for a Primary Copper Converter" (A-80-40/IV-A-4 and IV-A-5) and are summarized in the BID for the proposed standard (EPA 450/3-83-010a). The visual emission observations revealed that converter and crane operating practices can introduce significant variability in overall hood capture efficiency and that careful operations could minimize fume "spillage" and provide capture efficiencies of 90 percent or greater. Specifically, it was observed that hood capture efficiency increased considerably (more than 90 percent) during skimming operations when the crane operator held the ladle next to the converter while the converter was slowly rotated to the discharge position. In contrast, when the ladle was placed on the ground during skimming operations and the skimming rate was rapid, capture efficiencies were quite variable (ranging from 50 to 95 percent). It was also observed that during matte charging, capture effectiveness was improved if the crane was withdrawn slowly from the confines of the secondary hood. Thus, EPA concluded that the converter work practices did affect hood capture efficiencies and emissions escaping capture by the hood. When the recommended practices are used, it is estimated that hood capture efficiencies of 90 percent and greater are achieved, thus reducing converter secondary emissions.

The EPA recognizes that some smelter feed materials cause more fuming than other feed materials. For example, charging of dirty scrap (which contains essentially no arsenic) has been observed generally to overwhelm the secondary hood. In contrast, EPA does not expect that variations in matte or slag composition should seriously affect capture efficiencies achieved by the air curtain secondary hood. Consequently, for the requirements being established under this standard, this variation in fuming could at most affect the time that a converter must be held in an idle position but it does not affect the requirement to maximize emission capture. With a properly designed and operated secondary air curtain hood, this variation in fuming should not result in significant variations in secondary emission rates.

ASARCO and Phelps Dodge also responded to EPA's request in the preamble to the proposed standards (48 FR 33134) for comment on establishment

of minimum time periods for some of the work practices. These companies recommended that minimum time periods for converter work practices not be adopted because such time periods are unwarranted and would necessarily be arbitrary. ASARCO and Phelps Dodge argued: (1) That the converter and crane operators should be allowed discretion to determine the best methods to ensure capture of emissions, and (2) that smelter owners have ample incentives to operate air curtain secondary hoods in a reasonable manner consistent with maintaining production. The incentives cited were that proper uses would aid in achieving compliance with OSHA standards and in controlling SO_2 fugitive emissions.

Time periods for converter work practices are not included in the regulation being promulgated today. However, this does not preclude the Administrator from including time periods in any future amendment to the to the regulation establishing equivalent work practices, as provided under § 61.12(d). Whether or not the work practices for a facility specify minimum time periods will depend on the evaluation of the work practices and the Administrator's judgment of the need for such requirements. The Administrator will propose preliminary determinations of equivalent work practices in the **Federal Register**. During the public comment period, the company management can submit information on the adverse effects of time periods or any other requirements the Administrator considers necessary to achieve equivalent emission capture. As with the safety question discussed previously, the option of installing air curtain secondary hoods that entirely contain the fugitive emissions is available to copper smelting companies should they determine that practices necessary to minimize emissions interfere with production.

Need for additional controls. The USWA and NRDC commented that EPA's most important task is the identification of additional control measures. The USWA thought that the standard should provide for continuing evaluation of arsenic emissions from all sources in copper smelters. Similarly, the State of New York thought that additional control measures should be required. In particular, the State of New York objected to EPA's proposal to allow many low-arsenic smelters to continue using existing controls, instead of requiring the best technology available. In contrast, ASARCO argued that no emission controls beyond the secondary hoods and existing fugitive

control programs should be imposed in the final standard. The EPA agrees with the commenters who argued that EPA should identify all additional control measures that will help reduce inorganic arsenic emissions and exposures. For this reason in the development of the standard, EPA assessed the control measures used, the emission sources, and the feasibility of achieving any additional emission reductions. The final standard includes those control measures that EPA believes are technically feasible and are likely to result in a reduction in risks that is proportionate to the cost. In deciding which emission sources should be regulated, EPA considered several factors. The principal consideration was the emission reduction achievable and the remaining public exposure to inorganic arsenic that will occur after application of controls. Other factors which were considered included the estimated health risks; the economic impacts of the additional control measures, including the likelihood of closure; and the costs of these measures relative to the amount of risk reduction achieved. Thus, in consideration of possible additional control measures for low-arsenic smelters, EPA examined the feasibility of the measures, the associated emission reduction and expected reduction in health risks, and the costs to implement controls. These analyses showed that further process and fugitive emission controls would not be reasonable in light of the small emission and risk reduction achievable and the high costs of the controls. Therefore, it is the Administrator's judgment that the standard being addopted today will reduce inorganic arsenic emissions and hence risks to the practical minimum and that additional measures are not warranted.

As part of their arguments on the need for additional control, NRDC disagreed with the approach followed by EPA at proposal to evaluate gas cooling as a control option for copper smelter process emissions. The two main points of disagreement are: (1) EPA's assumption that 121 °C (250 °F) is a reasonable lower limit for gas cooling because of potential corrosion problems; and (2) EPA's use of vapor pressure data in predicting potential inorganic arsenic emission reduction achievable with gas cooling. The NRDC suggested that EPA thoroughly examine the disagreement between emission test data and theory, and that EPA reconsider the benefits of gas cooling as a control option. The State of New Mexico also expressed concerns regarding EPA's analysis of the benefits of cooling and recommended

that EPA conduct a more thorough analysis of controls for process emissions.

At proposal, EPA used arsenolite (As_4O_6) saturation concentrations to predict collectability of arsenic, although it was recognized that other factors, such as the presence of pre-existing nuclei in the gas stream, other forms of arsenic, and residence time at lower temperatures, can also affect condensation. Saturation concentrations were used because analysis of available data showed the two most important factors were operating temperature of the control device and the arsenic concentration in the gas stream. Specifically, the contention that temperature has a significant effect on the collectability of inorganic arsenic is supported by EPA test data, presented in the proposal BID, showing the inorganic arsenic collection efficiencies for three collection devices used on process streams at primary copper smelters. Emission test data for two control devices (one electrostatic precipitator [ESP] and one baghouse) operated at about 100 °C (about 212 °F) showed the devices achieved average arsenic collection effiences of about 98 and 99 percent. In contrast, an ESP operated at 327 °C (620 °F) only achieved about 30% arsenic collection efficiency. The concentrations of inorganic arsenic measured in the inlet streams to these three control devices were comparable. Thus, EPA analyzed the potential inorganic arsenic emisisons reduction achievable if gas stream cooling in conjunction with an efficient particulate control device were utilized to control process streams at several smelters that do not currently use either this method of control or an acid plant to control process emission streams. Cooling of the gas stream to 121 °C (250 °F) was assumed in the analysis because it was believed to represent a reasonable estimate of operating temperatures for primary copper smelters' process gas streams, although it was also recognized that acid dew points may be higher or lower than 121 °C (250 °F) at some facilities. An additional consideration was that below 125 °C (257 °F) saturation concentrations are very small and further cooling would achieve very little additional emission reduction. Since no significant emission reductions were expected, EPA did not evaluate the feasibility and costs of process controls for these smelters.

Following proposal, because of comments on the approach used, EPA assessed the maximum potential risk reduction achievable by control of these emission sources. For the second

assessment, the revised smelter arsenic balances were used to predict arsenic emissions from the process streams, and it was assumed that 100 percent of the arsenic would be controlled (i.e., the risk was reduced to zero). The EPA estimated the health risks associated with process emissions at all primary copper smelters where gas cooling could potentially be applied to reduce inorganic arsenic emissions from one or more process streams. The estimates were prepared using HEM. The smelters for which these risk estimates were prepared include the smelters for which gas cooling was evaluated as a control option at proposal plus Phelps Dodge-Ajo. The estimates of annual incidence associated with current process emissions at these smelters that could potentially be reduced if gas cooling were used are shown in Table III–5.

TABLE III–5.—ESTIMATED ANNUAL INCIDENCE ASSOCIATED WITH PROCESS EMISSIONS AT SMELTERS WHERE GAS COOLING COULD POTENTIALLY BE APPLIED AS A CONTROL OPTION

Smelter	Process stream(s)	Annual incidence (cases/yr)
Kennecott-Hayden	Smelting Furnaces	0.0028
Kennecott-McGill	Smelting Furnaces and Converters.	0.0008
Magma-San Manuel	Smelting Furnaces	0.0013
Phelps Dodge-Ajo	Smelting Furnaces	0.0034
Phelps Dodge-Douglas.	Roaster, Smelting Furnaces and Converters.	0.0036
Copper Range-White Pine.	Smelting Furnaces	0.0001

The EPA has also estimated preliminary annual costs associated with process stream gas cooling. For the purpose of these estimates, it was assumed that gas stream cooling to 121°C (250°F) or below could be achieved without requiring that special measures be taken to prevent corrosion problems. The annualized cost estimates are shown in Table III–6. It is important to note that these costs are approximate and may not accurately reflect the actual cost of applying gas cooling. However, EPA believes these estimates do provide a general indication of the relative magnitude of the costs of applying gas cooling as a control option.

TABLE III–6.—Preliminary Estimate of Costs to Apply Gas Cooling as a Control Option*

Smelter	Process stream(s)	Annualized cost
Kennecott-Hayden	Smelting Furnaces	$ 1,200,000
Kennecott-McGill	Smelting Furnaces and Converters.	ᵇ11,800,000
Magma-San Manuel	Smelting Furnaces	4,700,000
Phelps Dodge-Ajo	Smelting Furnaces	1,600,000

TABLE III–6.—Preliminary Estimate of Costs to Apply Gas Cooling as a Control Optionᵃ—Continued

Smelter	Process stream(s)	Annualized cost
Phelps Dodge-Douglas.	Roaster, Smelting Furnaces and Converters.	10,300,000
Copper Range-White Pine.	Smelting Furnaces and Converters.	ᶜ2,500,000

ᵃ Annualized costs include cost of reheating gas stream to stream temperature before cooling and, except as noted, it is assumed that the existing particulate control device would not have to be replaced.
ᵇ Includes cost of new particulate control device for the converter stream.
ᶜ Includes cost of new particulate control device for the smelting furnace stream.

As can be seen from Table III–5, the annual incidence associated with the process emission streams to which gas cooling could potentially be applied is very low in all cases, with 0.0036 incidence per year being the highest. Thus, even if gas cooling could reduce process stream emissions by 100 percent, the reduction in risk would be very small. In addition, the cost of achieving this small reduction in risk could be significant, as shown in Table III–6. These considerations led EPA to conclude that even if gas cooling to 121°C (250°F) or below were a feasible control option for process emissions at these smelters, the costs would be greatly disproportionate to the reduction in risk that could be achieved, and therefore gas cooling should not be required.

The State of New Mexico commented that if EPA uses emission estimates for ASARCO-El Paso that reflect improvement in the capture efficiency of the building evacuation system to 90 percent, EPA must include provisions in the regulation requiring maintenance of 90 percent capture efficiency by the building evacuation system and provisions to verify that the system is being properly operated and maintained.

In response to this comment, EPA reviewed its analysis of emissions from and operations of the converter building at the ASARCO-El Paso smelter to ensure that decisions and analyses were made based on the best information available. The reassessment included: (1) An on-site inspection of the converter building ventilation system; and (2) discussions with ASARCO regarding anticipated future operation of the system after installation of the converter secondary hoods and the impact of the computerized gas management system on fugitive emissions. The on-site inspection showed that the converter building evacuation system is achieving about 90 percent capture efficiency and EPA believes that if the existing total flow

rate from the converter building is maintained after installation of the converter secondary hoods the capture efficiency of the building evacuation system should not be diminished. The EPA also recognizes that the converter secondary hoods could, by altering the dispersion of emissions and gas flow within the building, affect the performance of the building evacuation system. Since the design of the ventilation system incorporating the converter secondary hoods has not been established yet, EPA cannot determine what the effects will be and whether it is necessary to require maintenance of 90 percent capture efficiency in the converter building. The EPA also cannot determine whether it is necessary or reasonable to maintain 90 percent capture efficiency owing to uncertainties in the emission factor for the anode furnace and the converter fugitive emission factor and their effect on estimates of fugitive emissions from the building. To determine the necessary level of control, it would be necessary to monitor emissions, air flows, and system changes after installation of the converter secondary hoods.

From discussions with ASARCO and review of applicable State and SIP requirements, EPA concluded that ASARCO will continue to maintain the converter building in its present condition if this can be done without increasing worker exposures and creating unacceptably high temperatures in the work area. While it appears likely that ASARCO will maintain a relatively closed building, neither EPA nor ASARCO can determine with certainty whether this will be technically feasible. Therefore, the standard does not include provisions requiring maintenance of 90 percent capture efficiency in the converter building or maintenance of the measures taken by ASARCO to seal the building. The standard does, however, require ASARCO, or the owner or operator of any other facility that might be required to install converter secondary hoods, to report any significant changes in the operation of the emission control system capturing and controlling emissions from converter operations. Examples of changes that must be reported are reductions in air flow through the capture system of more than 20 percent and an increase in the area of the converter building that is open to the atmosphere. Because changes could affect the capture efficiency achieved by the secondary hoods and the building evacuation system, EPA will evaluate these if they occur.

Standard for New Smelters. The State of New Mexico commented that EPA has failed to determine control requirements for new smelters that will provide an ample margin of safety for protection of public health. The State of New Mexico thought that a thorough review by EPA would result in additional control requirements beyond those proposed for existing smelters. The EPA did not develop a separate standard for new smelters because it is EPA's best projections that no new primary copper smelters will be built during the next 5 years. To determine the applicable control measures and the impacts and benefits of those measures, it is necessary to rely on reasonable projections of possible new construction, including projections of process technologies and associated emission rates which would be associated with new plants. Consequently, EPA's analysis at proposal was based on application of control to the existing domestic primary copper smelters. Should any new primary copper smelters be constructed and the converter arsenic feed rate is above the cutoff, the standard would require control of converter secondary emissions. However, as is evident throughout this rulemaking, the need for and applicability of controls depends to a large degree on knowledge of specific processes and feed materials. Thus, EPA believes that it is impractical to attempt to project emission control requirements for technology that would be installed more than 5 years from now.

Costs and Economic Impact

Comments were received on the estimated costs to control converter secondary emissions and on the economic analysis of the affordability of arsenic controls for low-arsenic copper smelters presented in the July 20, 1983, notice of proposal. Owing to the comments received on the initial cost estimates, EPA revised its estimates of control costs and published estimates for comment in a September 20, 1984, Federal Register notice (49 FR 36877). Comments on the revised estimates were received from the three copper companies that had submitted comments on the initial cost estimates.

In comments on the initial cost estimates, ASARCO, Kennecott, and Phelps Dodge commented that estimated costs for six of their smelters were understated in the proposal and based on faulty assumptions. The companies submitted their estimates of emission control costs for these smelters. In several cases, EPA obtained from the companies additional information on their cost estimates. The EPA reviewed

the cost information supplied by the companies and analyzed the differences between these estimates and those made by EPA at proposal. Factors contributing to the cost differences included: (1) Site-specific factors, requiring modification of the converter secondary hood design; (2) installation of new ductwork and fans rather than reuse of existing equipment; (3) different assumptions regarding the control systems needed; and (4) different assumptions for the annualized cost capital recovery factor (i.e., the interest rate and equipment service life). For each case where the company provided additional cost information, EPA reviewed the reasonableness of the companies' assumptions and reevaluated the control costs.

Comments on the revised cost estimates were received from ASARCO, Kennecott, and Phelps Dodge. These comments consisted of comments on EPA's annualized cost factor (i.e., interest rate and equipment service life) as well as comments on EPA's consideration of costs at the specific smelters. The EPA's consideration of the comments on the cost estimates and the economic impact assessments is discussed under three areas: (1) General comments on cost estimating assumptions; (2) comments on cost estimates for specific smelters; and (3) comments on economic impacts.

General Comments on Cost Estimating Assumptions. All three copper companies commented that EPA's annualized cost factor should be based on 15 percent interest and 15-year equipment life. The commenters argued that 15 percent interest represented real interest rates that would be incurred today and that the 15-year equipment life is more realistic for the conditions under which the hoods would be operated.

The EPA's assumption at proposal was a 10 percent interest rate, and 20-year service life represented a reasonable estimate of costs that would be incurred with the installation of converter secondary controls. The annualized cost estimates are developed assuming dollars of constant value and hence, at the 5 to 6 percent inflation rate experienced at the time of proposal, the 10 percent interest rate represents a constant dollar equivalent of the nominal 15 percent interest rate. Thus, EPA believes that the interest rate assumed is close to the rate suggested by the commenters. The use of the 10 percent interest is further supported by the interest rate being experienced with tax-exempt municipal revenue bond issues, which most firms use to finance

pollution control equipment. In general, current interest rates on tax-exempt bonds are below 10 percent. For example, ASARCO, Phelps Dodge, Magma, and Kennecott have financed air pollution controls at interest rates ranging from 3.75 to 10.8 percent. Therefore, EPA believes that a 10 percent interest rate represents a realistic assessment of capital cost of financing air pollution control equipment. The cost analysis an equipment service life of 20 years because that is the service life generally assumed for sheet metal and this life had been used by ASARCO to amortize the cost of installation of launder covers at Tacoma. The Agency recognizes that the service life of the equipment to be used in cost analysis is somewhat a matter of judgment. However, since changing the interest rate from 10 to 15 percent and equipment life from 20 to 15 years will increase the annualized cost by only 18 to 27 percent, these differences in the cost do not affect any decisions on the standard.

ASARCO commented that EPA's use of incremental cost makes the proposed standard appear to be most costly for those companies that have installed the fewest controls in the past and penalizes those that have installed controls. To consider prior installation of controls, ASARCO thought that the cost of operating or scrapping existing equipment should be attributed to the standard. The Agency does not agree that the method of cost analysis penalizes those companies that have installed controls. The assessment of whether to require further emission control at a facility considers the effectiveness of existing control systems in the assessment of present risks and the risk reductions achievable as well as the cost to achieve that emission reduction (cost effectiveness). Thus, prior installation of control systems is explicitly considered in the assessment of the need for additional emission reduction and the approach does not penalize those companies that have previously installed emission control systems.

Regarding ASARCO's second point, the Agency recognizes that some of the cited costs (i.e., operating or scrapping of existing equipment) may be legitimate expense, however, EPA did not consider them in this analysis for several reasons. The EPA believes that to consider these costs it would be necessary for EPA to evaluate the validity of the claimed expenses in terms of justification and assigned value. To conduct such an analysis would result in further delays in

issuance of this rulemaking. Furthermore, there is no single accounting procedures which is universally used for depreciating equipment. Thus, consideration of costs to scrap equipment is also subject to dispute. Consequently, EPA did not evaluate these costs for the smelters. A prime consideration in this decision was the fact that consideration of these costs would not affect the decision whether to regulate the specific smelters.

Comments on Smelter Specific Cost Estimates. As previously indicated, EPA reviewed each comment on the control cost estimates and where determined to be appropriate reevaluated the control cost estimate. The final cost estimates are presented in Tables III-1 and III-2, along with the final estimates of emission reduction achievable by the best emission controls. The bases of the revisions to the cost estimates for each smelter are summarized below and described in detail in the BID for the promulgated standard (EPA-450/3-83-010b).

ASARCO-El Paso: In comments on EPA's initial cost estimate, ASARCO submitted estimated capital costs for installation of air curtain secondary hoods that were approximately 35 percent higher than EPA's estimate at proposal. The EPA's review of the detailed breakdown of the cost estimate showed that ASARCO's estimate was higher primarily because it included costs for demolition and installation of new ductwork. Since the cost differences reflected slight differences in engineering judgment and were based on sound design and engineering practices, ASARCO's capital cost estimate was used in the reanalysis of annualized control cost. In comments on EPA's revised cost estimate of $1.8 million, ASARCO stated that changes in the design of the ventilation system for the converter secondary hoods have increased the estimated costs by approximately 90 percent. The EPA did not further revise the capital cost estimates from $1.8 million to $3.5 million to reflect these changes because the validity of the cost estimate could not be determined from the information provided. Additional information was not requested since this increase in capital costs in itself would not affect the decision to require converter secondary controls at this smelter.

ASARCO's initial estimate of annualized costs for the converter secondary hoods was about 2.3 times EPA's estimate in the July 20, 1983, notice of proposal. The EPA's and ASARCO's annualized cost analyses differed because ASARCO assumed a 15

percent interest on capital and 15-year equipment life, and attributed a prorated share for operation of the existing control device to the cost of implementing the standard. ASARCO's basis for calculating capital recovery costs was not used in the reanalysis of control costs. The EPA's revised estimate of annualized costs still reflects use of 10 percent real interest on capital and 20 year equipment life because EPA believes this basis more realistically reflects actual capital costs and the expected life for this equipment. Furthermore, on incremental costs of operation of the control device were attributed to this standard for the previously discussed reasons and since EPA is not in a position to realistically evaluate these costs. Therefore, the final annualized costs are the costs presented in the September 20, 1984, notice which reflect the ASARCO's first capital cost estimate of $1.8 million for installation of converter secondary hoods.

ASARCO-Hayden: ASARCO commented that EPA underestimated the capital and annualized costs of converter fugitive emission controls for this smelter. ASARCO argued that EPA's estimates were too low because of site-specific differences that affect hood design (the costs at proposal were derived from actual costs incurred at the ASARCO-Tacoma smelter), and because several direct and indirect costs were not included. The principal difference between EPA's proposal estimate and ASARCO's estimate was the costs pertaining to demolition of the existing secondary hoods and to the actual costs of a new air curtain secondary hood and ductwork structures. The EPA evaluated ASARCO's cost estimate and determined these costs to be reasonable, considering the specific design requirements at this facility. Consequently, ASARCO's capital cost estimate of $3.66 million was used in EPA's reanalysis of control costs for converter operations at ASARCO-Hayden.

ASARCO's estimate of annualized costs differed from EPA's estimate in the use of 15 percent interest on capital, 15 year equipment life, a pro rata share of the existing control device's operating costs, and a write-off of the value of the scrapped existing secondary hoods. Again, EPA's revised estimate of annualized costs is based on 10 percent real interest and 20 year equipment life rather than ASARCO's basis. The revised costs also do not include the write-off cost or the prorata share of operating costs of the existing ESP. The EPA did not consider it appropriate to attribute the write-off costs to the cost

of the converter secondary controls since the emission and cost analysis (i.e., cost-effectiveness) considers the cost to achieve additional emission reduction. The operating costs of the existing ESP also were not included since EPA could not verify that the standard would significantly affect the cost to operate this control device. Therefore, the final estimate of annualized costs only reflects the higher capital costs for installation of converter air curtain secondary hoods at this smelter.

Kennecott-Utah: Kennecott commented that EPA's estimate of control costs for converter and matte and slag tapping operations were low. The EPA's review of a detailed breakdown of the capital cost estimate for converter controls showed the primary reason for the difference in the two estimates was that Kennecott's estimate included costs for installation of new ductwork and fans. The EPA reviewed Kennecott's capital cost estimates for accuracy and adherence to sound engineering principles and concluded that the costs were reasonable. Therefore, Kennecott's estimate of capital costs for converter controls were used in EPA's revised cost estimates.

Kennecott's annualized cost of converter controls also included a capital recovery cost based on 15 percent interest and 15 year equipment life. For the previously described reasons, EPA's revised annualized cost estimate is based on 10 percent real interest and 20 year equipment life. Thus, the revised annualized costs only reflect the increase in the capital costs of the secondary hoods.

Kennecott's capital cost estimates for matte and slag tapping controls differed significantly from EPA's primarily because costs for new ductwork, increased fan capacity, and a larger capacity control device (11,500 acmm [400,000 acfm]) were included. In the revised estimate of capital cost, EPA assumed use of new ductwork and increased fan capacity, but did not assume use of the larger capacity control device since the capacity was significantly in excess of that normally used. In comments on the revised cost estimates, Kennecott reiterated its belief that the higher capacity control device is needed. The EPA considered these comments and concluded that, considering costs and crane availability, a reasonable design would provide sufficient capacity to treat emissions from simultaneous tapping of one matte and one slag stream (i.e., the previously assumed capacity of 5,600 acmm

[200,000 acfm]). The EPA also considered that further revision of the cost estimate would not be useful since the cost to control matte and slag tapping emissions was disproportionate to the risk reduction at the lower capacity control device. Therefore, EPA's estimated capital cost for the control device was retained and the final cost estimate reflects Kennecott's estimated costs for new ductwork and fan capacity.

The annualized costs for matte and slag tapping controls estimated by Kennecott again used 15 percent interest and 15 year equipment life as the basis of the capital recovery factor. The final cost estimates reflect only the higher capital cost for installation of matte and slag tapping controls.

Kennecott-Hayden: For its Hayden smelter, Kennecott provided estimates of capital and annualized costs for converter secondary controls, which were only slightly higher than EPA's estimates at proposal. Kennecott's capital cost estimates were only 19 percent higher than EPA's and were accepted as reasonable. Their estimate of annualized costs was revised to reflect a 10 percent interest rate and 20 year equipment life basis for calculating capital recovery costs.

Kennecott-McGill: Kennecott's estimates of capital and annualized costs for controls on converters and matte and slag tapping operations were slightly lower than EPA's estimates at proposal. The EPA reviewed the cost estimates provided by Kennecott and concluded their estimates were reasonable. Consequently, the final cost estimates reflect only minor changes that resulted from Kennecott's comments.

Phelps Dodge-Morenci: Phelps Dodge submitted capital and annualized cost estimates for installing converter secondary emission controls that were considerably higher than EPA's estimates at proposal. Phelps Dodge's capital cost estimate differed from EPA's in its inclusion of: (1) costs to demolish the existing secondary hood system and to replace the existing ductwork and fans; and (2) costs for a gas treatment plant (stainless steel ESP's and lime spray pretreatment). The EPA reviewed the basis of Phelps Dodge's cost estimates, and concluded that only the additional costs for demolition of the existing system and replacement of ductwork were reasonable. The costs for gas treatment were considered to be unnecessary because EPA would not require operation of the converter secondary emission control system at a temperature below the acid dew point of

the gas stream. The costs for demolition of the existing system and installation of new ductwork and fans were accepted since they were based on actual expenses incurred by Phelps Dodge in installing a secondary hood on a converter at Morenci. Therefore, EPA revised the capital costs for converter controls using Phelps Dodge's estimate of costs to demolish and replace existing ductwork. The revised capital cost for control of converter secondary emissions also reflects use of a baghouse rather than an ESP fabricated of stainless steel to control emissions. (The capital cost of a baghouse was included in the cost estimate presented at proposal). Phelps Dodge's comments on the revised estimate were that a stainless steel ESP is necessary for treatment of gas streams below the acid dew point and is the proper basis for determining control costs for this smelter. The capital cost estimate was not revised to reflect use of a stainless steel ESP as recommended since the standard would not require the control device to be operated below the dew point of the gas being treated. In addition, revision of the cost estimate would not affect the decision to require control of converter fugitive emissions at this smelter. The final capital cost estimate, thus, reflects the cost to demolish and replace existing ductwork and the cost of a baghouse. The final cost estimate is the same as the estimate used in the September 20, 1984 notice.

Phelps Dodge estimated annualized costs using a capital recovery factor based on 15 percent interest on capital and 15 year equipment life, their estimate of capital costs, and utilities required for an ESP. As with the cost estimates discussed earlier in this section, EPA calculated the capital recovery cost for the revised capital cost estimate assuming 10 percent real interest and 20 year equipment life. In addition, Phelps Dodge's estimate for electric power costs was adjusted to apply to a baghouse rather than an ESP. The final estimate of annualized costs primarily reflect the higher capital costs of the control system. The final cost estimate is the same as the estimate given in the September 20, 1984 notice.

Phelps Dodge-Ajo. Phelps Dodge commented that EPA's estimated costs to cool the reverberatory furnace offgases and collect condensed inorganic arsenic particulate should Phelps Dodge not convert the furnace to oxy-sprinkle smelting and install an acid plant were too low. To support its argument, Phelps Dodge submitted cost estimates. As previously discussed, EPA cannot presently determine the technical feasibility of cooling gas streams below

the acid dew point without creating corrosion problems or predict the emission reduction that could be attained. Moreover, owing to the changes in the estimate of inorganic arsenic emissions from this smelter, the reduction in risk is very small and the costs are disproportionately high. Therefore, EPA is not requiring that gas stream cooling be used and is not revising its cost estimates since this option would not be selected at the lower cost.

Comments on Economic Impacts. Comments on costs and economic impacts were also received from NRDC and the Sierra Club, Grand Canyon Chapter. The NRDC commented that to assess the affordability of controls EPA must obtain verifiable documentation of company claims of the economic impacts of control measures, such as financial planning documents for the affected smelters. The NRDC charged that the existing economic information on the facilities is incomplete and unsupported. The EPA believes that the cost and economic information is sufficiently complete and documented for the following reasons. The EPA's economic analyses for primary copper smelters are based on data which are available in the public domain or from the companies. Information was obtained from a wide variety of sources, including past submissions of data by the copper companies, reports prepared by others on the companies, information on prices from standard reference, and engineering cost studies of the specific operations. As previously described, detailed economic and engineering information has been obtained under Section 114 of the Act from several of the copper companies since proposal. Therefore, EPA believes that obtaining further information such as internal planning documents is unnecessary and EPA's economic analyses of affordability are sufficient for decisionmaking purposes.

The Sierra Club stated that the proposal should include sufficient economic data for the public to judge the economic feasibility and costs of controls, including income figures for all operations at a smelter such as gold and silver production. In addition, the actual costs of plant closure should be detailed for each smelter and compared to benefits (e.g., health cost savings). The EPA agrees with the commenter that sufficient information should be presented to allow the public an opportunity for meaningful participation in the rulemaking. It is for this reason that detailed supporting information is made available for public inspection in

the docket and a document summarizing the supporting information is made available to interested parties. The EPA believes that, since the economic analyses and their bases are available, sufficient information has been provided. Because the financial health of the low-arsenic primary copper smelters depends heavily on the price of copper, EPA does not believe that consideration of income from by-products and co-products would significantly have affected the conclusions of the economic analysis for the low-arsenic smelters.

The EPA believes that the recommended comparison of closure costs and benefits is beyond the scope of this rulemaking. To perform the type of analysis suggested by the commenter would require consideration of a large number of factors including: (1) Costs and economic impacts to the affected companies; (2) costs and economic impacts to businesses in the community; (3) social costs, such as impacts on property values, health care costs, lost development opportunities, and unemployment compensation costs; and (4) health impacts associated with unemployment. Some of these costs such as closure costs are relatively easy to quantify (data are readily available, can be developed, and require few value judgements); while others such as impacts on property values, quality of life, and health care costs are extremely difficult to quantify (data are not available, and there is no generally accepted method for quantifying the impacts in economic terms). Consequently, EPA believes this type of analysis cannot be reasonably done within this rulemaking. These secondary impacts are considered qualitatively in selecting the level of a standard. Therefore, EPA believes that this type analysis is not necessary for selecting the appropriate control level for the standard. Taking all available qualitative and quantitative information into account, EPA judges that the social and economic costs of closing the smelters would far outweigh the resulting health benefits.

Emission Monitoring Requirements

ASARCO and Phelps Dodge took issue on several grounds with the proposed opacity monitoring requirement for converter secondary emissions exiting a control device. First, ASARCO and Phelps Dodge commented that opacity monitoring will not be useful for evaluating proper operation and maintenance of control devices because short-term variations in particle size distributions due to combining of gas streams will cause variations in observed opacities that are not

associated with a change in outlet mass concentration. ASARCO and Phelps Dodge recommended revision of the opacity monitoring requirement to a requirement for keeping a record of all maintenance of the control device and for annual emission testing of the device. The EPA agrees with the commenters that, if they occur, significant fluctuations in particle size distribution of emissions could cause variations in observed opacities. However, the magnitude of opacity variations due to particle-size changes are expected to be small relative to changes associated with malfunctions or improper operation or maintenance of the control device. Because the intent of the opacity monitoring requirement is to detect increased emissions due to malfunctions and improper operation, EPA reassessed the opacity monitoring requirement and concluded that the most reasonable approach is to establish a maximum 1-hour average reference opacity level that considers the fluctuations in opacity levels. One-hour average opacity levels above the reference opacity level would indicate that the collection device may no longer be meeting the particulate matter emission limit. A Method 5 test could then be performed to determine compliance.

ASARCO and Phelps Dodge also disagreed with EPA's requiring the use of transmissometers for monitoring gas streams with low particulate concentrations. ASARCO commented that frequent Method 5 testing would have to be performed to determine the validity of using transmissometers to monitor compliance with the 11.6 mg/dscm (0.005 gr/dscf) emission standard because opacity levels associated with concentrations of 11.6 mg/dscm (0.005 gr/dscf) are close to or at a transmissometer's limit of detection. The EPA agrees with ASARCO and Phelps Dodge that opacity levels associated with concentrations of 11.6 mg/dscm (0.005 gr/dscf) may be near the detection limit of transmissometers. The intent of the proposed requirement was to monitor for significant changes in the level of particulate matter emission control resulting from operation or maintenance practices, and such increased levels would be well above the detection limit of the transmissometer. Therefore, EPA revised the method for defining excess opacity levels. The revisions include using 1-hour averages of opacity data to determine the highest average and establishing the reference opacity level at 5 percent opacity above the highest 1-hour average opacity determined during

an evaluation period that includes the emission test. The EPA believes that reference opacity levels defined in this manner will be a useful indicator of significant changes in the performance of the control device.

The Administrator would like to emphasize that this opacity monitoring and reporting of excess emissions is only a monitoring requirement and is not a directly enforceable opacity standard. However, excess emissions do provide evidence of possible violation of operation and maintenance requirements. In other standards, the EPA establishes enforceable opacity limits based on visual evaluations of opacities of gases exiting stacks and other conveyances, and on consideration of the effect on opacities of the expected range of normal operating variables. In addition, these opacity limits are based on Method 9, which determines opacity using human observers. At the primary copper smelters, opacity limits could not be established for the control devices because emissions from several control devices frequently are discharged in common to the atmosphere through one stack. Consequently, EPA established the monitoring requirements.

ASARCO further commented that they have had frequent maintenance problems with their existing transmissometers and that these problems are costly and undercut the usefulness of the instrument. The EPA does not agree that all transmissometers will experience frequent maintenance problems. Available information on performance of transmissometers indicates that transmissometers which meet 40 CFR 60 Appendix B specifications have repeatedly demonstrated more than 95 percent availability when properly operated and maintained. Therefore, EPA believes that transmissometers are a useful means for ensuring continuous effective operation of collection devices.

Magma Copper Company questioned whether the waiver of the emission test requirements referred to in § 61.175(a)(4) could be used to waive the requirement for collection and analysis of daily grab samples of matte, slag, and total smelter charge for any smelter that has arsenic inputs well below the cutoff. The waiver of emission tests discussed in § 61.13 and referred to in § 61.175(a)(4) of the proposed regulation for low-arsenic copper smelters, applies to sources that are required to demonstrate compliance with the standards through periodic testing of emissions. Thus, this reference in the regulation does not refer to the

sampling requirements for demonstrating applicability.

The EPA agrees that the daily collection and monthly analysis of grab samples would prove burdensome for a smelter that fell well under the applicability cutoff of 75 kg/h (164 lb/h) converter arsenic charging rate. Consequently, paragraph 61.174(g) has been included in the final regulation to permit an owner or operator to petition the Administrator for a modified sampling schedule if the analyses performed in the first year of the standard show the source to have very low arsenic processing rates in relation to the cutoff values. An example of modified sampling schedule would be weekly, instead of daily, grab samples being collected to form the composite monthly samples.

Compliance Provisions

The proposed compliance provisions have been redrafted to remove provisions that were established as general provisions to 40 CFR Part 61 (see 50 FR 46284) and to improve the organization of sections in the regulation. The final standard also includes specific provisions requiring the owner or operator to operate the secondary hood system in a manner which will achieve maximum capture of arsenic emissions. The optimum operating conditions necessary to achieve maximum capture of emissions will be determined by the Administrator. The Administrator will propose separate optimum operating conditions for each secondary hood system which will be based on an assessment of capture efficiencies achieved by the hood under different operating conditions. The assessment of hood capture efficiency may include an evaluation of emissions by a panel as well as evaluation of hood design and performance by EPA personnel. After a period of public comment, the Administrator will publish final optimum operating conditions for each system.

The standard requires the owner or operator of each secondary hood system to submit to the Administrator a list of initial operating conditions for the system that in the owner or operator's judgment result in the greatest capture of converter secondary emissions. This list must be submitted by September 3, 1986, or within 30 days of the initial operation of the system, whichever is later. The system shall be operated under these conditions, or under conditions specified by the Administrator, until optimum operating conditions are established.

The potential use of a panel to evaluate hood performance was discussed in the July 20, 1983, **Federal Register** notice of proposal (48 FR 33112). The EPA requested comments on the proposed use of a panel in evaluating air curtain secondary hoods and in determining optimum operating conditions. Based on comments received on this "panel approach", the Administrator thinks that the method for establishing optimum operating conditions for the hoods should be clarified. The conditions will be determined by the Administrator based on visual observations of overall capture efficiency under different operating conditions such as different face velocities in the exhaust hood, horizontal slot dimensions, air velocity through the horizontal slot, and other operating conditions specified by the Administrator. These observations may be made by EPA personnel alone or by a group of individuals (i.e., "panel") comprised of representatives of EPA, industry, and the State or local air pollution control agency.

A variety of comments was received concerning the method for determining optimum hood operating conditions. Some commenters endorsed the concept of the panel approach, while others opposed it. One commenter argued that the panel approach is subjective and thus will result in different requirements for different facilities. The commenter suggested that EPA use the tracer mass balance procedure to determine capture efficiency of air secondary hoods. The EPA agrees with the commenter that visual evaluation of fume capture efficiency is a subjective procedure; however, EPA believes it is superior to other procedures, including the tracer technique. In tests to evaluate the air curtain secondary hood at ASARCO-Tacoma, EPA characterized hood performance by tracer mass balance tests, visual evaluations, and transmissometer measurements. The tracer mass balance procedure used could not at any one time evaluate the capture efficiency within the entire converter-secondary hood area. That is, owing to technical limitations, the capture efficiency could be evaluated only within subregions such as near the air curtain or near the converter. In contrast, the visual observations were overall assessments of the entire converter-secondary hood area. The average observations for the various converter operating conditions showed the same trends as the tracer experiments. In addition, tracer mass balance determinations are difficult and expensive to conduct. The EPA,

therefore, believes it is unnecessary and unreasonable to require tracer mass balance determinations to evaluate hood capture efficiencies. The study also found the transmissometer data to be of limited usefulness because, again, overall capture efficiencies for the entire converter-secondary hood area could not be evaluated. (The transmissometer was mounted on top of the air curtain and measured emissions escaping capture by the air curtain and passing through the slot. It was not practical to monitor emissions escaping the lower portion of the hood and pouring into the converter aisle.) Consequently, the Administrator concluded that visual evaluation of fume capture efficiency should be used to evaluate optimum conditions for secondary hoods.

The use of observers to determine hood capture effciencies would not change the basic control requirements for the facilities. The standard requires installation of an air curtain secondary hood and use of operating practices that maximize the capture efficiency obtained. The EPA recognizes that design and operating requirements will vary among facilities and possibly among converters at any given facility. These differences will occur because each air curtain secondary hood will have to be custom designed to fit each existing converter. It is expected that any differences resulting from differences in judgments of capture efficiency will be negligible relative to differences imposed by design constraints.

ASARCO and Phelps Dodge argued that it would be costly and time consuming to use the proposed panel approach to establish optimum operating conditions for the converter secondary hoods. In lieu of the panel, ASARCO and Phelps Dodge recommended that each company be required to optimize its hoods through trail and error and that the company be required to keep a log of the parameters and emissions. during this period. The record would be submitted to EPA for review and assessment. The requirements of the standard do not preclude an owner or operator from conducting studies on the capture effectiveness and operating parameters. In fact, EPA believes that such studies by the owner or operator could expedite the Administrator's evaluation of operating conditions. However, EPA does not believe that the optimum operating conditions should be solely determined by the owner or operator of the source. The EPA believes that optimum operating conditions should be determined by the Agency since

evaluation of optimum operating conditions for converter secondary hoods is a further step in the development of the regulation. This part of the standard cannot be developed or established until the equipment required by the regulation is in place and operating. The Administrator will consider the assessment of the secondary hood's performance under a variety of operating conditions in the selection of operating conditions. The specific requirements that will establish optimum capture of converter secondary emissions will then be proposed by EPA in the Federal Register and established after consideration of public comments. Until optimum operating conditions are established for the source, the standard requires the owner or operator to operate the hood in a manner which will achieve effective capture of secondary emissions. These operating conditions will be established by the Administrator based on review of operating conditions recommended by the owner or operator of the source.

ASARCO further commented that if EPA decides to use a panel to evaluate and optimize hood operations, EPA should take steps to ensure that the panel is unbiased. ASARCO recommended that the panel be composed of persons knowledgeable about smelting and that it include at least one neutral member who is selected and compensated jointly by EPA and the company. The Administrator will establish optimum operating conditions based on visual assessments of hood capture efficiency under a variety of operating conditions and consideration of public comments on the proposed requirements. Because EPA plans to use observations made by more than one observer and measurements of operating parameters (e.g., hood flow rate, horizontal slot dimension, etc.), significant discrepancies among observations by the different observers would be detectable and, thus, considered in the selection of optimum operating conditions. (Observations of hood capture efficiency by EPA and local air pollution control agency personnel at the ASARCO-Tacoma smelter were generally in close agreement and EPA expects that observations by several individuals should be comparable and any biases detectable.) Public comment on the proposed standard will also serve to identify any bias in the basis for the proposed standard. Consequently, EPA does not agree that additional measures are needed to ensure that the observers and hence the assessments of hood capture efficiency are unbiased.

The NRDC and the USWA supported the panel approach, but favored expanding the size of the panel and its responsibilities. These commenters recommended that the panel include representatives of the union and local environmental groups. It was also suggested that the panel consider all sources of arsenic emissions, enforcement of the standard, and review of monitoring data. The Administrator considered these recommendations and concluded that they were inconsistent with the intended approach and should not be adopted as suggested. The EPA views the determination of optimum operating conditions as a further step in the regulatory development process of this standard. Hence, EPA believes that this determination should be conducted by EPA personnel considering assessments and information provided by EPA personnel, local air pollution control agency personnel, and the affected industry. During the development of the optimum operating conditions, there will be opportunities for NRDC, the USWA and members of the public to review and comment on the basis of the suggested operating conditions. Therefore, EPA believes that it is not necessary to include formally NRDC, the USWA, and other groups in the standards development process. The suggested use of a panel to review control of all arsenic emission sources, enforcement of the standard, and the monitoring data is also considered to be unnecessary. Arsenic emissions from sources in the primary copper smelters are presently being controlled under consent decrees, SIP's and OSHA standards, and additional control of other emission sources cannot be achieved at a reasonable cost. The EPA further believes that it would be inappropriate to delegate enforcement of the standard to a panel.

The NRDC suggested that the optimization panel may need to be chartered under the Federal Advisory Committee Act (FACA) and required to report annually to the Administrator, the local air pollution control agency, and the public on the status of arsenic emission control and prospects for additional emission control. The EPA did not intend to create an advisory committee with the proposed panel approach. The EPA proposed use of a panel to report data which can be used to identify optimum operating conditions for the converter secondary hoods as a means of continuing the development of the regulatory requirements. Hood operating parameters cannot be evaluated, or determined, until the equipment required by the regulation is

in place. It is intended that optimum operating parameters will be proposed by the Administrator and established after consideration of public comments. Therefore, EPA has revised the regulation to indicate clearly that the optimum operating conditions for the secondary hoods are established by EPA based on a case-by-case evaluation of the hood's performance and public comments. At present, EPA plans to evaluate each hood's capture efficiency under varying operating conditions using observers, as appropriate and practicable, from EPA, the local air pollution control agency, and industry. The observers will only serve as a fact-finding body and will not recommend operating parameters for secondary hoods. Consequently, EPA does not believe the observers or "panels" need to be chartered under FACA or to report annually to the Administrator.

Impacts of Reporting and Recordkeeping Requirements

The EPA believes that the required reporting and recordkeeping requirements are necessary to assist the Agency in: (1) Identifying sources; (2) determining initial compliance; and (3) enforcing the standards.

The Paperwork Reduction Act (PRA) of 1980 (Pub. L. 96–511) requires that the Office of Management and Budget (OMB) approve reporting and recordkeeping requirements that qualify as an "information collection request" (ICR). To accommodate OMB review, EPA uses 3-year periods in its impact analysis procedures for estimating the labor-hour burden of reporting and recordkeeping requirements.

The average annual burden on primary copper smelters to comply with the reporting and recordkeeping requirements of the final standard over the first 3 years after the effective date is estimated to be about 8,000 labor-hours.

IV. Glass Manufacturing Plants

As indicated in the Overview section of this preamble, a standard limiting inorganic arsenic emissions from glass manufacturing plants was proposed on July 20, 1983, in the Federal Register (48 FR 33112). The public comment period for the proposed standard ended on January 31, 1984. The public comment period was reopened from March 20, 1984, to April 19, 1984, to allow comment on the proposed method for calculating zero production offset and proposed control options for soda-lime glass furnaces (49 FR 10278). This part of the preamble presents the final standard, its

basis, and a discussion of the public comments on the proposed standard.

Summary of Promulgated Standard

Applicability

The promulgated standard for inorganic arsenic emissions from glass manufacturing plants applies to each glass melting furnace that uses commercial arsenic as a raw material. It does not apply to pot furnaces (i.e., furnaces that contain one or more refractory vessels and melt glass by indirect heating), nor does rebricking cause a furnace to become subject to the standard.

Emission Limits

The standard requires that the owner or operator of an existing glass melting furnace limit uncontrolled arsenic emissions to 2.5 Mg (2.75 tons) per year or less or reduce arsenic emissions by 85 percent. Similarly, new or modified glass melting furnaces must keep emissions below 0.4 Mg (0.44 ton) per year or meet the 85 percent reduction requirement.

Compliance Provisions

To demonstrate compliance with the precent reduction option, the owner or operator must determine the concentration of arsenic in the inlet and outlet gas streams to the control device and calculate the emission reduction. Test Method 108 is used to determine arsenic concentration, which consists of gas and particulate phase arsenic.

To demonstrate compliance with the annual uncontrolled emission limits, an owner or operator is required to conduct emission tests unless the amount of arsenic added annually to be an existing furnace is less than 8.0 Mg (8.8 tons) or less than 1.0 Mg (1.1 tons) for new or modified furnaces, and the owner or operator can demonstrate through a material balance that the applicable uncontrolled emission limit is being met. Owners or operators of all affected furnaces must estimate the uncontrolled arsenic emissions for the forthcoming 12-month period each 6 months by multiplying an arsenic emission factor for each type of glass produced by the amount of each type of glass produced during the 12 months.

Continuous Monitoring

An owner or operator who chooses to comply with the percent reduction requirement must continuously monitor the opacity of emissions discharged from the control device. Opacity monitoring must be conducted during the compliance test to establish a reference opacity level. Following the compliance test, owners or operators

must reduce all opacity data to 6 minute averages and report any occurrence of excess opacity levels above the reference level to the Administrator. The temperature of the furnace exhaust gas entering a control device must also be continuously monitored and recorded.

Recordkeeping and Reporting Requirements

In addition to the reporting requirements of 40 CFR Part 61, Subpart A, owners or operators must report the results of the continuous monitoring system evaluation, any excess opacity occurrence, and any change from compliance with uncontrolled emission limit provisions to percent reduction provisions. Owners or operators who choose to comply with the annual uncontrolled emission limit must keep records of the arsenic emission factors, supporting calculations, and emission forcasts for the preceding and forthcoming 12-month periods. All owners or operators of a source subject

to the standard must maintain records of all measurements, all calculations used to produce emission estimates, monitoring system performance evaluations, any malfunction of process or control equipment, and any maintenance and repairs made to the controls or monitoring systems. All records must be suitable for inspection and retained for 2 years.

Summary of Environmental, Health, Energy, and Economic Impacts

The standard being established today will affect eight existing glass manufacturing furnaces and any new or modified glass manufacturing furnace. It is expected that control devices would have to be installed on two of the existing furnaces or the use of arsenic as a raw material would have to be decreased and that the other six furnaces would be able to continue using their existing control systems to meet the standard. Environmental, energy, and economic impacts of the standard are summarized in Table IV-1.

TABLE IV-1.—SUMMARY OF ENVIRONMENTAL, ENERGY, AND ECONOMIC IMPACTS FOR GLASS MANUFACTURING PLANTS

Plant location	Uncon- trolled arsenic emissions (Mg/yr)	Reduction in arsenic emissions (Mg/yr)	Increase in solid waste (Mg/yr)	Increase in energy use (MW-hr/yr)	Decline in profit (percent)
Martinsburg, West Virginia	13.2	11.22	*2.0	185	<5
Charleroi, Pennsylvania	3.4	b3.40	0	0	0
Danville, Kentucky	7.6	c7.40	0	0	0
Charleroi, Pennsylvania	7.3	c7.29	0	0	0
State College, Pennsylvania	6.9	c6.88	0	0	0
Fall Brook, New York	3.8	c3.73	0	0	0
Fall Brook, New York	2.7	c2.65	0	0	0
Central Falls, Rhode Island	2.6	c2.41	0	0	0
Total	47.5	44.98	2.0	185	<5

*Assumes that 90 percent of waste is recycled to furnace.
bAssumes that non-arsenic containing glass recipe will be used; no impacts.
cControls presently in place; no additional controls required.

Significant Changes Since Proposal

In response to public comments received on the proposed rulemaking and as a result of EPA re-evaluation, five major changes were made to the proposed standard. These changes involve: (1) Revising the annual limit on uncontrolled emissions above which add-on control is required for existing furnaces, (2) revising the format of the emission limits, (3) allowing the control device to be by-passed for periods of maintenance, (4) eliminating the exemption to 40 CFR Part 60, Subpart CC for sources that comply with the NESHAP, and (5) establishing a provision to exempt certain sources from testing requirements.

Existing Furnace Annual Uncontrolled Emission Limit

After proposal, further examination of

the costs, risks, and potential risk reductions associated with inorganic arsenic emissions and controls for specific existing glass manufacturing plants led the Agency to change the regulation by establishing the limit on uncontrolled arsenic emissions for existing glass melting furnaces at 2.5 Mg (2.75 ton) per year. The proposed limit on uncontrolled arsenic emissions of 0.4 Mg/year (0.44 ton) is retained for new or modified furnaces. The rationale for this revision is discussed below under Basis for Standard.

Format of the Standard

The second major change in the regulation since proposal involves a change in the format for emission limits. The proposed standard was in the form of a particulate matter emission limit. The promulgated standard requires

owners or operators of glass furnaces to ensure either that uncontrolled arsenic emissions are less than limits described above or that arsenic emissions are reduced by 85 percent. Compliance with the percent reduction requirement is determined using Test Method 108. The rationale for this revision is discussed below under Basis for Standard.

Bypass of the Control Device

The third major change in the regulation allows owners or operators of glass furnaces to petition the Administrator for permission to by-pass the control device for a limited period for purposes of maintaining the control device. However, the Agency has included provisions to minimize arsenic emissions during maintenance periods and will allow by-pass of the control device only upon demonstration of its necessity. The revision is fully discussed in the Discussion of Comments section of this part of the preamble.

Elimination of Exemption from NSPS

In the proposed standard, particulate emission limits were identical to those in the glass manufacturing NSPS (40 CFR Part 60, Subpart CC), and no furnace was allowed to operate with uncontrolled arsenic emissions in excess of 0.4 Mg (0.44 ton) per year. The promulgated standard has been revised such that the emission limits are no longer identical and the exemption from the NSPS is no longer appropriate.

Compliance Testing

In the final major change, EPA created a provision which exempts owners or operators of certain furnaces from the requirement to conduct emission tests to demonstrate compliance. Emission tests are not required for existing furnaces that use less than 8.0 Mg (8.8 tons) arsenic per year and new or modified furnaces that use less than 1.0 Mg (1.1 tons) arsenic per year if the owner or operator demonstrates through a material balance that the applicable annual uncontrolled emission limit is being met. Analysis has shown that at least 70 percent of the arsenic added to the raw materials is retained in the glass product. Therefore, the Agency believes that existing furnaces to which less than 8.0 Mg (8.8 tons) of arsenic is added annually, or new and modified furnaces to which less than 1.0 Mg (1.1 tons) of arsenic is added annually, would not be likely to exceed the respective limits on uncontrolled inorganic arsenic emissions. The Administrator does reserve the right to require an emission test of any furnace using arsenic to ensure that the annual uncontrolled

emission limits are not exceeded under any circumstances.

Additional Analyses

As a result of public comments, EPA has conducted additional analyses to ensure that the promulgated standard is based on the most complete and accurate information available. These additional analyses focused on the status of the industry, arsenic emission sources and characteristics, and risk assessment. The scope and results of these additional analyses are summarized below. The analyses and conclusions are discussed in greater detail in the Discussion of Comments section of this preamble and in the BID for the promulgated standard.

Update of Industry Status

At the time of proposal, the Agency had identified a total of 32 glass melting furnaces that use arsenic as a raw material. Five of these furnaces were determined to emit arsenic at uncontrolled levels at or below 0.4 Mg (0.44 ton) per year, which was the proposed cutoff for requiring add-on controls. Of the remaining 27 furnaces, 13 were identified as being controlled by electrostatic precipitators or fabric filters. Arsenic emissions from the 32 furnaces were estimated to be 36.7 Mg (40.4 tons) per year. The Agency also noted at the time of proposal, however, that more arsenic-using furnaces probably existed, although most of these furnaces were believed to be small pot furnaces and all-electric melters or other furnaces that would not be affected by the proposed regulation.

Upon further investigation, a total of 53 additional arsenic-using glass furnaces were identified. Total emissions of arsenic from these 53 furnaces were estimated to be 12 Mg (13.2 tons) per year. Over 60 percent of these additional arsenic emissions arise from a single glass plant which is equipped with 9 individual arsenic-using furnaces, 5 of which emit more than 0.40 Mg (0.44 ton) of arsenic annually. Each of the remaining 44 furnaces identified after proposal were estimated to emit 0.4 Mg (0.44 ton) or less of arsenic per year. Additional data were also gathered after proposal on the 32 furnaces that had been previously identified. It was found that since proposal the use of arsenic had been eliminated from 10 of these furnaces.

The information currently available to the Agency indicates that a total of 75 glass furnaces located at 27 plants are known to use arsenic as a raw material. Arsenic emissions from these 75 furnaces are estimated to be 32.2 Mg

(35.4 tons) per year. Of the total arsenic emissions from the source category, nearly 80 percent (25.2 Mg/yr) arise from 11 uncontrolled furnaces each of which emits more than 0.40 Mg (0.44 ton) annually. These 11 furnaces are located at 5 separate glass manufacturing plants. A complete listing of all furnaces known to use arsenic is provided in Appendix C of the BID.

Emission Sources and Characteristics

Several analyses were conducted to estimate the magnitude of inorganic arsenic emissions from various sources within the glass manufacturing plants, and to characterize the factors affecting inorganic arsenic emissions. These analyses included:

(1) An estimate of the magnitude of fugitive emissions of arsenic from glass manufacturing plants (A-83-8/IV-B-11). Although several sources of fugitive arsenic emissions were identified, even under worst case conditions they were found to be very small compared to stack emissions.

(2) An analysis to determine if furnaces that do not add arsenic as a raw material could exceed the proposed 0.4 Mg/yr (0.44 ton/yr) emissions cutoff due to the presence of arsenic impurities in other raw materials (A-83-8/IV-B-12). It was concluded that the concentration of arsenic impurities in other raw materials would be insufficient to result in an exceedance of the proposed emission cutoff.

(3) Estimates of the cost and emission impacts of allowing furnaces to by-pass the emission control device during periods of routine maintenance of the control device (A-83-8/IV-B-10).

(4) An evaluation of the feasibility of reducing or eliminating the use of arsenic in soda-lime glass (A-83-8/IV-B-13).

(5) A study of the factors affecting arsenic emissions from glass melting furnaces, particularly those affecting the proportion of arsenic that is emitted as particulate matter. Additional emission test data were obtained through EPA testing and from industry representatives. The results of this study are reviewed below under Basis for Standard, and more detailed summaries of the emission test data can be found in Appendix A of the BID.

Risk Assessment

Risk assessment for all known arsenic-using furnaces had been performed at proposal. However, for several of these furnaces stack parameter data were not available and model plant parameters were used.

After proposal, stack parameter information was obtained for those furnaces. In addition, more accurate location (latitude/longitude) data were obtained for all furnaces. Risk assessments were then performed for the actual furnaces known to use arsenic rather than for model furnaces. Maximum individual risk and aggregate risk values were calculated for each plant at existing control levels and the levels required by the final standard. These risk estimates also reflect extension of the analysis out to 50 km (31 miles) from a plant and the use of 1980 census data.

The risk estimates were developed using the procedure described in Part I, *Risk Assessment Methodology,* of this preamble and a unit risk factor of 4.29 x $10^{-3}/\mu g - m^3$. The Agency determined that most of the emissions and risks were associated with 11 uncontrolled furnaces emitting more than 0.4 Mg/yr (0.44 tons/yr) each. These furnaces are located at 5 different plants. A sixth plant operating 9 uncontrolled furnaces, each emitting less than 0.4 Mg/yr (0.44 ton/yr) of arsenic, was also found to present relatively high aggregate risks. Because the proposed annual limit on uncontrolled arsenic emissions was set at 0.4 Mg/yr (0.44 ton/yr), none of the furnaces at this plant would have been subject to the proposed control requirements. However, risks to the population in the vicinity of a plant are a function of the emissions from an entire plant, rather than emissions from individual furnaces within a plant. Therefore, EPA considered whether the proposed annual limit should be lowered to include furnaces emitting less than 0.4 Mg/yr (0.44 ton/yr) when these furnaces contribute significantly to plant-wide emissions, and thereby to plant-wide risks.

The Agency also reviewed the availability of closer or more representative meteorological sites from those used in the proposal analysis. Meteorological experts within the Agency identified four sites in which more representative meteorological data were available, collected the data, and used it in the analysis which supports today's rulemaking. The plant sites involved are located in Dunkirk, Indiana; Baltimore, Maryland; Charleroi, Pennsylvania; and Moundsville, West Virginia.

Basis For Standard

As discussed in Part I of this preamble, the risk management approach provides a comprehensive assessment of candidate source categories, including the evaluation of current and applicable emission control

alternatives, as well as the associated health risks, risk reductions, and costs and economic impacts. This section describes the application of this approach in the development of the standard for glass manufacturing plants. The points addressed here are: (1) Application of risk management approach including consideration of risks and the effectiveness and cost of control technology; and (2) selection of the format and the level of the final standard.

Application of Risk Management Approach

The standard that is being established today is based on the best technology which, in the Administrator's judgment, is available and can be applied without causing widespread plant closure or imposing costs that far exceed any public health benefit. Accordingly, the standard reflects consideration of the estimated risks, the costs and availability of further controls and the associated potential for risk reduction, and the potential societal impacts of regulatory alternatives. The following sections describe the principal factors considered in this decision.

Consideration of Effectiveness of Control Technology. At the time of proposal, it was believed that the most effective technology for control of arsenic emissions was identical to the best demonstrated technology for control of total particulate emissions from glass melting furnaces, fabric filter collectors and ESP's. This determination was based on data obtained from two tests on particulate control devices (one fabric filter and one ESP) installed on glass melting furnaces that use arsenic, which showed that at least 90 percent of the emitted arsenic was in the particulate matter and captured in the control devices. Because only arsenic emitted in the particulate matter can be controlled with existing technologies, and because most of the arsenic emitted from glass melting furnaces was believed to occur as particulate matter, it was concluded that application of the best systems for control of particulate matter would result in the maximum achievable control of arsenic emissions. Therefore, the Agency proposed to require affected sources to reduce emissions of total particulate to the levels required by the NSPS for glass manufacturing plants.

Data gathered by the Agency after proposal, and information supplied by commenters on the propsed standard, led to the conclusion that some furnaces would be able to meet the proposed emission limits without installing the most effective technology for control of

arsenic emissions. For example, it was found that the largest arsenic emitting furnace, located in Martinsburg, West Virginia, could meet the proposed emission limit by reducing total particulate emissions by about only 45 percent. In this case, the corresponding reduction achieved in arsenic emissions would be no greater than 45 percent. In addition, data gathered from further EPA emission tests and emission test data supplied by industry representatives indicated that inorganic arsenic emissions from some glass melting furnaces may occur less predominantly in the particulate matter than previously believed. Therefore, a requirement that only emissions of total particulate be controlled would not guarantee that the most effective control of inorganic arsenic emissions would be achieved in all cases.

Prior to proposal, consideration was given to two alternative formats for the emission limits. One alternative considered was to establish a limit on the amount of arsenic emitted. This alternative was not adopted because the wide variability in the amount of arsenic added to the raw materials and the amount of arsenic retained in the product glass results in considerable variability in the amount of arsenic emitted from glass melting furnaces. Therefore, if the arsenic emission limit were set high enough to allow for the variability observed, the standard would not have resulted in application of the most effective control to all affected furnaces. Consideration was also given to an efficiency format that would require arsenic emissions to be reduced by a specific percentage. An efficiency format was not proposed because it was believed that a particulate emission limit would require the same level of control without the additional costs involved in measuring arsenic emissions at both the inlet and outlet of the control device.

In considering all of the available data, the Agency has concluded that, as believed at proposal, well-maintained and -operated ESP's and fabric filters represent the most effective technologies for controlling inorganic arsenic emissions from glass manufacturing plants. However, based on the data collected after proposal, the Agency has also concluded that the effectiveness of fabric filters and ESP's in controlling emissions of arsenic from glass melting furnaces can best be determined by measuring the efficiency of these control devices in reducing inorganic arsenic emissions. Only in this way can the Agency be assured that inorganic arsenic emissions from all

affected furnaces will be reduced to the greatest extent possible. Therefore, the Agency believes that the additional costs involved in measuring the amount of arsenic at both the inlet and the outlet of the control device are warranted given the increased effectiveness of control that would be achieved by requiring emissions of arsenic to be reduced by a specific percentage.

As mentioned above, data made available after proposal have indicated that arsenic emissions from some glass melting furnaces may occur less predominantly as particulate matter. However, data collected during EPA emission testing and additional data supplied by industry representatives did not demonstrate any correlations between the proportion of arsenic emitted as particulate matter and the type of glass produced, the type of furnace used, or the type of arsenic added to the raw materials. In light of this finding, the EPA examined further whether cooling of the exhaust gases would cause gaseous arsenic emissions to condense and thereby increase the overall efficiency of particulate control devices in reducing total arsenic emissions. One emission test performed by EPA after proposal indicated that cooling of the furnace exhaust gas might increase the proportion of arsenic emitted as particulate matter, although the results were inconclusive. A subsequent emission test performed on the furnace located in Martinsburg, West Virginia, did clearly demonstrate that, for that furnace, arsenic removal efficiencies could be increased by cooling the furnace exhaust gas to a temperature of 121°C (250°F) or below.

The Agency also considered the performance of existing control devices in reducing emissions of inorganic arsenic. Available performance data for arsenic-using furnaces that are presently equipped with ESP's or fabric filters are shown in Table IV–2. The average efficiencies in controlling total arsenic emissions range from 92.6 percent to 99.7 percent. The relatively lower removal efficiency achieved by the fabric filter system installed on the furnace located in Central Falls, Rhode Island, is attributable to the fact that a relatively larger fraction of the arsenic emitted from this furnace was in the gaseous phase and not captured by the control device. The fabric filters at this plant achieved a greater than 99 percent removal efficiency of particulate arsenic emissions and the furnace exhaust gas is cooled to about 138°C (280°F) prior to entering the existing control system.

TABLE IV-2.—AVAILABLE ARSENIC EMISSION DATA FOR GLASS MELTING FURNACES WITH EXISTING CONTROL DEVICES

Plant Location	Furnace	Control device type*	Uncontrolled emissions (Mg/yr)	Controlled emissions (Mg/yr)	Average percent reduction
Danville, Kentucky	A	ESP	7.6	0.20	97.5
Charleroi, Pennsylvania	C	ESP	7.3	0.01	98.6
State College, Pennsylvania	A	ESP	6.9	0.02	99.7
Fall Brook, New York	A B C	ESP	3.1	0.05	98.5
Fall Brook, New York	C D	ESP	3.8	0.07	98.0
Central Falls, Rhode Island	A	FF	2.6	0.19	92.6
Moundsville, West Virginia	A	ESP	1.7	0.04	98.7
Corning, New York	B	FF	0.6	0.04	94.0
Circleville, Ohio	A	ESP	0.6	0.03	95.0
	B	ESP	0.2	0.006	97.0

* ESP=Electrostatic Precipitator; FF=Fabric Filter.

Consideration of Costs and Economic Impacts. At the time of proposal, insufficient data were available to estimate the cost and economic impacts of applying controls to specific furnaces at specific glass manufacturing plants. To more accurately evaluate the cost and economic impacts associated with the final standard, detailed information was gathered on the largest emitting furnaces and the plants at which those furnaces are located. This information enabled the costs associated with alternative control options to be estimated for specific furnaces and the economic impacts to be estimated for the companies that operate those furnaces.

The detailed cost and economic analysis was conducted only for arsenic-using furnaces that are not presently equipped with ESP's or fabric filters. Total arsenic emissions from the 16 arsenic-using furnaces with existing control devices were estimated to be about 1.3 Mg/yr (1.4 tons/yr), or less than 5 percent of the emissions from the source category. Moreover, the available data indicate that arsenic emissions from these furnaces are presently being reduced to the maximum extent possible, although 4 furnaces were found to be emitting particulate emissions at levels higher than those required by the proposed standard. The costs of upgrading these control devices to meet the proposed emission limits were estimated and found to be excessive given that little, if any,

incremental reduction in arsenic emissions could be achieved by further control. Therefore, the Agency concluded that it would unreasonable to require any additional control of arsenic-using furnaces equipped with existing fabric filters or ESP's, and no further cost or economic analysis was conducted for these furnaces.

Of the total 59 uncontrolled glass melting furnaces that use arsenic, about 90 percent of the emissions and risks are associated with 24 individual furnaces. Therefore, the cost and economic impacts of applying controls to these 24 furnaces were investigated. The 24 furnaces are located at 6 separate glass manufacturing plants and are owned and operated by 3 different companies.

The costs of controlling arsenic emissions from the six plants are shown in Table IV–3. Capital costs were calculated to range from about $2,239,000 to $4,650,000. Annualized costs were calculated to range from about $450,000 to $940,000. Assuming that the costs of controls are absorbed by the companies operating these furnaces (i.e., control costs are not passed on to consumers), the estimated decline in profit ranges from less than 5 percent to more than 30 percent. A decline in profit of 15 percent or more is considered by the Agency to be significant, and could result in the closure of a furnace. A more detailed discussion of the cost and economic analysis is provided in Appendix B of the BID.

TABLE IV-3.—COSTS OF CONTROL AND ECONOMIC IMPACTS

Plant	Number of uncontrolled furnaces	Uncontrolled emissions (milligrams per year)	Capital cost ($1,000)	Annual cost ($1,000 per year)	Decline in profit (percent)
Martinsburg, Virginia	1	13.3	2,634	533	<5
Dunkirk, Indiana	¹9	7.6	2,979	597	15–30
Charleroi, Pennsylvania	1	3.4	2,628	531	30–50

TABLE IV-3.—COSTS OF CONTROL AND ECONOMIC IMPACTS—Continued

Plant	Number of uncontrolled furnaces	Uncontrolled emissions (milligrams per year)	Capital cost ($1,000)	Annual cost ($1,000 per year)	Decline in profit (percent)
Shreveport, Louisiana	3	2.4	2,746	556	5–15
Toledo, Ohio	² 9	1.6	4,650	938	5–15
Corning, New York	1	0.8	2,239	451	15–30

¹ Four furnaces at plant each emit less than 0.4 Milligrams per year of arsenic; no controls were assumed to be applied to these four furnaces.
² All nine furnaces at plant each emit less than 0.4 Milligrams per year of arsenic; controls were assumed to be applied to all nine furnaces.

As mentioned above, cooling of the exhaust gases from glass melting furnaces may, in some cases, be necessary to achieve the best control of arsenic emissions. Because cooling of the exhaust gases may result in corrosion of the metal surfaces in an emission control system, the costs of installing systems to remove corrosive substances (dry scrubbers) from the exhaust gas were also estimated (A–83–08/IV–B–14). The use of dry scrubbing systems was found to increase annualized control costs by 40 to 50 percent above those for an ESP or fabric filter alone. However, no existing furnaces affected under the promulgated standard would need to install dry scrubbing systems.

Consideration of Risks. In reaching the decision on the standard, the Administrator considered of particular importance the present magnitude of estimated risks and the degree to which risks can be reduced by control measures which are available.

The magnitude of the reduction in risk achievable by application of control technology was determined by comparing the maximum individual risk and the annual incidence before control to the residual risks remaining after control. Any changes in the emission source characteristics caused by the application of controls, such as exhaust gas cooling, were considered in the estimates of residual risks. The accuracy of the exposure analysis was evaluated by comparing the results obtained from alternative dispersion models and, where possible, by comparing the modelled concentrations to the

concentrations actually measured near specific sites.

Estimated Risk—Using the approach and procedures described above, the maximum lifetime risks and the annual incidence prior to control were calculated for the six highest emitting plants. Over 90 percent of the total arsenic emissions from the source category arise from the 24 individual melting furnaces operated at these 6 plants. The residual risks that would remain if emissions from these plants were controlled to the maximum extent possible were then estimated.

The results of the risk analysis are summarized in Table IV–4. Maximum lifetime risks prior to control range from a low of about 0.3×10^{-4} for the plant located in Corning, New York to a high of about 9×10^{-4} for the plant located in Dunkirk, Indiana. Annual incidence was determined to range from 0.005 per year to 0.12 per year. With the exceptions of the highest emitting plant and the lowest emitting plant, the magnitude of the risks were found not to correlate directly with the magnitude of the emissions. This finding reflects the sensitivity of risk to the physical charcteristics of the emission source as well as to the location of the population with respect to the emission source.

TABLE IV-4.—BASELINE RISKS AND RESIDUAL RISKS AFTER CONTROL OF GLASS MANUFACTURING PLANTS WITH HIGHEST ARSENIC EMISSIONS

Plant	Number of uncontrolled furnaces	Uncontrolled arsenic emissions (Manufactured/year)	Prior to control		After control		Reduction in annual incidence
			Maximum risk (X 10⁻⁹)	Annual incidence	Maximum risk (X 10⁻⁹)	Annual incidence	
Martinsburg, West Virginia	1	13.3	8	0.12	0.5	0.013	0.11
Dunkirk, Indiana	¹ 9	7.6	9	0.038	1.7	0.0085	0.03
Charleroi, Pennsylvania	1	3.4	4	0.11	0.2	0.012	0.10
Shreveport, Louisiana	3	2.4	0.7	0.035	0.06	0.0037	0.03
Toledo, Ohio	² 9	1.6	3	0.07	0.09	0.0066	0.059
Corning, New York	1	0.8	0.3	0.005	0.14	0.0016	0.003

¹ Four furnaces at plant each emit less than 0.4 Mg/yr of arsenic; no controls were assumed to be applied to these four furnaces.
² All nine furnaces at plant each emit less than 0.4 Mg/yr of arsenic; controls were assumed to be applied to all nine furnaces.

The estimated reduction in annual incidence achievable through the application of emission controls were found to range from less than 0.01 per year to more than 0.10 per year. The estimated reduction in annual incidence achievable from the plants located in Martinsburg, West Virginia, and Charleroi, Pennsylvania, were found to be three to four times greater than the reduction in annual incidence achievable from the other four plants. Because emission test data gathered at the Martinsburg plant indicated that cooling of the furnace exhaust gas would result in more effective control of arsenic emissions, residual risks were

estimated for a control system that included gas cooling.

Validation of the Exposure Estimates—The EPA has used HEM to estimate exposure and risks associated with the glass plants. However, similar to what the Agency did in the case of the primary copper smelter source category, EPA has validated its HEM exposure assessment of the glass plants in several ways. First, at two sites, EPA has conducted a more site-specific air quality modeling analysis and compared the results to the concentration profiles that are predicted by the HEM dispersion model. In the original HEM analysis, EPA did not consider terrain effects or the full effect of building

downwash on stack emissions from glass manufacturing plants. Glass plants often have short stacks that cause effluents to be entrained in the building wake on the leeward side of the furnace buildings or other adjacent structures. As a consequence, it was regarded as likely that airborne arsenic concentrations to which people might be exposed near these plants could be underestimated. In addition, it was felt that the extent of building downwash could be expected to be different depending on the temperature of the gas stream exiting the control device. If so, the relative reduction in risk achieved would be affected. For these reasons, more sophisticated dispersion analyses

were carried out for two glass plant locations: Martinsburg, West Virginia, and Shreveport, Louisiana. These two plants were selected because of availability of representative meteorological data that were collected at monitoring stations near the plants and because of the availability of some limited ambient monitoring data to which the modeling results could be compared. Although the concentrations predicted by HEM were somewhat higher, generally the HEM and the site-specific analyses provided comparable results.

Where possible at other glass plant sites, the Agency has validated the results of the air dispersion models by comparing the modeled concentrations to ambient concentrations measured near the plants. Ambient data in sufficient quantities to make limited comparisons were found at four glass plant sites. Generally, EPA's dispersion modeling estimates were close to the measured concentrations or were overpredictions of the measured concentrations. However, much of the available data were below the detection limit of the sampling and analytical techniques used in the ambient monitoring program, thus, limiting the usefulness of the comparison.

Selection of Standard

Based on EPA's interpretation of section 112, as previously discussed in Overview—Basis for Promulgated Standards, the following factors were considered in the selection of the standard: (1) The magnitude of the risks; (2) the costs and availability of further controls; and (3) the potential economic and social impacts of the alternatives.

Applicability of the Standard. In assessing the need for further control, the risks and control cost estimates for the six plants with the highest uncontrolled emissions were considered. These estimates are shown in Tables IV–3 and IV–4. The cost control at each of the six plants is similar except for the Toledo, Ohio, plant which has an estimated annual control cost approximately double the others. In contrast, the estimated risks and risk reduction potential varies widely among the six plants. The reduction in annual incidence achievable from plants located in Martinsburg, West Virginia, and in Charleroi, Pennsylvania (from Table IV–4), is three to four times greater than the reduction in annual incidence achievable from the other four plants.

Based on a consideration of these risk and cost data, it was concluded that further control should be required at the Martinsburg and Charleroi plants.

However, at the other four plants where risk and achievable risk reduction potential are lower, it was concluded that further control is not necessary, and if required, would impose costs which are disproportionately high compared to the benefits of reducing the estimated current risks. Accordingly, the promulgated standard establishes an annual emission limit on uncontrolled arsenic emissions from existing glass melting furnaces that would require only the plants located in Martinsburg, West Virginia, and Charleroi, Pennsylvania, to install add-on control technology. Because emissions from these two plants arise from a single uncontrolled furnace having emissions higher than any furnace at the other plants, and because no furnaces at any of the other plants emit more than 2.5 Mg (2.75 tons) per year of arsenic, the limit on uncontrolled emissions of arsenic for existing glass melting furnaces is established at 2.5 Mg/yr (2.75 tons/yr). In establishing this limit, the estimated economic impact of applying controls to the plant located in Charleroi, Pennsylvania, was given particular consideration because the economic analysis indicated that possible closure would result. However, representatives of the firm that owns this plant indicated that they do not intend to produce an arsenic-containing glass in this furnace in the future (A–83–08/IV–E–58). Therefore, the Agency concluded that establishing the limit at 2.5 Mg/yr (2.75 tons/yr) would not result in adverse economic impacts. The EPA has also identified six other glass melting furnaces with uncontrolled inorganic arsenic emissions of more than 2.5 Mg/yr (2.75 tons/yr). However, all six of the furnaces are presently equipped with the control technology that would be necessary to meet the promulgated emission control requirements, and, as discussed below, are not expected to need any additional control to demonstrate compliance.

The selected uncontrolled emission limit of 2.5 Mg/yr (2.75 tons/yr) applies only to existing glass melting furnaces that use commercial arsenic. For new or modified furnaces, the proposed limit of 0.4 Mg/yr (0.44 tons/yr) of uncontrolled arsenic emissions has been retained in the promulgated standard. It is not feasible to establish an emission limit for new or modified glass melting furnaces on the basis of risk because it is impossible to characterize the factors that affect risk estimates for glass furnaces that do not presently exist, or do not at present use arsenic. The risks associated with emissions of arsenic are a function of the amount of arsenic emitted, the specific physical

parameters of the emission source (i.e., stack height, exhaust gas temperature, and velocity, etc.), and the location of the emission source with respect to the surrounding population. The Agency does not anticipate that any new arsenic-using furnaces will be built, or that any furnaces that do not at present use arsenic will do so in the future. Since proposal, the use of arsenic in some glass melting furnaces has been eliminated and the Agency believes that this trend is likely to continue. The companies that operate these furnaces have indicated that they do not plan to resume using arsenic. The cutoff applied to new or modified glass melting furnaces is based on consideration of cost and economic factors and has been retained in the promulgated standard to discourage reintroduction of arsenic in furnaces that have recently eliminated its use and to discourage future use. The Agency believes that this is appropriate to prevent risks from increasing near those furnaces that have recently eliminated arsenic use and because reasonable alternatives to exceeding this cutoff level are available at these facilities. These include the use of low-arsenic glass recipes and the use of controlled furnaces for production of those glass types which would result in uncontrolled emissions of arsenic of more than 0.4 Mg (0.44 ton) per year.

Format and Level of the Standard. As discussed above under Consideration of the Effectiveness of Control Technology, EPA believes that well-maintained and operated ESP's and fabric filters represent the most effective technologies for controlling emissions of arsenic from glass manufacturing plants. However, based on information and data made available after proposal, the Agency has determined that a standard requiring arsenic emissions to be reduced by a specific percentage is necessary to ensure that these control devices are applied and operated in a manner that best reflects their full effectiveness in controlling arsenic emissions.

Consideration was given to applying the percent reduction requirement to emissions of particulate arsenic rather than total arsenic. This option was considered because only arsenic emitted as particulate matter can be collected by ESP's and fabric filters. However, emission test data have indicated that for some glass melting furnaces only a relatively small proportion of the emitted arsenic occurs as particulate matter. In these cases, a control requirement based on a percent reduction in particulate arsenic would result in some furnaces meeting the

standard without reducing emissions of total arsenic to the maximum extent possible. Also, the results obtained from a recent test on a glass melting furnace (summarized in Appendix A of the BID) indicated that the Test Method 108 sampling train may not provide a reliable indication of the ratio of particulate arsenic emissions to gaseous arsenic emissions in instances where the concentration of gaseous arsenic is sufficiently high to be sensitive to gas stream temperature. Therefore, measurements of particulate arsenic, as opposed to total arsenic, may be subject to error in some instances and may not provide an accurate indication of the degree of emission reductions achieved in all cases. For these reasons, the Agency concluded that the standard should be based on the reductions of total arsenic achievable through the application of ESP's and fabric filters.

As the data from furnaces with existing control devices demonstrate (see Table IV–2), the efficiency of a given control device in reducing total arsenic emissions may not be obtained by a similar device installed on a different glass melting furnace. The variability observed in removal efficiency is primarily a function of the proportion of arsenic emitted as particulate matter. As discussed above, no correlations have been identified between the proportion of arsenic emitted as particulate matter and the type of glass produced, the type of glass melting furnace employed, the type of arsenic added to the raw materials, or other process characteristics. Although the available data do indicate that cooling of the furnace exhaust gas prior to entering a control device can sometimes be effective in increasing the proportion of arsenic emitted as particulate matter, sufficient data are not available to predict quantitatively the extent to which cooling will increase the effectiveness of control. As a result of these uncertainties, available data on the efficiencies of existing control devices in controlling total arsenic emissions cannot be generalized to glass melting furnaces that are not presently controlled. Therefore, the degree of emission reduction achievable from the two uncontrolled furnaces emitting more than 2.5 Mg/yr (2.75 tons/yr) of arsenic were also investigated.

Available emission test data for the furnace located in Charleroi, Pennsylvania, showed that the fraction of total arsenic emitted from this furnace in the particulate phase ranges from about 89 to 95 percent. Assuming that the stack gas sampling system used in these tests accurately measured the ratio of particulate arsenic to gaseous arsenic, control efficiencies for total arsenic of from 89 to 95 percent would be expected. However, because EPA expects that no arsenic will be used in this furnace in the future, no further analysis of the arsenic control efficiencies achievable for the Charleroi furnace was performed.

Emission test data supplied by Corning Glass Works on the furnace located in Martinsburg, West Virginia, showed wide variability in the proportion of arsenic emitted from the furnace as particulate matter. Data collected over a five-year period indicated that the proportion of arsenic emitted as particulate matter ranges from a low of about 30 percent to a high of about 100 percent. Wide variability was observed even for tests performed on the same day, under stable operating conditions. Because the available data on the Martinsburg furnace did not provide the Agency with any clear indication of the arsenic removal efficiencies achievable from this furnace, additional testing was performed by EPA. Simultaneous with the EPA tests, Corning conducted a series of performance tests on a pilot-scale fiber filter system that was installed on the furnace. In reviewing the data from these tests, it was concluded that cooling of the furnace exhaust gas to a temperature of approximately 121 °C (250 °F), or below, was effective in increasing the efficiency of the pilot-scale fabric filter in reducing emissions of arsenic. When the control device was operated at temperatures above 121 °C (250 °F), control efficiencies ranged from about 58 percent to 82 percent and averaged 71 percent. Control efficiencies at temperatures below 121 °C (250 °F) ranged from 75 percent to 97 percent and averaged 87 percent. The variability observed in these results reflects the fact that the operating conditions of both the furnace and the control device were variable over the course of the test program.

The operating condition that exerted the greatest influence on the percentage of arsenic reduced across the control device was the production rate of the furnace. As the production rate decreased, the concentration of particulate arsenic in the gas entering the control device also decreased. The concentration of gaseous arsenic at the inlet of the control device did not decrease at lower production rates. Because proportionally less arsenic entered the control device in particulate form at lower production rates, the percentage of the total arsenic captured by the control device decreased. However, the total concentration of arsenic in the gas leaving the control device remained constant at all furnace production rates. Therefore, although the efficiency of the control device decreased with decreasing production rate, the production rate of the furnace did not affect the amount of arsenic emitted to the air. A detailed summary of these tests is provided in Appendix A of the BID.

In selecting the level of the final standard, the Agency considered the performance of existing control devices installed on arsenic-using glass furnaces in reducing arsenic emissions, the factors affecting control device performance, the control efficiencies achievable for uncontrolled furnaces that would be required to install controls, and the cost and economic impacts of control. As reviewed above, the performance of ESP's and fabric filters installed on existing furnaces demonstrate that efficiencies of between about 92 percent and 99 percent are achievable. However, in considering the factors affecting performance, the Agency determined that no basis exists for concluding that existing control devices with relatively lower arsenic removal efficiencies could achieve higher removal efficiencies by modifying either the design or the operation of the control system. In addition, the costs of modifying any existing control systems would be disproportionate to the incremental reductions in arsenic emissions that might be achieved, even if there were reason to believe that these modifications would increase the effectiveness of control. Therefore, the Agency concluded that the final standard should be set at a level that would not require any additional control of furnaces equipped with existing control devices. In considering the data gathered from the emission tests on the uncontrolled furnace located in Martinsburg, West Virginia, the Agency concluded that the level of control achievable within the range of production rates typical for this furnace would be an 85 percent reduction in total uncontrolled arsenic emissions. Because the Agency also believes that all furnaces with existing control devices affected under the emission cutoff are capable of achieving an 85 percent reduction in total arsenic emissions without installing any additional control, the level of the final standard was set at 85 percent.

The Agency believes that the level of the final standard will ensure that the most effective technology for reducing emissions of arsenic will be applied to

the furnace that will be required to install add-on controls as a result of this regulation. Because the factors affecting the performance of particulate control devices in reducing emissions of arsenic are variable and cannot be accurately predicted, any control device installed as a result of this rulemaking can reasonably be expected to be designed and operated in a manner that ensures the most effective possible control under all furnace operating conditions. Therefore, the Agency concluded that setting the standard at a level higher than 85 percent would not result in the application of control technology any more effective than that which would be applied to reduce emissions by 85 percent. If the level of the standard were set at a higher level, however, the probability that a source may fail to demonstrate compliance would be correspondingly higher, without providing any additional environmental benefit. The Agency believes that reductions in arsenic emissions of at least 90 percent will be typically achieved by all existing controlled furnaces affected by the standard. To ensure that the intent of the standard is not circumvented by any existing or future source, provisions are included in the final regulation that prohibit the application of controls to only a portion of the furnace exhaust gas. This provision will prevent the installation of partial controls on those furnaces where all of the arsenic is emitted as particulate matter under all furnace operating conditions, and an overall 85 percent reduction could be achieved by applying controls to only a portion of the furnace exhaust gas.

The final standard does not require cooling of furnace exhaust gases to any specific level prior to entering a control device. The Agency has no basis for determining under what conditions cooling would be effective in increasing control device performance or for predicting the extent to which cooling might increase performance. Therefore, a requirement that the exhaust gas from all affected furnaces be cooled to some specific level prior to entering a control device would result in increased costs with no guarantee that additional arsenic emission reductions would be achieved. The Agency believes that both the level and the format of the final standard are sufficient to ensure that furnace exhaust gases are cooled in those instances where the effectiveness of control is dependent on the operating temperature of the control device. In the case of the furnace located in Martinsburg, West Virginia, the Agency expects that the temperature of the

furnace exhaust gas will be cooled to below 121 °C (250 °F) prior to entering the control device. The final standard includes provisions for continuous monitoring and recording of the operating temperature of a control device to ensure that the temperature maintained during the emission test to demonstrate compliance is also maintained thereafter.

Discussion of Comments

Comments on the proposed standard were received from 20 interested parties, and three speakers commented on the proposed standard for glass manufacturing plants at the public hearing. In addition, four comment letters were received on the March 20, 1984, Federal Register notice regarding options proposed by EPA for controlling emissions from furnaces producing soda-lime glass and calculating zero production offsets. The following sections summarize the Agency's responses to the major comments and the consideration given these comments in formulating the standard being established today.

Applicability

Several commenters raised questions about the applicability of the regulation to glass manufacturing plants, both generally and with respect to specific circumstances. The major issues raised by the commenters concerned the consideration of risk in establishing an emissions cutoff, the applicability of the regulation of furnaces that are at present equipped with add-on control devices, the applicability of the regulation to emissions arising from trace impurities of arsenic in non-arsenic raw materials, the reliance on OSHA standards for controlling fugitive emissions of arsenic, and the applicability of various allowances and exemptions.

Selection of Annual Uncontrolled Emission Limit. One commenter (the New Jersey Department of Environmental Protection) stated that the proposed arsenic emission limit of 0.4 Mg/yr (0.44 ton/yr) for uncontrolled emissions was based entirely on cost and economic factors, with no consideration given to the risks associated with these emissions.

At the time of proposal, the Agency's standard setting approach involved first selecting a standard that was achievable through the application of best available technology (BAT). Determination of BAT was based on the capability of existing technologies to reduce emissions, as well as on the costs of emission controls and on the economic impact of applying the controls at specific facilities. The

residual risks remaining after application of BAT to furnace that would have been affected by the proposed limit (0.4 Mg/yr of arsenic prior to control) were then considered to determine if a more stringent standard would be necessary to protect public health. The Agency determined that eliminating the 0.4 Mg (0.44 ton) per year exclusion level would not affect the estimated maximum lifetime risk and would have negligible effect on estimated cancer incidence. Since proposal, Agency policy has evolved to place greater emphasis on risk and risk reduction in determining which specific sources within a source category shall be subject to an emission limit under section 112. Costs and economic impact are still considered in relation to the reductions in risk achievable through the use of selected control technologies.

Because of various site-specific factors, the degree of risk associated with inorganic arsenic emissions from glass manufacturing plants does not, in all cases, directly correlate with the absolute magnitude of those emissions. For instance, a fugitive emission source with a relatively low emission rate released relatively close to the ground may have a similar air quality impact as a stack with a higher emission rate and a higher point of release. Moreover, risks to the population in the vicinity of a plant must be assessed in terms of emissions of inorganic arsenic from an entire plant, rather than emissions from individual furnaces within a plant. Therefore, in establishing an emission cutoff, the emphasis has shifted from consideration of the magnitude of the emissions arising from individual furnaces, and the costs of controlling those emissions, to consideration of the magnitude of the risks associated with specific plants and the degree to which those risks can be reduced at a reasonable cost. The application of this policy in developing the final standard was described above under Selection of Standard.

Applicabilty to Furnaces with Existing Control Devices. One commenter representing Corning Glass Works stated that all glass melting furnaces that are currently equipped with add-on control technology should not be required to install additional control. The commenter indicated that the largest and most cost-effective reductions in arsenic emissions could be obtained from furnaces that are currently uncontrolled.

The promulgated emission limit requiring 85 percent reduction of arsenic emissions applies to all existing glass melting furnaces that emit more than 2.5

Mg/yr (2.75 tons/yr) of arsenic prior to an add-on control device. Thus, furnaces with existing control devices must achieve this limit if emissions of arsenic from these furnaces would be more than 2.5 Mg/yr (2.75 tons/yr) if controls were not in place; EPA is aware of 6 such furnaces. Available emission data indicate that arsenic emissions from each of these furnaces are currently being reduced by more than 85 percent; therefore, demonstration of compliance should be possible without installation of additional control.

Trace Amounts of Arsenic in Raw Materials. Three commenters, including the Glass Packaging Institute, addressed the issue of whether the presence of arsenic as an impurity in the raw materials used to manufacture glass should be considered in determining the applicability of the standard. Each of these commenters expressed concern that it would be burdensome and costly to require facilities that do not use arsenic as a raw material to demonstrate that emissions arising from trace arsenic contamination of other raw materials would not result in exceedance of the proposed annual uncontrolled emission limit of 0.4 Mg per year (0.44 ton per year). The commenters requested that EPA explicitly exclude from the promulgated regulation all furnaces that do not intentionally use arsenic as a raw material. One commenter noted that the arsenic content of raw materials is not routinely specified by raw material suppliers since arsenic is not known to impair glass quality. However, the commenter indicated that in a telephone survey of glass manufacturers and raw material suppliers, no evidence was found that arsenic exists in significant quantities as an impurity of raw material components. The only detectable quantity of arsenic was found in Green River soda-ash concentrations ranging from 0.03 to 0.5 ppm. These concentrations would result in maximum uncontrolled arsenic emissions of about 1.1 kilogram (2.5 pounds) per year from a typical 225 Mg/day (250 ton/day) glass container furnace. This commenter concluded that EPA should give no consideration to the arsenic content of raw materials since there is no reason to believe that the arsenic content of raw materials used for glass manufacture is any higher than it is raw materials used in other process industries. Another commenter, however, pointed out that for the size of furnace typically used to produce flat glass (450 to 545 Mg/day [500 to 600 tons/day]), trace amounts of arsenic in the raw materials on the order of 2 to 3 ppm by weight could result in

uncontrolled arsenic emissions approaching the proposed emission cutoff of 0.4 Mg/year (0.44 tons/yr). The commenter is aware of only one conventional raw material that contains arsenic as an impurity. That one exception, an additive used in small amounts in producing body-colored glass, would result in arsenic emissions of less than one pound per year.

The EPA has examined the problems posed by the presence of arsenic as an impurity in various raw materials used in the production of glass, and has concluded, based on available information, that this source of arsenic is not expected to affect significantly the emissions of inorganic arsenic from glass manufacturing furnaces. The specific comment that appears to indicate that the presence of arsenic impurities may result in emissions approaching 0.4 Mg (0.44 ton) per year was closely examined. It was determined that the calculations present an unrealistic situation in presuming that all of the raw materials entering the furnace contain 2 to 3 ppm arsenic by weight, and that all of the arsenic entering the furnace is emitted. Because it would be uncommon for all raw materials to contain arsenic at that level, and because at least 70 percent of the arsenic is expected to be retained in the product, EPA has concluded that the emissions calculated in the example given in the comment are substantially overstated and not indicative of an actual condition that might occur.

The EPA has also independently investigated the concentration of arsenic found in the bulk raw materials commonly used in the glass industry (A-83-08/IV-B-12). During an emission test of an arsenic-using furnace, samples of the bulk raw materials were taken and analyzed for arsenic content. With the single exception of barium carbonate, the concentrations of arsenic in the raw materials from this plant were below the detection limits of the analytical method used. The measured concentration of arsenic in the barium carbonate sample was 2.32 ppm. However, barum carbonate is not widely used in large quantities within the glass industry. Even assuming that the concentration of arsenic in bulk raw materials is equal to the detection limit of the analytical methods used on the test samples, the maximum uncontrolled emissions of arsenic arising from raw material impurities would be about 0.19 Mg/yr (0.21 ton/yr) from a furnace producing 500 Mg/day (550 tons/day) of glass.

Based on all of the information available to the Agency, glass melting plants that do not use commercial

arsenic as an ingredient of their batch composition would not emit enough arsenic to be affected by the promulgated uncontrolled emission limits of 0.4 Mg (0.44 ton) per year for new and modified furnaces and 2.5 Mg (2.75 tons) per year for existing furnaces. The EPA agrees it would be unreasonable to require demonstration of this; and, therefore, the applicability section of the promulgated regulation has been revised to exclude all furnaces that do not use commercial arsenic as a raw material. Commercial arsenic is defined as any form of arsenic that is produced by extracting arsenic from any arsenic-containing substance and is intended for sale or for intentional use in a manufacturing process.

Fugitive Emissions. The NRDC representative objected to EPA's reliance on compliance with OSHA standards for fugitive emissions of inorganic arsenic in the workplace. The NRDC felt it was not appropriate to consider OSHA standards in deciding not to propose standards for these emissions. The commenter stated that: (1) This reliance was based solely on statements made by company representatives, and had not been independently verified by the Agency; (2) although OSHA standards, if implemented, may provide protection to workers in glass manufacturing plants, they do not give persons living around the plants the enforcement power to compel compliance with the standards that would be available under the Clean Air Act; and (3) the Agency should, at the least, incorporate into a section 112 standard the equipment and work practice requirements needed to comply with the OSHA standards.

The Administrator believes that where standards established under separate authorities are effective in reducing emissions, redundant standards need not be established by EPA. The Agency establishes separate standards when there is evidence that either the control measures are not likely to remain in place or are unlikely to be properly operated and maintained. The EPA has again reviewed the emission sources at glass manufacturing plants to determine any need for controls beyond those required by OSHA.

Information gathered after proposal during visits to glass plants that use arsenic indicated that fugitive emissions from some plants may not be controlled. As a result of this finding, EPA has estimated the magnitude of the emissions of inorganic arsenic that could arise from fugitive sources within glass manufacturing plants (A-83-03/

IV–B–11). These estimates were based on published fugitive emission factors for various material handling operations, as well as on data gathered during visits to glass plants that use arsenic. To be conservative, "worst case" conditions were assumed in estimating potential fugitive arsenic emissions. For example, in this analysis it was assumed that the plant uses unusually high concentrations of arsenic (7 kg/Mg [14 lb/ton]) in the batch raw materials. The major potential source of fugitive particulate emissions at glass manufacturing plants are the material handling operations associated with the unloading, storage, and weighing of the bulk raw materials. However, arsenic is not present during these operations. Arsenic is added later, just prior to mixing the batch. Fugitive emissions of arsenic could occur during mixing of the batch materials, during the transfer of these materials to the furnaces, when the materials are charged into the furnace, and when control devices (if used) are emptied and the waste products are removed for disposal or recycled to the melting furnace. In considering all of the possible sources of fugitive emissions from glass manufacturing plants, and employing the best information currently available to the Agency, the EPA estimated that the maximum fugitive emissions of arsenic from a large, 545 Mg per day (600 tons per day), plant would amount to 0.21 Mg/yr (0.23 ton/yr) if emission control devices were not used. For a plant of this size, uncontrolled stack emissions would be about 145 Mg/yr (160 tons/yr). The same plant, if controlled, would emit about 7 Mg/yr (8 tons/yr) out of the stack(s); fugitive arsenic emissions from a 545 Mg/day (600 tons/day) controlled plant were estimated to be 0.33 Mg/yr (0.36 ton/yr) under worst case conditions. Because all of the plants known to use arsenic have capacities less than 545 Mg/day (600 tons/day), and because the estimates summarized above are based on "worst case" assumptions, the EPA has concluded that fugitive emissions of inorganic arsenic from glass manufacturing plants are negligible, and, hence, risks are expected to be small; thus, fugitive emissions are not expected to endanger public health. Therefore, the promulgated standard neither requires controls for fugitive inorganic arsenic emissions at glass manufacturing plants nor incorporates OSHA requirements into the promulgated standard as suggested by the commenter.

Allowances and Exemptions. One commenter representing Corning Glass Works requested that the EPA include provisions for conducting normal maintenance on control devices. Most glass furnaces operate continuously for a period of years, while emission control devices require frequent maintenance. The commenter stated that the maintenance requirement on an electrostatic precipitator is about 144 hours per year and that provisions should be made for by-pass of the control device while maintenance is being conducted.

The EPA has investigated the cost and environmental impacts associated with performing routine maintenance on emission control devices installed on affected glass furnaces (A–83–08/IV–B–10). Two alternatives were considered. The first alternative would be to require the glass furnace to shut down during these maintenance periods in order to avoid uncontrolled emissions of arsenic. The second alternative would allow furnace operators to by-pass the control device for a limited period of time for maintenance purposes. Emissions of arsenic during these periods would not be controlled. The EPA analysis compared the increase in the cost incurred by a model manufacturing plant that would result from the first alternative to the increase in emissions that would follow from the by-pass alternative. In this analysis both large and small furnaces and high and low glass production costs were considered. In total, the cost and environmental impacts associated with the alternative requirements were evaluated for eight different cases.

In the first four cases, the impacts were calculated for two furnace sizes (45 and 136 Mg/day [50 and 150 tons per day]) and for two levels of specific arsenic emissions (0.025 kg/Mg of glass produced and 0.05 kg/Mg of glass produced [0.05 lb and 1.00 lb ton/of glass]). In the first four cases, relatively low glass production costs were assumed, on the order of $0.75/kg ($0.34/lb) of product. The second four cases assumed the same furnace sizes and specific arsenic emission rates, but were based on the assumption of a glass with higher production costs of $4.19/kg ($1.90/lb). These values represent the low and high end of the ranges for actual glass furnaces that use arsenic. In all cases, it was assumed that the time required for maintenance of control devices is 144 hours per year.

The results of this analysis showed that a large furnace with a high arsenic emission rate could emit up to 0.41 Mg (0.45 ton) of arsenic during the 144 hours that the control device is by-passed. Small furnaces with low arsenic emission rates would emit 0.01 Mg (0.01 ton) of arsenic during this maintenance period. The annual costs of furnace shutdown were estimated to range from a low of $63,000 for a small furnace producing a low-cost glass, to a high of $1,000,000 for a large furnace producing a high-cost glass. Thus, the cost effectiveness of requiring all arsenic-using furnaces to be shut down while maintenance is carried out on emission control devices would range from about $463,000 per Mg ($420,000 per ton) of arsenic removed to over $51,800,000 per Mg ($47,000,000 per ton) of arsenic removed.

Because the economic impacts of requiring furnaces to be temporarily shut down while maintenance is performed on emission control devices would be excessive in some cases, and because the use of well-maintained control devices is essential in effectively controlling arsenic emissions on a continuing basis, the promulgated standard allows emission control devices installed on furnaces affected by the standard to be by-passed for purposes of conducting necessary maintenance. The EPA has also determined, however, that inorganic arsenic emissions from glass melting furnaces can be reduced by implementing certain work practices during maintenance periods. Therefore, each owner or operator of an affected furnace who needs to by-pass the control device for maintenance purposes is required to submit a plan to the Administrator that details (1) the length of time it will be necessary to by-pass the control device; (2) the emissions of arsenic that would occur during maintenance periods if no steps were taken to reduce them; (3) the procedures and work practices that will be implemented to minimize arsenic emissions during maintenance periods; and (4) the expected reduction in emissions of arsenic achieved by the implementation of these procedures and work practices. Only after approval by the Administrator of this plan will the by-pass of an emission control device by allowed.

In some cases, emissions of inorganic arsenic can be prevented entirely while control devices are undergoing maintenance. For example, control device maintenance should be scheduled during periods of normal furnace shutdown whenever possible. For some plants, it may be feasible to switch production temporarily during periods of control device maintenance to glasses that do not contain arsenic. All facilities affected by the regulation should make maximum use of control devices that are divided into two or

more independently operated sections. Use of so-called "sectionalized" control devices enables maintenance to be performed on one section of the device without affecting the operation of the other(s). Other steps that can be taken to minimize emissions of inorganic arsenic during maintenance of control devices are the maximum use of cullet, the temporary reduction in arsenic feed, or the temporary reduction of furnace output.

Format of the Standard

Two commenters on the proposed regulation stated that using the emission rates for total particulate allowed under the standard of performance for new sources (NSPS) as the basis of the control requirement for an arsenic NESHAP would lead to numerous problems in demonstrating compliance with the regulation. Corning Glass Works provided several examples in which multiple furnaces, each melting a different type of glass, are exhausted to a common stack. Because the proposed emission rates were different for different glass types, the commenter felt that it would be virtually impossible to determine compliance for each possible combination of furnaces and glass types. The commenter also noted that some furnaces currently equipped with the best control technology available would not comply with the proposed emission rates for total particulates. The New Jersey Department of Environmental Protection recommended that the Agency establish an efficiency standard for arsenic removal, rather than an emission rate for total particulate matter.

In carefully evaluating all of the comments and available data, the Agency has determined that a control requirement based on a percent reduction of arsenic emissions is preferable to a limit on emissions of total particulates from glass melting furnaces. Some furnaces in the pressed and blown segment of the industry are used to melt various types of glass. The type of glass being melted in these furnaces may change frequently, causing a corresponding change in particulate emission rates. No satisfactory approach could be developed for determining compliance with a particulate emission rate on a continuing basis under these circumstances, or for prorating emissions from multiple furnaces that exhaust to a common stack. The EPA has also found that particulate emission rates from arsenic-using furnaces that are currently uncontrolled are, in some instances, significantly less than would be normally expected. Thus, these furnaces could conceivably meet the

proposed particulate emission limit by reducing particulate emissions by as little as 45 percent. In this case, the corresponding reduction achieved in arsenic emissions would be only 40 to 45 percent, even though all of the emitted arsenic may be in the particulate matter. Therefore, EPA has found that control equipment that would meet the proposed particulate emission limits may not, in all instances, represent the most effective control technology for arsenic emissions. Finally, EPA has assembled all of the available data on control devices currently installed on arsenic-using glass furnaces. Many of these control devices achieve more than 95 percent reduction in total arsenic emissions, although some of them are not capable of reducing emissions of total particulates to the level prescribed by the NSPS. The costs of upgrading these control devices to meet the NSPS particulate emission rates were investigated and found to be excessive when compared to the additional reduction in arsenic emissions that would be achieved. There is one disadvantage of an emission limit based on arsenic emission reduction efficiency—the increased cost of testing the inlet and outlet of the control device. This type of testing using Test Method 108 would cost about $13,250 for a typical furnace as opposed to about $10,000 for particulate matter testing using Reference Method 5. The EPA believes, however, that the additional testing costs involved in determining the efficiency of a control device in reducing arsenic emissions are warranted, considering the various problems and impacts associated with the proposed emission limits for total particulates. Therefore, the format of the final standard is in terms of percent reduction of arsenic emissions.

Control Technology

Several commenters addressed the issue of the level of control of arsenic emissions achievable by conventional particulate control technologies. Many of these comments were concerned with the effect of temperature on the percentage of total arsenic emitted in particulate form, and, therefore, available for removal by the control devices.

As discussed in the preamble to the proposed regulation, theoretical considerations indicate that all of the arsenic emitted from glass melting furnaces would be in the vapor phase at typical furnace exhaust temperatures. At the time of proposal, however, data from EPA tests on two particulate control devices installed on glass melting furnaces that use liquid arsenic

acid as a raw material showed that more than 90 percent of the emitted arsenic was in particulate form and collected by the control devices. On the basis of these data, EPA concluded that cooling of the exhaust gases may not be effective in increasing the efficiency of particulate control devices in reducing arsenic emissions from glass melting furnaces. The EPA acknowledged at the time, however, that emissions from furnaces using powdered arsenic trioxide rather than liquid arsenic acid might consist of substantially more vapor-phase arsenic. It was also uncertain whether the relationship between temperature and the proportion of arsenic emitted in the solid phase was the same for all types of glass.

In order to resolve these questions, the EPA performed five emission tests after proposal on arsenic-using glass melting furnaces. The tests proved helpful in demonstrating that the use of powdered arsenic trioxide instead of arsenic acid had little or no effect on the proportion of arsenic emitted in the solid phase. The results of these tests were inconclusive, however, as to the effect of temperature on the proportion of arsenic in the solid phase for different types of glass. The EPA presented a summary of the data in the **Federal Register** on March 20, 1984 (49 FR 10278), and tentatively concluded that a decrease in temperature would result in an increase in particulate arsenic for soda-lime furnaces, but not for other types of furnaces. These data are discussed fully in that notice and in the BID for the promulgated standard. In developing the requirements in the final standard, EPA considered public comments on the March 20, 1984, **Federal Register** notice and the results of two additional emission tests that are discussed below.

Control Methods for Soda-Lime Furnaces. The representative for Corning Glass Works stated that data from one of the commenter's soda-lime furnaces indicate that the percentage of arsenic in the particulate matter increases, rather than decreases, with increasing exhaust gas temperature. The proportion of arsenic found in the particulate from this furnace varied widely, however, from a low of about 50 percent to a high of 99 percent. Data provided by the commenter for a furnace producing aluminosilicate glass also showed a wide variability in the proportion of total arsenic that was emitted as particulate matter. For 23 representative samples collected on this furnace, from about 30 to 100 percent of the total arsenic was emitted as particulate. The commenter concluded that temperature is not the only factor

affecting the fraction of total arsenic emitted as particulate matter. The commenter for Owens-Illinois challenged the validity of the data presented by EPA in the March 20, 1984, Federal Register. This commenter stated that the data were flawed and did not conclusively demonstrate that there is a relationship between temperature and the fraction of total arsenic emitted in particulate form. The commenter believes that EPA's earlier conclusion that at least 90 percent control of arsenic emissions can be achieved by particulate control devices is correct. The NRDC stated that the data presented by EPA demonstrate that emissions of particulate arsenic increase sharply as the temperature of the furnace exhaust gases decreases, and that EPA should require exhaust gases from soda-lime furnaces to be cooled to 121°C (250°F) prior to entering a particulate control device.

The results of the first test on a furnace melting soda-lime glass showed that less of the total arsenic emitted from the furnace was in particulate form compared to the previous tests (about 74 percent compared to more than 90 percent) at the standard EPA Method 108 sampling temperature of 121°C (250°F). In addition, samples taken simultaneously at three different temperatures (121°C, 204°C, and 288°C) showed that the amount of arsenic in the particulate matter generally increased as the filtered gas was cooled from 288°C (550°F) to 121°C (250°F). However, the amount of vapor-phase arsenic detected in these samples did not decrease in proportion to the increase observed in particulate arsenic, and the total amount of arsenic collected at 288°C (550°F) was uniformly less than the total amount collected at a filtered gas termperature of 121°C (250°F). The results of this test were also complicated by the fact that some of the filters used during the test were later found to be torn. Because there was not a decrease in vapor-phase arsenic emissions in proportion to the apparent increase in particulate arsenic, no clear basis exists for concluding that cooling of the exhaust gases causes a significant amount of vapor-phase arsenic to condense and form particulate arsenic. For this reason, the Agency has no assurance that cooling of furnace exhaust gases would result in a significantly higher arsenic removal efficiency. The Agency agrees with the commenter that the data obtained from the first test on a soda-lime furnace are inconclusive, and are insufficient to support a limit on the temperature of the

gases at the inlet of particulate control devices.

After publication of the notice in the Federal Register on March 20, 1984, a second arsenic emission test was performed on a soda-lime glass melting furnace. No significant amounts of vapor-phase arsenic were found in the emissions from this furnace regardless of the temperature of the filtered gas. In all test runs, more than 99 percent of the total arsenic was captured as particulate matter. Therefore, even if the results of the first test on a soda-lime furnace had quantified a relationship between temperature and the amount of arsenic emitted as particulate matter, this relationship could not be generalized to all furnaces producing soda-lime glass.

The EPA also performed emission tests on a glass melting furnace producing an aluminosilicate glass. Although the furnace is not presently equipped with a permanent control device, a pilot-scale fabric filter system had been recently installed on the furnace. The test program included both EPA Method 108 and single-point sampling, as well as a series of performance tests on the pilot-scale fabric filter. The results of these tests did conclusively demonstrate that cooling of the furnace exhaust gases caused gaseous arsenic to condense, and thereby increased the effectiveness of the fabric filter in reducing arsenic emissions. When the temperature of the exhaust gas was cooled to below 121°C (250°F), control efficiencies ranged from about 75 percent to 97 percent and averaged about 87 percent. When the temperature of the exhaust gas was maintained above 121°C (250°F), control efficiencies ranged from about 58 percent to 82 percent and averaged about 71 percent. The data also indicated that the effectiveness of cooling is sensitive to the concentration of gaseous arsenic in the exhaust gas and to the residence time of the gas stream at lower temperatures. However, the data collected during these tests are not sufficient to correlate specific temperatures to specific removal efficiencies.

Although the available data to indicate that arsenic emissions from some glass melting furnaces may occur less predominantly as particulate matter than was previously believed, and that cooling can be effective in increasing the proportion of total arsenic emitted as particulate matter, no correlations have been identified between the proportion of arsenic emitted as particulate matter and the type of glass produced, the type of melting furnace used, the type of arsenic added to the raw materials, or

any other source characteristics. In addition, EPA does not have sufficient data to conclude that cooling of furnace exhaust gases would be effective in incrasing the efficiency of a control device in all cases. Therefore, a requirement that the exhaust gas from all affected furnaces be cooled to some specific level prior to entering a control device would result in increased costs with no guarantee that additional control would be achieved. The Agency does nonetheless believe, that both the format and the level of the final standard are sufficient to ensure that furnace exhaust gases are cooled in those instances where the effectiveness of control is dependent on the operating temperature of the control device.

Elimination of Arsenic in Glass Manufacturing

Four commenters representing Owens-Illinois, the Glass Packaging Institute, NRDC, and legal counsel for Container Glass Manufacturers, discussed the elimination of arsenic as a raw material in the manufacture of glass. Two of these commenters stated that use of arsenic in the manufacture of glass containers has been completely eliminated, and that there is no technical reason to use arsenic in the manufacture of glass container products. These two commenters made no objection to a requirement that arsenic be eliminated from glass container manufacturing, as long as no additional administrative burdens were placed upon container glass manufacturers. The commenter for Owens-Illinois stated that the use of arsenic in the manufacture of pressed and blown glassware is essential and that no acceptable substitutes are currently available. Without arsenic, tableware glass tends to have an objectionable green tint. The NRDC objected to the contention that the elimination of arsenic in pressed and blown glass manufacturing would have serious consequences for this sector of the glass manufacturing industry. The commenter stated that the only benefit to the glass industry stemming from the use of arsenic is that it improves the cosmetic qualities of the glass by making it clearer. The NRDC asserted that cosmetic benefits are insufficient to justify public exposure to arsenic emissions and urged that the standard be amended to eliminate arsenic from the manufacture of pressed and blown glass. The commenter also stated that if there are specialized, nonsubstitutable uses for arsenic that rise above the level of cosmetics, then EPA should set a standard requiring extremely stringent

controls for a small number of furnaces dedicated to such uses.

Based on the public comments received and the information available before and after proposal of the standard, the EPA has concluded that the container glass, flat glass, and wool fiberglass segments of the glass manufacturing industry do not use arsenic as a raw material in the manufacturing process. Because the promulgated standard applies only to furnaces that use arsenic as a raw material, no furnaces in the container, flat, or wool fiberglass segments of the glass industry would be affected. Owners or operators of furnaces that do not melt a glass in which arsenic is added as a raw material are not subject to the requirements of this standard, including those for reporting and recordkeeping. If an owner or operator of a furnace in any of these segments of the industry were to begin using arsenic, the furnace would be subject to the standard.

Arsenic is used in the manufacture of some products in the pressed and blown segment of the glass industry, however. A case-by-case assessment of the potential to eliminate arsenic use was conducted by contacting all six major manufacturers of pressed and blown soda-lime glassware (A-83-08/IV-B-13). Although some companies have been successful in removing arsenic entirely from their raw batch materials, other companies producing similar types of glass have been unable to obtain a product of acceptable quality when arsenic is removed. Although the qualities achieved by the inclusion of arsenic (clarity, elimination of unwanted color, etc.) are "cosmetic," they do have economic value, and reflect certain physical attributes of the final product that are required by the consumer. Demand for these products is inherently connected to their physical appearance which, therefore, has a tangible economic value. The EPA expects that producers of pressed and blown glassware will continue to try to eliminate arsenic from their batch recipes to avoid being subject to the requirements of this standard. It is not clear, however, when (and if) these efforts will be successful. Because a requirement to eliminate the use of arsenic in the pressed and blown glass segment of the industry could cause severe economic impacts for some producers, it is not included in the final standard but will be evaluated as part of the 5-year review of the standard.

Costs and Economic Impact

The Corning Glass Works representative stated the belief that

some plants would close down if the proposed standard were promulgated, but did not provide any data to support that statement. Another commenter representing Owens-Illinois stated that the monetary costs required to comply with the standard would severlly affect an already depressed market, which is facing significant and increasing competition from foreign producers of glass tableware. Between 1979 and 1982, the compound growth in imports has been 6.8 percent, while growth in the domestic share of the market has declined by 0.4 percent. In addition, over the past 10 years there has been a decline in real total dollar market value for the U.S. tableware industry. Two tableware manufacturers have recently closed plants. The strong U.S. dollar will continue to favor imports of glass tableware. The commenter stated that reducing emissions to the level proposed by the standard is estimated to cost $15.65/Mg ($14.20/ton) of glass. These costs would increase operating costs by over $2 million per year. This represents an increase of 2.1 percent in production costs over 1982 levels, which would have decreased 1982 profits by 25 percent.

The EPA recognizes that machine-made glass tableware manufacturers are facing competition from foreign producers of glass tableware; and in the economic analysis conducted after proposal, it was assumed that prices cannot be raised and that companies must absorb the control costs as decreased profits. (See Appendix B of the BID for promulgated standard.) The costs cited by the commenter were for a specific plant owned and operated by the commenter. The costs and economic impacts of the promulgated standard were analyzed for this plant, and EPA concluded that they would be disproportionately high compared to the risk reduction that would be achieved through compliance with the standard. Therefore, while the plant is one of several that would have had to install control devices to achieve the proposed standard, it is expected to have average annual arsenic emissions below the revised emission limit for existing furnaces in the final standard.

The economic analysis indicated a potential closure for only one furnace currently using arsenic and with arsenic emissions above the revised cutoff. Company representatives have informed EPA, however, that they plan to eliminate the use of arsenic at this furnace; therefore, it would not be affected by the standard. The EPA's analysis indicated that no other furnace closures would result from the standard.

One commenter for NRDC stated that the "worst case" economic analysis conducted by EPA has been grossly exaggerated in reaching a conclusion that under certain conditions the proposed regulation could cause some furnaces to close. Further, the commenter stated that the assertion that the elimination of arsenic from pressed and blown glass would make U.S. manufactured glassware uncompetitive with glassware imported from countries that do not restrict arsenic use has not been supported by hard data or analysis. The commenter stated that if the regulation does impose a competitive disadvantage on U.S. glass manufacturers, other steps should be taken to protect their position, such as the imposition of duties on imports of arsenic-containing glass.

The revised economic analysis of the promulgated standard explains that cost absorption (profit reduction) by producers, rather than cost pass-through to consumers, is more likely to result because of the competitive role of imports. Using this assumption, all control costs were analyzed as additions to baseline operating expenses. No closures are anticipated as a result of the promulgated standard.

The EPA's assertion that U.S. manufacturers of pressed and blown glass would be at a competitive disadvantage to foreign manufacturers if arsenic were eliminated as a glass additive is based on the fact that the properties that arsenic provides for glass products have an economic value. Such properties as clarity are desired by the consumer and, thus, are considered necessary for certain products to be competitive in the market. The economic value of these properties has not been quantified but is, nevertheless, real. The commenter's suggestion that duties be imposed on imports of pressed and blown glass that contain arsenic cannot be implemented because EPA does not have legislative authority to impose such duties or to take any similar measure to reduce possible competition to U.S. glassware manufacturers by foreign glass.

Monitoring and Measurement Methods

One commenter for the Toledo, Ohio, Environmental Services Agency supported EPA's position that a material balance or other non-stack test data be used to establish whether a facility is affected by the proposed regulation and to monitor compliance. However, the commenter requested clarification on two points. First, how much confidence does the EPA have in the estimates of arsenic retention in glass? Specifically,

should the low end of the estimate, 70 percent retention, be used in estimating uncontrolled arsenic emissions? Second, how should the arsenic content of the cullet be determined? Is it accurate to assume that all of the arsenic entering with the cullet remains in the glass, and thus has no impact on arsenic emissions?

The estimates of the amount of arsenic in the glass product were provided by the glass industry. Data obtained from tests conducted by EPA have been found to be reasonably consistent with data supplied by industry representatives. It should be noted, however, that the amount of arsenic retained in the glass can vary significantly according to the specific recipe used in making glass.

The 70 percent retention value published in the proposal BID (EPA–450/3–83–011a) was supplied by industry representatives as a typical retention rate for lead silicate type glass. Data gathered by the EPA after proposal have demonstrated that at least 70 percent of the arsenic is retained in the glass product, regardless of its composition. However, the amount of arsenic retained in the glass product is not strictly a function of the type of glass produced. For any given type of glass, the percentage of arsenic retained in the product can vary widely. For . example, data collected by EPA show that the percent of arsenic retained in soda-lime glass can range from about 70 percent to about 90 percent. Therefore, in estimating uncontrolled arsenic emissions the arsenic retention value should be based on actual laboratory analysis of the glass produced in a specific melting furnace. If analytical data are not available, an assumed retention value of 70 percent would provide an estimate of the maximum rate of uncontrolled arsenic emissions from the glass melting furnace. In developing a material balance for monitoring compliance, it is the responsibility of the furnace owner or operator to provide a theoretical emission factor that accurately takes into account the amount of arsenic retained in the glass. Retention values should be based on actual analytical data for the specific type(s) of glass produced by the affected furnace.

The amount of arsenic entering the furnace in the cullet should be explicitly accounted for. Some furnaces may add mixed cullet that is not exactly similar in chemical composition to the type of glass being melted. When the cullet added is identical to the glass being produced, the percentage of arsenic in the cullet can be assumed to be identical

to the percentage retained in the glass. Thus, the arsenic entering with the cullet would not have any impact on inorganic arsenic emissions. When this assumption is made, however, care must be taken to calculate the amount of arsenic retained in the glass on the basis of the percent of product weight that is derived from fresh raw materials rather than on the basis of the total product weight. This is discussed in more detail in the BID for the promulgated standard.

Opacity Monitoring

Two commenters (Owens-Illinois and Corning Glass Works) stated that the proposed requirement for opacity monitoring of emissions exiting the control device in unnecessary and inconsistent with the NSPS for glass manufacturing, which does not require opacity monitoring. The commenter for Owens-Illinois indicated that opacity monitoring would represent an unjustifiable cost burden. The commenter for Corning stated that opacity monitoring is administratively burdensome, and readings cannot be correlated with emissions of either inorganic arsenic or particulate, especially when multiple furnaces are exhausted to a common stack. The commenter noted that excessive stack opacity occurs in one of the commenter's furnaces as a result of gaseous fluoride emissions from melting one type of glass, and that this opacity is unrelated to inorganic arsenic or total particulate emissions.

The requirement for opacity monitoring was proposed as a means to ensure that emission control devices installed on arsenic-using glass furnaces are continuously operated and maintained in a manner consistent with the procedures followed to comply with the standard initially. These requirements have been retained in the promulgated standard. Under the glass manufacturing NSPS promulgated October 19, 1984, opacity monitoring is not required for glass furnaces equipped with control devices. However, opacity monitoring is required for furnaces using process modifications to meet the NSPS. The NSPS requirement for glass manufacturing plants has no bearing on this action because the intent of this regulation is to control a hazardous air pollutant that is not specifically regulated under the NSPS. With respect to the costs of opacity monitoring, EPA has determined that the costs involved are reasonable in light of the additional information provided to the owner and operator of a control system and the improved effectiveness in enforcement that will be gained as a result of this requirement. No information has been

presented to the Agency that indicates that continuous monitoring of opacity represents an unjustifiable cost burden.

The promulgated standard does not set any specific limit on stack gas opacity based on correlations between opacity and emissions of either particulate matter or of arsenic. Rather, the promulgated standard requires that a 6-minute average reference opacity value for a given furnace be determined during compliance testing. Any subsequent exceedance of the reference opacity value established during a compliance test must be reported semiannually. If excess opacity occurs as a result of a change in the composition of the glass being melted in a furnace, this cause should be cited in the report. Alternatively, if multiple types of glass are typically melted in a single furnace, and stack gas opacity is expected to be significantly higher for one type of glass, the initial compliance test may be performed while this glass is being melted. Finally, paragraph 61.163(h) of the promulgated standard allows owners or operators of affected furnaces to petition the Administrator for approval of any alternative continuous monitoring system that can be demonstrated to provide accurate and representative monitoring of a properly operating control device.

Several commenters suggested changes in the proposed Method 108. These suggestions and the rationale for changes are discussed in the BID for the promulgated standard. Briefly, changes in Method 108 include deletion of all references to SO_2 collection and analysis, a change in the sampling temperature for glass furnaces to $121°C±14°C$ ($250°F±25°F$), a revision requiring that audit samples be analyzed at least once per month, and elimination of the digestion procedure when Method 108 is applied to glass furnaces.

One commenter for the Department of Environmental Resources in Harrisburg, Pennsylvania, saw no reason to differentiate between sources firing fuels with more than, or less than, 0.5 percent by weight sulfur content. The Agency agrees that there is no reason to differentiate between sources firing fuel with greater than 0.5 percent by weight sulfur from those with less than 0.5 percent, and has revised the standard accordingly.

The commenter for Corning Glass Works stated that the time allowances for testing under the proposed § 61.163 were inflexible and inadequate, and that the specified testing procedures were inflexible and unnecessary. In support, the commenter provided data showing that other analytical methods can

provide similar results to those obtained when using the specified EPA Method 108 procedures.

The major difference between the procedure proposed by the commenter and the EPA Method 108 procedure was in the method used in determining arsenic concentration of the samples. The procedure proposed by the commenter employed the colorimetric molybdenum blue method instead of atomic absorption. There were also slight differences in the types of reagents employed, and the procedures followed in leaching the materials collected by the probe, filter, and impingers. In the example provided, the amount of arsenic detected when using the molybdenum blue method was 21 mg, 5 mg, and 0.2 mg in the filter, probe, and impingers, respectively. These results compared to detected arsenic levels when using EPA Method 108 procedures of 21 mg in the filter, 1 mg in the probe, and 0.4 mg in the impingers.

Under 40 CFR 61.14 in Subpart A—General Provisions, the Administrator may allow the use of any alternative method that he has determined to be adequate for indicating whether a source is in compliance. Anyone wishing to have a method approved as an alternative may submit comparative data between the candidate method and the reference method for evaluation by the Administrator.

Reporting Requirements

The commenter for Owens-Illinois stated that it is unreasonable and irrational to require 12-month projections of arsenic emissions from glass plants and that semiannual reporting of past emissions should be sufficient for enforcement purposes.

The requirement that inorganic arsenic emissions be projected over a 12-month period is necessary in order for the operator of the glass manufacturing furnace to anticipate the level of control that will be required for each facility. Only in this way can possible instances of noncompliance with the standard be prevented. The calculation of past emissions may reveal actual instances of noncompliance, but only after unacceptable levels of inorganic arsenic have been emitted into the atmosphere. This result would be inconsistent with the objectives of section 112 of the Act.

The commenter for Corning Glass Works stated that many administrative problems could result with EPA's semiannual reporting requirements under the proposed § 61.163. The administrative problems referred to in this comment have not been specified. However, it is EPA's conclusion that the

reporting, recordkeeping, and other requirements contained in the standard are both necessary to the implementation of the regulation and reasonable in their impact on the glass manufacturing industry and individual furnace owners and operators.

Impacts of Reporting and Recordkeeping Requirements

The EPA believes that the required reporting and recordkeeping requirements are necessary to assist the Agency in (1) identifying sources; (2) determining initial compliance; and (3) enforcing the standard.

The Paperwork Reduction Act (PRA) of 1980 (Pub. L. 96–511) requires that the Office of Management and Budget (OMB) approve reporting and recordkeeping requirements that qualify as an "information collection request" (ICR). To accommodate OMB review, EPA uses 3-year periods in its impact analysis procedures for estimating the labor-hour burden of reporting and recordkeeping requirements.

The average annual burden on owners and operators of glass maunfacturing plants to comply with the reporting and recordkeeping requirements of the standard over the first 3 years after the effective date is estimated to be about 23,100 labor-hours.

V. Arsenic Trioxide and Metallic Arsenic Production Facilities

As discussed in the overview section of this preamble, on July 20, 1983, EPA proposed a standard in the **Federal Register** for primary copper smelters procesing feed materials with 0.7 percent or greater arsenic. This proposed standard would have affected only the ASARCO smelter in Tacoma, Washington. The EPA proposed for comment additional controls for fugitive emission sources in the copper smelter and the arsenic plants at the ASARCO-Tacoma facility in a **Federal Register** notice on December 16, 1983 (48 FR 55880). On June 27, 1984, ASARCO announced plans to close its primary copper smelting operations at Tacoma, Washington by June 30, 1985; and subsequently ceased copper smelting operations at Tacoma. In the June 1984 announcements, ASARCO also stated that it will continue to operate the arsenic trioxide and metallic arsenic plants at the site and that the plants will be operated in an environmentally acceptable manner. From discussions with ASARCO personnel, EPA has concluded that there is some uncertainty regarding the process to be used and the future configuration of the arsenic trioxide plant. According to public statements, ASARCO is considering

several different modifications to its arsenic trioxide production process including the use of a wet leaching process or enclosure of the Godfrey roasters and control of emissions using a fabric filter collector. ASARCO expects that these modifications will significantly reduce arsenic emissions from the facility, but has not yet completed detailed plans or a schedule for this change. Consequently, the Administrator decided that the proposed fugitive emission standard for arsenic plants should be promulgated. This part of the preamble presents the standard for arsenic trioxide and metallic arsenic production facilities, its basis, and a discussion of the comments on the proposed standard.

Summary of Promulgated Standard

Applicability

The standard that is being promulgated today applies to each new and existing arsenic trioxide production facility processing low-grade arsenic bearing materials by a pyrometallurgical (roasting and condensation) process and to each new and existing metallic arsenic facility. Facilities that produce arsenic trioxide solely by wet leaching or extraction processes are not subject to this standard.

Standard

The standard requires the identification of potential arsenic emission sources and preparation and implementation of a detailed inspection, maintenance, and housekeeping plan that will be used to minimize emissions from the arsenic trioxide and metallic arsenic production facilities. The standard requires the plan to fulfill the stated objectives of: (1) Cleanup of arsenic containing materials; (2) regular maintenance and inspection of process, conveying, and air pollution control equipment; and (3) reduction of emissions during malfunctions to the maximum extent feasible.

Requirements for Periods of Excess Emissions

During periods of startup and shutdown, the standard requires that emissions of inorganic arsenic be minimized to the greatest extent possible. The standard also requires the following measures to minimize emissions from malfunctions and upsets: (1) All steps necessary to limit emissions, including curtailing operations until the equipment is repaired or the process is operating normally; (2) establishment of a plan that describes specific actions to be taken during malfunctions and upsets:

and (3) a routine maintenance program for process, conveying, and emission control equipment.

Compliance Provisions

The standard requires compliance within 90 days of today's date, unless a waiver of compliance is obtained from the Administrator. If a waiver of compliance is granted, the plan shall be submitted on a date set by the Administrator. Waivers can be granted for a period of time needed to install controls to comply with the standard, not to exceed 2 years from today's date.

Continuous Monitoring

Continuous opacity monitoring is required for process emissions that exist from a control device. The standard requires that a reference opacity level be established for each emission stream based on the highest 6-minute average opacity level monitored during a 36-hour evaluation period. Thereafter, occurrences of opacity readings above the respective reference level must be reported as exceedances to the Administrator along with information describing the cause of the exeedances.

Recordkeeping and Reporting Requirements

Owners or operators of sources covered by the standard will be subject to the reporting and recordkeeping requirements of the standard as well as those prescribed in the General Provisions (Subpart A) of 40 CFR Part 61. Reporting and recordkeeping requirements of the General Provisions were discussed in the preamble to the proposed standards (48 FR 33112). Specific reporting requirements of the promulgated standard include: (2) Quarterly reports of occurrences of excess opacity readings and ambient arsenic concentrations; and (1) semiannual status reports on pilot plant studies on alternative arsenic trioxide production processes. Owners and operators are also required to submit the following reports for the opacity monitoring system: (1) Evaluation to verify the operational status of the opacity monitors; and (2) report of reference opacity level and supporting data.

Records of supporting data for the reports described above must be maintained at the source for a period of 2 years and made available to the Administrator upon request. These records will include the logs demonstrating compliance with the general work practices and records of all opacity measurements and repairs to the monitoring device.

Summary of Enviromental, Health, Energy, and Economic Impacts

The standard being established today affects new and existing arsenic trioxide and metallic arsenic production facilities. It is expected that the standard will affect one facility, the arsenic plant at ASARCO-Tacoma.

The standard is expected to reduce emissions from malfunctions and upsets in the arsenic plant and to reduce reentrainment of arsenic-containing materials from plant surfaces. However, the impact of the standard on fugitive emissions from the arsenic plant cannot be quantified because of the difficulties inherent in estimating fugitive emissions, the unpredictability of malfunctions, and the considerable uncertainties regarding the processes and operations that will be used at the facility in the future. The standard is based on application of control measures that are necessary and are applicable at this time, and is not based on application of a quantitative risk management approach.

Application of the required housekeeping and maintenance provisions should have no effect on the solid waste, water, or energy impacts of the facility. Annualized costs required to comply with the standard are estimated to be about $265,000. The primary economic impacts associated with the standard are projected small decreases in profitability for the ASARCO-Tacoma arsenic plant, if costs cannot be passed through. If costs are passed forward in the form of a price increase, it is estimated that the standard will result in less than a 5 percent increase in the price of arsenic trioxide. This standard is not expected to cause closure of the affected plant.

Significant Changes Since Proposal

A number of major changes have been made to the requirements proposed on July 20, 1983, and December 16, 1983. These changes are: (1) Deletion of specific equipment requirements for the arsenic plant. The proposed requirements for modifications to equipment in the arsenic plant have been removed from the standard. These modifications are not being required because either the equipment is in place and likely to remain in place or there is a more cost-effective means of achieving the emission reduction; (2) Modification of the proposed work practices. While the proposed requirement for preparation of an inspection, maintenance, and housekeeping plan has been retained, specific aspects have been modified. The final requirements for an approvable plan do not require

the inspector to follow a prescribed route. In addition, the proposed requirement to shut down malfunctioning equipment until it is repaired has been modified to require the source to describe the time and actions required to curtail increased emissions due to malfunctions; and (3) Clarification of the recordkeeping and reporting requirements provisions and inclusion of minor new provisions. The standard requires quarterly reporting of excess opacity readings and of ambient arsenic concentration monitoring data and semiannual status reports on pilot plant studies on alternative arsenic trioxide production processes. The basis for the changes is described in the Discussion of Comments section of this part of the preamble.

Additional Analyses

Since proposal of the standards on July 20, 1983 (48 FR 33112), EPA has developed estimates of process and fugitive emissions from the arsenic plant and has identified additional control measures to reduce arsenic emissions from the facility. These revised emission estimates are based on an on-site emission inventory and emission testing.

Emission estimates for the arsenic plant fabric filter collector are based on the results of EPA emission tests conducted in September 1983. Operation of the arsenic trioxide plant and the metallic arsenic plant were closely monitored during the tests to ensure that testing was conducted during normal operations. These test results showed average outlet arsenic concentrations and mass emission rates of 3.17 mg/dscm (0.0014 gr/dscf) and 0.15 kg/h (0.33 lb/h), respectively. These results represent an average collection efficiency for the fabric filter collector greater than 99 percent.

Potential sources of low-level fugitive emissions in the arsenic plant were assessed during extensive on-site inspections during June 1983, and emission estimates were developed. Based on these assessments, it is estimated that approximately 15 Mg/yr (17 tons/yr) of fugitive arsenic emissions were released from operations of the arsenic trioxide plant at ASARCO-Tacoma in 1982. These estimates are based on visual observations of the sources and operations and on engineering judgment since fugitive emissions from these sources cannot be measured readily. Consequently, these estimates are subject to significant imprecision.

The EPA conducted further investigations to identify controls that could reduce fugitive arsenic emissions

from the arsenic plant as well as from other sources at the ASARCO-Tacoma smelter. The on-site inspection revealed that specific equipment modifications and housekeeping practices would reduce arsenic emissions. The list of potential control measures for fugitive arsenic sources was published in the December 16, 1983, **Federal Register** notice (48 FR 55880). The EPA reviewed the condidate control requirements considering public comments on the requirements. The final requirements are based on this review and on consideration of whether the controls are already installed or required by another regulation or agreement, and are likely to remain in operation or good repair. The final requirements are summarized in the Summary of Promulgated Standard section and are discussed in the Basis for Standard and Discussion of Comments—Control Technology sections of this preamble. Cost estimates were also developed for the fugitive arsenic emission controls.

Basis for Standard

A standard is being established for the arsenic trioxide and metallic arsenic production facilities at ASARCO-Tacoma because with current production processes and operations the arsenic plant is a significant contributor to ambient exposures to inorganic arsenic. Fugitive emissions from the arsenic plant are estimated currently to be about 6 Mg per year (7 tons per year), due to recent implementation of controls required by the Tripartite Agreement (i.e., the agreement among ASARCO, the union, and the State of Washington Department of Labor and Industries).

The standard that is being established today is based on available fugitive emissions control measures that can be readily applied. Section 112(e)(1) of the Act authorizes design, equipment, work practice, or operational standards when (a) the pollutant cannot be emitted through a conveyance designed and constructed to emit or capture the pollutant; or (b) the application of a measurement methodology is not practicable due to technological or economic limitations. The fugitive emissions that are being controlled through the arsenic plant standard would result from poor housekeeping practices and poor maintenance of process and emission control equipment. They cannot be emitted through a conveyance designed and constructed to emit or capture them, and their frequency and magnitude would vary to such an extent that measurement would not be practicable. Therefore, the format of the standard is one in which work practices and preventative maintenance

control measures are required rather than a numerical emission limit. These control measures reflect application of general housekeeping procedures to the facility, and represent a level of control that can be required at this time in the absence of certainty on the future production process. Control measures beyond this minimum level of control are not being required because EPA is not in a position to identify the processes and applicable controls at this time. The standard was based on consideration of the need to minimize arsenic emissions through use of additional control measures, as well as on the feasibility and cost of these measures. The control measures considered include improved housekeeping practices and curtailment of emissions during malfunctions.

Equipment and Work Practices for Fugitive Emission Control

During the evaluation of additional controls, EPA conducted onsite inspections of processes and operations at the ASARCO-Tacoma facility. The on-site investigation identified several low-level arsenic emission sources where additional emission control is possible. Specifically, it was noted that overall housekeeping in the arsenic trioxide process area was poor with light to heavy accumulations of dust on all surfaces. Since this dust can be re-entrained and release emissions to the atmosphere, it was concluded that emission controls and improved housekeeping practices are needed. The contribution of these sources to total emissions from the facility cannot be accurately estimated. However, high ambient arsenic concentrations measured at the close-in ambient air monitors have been attributed by ASARCO, in part, to re-entrainment of dust from buildings and plant surfaces. Furthermore, in the public hearings on the proposed standards, testimony by representatives of ASARCO indicated that no formal operations and emissions logging procedure is used by ASARCO to assess the causes of high ambient arsenic concentrations.

Potential equipment, work practice, and recordkeeping requirements for sources of fugitive emissions were described in the December 16, 1983, **Federal Register** notice (48 FR 55880). Comments were received on the need for these additional controls and on their technical feasibility and costs. The comments were reviewed, and the equipment and work practice requirements which are feasible and likely to result in significant additional emission reduction were identified. This assessment of the control measures is

presented in the Discussion of Comments section of this part of the preamble. From the consideration of public comments, it was concluded that none of the proposed equipment requirements should be imposed and that the proposed work practices should be slightly modified. Also identified were recordkeeping requirements that will be useful in determining probable causes of high ambient arsenic concentrations and steps that must be taken to prevent their reoccurrence. Combined, the identified control options for low-level fugitive emission sources are expected to reduce emissions from fugitive sources (and to maintain them) below current levels. The estimated combined annualized cost for inspection and maintenance requirements is about $265,000. In the Administrator's judgment, this cost is reasonable and affordable. Therefore, these requirements are included in the final standard.

Curtailment During Malfunctions

At the ASARCO-Tacoma smelter, ambient monitoring data for monitors at or near the plant boundaries have shown that arsenic concentrations dramatically increased when malfunctions and upsets occurred with the converters, the reverberatory furnace, the arsenic plant, or the liquid sulfur dioxide (SO₂) plant. Furthermore, on occasion these malfunctions have persisted for several days. The need for prompt attention to malfunctions was also demonstrated during EPA's emission test program conducted in September 1983. During emission testing of the arsenic plant baghouse, EPA personnel observed that the air slide conveying system, which transfers arsenic-laden dust back to the process, was blowing dust into the air. A large quantity of arsenic-laden dust (white dust) had accumulated under and around the air slide. No ASARCO personnel were in the immediate area, and based on EPA's understanding of the operations, none would have been in the area until the next day. (ASARCO personnel were located and the process was taken out of service until the air slide was repaired.)

The Administrator recognizes that malfunctions cannot be completely prevented. However, there are measures that can be taken to reduce emission rates significantly and to minimize the time during which increased emissions occur due to malfunctions. The most effective of these emission reduction measures is to shut down the affected operations when malfunctions occur. Therefore, in the December 16, 1983,

Federal Register notice (48 FR 55880) EPA proposed that a housekeeping plan be submitted that would include provisions for : (1) Regular inspection of all process, conveying, and emission control equipment; and (2) repair of malfunctioning or damaged equipment as soon as possible and shutdown of any operation involving material having an arsenic content greater than 2 percent until the equipment is repaired. Because the inclusion of a comprehensive list of all potential malfunctions in a regulation is impractical, the Administrator concluded that it would be more effective if the owner or operator of the source were to identify potential emission sources and the steps to be taken to minimize emissions (including shutdown) when they occur. Therefore, the final standard requires the owner or operator to submit a plan for EPA approval that outlines the steps that can and will be taken to curtail operations when equipment malfunctions or process upsets occur. The plan will include all operations, processes, and control equipment that handle material having an arsenic content greater than 2 percent. The program will describe the specific steps that will be taken to take out of operation or idle the affected operations, and the minimum time in which this can be accomplished. For the purpose of this standard, a malfunction is defined as any sudden failure of process or air pollution control equipment or of a process to operate normally which results in increased emissions of arsenic. Shutdown means the cessation of operation of the equipment or the addition of materials to process equipment.

The EPA would consider a failure of equipment or a process upset caused entirely or in part by poor maintenance, careless operation, or other preventable upset condition or equipment breakdown, to be the result of improper operation and maintenance. Improper operation and maintenance is a violation of the standard. The provisions pertaining to malfunctions which are discussed above do not excuse such violations.

Discussion of Comments

This section presents a summary of the specific comments pertaining to the arsenic plant at the ASARCO-Tacoma smelter. The comments were made in letters and in hearing testimony on the proposed standard for ASARCO-Tacoma's copper smelting operations. The comments are discussed by major topic area below.

Emission Estimates

Throughout the public comment period, comments were received concerning EPA's estimates of inorganic arsenic emissions from the ASARCO-Tacoma copper smelter and arsenic plant. Initially, the comments concerned the emission estimates presented in the July 20, 1983, **Federal Register** notice of proposed rulemaking and the BID for the proposed standard (EPA–450/3–83–009a). Several commenters, including ASARCO and PSAPCA, claimed that . the emission rates presented by EPA significantly overstated the amount of arsenic being emitted. During the public comment period, EPA published several revised estimates of arsenic emission rates in 1982. Additional comments were received regarding these revised emission estimates. These commenters primarily focused on the emission estimates for the smelter's converter fugitive emissions and other low-level sources. The commenters still thought that EPA's emission estimates overstated the amount of arsenic being emitted from the ASARCO-Tacoma copper smelter and arsenic plant.

Since proposal, EPA has conducted emission tests of the arsenic plant fabric filter collector. New information on sources of low-level arsenic emissions was also obtained by EPA during extensive on-site visits to the ASARCO-Tacoma smelter. The EPA also reviewed the comments and evaluated the supporting information provided by the commenters. Based on the emission test results, observations, and the improved understanding of plant operations, EPA revised its emission estimates. These revised emission estimates were submitted for review to representatives of national and local environmental groups, PSAPCA, the USWA, and ASARCO who had attended a December 20, 1983, working level meeting. The emission estimates were further revised and EPA now estimates that arsenic emissions from the arsenic plant in 1982 were about 15 Mg (17 tons) and current emissions are about 6 Mg (7 tons) per year. The emission rate of fugitive sources in the arsenic plant will be less than 6 Mg (7 tons) per year when all control measures required by the standard are in place. The actual emission reduction cannot be estimated inasmuch as the required control measures are for unpredictable events of varying emission potential. The basis of the final emission estimates is presented in the BID for the promulgated standard (EPA–450/3–83–010b).

The EPA recognizes that the emission estimates retain some uncertainty, and some commenters may think the

estimates continue to overstate arsenic emissions from the arsenic plant. The EPA believes that, although uncertainties persist, these estimates represent a good approximation of the actual emission rates. These emissions can be significantly reduced through improved housekeeping practices.

Control Technology

Low-level fugitive sources. Several commenters, including PSAPCA and Washington State Department of Ecology (DOE), recommended that EPA establish standards which require control of low-level fugitive arsenic emission sources. The Administrator agrees with the commenters and has established work practice requirements to reduce fugitive emissions. These final requirements were selected from those published in the December 16, 1983, **Federal Register** notice, considering public comments on their need, feasibility, and costs. The requirements are expressed as work practice and operational standards because emissions from these sources cannot be measured accurately.

General and specific comments on the proposed equipment, work practice, and operational requirements were received from ASARCO and the USWA, and are discussed in the following paragraphs. ASARCO commented that the listed control measures were developed without considering the likelihood of the material being emitted into the ambient air, their technical feasibility, cost, or the cost effectiveness of the measures in reducing any health risk. The proposed additional control measures were based on EPA's assessment of controls that could be used to reduce fugitive emissions from the arsenic plant and smelter. The likelihood of fugitive emissions being released to the atmosphere was considered by the EPA in developing the requirements. The generally open configuration of buildings and EPA observations show that emissions released inside buildings at the ASARCO-Tacoma facility are likely to be released to the atmosphere. In some cases, such emissions disperse directly to the air outside buildings. In other cases, the emissions may settle on supporting structures and surfaces within the buildings. These deposits of dust on buildings and plant surfaces can be re-entrained during periods with high winds. In fact, ASARCO has attributed some episodes of high ambient arsenic concentrations to re-entrainment of dust from plant and building surfaces. Similarly, EPA believes that spills of materials can also serve as a source of fugitive emissions through re-

entrainment of dust from building and plant surfaces. Thus, the additional control measures addressed all known sources or potential sources of fugitive emissions.

In developing the additional control measures, EPA also developed estimates of the costs. These control measures were briefly discussed in the meeting held December 20, 1983, and were placed in Docket Number A–80–40 for public inspection. (In response to comments, these estimates were revised and the revised estimates were also distributed to the meeting attendees for comment and to the public docket). The final control requirements are estimated to cost about $265,000 per year (increase in costs due to controls). These control measures were selected based on consideration of the need for the measure, the technical feasibility, and the estimated costs. The bases for the specific requirements are summarized below along with ASARCO's and the USWA's comments.

1. Equipment Standards—"Arsenic plant, raw dust conveyor system"— ASARCO's comments on the proposed requirement for a dust-tight conveying system for the arsenic plant were: (1) It is not possible to use an enclosed pneumatic conveying system to transfer wet dust (the dust is wetted because the Godfrey roasters cannot accept dry dust); and (2) the present covered belt conveyor system is best available technology. The USWA also commented that pneumatic conveying would require relocation of the zig-zag blender and recommended as an alternative that ASARCO be required to maintain the fullest possible enclosure of the zig-zag blender and belt transfer system and to ensure that leaks are promptly identified and repaired. The EPA considered these comments and believes that a pneumatic conveyor could be used as proposed by relocating the zig-zag blender closer to the Godfrey roasters. The EPA, however, also concluded that there were other more cost-effective ways of reducing emissions from transfer of raw dust from the arsenic plant storage bunkers to the Godfrey roasters. Specifically, the objective could be accomplished through improved housekeeping and maintenance of the existing system. Since EPA is establishing provisions that require a routine maintenance and repair program, the standard does not require installation of a dust-tight conveyor system in the arsenic plant.

"Godfrey roasters"—In response to the proposal to require installation and maintenance of a solid refractory arch on each Godfrey roaster, both ASARCO

and USWA commented that all the arches have been installed. The final standard does not include this provision because the controls are in place and it is EPA's judgment that the controls are likely to remain in place.

"Calcine conveyor system"—In response to the proposal to require a pneumatic conveyor system for transfer of calcine from the Godfrey roaster water-cooled screw conceyors to the railcar loading station, ASARCO and USWA commented that this system has been installed and is operating. Thus, it is EPA's judgment that there is no need to require this system since it is in place and likely to remain in operation.

"Arsenic kitchen pulling area"— ASARCO commented that the enclosure around the kitchen pulling area that EPA proposed to require would be extremely large and expensive and is not justifiable. The USWA's industrial hygienist commented that the enclosure might exacerbate worker exposure to arsenic without any clear benefit to community air quality. The final standard does not require enclosure of the kitchen pulling areas because of the potential for significantly increased worker exposure in this area. This conclusion is based on a review of the conceptual design and calculations of expected arsenic concentrations within the enclosures where the kitchen pullers must work. Although workers in this area use full face respirators, this protection is not sufficient to fully isolate workers from exposure to arsenic because of the difficulties associated with the use of respirators. While it is theoretically possible to prevent increased exposure using respirators, it is more probable that employee exposures would significantly increase. Furthermore, EPA believes that substantial emission reductions can be achieved by improved housekeeping and maintenance of the arsenic plant without increasing worker exposures. Consequently, the regulation requires emissions from arsenic kitchen pulling to be minimized by cleaning up, wetting, or stabilizing dry, dusty, arsenic-bearing materials in the area.

2. Work Practices—Five general work practice objectives were listed in the December 16, 1983, **Federal Register** notice. Only ASARCO and the USWA commented on these proposed objectives for an inspection, maintenance, and housekeeping plan. The comments on each objective, and the objective, are discussed below.

"No accumulation of material having an arsenic content greater than 2 percent on any surface within the plant outside of a dust-tight enclosure"—

ASARCO's comments on this objective of the management plan were: (1) This requirement can only be intepreted as meaning the entire plant would have to be placed within an enclosure; and (2) the costs of such an enclosure would be astronomical. The USWA commented that dry, dusty materials with arsenic concentrations well below 2 percent may contribute significantly to fugitive emissions from the plant, while damp materials with higher arsenic content would not contribute significantly. The USWA recommended that the regulation require clean-up or stabilization of dry materials containing more than 0.2 percent arsenic.

The rationale for requiring no accumulation and clean-up of arsenic-containing materials is that, as previously discussed, re-entrainment of part or all of the material is possible and re-entrained material is likely to be released to the atmosphere. The intent of the requirement was not, as suggested by ASARCO, to require enclosure of the entire plant, which is obviously not practicable. Instead, the intent was to focus attention on control of potentially significant sources of fugitive arsenic emissions from sources such as arsenic kitchen pulling or handling of baghouse dust and to exclude nonarsenic-bearing materials. The EPA considers the USWA's comment that the requirement should be limited to dry, dusty materials to be valid. Consequently, this objective has been reworded in the general work practices standard to require cleaning up or wetting of dry, dusty materials. The objective has not been revised as suggested by USWA to include materials with more than 0.2 percent arsenic because limiting the requirement to materials with more than 2 percent arsenic essentially requires cleanup or control of all sources in the arsenic plant.

"Immediate cleanup of any spilled material having an arsenic content greater than 2 percent"—ASARCO's comments on this objective were: (1) There is a housekeeping program in place as part of the OSHA/WISHA arsenic compliance requirements; (2) any clean-up requirements should be directed toward specific sources and materials and should be handled by a regulatory agency compliance requirement; and (3) the objective does not consider whether the material is likely to become airborne. The USWA comments on this proposed requirement were the same as its comments on the preceding requirement. The EPA reviewed ASARCO's housekeeping plan submitted to the Washington State Department of Labor and Industries and

found that its scope was much narrower than intended by EPA's proposal. Thus, at present the existing housekeeping program cannot be considered an adequate substitute for the proposed objective.

The EPA believes this objective of the general work practice plan should be included in the standard to ensure that prompt attention is given to clean-up or control of spilled materials containing greater than 2 percent arsenic. It would not be practicable to identify every potential source in the regulation because of the large number of sources and materials processed at the facility. Unless this requirement is part of the regulation, EPA believes there would be no means of ensuring the attendant emission control. Therefore, the requirement has been included in the regulation.

"Regular scheduled maintenance of all smelter process, conveying, and emission control equipment to minimize equipment malfunctions"—Both ASARCO and USWA commented that this proposed objective is currently required by the Tripartite Agreement, and USWA further commented that it should be included in the final standard. This provision is being required to establish more explicit requirements for the arsenic plant than does the Tripartite Agreement. The standard includes this as a necessary part of an approvable housekeeping, inspection, and maintenance plan.

"Regular inspection to ensure equipment is operating properly"— ASARCO commented that there is an inspection procedure in place, and it is unreasonable to require the proposed inspection routine and documentation. In contrast, the USWA agreed with the proposed objective and recommended that the inspector document general housekeeping in each area to ensure plant surfaces are kept free of dry, dusty materials. Both ASARCO and USWA commented that it is unnecessary to require the inspector to follow a prescribed route. The EPA believes that the proposed regular inspection objective is a necessary element of the management plan to minimize fugitive and excess emissions and thus should be included in the standard. The proposed requirement of a prescribed route, however, has been deleted as it is unnecessary as long as all equipment and areas are inspected. The inspection and documentation of equipment status will ensure that malfunctioning equipment is quickly detected and will create a record that can be used to evaluate possible causes of higher than normal ambient arsenic concentrations.

The EPA believes that regular inspection and documentation is necessary because ASARCO's correspondence with PSAPCA and EPA suggests that equipment malfunctions and upsets and other causes of higher than normal emissions are not systematically documented. Further, during the public hearing in Tacoma, ASARCO representatives confirmed that they do not have procedures which document all observed emissions and their causes. The EPA believes that such documentation is necessary to objectively pursue an effective emission control program. As suggested by the USWA, the inspection procedure has been expanded to include observation and documentation of housekeeping practices. The EPA believes that the inspection procedure and its required documentation will increase awareness of and emphasis on emission control.

"Repair of malfunctioning or damaged equipment"—ASARCO commented that they oppose the proposed requirements because the urgency of the repair is not related to the quantity of emissions to the air or impact on air quality. ASARCO also considered the proposal to be unreasonable because it would remove from ASARCO the discretion and authority to determine and take appropriate action. The USWA commented that it is not always practicable or necessary to shut down operations involving releases of material with more than 2 percent arsenic. The EPA considered these comments and consequently revised the proposed objective to require the company to submit a plan, subject to the approval of the Administrator, describing the actions that will be taken to curtail operations when process upsets and malfunctions of process, emission control, or material handling equipment occur that will result in increased emissions of arsenic. This plan will describe the time and actions required to curtail increased emissions due to malfunctions. The plan will also describe any technical limitations on curtailments. The EPA believes that this approach will allow sufficient flexibility to consider technical limitations and to consider whether specific individual malfunctions would increase emissions of inorganic arsenic to the atmosphere.

Arsenic trioxide production techniques. Both PSAPCA and NRDC recommended that EPA consider alternative arsenic trioxide production processes in the evaluation of best available controls for the ASARCO-Tacoma facility. These commenters recommended replacing the existing hot roasting process with a

hydrometallurgical process as the best approach to reducing low-level arsenic emissions. Another commenter (the USWA) recommended that EPA require ASARCO to research alternative technologies for the production of arsenic trioxide and metallic arsenic.

The EPA has examined the status and applicability of hydrometallurgical processes to materials processed in the ASARCO-Tacoma arsenic production facility. The EPA is monitoring the development of hydrometallurgical processes and is aware of a number of processes that are being developed. Since flue dusts used in the ASARCO-Tacoma arsenic plant vary considerably in composition and contain impurities not found at other smelters, there is no known established process that can be readily applied at Tacoma. At this time, ASARCO is researching several processes for extracting arsenic from various flue dusts and is operating a pilot plant to evaluate further the feasibility of several processes recommended by the research department. Pilot plant operations began in September 1984.

The EPA is not requiring ASARCO to research alternative technologies for the production of arsenic trioxide and metallic arsenic for two reasons. First, the Tripartite Agreement among ASARCO, OSHA, and USWA already requires ASARCO to monitor and evaluate the development of alternative technologies for the production of arsenic trioxide and metallic arsenic. As previously indicated, EPA does not believe it is necessary to establish redundant standards when the measures required would be implemented even in the absence of EPA standards. Second, such a new requirement would have no impact because ASARCO is committed to, and is, in fact, already conducting pilot plant tests. Today's regulation does, however, require ASARCO to report to the Administrator the findings of studies conducted on the feasibility of alternative processes for producing arsenic trioxide. The EPA plans to continue to monitor the development of hydrometallurgical processes and the process changes to the arsenic trioxide plant, and to revise the regulation when appropriate.

Compliance Provisions

The Washington State DOE recommended that requirements for good operation and maintenance for process controls be included in the final regulation. The EPA agrees with DOE and, as described in the Summary of Promulgated Standard section of this preamble, the regulation includes

provisions that require good operation and maintenance of process, conveying, and emission control equipment associated with the arsenic plant.

Reporting and Recordkeeping

The Washington State DOE recommended that the standard include recordkeeping and reporting requirements for malfunctions, upsets, and spills, and operation and maintenance provisions for control equipment. The Administrator considered this comment (and comments made at the public hearing that additional controls were needed) and concluded that additional inspection, maintenance, and recordkeeping requirements would be helpful in achieving better control of arsenic emissions. Consequently, the final standard requires regular inspection and maintenance of process, conveying, and emission control equipment as well as reporting of all malfunctions and process upsets that result in increased arsenic emissions.

ASARCO commented that it considers the monitoring, recordkeeping, and reporting requirements to be extremely burdensome and far beyond what is necessary, considering that emissions are negligible. The EPA believes that recordkeeping and reporting requirements are necessary to assist the Agency in identifying emission sources and to assist in enforcing the standard after the initial compliance demonstration. The final recordkeeping and reporting requirements will require on the average about 800 labor-hours per year over the first 3 years after the effective date of the standard. These requirements have been imposed because ambient arsenic concentrations around the facility are high, and fugitive emissions from the various operations in the facility, and in particular the arsenic plant, contribute significantly to ambient arsenic concentrations.

Ambient Limits

A number of commenters, local governmental agencies (PSAPCA and Washington State Department of Social and Health Services (DSHS)), and environmental groups, recommended that EPA establish an ambient arsenic standard which the ASARCO-Tacoma facility must achieve. It was also suggested that the standard should specify the monitoring and analytical techniques to be used. The PSAPCA specifically recommended that EPA establish 24-hour and annual average arsenic "action levels" to enforce implementation of a fugitive emission control program at the ASARCO-Tacoma facility. Conversely, other

commenters argued that EPA should not establish an ambient standard for inorganic arsenic. The Washington DOE said that while it intends to establish 24-hour and annual average community exposure standard to limit inorganic arsenic emissions, it did not recommend that EPA adopt an ambient, or community exposure, standard. The DOE believes there is a need for flexibility in implementing such a standard applied to the ASARCO-Tacoma facility. Hence, in April 1984 the DOE adopted an interim ambient standard and plan to adopt permanent standards after evaluation and study of the causes of high ambient arsenic concentrations in the Tacoma area. The interim standard limits maximum 24-hour ambient concentrations of arsenic to 2.0 $\mu g/m^3$ and maximum annual average ambient concentrations of arsenic to 0.3 $\mu g/m^3$. The USWA and NRDC commented that an ambient standard for carcinogens is inappropriate and is not authorized under the Act. These commenters argued that an ambient standard is inappropriate because no safe level can be established for zero-threshold pollutants. These commenters did, however, believe that an ambient monitoring requirement and an "action level" used as an adjunct to enforcement would be useful and is authorized under the Act. The USWA specifically recommended: (1) That the action level should be achievable when all controls are working properly and should be revised periodically and (2) that exceedances of the action level should trigger an investigation by the company and a report to EPA. The USWA also recommended that the ambient monitoring requirement include provisions which require ASARCO to study and estimate regularly fugitive emissions from all sources in the plant, and to prepare and implement a management plan for control of fugitive emissions.

ASARCO commented on the legal authority and recommendations for an ambient arsenic standard or community exposure level. ASARCO commented that the language and legislative history of the Clean Air Act shows that section 112 does not empower EPA to set an enforceable ambient standard. ASARCO maintained that the clear thrust of section 112 is that EPA is responsible for adopting standards that limit continuously the amount of emissions of hazardous air pollutants from individual sources. ASARCO argued that an ambient standard would not be useful or appropriate because: (1) Ambient arsenic concentrations are

presently and will continue to be monitored; (2) ambient concentrations around a source vary, depending on factors other them emissions, including meterological conditions and local terrain; (3) fugitive emissions are already will-controlled; and (4) there are no medical criteria that can be used to establish the level and averaging period of a standard. A further argument against an ambient standard presented by ASARCO was that an ambient standard would not be an effective means of reducing arsenic emissions. ASARCO commented that an ambient standard would have to be achieved either by emission controls or by production curtailments, and that EPA would have to identify sources of emissions causing high ambient arsenic levels and determine the controls required to attain the standard. ASARCO pointed out that, in the case of a 24-hour standard, it would be difficult to determine what controls should be required because it is not possible to determine retroactively the causes of high ambient arsenic values. It was also argued that maintaining an ambient arsenic standard by intermittent production curtailment was not feasible. Curtailment is not a feasible approach to arsenic control because: (1) There is currently no real-time monitoring system for arsenic; (2) it is not practicable because of lack of knowledge about which sources should be curtailed; and (3) arsenic emission sources require lengthy shutdown periods before they cease emitting arsenic.

Since an enforceable ambient standard is not being established in the standard being promulgated today, ASARCO's comment (that section 112 of the Clean Air Act does not give EPA the authority to set enforceable ambient standards) is not pertinent to this rulemaking. The EPA agrees that an ambient standard cannot be established for inorganic arsenic based solely on health effects or risk estimates. The EPA does believe, however, that an enforceable ambient limit, which is an indicator of proper operation and maintenance of emission control systems and is developed considering all relevant factors, is consistent with the goals of Section 112 and may consider establishing a limit at a later date. This limit would serve as a direct measure of the degree to which fugitive arsenic emission sources at the arsenic production facilities are being controlled. The EPA intends to review ambient arsenic monitoring data in the future to determine if additional control measures are needed, and the standard requires quarterly reporting of ambient

arsenic concentration monitoring data to facilitate this review. Among the measures that would be considered would be an enforceable boundary limit providing sufficient information and data are available to establish a limit. The enforceable boundary limit would be used to evaluate the effectiveness of required control measures and would not impose any additional emission control requirements. Thus, the enforceable boundary limit would not require production curtailments to achieve compliance with the limit. Hence, ASARCO's comments regarding the utility of an ambient standard are not applicable to the concept of the enforceable boundary limit.

Depending on the steps which ASARCO takes to reduce emissions in future operations of the arsenic plant, EPA plans to determine the need for additional control measures and the need for an enforceable boundary limit after the effects of the required control actions are assessed. This assessment will involve comparison of ambient levels of arsenic measured near the plant with ASARCO's records of operation at the arsenic plant. The EPA believes that this information will help to identify operating practices that cause high ambient concentrations, and the agree to which additional controls might reduce ambient arsenic concentration levels. In particular, exceedances of the DOE standard would be investigated to determine the cause and to determine possible control measures. The review may also consider the need for requiring periodic review of emissions and control measures to ensure the continued effectiveness of the housekeeping plan.

Impacts of Reporting and Recordkeeping Requirements

The EPA believes that the required reporting and recordkeeping requirements are necessary to assist the Agency in: (1) Identifying sources; (2) determining initial compliance; and (3) enforcing the standards.

The Paperwork Reduction Act (PRA) of 1980 (Pub. L. 96–511) requires that the Office of Management and Budget (OMB) approve reporting and recordkeeping requirements that qualify as an "information collection request" (ICR). To accommodate OMB review, EPA uses 3-year periods in its impact analysis procedures for estimating the labor-hour burden of reporting and recordkeeping requirements.

The average annual burden on owners and operators of arsenic trioxide and metallic arsenic production facilities to comply with the reporting and recordkeeping requirements of the final

standard over the first 3 years after the effective date is estimated to be about 800 labor-hours.

VI. Negative Determinations

On July 20, 1983, EPA proposed not to establish standards limiting emissions of inorganic arsenic for six categories of sources. These sources were primary lead smelters, secondary lead smelters, primary zinc smelters, zinc oxide plants, cotton gins, and arsenic chemical manufacturing plants. The public comment period on these negative determinations ended on January 31, 1984. This part of the preamble presents the basis of the Administrator's decision to reaffirm the decision not to establish emission limits for these sources and responds to comments on the preposed action.

Summary of Decisions

The EPA identified the following six inorganic arsenic source categories, but concluded that standards were not warranted at this time: Primary lead smelters, primary zinc smelters, zinc oxide plants, arsenic chemical plants, secondary lead smelters, and cotton gins. The EPA has not developed standards for these source categories for the following reasons:

1. As a result of the existing level of control for these six source categories, maximum lifetime risk and annual incidence for each source category are generally small.

2. Requiring further controls under section 112 beyond OSHA and SIP requirements for either individual sources or for the six categories would not result in a significant reduction in maximum lifetime risk or annual incidence.

3. The EPA analyses indicate that severe economic impacts, including plant closure, could result if further control were required. The Agency does not believe that plant closure is a reasonable alternative.

The EPA believes that the cost of any additional controls that may be possible appear to far exceed any small incremental health benefit which might result. For the above reasons, the Agency believes that Federal regulation under section 112 of these six categories of sources of arsenic emissions is not currently warranted.

Significant Changes Since Proposal

No changes have been made in the Agency's decision not to regulate primary lead smelters, secondary lead smelters, primary zinc smelters, zinc oxide plants, cotton gins, and arsenic chemical manufacturing plants.

Additional Analyses

As a result of public comments, EPA conducted additional analyses to ensure that the decision whether to regulate primary lead smelters, primary zinc smelters, zinc oxide plants, arsenic chemical manufacturing plants, secondary lead smelters, and cotton gins is based on the most complete and accurate information available. Additional information on arsenic emissions and control technology was collected and analyzed for primary zinc smelters and secondary lead smelters. For primary zinc smelters, plant visits were conducted to verify the emission estimates and use of emission control equipment. During the plant visits, feedstock samples and process information were obtained to develop a material balance for estimating emissions. For secondary lead smelters, additional information was collected concerning the secondary lead industry. The current level of control practiced throughout the secondary lead industry was assessed in-depth. New nationwide arsenic emission estimates were made for secondary lead process sources and process and area fugitive sources based on EPA source testing. Risk analyses were performed based on these revised secondary lead emission estimates. These additional analyses undertaken for primary zinc smelters and secondary lead smelters are described in the responses to public comments.

Risk estimates, both maximum lifetime risk and annual incidence, for all six categories were revised by increasing the distance modeled from 20 km to 50 km (12 to 31 miles) from the source, by incorporating 1980 population data, and by more exactly locating the coordinates of some plant sites.

Basis for Decisions

This section presents the application of EPA's risk management approach in the review of the decision not to develop standards for the six source categories. The factors considered in the review were the risks posed by the sources, both maximum lifetime risk and annual incidence; the emission and risk reductions achievable through application of additional emission controls; and the costs and economic impacts of these control measures. The assessment of the risks and control options is summarized below.

Although the Agency did not perform site-specific air dispersion analysis for any of the six source categories which the Administrator has decided not to regulate under section 112, EPA has, where possible, made comparisons

between the predicted and measured values. Generally, ambient data were not available in sufficient quantity to allow meaningful comparisons, but when obtained, the measured ambient values tended to be slightly higher than predicted by HEM for these source categories. This result is expected and reasonable since the ambient monitors would be affected by naturally-occurring arsenic in the soil and by other local arsenic sources that were not considered in EPA air dispersion analysis. The risk estimates ae given in Table VI–1.

More detailed information regarding the risk assessments for the source categories that remain unregulated under Section 112 may be found in the background information document (EPA–450/5–85–002). An explanation of EPA's risk management approach is found in the Overview—Basis for Promulgated Standards section of this preamble.

1. Secondary lead smelters. Maximum lifetime risk and annual incidence are small for most plants in this source category under the existing level of control. The highest annual incidence which occurs at one secondary lead smelter is 0.14, associated with a large exposed population (8.86 million within a 50 km radius). The EPA expects that OSHA and SIP requirements will lead to additional control to be implemented at this smelter as well as at many others. Fugutive sources are now largely controlled so that improvement, if possible, would be necessarily site-specific, and not practical or reasonable in a national standard. Due to the small maximum lifetime risk the probable inability to achieve further significant reductions in emissions and incidence, the potential negative societal and economic impacts that would result from additional control, and the difficulty in developing a uniform national standard, EPA has decided that regulation of secondary lead smelters under Section 112 is not currently warranted.

2. Cotton gins. For cotton gins, EPA developed "model" plants located in "model" locations for use in estimating maximum lifetime risks. However, with this approach, which was used since detailed location data were not available for all plants, the Agency cannot reasonably calculate aggregate or total risks to those living within 50 km (31 miles) of the gins. To look more closely at this category, EPA conducted an ambient monitoring study around two gins in the Texas area. When comparing the measured arsenic values to the predicted concentrations from the

appropriate model gin exposure analysis, EPA found that the predicted values were reasonably close to concentrations measured very near the gins. The monitoring study data also showed that the arsenic concentrations fell off very rapidly with distance from the gins. This result suggests that people living at some distance from the gins are not being significantly exposed to the gins' emissions. Such a result, coupled with the observation that many gins are in rural areas, supports the Agency's conclusion that the aggregate risks for this source category are small.

The estimated maximum lifetime risks associated with the current level of process emission control from cotton gins is also small. There is not sufficient information available on the effectiveness of fugitive emission control techniques and such techniques have not been demonstrated to be applicable to all operational variabilities of cotton gins, leading the Agency to conclude that additional fugitive emission control is not reasonable. Taking these factors into consideration, the Agency has concluded: (1) That the existing level of control is acceptable because of the potential economic and societal consequences of gin closure and (2) that regulation of cotton gins under section 112 is not currently warranted.

3. Zinc oxide plants. Annual incidence estimates are small for both existing zinc oxide plants under current levels of control.

TABLE VI–1.—RISK ESTIMATES FOR SOURCE CATEGORIES FOR WHICH THE AGENCY IS NOT PROPOSING STANDARDS

Source category	Number of plants	Maximum individual risks	Aggregate risks (cases/yr)
Secondary lead smelters	35	4×10^{-4}	0.39
Cotton gins	~300	5×10^{-4}	
Primary lead smelters	5	20×10^{-4}	0.07
Primary zinc smelters	5	0.07×10^{-4}	0.004
Zinc oxide plants	2	10×10^{-4}	0.08
Arsenic chemical plants	8	2×10^{-4}	0.004

The one plant where maximum lifetime risk is highest has process and fugitive controls in place. Existing controls and those planned for the near future to comply with OSHA and SIP regulations will reduce emissions and associated maximum lifetime risk from both plants. The EPA cannot identify any control requirements beyond those established by OSHA that would not result in closure of the plant associated with the highest maximum lifetime risk. Thus, EPA has decided that regulation of zinc oxide plants under section 112 is not warranted at this time.

4. Primary lead smelters. The annual incidence is small for all of the existing smelters under current levels of control. The highest predicted maximum lifetime risk which occurs at one smelter is 2×10^{-3}. Controls implemented at this plant as a result of recent tripartite agreements among OSHA, smelter management, and labor have already resulted in reduced ambient arsenic levels at this plant. Moreover, EPA has not identified any controls beyond those necessary to comply with OSHA and lead SIP requirements that could further reduce arsenic emissions to a significant degree. Thus, the Agency has concluded that section 112 regulation is not warranted at this time.

5. Primary zinc smelters. Annual incidence and maximum lifetime risk estimates are small for this source category under existing levels of control. No technology has been demonstrated that can reduce emissions further. Thus, the Agency has concluded that regulation under section 112 is not currently warranted.

6. Arsenic chemical manufacturing plants. Annual incidence and maximum lifetime risk estimates are small for this source category under existing levels of control. There are no demonstrated control techniques that would result in further emission reductions. Thus, the Agency has concluded that regulation of this soruce category under section 112 is not currently warranted.

Discussion of Comments

Comments on the decision not to propose standards for these source categories were solicited in the July 20, 1983, **Federal Register** (48 FR 33112). Eleven letters were received pertaining to these source categories. One of the parties who testified at the public hearing alluded to these source categories, and later submitted more detailed written comments. Comments concerned general topics that pertained to all six source categories as well as to particular source categories. Comments and Agency responses are presented here in the following order: General comments, secondary lead smelters, cotton gins, zinc oxide plants, primary lead smelters, primary zinc smelters, and arsenic chemical manufacturing plants. The docket reference is indicated in parentheses in each comment.

General Comments

The Attorney General's Office of the State of New York (A–83–09/IV–D–9, A–83–10/IV–D–12, A–83–11/IV–D–9, A–83–23/IV–D–9) submitted a list of companies located in New York and New Jersey, some of which are in the

source categories EPA has identified as potential sources of inorganic arsenic emissions. The commenter claimed that EPA has neither identified these companies as inorganic arsenic sources, nor demonstrated that they do not emit inorganic arsenic.

The list of companies provided was reviewed by EPA. The list apparently involves firms which fall under the same industrial source classification as the sources which emit arsenic. However, in general, the list contained companies that did not fall into the source categories identified as potential arsenic emission sources. A good example of this misclassification was observed when reviewing the secondary lead smelter category. Of the 27 companies included on the secondary lead smelter list submitted by the State of New York, only two were included on EPA's list of secondary lead smelters. These companies (Federated Metals, Newark, NJ, and Roth Brothers Smelting, E. Syracuse, NY) are also the only two companies recognized as secondary lead smelters by the Secondary Lead Smelting Association. Upon receipt of the listing, EPA initiated an additional data gathering effort to obtain information pertaining to the nature of business conducted by the remaining 25 companies. After the investigation, EPA identified the majority of these companies as remelters (plants that operate a melting pot) and/or companies that produce special alloys. The majority of these companies produced zinc, aluminum, copper, or other nonlead alloys. Also included on the list of potential secondary lead smelters was: (1) A company that recovers precious metals (gold, silver, and platinum) from scrap jewelry, (2) a fabrication and construction company that uses lead fabricated products in various construction applications, (3) a company that produces metal decoration for churches, (4) a company that weaves industrial wire cloth for reinforcing washing machine hoses, and (5) a paper company. Six of the companies listed by the commenter were either permanently closed or had no current telephone listing.

The EPA finds no reason to believe that any of these companies use significant quantities of arsenic or arsenic bearing materials in processes that would release arsenic to the atmosphere. The EPA, therefore, concludes that all significant sources of inorganic arsenic emissions have previously been identified, and the list provided by the State of New York does not identify any additional companies in any of the subject source categories.

The State of New York Attorney General's Office (A–83–09/IV–D–9, A–83–10/IV–D–12, A–83–10/IV–D–9, A–83–23/IV–D–9) also commented that fugitive emission sources and the status of their control had not been statisfactorily characterized and that this information is needed to support EPA's claim that fugitive sources are well controlled. The commenter stated that control techiques such as secondary hood systems, dust control, building enclosures, and fines agglomeration may be applicable to many types of sources of fugitive arsenic emissions and should be applied wherever those controls would reduce fugitive arsenic emissions.

The EPA attempted to characterize controls used on the major fugitive sources from all source categories (Preliminary Study of Sources of Inorganic Arsenic [EPA–450/5–82–005]). Plants were contacted for information on fugitive emissions and controls. As described in the preliminary study, the magnitude of fugitive arsenic emissions was estimated quantitatively or qualitatively for all source categories. The quantity of fugitive emissions from primary lead smelter was based on previously conducted fugitive arsenic and lead emission tests at two primary lead smelter. Fugitive arsenic emissions from secondary lead smelter were estimated based on measured lead emissions and estimated lead to arsenic ratios. The OSHA arsenic measurements provide an indication of the quantity of fugitive arsenic emitted from arsenic chemical manufacturing, primary zinc, and zinc oxide plants. Based on workplace arsenic levels reported, EPA concluded that fugitive emissions from these sources were well controlled.

Fugitive emissions are difficult to measure and limited data are available, so there is uncertainty in EPA's characterization of both area and process fugitive emissions. Where quantitative control efficiency data were not available, EPA qualitatively analyzed fugitive capture and control efficiency based on engineering design. The preliminary source study did identify secondary lead smelters as a category warranting further study. Fugitive emissions from secondary lead smelters were investigated further after the July 20, 1983, proposal, and the results are summarized in Docket A–83–09, item IV–A–4.

The EPA agrees that the control technologies mentioned by the commenter have been effective in achieving reductions in fugitive emissions in various applications. However, fugitive arsenic emission controls to meet OSHA requirements

are currently in operation at all plants. The types of existing fugitive control systems vary from plant to plant because of differences in the physical configurations of plant equipment and because of variations in production processes and emission points among plants in the various source categories.

The EPA investigated the effect of existing regulations on reducing fugitive arsenic emissions from all source categories (A–83–08/II–A–5). Applicable regulations include OSHA lead and inorganic arsenic standards; lead, SO_2, and particulate National Ambient Air Quality Standards (NAAQS); and New Source Performance Standards (NSPS) for some source categories. The conclusion of this investigation was that many sources of fugitive emissions within all source categories are currently well controlled, and industry compliance with existing regulations will result in the application of effective control to all remaining fugitive emission sources. After this characterization of fugitive emissions and controls, EPA concluded that the risks associated with fugitive arsenic emissions from primary and secondary lead smelters, primary zinc smelters, zinc oxide plants, cotton gins, and arsenic chemical plants are generally small; and additional control at the Federal level through a Section 112 standard would not result in significant reduction of inorganic arsenic emissions and associated risks.

The Attorney General's Office of the State of New York (A–83–09/IV–D–9, A–83–10/IV–D–12, A–83–11/IV–D–9, A–83–23/IV–D–9) thought that EPA has not adequately taken into consideration the physical properties of the arsenic trioxide that affect efficiency achieved by control devices. This commenter felt that EPA did not adequately consider emission controls for vapor phase arsenic. The commenter noted that arsenic trioxide is appreciably volatile at 100 °C (212 °F). Since most industrial processes involve temperatures well in excess of 100 °C (212 °F), they concluded that any arsenic in a feed material will be found in the vapor phase.

The State of New York also said that when gas streams saturated with arsenic trioxide vapor are cooled, condensation does not occur as expected. Depending on the quantity of arsenic present in the feed material, they felt that process vapors may not be saturated with arsenic trioxide. The commenter stated that when the vapor is not saturated with arsenic trioxide, substantially lowering the temperature will not force arsenic trioxide to condense. Therefore, since arsenic

trioxide remains in the gaseous phase, they concluded that particulate control methods dependent on arsenic trioxide condensation will be ineffective.

The commenter presents two conflicting ideas. The first is that EPA has not proposed controls that remove vapor phase arsenic in hot (>100 °C) offgas streams (removal by condensation). The second idea presented and conclusion drawn by the commenter is that control of gaseous phase arsenic trioxide by condensation is ineffective unless the vapor is saturated.

The commenter also stated that because of the high temperature required for industrial processes (100 °C), any arsenic in the feed material will be found in the vapor phase. In contrast, EPA found, based on samples collected by the Agency and information provided by plants in each of the subject source categories, some arsenic is typically found in the product metal, slag, matte, and flue dust.

Process arsenic emissions from zinc oxide plants, arsenic chemical manufacturing, primary lead and zinc smelters, and secondary lead smelters are controlled by either wet scrubbers, contact acid plants, or fabric filters. Because of the presence of vapor phase arsenic in these offgas streams, EPA investigated the feasibility and effectiveness of low temperature controls for all "hot" process sources. Preliminary calculations based upon the limited data available at the time of the initial survey showed that additional cooling of the offgas streams from zinc oxide plants, secondary lead smelters, and glass manufacturing plants could potentially result in additional arsenic trioxide condensation. These preliminary calculations demonstrated that offgas cooling could potentially reduce arsenic emissions by condensing the vapor phase arsenic and capturing it as particulate arsenic.

Following the preliminary calculations, emission tests were performed at glass manufacturing plants and secondary lead smelters (see "Inorganic Arsenic Emissions from Glass Manufacturing Plants— Backgound Information for Promulgated Standards," EPA 450/3-83-011b, and "Secondary Lead Smelter Tests of Area Source Fugitive Emissions for Arsenic, Cadmium, and Lead; Chloride Metals, Tampa, Florida," EMB 84-SLD-3, A-83-09/IV-A-4)

Results from the process emission tests at a secondary lead smelter demonstrated that arsenic entering the process baghouse was primarily associated with particulate matter at temperatures of 175 ° to 200 °C (350 to

390 °F) (A-83-09/IV-A-2). Simultaneous inlet-outlet measurements conducted on the process baghouse indicated an average total arsenic removal efficiency of 98.86 percent. Based on arsenic trioxide saturation theory, the measured arsenic concentrations entering the baghouse correspond to less than one percent of the concentration required for vapor saturation. Arsenic emissions from glass manufacturing have also been shown to be predominantly in the solid phase. A series of tests on glass furnace offgas demonstrate that for most types of arsenic containing glasses, more than 90 percent of the arsenic exists in the particulate phase at typical stack gas temperatures of 288 °C (550 °F) (A-83-08/II-A-5).

These data apparently contradict theoretical considerations (based upon arsenic being present as arsenic trioxide), which predict all of the arsenic to exist in the vapor phase at the measured temperatures. However, theoretical considerations are based only on arsenic in the form of arsenic trioxide and do not consider the presence of other chemical species (chlorides, etc.) in the stack gas or adsorptive interactions with particulate matter. The presence of other components changes the way arsenic would react alone in the furnace offgas streams.

Therefore, EPA concludes that arsenic emissions from some processes are effectively controlled by particulate control devices even at elevated temperatures. Despite theoretical predictions, exhaust stream measurements demonstrate that arsenic can be controlled from some processes by particulate capture and that high removal efficiencies can be achieved even at temperatures exceeding 260 °C (500 °F). In addition, the data available to EPA do not conclusively demonstrate a correlation between temperature and arsenic in vapor or solid phase and, thus, cannot serve as the basis for any requirement to cool gas streams.

The Attorney General's Office of the State of New York (A-83-09/IV-D-9, A-83-10/IV-D-12, A-83-11/IV-D-9, A-83-23/IV-D-9) commented that EPA has not adequately dealt with the special control problems associated with arsenic particulate matter. They stated that there are much higher concentrations of arsenic in small particle size fractions (1-2 micrometers) than in larger size fractions. They noted that the concentration of arsenic in particulate matter with a diameter greater than 11.3 micrometers is 680 ppm and the concentration in the 1-2 micrometers range is 1,700 ppm. The commenter concluded that arsenic

controls must be efficient at collection of the fine particulate fraction.

The State of New York said that even though fabric filters can achieve removal efficiencies of 90 to 99 percent for particulate matter, EPA cannot assume that this represents 99 percent removal of arsenic. They noted that: (1) Arsenic occurs preferentially in the fine particulate fraction that escapes collection, and (2) fabric filters will not remove arsenic in the vapor phase. New York State contended that if fabric fileters are operated properly, particulate emissions can be reduced to 23 mg/dscm (0.01 gr/dscf) and a concurrent fine particulate (less than 2 micrometers) reduction to 18 mg/dscm (0.008 gr/dscf). They note that if the equipment is well maintained, one can expect arsenic control of approximately 90 percent with the use of state-of-the-art fabric filters. The commenter felt that such filters must be required as a minimum control device, and that design and maintenance standards should also be specified.

Thus, the State of New York concluded that among technologies for particulate control, fabric filters are the most effective. They also concluded that fabric filters are the only acceptable method of arsenic control and that arsenic control with wet scrubbing systems is ineffective and expensive. However, this commenter noted that EPA has not specified fabric filters as BAT for all arsenic sources.

Two conflicting viewpoints are presented by the commenter. The logic behind recommending fabric filters as BAT for all arsenic sources is inconsistent with the commenter's earlier statements concerning the physical properties of arsenic emissions (i.e., vapor phase arsenic and size fraction of the arsenic-bound particulate). However, previous statements by the same commenter indicated that arsenic control based on condensation "is ineffective," and arsenic bound particulate occurs in the fine particulate fraction "which escape collection."

The EPA agrees that for a control device to be effective in reducing arsenic emissions it must be effective in collecting fine particulate matter. Control devices currently used in these source categories are effective in collecting fine particulate matter.

The EPA has not assumed that since fabric filters are capable of achieving 99 percent collection of particulates, they are also capable of achieving 99 percent collection of arsenic. Therefore, EPA agrees with the commenter that such an assumption cannot be made. However,

EPA believes fabric filters to be an effective fine particulate control technique with efficiencies in the 90 percent range for arsenic bound particulate less than 10 micrometers. The EPA disagrees with the commenter regarding the effectiveness of wet scrubbing systems. Wet scrubbing systems use a liquid stream to recover small particles from a gas stream. Wet scrubbing systems also serve to cool the offgases and promote some degree of condensation. In one test conducted on a wet scrubber which followed a fabric filter that achieved about 99 percent control, approximately a 60 percent reduction in remaining arsenic was noted. The commenters did not provide any information to support the claim that wet scrubbers are ineffective.

It is unclear what the commenter means by the statement that EPA has not "specified" fabric filters as BAT for all inorganic arsenic sources. The EPA has, however, concluded that effective control is in place or will be in place in the near future for the subject source categories due to lead SIP's and OSHA requirements; and the level of control that would have been required by a NESHAP is no more stringent than currently exists and thus would not have resulted in any additional inorganic arsenic emission reduction.

Three commenters mentioned that EPA had omitted any discussion at proposal of the need to regulate coal and oil combustion sources (A–83–08/ IV–D–17, A–83–08/IV–D–18a, A–83–08/ IV–D–18b). Two of these commenters felt that EPA has unjustifiably ignored this potentially significant category and wanted the Agency to carefully study or regulate it. In the case of coal combustion, EPA had reviewed the literature in 1979–80 and made a simple but conservative risk analysis with a series of model plants. Because of the large number of utility and industrial boilers that burn coal or oil and the lack of specific location data, EPA could not perform its normal nationwide exposure analysis; however, EPA was able to estimate the maximum concentrations and concluded that risks associated with those ambient concentrations were small. The report, entitled "Human Exposure to Atmospheric Arsenic" (OAQPS–19–8/II–A–9) concluded that because the realistic worst-case annual average environmental arsenic exposures for coal-fired power plants (and industrial boilers) are less than 0.003 $\mu g/m^3$ for all power plants and less than 0.001 $\mu g/m^3$ for most power plants, power plant (and industrial boiler) emissions do not add appreciably to nominal urban background

concentrations. For oil combustion, EPA's review of the literature indicated that arsenic concentrations in oil were substantially lower than those measured in coal, and estimated that the exposure associated with oil combustion would be even lower than those concentrations given above for coal combustion. Based on further analysis of available data, the Agency continues to believe that the ambient concentrations of inorganic arsenic associated with emissions from coal and oil combustion are low. Inorganic arsenic, however, is only one of several trace elements of potential concern that are present in combustion emissions. Taken together, the Agency has concluded that such emissions warrant further study. The Agency is conducting exposure analyses for inorganic arsenic and a number of other pollutant emissions from this source category.

The NRDC stated that EPA has the obligation to regulate under section 112 *all* source categories of inorganic arsenic (A–83–08/IV–D–18a, A–83–08/ IV–D–18b). The commenter's concerns would apply to two classifications of source categories that the Agency had decided not to regulate. The first classification of source categories includes those source categories with risks that, in the Administrator's judgment, are small or not significant. Regulating these source categories would provide only a small measure of risk reduction and as previously discussed, the impacts of control outweigh the benefits. The NRDC agreed to this approach in one of their comments (A–83–08/IV–D–18a), but there is a disagreement over when the Agency should stop consideration of a source category and move on to another. The second classification includes source categories that pose somewhat greater risks but, in light of the small benefits and large impacts of requiring further emission reduction, the risk levels are thought to be not unreasonable.

Two commenters listed a number of potential inorganic arsenic sources that were not mentioned in the July 20, 1983, notice of proposal (A–83–08/IV–D–17, A–83–08/IV–D–18a, A–83–08/IV–D–18b). For instance, municipal incinerators, rock wool manufacturing, and oil shale reporting were identified as inorganic arsenic source categories for regulation. One commenter (A–83–08/IV–D–17) felt that the Agency may have underestimated the emissions from these source categories. This commenter contended that the Agency failed to adequately address fugitive emissions and did not identify many individual

sources within the categories. For example, the State of New York mentioned that the municipal incinerator and rockwool manufacturing emissions were estimated by assuming that the arsenic concentrations in the collected particulate matter were equivalent to the arsenic concentrations in the emitted particulate matter. The commenter suggested that this assumption leads to emission rate estimates that are lower than actual emissions because, based on measurements made at other source category facilities, arsenic concentrations in the emitted particulate matter are generally higher than those in the collected particulate matter. Also, the commenter pointed out that the number of incinerators will potentially increase in the future.

For these source categories, EPA had performed a preliminary study ("Study of Inorganic Arsenic Sources," OAQPS– 79–8/IV–A–2) and had concluded that these source categories emit very small quantities of inorganic arsenic and pose small risks. For example, 102 municipal incinerators emitted about 5 Mg of inorganic arsenic per year and 43 rockwool production plants emitted 0.5 Mg of inorganic arsenic per year. The Agency reviewed the commenters' information and, although several of the suggestions were potentially valid, the Agency's emission estimates would not be significantly increased. Based on the Agency's understanding of the nature of the emissions, the low emission rates, and the number of plants, the Administrator has concluded that standards are not warranted for these categories.

Secondary Lead Smelters

One commenter (A–83–09/IV–D–8) stated that EPA does not know how many secondary lead smelters there are, and, as a result, EPA has no basis for statements referring to the level of control exhibited throughout the industry.

Following the publication of the negative determination proposal, an in-depth study was initiated by EPA to obtain additional information about the secondary lead industry and to assess the current level of control practiced throughout the industry. The information gathered in this study is contained in A– 83–09/IV–A–5, "Control of Arsenic Emissions from Secondary Lead Smelting Industry—Technical Document."

The EPA defines a secondary lead smelter as any facility operating a blast, rotary, or reverberatory furnace for the purpose of reclaiming lead from lead

bearing scrap. Facilities that simply remelt lead in a melting pot for refining or recasting were not included in this category since these plants do not engage in smelting operations.

A preliminary list of secondary lead smelters was developed based on information obtained from previous EPA studies. It was soon learned that several secondary lead smelters had recently closed. The remaining facilities were contacted by EPA and subsequently requested to respond to a questionnaire regarding process and fugitive emission controls, arsenic usage, and emissions. Additional closures were identified during this survey. At the conclusion of this information gathering (December 1983), it had been determined that there were 43 secondary lead smelting plants in the United States (either open or temporarily closed). Confirmation of the accuracy and completeness of this listing was provided by both representatives of the Secondary Lead Industry Association and of several of the secondary smelters (A–83–09/II–B–25, A–83–09/II–1–6, A–83–09/II–I–7).

The level of emission control at each of the 43 plants was characterized using information obtained from responses to the questionnaire, telephone contacts with plant officials, and previously conducted trip reports or tests. In addition, EPA conducted plant visits to 14 of the 43 smelters (A–83–09/II–B–18, A–83–09/II–B–17, A–83–09/II–B–19, A–83–09/II–B–21, A–83–09/II–B–28). As a result of this study, EPA is confident that it has up-to-date information on emissions and controls for characterizing and basing decisions on the secondary lead smelting industry (A–83–09/IV–A–5 and A–83–09/IV–B–1).

One commenter (A–83–09/IV–D–9) expressed strong objection to EPA's reliance on OSHA workplace standards for inorganic arsenic, and the NAAQS for lead to control inorganic arsenic emissions from secondary lead smelters.

In response, EPA notes that data derived from a long-term ambient monitoring program near a large secondary lead smelter demonstrate a correlation between ambient lead and arsenic concentrations (A–83–09/II–A–2). The 758 measurements demonstrate a statistically significant relationship between the measured ambient arsenic and lead concentrations (i.e., high arsenic corresponds to high lead). Based on this correlation and on ambient arsenic levels measured near 16 secondary lead smelters (approximately 10 measurements for each plant), it is estimated that arsenic levels would be decreased by controls installed to achieve the lead NAAQS. Secondary lead smelters which were in compliance

with the lead NAAQS (1.5 μg/m³) demonstrated ambient arsenic levels of less than 0.03 μg/m³.

The Administrator believes that where standards established under separate authorities (e.g., the OSHA inorganic arsenic standards) are effective in reducing emissions, redundant standards need not be established by EPA. The EPA establishes separate standards when there is evidence that either the control measures are not likely to remain in place or are unlikely to be properly operated and maintained. The Agency has concluded that adoption of redundant EPA standards would result in no emission reduction or other public health benefit beyond that achievable under OSHA standards.

One commenter (A–83–09/IV–D–20) stated that the process fugitive capture and control equipment used in the industry has not been characterized adequately (e.g. hood design, capture efficiency, etc.), and, consequently, EPA cannot validly conclude that process fugitive emissions are well controlled. During plant visits to 14 of the 43 secondary lead smelters, EPA qualitatively assessed the effectiveness of the fugitive capture and control equipment for process fugitive emissions. Based on these visual inspections, the industry-wide survey, and records demonstrating compliance with OSHA inorganic arsenic standards, EPA concluded that process fugitive emissions are well controlled. During a fugitive arsenic emissions test at a secondary lead smelter, samples were collected inside the smelter building near process fugitive emission points. The results from this study are summarized in "Control of Arsenic Emissions from Secondary Lead Smelting Industry—Technical Document (A–83–09/IV–A–5)."

One commenter (A–83–09/IV–D–10) pointed to apparent conflicts between statements in the Preliminary Source Survey document and statements in the July 20, 1983, **Federal Register** notice (48 FR 33121) concerning the current degree of area fugitive control. The commenter noted that the Preliminary Source Study indicates that most of the area sources are currently uncontrolled, whereas the conclusion drawn by the preamble is that fugitive sources are already controlled at the BAT level. Consequently, the commenter felt that fugitive emission sources and the status of their control had not been satisfactorily characterized.

After preparation of the Preliminary Source Survey document, a more detailed study of area fugitive sources and control was initiated. Of the

potential fugitive area sources identified at secondary lead smelters, the only significant source of arsenic emissions was flue dust handling. Data on flue dust arsenic content from different smelters range from 0.001 to 5.0 percent by weight arsenic. The arsenic content of material from other potential fugitive sources were all approximately one order of magnitude lower.

Additional data were gathered on flue dust handling and storage practices (A–83–09/II–A–1). It was determined that, at the majority of plants, flue dust is controlled by enclosed and ventilated screw conveyors; and flue dust storage is either controlled by enclosure, or flue dust is recycled directly to the furnace. Only three of the plants (less than 5 percent) have open flue dust storage, and these facilities are in the process of eliminating this process. Thus, the Agency has concluded that additional control of area fugitive sources is not warranted.

Two commenters (A–83–09/IV–D–8, A–83–09/IV–D–10) said that EPA should consider requiring that secondary lead smelters be controlled with fabric filters followed by wet scrubbers. The commenters pointed out that the July 20, 1983, **Federal Register** notice of proposal (48 FR 33112) stated that "a fabric filter/wet scrubber is a demonstrated technology in the industry." The commenters thought emissions might be significantly reduced by requiring this technology.

Based on calculations in the Preliminary Source Survey document, EPA estimated at proposal that arsenic emissions from a fabric filter/scrubber combination could be approximately 60 percent less than arsenic emissions from a fabric filter alone.

Subsequent to the publication of the July 20, 1983, **Federal Register** notice, EPA conducted performance tests on a control system in which furnace offgases are controlled with a fabric filter and a wet scrubber (A–83–09/IV–A–2). Total inorganic arsenic removal efficiency of 98.86 percent was achieved by the fabric filter, while the fabric filter/wet scrubber combination removed 99.61 percent of the inorganic arsenic from the furnace offgases. These performance test results are in agreement with the preliminary estimates of arsenic emission reduction associated with the use of a wet scrubber after the fabric filter. However, the test results showed that arsenic concentrations in the inlet to the scrubber are much lower than had been estimated originally from lead to arsenic ratios. Therefore, arsenic emissions from fabric filter-controlled process sources at secondary lead

smelters are much lower than originally estimated.

Following the July 20, 1983, **Federal Register** notice, new nationwide arsenic emission estimates were made for process sources at secondary lead smelters. Requiring fabric filters to be followed by wet scrubbers would result in an estimated nationwide inorganic arsenic emission reduction of about 1.6 Mg/yr (1.8 tons/yr). This level of control would reduce inorganic arsenic emission estimates from about 7.2 to 5.6 Mg/yr (7.9 to 6.2 tons/yr). These estimates correspond to a 22 percent reduction in inorganic arsenic emissions from secondary lead smelters resulting from the use of scrubbers. However, the risks associated with all sources of inorganic arsenic emissions at secondary lead smelters would be reduced by a considerably lower percentage because the fugitive emissions which are released at or near ground level have the greatest effect on maximum lifetime risk.

As indicated in the **Federal Register**, the cost effectiveness of the fabric filter/wet scrubber control would correspond to approximately $600,000 to $12 million per Mg of arsenic removed depending upon total arsenic reduction achieved. According to a preliminary economic impact analysis, these control costs would have a severe effect on the secondary lead industry (A–83–09/IV–A–1).

Based on the small reduction in maximum lifetime risk and annual incidence associated with installing and operating a fabric filter/wet scrubber combination and the adverse economic impact, EPA has concluded that a Federal standard requiring this system is not warranted. Thus, the Agency is not requiring additional process control at secondary lead smelters.

Although maximum lifetime risk for secondary lead smelters is small (4×10^{-4}), the estimated annual incidence is higher (0.39 cases per year) than the other five sources for which standards were not promulgated. This higher estimated annual incidence is largely comprised of the incidence of 0.14 associated with a particular smelter. All other annual incidence estimates are below 0.01, with most below 0.0047. One reason for the higher incidence estimates at the one smelter is that the population exposed to emissions from that smelter is quite large (8.86 million within 50 km) compared to the entire category. The highest maximum estimated lifetime risk associated with any single secondary lead smelter is estimated to be 4×10^{-4}. The current estimate of emissions and health impacts are almost an order of

magnitude lower than the impacts presented in the July 20, 1983, **Federal Register** notice.

The Agency believes that the fugitive emission sources in this industry are now largely controlled. Additional emission reduction, therefore, would be through increasing the efficiency of existing controls. A nationwide uniform standard to effect such controls would be difficult, if not impossible, to develop, and improvements that can be made would be necessarily site specific. The absence of site-specific engineering and emission information, the small maximum risk, the probable inability to achieve further significant reductions in emissions and incidence, and the difficulty in developing a uniform nationwide standard, have led EPA to conclude that Federal regulation of secondary lead smelters under section 112 is not warranted.

Cotton Gins

One commenter claimed that there is no valid basis for listing cotton gins as a point source for inorganic arsenic emissions under section 112 of the Clean Air Act (A–83–10/IV–D–5). The commenter stated that the usage of arsenic acid as a desiccant was overstated in EPA's study and, therefore, the Agency overestimated arsenic emissions and exposure from cotton gins. Another commenter stated that the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) restriction of arsenic acid application to 0.35 liters (1) per 1,000 m² (3 pints per acre) of cotton field was sufficient to protect the public (A–83–10/IV–D–4).

The Agency, when developing emission estimates for the cotton gins, did not use the usage data to which the commenter refers, but instead used the available data on measured arsenic in the cotton gin trash. Gin trash concentration data are directly related to gin emissions and provide a better estimate than arsenic acid usage figures. The Administrator agrees with the second commenter and believes that, as a result of the arsenic acid restriction, the estimated arsenic emissions will not increase over current levels.

Several commenters (A–83–10/IV–D–3, A–83–10/IV–D–4, A–83–10/IV–D–5, A–83–10/IV–D–6) expressed support for EPA's decision not to propose an inorganic arsenic emission standard for cotton gins. One commenter (A–83–10/IV–D–5) agreed with EPA's determination that the existing level of control for process emissions from cotton gins is BAT. Another commenter (A–83–10/IV–D–4) stated that the high cost of requiring any further control

techniques would cause many cotton gin plants to close.

One commenter (A–83–10/IV–D–6) said that the State of California produces one-third of the cotton grown in the United States and does not permit any chemicals which contain inorganic arsenic to be used on cotton. The commenter concludes that no inorganic arsenic is emitted from cotton gins in California, and that, therefore, cotton gins should not be regulated.

The Agency agrees that cotton gins should not be regulated. However, although arsenic acid may not be used as a desiccant on cotton in California, it is used in other cotton-producing states, such as Texas and Oklahoma. Therefore, cotton gins were identified as a potential source of inorganic arsenic emissions. Farmers in Texas and Oklahoma grow varieties of short season cotton that have been specifically adapted for stripper harvesting. A desiccant must be applied to short season cotton prior to stripper harvesting to dry out green plant leaves to prevent fiber staining and unacceptable levels of fiber moisture content. In California, on the other hand, different varieties of cotton suited to the climate are grown and different harvesting techniques that do not require the use of arsenic are used.

The NRDC (A–83–09/IV–D–10) believes that the appropriate way to control cotton gin emissions is to prohibit the use of arsenic acid as a desiccant. The commenter added that the Preliminary Source Study only briefly mentions what seems to be a perfectly adequate alternative (i.e., heat treatment), while the preamble in the **Federal Register** does not mention this technique at all. The commenter said that according to the Preliminary Source Study, cotton can be desiccated by application of a relatively intense heat for a short time, and that experiments to date have required approximately 9.4 liters of liquid propane gas per 1,000 m² (10 gallons per acre). The commenter believes that commercial scale units for such desiccation would be more efficient, but gives no evidence to support this conclusion.

In response, EPA notes that the use of heated air for cotton desiccation was considered in a recent study which evaluated the potential economic impacts of restricting inorganic arsenicals (A–83–10/IV–A–1). The study reports a pilot test in which intense heat application was investigated as an alternative to arsenic acid for cotton desiccation. Preliminary estimates of heat desiccation provided by the commenter were $1.23 per 1,000 m²

($4.98/acre) (arsenic acid is $0.62 per 1,000 m² [$2.50/acre]). However, heat desiccation has not been commercially demonstrated. Among the chemicals investigated, paraquat was identified as the only acceptable alternative to arsenic acid for cotton desiccation. However, the economic impact study demonstrated that the paraquat cost of $1.24 to $2.47/1,000 m³ ($5–10/acre) was more than twice the cost of arsenic acid, which costs $0.62/1,000 m³ ($2.50/acre). Among the other alternate technologies identified for cotton desiccation, a killing frost was the only acceptable alternative. The study concluded that "at present, there is no replacement chemical or new technique which is suited for preparation of cotton for mechanical stripping."

The maximum lifetime risk (5×10^{-4}) associated with the current level of process emission control from cotton gins is small and further possible reductions in this risk would be small. Furthermore, cotton gins are generally located in areas of low population density which would result in small annual incidence. There is not sufficient information available on the effectiveness of fugitive emission control techniques and such techniques have not been demonstrated amenable to all operational variabilities of cotton gins. Taking these factors into consideration, the Agency has decided that regulation of cotton gins under section 112 is not warranted at this time.

Additional studies are being conducted by EPA's Office of Pesticide Programs (OPP) to review all non-wood uses for inorganic arsenicals, including arsenic acid; this review is scheduled for completion later this year. A risk/benefit analysis will be done for arsenic acid use on cotton. This analysis will examine the adverse risks associated with the use of arsenic acid as a cotton desiccant. Also, information on the benefits of the use of the desiccant is being collected and analyzed. The risks and benefits of alternative chemicals for arsenic acid will also be analyzed.

Alternative courses of regulatory action will be considered as a result of the risk/benefit analysis. There are a number of components of alternative courses of action; these are the various statutory and regulatory methods EPA can use for restricting arsenic acid use under FIFRA. Examples of alternative courses of action are changes in labeling, classification, and tolerances, or cancellation for some or all uses. Some of these actions could result in reduction or elimination of arsenic emissions from cotton gins.

Zinc Oxide Plants

One commenter (A–83–11/IV–D–8) recommended that EPA again review the control technologies on zinc oxide plants. The commenter thought that an inorganic arsenic emission standard should be applied to zinc oxide plants. The commenter provided no specific criticisms of EPA's review and analysis of controls on zinc oxide plants or any reasons why EPA's analysis is inadequate. The EPA has reviewed the information contained in the public docket (A–83–11) and summarized in the July 20, 1983, **Federal Register** (48 FR 33117) and believes it adequately supports the decision not to propose a standard for inorganic arsenic emissions from zinc oxide plants.

One commenter (A–83–11/IV–D–10) said that the Preliminary Source Study (EPA–450/5–82–005) contains no specific information on the capture efficiency of the hoods and other fugitive emission controls at ASARCO-Columbus and New Jersey Zinc-Palmerton zinc oxide plants. The commenter added that EPA must evaluate whether emission controls are well designed and well operated before pronouncing them BAT.

Quantitative test data on fugitive emissions capture and control efficiencies are not available, but EPA does not believe such data are necessary to determine that fugitive controls used are adequate. As reported in the Preliminary Source Study, fugitive sources at both plants are controlled with estimated adequate ventilation technology followed by particulate removal in fabric filters (A–83–11/II–A–2). All ore storage areas, material transfer points, and furnace operations are enclosed and/or properly ventilated at each of these plants. In addition, both plants are in compliance with existing OSHA inorganic arsenic workplace standards indicating that the amount of fugitive emissions escaping capture is low. Consequently, no further study was made of the potential for fugitive capture and control device improvements.

One commenter (A–83–11/IV–D–10) said that the Preliminary Source Study concludes that the New Jersey Zinc-Palmerton plant is not equipped with "estimated best control" (EBC) technology, yet this conclusion was not mentioned in the notice of proposal and EPA has proposed to accept its current controls as BAT and sufficient. The commenter added that the Preliminary Source Study states that the best technique for fugitive emission collection for this plant is cooling the gas streams to a temperature of 110 °C (230 °F) and passing them through fabric

filters. According to the Preliminary Source Study as cited by the commenter, all streams except the Walez kiln offgas stream are controlled at EBC. This stream is passed through a fabric filter operated at 140 °C (285 °F). The study states that lowering the temperature closer to the acid dew point of the stream (below 100 °C) would improve arsenic collection and concludes: "economic feasibility does not appear to be an impediment to estimated best control use" at this plant. The commenter said that the preamble states the general conclusion, derived from theoretical calculations, that further cooling of gas streams would not result in more arsenic collection. However, the commenter noted that the actual data consistently show more arsenic collected than the theory predicts, for given combinations of concentration and temperature, and therefore, EPA should not rely on the theory to excuse further controls.

After the Preliminary Source Study was completed, EPA visited the New Jersey Zinc Palmerton plant. Samples of all major streams and mass flowrate data were collected during the site visit to verify the estimated material balance from the preliminary study. The mass flowrates, arsenic contents, and analysis examining the potential effect of cooling the gas streams to condense additional arsenic are included in Docket Number A–83–11, Item Numbers II–B–3 and II–B–5. The temperature of the Waelz kiln emission stream was found to be lower than that reported in the Preliminary Study. The temperature above the discharge hoppers from the fabric filter ranged from 77 to 199 ° C (170 to 390 °F). Based on material balance calculations, the stream was not saturated with arsenic at this temperature. Further cooling of the stream with, for example, spray chambers would be impossible without redesign of the entire cooling system since the Waelz oxide must be collected dry. The company has tried additional cooling in the past, but the procedure resulted in water condensation on oxide particles, which required downtime for cleanup. Furthermore, additional cooling would not result in a significant increase in arsenic collection because of the low arsenic concentration in the stream.

In conclusion, EPA has determined that regulation of inorganic arsenic emissions from zinc oxide plants is not warranted at this time. The estimated annual incidence is 0.08, and the maximum lifetime risk is 1×10^{-3}. Although the current estimate of maximum lifetime risk is higher than four of the other five negative

determination source categories, EPA has concluded that existing controls (A–83–11/II–B–4) or those planned for the near future to comply with OSHA and SIP regulations (A–83–11/II–A–2) will reduce emissions and associated maximum lifetime risk without causing serious economic impacts. The EPA cannot identify any control requirements beyond those established by OSHA that would not result in closure of the plant associated with the highest maximum lifetime risk in this source category. Thus, the Agency is not promulgating a standard for zinc oxide plants under section 112.

Primary Lead Smelters

The NRDC (A–83–23/IV–D–10) stated that limited information on arsenic emissions and arsenic controls from the five primary lead smelters is presented in a document entitled "Preliminary Study of Sources of Inorganic Arsenic" (EPA–450/5–82–005). The commenter added that arsenic is present in Missouri lead ore concentrates at levels "typically" about 0.02 percent by weight, and in Western lead ore concentrates at levels ranging from "about 0.1 to 0.4 percent." The commenter stated, however, that in the above mentioned document, no range is given for the Missouri ore concentrates. The NRDC pointed out that the arsenic content of the Western ore concentrates is in the same range as the low-arsenic copper ore concentrates, the smelting of which EPA proposed to regulate.

The EPA believes information summarized in the July 20, 1983, **Federal Register** notice of the proposed standard for inorganic arsenic (48 FR 33112) and in the Preliminary Source Study adequately supports EPA's decision not to regulate primary lead smelters. Arsenic is present in Missouri lead ore concentrates at levels ranging from 0 to 0.02 percent by weight (A–83–23/IV–E–2). Although arsenic contents may be similar in Western lead ore concentrates and low arsenic copper ore concentrates, the types of control systems, production processes, and emission points vary considerably between copper and lead smelting. All primary lead smelters are covered by SIP's for SO₂ and particulate matter. In addition, they are moving toward compliance with OSHA lead standards (A–83–23/IV–B–2, A–83–23/IV–J–6, A–83–23/IV–J–7, A–83–23/IV–J–8). As a result, low temperature fabric filter systems or contact sulfuric acid plants are reducing emissions from process vents, and fugitive emissions are controlled by enclosing ore storage areas, ventilating and/or enclosing material transfer points, ventilating

and/or enclosing furnace operations, and treatment of all the ventilation gas streams with fabric filter systems. The EPA considers these controls effective and in view of this does not consider the inorganic arsenic emissions or estimated risks to warrant further control.

The NRDC (A–83–23/IV–D–10) stated that arsenic is contained in process emissions from sintering machines, blast furnaces, drossing kettles, dross furnaces, and lead refineries. They added that the Preliminary Source Study defines "estimated best technology" for process emissions as use of a sulfuric acid plant on streams in which SO₂ is present in sufficient concentrations, and use of fabric filters on other systems. The NRDC noted that the study reports that EPA has no test data on the removal efficiency of existing systems, but by analogy to copper smelting controls, EPA estimates that "arsenic removal efficiencies greater than 90 percent are currently being achieved by existing acid plants and fabric filter systems." The NRDC argued that from this, the preamble draws the following conclusions: (1) That existing controls represent BAT, and (2) that "EPA knows of no demonstrated control techniques, short of closure, that would result in further inorganic arsenic emissions reduction" (48 FR 33117). The NRDC felt that several additional questions must be asked before this conclusion could be accepted.

First, NRDC stated that according to the available copper smelting background information materials, the arsenic collection efficiency of acid plants is estimated to be as high as 99 percent. They added that the collection efficiency of baghouses is estimated to be as high as 99.5 percent (for particulate matter, and presumably for arsenic in the particulate phase). They concluded that if the collection efficiency of the lead smelter systems is only "greater than 90 percent," why is it considered BAT?

Second, NRDC said that the study states that the ideal temperature for operation of fabric filters, for greatest removal efficiencies without corrosion problems, is 10 to 25 °C (18 to 45 °F) above the acid dew point of the gas streams. They added that the study then states that filters are currently run without corrosion problems at temperatures of 100 to 125 °C (212 to 257 °F). However, NRDC pointed out that no data have been collected for the temperature representing the acid dew points. They also noted that, from the data presented, it is not possible to conclude that filters are currently being run at the optimum temperature—i.e., at

no more than 10 to 25 °C (18 to 45 °F) above the acid dew point. They postulated that perhaps the gas streams can be cooled further and arsenic collection efficiencies enhanced. The NRDC also stated that EPA has not given any information on the feasibility or cost of means to deal with corrosion at temperatures below the acid dew point. They noted that even though the BID's for proposed standards for high- and low-arsenic copper smelters state that spray chambers are effective in combating corrosion, and that a variety of corrosion resistant materials are available, none of this is discussed with regard to primary lead smelting.

The NRDC felt that neither measures to enhance capture and collection efficiencies to percentages in the high 90's, nor measures to further reduce the operating temperatures of fabric filters so as to enhance arsenic condensation, are necessarily expensive. They concluded that EPA does not seem justified in its conclusion that no additional control measures short of closure have been demonstated.

In response, EPA is not aware of any data on the efficiency of sulfuric acid plants for controlling arsenic emissions from primary lead smelter offgases. By analogy to copper smelting controls, EPA conservatively estimated that removal efficiencies greater than 90 percent are being achieved. The removal efficiency estimate persented in the **Federal Register** was conservative and, therefore, by no means intended to imply that contact acid plants at primary lead smelters were any less efficient than those operated at primary copper smelters. Since acid plant control is similar in both cases, and arsenic is objectionable in the project acid (maximum allowable limit of arsenic in the gas stream entering the contact acid plant is 1.1 mg/dscm [0.0005 gr/scf]) (A–83–23/IV–J–1), EPA concludes that collection efficiency percentages are greater than 90 percent and presumably in the high 90's (A–83–11/II–A–1). Consequently, EPA has not investigated additional control measures to enhance capture and collection efficiencies beyond the existing level of control.

The NRDC recommended that acid dew point temperatures for various offgas streams be determined to investigate the possibility of enhancing arsenic collection efficiencies by additional cooling of the streams. Estimation of acid dew points requires the determination of moisture (which is readily available) and sulfur trioxide (SO₃) content of the gases. Sulfur trioxide is generally measured by indirect methods (conversion of the

vapor phase SO_3 to sulfuric acid and the subsequent condensation of sulfuric acid), and each of the commonly used methods has limitations and problems associated with reproducibility and accuracy (A–83–23/IV–J–4). Therefore, in general, plants do not have the equipment and/or techniques available for determining SO_3 concentrations in process offgases and, consequently, these measurements have not been made. In review of the available literature, SO_3 measurements have not been reported for any of the primary lead smelter process streams which are currently controlled by fabric filters.

In well-characterized streams, SO_3 values may be estimated based on the quantity of SO_2 in the gas (A–83–23/IV–J–3). However, many factors affecting primary lead smelter offgas streams, such as firing rate, excess air, presence of catalytic metallic oxides of vanadium, iron, nickel, or sulfur adsobing additives such as magnesium oxide, will drastically change the SO_3 content (A–83–23/VI–J–2). Such uncertainties mean that it is not feasible to estimate SO_3 concentrations in primary lead smelter streams. Consequently, acid dew points vary from plant to plant and do not remain constant even for a single process stream.

Plan operators "determine" acid dew points by noting temperature ranges at which the fabric filter beings to corrode due to acid condensation. As a result, operators maintain the stream temperature well above this temperature range to ensure that acid condensation, and subsequent corrosion, do not occur.

The NRDC would have EPA require plant operators to adjust the process stream temperature to slightly above the acid dew point in hopes of increasing arsenic trioxide condensation, and thus the arsenic collection efficiency of the fabric filter. Because an accurate estimate of acid dew point cannot be made based on the available data, EPA estimated the amount of cooling that would be required to enhance arsenic collection based on arsenic trioxide saturation theory. Based on low arsenic concentrations in the process streams (less than 1 percent of the concentration required for saturation), theory predicts substantial cooling must take place before arsenic trioxide saturation conditions are reached. Such cooling corresponds to offgas temperatures that are below the dew point of water and, therefore, below the lower bound of the acid dew point. For some streams, cooling to below ambient temperatures would be required to reach arsenic trioxide saturation. The EPA believes that to require cooling of gas streams to

below ambient temperatures would be inappropriate and the costs would not be justified by the small additional emission reduction achieved.

The NRDC (A–83–12/IV–D–10) stated that according to the Preliminary Source Study, fugitive emissions can be captured and controlled by "hooding and enclosure of emission points followed by particulate removal using fabric filter or wet scrubbing systems," or in the case of sintering machines, by "total or partial enclosure of the operation." The NRDC noted that these techniques are said to be "commonly used" or "generally used," implying that they are not universally used.

The commenter said that for inorganic arsenic standards development, EPA has collected no test data on capture efficiencies of such equipment as is used. They quoted the study as follows (p. 59): "By analogy to the copper smelting industry, it is expected that the best available capture ventilation systems should be capable of approximately 90 percent fugitive arsenic emission capture. The performance of the existing ventilation system in the primary lead smelting industry is expected to be below this level."

The NRDC concluded that if the equipment in use in the lead smelters is less effective than the best available technology, then EPA is not justified in concluding that the Agency knows of no additional control measures short of closure which are available. They argued that substandard fugitive emission controls can be improved.

In response, EPA noted that test data are not available to determine the arsenic removal efficiencies of existing primary lead smelter fugitive control systems. the OSHA lead standard of 50 $\mu g/m^3$ is being exceeded at all five primary lead smelters, and the OSHA inorganic arsenic standard of 10 $\mu g/m^3$ is being exceeded at two of the five plants. The OSHA work place standard exceedances measured at primary lead smelters are due to emissions from fugitive sources. On this basis, the current level of fugitive control in the primary lead industry is estimated as lower than that achieved by the copper smelting industry. However, as a result of the current OSHA exceedances, improvements in the fugitive control systems are being required at all plants and are specifically described in consent agreements for SIP compliance and tripartite agreements signed by smelters and OSHA (A–83–23/IV–J–6, A–83–23/IV–J–7, A–83–23/IV–J–8). The modifications are specifically designed to achieve compliance with the OSHA

inorganic lead standard. The ASARCO–El Paso and ASARCO–East Helena smelters have already signed agreements with OSHA that will result in improvements in their fugitive emission control systems. Therefore, EPA estimates that the performance of the modified ventilation systems will be capable of capture efficiencies similar to those demonstrated at primary copper smelters.

The NRDC (A–83–23/IV–D–10) strongly disagreed with the implication in the July 20, 1983, **Federal Register** notice (48 FR 33117) that it is sufficient to rely on the existing SIP requirements for SO_2 and particulate matter, the OSHA standards, and the still-to-be-formulated SIP's for lead. The NRDC notes that since EPA reports substantial noncompliance with such standards, they can hardly be an adequate substitute for a section 112 standard for inorganic arsenic.

As explained in response to the first comment discussed on primary lead smelters, EPA believes that effective controls will be installed on all smelters as a result of recent agreements among OSHA, smelter management, and labor. Agency policy is to avoid promulgating standards that would increase administrative costs but would not produce additional emission reduction.

The Attorney General's Office of the State of New York (A–83–23/IV–D–9) objected to EPA's decision to not regulate primary lead smelting fugitive emissions even though fugitive emissions are estimated at 0.59 kg (1.3 lb) arsenic per hour. The commenter added that of this amount, 96.2 percent occurs in the dross/reverb building.

The Agency is not regulating primary lead smelting plants under section 112 for two main reasons. First, the predicted annual incidence of cancer is small for all primary lead smelters (less than 0.07 cases per year). Second, although the maximum lifetime risk estimate (2×10^5) is higher compared to other negative determination source categories, this is mainly attributable to one of the five primary lead smelters. Engineering controls such as ventilation systems and fabric filters are now required at all primary lead smelters to reduce work-place lead-in-air concentrations as a result of recent tripartite agreements among OSHA, smelter management, and labor. Preliminary actions in response to these agreements have resulted in reduced ambient arsenic levels at the smelter with the highest risk estimates (A–83–23/IV–B–2). Data show an average reduction in the ambient concentration of about 45 percent in the first three

quarters of 1984 compared to 1981 through 1983. The EPA has not identified any controls beyond those necessary to comply with the OSHA and lead SIP requirements that could further reduce arsenic emissions to a significant degree.

Primary Zinc Smelters

The NRDC (A–83–23/IV–D–10) stated that EPA has not sufficiently investigated whether the equipment and techniques for fugitive emissions capture at the St. Joe Minerals smelter in Monaco, Pennsylvania, are state-of-the-art. They added that further documentation of the adequacy of these controls is necessary before EPA can make the conclusion that no further controls short of closure are available.

The EPA believes that effective technology for controlling fugitive emissions from zinc smelters includes enclosure of ore storage areas, enclosure and/or ventilation of materials transfer points and furnace operations, and treatment of all ventilation gas streams with fabric filters. Efficiencies of fugitive emission capture and control systems are difficult to test, and quantitative control efficiency data are not available for the St. Joe zinc plant. However, there is nonquantitative information that shows the controls are effective.

The following information supports the conclusion that St. Joe Minerals is using effective control for fugitive arsenic emissions. At St. Joe Minerals, all of the major operations with fugitive arsenic emissions are conducted inside buildings (A–83–23/IV–C–1, A–83–23/IV–E–1, A–83–23/IV–J–5). All ore is received by train and unloaded in the receiving building, and sinter material is stored in silos above the furnaces. There are no visible fugitive emissions from these two sources. Fugitive emissions from the electrothermal furnaces are dependent on furnace operation. When properly operated, negative pressure is maintained in the lower sections of the furnace so emissions from this source do not escape capture. During upsets, there may be fugitive emissions from this source. However, according to State agency personnel, furnaces at the plant are well-operated. Captured fugitive dusts from the electrothermal furnaces are ducted through fabric filters (A–83–23/IV–C–1, A–83–23/IV–E–1, A–83–23/IV–J–5). Emissions from holding bins, feeders, and transfer points are also collected and passed through fabric filters (A–83–23/IV–C–1, A–83–23/IV–E–1, A–83–23/IV–J–5). Arsenic emissions testing at St. Joe indicated that the largest source of controlled arsenic emissions is the sinter machine offgas stream (A–83–23/II–A–1). Arsenic

emissions from fugitive sources are reported to be negligible in comparison to sinter machine emissions. The facility is constantly upgrading the process fugitive capture systems to reduce the work place lead concentrations. The plant is in compliance with the OSHA regulations for inorganic arsenic, which demonstrates the efficiency of the fugitive emission controls applies at the smelter. For these reasons, the Agency believes that the St. Joe Minerals smelter is adequately controlled.

To summarize, the Agency has not developed a standard for primary zinc smelters because these sources are effectively controlling emissions in response to existing regulatory requirements. Maximum lifetime cancer risk (7×10^{-6}) and annual incidence (0.004 cancer cases per year) are small. Further significant reductions in incidence and maximum lifetime risks cannot be achieved with available control measures. Additional significant emission reduction can be achieved only by closing facilities. The Agency does not believe that requiring plant closure is a reasonable control alternative. Taking these factors into consideration, the Administrator has concluded that Federal regulation under section 112 is not currently warranted.

Arsenic Chemical Manufacturing Plants

The New Jersey Department of Environmental Protection (DEP) (A–83–23/IV–D–8) felt that for arsenic chemical manufacturing plants with relatively high risk, the use of both fabric filters and wet scrubbers in series would seem appropriate. They stated that in the July 20, 1983, notice EPA reported that for secondary lead smelters a 65 percent reduction in the cancer risk would result when a fabric filter/wet scrubber combination was used rather than a fabric filter without a scrubber. The New Jersey DEP stated that since most arsenic emissions from arsenic chemical manufacturing plants are emitted in the vapor phase and scrubbers will cause condensation of some of the arsenic, a comparison should be made between the arsenic removal efficiencies of fabric filters and wet scrubbers.

Some secondary lead smelters use wet scrubbers in series with fabric filters for SO_2 control. This combination of control devices has been demonstrated to achieve further reduction of arsenic emissions. It is thought that the scrubbr provides additional cooling which results in additional condensation and, hence, removal of arsenic. However, the Agency is not requiring the use of wet scrubbers under Section 112 because of the relatively small reduction in

maximum lifetime risk and annual incidence and because of the adverse economic impact. This decision is discussed in response to comments concerning secondary lead smelters.

The exhaust gas in arsenic chemical plants is at ambient temperature, while the flue gas in secondary lead smelters ranges from 31 °C to 200 °C (88 °F to 392 °F). Since the flue gas of arsenic chemical manufacturing plants is cool and emissions are already in particulate form, a wet scrubber is not needed. If proper engineering design and operating procedures are followed, fabric filters can reduce these arsenic trioxide particulate emissions by about 99.5 percent. The efficiency of fabric filters at chemical manufacturing facilities is higher than for some other source categories that emit arsenic because arsenic trioxide particulate is at ambient temperures in chemical manufacturing.

The NRDC (A–83–23/IV–D–10) stated that the principal weakness of the analysis for this category is the lack of date or analysis regarding the efficiency of capture of fugitive arsenic trioxide dusts at the eight sources of most interest. The NRDC noted that for four of the facilities, the information EPA does have is considered confidential. For the other plants, the commenter stated that the descriptions of capture techniques are cursory. The NRDC said that EPA does not appear to have engaged in any evaluation of their efficiency. They concluded that EPA is then unable to say if the hoods, enclosures, or vacuum systems used are really BAT.

In response, EPA notes that no quantifiable data are available on the capture efficiency of the hooding and enclosures used to collect fugitive arsenic trioxide dusts within the eight arsenic chemical manufacturing plants studied. However, qualitative evaluations were conducted based on the engineering design of the capture devices. Because the arsenic plants were in compliance with the OSHA workplace limit of 10 μg/m³, the capture devices used during the handling and processing of powdered arsenic trioxide can reasonably be expected to be operating efficiently. The companies provided EPA with data on the design of the capture systems used for controlling fugitive emissions. In several cases, these data were considered proprietary by the companies and, therefore, EPA did not release them for publication. The EPA considers these capture systems to be effective.

The EPA is not regulating arsenic chemical manufacturing plants under

Section 112 of the Act because the maximum individual cancer risks (2×10^{-4}) and the annual incidence (0.004 cancer cases per year) are small, and the plants are currently controlled in response to existing regulatory requirements and due to the economic benefits of collecting and reusing arsenic trioxide. Further significant reductions in annual incidence and maximum lifetime risk cannot be achieved.

VII. Miscellaneous

The effective date of these regulations is August 4, 1986. Section 112 of the Clean Air Act provides that national emission standards for hazardous air pollutants, or revisions thereof, become effective upon promulgation.

As prescribed by section 112, establishment of these standards was preceded by the Administrator's determination that inorganic arsenic is a hazardous air pollutant as defined in section 112(a)(1) of the Act. Inorganic arsenic was added to the list of hazardous air pollutants on June 5, 1980.

An economic impact assessment was prepared for each standard and for other regulatory alternatives. The updated economic impact assessment for each standard is included in the BID's for the promulgated standards (EPA–450/3–83–010b and EPA–450/3–83–011b).

Docket

The docket is an organized and complete file of all information submitted to or otherwise considered by EPA in the development of the standards. The principal purposes of the dockets are (1) to allow interested parties to identify and located documents readily so that they can intelligently and effectively participate in the rulemaking process, and (2) to serve as the record in case of judicial review (except for interagency review materials (§ 307(d)(7)(A))).

Reporting and Recordkeeping

The information collection requirements contained in these standards (§§ 61.165, 61.176, 61.177, 61.185, 61.186) have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1980, 44 U.S.C. 3501 *et seq.* The OMB control numbers assigned to the regulations are as follows: (1) Glass manufacturing plants, 2060–0043; (3) primary copper smelters; 2060–0044; and (3) arsenic trioxide and metallic arsenic production facilities, 2060–0042. The preamble and BID for each standard responds to

comments on the recordkeeping and reporting requirements of that standard.

There are no reporting requirements by other governmental agencies for the information required by these standards which would result in overlapping requirements. In particular, there is no overlap with the reporting requirements of the Superfund program. The Superfund program was established in 1980 by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, Pub. L. 96–510) and authorizes the Federal government to respond directly to releases (or threatened releases) of hazardous substances and pollutants or contaminants to any media that may endanger public health or welfare. Under the notification and liability provisions of section 103 (see 48 FR 23552, May 25, 1983), CERCLA requires that persons in charge of vessels or facilities from which hazardous substances have been released in quantities that are equal to or greater than the reportable quantities immediately notify the National Response Center of the release (800–424–8802; in Washington, DC, metropolitan area 202–426–2675). However, air releases which qualify as federally-permitted releases, such as inorganic arsenic emissions that are regulated under section 112 of the Clean Air Act, are not subject to the notification or liability provisions of CERCLA unless the air releases are in excess of the allowable NESHAP emissions by an amount equal to or greater than the reportable quantity; in this case, persons in charge must report the excess air releases to the National Response Center. (Reporting under CERCLA does not excuse the persons in charge from any responsibility, including reporting, or liability under the NESHAP program.)

Executive Order 12291

Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore subject to the requirements of a Regulatory Impact Analysis. None of the standards are considered major because none are expected 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. This rulemaking was submitted to the Office of Management and Budget for review as required by the Executive Order 12291. Any comments from OMB to EPA and any EPA response to those comments are available for public inspection in the Dockets (see **ADDRESSES**).

Regulatory Flexibility Analysis

The Regulatory Flexibility Act of 1980 (RFA) requires that differential impacts of Federal regulations upon small businesses be identified and analyzed. The RFA stipulates that an analysis is required if a substantial number of small businesses will experience significant impacts. Both measures must be met: that is, a substantial number of small businesses must be affected and they must experience significant impacts, to require an analysis. Twenty percent or more of the small businesses in an affected industry is considered a substantial number. The EPA definition of significant impact involves three tests, as follows: (1) Prices of produced by small entities rise 5 percent or more, assuming costs are passed on to consumers; (2) annualized investment costs for pollution control are greater than 20 percent of total capital spending; or (3) costs as a percent of sales for small entities are 10 percent greater than costs as a percent of sales for large entities.

The EPA has analyzed the impacts of the standards and has concluded that small businesses will not incur significant impacts. The bases for these conclusions are summarized below.

The Small Business Administration (SBA) definition of a small business for Standard Industrial Classification (SIC) Code 3331, Primary Smelting and Refining of Copper is 1,000 employees. All primary copper smelters in the United States are owned by seven companies that each have more than 1,000 employees. Therefore, none of the seven companies meets the SBA definition of a small business and no regulatory flexibility analysis is required for the primary copper smelter standard. Similarly the metallic arsenic and arsenic trioxide production facilities standard affects only one facility that is operated by a copper company with more than 1,000 employees. Therefore, no regulatory flexibility analysis is required for this standard.

Because of several aspects of the standard, the glass manufacturing plants standard will not result in significant small business impacts. These aspects are: (1) The exclusion of existing furnaces that emit 2.5 Mg of arsenic per year, or less, and new or modified

furnances that emit 0.4 Mg per year, or less, from the requirement of 85 percent emission reduction; (2) the exemption of pot furnaces; and (3) the provision that the emission testing requirement can be waived if nontest methods are adequate to demonstrate that arsenic emissions do not exceed 2.5 Mg/yr or 0.4 Mg/yr. Owning to these provisions, the standard does not significantly affect any small businesses. Therefore, no regulatory flexibility analysis is required, and the preliminary analysis that was prepared at the time of proposal was not finalized.

Regulatory Flexibility Act Certification

Under the provisions of 5 U.S.C. 605(b), I hereby certify that the standards for primary copper smelters, glass manufacturing plants, and arsenic trioxide and metallic arsenic production facilities promulgated today will not have a significant economic impact on small business entities because the only affected firms are not small and no new facilities ae expected.

List of Subject in 40 CFR Part 61

Asbestos, Beryllium, Glass, Hazardous substances, Inorganic arsenic, Mercury, Primary copper smelters, Radionuclides, Reporting and recordkeeping requirements, Vinly chloride.

Dated July 3, 1986.

Lee M. Thomas,

Administrator.

Part 61-[Amended]

Part 61 is amended by adding Subparts N, O, and P, and Reference Methods 108 and 108A to Appendix B, as follows:

1. The authority citation for Part 61 continues to read as follows:

Authority: 42 U.S.C. 7401, 7412, 7414, 7416, 7601.

2. The Table of Sections is amended by adding Subparts N, O, and P and Reference Methods 108 and 108A as follows:

Subpart N—National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants

Sec.
61.160 Applicability and designation of source.
61.161 Definitions.
61.162 Emission limits.
61.163 Emission monitoring.
61.164 Test methods and procedures.
61.165 Reporting and recordkeeping requirements.

Subpart O—National Emission Standard for Inorganic Arsenic Emissions from Primary Copper Smelters

Sec.
61.170 Applicability and designation of source.
61.171 Definitions.
61.172 Standard for new and existing sources.
61.173 Compliance provisions.
61.174 Test methods and procedures.
61.175 Monitoring requirements.
61.176 Recordkeeping requirements.
71.177 Reporting requirements.

Subpart P—National Emission Standard for Inorganic Arsenic Emissions from Arsenic Trioxide and Metallic Arsenic Production Facilities

Sec.
61.180 Applicability and designation of sources.
61.181 Definitions.
61.182 Standard for new and existing sources.
61.183 Emission monitoring.
61.184 Ambient air monitoring for inorganic arsenic.
61.185 Recordkeeping requirements.
61.186 Reporting requirements.

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Appendix B—Test Methods

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2. Part 61 is amended by adding Subpart N as follows:

Subpart N—National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants

§ 61.160 Applicability and designation of source.

(a) The source to which this subpart applies is each glass melting furnace that uses commercial arsenic as a raw material. This subpart does not apply to pot furnaces.

(b) Rebricking is not considered construction or modification for the purposes of § 61.05(a).

§ 61.161 Definitions.

The terms used in this subpart are defined in the Clean Air Act, in § 61.02, or in this section as follows:

"Arsenic-containing glass type" means any glass that is distinguished from other glass solely by the weight percent of arsenic added as a naw material and by the weight percent of arsenic in the glass produced. Any two or more glasses that have the same weight percent of arsenic in the raw materials as well as in the glass produced shall be considered to belong to one arsenic-containing glass type; without regard to the recipe used or any other characteristics of the glass or the method of production.

"By-pass the control device" means to operate the glass melting furnace without operating the control device to which that furnace's emissions are directed routinely.

"Commercial arsenic" means any form of arsenic that is produced by extraction from any arsenic-containing substance and is intended for sale or for intentional use in a manufacturing process. Arsenic that is a naturally occurring trace constituent of another substance is not considered "commercial arsenic."

"Cullet" means waste glass recycled to a glass melting furnace.

"Glass melting furnace" means a unit comprising a refractory vessel in which raw materials are charged, melted at high temperature, refined, and conditioned to produce molten glass. The unit includes foundations, superstructure and retaining walls, raw material charger systems, heat exchangers, melter cooling system, exhaust system, refractory brick work, fuel supply and electrical boosting equipment, integral control systems and instrumentation, and appendages for conditioning and distributing molten glass to forming apparatuses. The forming apparatuses, including the float bath used in flat glass manufacturing, are not considered part of the glass melting furnace.

"Glass produced" means the glass pulled from the glass melting furnace.

"Inorganic arsenic" means the oxides and other noncarbon compounds of the element arsenic included in particulate matter, vapors, and aerosols.

"Malfunction" means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of arsenic are increased.

"Pot furnace" means a glass melting furnace that contains one or more refractory vessels in which glass is melted by indirect heating. The openings of the vessels are in the outside wall of the furnace and are covered with refractory stoppers during melting.

"Rebricking" means cold replacement of damaged or worn refractory parts of the glass melting furnace. Rebricking includes replacement of the refractories comprising the bottom, sidewalls, or roof of the melting vessel; replacement of refractory work in the heat exchanger; and replacement of refractory portions of the glass conditioning and distribution system.

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

"Theoretical arsenic emissions factor" means the amount of inorganic arsenic,

expressed in grams per kilogram of glass produced, as determined based on a material balance.

"Uncontrolled total arsenic emissions" means the total inorganic arsenic in the glass melting-furnace exhaust gas preceding any add-on emission control device.

§ 61.162 Emission limits.

(a) The owner or operator of an existing glass melting furnace subject to the provisions of this subpart shall comply with either paragraph (a)(1) or (a)(2) of this section; except as provided in paragraph (c) of this section.

(1) Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 2.5 Mg per year, or

(2) Total arsenic emissions from the glass melting furnace shall be conveyed to a control device and reduced by at least 85 percent.

(b) The owner or operator of a new or modified glass melting furnace subject to the provisions of this subpart shall comply with either paragraph (b)(1) or (b)(2) of this section, except as provided in paragraph (c) of this section.

(1) Uncontrolled total arsenic emissions from the glass melting furnace shall be less than 0.4 Mg per year, or

(2) Total arsenic emissions from the glass melting furnace shall be conveyed to a control device and reduced by at least 85 percent.

(c) An owner or operator of a source subject to the requirements of this section may, after approval by the Administrator, bypass the control device to which arsenic emissions from the furnace are directed for a limited period of time for designated purposes such as maintenance of the control device, as specified in § 61.165(e).

(d) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of a glass melting furnace subject to the provisions of this subpart shall operate and maintain the furnace and associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.

§ 61.163 Emission monitoring.

(a) An owner or operator of a glass melting furnace subject to the emission

limit in § 61.162(a)(2) or § 61.162(b)(2) shall:

(1) Install, calibrate, maintain, and operate a continuous monitoring system for the measurement of the opacity of emissions discharged into the atmosphere from the control device; and

(2) Install, calibrate, maintain, and operate a monitoring device for the continuous measurement of the temperature of the gas entering the control device.

(b) All continuous monitoring systems and monitoring devices shall be installed and operational prior to performance of an emission test required by § 61.164(a). Verification of operational status shall, at a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures contained in Performance Specification 1 of Appendix B of 40 CFR Part 60.

(c) During the emission test required in § 61.164(a) each owner or operator subject to paragraph (a) of this section shall:

(1) Conduct continuous opacity monitoring from the beginning of the first test run until the completion of the third test run. Process and control equipment shall be operated in a manner that will minimize opacity of emissions, subject to the Administrator's approval.

(2) Calculate 6-minute opacity averages from 24 or more data points equally spaced over each 6-minute period during the test runs.

(3) Determine, based on the 6-minute opacity averages, the opacity value corresponding to the 97.5 percent upper confidence level of a normal or lognormal (whichever the owner or operator determines is more representative) distribution of the average opacity values.

(4) Conduct continuous monitoring of the temperature of the gas entering the control device from the beginning of the first test run until completion of the third test run.

(5) Calculate 15-minute averages of the temperature of the gas entering the control device during each test run.

(d) An owner or operator may redetermine the values described in paragraph (c) of this section during any emission test that demonstrates compliance with the emission limits in § 61.162(a)(2) or § 61.162(b)(2).

(e) The requirements of § 60.13(d) and § 60.13(f) shall apply to an owner or operator subject to paragraph (a) of this section.

(f) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under § 60.13(d), all continuous monitoring

systems shall be in continuous operation and shall meet minimum frequency of operation requirements by completing a minimum of one cycle of sampling and analyzing for each successive 10-second period and one cycle of data recording for each successive 6-minute period.

(g) An owner or operator subject to paragraph (a) of this section shall:

(1) Reduce all opacity data to 6-minute averages. Six-minute averages shall be calculated from 24 or more data points equally spaced over each 6-minute period. Data recorded during periods of monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages calculated under this paragraph, and

(2) Calculate 15-minute averages of the temperature of the gas entering the control device for each 15-minute operating period.

(h) After receipt and consideration of written application, the Administrator may approve alternative monitoring systems for the measurement of one or more process or operating parameters that is or are demonstrated to enable accurate and representative monitoring of a properly operating control device. Upon approval of an alternative monitoring system for an affected source, the Administrator will specify requirements to replace the requirements of paragraphs (a)–(g) of this section for that system.

§ 61.164 Test methods and procedures.

(a) To demonstrate compliance with § 61.162, the owner or operator shall conduct emission tests, reduce test data, and follow the procedures specified in this section unless the Administrator:

(1) Specifies or approves, in specific cases, the use of a reference method with minor changes in methodology;

(2) Approves the use of an equivalent method;

(3) Approves the use of an alternative method the results of which he has determined to be adequate for indicating whether a specific source is in compliance; or

(4) Waives the requirement for emission tests as provided under § 61.13.

(b) Unless a waiver of emission testing is obtained, the owner or operator shall conduct emission tests required by this section:

(1) No later than 90 days after the effective data of this subpart for a source that has an initial startup date preceding the effective date; or

(2) No later than 90 days after startup for a source that has an initial startup date after the effective date.

(3) At such other times as may be required by the Administrator under Section 114 of the Act.

(4) While the source is operating under such conditions as the Administrator may specify, based on representative performance of the source.

(c) To demonstrate compliance with § 61.162(a)(1) when less than 8.0 Mg per year of elemental arsenic is added to any existing glass melting furnace, or to demonstrate compliance with § 61.162(b)(1) when less than 1.0 Mg per year of elemental arsenic is added to any new or modified glass melting furnace, an owner or operator shall:

(1) Derive a theoretical uncontrolled arsenic emission factor (T), in grams of elemental arsenic per kilogram of glass produced, based on material balance calculations for each arsenic-containing glass type (i) produced during the 12-month period, as follows:

$$T_i = (A_{bi} \times W_{bi}) + (A_{ci} \times W_{ci}) - A_{gi}$$

Where:
T_i = the theoretical uncontrolled arsenic emission factor (g/kg) for each glass type (i).
A_{bi} = fraction by weight of elemental arsenic in the fresh batch for each glass type (i).
W_{bi} = weight (g) of fresh batch melted per kg of glass produced for each glass type (i).
A_{ci} = fraction by weight of elemental arsenic in cullet for each glass type (i).
W_{ci} = weight (g) of cullet melted per kg of glass produced for each glass type (i).
A_{gi} = weight (g) of elemental arsenic per kg glass produced for each glass type (i).

(2) Estimate theoretical uncontrolled arsenic emissions for the 12-month period for each arsenic-containing glass type as follows:

$$Y_i = \frac{(T_i \times G_i)}{10^6}$$

Where:
Y_i = the theoretical uncontrolled arsenic emission estimate for the 12-month period for each glass type (Mg/year).
T_i = the theoretical uncontrolled arsenic emission factor for each type of glass (i) produced during the 12-month period as calculated in paragraph (c)(1) of this section (g/kg).
G_i = the quantity (kg) of each arsenic-containing glass type (i) produced during the 12-month period.

(3) Estimate the total theoretical uncontrolled arsenic emissions for the

12-month period by finding the sum of the values calculated for Y_i in paragraph (c)(2) of this section.

(4) If the value determined in paragraph (c)(3) of this section is equal to or greater than the applicable limit in § 61.162(a)(1) or (b)(1), conduct the emission testing and calculations described in paragraphs (d)(1) through (d)(5) of this section. If the value is less than the applicable limit, the source is in compliance and no emission testing or additional calculations are required.

(d) To demonstrate compliance with § 61.162(a)(1) when 8.0 Mg per year or more of elemental arsenic are added to any existing glass melting furnace, or to demonstrate compliance with § 61.162(b)(1) when 1.0 Mg per year or more of elemental arsenic is added to any new or modified glass melting furnace, an owner or operator shall:

(1) Estimate the theoretical uncontrolled arsenic emissions for each glass type for the 12-month period by performing the calculations described in paragraphs (c)(1) and (c)(2) of this section.

(2) Conducte mission testing to determine the actual uncontrolled arsenic emission rate during production of the arsenic-containing glass type with the highest theoretical uncontrolled arsenic emissions as calculated under paragraph (d)(1) of this section. The owner or operator shall use the following test methods and procedures:

(i) Use Method 108 in Appendix B to this part for determinig the arsenic emission rate (g/h). The emission rate shall equal the arithmetic mean of the results of three 60-minute test runs.

(ii) Use the following methods in Appendix A to 40 CFR Part 60:

(A) Method 1 for sample and velocity traverse.

(B) Method 2 for velocity and volumetric flowrate.

(C) Method 3 for gas analysis.

(D) For sources equipped with positive pressure fabric filters, use Section 4 of Method 5D to determine a suitable sampling location and procedure.

(3) Determine the actual uncontrolled arsenic emission factor (R_a) in grams of elemental arsenic per kilogram of glass produced, as follows:

$$R_a = E_a \div P$$

Where:
R_a = the actual uncontrolled arsenic emission factor (g/kg).
E_a = the actual uncontrolled arsenic emission rate (g/h) from paragraph (d)(2) of this section.

P = the rate of glass production (kg/h), determined by dividing the weight (kg) of glass pulled from the furnace during the emission test by the number of hours (h) taken to perform the test under paragraph (d)(2) of this section.

(4) Calculate a correction factor to relate to the theoretical and the actual uncontrolled arsenic emission factors as follows:

$$F = R_a \div T_i$$

Where:
F = the correction factor.
R_a = the actual uncontrolled arsenic emission factor (g/kg) determined in paragraph (d)(3) of this section.
T_i = the theoretical uncontrolled arsenic emission factor (g/kg) determined in paragraph (c)(1) of this section for the same glass type for which R_a was determined.

(5) Determine the uncontrolled arsenic emission rate for the 12-month period, as follows:

$$U = \frac{\sum_{i=1}^{n} (T_i \times F \times G_i)}{10^6}$$

Where:
U = the uncontrolled arsenic emission rate for the 12-month period (Mg/year).
T_i = the theoretical uncontrolled arsenic emission factor for each arsenic-containing glass type (i) produced during the 12-month period, as calculated in paragraph (c)(1) of this section (g/kg).
F = the correction factor calculated in paragraph (d)(4) of this section.
G_i = the quantity (kg) of each arsenic-containing glass type (i) produced during the 12-month period.
n = the number of arsenic-containing glass types produced during the 12-month period.

(6) If the value determined in paragraph (d)(5) of this section is less than the applicable limit in § 61.162(a)(1) or (b)(1), the source is in compliance.

(e) To demonstrate compliance with § 61.162(a)(2) or (b)(2), an owner or operator shall:

(1) Conduct emission testing to determine the percent reduction of inorganic arsenic emissions being achieved by the control device, using the following test methods and procedures:

(i) Use Method 108 in Appendix B to this part to determine the concentration of arsenic in the gas streams entering and exiting the control device. Conduct three 60-minute test runs, each consisting of simultaneous testing of the inlet and outlet gas streams. The gas streams shall contain all the gas exhausted from the glass melting furnace.

(ii) Use the following methods in Appendix A to 40 CFR Part 60:

(A) Method 1 for sample and velocity traverses.

(B) Method 2 for velocity and volumetric flowrate.

(C) Method 3 for gas analysis.

(D For sources equipped with positive pressure fabric filters, use Section 4 of Method 5D to determine a suitable sampling location and procedure.

(2) Calculate the percent emission reduction for each run as follows:

$$D = \frac{(C_b - C_a) \times 100}{C_b}$$

Where:

D= the percent emission reduction.
C_b= the arsenic concentration of the stack gas entering the control device, as measured by Method 108.
C_a= the arsenic concentration of the stack gas exiting the control device, as measured by Method 108.

(3) Determine the average percent reduction of arsenic by calculating the arithmetic mean of the results for the three runs. If it is at least 85 percent, the source is in compliance.

§ 61.165 Reporting and recordkeeping requirements.

(a) Each owner or operator of a source subject to the requirements of § 61.162 shall maintain at the source for a period of at least 2 years and make available to the Administrator upon request a file of the following records:

(1) All measurements, including continuous monitoring for measurement of opacity, and temperature of gas entering a control device;

(2) Records of emission test data and all calculations used to produce the required reports of emission estimates to demonstrate compliance with § 61.162;

(3) All continous monitoring system performance evaluations, including calibration checks and adjustments;

(4) The occurrence and duration of all startups, shutdowns, and malfunctions of the furnace;

(5) All malfunctions of the air pollution control system;

(6) All periods during which any continuous monitoring system or monitoring device is inoperative;

(7) all records of maintenance and repairs for each air pollution control system, continuous monitoring system, or monitoring device;

(b) Each owner or operator who is given approval by the Administrator to bypass a control device under paragraph (e) of this section shall maintain at the source for a period of at least 2 years and make available to the Administrator upon request a file of the following records:

(1) The dates the control device is bypassed; and

(2) Steps taken to minimize arsenic emissions during the period the control device was bypassed.

(c) Each owner or operator of a source subject to the emission limit in § 61.162(a)(1) or (b)(1) shall determine and record at the end of every 6 months the uncontrolled arsenic emission rate for the preceding and forthcoming 12-month periods. The determinations shall:

(1) Be made by following the procedures in § 61.164(c)(1), (c)(2), and (c)(3); or in § 61.164(d)(5), whichever is applicable; and

(2) Take into account changes in production rates; types of glass produced, and other factors that would affect the uncontrolled arsenic emission rate.

(d) Each owner or operator of a source subject to the provisions of this subpart shall:

(1) Provide the Administrator 30 days prior notice of any emission test required in §61.164 to afford the Administrator the opportunity to have an observer present; and

(2) Submit to the Administrator a written report of the results of the emission test and associated calculations required in § 61.164(d) or (e), as applicable, within 60 days after conducting the test.

(3) Submit to the Administrator a written report of the arsenic emission estimates calculated under § 61.164(c):

(i) Within 45 days after the effective date of this subpart for a source that has an initial startup date preceding the effective date; or

(ii) Within 45 days after startup for a source that has an initial startup date after the effective date.

(4) Submit to the Adminstrator a written report of the uncontrolled arsenic emission rates determined in accordance with paragraph (c) of this section, if:

(i) The emission rate for the preceding 12-month period (or preceding 6-month period for the first 6-month determination) exceeded the applicable limit in § 61.162(a)(1) or (b)(1).

(ii) The emission rate for the forthcoming 12-month period will exceed the applicable limit in § 61.162(a)(1) or (b)(1). In this case, the owner or operator shall also notify the Administrator of the anticipated date of the emission test to demonstrate compliance with the applicable limit in § 61.162(a)(2) or (b)(2).

(5) Ensure that the reports required in paragraph (d)(4) of this section are postmarked by the tenth day following the end of the 6-month reporting period.

(e) To obtain approval to bypass a control device, as provided in § 61.162(c), an owner or operator of a source subject to this subpart may make written application to the Administrator. Each application for such a waiver shall be submitted to the Administrator no later than 60 days before the bypass period would begin and shall include:

(1) Name and address of the owner or operator;

(2) Location of the source;

(3) A brief description of the nature, size, design, and method of operation of the source;

(4) The reason it is necessary to by-pass the control device;

(5) The length of time it will be necessary to by-pass the control device;

(6) Steps that will be taken to minimize arsenic emissions during the period the control device will be by-passed.

(7) The quantity of emissions that would be released while the control device is by-passed if no steps were taken to minimize emissions;

(8) The expected reduction in emissions during the by-pass period due to the steps taken to minimize emissions during this period; and

(9) The type of glass to be produced during the bypass period, and, if applicable, an explanation of why non-arsenic or lower-arsenic-containing glass cannot be melted in the furnace during the bypass period.

(f) Each owner or operator required to install and operate a continuous opacity monitoring system under § 61.163 shall:

(1) Submit a written report to the Administrator of the results of the continuous monitoring system evaluation required under § 61.163(b) within 60 days after conducting the evaluation.

(2) Submit a written report to the Administrator every 6 months if excess opacity occurred during the preceding 6-month period. For purposes of this paragraph, an occurrence of excess opacity is any 6-minute period during which the average opacity, as measured by the continuous monitoring system, exceeds the opacity level determined under § 61.163(c)(3) or the opacity level redetermined under § 61.163(d).

(3) Ensure that any semiannual report of excess opacity required by paragraph (f)(2) of this section is postmarked by the thirtieth day following the end of the

6-month period and includes the following information:

(i) The magnitude of excess opacity, any conversion factor(s) used, and the date and time of commencement and completion of each occurrence of excess opacity.

(ii) Specific identification of each occurrence of excess opacity that occurs during startups, shutdowns, and malfunctions of the source.

(iii) The date and time identifying each period during which the continuous monitoring system was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.

(Approved by the Office of Management and Budget under control number 2060-0043)

3. Part 61 is amended by adding Subpart O as follows:

Subpart O—National Emission Standard for Inorganic Arsenic Emissions from Primary Copper Smelters

§ 61.170　Applicability and designation of source.

The provisions of this subpart are applicable to each copper converter at any new or existing primary copper smelter, except as noted in § 61.172(a).

§ 61.171　Definitions.

All terms used in this subpart shall have the meanings given to them in the Act, in Subpart A of Part 61, and in this section as follows:

"Blowing" means the injection of air or oxygen-enriched air into a molten converter bath.

"Charging" means the addition of a molten or solid material to a copper converter.

"Control device" means the air pollution control equipment used to collect particulate matter emissions.

"Converter arsenic charging rate" means the hourly rate at which arsenic is charged to the copper converters in the copper converter department based on the arsenic content of the copper matte and of any lead matte that is charged to the copper converters.

"Copper converter" means any vessel in which copper matte is charged and is oxidized to copper.

"Copper converter department" means all copper converters at a primary copper smelter.

"Copper matte" means any molten solution of copper and iron sulfides produced by smelting copper sulfide ore concentrates or calcines.

"Holding of a copper converter" means suspending blowing operations while maintaining in a heated state the molten bath in the copper converter.

"Inorganic arsenic" means the oxides and other noncarbon compounds of the element arsenic included in particulate matter, vapors, and aerosols.

"Lead matte" means any molten solution of copper and other metal sulfides produced by reduction of sinter product from the oxidation of lead sulfide ore concentrates.

"Malfunction" means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of inorganic arsenic are increased.

"Opacity" means the degree to which emissions reduce the transmission of light.

"Particulate matter" means any finely divided solid or liquid material, other than uncombined water, as measured by the specified reference method.

"Pouring" means the removal of blister copper from the copper converter bath.

"Primary copper smelter" means any installation or intermediate process engaged in the production of copper from copper-bearing materials through the use of pyrometallurgical techniques.

"Primary emission control system" means the hoods, ducts, and control devices used to capture, convey, and collect process emissions.

"Process emissions" means inorganic arsenic emissions from copper converters that are captured directly at the source of generation.

"Secondary emissions" means inorganic arsenic emissions that escape capture by a primary emission control system.

"Secondary hood system" means the equipment (including hoods, ducts, fans, and dampers) used to capture and transport secondary inorganic arsenic emissions.

"Shutdown" means the cessation of operation of a stationary source for any reason.

"Skimming" means the removal of slag from the molten converter bath.

§ 61.172　Standard for new and existing sources.

(a) The provisions of paragraphs (b)–(f) of this section do not apply to any copper converter at a facility where the total arsenic charging rate for the copper converter department averaged over a 1-year period is less than 75 kg/h, as determined under § 61.174(f).

(b) The owner or operator of each copper converter subject to the provisions of this subpart shall reduce inorganic arsenic emissions to the atmosphere by meeting the following design, equipment, work practice, and operational requirements:

(1) Install, operate, and maintain a secondary hood system on each copper converter. Each secondary hood system shall consist of a hood enclosure, air curtain fan(s), exhaust system fan(s), and ductwork that conveys the captured emissions to a control device, and shall meet the following specifications:

(i) The configuration and dimensions of the hood enclosure shall be such that the copper converter mouth, charging ladles, skimming ladles, and any other material transfer vessels used will be housed within the confines or influence of the hood enclosure during each mode of copper converter operation.

(ii) The back of the hood enclosure shall be fully enclosed and sealed against the primary hood. Portions of the side-walls in contact with the copper converter shall be sealed against the converter.

(iii) Openings in the top and front of the hood enclosure to allow for the entry and egress of ladles and crane appartus shall be minimized to the fullest extent practicable.

(iv) The hood enclosure shall be fabricated in such a manner and of materials of sufficient strength to withstand incidental contact with ladles and crane apparatus with no significant damage.

(v) One side-wall of the hood enclosure shall be equipped with a horizontal-slotted plenum along the top, and the opposite side-wall shall be equipped with an exhaust hood. The horizontal-slotted plenum shall be designed to allow the distance from the base to the top of the horizontal slot to be adjustable up to a dimension of 76 mm.

(vi) The horizontal-slotted plenum shall be connected to a fan. When activated, the fan shall push air through the horizontal slot, producing a horizontal air curtain above the copper converter that is directed to the exhaust hood. The fan power output installed shall be sufficient to overcome static pressure losses through the ductwork upstream of the horizontal-slotted plenum and across the plenum, and to deliver at least 22,370 watts (30 air horsepower) at the horizontal-slotted plenum discharge.

(vii) The exhaust hood shall be sized to completely intercept the airstream from the horizontal-slotted plenum combined with the additional airflow resulting from entrainment of the surrounding air. The exhaust hood shall be connected to a fan. When activated, the fan shall pull the combined airstream into the exhaust hood.

(viii) The entire secondary hood system shall be equipped with dampers

and instrumentation, as appropriate, so that the desired air curtain and exhaust flow are maintained during each mode of copper converter operation.

(2) Optimize the capture of secondary inorganic arsenic emissions by operating the copper converter and secondary hood system at all times as follows:

(i) Copper converter.

(A) Increase the air curtain and exhaust flow rates to their optimum conditions prior to raising the primary hood and rolling the copper converter out for charging, skimming, or pouring.

(B) Once rolled out, prior to the commencement of skimming or pouring, hold the copper converter in an idle position until fuming from the molten bath has been minimized.

(C) During skimming, raise the receiving ladle off the ground and position the ladle as close to the copper converter mouth as possible to minimize the drop distance between the converter mouth and the receiving ladle.

(D) Control the rate of flow into the receiving ladle to the extent practicable to minimize fuming.

(E) Upon the completion of each charge, withdraw the charging ladle or vessel used from the confines of the secondary hood in a slow, deliberate manner.

(F) During charging, skimming, or pouring, ensure that the crane block does not disturb the air flow between the horizontal-slotted plenum and the exhaust hood.

(ii) Secondary hood system.

(A) Operate the secondary hood system under conditions that will result in the maximum capture of inorganic arsenic emissions.

(B) Within 30 days after the effective date of this subpart, or within 30 days after the initial operation of each secondary hood system, whichever comes later, provide to the Administrator a list of operating conditions for the secondary hood system that will result in the maximum capture of inorganic arsenic emissions. This list shall specify the operating parameters for the following:

(1) The dimensions of the horizontal slot.

(2) The velocity of air through the horizontal slot during each mode of converter operation.

(3) The distance from the horizontal slot to the exhaust hood.

(4) The face velocity at the opening of the exhaust hood during each mode of converter operation.

(C) Operate the secondary hood system under the conditions listed in paragraph (b)(2)(ii)(B) of this section, unless otherwise specified by the Administrator.

(D) Notify the Administrator in writing within 30 days if there is any change in the operating conditions submitted pursuant to the requirements of paragraph (b)(2)(ii)(B) that will result in any reduction in the maximum capture of inorganic arsenic emissions.

(3) Comply with the following inspection and maintenance requirements after installing the secondary hood system required in paragraph (b)(1) of this section:

(i) At least once every month, visually inspect the components of the secondary hood system that are exposed to potential damage from crane and ladle operation, including the hood enclosure, side- and back-wall hood seals, and the horizontal slot.

(ii) Replace or repair any defective or damaged components of the secondary hood system within 30 days after discovering the defective or damaged components.

(c) No owner or operator of a copper converter subject to the provisions of this subpart shall cause or allow to be discharged into the atmosphere any copper converter secondary emissions that exit from a control device and contain particulate matter in excess of 11.6 milligrams per dry standard cubic meter.

(d) The owner or operator of a copper converter subject to the provisions of this subpart shall submit a description of a plan for control of inorganic arsenic emissions from the copper converter and associated air pollution control equipment. This plan shall be submitted within 90 days after the effective date of this subpart, unless a waiver of compliance is granted under § 61.11. If a waiver of compliance is granted, the plan shall be submitted on a date set by the Administrator. Approval of the plan will be granted by the Administrator provided he finds that:

(1) It includes a systematic procedure for identifying malfunctions and for reporting them immediately to smelter supervisory personnel.

(2) It specifies the procedures that will be followed to ensure that equipment or process breakdowns due entirely or in part to poor maintenance or other preventable conditions do not occur.

(3) It specifies the measures that will be taken to ensure compliance with paragraph (b)(2) of this section.

(e) The owner or operator shall implement the plan required under paragraph (d) of this section unless otherwise specified by the Administrator.

(f) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of a copper converter subject to the provisions of this subpart

shall operate and maintain the converter and associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.

§ 61.173 Compliance provisions.

(a) The owner or operator of each copper converter to which § 61.172(b)–(f) applies shall demonstrate compliance with the requirements of § 61.172(b)(1) as follows:

(1) The owner or operator of each existing copper converter shall install a secondary hood system to meet the requirements of § 61.172(b)(1) no later than 90 days after the effective date, unless a waiver of compliance has been approved by the Administrator in accordance with § 61.11.

(2) The owner or operator of each new copper converter shall install a secondary hood system to meet the requirements of § 61.172(b)(1) prior to the initial startup of the converter, except that if startup occurs prior to the effective date, the owner or operator shall meet the requirements of § 61.172(b)(1) on the effective date.

§ 61.174 Test methods and procedures.

(a) To determine compliance with § 61.172(c), the owner or operator shall conduct emission tests and reduce the test data in accordance with the test methods and procedures contained in this section unless the Administrator:

(1) Specifies or approves, in specific cases, the use of a reference method with minor changes in methodology,

(2) Approves the use of an equivalent method,

(3) Approves the use of an alternative method, the results of which he has determined to be adequate for indicating whether a specific source is in compliance, or

(4) Waives the requirement for emission tests as provided in § 61.13.

(b) The owner or operator shall conduct the emission tests required in paragraph (a) of this section:

(1) After achieving the optimum operating conditions submitted under § 60.172(b)(2)(ii)(B) for the equipment required in § 61.172(b)(1), but no later than 90 days after the effective date of

this subpart in the case of an existing copper converter or a copper converter that has an initial startup date preceding the effective date, or

(2) After achieving the optimum operating conditions submitted under § 60.172(b)(2)(ii)(B) for the equipment required in § 61.172(b)(1), but no later than 90 days after startup in the case of a new copper converter, initial startup of which occurs after the effective date, or

(3) At such other times as may be required by the Administrator under section 114 of the Act.

(c) The owner or operator shall conduct each emission test under representative operating conditions and at sample locations subject to the Administrator's approval, and shall make available to the Administrator such records as may be necessary to determine the conditions of the emission test.

(d) For the purpose of determining compliance with § 61.172(c), the owner or operator shall use reference methods in 40 CFR Part 60, Appendix A, as follows:

(1) Method 5 for the measurement of particulate matter,

(2) Method 1 for sample and velocity traverses,

(3) Method 2 for velocity and volumetric flow rate,

(4) Method 3 for gas analysis, and

(5) Method 4 for stack gas moisture.

(e) For Method 5, the sampling time for each run shall be at least 60 minutes and the minimum sampling volume shall be 0.85 dscm (30 dscf) except that smaller times or volumes when necessitated by process variables or other factors may be approved by the Administrator.

(f) For the purpose of determining applicability under § 61.172(a), the owner or operator shall determine the converter arsenic charging rate as follows:

(1) Collect daily grab samples of copper matte and any lead matte charged to the copper converters.

(2) Each calendar month, from the daily grab samples collected under paragraph (f)(1) of this section, put together a composite copper matte sample and a composite lead matte sample. Analyze the composite samples individually using Method 108A to determine the weight percent of inorganic arsenic contained in each sample.

(3) Calculate the converter arsenic charging rate once per month using the following equation:

$$R_d = \sum_{i=1}^{n} \frac{A_c W_{cl} + A_l W_{ll}}{100 \, H_c}$$

Where:

Rc is the converter arsenic charging rate (kg/h).

A_c is the monthly average weight percent of arsenic in the copper matte charged during the month (%) as determined under paragraph (f)(2) of this section.

A_l is the monthly average weight percent of arsenic in the lead matte charged during the month (%) as determined under paragraph (f)(2) of this section.

W_{cl} is the total weight of copper matte charged to a copper converter during the month (kg).

W_{ll} is the total weight of lead matte charged to a copper converter during the month (kg).

H_c is the total number of hours the copper converter department was in operation during the month (h).

n is the number of copper converters in operation during the month.

(4) Determine an annual arsenic charging rate for the copper converter department once per month by computing the arithmetic average of the 12 monthly converter arsenic charging rate values (R_c) for the preceding 12-month period.

(g) An owner or operator may petition the Administrator for a modified sampling and analysis schedule if analyses performed for the first 12-month period after the effective date show the source to be considerably below the applicability limit prescribed in § 61.172(a).

§ 61.175 Monitoring requirements.

(a) Each owner or operator of a source that is subject to the emission limit specified in § 61.172(c) shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of the opacity of emissions discharged from the control device according to the following procedures:

(1) Ensure that each system is installed and operational no later than 90 days after the effective date of this subpart for a source that has an initial startup date preceding the effective date; and no later than 90 days after startup for other sources. Verification of the operational status shall, as a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures contained in Performance Specification 1 of Appendix B of 40 CFR Part 60.

(2) Comply with the provisions of § 60.13(d) of 40 CFR Part 60.

(3) Except for system breakdowns, repairs, calibration checks, and zero span adjustments, ensure that each continuous monitoring system is in continuous operation and meets frequency of operation requirements by

completing a minimum of one cycle of sampling and analysis for each successive 10-second period and one cycle of data recording for each successive 6-minute period. Each data point shall represent the opacity measured for one cycle of sampling and analysis and shall be expressed as percent opacity.

(b) Except as required in paragraph (c) of this section, calculate 1-hour opacity averages from 360 or more consecutive data points equally spaced over each 1-hour period. Data recorded during periods of monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph.

(c) No later than 60 days after each continuous opacity monitoring system required in paragraph (a) of this section becomes operational, the owner or operator shall establish a reference opacity level for each monitored emission stream according to the following procedures:

(1) Conduct continuous opacity monitoring over a preplanned period of not less than 36 hours during which the processes and emission control equipment upstream of the monitoring system are operating under representative operating conditions subject to the Administrator's approval. This period shall include the time during which the emission test required by § 61.13 is conducted.

(2) Calculate 6-minute averages of the opacity readings using 36 or more consecutive data points equally spaced over each 6-minute period.

(3) Calculate 1-hour average opacity values using 10 successive 6-minute average opacity values (i.e., calculate a new 1-hour average opacity value every 6 minutes). Determine the highest 1-hour average opacity value observed during the 36-hour preplanned test period.

(4) Calculate the reference opacity level by adding 5 percent opacity to the highest 1-hour average opacity calculated in paragraph (c)(3) of this section.

(d) The owner or operator may redetermine the reference opacity level for the copper converter secondary emission stream at the time of each emission test that demonstrates compliance with the emission limit required in § 61.172(c) according to the provisions of paragraphs (c)(1) through (c)(4) of this section.

(e) With a minimum of 30 days prior notice, the Administrator may require the owner or operator to redetermine the reference opacity level for any monitored emission stream.

(f) Each owner or operator who is required to install the equipment specified in § 61.172(b)(1) for the capture of secondary copper converter emissions shall install, calibrate, maintain, and operate a continuous monitoring device on each secondary hood system for the measurement of the air flow through the horizontal-slotted plenum and through the exhaust hood. Each device shall be installed and operational no later than 90 days after the effective date of this subpart for a source that has an initial startup preceding the effective date; and no later than 90 days after startup for other sources.

(g) Each owner or operator subject to the requirements in paragraph (f) of this section shall establish for each secondary hood system reference air flow rates for the horizontal-slotted plenum and exhaust hood for each mode of converter operation. The reference flow rates shall be established when the equipment is operating under the optimum operating conditions required in § 61.172(b)(2)(ii).

(h) Each owner or operator shall install the continuous monitoring systems and monitoring devices required in paragraphs (a) and (f) of this section in such a manner that representative measurements of emissions and process parameters are obtained.

§ 61.176 Recordkeeping requirements.

(a) Each owner or operator subject to the requirements of § 61.172(b)(1) shall maintain at the source for a period of at least 2 years records of the visual inspections, maintenance, and repairs performed on each secondary hood system as required in § 61.172(b)(3).

(b) Each owner or operator subject to the provisions of § 61.172(c) shall maintain at the source for a period of at least 2 years and make available to the Administrator upon request a file of the following records:

(1) All measurements, including continuous monitoring for measurement of opacity;

(2) Records of emission test data and all calculations used to produce the required reports of emission estimates to demonstrate complaince with § 61.172(c);

(3) All continuous monitoring system performance evaluations, including calibration checks and adjustments;

(4) The occurrence and duration of all startups, shutdowns, and malfunctions of the copper converters;

(5) All malfunctions of the air pollution control system;

(6) All periods during which any continuous monitoring system or device is inoperative;

(7) All maintenance and repairs performed on each air pollution control system, continuous monitoring system, or monitoring device;

(8) All records of 1-hour average opacity levels for each separate control device; and

(9) For each secondary hood system:

(i) The reference flow rates for the horizontal-slotted plenum and exhaust hood for each converter operating mode estabilshed under § 61.175(g);

(ii) The actual flow rates; and

(iii) A daily log of the start time and duration of each converter operating mode.

(c) Each owner or operator subject to the provisions of this subpart shall maintain at the source for a period of at least 2 years and make available to the Administrator upon request the following records:

(1) For each copper converter, a daily record of the amount of copper matte and lead matte charged to the copper converter and the total hours of operation.

(2) For each copper converter department, a monthly record of the weight percent of arsenic contained in the copper matte and lead matte as determined under § 61.174(f).

(3) For each copper converter department, the monthly calculations of the average annual arsenic charging rate for the preceding 12-month period as determined under § 61.174(f).

(Approved by the Office of Management and Budget under control number 2060–0044)

§ 61.177 Reporting requirements.

(a) Each owner or operator subject to the provisions of § 61.172(c) shall:

(1) Provide the Administrator 30 days prior notice of the emission test required in § 61.174(a) to afford the Administrator the opportunity to have an observer present; and

(2) Submit to the Administrator a written report of the results of the emission test required in § 61.174(a) within 60 days after conducting the test.

(b) Each owner or operator subject to the provisions of § 61.175(a) shall provide the Administrator at least 30 days prior notice of each reference opacity level determination required in § 61.175(c) to afford the Administrator the opportunity to have an observer present.

(c) Each owner or opertor subject to the provisions of § 61.175(a) shall submit to the Administrator:

(1) Within 60 days after conducting the evaluation required in § 61.175(a)(1),

a written report of the continuous monitoring system evaluation;

(2) Within 30 days after establishing the reference opacity level required in § 61.175(c), a written report of the reference opacity level. The report shall also include the opacity data used and the calculations performed to determine the reference opacity level, and sufficient documentation to show that process and emission control equipment were operating normally during the reference opacity level determination; and

(3) A written report each quarter of each occurrence of excess opacity during the quarter. For purposes of this paragraph, an occurrence of excess opacity is any 1-hour period during which the average opacity, as measured by the continuous monitoring system, exceeds the reference opacity level established under § 61.175(c).

(d) The owner or operator subject to the provisions of § 61.175(g) shall submit to the Administrator:

(1) A written report of the reference air flow rate within 30 days after establishing the reference air flow rates required in § 61.175(g);

(2) A written report each quarter of all air flow rates monitored during the preceding 3-month period that are less than 80 percent of the corresponding reference flow rate established for each converter operating mode; and

(3) A written report each quarter of any changes in the operating conditions of the emission capture system, emission control device, or the building housing the converters that might increase fugitive emissions.

(e) All quarterly reports shall be postmarked by the 30th day following the end of each 3-month period and shall include the following information:

(1) The magnitude of each occurrence of excess opacity, any conversion factor(s) used, and the dates and times of commencement and completion of each occurrence of excess opacity, the cause of each exceedance of the reference opacity level, and the measures taken to minimize emissions.

(2) The magnitude of each occurrence of reduced flow rate and the date and time of commencement and completion of each occurrence of reduced flow rate, the cause of the reduced flow rate, and the associated converter operating mode.

(3) Specific identification of each occurrence of excess opacity or reduced flow rate that occurs during startups, shutdowns, and malfunctions of the source.

(4) The date and time identifying each period during which the continuous

monitoring system or monitoring device was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.

(5) Specific identification of each change in operating conditions of the emission capture system or control device, or in the condition of the building housing the converters.

(f) Each owner or operator of a source subject to the provisions of this subpart shall submit annually a written report to the Administrator that includes the monthly computations of the average annual converter arsenic charging rate as calculated under § 61.174(f)(4). The annual report shall be postmarked by the 30th day following the end of each calendar year.

(Approved by the Office of Management and Budget under control number 2060–0044)

4. Part 61 is amended by adding Subpart P as follows:

Subpart P—National Emission Standard for Inorganic Arsenic Emissions From Arsenic Trioxide and Metallic Arsenic Production Facilities

§ 61.180 Applicability and designation of sources.

The provisions of this subpart are applicable to each metallic arsenic production plant and to each arsenic trioxide plant that processes low-grade arsenic bearing materials by a roasting condensation process.

§ 61.181 Definitions.

All terms used in this subpart shall have the meanings given them in the Act, in Subpart A of Part 61, and in this section as follows:

"Arsenic kitchen" means a baffled brick chamber where inorganic arsenic vapors are cooled, condensed, and removed in a solid form.

"Control device" means the air pollution control equipment used to collect particulate matter emissions.

"Curtail" means to cease operations to the extent technically feasible to reduce emissions.

"Inorganic arsenic" means the oxides and other noncarbon compounds of the element arsenic included in particular matter, vapors, and aerosols.

"Malfunction" means any sudden failure of air pollution control equipment or process equipment or of a process to operate in a normal or usual manner so that emissions of inorganic arsenic are increased.

"Opacity" means the degree to which emissions reduce the transmission of light.

"Primary emission control system" means the hoods, enclosures, ducts, and control devices used to capture, convey, and remove particulate matter from exhaust gases which are captured directly at the source of generation.

"Process emissions" means inorganic arsenic emissions that are captured and collected in a primary emission control system.

"Roasting" means the use of a furnace to heat arsenic plant feed material for the purpose of eliminating a significant portion of the volatile materials contained in the feed.

"Secondary emissions" means inorganic arsenic emissions that escape capture by a primary emission control system.

"Shutdown" means the cessation of operation of a stationary source for any purpose.

§ 61.182 Standard for new and existing sources.

(a) Within 30 days after the effective date of this subpart, the owner or operator of each source to which this subpart applies shall identify and submit to the Administrator a list of potential sources (equipment and operations) of inorganic arsenic emissions.

(b) The owner or operator shall submit a description of an inspection, maintenance, and housekeeping plan for control of inorganic arsenic emissions from the potential sources identified under paragraph (a) of this section. This plan shall be submitted within 90 days after the effective date of this subpart, unless a waiver of compliance is granted under § 61.11. If a waiver of compliance is granted, the plan shall be submitted on a date set by the Administrator. Approval of the plan will be granted by the Administrator provided he finds that:

(1) It achieves the following objectives in a manner that does not cause adverse impacts in other environmental media:

(i) Clean-up and proper disposal, wet-down, or chemical stabilization to the extent practicable (considering access and safety) of any dry, dusty material having an inorganic arsenic content greater than 2 percent that accumulates on any surface within the plant boundaries outside of a dust-tight enclosure.

(ii) Immediate clean-up and proper disposal, wet-down, or chemical stabilization of spills of all dry, dusty material having an inorganic arsenic content greater than 2 percent.

(iii) Minimization of emissions of inorganic arsenic to the atmosphere during removal of inorganic arsenic from the arsenic kitchen and from flue pulling operations by properly handling, wetting down, or chemically stabilizing all dusts and materials handled in these operations.

(2) It includes an inspection program that requires all process, conveying, and air pollution control equipment to be inspected at least once per shift to ensure that the equipment is being properly operated and maintained. The program will specify the evaluation criteria and will use a standardized checklist, which will be included as part of the plan required in paragraph (b) of this section, to document the inspection, maintenance, and housekeeping status of the equipment and that the objectives of paragraph (b)(1) of this section are being achieved.

(3) It includes a systematic procedure for identifying malfunctions and for reporting them immediately to supervisory personnel.

(4) It specifies the procedures that will be followed to ensure that equipment or process malfunctions due entirely or in part to poor maintenance or other preventable conditions do not occur.

(5) It includes a program for curtailing all operations necessary to minimize any increase in emissions of inorganic arsenic to the atmosphere resulting from a malfunction. The program will describe:

(i) The specific steps that will be taken to curtail each operation as soon as technically feasible after the malfunction is discovered.

(ii) The minimum time required to curtail each operation.

(iii) The procedures that will be used to ensure that the curtailment continues until after the malfunction is corrected.

(c) The owner or operator shall implement the plan required in paragraph (b) of this section until otherwise specified by the Administrator.

(d) At all times, including periods of startup, shutdown, and malfunction, the owner or operator of each source to which this subpart applies shall operate and maintain the source including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions of inorganic arsenic to the atmosphere to the maximum extent practicable. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Administrator, which may include, but is not limited to, monitoring results, review of operating and maintenance procedures, inspection of the source, and review of other records.

§ 61.183 Emission monitoring.

(a) The owner or operator of each source subject to the provisions of this subpart shall install, calibrate, maintain, and operate a continuous monitoring system for the measurement of the opacity of each arsenic trioxide and metallic arsenic process emission stream that exits from a control device.

(b) The owner or operator shall install, operate, and maintain each continuous monitoring system for the measurement of opacity required in paragraph (a) of this section according to the following procedures:

(1) Ensure that each system is installed and operational no later than 90 days after the effective date of this subpart for an existing source or a new source that has an initial startup date preceding the effective date. For a new source whose initial startup occurs after the effective date of this subpart, ensure that the system is installed and operational no later than 90 days after startup. Verification of the operational status shall, as a minimum, consist of an evaluation of the monitoring system in accordance with the requirements and procedures contained in Performance Specification 1 of Appendix B of 40 CFR Part 60.

(2) Comply with the provisions of § 60.13(d) of 40 CFR Part 60.

(3) Except for system breakdowns, repairs, calibration checks, and zero and span adjustments required under § 60.13(d), ensure that each continuous monitoring system is in continuous operation and meets frequency of operation requirements by completing a minimum of one cycle of sampling and analysis for each successive 10-second period and one cycle of data recording for each successive 6-minute period. Each data point shall represent the opacity measured for one cycle of sampling and analysis and shall be expressed as percent opacity.

(c) The owner or operator shall calculate 6-minute opacity averages from 36 or more consecutive data points equally spaced over each 6-minute period. Data recorded during periods of monitoring system breakdowns, repairs, calibration checks, and zero and span adjustments shall not be included in the data averages computed under this paragraph.

(d) No later than 60 days after each continuous opacity-monitoring system required in paragraph (a) of this section becomes operational, the owner or operator shall establish a reference opacity level for each monitored emission stream according to the following procedures:

(1) Conduct continuous opacity monitoring over a preplanned period of not less than 36 hours during which the processes and emission control equipment upstream of the monitoring system are operating in a manner that will minimize opacity under representative operating conditions subject to the Administrator's approval.

(2) Calculate 6-minute averages of the opacity readings using 36 or more consecutive data points equally spaced over each 6-minute period.

(3) Establish the reference opacity level by determining the highest 6-minute average opacity calculated under paragraph (d)(2) of this section.

(e) With a minimum of 30 days prior notice, the Administrator may require an owner or operator to redetermine the reference opacity level for any monitored emission stream.

(f) Each owner or operator shall install all continuous monitoring systems or monitoring devices required in paragraph (a) of this section in such a manner that representative measurements of emissions or process parameters are obtained.

§ 61.184 Ambient air monitoring for inorganic arsenic.

(a) The owner or operator of each source to which this subpart applies shall operate a continuous monitoring system for the measurement of inorganic arsenic concentrations in the ambient air.

(b) The ambient air monitors shall be located at sites to detect maximum concentrations of inorganic arsenic in the ambient air in accordance with a plan approved by the Administrator that shall include the sampling and analytical method used.

(c) The owner or operator shall submit a written plan describing, and explaining the basis for, the design and adequacy of the monitoring network, sampling and analytical procedures, and quality assurance within 45 days after the effective date of this subpart.

(d) Each monitor shall be operated continuously except for a reasonable time allowance for instrument maintenance and calibration, for changing filters, or for replacement of equipment needing major repair.

(e) Filters shall be changed daily and shall be analyzed and concentrations calculated within 30 days after filters are collected.

(f) The Administrator at any time may require changes in, or expansion of, the sampling program, including sampling and analytical protocols and network design.

§ 61.185 Recordkeeping requirements.

(a) Each owner or operator of a source subject to the provisions of this subpart shall maintain at the source for a period of at least 2 years the following records: All measurements, including continuous monitoring for measurement of opacity; all continuous monitoring system performance evaluations, including calibration checks and adjustments; all periods during which the continuous monitoring system or monitoring device is inoperative; and all maintenance and repairs made to the continuous monitoring system or monitoring device.

(b) Each owner or operator shall maintain at the source for a period of at least 2 years a log for each plant department in which the operating status of process, conveying, and emission control equipment is described for each shift. For malfunctions and upsets, the following information shall be recorded in the log:

(1) The time of discovery.

(2) A description of the malfunction or upset.

(3) The time corrective action was initiated.

(4) A description of corrective action taken.

(5) The time corrective action was completed.

(6) A description of steps taken to reduce emissions of inorganic arsenic to the atmosphere between the time of discovery and the time corrective action was taken.

(c) Each owner or operator subject to the provisions of this subpart shall maintain for a period of a least 2 years records of 6-minute average opacity levels for each separate control device.

(d) Each owner or operator subject to the provisions of § 61.186 shall maintain for a period of at least 2 years records of ambient inorganic arsenic concentrations at all sampling sites and other data needed to determine such concentrations.

(Approved by the Office of Management and Budget under control number 2060–0042.)

§ 61.186 Reporting requirements.

(a) Each owner or operator subject to the provisions of § 61.183(a) shall provide the Administrator at least 30 days prior notice of each reference opacity level determination required in § 61.183(a) to afford the Administrator the opportunity to have an observer present.

(b) Each owner or operator subject to the provisions of § 61.183(a) shall submit to the Administrator:

(1) Within 60 days of conducting the evaluation required in § 61.183(b)(1), a written report of the continuous monitoring system evaluation;

(2) Within 30 days of establishing the reference opacity level required in § 61.183(d), a written report of the reference opacity level. The report shall also include the opacity data used and the calculations performed to determine the reference opacity level, and sufficient documentation to show that process and emission control equipment were operating normally during the reference opacity level determination; and

(3) A written report each quarter of each occurrence of excess opacity during the quarter. For the purposes of this paragraph, an occurrence of excess opacity is any 6-minute period during which the average opacity, as measured by the continuous monitoring system, exceeds the reference opacity level established under § 61.183(d).

(c) All quarterly reports of excess opacity shall be postmarked by the 30th day following the end of each quarter and shall include the following information:

(1) The magnitude of excess opacity, any conversion factor(s) used, and the dates and times of commencement and completion of each occurrence of excess opacity, the cause of each exceedance of the reference opacity level, and the measures taken to minimize emissions.

(2) Specific identification of each period of excess opacity that occurred during startups, shutdowns, and malfunctions of the source.

(3) The date and time identifying each period during which the continuous monitoring system or monitoring device was inoperative, except for zero and span checks, and the nature of the system repairs or adjustments.

(d) Each owner or operator subject to this subpart shall submit a written report semiannually to the Administrator that describes the status

and results, for the reporting period, of any pilot plant studies on alternative arsenic trioxide production processes. Conclusions and recommendations of the studies shall also be reported.

(e) All semiannual progress reports required in paragraph (d) of this section shall be postmarked by the 30th day following the end of each 6-month period.

(f) Each owner or operator of a source to which this subpart applies shall submit a written report each quarter to the Administrator that includes the following information:

(1) All ambient inorganic arsenic concentrations measured at all monitoring sites in accordance with § 61.184.

(2) A description of any modifications to the sampling network, during the reporting period, including any major maintenance, site changes, calibrations, and quality assurance information including sampling and analytical precision and accuracy estimates.

(g) All quarterly reports required in paragraph (f) of this section shall be postmarked by the 30th day following the end of each quarter.

(Approved by the Office of Management and Budget under control number 2060–0042)

Appendix B—[Amended]

5. Part 61 is amended by adding Method 108 to Appendix B as follows:

* * * * *

Method 108—Determination of Particulate and Gaseous Arsenic Emissions

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of inorganic arsenic (As) emissions from stationary sources as specified in the applicable subpart.

1.2 Principle. Particulate and gaseous arsenic emissions are withdrawn isokinetically from the source and collected on a glass mat filter and in water. The collected arsenic is then analyzed by means of atomic absorption spectrophotometry.

2. Apparatus

2.1 Sampling Train. A schematic of the sampling train is shown in Figure 108–1; it is similar to the Method 5 train of 40 CFR Part 60, Appendix A. NOTE: This and all subsequent references to other methods refer to the methods in 40 CFR Part 60, Appendix A. The sampling train consists of the following components:

2.1.1 Probe Nozzle, Probe Liner, Pitot Tube, Differential Pressure Gauge, Filter Holder, Filter Heating System, Metering System, Barometer, and Gas Density Determination Equipment. Same as Method 5. Sections 2.1.1 to 2.1.6 and 2.1.8 to 2.1.10, respectively.

2.1.2 Filter Heating System. Any heating (or cooling) system capable of maintaining a sample gas temperature at the exit end of the filter holder during sampling at 121 ± 14°C (250 ± 25°F). Install a temperature gauge capable of measuring temperature to within 3°C (5.4°F) at the exit end of the filter holder so that the sample gas temperature can be regulated and monitored during sampling. The tester may use systems other than the one shown in APTD–0591.

2.1.3 Impingers. Four impingers connected in series with leak-free ground-glass fittings or any similar leak-free noncontaminating fittings. For the first, third, and fourth impingers, use the Greenburg-Smith design, modified by replacing the tip with a 1.3-cm-ID (0.5 in.) glass tube extending to about 1.3 cm (0.5 in.) from the bottom of the flask. For the second impinger, use the Greenburg-Smith design with the standard tip. The tester may use modifications (e.g., flexible connections between the impingers, materials other than glass, or flexible vacuum lines to connect the filter holder to the condenser), subject to the approval of the Administrator.

Place a thermometer, capable of measuring temperature to within 1°C (2°F), at the outlet of the fourth impinger for monitoring purposes.

TEMPERATURE
SENSOR

STACK
WALL

PROBE

THERMOMETER

THERMOMETER

CHECK VALVE

REVERSE TYPE
PITOT TUBE

FILTER
HOLDER

VACUUM
LINE

PITOT MANOMETER

IMPINGERS

ICE BATH

VACUUM
GAUGE

THERMOMETERS

BYPASS·
VALVE

MAIN
VALVE

ORIFICE
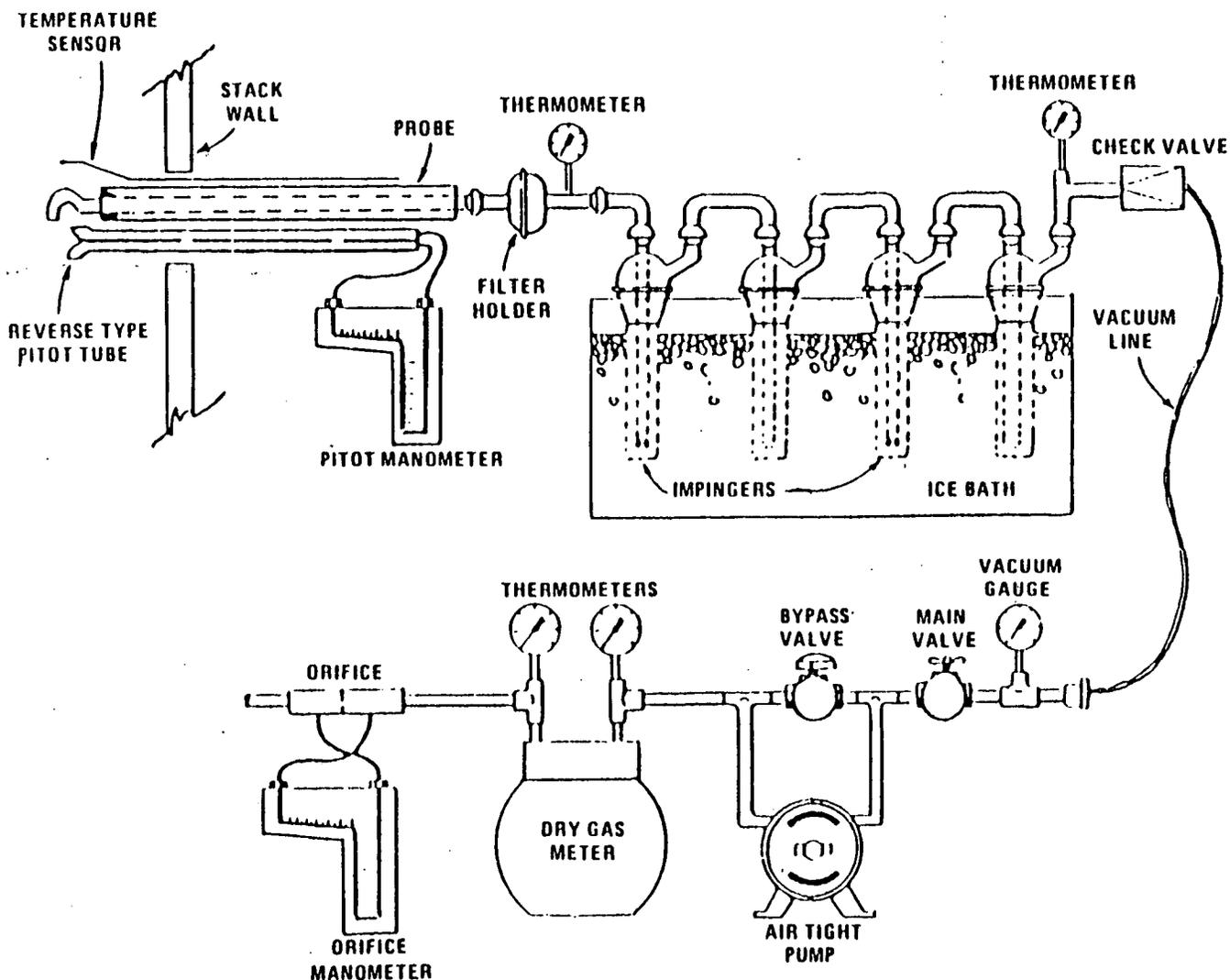
DRY GAS
METER

AIR TIGHT
PUMP

ORIFICE
MANOMETER

Figure 108-1. Arsenic sampling train.

2.2 Sample Recovery. The following items are needed:

2.2.1 Probe-Liner and Probe-Nozzle Brushes, Petri Dishes, Graduated Cylinder or Balance, Plastic Storage Containers, Rubber Policeman, and Funnel. Same as Method 5, Sections 2.2.1 and 2.2.4 to 2.2.8, respectively.

2.2.2 Wash Bottles. Polyethylene (2).

2.2.3 Sample Storage Containers. Chemically resistant, polyethylene or polypropylene for glassware washes, 500- or 1000-ml.

2.3 Analysis. The following equipment is needed:

2.3.1 Spectrophotometer. Equipped with an electrodeless discharge lamp and a background corrector to measure absorbance at 193.7 nm. For measuring samples having less than 10 μg As/ml, use a vapor generator accessory or a graphite furnace.

2.3.2 Recorder. To match the output of the spectrophotometer.

2.3.3 Beakers. 150-ml.

2.3.4 Volumetric Flasks. Glass 50-, 100-, 200-, 500-, and 1000-ml; and polypropylene, 50-ml.

2.3.5 Balance. To measure within 0.5 g.

2.3.6 Volumetric Pipets. 1-, 2-, 3-, 5-, 8-, and 10-ml.

2.3.7 Oven.

2.3.8 Hot Plate.

3. Reagents

Unless otherwise specified, use American Chemical Society reagent grade (or equivalent) chemicals throughout.

3.1 Sampling. The reagents used in sampling are as follows:

3.1.1 Filters. Same as Method 5 except that the filters need not be unreactive to SO_2.

3.1.2 Silica Gel, Crushed Ice, and · Stopcock Grease. Same as Method 5, Sections 3.1.2, 3.1.4, and 3.1.5, respectively.

3.1.3 Water. Deionized distilled to meet American Society for Testing and Materials Specification D 1133–74, Type 3 (incorporated by reference—see § 60.17). When high concentrations of organic matter are not expected to be present, the analyst may omit the $KMnO_4$ test for oxidizable organic matter.

3.2 Sample Recovery. 0.1 N sodium hydroxide (NaOH) is required. Dissolve 4.00 g of NaOH in about 500 ml of water in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with water.

3.3 Analysis. The reagents needed for analysis are as follows:

3.3.1 Water. Same as 3.1.2.

3.3.2 Sodium Hydroxide, 0.1 N. Same as 3.2.

3.3.3 Sodium Borohydride (NaBH₄), 5 Percent (W/V). Dissolve 5.00 g of NaBH₄ in about 500 ml of 0.1 N NaOH in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with 0.1 N NaOH.

3.3.4 Hydrochloric Acid (HCl), Concentrated.

3.3.5 Potassium Iodine (KI), 30 Percent (W/V). Dissolve 300 g of KI in 500 ml of water in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with water.

3.3.6 Nitric Acid (HNO₃), Concentrated.

3.3.7 Nitric Acid, 0.8 N. Dilute 52 ml of concentrated HNO₃ to exactly 1.0 liter with water.

3.3.8 Nitric Acid, 50 Percent (V/V). Add 50 ml concentrated HNO₃ to 50 ml water.

3.3.9 Stock Arsenic Standard, 1 mg As/ml. Dissolve 1.3203 g of primary standard grade As₂O₃ in 20 ml of 0.1 N NaOH in a 150-ml beaker. Slowly add 30 ml of concentrated HNO₃. Heat the resulting solution and evaporate just to dryness. Transfer the residue quantitatively to a 1-liter volumetric flask and dilute to 1.0 liter with water.

3.3.10 Arsenic Working Solution, 1.0 µg As/ml. Pipet exactly 1.0 ml of stock arsenic standard into an acid-cleaned, appropriately labeled 1-liter volumetric flask containing about 500 ml of water and 5 ml of concentrated HNO₃. Dilute to exactly 1.0 liter with water.

3.3.11 Air. Suitsble quality for atomic absorption analysis.

3.3.12 Acetylene. Suitable quality for atomic absorption analysis.

3.3.13 Nickel Nitrate, 5 Percent (W/V). Dissolve 24.780 g of nickel nitrate hexahydrate in water in a 100-ml volumetric flask and dilute to 100 ml with water.

3.3.14 Nickel Nitrate, 1 Percent (W/V). Pipet 20 ml of 5 percent nickel nitrate solution into a 100-ml volumetric flask and dilute to exactly 100 ml with water.

3.3.15 Hydrogen Peroxide, 3 Percent. Pipet 50 ml of 30 percent hydrogen peroxide into a 500 ml volumetric flask and dilute to exactly 500 ml with water.

3.3.16 Quality Assurance Audit Samples. Arsenic samples prepared by the Environmental Protection Agency's (EPA) Environmental Systems Laboratory, Quality Assurance Division, Source Branch, Mail Drop 77A, Research Triangle Park, North Carolina 27711. Each set will consist of two vials of unknown concentrations. Only when making compliance determinations, obtain an audit sample set from the Quality Assurance Management Office at each EPA regional office or the responsible enforcement office. (NOTE: The tester should notify the Quality Assurance Office or the responsible enforcement agency at least 30 days prior to the test date to allow sufficient time for delivery.)

4. Procedure

4.1 Sampling. Because of the complexity of this method, testers must be trained and experienced with the test procedures in order to obtain reliable results.

4.1.1 Pretest Preparation. Follow the general procedure given in Method 5, Section 4.1.1, except the filter need not be weighed.

4.1.2 Preliminary Determinations. Follow the general procedure given in Method 5, Section 4.1.2, except select the nozzle size to maintain isokinetic sampling rates below 28 liters/min (1.0 cfm).

4.1.3 Preparation of Collection Train. Follow the general procedure given in Method 5, Section 4.1.3.

4.1.4 Leak-Check Procedures. Follow the leak-check procedures given in Method 5, Sections 4.1.4.1 (Pretest Leak-Check), 4.1.4.2 (Leak-Checks During Sample Run), and 4.1.4.3 (Post-Test Leak-Check).

4.1.5 Arsenic Train Operation. Follow the general procedure given in Method 5, Section 4.1.5, except maintain a temperature of 107° to 135°C (225° to 275°F) around the filter and maintain isokinetic sampling flow rates below 28 liters/min (1.0 cfm). For each run, record the data required on a data sheet such as the one shown in Figure 108-2.

4.1.6 Calculation of Percent Isokinetic. Same as Method 5, Section 4.1.6.

BILLING CODE 6560-50-M

PLANT _____

LOCATION _____

OPERATOR _____

DATE _____

RUN NO. _____

SAMPLE BOX NO. _____

METER BOX NO. _____

METER ΔH@ _____

C FACTOR _____

PITOT TUBE COEFFICIENT, C_p _____

AMBIENT TEMPERATURE _____

BAROMETRIC PRESSURE _____

ASSUMED MOISTURE, % _____

PROBE LENGTH, m (ft) _____

NOZZLE IDENTIFICATION NO. _____

AVERAGE CALIBRATED NOZZLE DIAMETER, cm(in.) _____

PROBE HEATER SETTING _____

LEAK RATE, m³/min.(cfm) _____

PROBE LINER MATERIAL _____

SCHEMATIC OF STACK CROSS SECTION

TRAVERSE POINT NUMBER	SAMPLING TIME (θ), min.	STATIC PRESSURE mm Hg (in Hg)	STACK TEMPERATURE (T_s) °C (°F)	VELOCITY HEAD (ΔP_s), mm(in.)H₂O	PRESSURE DIFFERENTIAL ACROSS ORIFICE METER mm H₂O (in. H₂O)	GAS SAMPLE VOLUME m³ (ft³)	GAS SAMPLE TEMPERATURE AT DRY GAS METER		FILTER HOLDER TEMPERATURE. °C (°F)	TEMPERATURE OF GAS LEAVING CONDENSER OR LAST IMPINGER. °C (°F)
							INLET °C (°F)	OUTLET °C (°F)		
TOTAL							Avg.	Avg.		
AVERAGE							Avg.			

Figure 108-2. Arsenic field data.

4.2 Sample Recovery. The same as Method 5, Section 4.2 except that 0.1 N NaOH is used as the cleanup solvent instead of acetone and that the impinger water is treated as follows:

Container Number 4 (Impinger Water). Clean each of the first two impingers and connecting glassware in the following manner:

a. Wipe the impinger ball joints free of silicone grease, and cap the joints.

b. Weigh the impinger and liquid to within ±0.5 g. Record in the log the weight of liquid along with a notation of any color or film observed in the impinger catch. The weight of liquid is needed along with the silica gel data to calculate the stack gas moisture content.

c. Rotate and agitate each impinger, using the impinger contents as a rinse solution.

d. Transfer the liquid to Container Number 4. Remove the outlet ball-joint cap, and drain the contents through this opening. Do not separate the impinger parts (inner and outer tubes) while transferring their contents to the cylinder.

e. (Note: In Steps e and f below, measure and record the total amount of 0.1 N NaOH used for rinsing.) Pour approximately 30 ml of 0.1 NaOH into each of the first two impingers, and agitate the impingers. Drain the 0.1 N NaOH through the outlet arm of each impinger into Container Number 4. Repeat this operation a second time; inspect the impingers for any abnormal conditions.

f. Wipe the ball joints of the glassware connecting the impingers and the back half of the filter holder free of silicone grease, and rinse each piece of glassware twice with 0.1 N NaOH; transfer this rinse into Container Number 4. (DO NOT RINSE or brush the glass-fritted filter support.) Mark the height of the fluid level to determine whether leakage occurs during transport. Label the container to identify clearly its contents.

4.2.1 Blanks. Save a portion of the 0.1 N NaOH used for cleanup as a blank. Take 200 ml of this solution directly from the wash bottle being used and place it in a plastic sample container labeled "NaOH blank." Also save a sample of the water, and place it in a container labeled "H₂O blank."

4.3 Arsenic Sample Preparation.

4.3.1 Container Number 1 (Filter). Place the filter and loose particulate matter in a 150-ml beaker. Also, add the filtered material from Container Number 2 (see Section 4.3.3). Add 50 ml of 0.1 N NaOH. Then stir and warm on a hot plate at low heat (do not boil) for about 15 minutes. Add 10 ml of concentrated HNO₃, bring to a boil, then simmer for about 15 minutes. Filter the solution through a glass fiber filter. Wash with hot water, and catch the filtrate in a clean 150-ml beaker. Boil the filtrate, and evaporate to dryness. Cool, add 5 ml of 50 percent HNO₃, and then warm and stir. Allow to cool. Transfer to a 50-ml volumetric flask, dilute to volume with water, and mix well.

4.3.2 Container Number 4 (Arsenic Impinger Sample).

Note: Prior to analysis, check the liquid level in Containers Number 2 and Number 4; confirm as to whether leakage occurred during transport on the analysis sheet. If a noticeable amount of leakage occurred, either void the sample or take steps, subject to the

approval of the Administrator, to adjust the final results.

Transfer the contents of Container Number 4 to a 500-ml volumetric flask, and dilute to exactly 500 ml with water. Pipet 50 ml of the solution into a 150-ml beaker. Add 10 ml of concentrated HNO₃, bring to a boil, and evaporate to dryness. Allow to cool, add 5 ml of 50 percent HNO₃, and then warm and stir. Allow the solution to cool, transfer to a 50-ml volumetric flask, dilute to volume with water, and mix well.

4.3.3 Container Number 2 (Probe Wash). See note in 4.3.2 above. Filter (using a glass fiber filter) the contents of Container Number 2 into a 200-ml volumetric flask. Combine the filtered material with the contents of Container Number 1 (Filter).

Dilute the filtrate to exactly 200 ml with water. Then pipet 50 ml into a 150-ml beaker. Add 10 ml of concentrated HNO₃, bring to a boil, and evaporate to dryness. Allow to cool, add 5 ml of 50 percent HNO₃, and then warm and stir. Allow the solution to cool, transfer to a 50-ml volumetric flask, dilute to volume with water, and mix well.

4.3.4 Filter Blank. Determine a filter blank using two filters from each lot of filters used in the sampling. Cut each filter into strips, and treat each filter individually as directed in Section 4.3.1, beginning with the sentence, "Add 50 ml of 0.1 N NaOH."

4.3.5 0.1 N NaOH and Water Blanks. Treat separately 50 ml of 0.1 N NaOH and 50 ml water, as directed under Section 4.3.2, beginning with the sentence, "Pipet 50 ml of the solution into a 150-ml beaker."

4.4 Spectrophotometer Preparation. Turn on the power; set the wavelength, slit width, and lamp current; and adjust the background corrector as instructed by the manufacturer's manual for the particular atomic absorption spectrophotometer. Adjust the burner and flame characteristics as necessary.

4.5 Analysis.

4.5.1 Arsenic Determination. Prepare standard solutions as directed under Section 5.1, and measure their absorbances against 0.8 N HNO₃. Then, determine the absorbances of the filter blank and each sample using 0.8 N HNO₃ as a reference. If the sample concentration falls outside the range of the calibration curve, make an appropriate dilution with 0.8 N HNO₃ so that the final concentration falls within the range of the curve. Determine the arsenic concentration in the filter blank (i.e., the average of the two blank values from each lot). Next, using the appropriate standard curve, determine the arsenic concentration in each sample fraction.

4.5.1.1 Arsenic Determination at Low Concentration. The lower limit of flame atomic absorption spectrophotometry is 10 µg As/ml. If the arsenic concentration of any sample is at a lower level, use the graphite furnace or vapor generator which is available as an accessory component. The analyst also has the option of using either of these accessories for samples whose concentrations are between 10 and 30 µg/ml. Follow the manufacturer's instructions in the use of such equipment.

4.5.1.1.1 Vapor Generator Procedure. Place a sample containing between 0 and 5 µg of arsenic in the reaction tube, and dilute

to 15 ml with water. Since there is some trial and error involved in this procedure, it may be necessary to screen the samples by conventional atomic absorption until an approximate concentration is determined. After determining the approximate concentration, adjust the volume of the sample accordingly. Pipet 15 ml of concentrated HCl into each tube. Add 1 ml of 30 percent KI solution. Place the reaction tube into a 50°C water bath for 5 minutes. Cool to room temperature. Connect the reaction tube to the vapor generator assembly. When the instrument response has returned to baseline, inject 5.0 ml of 5 percent NaBH₄, and integrate the resulting spectrophotometer signal over a 30-second time period.

4.5.1.1.2 Graphite Furnace Procedure. Dilute the digested sample so that a 5-ml aliquot contains less than 1.5 µg of arsenic. Pipet 5 ml of this digested solution into a 10-ml volumetric flask. Add 1 ml of the 1 percent nickel nitrate solution, 0.5 ml of 50 percent HNO₃, and 1 ml of the 3 percent hydrogen peroxide and dilute to 10 ml with water. The sample is now ready to inject in the furnace for analysis.

Because instruments from different manufacturers are different, no detailed operating instructions will be given here. Instead, the analyst should follow the instructions provided with his particular instrument.

4.5.1.2 Check for Matrix Effects on the Arsenic Results. Same as Method 12, Section 5.4.2.

4.5.2 Container Number 3 (Silica Gel). The tester may conduct this step in the field. Weigh the spent silica gel (or silica gel plus impinger) to the nearest 0.5 g; record this weight.

4.6 Audit Analysis. Concurrently, analyze the two unknown audit samples with each set of compliance samples to evaluate the techniques of the analyst and the standards preparation. (Note: It is recommended that known quality control samples be analyzed prior to the compliance and audit sample analysis to optimize the system's accuracy and precision. One source of these samples is the Source Branch listed in Section 3.3.16.) The same analyst, analytical reagents, and analytical system shall be used both for each set or sets of compliance samples and the EPA audit samples; if this condition is met, audit samples need not be included with any additional compliance analyses performed within the succeeding 30-day period for the same enforcement agency. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies unless prior arrangements are made with both enforcement agencies.

Calculate the concentration in g/m³ using the specified sample volume in the audit instructions. (Note: The analyst may determine immediately whether the audit analyses acceptable by reporting the audit results in g/m³ and compliance results in µg/ml by telephone). Include the results of both audit samples, their identification numbers, and the analysts' names with the results of the compliance determination samples in appropriate reports to the EPA regional office

or the appropriate enforcement agency. Include this information with subsequent compliance analyses for the same enforcement agency during the succeeding 30-day period.

5. Calibration

Maintain a laboratory log of all calibrations.

5.1 Standard Solutions. For the high level procedure pipet 1, 3, 5, 8, and 10 ml of the 1.0-mg As/ml stock solution into separate 100-ml volumetic flasks, each containing a ml of concentrated HNO_3. If the low level vapor generator procedure is used, pipet 1, 2, 3, and 5 ml of 1.0 μg As/ml standard solution into the separate reaction tubes. For the low level graphite furnace procedure, pipet 1, 5, 10 and 15 ml of 1.0 μg As/ml standard solution into the separate flasks along with 2 ml of the 5 percent nickel nitrate solution and 10 ml of the 3 percent hydrogen peroxide solution. Dilute to the mark with water. Then treat the standards in the same manner as the samples (Section 4.5).

Check these absorbances frequently against 0.8 N HNO_3 (reagent blank) during the analysis to insure that base-line drift has not occurred. Prepare a standard curve of absorbance versus concentration. (Note: For instruments equipped with direct concentration readout devices, preparation of a standard curve will not be necessary.) In all cases, follow calibration and operational procedures in the manufacturers' instruction manual.

5.2 Sampling Train Calibration. Calibrate the sampling train components according to the indicated Sections of Method 5: Probe Nozzle (Section 5.1), Pitot Tube Assembly (Section 5.2), Metering System (Section 5.3), Probe Heater (Section 5.4), Temperature Gauges (Section 5.5), Leak Check of Metering System (Section 5.6), and Barometer (Section 5.7).

6. Calculations

6.1 Nomenclature—

B_{ws} = Water in the gas stream, proportion by volume.

C_a = Concentration of arsenic as read from the standard curve, μg/ml.

C_c = Actual audit concentration, g/m^3.

C_d = Determined audit concentration, g/m^3.

C_s = Arsenic concentration in stack gas, dry basis, converted to standard conditions, g/dsm^3 (g/dscf).

E_a = Arsenic mass emission rate, g/hr.

F_d = Dilution factor (equals 1 if the sample has not been diluted).

I = Percent of isokinetic sampling.

m_{bi} = Total mass of all four impingers and contents before sampling, g.

m_{fi} = Total mass of all four impingers and contents after sampling, g.

m_n = Total mass of arsenic collected in a specific part of the sampling train, μg.

m_t =Total mass of arsenic collected in the sampling train, μg.

T_m =Absolute average dry gas meter temperature (see Figure 108-2), °K (°R).

V_m = Volume of gas sample as measured by the dry gas meter, dm^3 (dcf).

$V_{m(std)}$ = Volume of gas sample as measured by the dry gas meter correlated to standard conditions, sm^3 (scf).

V_n = Volume of solution in which the arsenic is contained, ml.

$V_{w(std)}$ = Volume of water vapor collected in the sampling train, corrected to standard conditions, sm^3 (scf).

ΔH =Average pressure differential across the orifice meter (see Figure 108-2), mm H_2O (in. H_2O).

6.2 Average dry gas meter temperatures (T_m) and average orifice pressure drop (ΔH). See data sheet (Figure 108-2).

6.3 Dry Gas Volume. Using data from this test, calculate $V_{m(std)}$ by using Eq. 5-1 of Method 5. If necessary, adjust the volume for leakages.

6.4 Volume of Water Vapor.

$$V_{w(std)} = K_1 (m_{fi} - m_{bi}) \qquad \text{Eq. 108-1}$$

Where:

K_1 = 0.001334 m^3/g for metric units.
= 0.047012 ft^3/g for English units.

6.5 Moisture Content.

$$B_{ws} = \frac{V_{w(std)}}{V_{m(std)} + V_{w(std)}} \qquad \text{Eq. 108-2}$$

6.6 Amount of arsenic collected.

6.6.1 Calculate the amount of arsenic collected in each part of sampling train, as follows:

$$m_n = C_a F_d V_n \qquad \text{Eq. 108-3}$$

6.6.2 Calculate the total amount of arsenic collected in the sampling train as follows:

$m_t = m_n(filters) + m_n(probe) + m_n(impingers)$
$- m_n(filter\ blank) - m_n(NaOH) - m_n(H_2O)$
$\qquad \text{Eq. 108-4}$

6.7 Calculate the arsenic concentration in the stack gas (dry basis, adjusted to standard conditions) as follows:

$$C_s = K_2(m_t/V_{m(std)}) \qquad \text{Eq. 108-5}$$

Where:

$K_2 = 10^{-6} g/\mu g$

6.8 Pollutant Mass Rate. Calculate the arsenic mass emission rate using the following equation.

$$E_a = C_s Q_{sd} \qquad \text{Eq. 108-6}$$

The volumetric flow rate, Q_{sd}, should be calculated as indicated in Method 2.

6.9 Isokinetic Variation. Using data from this test, calculate I. Use Eq. 5-8 of Method 5.

6.10 Acceptable Results. Same as Method 5, Section 6.12.

6.11 Relative Error (RE) for QA Audits, Percent.

$$RE = \frac{C_d - C_c}{C_c} \times 100 \qquad \text{Eq. 108-7}$$

7. Bibliography

1. Same as Citations 1 through 9 of Section 7, of Method 5.

2. Perkin Elmer Corporation. Analytical Methods for Atomic Absorption Spectrophotometry. 303-0152. Norwalk, Connecticut. September 1976. pp. 5-6.

3. Standard Specification for Reagent Water. In: Annual Book of American Society for Testing and Materials Standards. Part 31: Water, Atmospheric Analysis. American Society for Testing and Materials. Philadelphia, PA. 1974. pp. 40-42.

6. Part 61 is amended by adding Method 108A to Appendix B as follows:

* * * * *

Method 108A—Determination of Arsenic Content in Ore Samples From Nonferrous Smelters

1. Applicability and Principle

1.1 Applicability. This method applies to the determination of inorganic arsenic (As) content of process ore and reverberatory matte samples from nonferrous smelters and other sources as specified in the regulations.

1.2 Principle. Arsenic bound in ore samples is liberated by acid digestion and analyzed by atomic absorption spectrophotometry.

2. Apparatus

2.1 Sample Preparation

2.1.1 Parr Acid Digestion Bomb. Stainless steel with vapor-tight Teflon cup and cover.

2.1.2 Volumetric Pipets. 2- and 5-ml sizes.

2.1.3 Volumetric Flask. 50-ml polypropylene with screw caps, (one needed per standard).

2.1.4 Funnel. Polyethylene or polypropylene.

2.1.5 Oven. Capable of maintaining a temperature of approximately 105°C.

2.1.6 Analytical Balance. To measure to within 0.1 mg.

2.2 Analysis.

2.2.1 Spectrophotometer and Recorder. Equipped with an electrodeless discharge lamp and a background corrector to measure absorbance at 193.7 nm. A graphite furnace may be used in place of the vapor generator accessory when measuring samples with low As levels. The recorder shall match the output of the spectrophotometer.

2.2.2 Volumetric Flasks. Class A, 50-ml (one needed per sample and blank).

2.2.3 Volumetric Pipets. Class A, 1-, 5-, 10-, and 25-ml sizes.

3. Reagents

Unless otherwise specified, use ACS reagent grade (or equivalent) chemicals throughout.

3.1 Sample Preparation.

3.1.1 Water. Deionized distilled to meet American Society for Testing and Materials Specification D-1193-74, Type 3 (incorporated by reference—See § 60.7). When high concentrations of organic matter are not expected to be present, the analyst may omit the $KMnO_4$ test for oxidizable organic matter. Use in all dilutions requiring water.

3.1.2 Nitric Acid (HNO_3), Concentrated. HANDLE WITH CAUTION.

3.1.3 Nitric Acid, 0.5 N. In a 1-liter volumetric flask containing water, add 32 ml of concentrated HNO_3 and dilute to volume with water.

3.1.4 Hydrofluoric Acid (HF), Concentrated. HANDLE WITH CAUTION.

3.1.5 Potassium Chloride (KCl) Solution, 10 percent (w/v). Dissolve 10 g KCl in water, add 3 ml concentrated HNO_3, and dilute to 100 ml.

3.1.6 Filter. Teflon filters, 3 micron porosity, 47mm size. (Available from

Millipore Co., type FS, Catalog Number FSLW04700.)

3.1.7 Sodium Borohydride ($NaBH_4$), 5 Percent (W/V). Dissolve 5.00 g of $NaBH_4$ in about 500 ml of 0.1 NaOH in a 1-liter volumetric flask. Then, dilute to exactly 1.0 liter with 0.1 NaOH.

3.1.8 Nickel Nitrate, 5 Percent (W/V). Dissolve 24.780 g of nickel nitrate hexahydrate in water in a 100-ml volumetric flask and dilute to 100 ml with water.

3.1.9 Nickel Nitrate, 1 percent (W/V). Pipet 20 ml of 5 percent nickel nitrate solution into a 100-ml volumetric flask and dilute to 100 ml with water.

3.2 Analysis.

3.2.1 Water. Same as in Section 3.1.1.

3.2.2 Sodium Hydroxide (NaOH), 0.1 N. Dissolve 2.00 g of NaOH in water in a 500-ml volumetric flask. Dilute to volume with water.

3.2.3 Nitric Acid, 0.5 N. Same as in Section 3.1.3.

3.2.4 Potassium Chloride Solution, 10 percent. Same as in Section 3.1.5.

3.2.5 Stock Arsenic Standard, 1 mg As/ml. Dissolve 1.320 g of primary grade As_2O_3 in 20 ml of 0.1 N NaOH. Slowly add 30 ml of concentrated HNO_3, and heat in an oven at 105°C for 2 hours. Allow to cool, and dilute to 1 liter with deionized distilled water.

3.2.6 Nitrous Oxide. Suitable quality for atomic absorption analysis.

3.2.7 Acetylene. Suitable quality for atomic absorption analysis.

3.2.8 Quality Assurance Audit Samples. Arsenic samples prepared by the Environmental Protection Agency's (EPA) Environmental Systems Laboratory, Quality Assurance Division, Source Branch, Mail Drop 77A, Research Triangle Park, North Carolina 27711. Each set will consist of two vials of unknown concentrations. Only when making compliance determinations, obtain an audit sample set from the Quality Assurance Management Office at each EPA regional office or the responsible enforcement office. (NOTE: The tester should notify the Quality Assurance Office or the responsible enforcement agency at least 30 days prior to the test date to allow sufficient time for delivery.

4. Procedure

4.1 Sample Collection. A sample that is representative of the ore lot to be tested must be taken prior to analysis. The sample must be ground into a finely pulverized state. (A portion of the samples routinely collected for metals analysis may be used provided the sample is representative of the ore being tested.)

4.2 Sample Preparation. Weigh 50 to 500 mg of finely pulverized sample to the nearest 0.1 mg. Transfer the sample into the Teflon cup of the digestion bomb, and add 2 ml each of concentrated HNO_3 and HF. Seal the bomb immediately to prevent the loss of any volatile arsenic compounds that may form. Heat in an oven 105° C for 2 hours. Then

remove the bomb from the oven and allow it to cool. Using a Teflon filter, quantitatively filter the digested sample into a 50-ml polypropylene volumetric flask. Rinse the bomb three times with small portions of 0.5 N HNO_3, and filter the rinses into the flask. Add 5 ml of KCl solution to the flask, and dilute to 50 ml with 0.5 N HNO_3.

4.3 Spectrophotometer Preparation. Turn on the power; set the wavelength, slit width, and lamp current; and adjust the background corrector as instructed by the manufacturer's manual for the particular atomic absorption spectrophotometer. Adjust the burner and flame characteristics as necessary.

4.4 Preparation of Standard Solutions. Pipet 1, 5, 10, and 25 ml of the stock As solution into separate 100-ml volumetric flasks. Add 10 ml KCl solution and dilute to the mark with 0.5 N HNO_3. This will give standard concentrations of 10, 50, 100, and 250 μg As/ml. For low-level-arsenic samples that require the use of a graphite furnace or vapor generator, follow the procedures in Section 4.4.1.

Dilute 10 ml of KCl solution to 100 ml with 0.5 N HNO_3 and use as a reagent blank. Measure the standard absorbances against the reagent blank. Check these absorbances frequently against the blank during the analysis to assure that baseline drift has not occurred.

Prepare a standard curve of absorbance versus concentration. (Note: For instruments equipped with direct concentration readout devices, preparation of a standard curve will not be necessary.) In all cases follow calibration and operational procedures in the manufacturer's instruction manual. Maintain a laboratory log of all calibrations.

4.4.1 Arsenic Determination at Low Concentration. The lower limit of flame atomic absorption spectrophotometry is 10 μg As/ml. If the arsenic concentration of any sample is at a lower level, use the vapor generator or graphite furnace which is available as an accessory component. Follow the manufacturer's instructions in the use of such equipment.

4.4.1.1 Vapor Generator Procedure. Place a sample containing between 0 and 5 μg of arsenic in the reaction tube, and dilute to 15 ml with water. Since there is some trial and error involved in this procedure, it may be necessary to screen the samples by conventional atomic absorption until an approximate concentration is determined. After determining the approximate concentration, adjust the volume of the sample accordingly. Pipet 15 ml of concentrated HCl into each tube. Add 1 ml of 30 percent KI solution. Place the reaction tube into a 50° C water bath for 5 minutes. Cool to room temperature. Connect the reaction tube to the vapor generator assembly. When the instrument response has returned to baseline, inject 5.0 ml of 5 percent $NaBH_4$ and integrate the resulting spectrophotometer signal over a 30-second time period.

4.4.1.2 Graphite Furnace Procedure. Pipet 5 ml of this digested solution into a 10-ml volumetric flask. Add 1 ml of the 1 percent nickel nitrate solution, 0.5 ml of 50 percent HNO_3, and 1 ml of the 3 percent hydrogen peroxide and dilute to 10 ml with water. The sample is now ready to inject in the furnace for analysis.

Because instruments from different manufacturers are different, no detailed operating instructions are given here. Instead, the analyst should follow the instructions provided with the particular instrument.

4.5 Analysis.

4.5.1 Arsenic Determination. Determine the absorbance of each sample using the blank as a reference. If the sample concentration falls outside the range of the calibration curve, make an appropriate dilution with 0.5 N HNO_3 so that the final concentration falls within the range of the curve. From the curve, determine the As concentration in each sample.

4.5.2 Mandatory Check for Matrix Effects on the Arsenic Results. Same as in Method 12, Section 5.4.2.

4.5.3 Audit analysis. With each set or sets of source compliance samples, analyze the two unknown audit samples in the same manner as the source samples to evaluate the techniques of the analyst and the standards preparation. The same analyst, analytical reagents, and analytical system shall be used both for each set or sets of compliance samples and the EPA audit samples; if this condition is met, it is not necessary to analyze additional audit samples for subsequent compliance analyses performed for the same enforcement agency within a 30-day period. An audit sample set may not be used to validate different sets of compliance samples under the jurisdiction of different enforcement agencies unless prior arrangements are made with both enforcement agencies.

Calculate the concentration in g/m³ using the specified sample volume in the audit instructions. (Note: The acceptability of the analyses of the audit samples may be obtained immediately by reporting the audit and compliance results by telephone). Include the results of both audit samples, their identification numbers, and the analysts' names with the results of the compliance determination samples in appropriate reports to the EPA regional office or the appropriate enforcement agency. Include this information with subsequent compliance analyses for the same enforcement agency during the succeeding 30-day period.

5. Calculations

5.1 Calculate the percent arsenic in the ore sample as follows:

$$\% \ AS = \frac{5 \ C_s \ F_d}{W} \qquad \text{Eq. 108A–1}$$

Where:

C_a=Concentration of As as read from the standard curve, $\mu g/ml$.

F_d=Dilution factor (equals 1 if the sample has not been diluted).

W=Weight of ore sample analyzed.

5=50-ml sample x $100/10^3$ $\mu g/ml$.

6. Bibliography

1. Same as Citations 1 through 9 of Section 7, of Method 5.

2. Perkin Elmer Corporation. Analytical methods of Atomic Absorption Spectrophotometry. 303–0152. Norwalk, Connecticut. September 1976. pp 5–6.

3. Ringwald, D. (TRW). Arsenic Determination on Process Materials from ASARCO's Copper Smelter in Tacoma, Washington. Unpublished Report. Prepared for Emission Measurement Branch, Emission Standards and Engineering Division, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina 27711. August 1980. 35 p.

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