TECHNICAL SUPPORT DOCUMENT

TO

PROPOSED CONTROL MEASURE FOR METAL MELTING PROCESSES

State of California
Air Resources Board
Stationary Source Division

October 1992

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PROPOSED AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF TOXIC METALS FROM NON-FERROUS METAL MELTING

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INTRODUCTION

Metal is melted to make many of the industrial and consumer products essential to our society. In addition, when these products are removed from service, the metal may be reclaimed for re-use by melting and refining it. Cadmium, arsenic, and nickel may be added to the metal or may be present as impurities. When metals containing cadmium, arsenic, or nickel are melted at high temperatures, these contaminants are emitted to the air. Emissions from melting and pouring, from open storage of particulate feed, products, or wastes, and from traffic in dusty parts of the facility contribute to public exposure to these toxic air contaminants.

The Health and Safety Code (section 39666) requires the Air Resources Board (ARB) to adopt control measures for emissions of pollutants, like cadmium, arsenic, and nickel that have been identified as "toxic air contaminants". State law requires that such control measures be based on the best available control technology for a particular kind of source of the pollutant. The ARB considers risk and cost in developing and adopting such control measures.

This is a revised version of the draft report released in January, 1992. This report presents the ARB staff's analysis and conclusions concerning the following:

- emissions of cadmium, arsenic, and nickel from non-ferrous metal melting operations,
- the resulting public exposure and risk of harm to public health,
- the emissions of lead from non-ferrous sources of cadmium, arsenic, and nickel,
- the technology for reducing emissions,
- the projected cost and environmental impact of requiring emission reductions.

Finally, the report presents and explains the provisions of a draft control measure (regulation). If adopted by the ARB, the control measure must be adopted and enforced by local air districts.

We wish to thank the many plant managers, industry association officers and staff, and air district staff who worked with us to develop and to revise this report and the proposed control measure.

I.

METAL MELTING PROCESSES AND OPERATIONS

This chapter describes metal melting processes and operations that the proposed control measure covers--those that are likely to be sources of emissions of cadmium, arsenic, and nickel, which have been identified as toxic air contaminants (TACs). Metal melting operations may also be sources of other metals, such as lead, which is under evaluation for identification as a toxic air contaminant.

A. BACKGROUND

Modern industrialized society is critically dependent on machines, devices, and products that are made from various metals and mixtures of metals called alloys. In producing the metals and alloys, and in many of the processes used to manufacture goods made of metal, metals are melted at high temperatures. Because of the high temperatures, some metals that are components of alloys, or that are present as contaminants in other metals, vaporize and are emitted as gases or fumes from the molten metal. As the vaporized metals cool, they become solid and take the form of particles, also known as particulate matter. Other metals may be emitted to the air from metal melting operations directly as particulate matter.

Some of the metals that may be emitted from metal melting operations have been designated as toxic air contaminants: arsenic, cadmium, nickel, and hexavalent chromium. Another metal, lead, is being evaluated for identification as a toxic air contaminant. All these metals (or their compounds, or in some cases both) may cause cancer; some have other serious adverse effects on human health.

The first three operations are carried out as parts of the process called smelting. The fourth operation is known as casting or founding, and is carried out at a foundry. Most of the facilities in California that melt metal are smelters or foundries.

The following sections briefly describe smelting and founding, with a focus on the air pollution aspects of the processes.

Smelting

Smelting processes can be classified as either primary or secondary. Primary smelters extract metals from a raw base ore. The only primary smelting that is done in California is for gold production.

Secondary smelting involves the cleaning, melting, refining, alloying, and pouring of either metal or alloys produced at primary smelters, or metal recovered from scrap. The scrap may be discarded consumer products (automobiles, beverage cans, lead-acid batteries, etc.), industrial material (structural steel, circuit boards, turnings and borings from machining operations, etc.), or the by-products of metal melting. These by-products include dross, slag, foundry returns, the excess metal that is cut off of castings, and reject castings.

One common type of non-ferrous smelting done in California is secondary lead smelting, in which lead/lead alloy is recovered from lead-acid storage batteries or other materials.

Some secondary lead smelters recover lead from spent automobile batteries. Others "sweat" lead off cable or out of bearings to separate it from higher melting point alloys; in sweating, the furnace temperature is raised just high enough to melt the lead content of the scrap metal. Operations at lead smelters can typically be classified into three general categories: sorting, melting, and refining.

Batteries or other scrap materials are first shredded in a crusher. Then, for batteries, the rubber, plastic, and lead/lead sulfate constituents are separated by specific gravity.

The metal is dried in a kiln and compacted before being fed into the furnace.

The reverberatory furnace is the most widely used furnace for initial melting in secondary lead smelting. The fuel is burned directly above the material charged into the furnace. The interior walls and roof of the furnace receive radiant heat from the hot combustion products and, in turn, re-radiate this heat to the surface of the metal or melt. Reverberatory furnaces are available in many types and designs, depending upon specific job requirements. The

metal is melted, and poured into the mold. A brief description of the two major types of foundry operations follows.

Sand casting

Sand casting foundry processes include mold making, melting the metal, pouring the melt, and freeing and cleaning the casting.

The first step is to create a mold and core of the desired shape. Cores are forms used to make the internal voids in casting, and molds are forms used to shape the casting exterior. Cores may be made of sand with organic binders, molded into the desired shape of an internal void in the casting and baked in an oven. Molds are commonly made of wet sand with clay and organic additives, dried with hot air. Current trends show an increasing use of cold-setting binders, which allows the cores and molds to cure at room temperature.

If a smooth metal surface is required on the cast object, the molds, once dried and hardened, are dipped into a ceramic surface coating. Molten metal is then poured into the molds and allowed to solidify. The molds are then removed. Because of the cost of sand and disposal costs for used sand, most foundries either have a sand recovery and recycle system, or send the sand offsite for reclamation.

The most common type of furnace used in non-ferrous foundry operations is the electric induction furnace. A coil around a crucible containing the metal induces a current in the metal, causing it to heat and melt. The crucible may be an integral part of the furnace, or may be separate. In either case the molten metal is poured into molds from the crucible or from a ladle. Other types of furnaces used by foundries include cupola or direct arc furnaces.

A cupola furnace, which can be considered a type of blast furnace, is essentially a vertical, refractory-lined cylinder. The furnace is open at the top and is equipped with ports at the bottom, to which air is supplied by a down draft blower. Alternating charges of scrap metal, coke, and flux are added through the top of the furnace onto a bed of coke. After the furnace has reached operating temperature, the molten metal is drawn off through a tap-hole and spout at the bottom of the furnace. Cupola furnaces are commonly used in foundries to reclaim metal from slag before disposal. Typical melting capacity is 55 to 65 metric tons per charge.

Direct-arc furnaces are also used at foundries. In a direct-arc furnace, electrodes are placed into the metal in the crucible. Current flowing between the electrodes heats the metal charge and melts it.

Some foundries use only ingots of alloys of specific nominal composition. Others may use cuttings and turnings as well; these are often returned to them by the purchasers of their casting and

casting machine. Injection pressures are extremely high, which accounts for the trend toward hydraulically actuated, instead of mechanically actuated, machines. Total pressures of 10,000 psi and higher are not uncommon, depending somewhat on the size and type of machine and its locking pressure, i.e., the force available to hold the two halves of the die together when the "shot" is being made. Injection pressures of this magnitude ensure that the molten metal will be forced into small and remote sections of the die before it can "freeze", and that the casting will be of high density and free of porosity.

Examples of typical composition and properties of zinc die casting alloys are in Table I-1.

TABLE I-1

COMPOSITION OF ZINC DIE CASTING ALLOYS

	Designation	
ASTM	XXIII	XXV
SAE	903	925
Component	Composition Percent	
Copper	0.10 max.	0.75-1.25
Aluminum	3.5-4.3	3.5-4.3
Magnesium	0.03-0.08	0.03-0.08
Iron	0.100 max.	0.100 max.
Lead	0.007 max.	0.007 max.
Cadmium	0.005 max.	0.005 max.
Tin	0.005 max.	0.005 max.
Zinc	Balance	

ASTM - American Society for Testing and Materials
SAE - Society of Automotive Engineers

C. OTHER METAL MELTING OPERATIONS

There are a number of other operations in which metal is melted. These include galvanizing and tinning, dip soldering and brazing, type casting, lead oxide production, and aluminum powder production.

In galvanizing and tinning, an object (usually iron or steel) is dipped into a bath of molten zinc (galvanizing) or tin (tinning) to form a protective surface coating. In some applications, the zinc or tin used is low in contaminants like cadmium and arsenic, because contaminants interfere with the quality of the coating.

In die casting, potential areas of emissions include the pot furnace (particularly during stirring of the alloy), transfer of the molten metal from the pot furnace to the die machine, and gases escaping through port holes during casting.

Current information on the sources of emissions from dip brazing is limited. As mentioned earlier, there are two methods of dip brazing processes: chemical, where brazing occurs in a salt bath, and molten metal.

E. NON-FERROUS METAL MELTING PROCESSES IN CALIFORNIA

A wide variety of non-ferrous metal melting operations are done in California.

To develop more specific information on cadmium and arsenic emissions at metal melting facilities, ARB surveyed metal melting facilities in California. A survey questionnaire was sent in February, 1991 to facilities identified by the air districts as non-ferrous metal melting operations. Appendix A is a copy of the survey questionnaire.

The facilities identified by the districts as having non-ferrous metal melting operations were identified through permit files maintained by districts. Some districts maintain information on sources of toxic air contaminants or potential toxic air contaminants; the Bay Area and the South Coast districts provided information from such toxic substance emission inventories. Because district permitting regulations differ, the lists included some but not all facilities where brazing, soldering, or other metal melting activities ancillary to a manufacturing process are carried out. In addition, some facilities that process ferrous metals were included in the lists. Although it is likely that some non-ferrous metal melting operations (particularly smaller ones) are unknown to the districts, we have assumed that the district lists included all facilities that melt non-ferrous metals.

These facilities are located in thirteen air districts: eighty percent in the South Coast district, seven percent in the Bay Area district, five percent in the San Joaquin Valley Unified district, and four percent in the San Diego district. The remaining four percent are distributed among the nine other districts with facilities. Table I-2 shows the distribution of facilities in the state.

TABLE I-3

PRIMARY ACTIVITIES OF NON-FERROUS FACILITIES WHICH RESPONDED TO THE SURVEY

SMELTERS
- 6 process precious metals
- 14 process aluminum
- 2 process lead
- 1 produces zinc alloys
- 7 process brass alloys (may also recover precious metals)
- 1 produces lead-tin solders

FOUNDRIES
- 13 cast brass and bronze
- 21 cast aluminum alloys
- 5 cast zinc
- 18 cast lead (including 4 lead-acid battery manufacturers and 8 that process linotype metal)
- 1 casts lead-tin solder
- 1 casts titanium alloys

DIE-CASTERS
- 11 cast zinc (most also cast aluminum)
- 5 cast aluminum
- 3 cast lead and lead alloys (may also cast zinc)

COATING PROCESSES
- 3 galvanizers
- 1 tinning line
- 1 solder plating operation

MISCELLANEOUS PROCESSES
- 1 aluminum powder producer
- 1 lead oxide producer

* Many of the foundries melted more than one type of metal. For this accounting, they were categorized on the basis of the metal they melted the most.

Of the 346 facilities identified by the air districts, 47 have declared they are closed or do not melt metal in a furnace. Based on the assumption that all potential facilities were surveyed, and excluding those known to us to process only ferrous alloys and those known to be closed or not melt metal in a furnace, we estimate that there are 280 non-ferrous metal melting facilities in California.

Of the 116 facilities which returned surveys we were unable to estimate emissions for 12, either because the data was not complete or we had no emission factors. Our emission estimation incorporates information from 104 non-ferrous smelters and foundries that returned completed surveys. We believe this represents 40 percent of the

II.

EMISSIONS, EXPOSURE, AND POTENTIAL RISK FROM METAL MELTING OPERATIONS

This chapter describes the method we used to estimate the amount of cadmium, arsenic, nickel, and lead that are emitted by non-ferrous metal melting operations; presents information on the fate of the metals once they are released into the atmosphere, and on concentrations that have been measured in ambient air; and explains how we estimated population exposure to these metals and the resulting potential public health impact (cancer risk).

A. PROPERTIES AND PERSISTENCE IN THE ATMOSPHERE

Physical and Chemical Properties of Emitted Metals

Pertinent chemical and physical properties of arsenic, cadmium, nickel, and lead are summarized in Table II-1. In general, these metals occur as (or on) particulate matter in the atmosphere and are chemically stable in that they are removed from the atmosphere by physical processes. A summary of information on the forms of arsenic, cadmium, nickel, and lead emitted to the atmosphere from high temperature sources like metal melting operations is discussed in the following sections. The staff reports for the identification of those metals classified as toxic air contaminants contain more detailed information on the valence states and the variety of chemical forms found. These staff reports are cited in the references of this chapter.

Germani, et al., (1981) found 10 to 30 percent of arsenic in the gas phase at stack gas temperatures of 130°C. These results suggest that the arsenolite form of arsenic trioxide was present in the stack gas.

However, more recent testing at a battery manufacturing facility showed that a fabric filter control device (baghouse) removed 98.86 percent of arsenic in the stack gas. Based on the temperature of the stack gases, 167-242°C, and the findings reported by Germani, et al., emitted arsenic would be expected to be found in the vapor phase. However, the test results demonstrated that arsenic entering the process baghouse was primarily associated with particulate matter, and not the vapor state (Radian, 1985). This may be so because the more volatile arsenolite may not be the form of arsenic trioxide emitted from such sources. Given the rapid cooling of process gas streams that occur for metal melting operations, it is possible that the amorphous form of the trioxide is the predominant form present. This is consistent with the lack of observed gas-phase arsenic, given the amorphous form's melting point of 315°C.

2. Inorganic Arsenic on Particulate Matter

Arsenic-containing particles in urban aerosols and from high temperature sources are significantly enriched in arsenic relative to the geological background (which can range from as little as one ppm to as much as 40 ppm in soils) (U.S.EPA, 1984). The greatest levels of arsenic enrichment are found with fine particulate matter, which indicate that the origin of most arsenic in the air is due to anthropogenic sources and not surface erosion. The level of enrichment varies with the nature of the arsenic source. This can range from a factor of 100 for coal fired power plants to a factor of a million (essentially pure arsenic trioxide) for copper smelters (Germani, et al., 1981). The geometric mean of arsenic concentration in urban aerosols from 29 cities in U.S., Europe, and Japan showed an enrichment factor of 136 above geological background (Davidson, et al., 1981).

Studies of particle size distribution of arsenic-containing particles indicate that the arsenic concentration of airborne particles increases with the inverse of particle size (Davison, et al., 1974; Natusch, et al., 1974; and Germani, et al., 1981). Davison, et al., (1974) hypothesized that arsenic trioxide is volatilized in high temperature processes and condenses or adsorbs onto the surface of entrained particles with the greatest amount of arsenic per unit weight on the smaller particles. Paciga and Jervis (1976) estimated that 37 percent of the mass of arsenic in urban aerosols was on particles of 1.1 micron or less with the average particle size being 1.5 micron. These results are consistent with the results of an ARB monitoring study which found the bulk of inorganic arsenic on particles less than 2.5 um in size (ARB, 1990b).

Ambient Concentrations

Atmospheric concentrations of particulate matter-bound arsenic, cadmium, and nickel are measured by the Air Resources Board ambient monitoring toxic network at 20 sites statewide. Atmospheric concentrations of inorganic lead are collected through the state and local air monitoring network which consists of 27 monitoring sites for lead (ARB, 1990a). The following information summarizes our estimates of population-weighted exposure for arsenic, cadmium, and nickel, and ambient concentrations of lead.

For inorganic arsenic, the mean population-weighted ambient exposure for California was estimated to be 1.9 nanograms per cubic meter (ARB, 1990b). Site-specific average concentrations ranged from 0.6 nanograms per cubic meter for the San Francisco air basin to 3.8 nanograms per cubic meter for the South Coast air basin. These concentrations are based on arsenic measured on particulate matter. A discussion of the potential for gas-phase arsenic in the ambient air follows.

Test results indicate that gas-phase arsenic from high temperature sources quickly condenses onto existing particles (occurring at higher concentrations on fine particulate matter) and will not be present to any great extent in the gas phase under normal atmospheric conditions. As discussed previously, some information suggests that a portion of the arsenic trioxide may be emitted in the gaseous phase. Thermodynamic data indicates that at temperatures of 10, 25, 40°C, up to 0.04 ug/m^3, 0.45 ug/m^3, and 4.03 ug/m^3, respectively, of arsenic could be in the gas phase as arsenic trioxide (As_4O_6) (Murray, et al., 1974 and Pupp, et al., 1974).

However, these levels of arsenic have not been observed in the atmosphere. This may be because it is adsorbed onto particulate matter in the atmosphere, or because the thermodynamic calculations of Murray, et al. and Pupp, et al. do not consider the reaction of water with As_2O_3 to form the less volatile and more water soluble species oxyacid or the oxidation of As(III) to As(V). Johnson and Braman (1975) performed total air sampling (both particle and gas phase) for arsenic. Virtually all of the inorganic arsenic was found in the solid phase, associated with particulate matter. Walsh, et al. (1977) measured gas phase and particulate matter arsenic in close proximity (500 m) to a large copper smelter. The source primarily emitted arsenic in the gas phase, probably as As_4O_6 (As III oxide). Walsh and co-workers observed that greater than 90 percent of the arsenic that they collected near the source was in the particle phase.

In 1987, cadmium population-weighted ambient exposure estimates ranged from 0.46 nanograms for the San Diego air basin to 2.18 nanograms per cubic meter for the San Francisco air basin. The statewide population-weighted average was 1.5 nanograms per cubic meter (Bradley, 1988).

fugitive emissions. On a pound-for-pound basis, fugitive emissions can have a greater impact on the public than stack emissions because they are released at ground level and therefore can cause higher ground-level concentrations.

TABLE II-2

PARTICULATE MATTER EMISSION FACTORS*
DERIVED FROM SURVEY RESULTS AT CONTROLLED FACILITIES

Facility Type	Pounds of Particulate Matter Captured/Ton Feed
Lead Remelt	44.5
Brass Smelter	25.8
Brass Smelter	97.2
Brass Smelter	33.4
Brass Smelter	38.4
Bronze Foundry	3.5
Bronze Foundry	1.4
Bronze Foundry	4.2
Brass Foundry	18.5
Brass Foundry	18.5
Zinc Dross Processing	55.2
Aluminum Smelter	2.3
Aluminum Smelter	1.9
Aluminum Smelter	3.8

* value from particulate matter capture in baghouses at controlled facilities.

Facilities that have control equipment typically installed it to satisfy district particulate matter emission standards or to meet the requirements of toxic new source review regulations. No districts have emission standards specifically for cadmium, arsenic, or nickel. Table IV-9, page IV-31, lists some district standards for particulate matter and lead.

Emission Estimation Methodology

Information provided by facilities in response to the February 1991 survey, and certain assumptions, were used to calculate emissions. Of the 116 facilities that returned completed surveys, we were able to estimate emissions from 104. The assumptions used depended on the type of metal being processed, and the type of

TABLE II-3

EXISTING ABATEMENT DEVICE ESTIMATED CONTROL EFFICIENCY

Device Type	Percent Control
Baghouse	95
Baghouse with Scrubber	97.5
Electrostatic Precipitator	90
Wet Scrubber	50
Packed Tower Scrubber	50
Carbon Adsorption	50

Emission Factors for Copper-Based Alloys

Emission factors for furnaces processing copper-based alloys supported grouping the furnaces into three groups: brass and bronze smelters, brass foundries, and bronze foundries. Particulate matter emission factors calculated for these three groups were 48.7 pounds per ton feed, 18.5 pounds per ton feed, and 3.0 pounds per ton feed, respectively. For speciation of the metals in emissions from brass and bronze smelters, we used the baghouse dust analysis from a brass foundry, since both types of facilities process similar material, and an analysis specific to the smelting facilities was not available.

A likely reason for the difference in emission factors for brass and for bronze foundries is the difference in alloy composition. The higher zinc content of brass compared to bronze is one explanation for the higher particulate matter emission rate of brass casting relative to bronze casting.

The processes involved in smelting are a likely source of the greater particulate emission from smelting related to casting. Scrap processed by smelters is likely to have more surface area exposed to air, and more of it may be oxidized, than in an ingot. There may be undesirable elements which have to be removed requiring additional time in the molten state and additional handling, which would be expected to cause more particulate matter emissions.

Emission Factors for Aluminum Processing

There are three basic types of facilities processing aluminum in furnaces in California; aluminum smelters, aluminum foundries (including die-casters), and aluminum powder producers. The smelters

particulate matter and lead from grid casting. No baghouse dust analyses were available to us because the dust is either sold to a primary or secondary smelter or returned to furnaces on site. Therefore, we assumed that the concentration of cadmium and arsenic in the feed reflects the concentration in the emissions. Because of the tendency for cadmium and arsenic to be enriched on emitted particulate matter, use of this assumption may understate emissions. The extent to which emissions may be underestimated is not known.

2. Secondary Lead Smelters

Source test results were available for the two largest secondary lead smelters in California; however, we were able to estimate emissions for only one of the two. No emission estimate was made for the other large lead smelter because we were unable to use the source test data for that purpose.

At the facility for which we have information, many emission points were tested and analyses were done for a number of potentially toxic metals. Detection limits vary from pollutant to pollutant and run to run. Since many of the samples for cadmium and arsenic concentrations were below the detection limit, a range of emission rates were determined using two different methods. The low end of the range for cadmium and arsenic is based on one half of the highest detection limit for each pollutant and emission point. This is consistent with recommendations in the CAPCOA Air Toxic Assesment Manual (CAPCOA, 1991). The high end of the range is based on the highest measured concentration or the lowest detection limit for each pollutant and emission point. Cadmium emission estimates ranged from 17 to 150 pounds per year. Arsenic emission estimations ranged from 18 to 30 pounds per year.

Unlike the arsenic and cadmium test results, the nickel and lead emissions rates were above the detection limit so the range is based on measured concentrations. Initial test results for the nickel and lead analysis resulted in the emission rate for nickel registering higher than expected. Consequently, the test at this emission point for nickel was repeated. Upon subsequent analysis, the second sample was lower in nickel but much higher in lead. Therefore, we developed two sets of emission estimates for nickel and lead for this facility. Nickel emissions could range from 600 to 12,000 pounds per year. Lead emissions could range from 1,600 to 3,900 pounds per year.

3. Lead Casting

The survey provided no information on baghouse catches from melting and pouring emissions from lead foundry operations. Staff elected to use the lead particulate matter emission factor from grid casting in lead-acid battery manufacturing as it was the process most similar to foundry operations. The concentrations of cadmium and arsenic in the feed was applied to particulate matter emission

Emission Factors for Zinc Processing

1. Zinc Dross Processing

One surveyed facility reclaims zinc from dross. Zinc dross is a mixture of zinc, oxides, and other metals that either accumulate at the bottom of the pots or crucibles used in galvanizing, or is skimmed off the surface of the melt during zinc smelting and casting. The zinc is removed from the dross in a process similar to sweating. The facility provided information on both quantity and concentration of the toxic metals in its baghouse dust. From the survey information, we estimated emissions of arsenic, cadmium, nickel, and lead.

2. Zinc Casting

None of the facilities that cast zinc-based alloys provided enough data to calculate an emission factor or speciate the particulate matter emissions. We used the particulate matter emission factors for pouring and casting processes at secondary zinc smelters as published by the U.S. EPA in AP-42. This does not include emissions from the furnace during melting, and therefore may underestimate zinc casting emissions. The concentration of cadmium and arsenic in particulate matter emissions was assumed to be the same as that in the alloy being cast. Specifications for many zinc die casting alloys restrict the allowable concentration of cadmium to very low levels.

3. Galvanizing

In the galvanizing process, iron products are dipped in molten zinc baths to produce a zinc surface coating that inhibits corrosion. At one facility we contacted, a stripping bath is used to remove defective coatings. A comparison of the ratio of cadmium to zinc in the wastewater from this process indicates that the concentration of cadmium in the coating is approximately half of the cadmium concentration in the zinc put into the bath. The other half of the cadmium may be emitted to the air or it may become tied up in the ash on the top of the bath. As a worst-case estimate, we have assumed that the cadmium that is not found in the stripping bath is emitted to the air.

Other Non-Ferrous Metals and Alloys

1. Magnesium

Magnesium is typically melted under a cover of inert gas because it burns in air. This practice is likely to reduce the potential for emission of any metal present. The survey yielded no information on which to base an estimate of emissions of cadmium, arsenic or nickel from melting and casting magnesium and magnesium-based alloys.

TABLE II-5

EMISSIONS BY DISTRICT

District	Emissions (pounds/year) Cadmium	Arsenic	Nickel	Lead
South Coast AQMD	780	180	830	120,000
Bay Area AQMD	4	4	0.2	450
San Diego APCD	2	0.8	0.1	80
El Dorado County APCD	0.4	0	0.01	5
San Joaquin Valley AQMD	0.6	0.3	0.01	2
Shasta County AQMD	0.5	0	0.01	0.6
Sacramento Metro. AQMD	0.04	0	0	0.7
Butte County APCD	0.01	0.01	0	0.01
Not Assigned*	1,200	300	1,270	179,500
Total**	2,000	480	2,100	300,000

* Emissions projected based on survey data and therefore not assigned to a specific district.
** figures rounded

Other Sources of Toxic Metals in California

There are other sources of toxic metal emissions in California, in addition to metal smelting. These include fuel combustion, electroplating, and mobile sources. Tables found in Appendix B list source categories for which we have emissions information for California.

C. EXPOSURE AND POTENTIAL CANCER RISK

This section describes the methods we used to calculate exposure and public health impact due to emissions of cadmium, arsenic, nickel, and lead from metal melting facilities. It contains our estimate of statewide potential excess cancer burden due to emissions of cadmium, arsenic, nickel, and lead from metal melting facilities, and estimates of maximum individual risk due to emissions of cadmium, arsenic, nickel, and lead from metal melting facilities, within the state. These calculations are based on data obtained in the survey previously described.

Estimating Effects on Public Health

Maximum individual risk and cancer burden are two ways of expressing the impact on public health due to emissions of a carcinogenic toxic air contaminant. The first is an estimate of

Estimates of potential cancer burden are based on concentrations of the pollutant in the air. Ambient concentrations of a pollutant can be estimated in two ways: 1) measured by collecting and analyzing an air sample, or 2) predicted by using air quality dispersion models. To assess the increase in pollutant concentration due to emissions from a specific facility or group of facilities, air quality modeling is typically used. Modeling is used rather than direct measurement, because we need to know the annual average concentrations of toxic metals. It is impractical to establish enough sampling points (time and location) to adequately characterize either the maximum or the area-wide annual average pollutant concentrations from a specific source category. However, some short-term, special air monitoring studies have been done which corroborate the modeling results (ARB, 1990b). ARB does measure the concentrations of toxic metals in the ambient air of an air basin on an ongoing basis, but not to determine exposure to pollutant concentrations from a specific source or source type.

The Modeling Approach

Dispersion models were used to estimate ambient pollutant concentrations at selected locations, or receptors, based on the rate and manner in which the pollutants are emitted, the surrounding terrain, and worst-case meteorological conditions in the area of the emission source. We used information gathered in the 1991 ARB survey (see Section I-D) to develop modeling characteristics for a typical metal melting facility. For the dispersion model we used, the variation in ambient concentration due to emission rate is linear so that one gram per second emissions served as the input for the model. The output of the model represented a maximum concentration or population-weighted average concentration per gram per second. Using the model output, we calculated maximum individual risk and cancer burden for individual pollutants and facilities.

We modeled a generic facility at two locations to account for the effect of meteorology on pollutant dispersion. We then assigned the facilities to one of two location groups. The coastal dispersion potential was represented by modeling the generic facility in South Gate, and the interior modeling location was in Ontario.

Emissions from stacks were modeled as point sources using the arithmetic average of stack heights, temperatures, and flow rates for the facilities which had returned completed surveys. Fugitive emissions were modeled as an area source. The estimated emissions for each pollutant from each facility were partitioned between fugitive and stack emissions as described in section II-B. Detailed modeling results are included in this report as Appendix C. A summary of the modeling results is given in Table II-7.

Statewide Potential Cancer Burden

Our estimate of statewide cancer burden is the sum of the calculated burden per million people exposed due to emissions from 104 facilities smelting aluminum, brass, lead, or zinc, or producing aluminum, brass, bronze, lead, or zinc castings or powders. We then adjusted this total for the response rate as discussed in section I-D and multiplied by the population in counties in which metal melting facilities exist.

Metal melting facilities operate in 22 counties in California. At the beginning of 1989, the population within the 22 counties, estimated by the California Department of Finance, was 22.3 million (Calif. Dept. of Finance, 1989).

We estimate that the 2,000 pounds of cadmium emitted per year will have the potential to result in a statewide cancer burden of 60 cases over 70 years. The arsenic emissions of 480 pounds per year translate to 40 potential cancers over 70 years. This estimate includes multi-pathway exposure as described in the next section. The cancer burden due to nickel emissions of 2,100 pounds per year from non-ferrous smelters and foundries is 2 cases over 70 years. We estimate lead emissions of 300,000 pounds per year from facilities that also emit one of the other toxic metals translate to 9 potential cancer cases statewide over 70 years. For these pollutants, the total statewide cancer burden attributable to emissions from facilities operating metal melting furnaces is estimated at 111 cases over 70 years at current emission levels as represented by an analysis of survey information.

Maximum Individual Risk

Maximum individual risk is facility- and location-specific. This is "hot spot" or excess risk attributable to emissions from the sources evaluated. Our estimate of maximum individual risk is based on the maximum ground level concentration predicted by the modeling study (see Table II-6). Maximum ground level concentrations (used to estimate maximum individual risk) were calculated for each facility and for each pollutant (see section II-B for emission estimation methodology). Maximum individual risk is the probability, using a worst-case scenario, that a person exposed for 70 years to the maximum ground level concentration may contract cancer.

The maximum risks calculated were over 800 per million for a lead oxide manufacturing plant. Risks exceeded 100 per million for 12 percent of the facilities. Risk was between 10 and 100 per million for 19 percent of the facilities. Twenty-five percent have estimated risks between 10 and 1 per million, and risks less than 1 per million were calculated for 44 percent of the facilities for which this analysis was done. Overall, the risk due to lead emissions was about

The resulting ratio of total risk to inhalation risk is the non-inhalation dose factor. This factor can be used to convert an estimate of inhalation risk to one of total risk from all pathways. To do so, we multiplied inhalation exposure or inhalation risk by 5.6 to get total exposure or risk.

The estimates of the potential impact of arsenic emissions presented in this document reflect this multi-pathway risk factor.

III.

EMISSION CONTROL TECHNOLOGY

A. EXISTING CONTROL TECHNOLOGIES

Metals may be emitted into the ambient air from metal melting facilities in three ways: from the furnace, kettle, etc., in which the metal is melted; during the transfer of the metal from the furnace to the molds; or as dust from materials storage and handling or dust from the re-entrainment of particulate matter from metal melting and pouring that has settled on the ground and other surfaces.

To reduce the amount of toxic metals emitted to the ambient air from metal melting furnaces and metal pouring operations, the pollutants can first be captured using an emission collection system. These collected emissions can then be conveyed to a device that has a high collection efficiency for small particles.

To reduce the amount of metal-bearing dust that is emitted, material storage areas and conveyors can be covered. To prevent re-entrainment of settled dust, areas can be vacuumed, washed, or wet-mopped on a regular basis.

Emission Collection Techniques

Industrial Ventilation, published by the American Conference of Governmental Industrial Hygienists (ACGIH, 1988), recommends arrangements for hood and conveying mechanism design as well as minimum hood and duct velocities.

Four types of hooding arrangements are frequently installed. The first is a canopy-type hood, which is suspended directly over the furnace. The second type is called a plenum roof. Here a flat hood

when properly designed and operated, can be used to control emissions found in metal melting operations.

Each of the systems will be discussed, with emphasis placed on those technologies considered best in specific applications, and where measured performance test results are available. Our determination of best available control technology (BACT) is based on the data summarized here on the availability, applicability, and efficiency of the control technologies.

Baghouses

1. Operating Principles

The most commonly-used method of particulate matter control at metal melting operations consists of fabric filtration, typically called baghouses because fabric bags of tubular or envelope shape are used.

The materials used in fabric filters are usually woven with relatively large open spaces, sometimes 100 microns or larger in size. As the air stream flows through the bags, small particles are initially captured and retained on the fibers of the cloth by means of interception, impingement, diffusion, gravitational settling and electrostatic attraction. Once a mat or cake of dust has accumulated on the walls of the bags, further collection is accomplished by sieving as well as by the previously mentioned methods. The cloth then serves mainly as a supporting structure for the dust mat, which accounts for the high collection efficiency. Periodically the bags are shaken and the dust accumulates in a hopper. The dust is later removed for disposal or recycling. Some residual dust remains on the bag walls and serves as an aid to further filtering.

2. Applicability and Limitations

Since the exhaust stream generated by the induction furnaces is of low temperature (typically 180 - 210°F/81 - 99°C) baghouses can be used with no upstream pre-cooling device. Baghouse collection efficiencies can reach 99.9 percent for coarse particles (two microns or larger) and exceed 90 percent for fine dust particles of one micron or less. This high separation efficiency plus the added benefit of being able to recycle the collected dust makes the properly designed fabric filter system appropriate for control of particulate matter emissions at metal melting operations. At secondary smelters where temperatures from reverberatory furnaces can be as high as 1200°F (650°C), cooling of the gas stream may be necessary before it enters the baghouse.

The various filtering materials selected for use in baghouses have a variety of temperature and chemical resistance properties. The

particles, a 99 percent particulate matter removal efficiency translates to approximately a 98 percent removal efficiency for arsenic or cadmium.

Electrostatic Precipitators

1. Operating Principles

Electrostatic precipitators (ESPs) make use of the phenomenon of corona discharge to electrostatically charge particles in a gas stream, and then attract these charged particles to a collection surface. A basic ESP design involves a cylindrical metal tube with a wire inside the tube running along the axis. A high voltage power supply is connected between the tube and the wire so that the tube is positive and the wire is negative. Near the wire a continuous sparking takes place, a phenomenon known as corona discharge. The gas near the wire becomes highly ionized. As the ions move outward they charge the particles in the gas stream. The charged particles are attracted to the oppositely charged cylinder wall. The wall is periodically vibrated to loosen the particles, which fall into a collection hopper. Other ESP designs use plates to supply electrical charge and collect the particulate matter.

2. Applicability and Limitations

The efficiency of ESP's in foundry applications is expected to exceed 99 percent for particulate matter collection. There is no theoretical lower limit to the size of particles that can be collected. Since particulate matter is collected dry, it can be recovered and recycled.

In some secondary lead smelter operations, care must be taken if an ESP is used. Lead oxide is difficult to collect because of its high resistivity.

3. Tests and Results

Currently there are two foundries or smelters in California employing ESPs as control devices. Operating data of ESP control systems serving electric-arc furnaces show a collection efficiency of 92-97 percent for particulate matter (Research and Education Technology, 1980).

Ionizing Wet Scrubber

1. Operating Principles

Ionizing wet scrubbers (IWS) are used for the removal of both particulate matter and gases from industrial process gas streams. The IWS is a two-stage device: an ionizing section and a wet scrubbing section. As the gas stream enters the first stage of the system high

control device applicability, commercial availability of the equipment and demonstrated control efficiency.

The applicability of a given control technology is dictated by the temperature and contents of the emitted air stream.

Based on the nature of emissions from metal melting operations and on the performance of ESPs in similar applications, the expected performance of IWS systems, and on the demonstrated performance of fabric filters at controlling particulate matter in the micron and submicron range, we believe the lowest emission rate achievable is at least 99 percent reduction of particulate matter, with a limitation of stack gas temperature into the control device of 360°F (182°C). A temperature limitation is necessary to ensure the existence of the more volatile metals (like cadmium and arsenic) in the solid phase so that a particulate matter control device effectively collects them.

IV.

PROPOSED CONTROL MEASURE

The purpose of this proposed control measure is to reduce emissions of toxic metals from facilities that operate non-ferrous metal melting furnaces. This is to be accomplished by collecting emissions from all emission points and ducting them to the best available equipment for control of particulate emissions and by requiring control of fugitive emissions.

A. BASIS FOR THE PROPOSED REQUIREMENTS

State law requires that airborne toxic control measures be designed to reduce emissions to the lowest level achievable through application of the best available control technology (BACT). Control measures are technology based, in consideration of risk, cost, and environmental impacts. The basis for each of the requirements and selected other elements of the measure is outlined below in the order the items appear in the proposed control measure. The text of the proposed control measure can be found in Appendix G.

Definitions

Aluminum and aluminum based alloys

To insure that the exemption allowed in subsection (c)(3) of the proposed control measure is applied only to those furnaces we intended, we have defined aluminum and aluminum-based alloys as a metal containing at least 80 percent aluminum. This was based on information provided by facilities that identified their feed as aluminum scrap. This definition is intended to exclude mixed scrap such as would be processed in a sweat furnace and furnaces processing

to reduce the possibility of wind erosion and consequent emission of fugitive particulate matter and toxic metals to the ambient air.

Fugitive emission control

The purpose of this definition is to make clear the types of emissions subsection (b)(3) covers. Some facilities have ventilation systems ducted to baghouses for sources of fugitive emissions such as materials handling and storage or buildings enclosing furnace orerations. It is not our intent that baghouses operated solely for the purpose of reducing fugitive emissions should be required to meet the control efficiency specified in subsection (b)(2).

Good operating practices

We have defined good operating practices in general terms because the appropriate activities and frequency of activities are site-specific. For systems that are relatively accessible, visual inspection and periodic clean-out may be adequate. For other systems, measurement of some parameter or parameters (such as face velocity at the hood) may be required.

Hard lead

The definition of hard lead pertains to the exemptions offered in subsection (c)(1) of the proposed control measure. This subsection exempts furnaces used for melting specified quantities of certain metals based on an assessment of risk, cost, the potential impacts of lead emissions, and the cost effectiveness of applying BACT to these types of operations. This definition is intended to identify the specific metals to be exempted and to limit the exemption to the specific metals included in our analysis.

Metal melting furnace

The definitions of molten metal and metal melting furnace are intended to limit the application of this proposed control measure to the processes which we have investigated in this regulatory assessment. This should not be construed as an affirmative statement that there are no emissions of toxic air contaminants or need to control the operations not covered by this measure; rather that they are not being addressed in this proposed control measure. For instance, benzene or formaldehyde may be emitted from the sand molds during pouring if certain organic binders are used. It also states the conditions, such as the metal being in a liquid state in a container and the molten metal being open to the atmosphere, that specifically define the operations we intend this proposed control measure to cover.

Scrap

The definition of scrap is intended to insure that the metals being granted exemption under subsection (c)(2) are not contaminated by the addition of feed of a lesser purity.

Solder

The definition of solder specifies the metal which we intend to exempt under subsection (c)(1) of the proposed control measure. This subsection exempts furnaces used for melting specified quantities of certain metals based on an assessment of risk, cost, the potential impacts of lead emissions, and the cost-effectiveness of applying BACT to these types of operations. This definition is intended to identify and limit the exemption to the specific metals included in our analysis.

Type metal

The definition of type metal specifies the metal which we intend to exempt under subsection (c)(1). This subsection exempts furnaces used for melting specified quantities of certain metals based on an assessment of risk, cost, the potential impacts of lead emissions, and the cost effectiveness of applying BACT to these types of operations. This definition is intended to identify the specific metals to be exempted and to limit the exemption to the specific metals included in our analysis.

Requirements

This section specifically limits the requirements for emission collection, furnace emission control, and fugitive emission control in this proposed control measure to facilities which bring non-ferrous metals to a molten (liquid) state in a furnace, kettle, or other container.

Emission Collection

This proposed control measure prohibits the operation of metal melting furnaces at any facility subject to the proposed control measure unless the furnace is equipped with hoods and ducts that collect emissions from furnace operations, pouring, and associated activities whenever molten metal is exposed to air.

The facility is required to develop and adhere to a maintenance plan to assure that the emission collection efficiency remains consistent with the design criteria for the system. At a minimum, a maintenance plan should specifically state the equipment to be inspected and the minimum frequency of such inspection and maintenance activities. The plan, to be developed in consultation with district staff, should specify measurable parameters such as air velocity at

temperature is above the temperature at which components of the emission stream will form droplets of hydrochloric or sulfuric acid which can cause maintenance problems in fabric filters.

The control efficiency of the system is to be demonstrated through a source test which simultaneously measures particulate matter emissions before and after the control device. The test must be conducted in accordance with ARB Test Method 5. ARB Test Method 5 involves isokinetic sampling and determination of particulate matter in four fractions of the sample captured; the filter catch, probe catch, impinger catch, and solvent extract. Complete characterization of the emissions and control efficiency requires summing the measured particulate matter in all four fractions.

The proposed control measure requires that facilities provide access, sampling ports and a duct configuration that accommodates Method 5 testing. Method 5 requires that the sampling location be specified distances upstream and downstream from flow disturbances. In addition there must be adequate clearance for the sampling apparatus. The facility should consult with the district before installing or modifying equipment.

We have chosen to use particulate matter control as an alternative to testing for each toxic air contaminant individually. Multi-metal source test methods are being developed but are still in the validation stage. Source tests required to analyze each metal in the emissions stream are more costly than particulate emission testing alone. Also, if the proposed control measure was based on removal efficiencies of toxic metals, complications might occur in determining final compliance if the metal concentrations were below the detection limit of the test method. For these reasons, we are proposing the measurement of removal efficiency of particulate matter across the control device as the basis for determining compliance. It provides essentially the same certainty of compliance determination, and is more effective and less costly than a metal removal efficiency.

Fugitive Emission Control

"Fugitive" emissions are those emissions from furnace charging, tapping, skimming, or pouring that in normal practice have escaped capture in a properly designed and operated emission collection system, and from dust that is released by materials handling or that is re-entrained by wind or by activity such as foot or vehicle traffic. Fugitive emissions can contribute more to maximum individual risk, on a pound per pound basis, than stack emissions. This is because fugitive emissions are released to the ambient air at near-ground level, in some cases at ambient temperature. Emissions at ambient temperatures do not undergo adiabatic mixing; therefore, the fugitive emissions are not diluted like heated stack emissions. The requirements of section (b)(3)(A), regarding storage, handling, and transfer of finely divided materials are designed to reduce dust

TABLE IV-1

PROPOSED EXEMPTIONS FOR SPECIFIC METALS[1]

Metal	Exemption Limit (tons per year)
Pure Lead	400
Hard Lead	200
Aluminum Scrap	125
Aluminum Alloys[2]	125
Solder	100
Zinc Scrap	30
Copper or copper-based alloys [3] (except scrap)	30
Type Metal (lead for linotype machines)	25

1.) A facility may only use one of these specific exemptions unless the weighted total of the metal melted is no more than the equivalent of one exemption.
2.) Aluminum and aluminum alloys, as defined in subsection (a)(1) of the proposed control measure, containing more than 0.002 percent arsenic or 0.004 percent cadmium.
3.) Copper or copper based-alloys, as defined in subsection (c)(3) of the proposed control measure, containing more than 0.002 percent arsenic or 0.004 percent cadmium.

Alloys used for a specific purpose, such as die casting alloys, generally meet a high purity level for contaminants such as cadmium or arsenic. Based on an assessment of cost-effectiveness, we have proposed a provision to exempt furnaces such as zinc and aluminum die casting furnaces and galvanizing baths that are used exclusively for high purity metals--those containing no more than 0.004 percent cadmium and no more than 0.002 percent arsenic--from emission control requirements. When a supplier sells such a special purpose alloy it is usually accompanied by an analysis of the elemental composition. This documentation allows a means of demonstrating a facility's eligibility for the high purity exemption.

In general, ASTM specifications require testing of each lot for impurity levels that will affect the suitability of the metal or alloy for the intended use. In addition, testing for elements not listed in the specification can be arranged by agreement between the buyer and supplier. In identifying test methods to be used for determining eligibility for this exemption, we have, wherever possible, specified ASTM test methods.

All facilities that melt more than 1 ton per year of non-ferrous metals that are not specifically exempted in subsections (c)(1) and

Recordkeeping

This section specifies the types of records the facilities will be required to make available to the districts to document their compliance with the provisions of this proposed control measure.

Applicable Material Testing Methods

In section (f) of the proposed control measure, we have identified applicable test methods for determining the arsenic and cadmium content of non-ferrous metals and alloys. The methods are discussed below. In addition, the district can approve acceptable alternative test methods.

In keeping with our desire to minimize the compliance costs of this proposed control measure, we have identified ASTM test methods wherever they are appropriate.

ASTM E 88 specifies sampling techniques to be followed for methods that do not incorporate sampling methods. Use of a standardized sampling procedure will provide more representative results.

We have determined that ASTM method E 117 is appropriate for determining whether a lead based alloy fits the definition given in subsection (a)(10), "hard lead" or that given in subsection (a)(17), "pure lead." ASTM E 46 is appropriate for determining whether an alloy meets the definition given in subsection (a)(20)

ASTM test method E 536 is adequate to determine the cadmium content of zinc and zinc alloys for comparison with the concentration limits for the purity exemption. For aluminum and aluminum alloys, ASTM E 227, or E 607, or E 1251 will yield a determination of cadmium content that is adequate to determine eligibility for the purity exemption.

ASTM test method E 53 is adequate to determine the cadmium content of copper and copper-based alloys for comparison with the concentration limits for the purity exemption. ASTM test method E 62 is adequate to determine the arsenic content of copper and copper-based alloys for comparison with the concentration limits for the purity exemption.

There are no ASTM test methods for measuring arsenic in aluminum or zinc. Therefore we have specified EPA's method 7061, Arsenic (atomic absorption, hydride evolution) as appropriate for determining arsenic content in these alloys to assess eligibility for the purity exemption. This method was developed for determining arsenic in solid waste and is published in EPA's SW-846 (U.S. EPA, 1988). Sample digestion is necessary for EPA method 7061. The method recommends acid digestion using concentrated nitric or hydrochloric acid.

Method of Estimating Costs

Capital Costs

Several steps were involved in determining the initial cost of meeting the requirements of the proposed control measure. The first step required computing the size and cost of a fabric filter system (baghouse) necessary to control the facility's emissions. Although fabric filter technology is not the only means available to meet the performance criteria in the proposed control measure, baghouse systems were used in this cost analysis for several reasons. Baghouses have been demonstrated to be effective in this application (nearly all facilities reporting the use of controls use baghouses), and they are typically lower in both initial and operating cost. The second step involved estimating installation and retrofit costs for the emission collection and control system. Third, and last, costs such as emissions testing to assess compliance, and district permit fees were estimated.

To compute the size of a baghouse system, a composite of the various types and sizes of furnaces was established from the ARB survey responses.

Two criteria were used to divide the furnaces into groups on the basis of furnace operating temperature and furnace capacity. First, they were separated into two groups, those above 1,500 degrees fahrenheit and those below. They were further separated by furnace capacities. The most commonly found furnace capacities were used: up to 500 pounds; between 501 and 1500 pounds; and, greater than 2,000 pounds. This yields a total of six furnace types: small, medium, and large capacity, and for each size category, high and low temperature.

A hood was designed for each furnace type. The designs were based on criteria established by the American Conference of Governmental Industrial Hygienists (ACGIH) published in their 20th Edition, Industrial Ventilation Manual. The size and recommended air flow through the hoods and outlet ducts were estimated. The outlet ducts connect the hoods to a central duct which carries the gas stream to the baghouse system. Data from the hood design was used to estimate the pressure losses due to each hood and duct arrangement.

Each furnace in the data base was assigned to one of the six hood arrangements. The design parameters for the hood designated to serve each furnace were used to determine the size and therefore the cost of the collection and control system. The sum of airflows and pressure losses through each hood were then used to design the central ducting section and estimate the size of the baghouse system. The cost of a traveling duct system used to control emissions during movement of the molten metal to the pouring location and during pouring was estimated. The estimate was based on the distance (cost per foot) between the furnaces and the pouring location. In some cases where small furnaces

Facilities in Category I-Housekeeping, currently have controls that meet the requirements of the proposed control measure, but may have no or inadequate housekeeping activities for fugitive dust control. Their costs are based on housekeeping cost estimates developed from information on facilities that currently carry out acceptable housekeeping activities for fugitive dust control. Because of the range of cost for housekeeping, we developed three cost categories based on similarity of hours of operation and number of furnaces.

Facilities in Category II-Incremental, meet some control requirements, but require additional control equipment, a housekeeping plan, or other activities to comply with the proposed control measure. Their cost includes a combination of items such as upgrading a baghouse system, increasing the fan size, or such related tasks to increase the performance of an existing system.

Facilities in Category III-Complete currently have no control. Those costs include equipment and installation costs; operation and maintenance costs; permit fees; housekeeping costs; and the cost of disposal of the collected and captured particulate matter. The costs estimated for each type of waste are given in Table IV-8 on page IV-29.

TABLE IV-2

COST OF COMPLIANCE FOR FACILITIES RETURNING SURVEYS

	Category	Typical Cost	% of Known Facilities
I	Housekeeping		53
	Capital*	$4,000	
	Annual	$14,000	
II	Incremental		27
	Capital	$26,000	
	Annual	$7,000	
III	Complete		20
	Capital	$112,000	
	Annual	$ 37,000	

* cost for source testing existing equipment, no additional equipment needed.

Total annualized costs for all affected facilities are expected to be approximately 1.7 million dollars. Estimates of annualized cost for those facilities that returned completed surveys range from $500 to $50,000 per year.

or art curriculum may encompass metal melting processes. The California Department of Corrections were surveyed for metal melting related training as well. None of these agencies indicated that they have facilities carrying out non-ferrous metal melting in quantities that would require installation of control systems.

Table IV-3

ESTIMATED COST TO INDIVIDUAL AIR DISTRICTS

District	Estimated Number of Facilities (Ex)	(Not-Ex)	Projected Initial Cost ($)	Projected Annual Cost ($)
Bay Area AQMD	14	6	13,300	4,200
Butte County APCD	1		1,000	100
El Dorado County APCD	1	1	100	80
Feather River AQMD		1	400	100
Lake County APCD		1	425	40
Monterey Bay Unified APCD		2	2,566	400
Northern Sierra AQMD		1	550	80
Sacramento Metro. AQMD	1		810	100
San Diego County APCD	7	3	6,406	820
San Joaquin Val. Un. APCD	11	3	3,500	1,400
Shasta County APCD		1	75	37
South Coast AQMD	145	78	105,450	37,000
Ventura County APCD		3	1,700	340
Total	180	100	136,000	45,000

Cost to Federal Agencies

Military installations such as Naval Shipyards, an Air Force aircraft repair depot and Federal civilian operations likely to carry out metal melting operations were surveyed. Data provided by facilities which responded to our survey indicates that those federal facilities with metal melting operations operate similar to civilian foundries. Based on the analysis of typical federal foundries, none would likely be affected by the proposed control measure.

D. ANALYSIS OF EMISSION/RISK REDUCTION AND COST

We have calculated anticipated reductions in emissions and potential risk from the 104 facilities for which we calculated emissions. These anticipated emission reductions are based on

TABLE IV-4

EMISSIONS FROM KNOWN FACILITIES*

Metal	Current Emissions (lb/yr)	Post-ATCM Emissions (lb/yr)	Overall Reduction (percent)
Arsenic	180	160	11
Cadmium	790	250	68
Nickel	830	620	25
Lead	118,000	63,000	47

* Includes only the 104 facilities for which we have enough information to estimate emissions. Based on survey response rate, we believe these represent about 40 percent of non-ferrous metal melting facilities, both in terms of number of facilities and emissions.

Table IV-5 gives a distribution of the number of facilities and the associated estimate of maximum individual risk for current emissions and for anticipated emissions following implementation of the proposed control measure.

TABLE IV-5

DISTRIBUTION OF MAXIMUM INDIVIDUAL RISK

For Known Facilities

Range of Risk (chances/million)	Current # of Facilities	Post-ATCM # of Facilities
999 - 500	3	0
499 - 250	5	1
249 - 100	5	3
99 - 50	7	3
49 - 10	13	9
9 - 0	71	88

Overall, the statewide cancer burden due to emissions of arsenic, cadmium, nickel, and lead from non-ferrous metal melting will be reduced to 50 potential cases over a seventy year period following implementation of this proposed control measure. The predicted

(ii) General construction, nine million five hundred thousand dollars ($9,500,000)
(iii) Special trade construction, five million dollars ($5,000,000)
(iv) Retail trade, two million dollars ($2,000,000)
(v) Wholesale trade, nine million five hundred thousand dollars ($9,500,000)
(vi) Services, two million dollars ($2,000,000)
(vii) Transportation and warehousing, one million five hundred thousand dollars ($1,500,000);

(d) A manufacturing enterprise not exceeding 250 employees;

(e) A health care facility not exceeding 150 beds or one million five hundred thousand dollars ($1,500,000) in annual gross receipts; or,

(f) Generating and transmitting electric power not exceeding 4.5 million kilowatt hours annually.

(2) The following professional and business activities shall not be considered a small business for purposes of this regulation:

(a) Financial institutions including banks, trusts, savings and loan associations, thrift institutions, consumer and industrial finance companies, credit unions, mortgage and investment bankers, and stock and bond brokers;

(b) Insurance companies, both stock and mutual;

(c) Mineral, oil, and gas brokers; subdividers and developers;

(d) Landscape architects, architects, and building designers;

(e) Entities organized as nonprofit institutions;

(f) Entertainment activities and productions including motion pictures, stage performances, television and radio stations, and production companies;

(g) All utilities, water companies, and power transmission companies, except electrical power generating transmission companies providing less than 4.5 million kilowatt hours annually; and,

(h) All petroleum and natural gas producers, refiners and pipelines."

(2) Annual compliance costs were estimated for each of these small businesses (see Section B in this Chapter). The estimated costs take into account current control equipment if it could be upgraded to meet the requirements of this proposed control measure.

(3) The estimated annual compliance costs were adjusted for both federal and state taxes.

(4) These adjusted costs were subtracted from net profit data. The results were used to calculate the Return on Owners' Equity (ROE). The resulting ROE was then compared with the ROE before the subtraction of the adjusted compliance costs to determine the impact on the profitability of the small businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts.

Assumptions

Since financial data for individual small businesses were not available, this study used Dun and Bradstreet's 1990 financial data for a nationwide typical business in each industry instead. Using the 1990 nationwide financial data, the ROEs before and after the subtraction of the adjusted compliance costs were calculated for the industries listed in Table IV-8. The calculation was based on the following assumptions.

(1) A typical business on a nationwide basis in each industry is representative of a typical California business in that industry.

(2) All small businesses are subject to federal and state tax rates of 34 percent and 9.3 percent respectively.

(3) Small businesses are not able to increase the prices of their products or to lower their costs of doing business through short run cost-cutting measures or long run innovative techniques.

These assumptions, though reasonable, might not be applicable to all small businesses.

Potential Impact On Small Business

Typical California small businesses are affected by the proposed control measure to the extent that the costs required for compliance would reduce their profitability. Using ROE to measure profitability, we found that the average ROE for all the affected small businesses

Generally within the limitations of the analysis, the category of non-ferrous smelters and foundries would require the smaller price increases, and aircraft parts manufacturers would require the larger price increases. Some consumers could also be impacted if some small businesses decided to relocate or to terminate their businesses because of the requirements of the proposed control measure.

Emission Levels

Small businesses are not necessarily small emitters. The highest emitting small business affected by this proposed control measure emits 76,500 pounds per year of toxic metals. The top ten emitters of toxic metals among the affected small businesses are listed in Table IV-7.

TABLE IV-7

EMISSIONS FROM SELECTED SMALL BUSINESSES

Facility Type	Emissions of Toxic Metals* (pounds per year)
Lead Oxide Production	76,500
Brass Smelting	2,900
Battery Manufacture	1,300
Aluminum and Lead Smelting	530
Battery Manufacture	400
Lead and Zinc Casting	380
Brass Casting	330
Zinc Smelting	280
Brass Smelting	270
Aluminum Smelting	170

* Sum of emissions of cadmium, arsenic, nickel, and lead

Conclusion

Overall, most California small businesses would appear to be able to absorb the costs of the proposed control measure without a significant adverse impact on their profitability. However, 16 out of the 30 non-exempt small businesses responding to our survey may be significantly impacted by the proposed control measure unless they are able to pass on the increased compliance costs to their consumers or lower their costs through cost-cutting measures. Moreover, the actual cost impact of the proposed control measure on the profitability of California small businesses is likely to be less than estimated in this analysis for the reasons described above.

Some metal-melting facilities collect particulate matter in existing emission collection and control systems already. If the facilities implement the proposed control measure, we estimate an increase of approximately 3,350 tons per year of hazardous particulate matter collected, with approximately 2,500 tons per year of this waste having the potential to be recycled. If the amount of waste is not recycled or reduced, then it must be disposed of in a permitted landfill, at a higher cost to the facility. Recycling or appropriate disposal constitutes mitigation for this environmental impact.

Waste Minimization and Recycling of Captured Particulate Matter

There are several advantages to minimizing the amount of waste for disposal. Besides the reduction in environmental risk, there can be cost savings associated with minimizing waste, including the reduction or avoidance of: 1) treatment, storage, and disposal fees; 2) transportation costs; 3) raw material costs; 4) insurance and liability costs; and 5) excessive operating costs resulting from inefficient processes (DHS, 1990).

There are many techniques to minimize the amount of waste generated for each type of process and facility. To achieve maximum reduction of metal-contaminated waste, a hierarchy of strategies can be followed. This entails first identifying and implementing all source reduction techniques appropriate to the plant's processes, then implementing recycling methods, and finally, in order to manage the waste streams that remain, using treatment techniques (DHS, 1990).

The DTSC has a specific set of laws that exclude qualifying wastes from regulation if they are recycled according to specific conditions. These laws are found in section 25143.2 of the Health & Safety Code. We recommend that facilities consult with DTSC about acceptable recycling options. For further information on options for proper reduction and disposal of metal-contaminated waste, facilities should contact Department of Toxic and Substance Control (DTSC) regional offices.

One option available to facilities producing waste high in zinc oxide (i.e., bronze, brass, zinc alloyers, etc.) is to sell the captured particulate matter to recycling facilities. This is an option only when the waste meets certain screening characteristics. It is the responsibility of the waste generator to ensure that the waste is sent to an authorized location. The one zinc reclaiming operation in California, Western Farms of Alpaugh, has recently stopped accepting waste particulate matter (Bollard, 1991). Currently, the nearest facility known to Air Resources Board staff that buys and recycles high zinc-containing waste is Micro-trace in Fairbury, Nebraska.

TABLE IV-8

COST ESTIMATES OF PARTICULATE MATTER DISPOSAL

Hazardous waste disposal:	
Transportation:	$250/ton
Class I Landfill:	$230/ton
Total Cost of Disposal:	$480.00/ton
Non-hazardous waste disposal:	
Transportation:	$70/ton
Class III Landfill:	$15 - $30/ton
Total Cost of Disposal:	$85 - $100/ton

(Martin, 1991 and Korn, 1991)

Metal-contaminated Water

One aspect of the proposed control measure requires facilities to take action to reduce the amount of metal-contaminated dust from areas within the facility exposed to regular foot or vehicle traffic. We expect facility operators to either "wash down" or vacuum areas of the facility as a form of housekeeping. Due to a few factors, facilities may not choose to incorporate a "washing down" of exposed areas. The primary factor being that the water used for wash down will become contaminated with metals and may have to be disposed of in accordance with CCR Title 22, depending upon what type of metal the facility is melting and whether the wastewater exhibits hazardous characteristics.

Besides the possible need for waste water treatment, another dis-incentive to using water is the recurring shortages of water within California. An alternative to washing exposed areas with water would be to clean them using a vacuum. It is likely that because vacuuming is probably a less expensive alternative and, therefore, preferred method in California, metal-contaminated water from wash down is not considered a significant adverse impact. Waste from vacuuming areas may be able to be disposed of in the same manner as particulate matter collected from the furnaces.

measure is consistent with Cal-OSHA guidelines for worker protection because both require best engineering practice for the capture of the emissions.

The DTSC oversees compliance with the regulations and laws for hazardous waste which are codified in Title 22 of the California Code of Regulations and Chapter 6.5, Division 20 of the Health & Safety Code. Most of the particulate matter collected from metal melting operations in control devices meets the definition of hazardous waste. Our proposed control measure will result in the particulate matter being collected more efficiently and at more facilities than under current regulations. Therefore, there will be an increase in hazardous waste production as discussed in section F of this chapter.

The Water Quality Control Board (WQCB) oversees compliance with effluent limitations, pretreatment standards, and new source performance standards for discharges of effluent (other than hazardous waste) for a variety of pollutants and processes. Also they oversee on-site disposal of waste that may cause a discharge of pollutants to water. Our proposed control measure is not expected to have any impact on the above regulations. In addition, it is expected to be consonant with the new storm-water runoff regulations being proposed by the WQCB because our fugitive emission control requirements are likely to reduce contaminated storm-water runoff from these facilities.

The Integrated Waste Management Board has no regulations that directly affect metal melting facilities. However, if evidence showed that regulation of wastes that do not qualify as hazardous waste and have no potential to cause water pollution was necessary, the IWMB could consider regulating them as special wastes. There currently does not appear to be any area of conflict or overlap between our proposed control measure and the current regulations for which the IWMB is responsible.

Districts

Each district has individual particulate matter standards and visible emission regulations. In general, particulate matter standards are based on grain loading or emission rates for high particulate matter emitting processes, and levels of control attainable using conventional control equipment. Such standards weren't intended to, and therefore do not necessarily, result in the lowest achievable emission levels. Examples of general particulate matter and lead emission limits are given in Table IV-9. None of the districts currently have regulations establishing emission limits specifically for arsenic, cadmium, or nickel.

V.

ALTERNATIVES TO THE PROPOSED CONTROL MEASURE

In developing the proposed control measure, we considered the following eight control alternatives.

A. no additional control;

B. an emission standard based on mass/time or particulate mater (PM) concentration, that is more stringent than existing particulate matter standards;

C. a prescriptive standard;

D. a requirement to control furnace emissions only;

E. a performance standard based on the reduction of specified metals;

F. substitute compounds;

G. closed-system operations; and,

H. exemption of small business from control requirements.

The staff believe the proposed control measure meets the Health and Safety Code's mandated objective of reducing emissions to the lowest level achievable through the application of the best available control technology (BACT), considering risk and cost. We believe there is no alternative to the proposed measure which achieves the lowest emissions, and is less burdensome to small business. In addition the proposed control measure allows facility operators the flexibility to achieve compliance with our proposed performance standard. Each of the alternatives to the proposed control measure is discussed below.

Currently about 30 percent of the non-ferrous metal melting furnaces are equipped with particulate matter control. In addition, existing standards address only stack emissions and do not address fugitive emissions. Therefore this approach would not meet the requirements of Health and Safety Code section 39666(c) which requires the Air Resources Board to adopt Air Toxic Control Measures (ATCMs) which "...reduce emissions to the lowest level achievable through application of best available control technology..." to reduce public exposure to toxic air contaminants.

B. PERFORMANCE STANDARD BASED ON MASS/TIME OR CONCENTRATION

We considered developing a performance standard based on an emission rate (lb/hr or gr/dscf). Compliance costs for this approach would be lower than for a control efficiency-based performance standard, because only an outlet source test would have to be performed. We found that emission rates varied widely. Post-control emission rates for various metal melting facilities are found in Table V-1. Facilities for which these emission rates were available used different types of furnaces and melted a wide variety and amount of metals, all of which affect the particulate output at the facility. Setting a performance standard based on a high emission rate would not result in the lowest achievable rate for smaller, lower-emitting facilities. Conversely, a performance standard based on a low emission rate would not necessarily be achievable by larger facilities. Because of the emissions variability within the industry, an emission rate-based performance standard could not be established.

C. PRESCRIPTIVE STANDARD

A prescriptive standard outlines minimum control equipment design and operating requirements. This approach could reduce compliance costs by eliminating source testing and reducing control design costs.

To ensure that the prescribed control device is providing the lowest achievable emission rate, there must be sufficient information available to relate device performance to both device design specifications and operating parameters. This is critical in the case of a prescriptive standard, because there will be no performance test of the system in operation.

Fabric filters (baghouses) are the most commonly used devices for particulate matter control in the metal melting industry. It is generally accepted that a properly designed and operated baghouse will achieve high (99% or greater) particulate matter removal efficiency. However, little work has been done to directly measure the variation of control efficiency under different design and operating parameters, such as air-to-cloth ratio or pressure drop. Consequently, we elected not to propose a prescriptive standard approach without any testing. The proposed control measure requires an initial source test to assess control device performance. It does not require subsequent periodic

sources which will result in the same product, and eliminate or reduce emissions of the metals of concern. The proposed control measure allows exemption from control requirements for facilities that melt metals meeting specific composition limits. Thus, this option is available to facilities that can use feed stock that meets the requirements.

G. USE OF CLOSED SYSTEM FACILITIES

Some metal melting facilities have been designed to completely enclose the operation. The facility and process air flow is passed through a control device. Although this alternative would be effective for reducing all particulate emissions from a facility, it is only available to facilities in the design phase of development. The costs for rebuilding existing facilities to meet such a requirement would be very high. The use of appropriate emission collection systems, control devices, and housekeeping practices on a statewide basis achieves ARB's goal of obtaining the lowest achievable emissions, and also reduces worker exposure.

H. SMALL BUSINESS EXEMPTION

The exemption of small businesses from emission control requirements would minimize costs to those facilities. However, within the metal melting industry, a small business is not necessarily a small emitter. Many factors (discussed previously in Chapter I) such as the type of feed and furnace used, determine the amount of pollutant emissions from a facility. The "size" of the facility as defined by the "small business" definition does not necessarily relate to the amount of emissions.

We are concerned about the costs to small business and have included, in the proposed control measure, size and alloy purity exemptions, which will exempt many small businesses from the control requirements, while still protecting public health. In addition, a compliance schedule of 24 months is included to provide lead time to plan and budget for equipment installation. Small business loans are available for pollution control equipment through a program being administered by the California Office of Small Business and the California Pollution Control Financing Authority (CPCFA). The South Coast Air Quality Management District is currently operating a loan guarantee program for small businesses.

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APPENDIX A

ARB METAL MELTING SURVEY 1991

STATE OF CALIFORNIA

PETE WILSON, Governor

AIR RESOURCES BOARD
1102 Q STREET
P.O. BOX 2815
SACRAMENTO, CA 95812

February 26, 1991

Dear Madam/Sir:

Survey of Secondary Smelters and Foundries
for Emissions of Cadmium and Arsenic

The Air Resources Board (ARB) staff is evaluating sources of cadmium and arsenic emissions in California for possible future regulation. Section 39660 of the Health and Safety Code authorizes the ARB to request and obtain information necessary to the implementation of this chapter.

We have identified secondary smelters and foundries as possible sources of these emissions. Cadmium was identified as a toxic air contaminant (TAC) on January 23, 1987. Arsenic was identified as a TAC on May 9, 1990. We are now assessing the need, and appropriate degree of regulation for sources of arsenic and cadmium emissions. In connection with this, we are requesting that you provide the information on the enclosed survey form.

You may request confidentiality for any data that you provide, except for emissions data. We will not release any data designated confidential unless required to do so by law. For details on protection for trade secrets, see Enclosure A.

Please complete the survey as requested on the instruction page. The information that you provide on this survey is an important part of regulation development. We want to base this process on the most complete and up-to-date information available. Your willingness to provide us with accurate and complete information will help us to take into account the unique conditions in your industry.

The ARB will be holding public workshops to discuss the information we have gathered, as well as any proposed control measures. The regulation developed will combine the input from both the local air pollution control agencies in consultation with the affected sources and the interested public.

Enclosure A

CONFIDENTIAL INFORMATION

The information you provide may be released to :

1) The public upon request, except trade secrets which are not emission data or other information which is exempt from disclosure or the disclosure of which is prohibited by law, and

2) The Federal Environmental Protection Agency, which protects trade secrets as provided in Clean Air Act Section 114(c) and amendments thereto (42 USC 7401 et seq.) and in Federal regulation, and

3) Other public agencies provided that those agencies preserve the protections afforded information which is identified as a trade secret, or otherwise exempt from disclosure by law. (Title 17 california Administrative Code Section 91000 and California Health and Safety Code Section 39660).

California Government Code Section 6254.7 defines trade secrets. Trade secrets are not considered public records and therefore, will not be released to the public. The Public Records Act (Government Code Section 6250 et seq.), however, provides that air pollution emission data are always public records, even if the data comes within the definition of trade secrets. The information used to calculate air pollution emissions may be withheld from the public if the information is a trade secret.

If you believe that any of the information you are providing is a trade secret or otherwise exempt from disclosure under any other provision of law, you should identify is as such at the time of submission (California Health and Safety Code Section 39660 (e)). The Air Resources Board may ask you to document your claim of trade secret or exemption.

If you have questions on the confidentiality of any data that you provide, you may contact our Office of Legal Affairs at (916) 322-2884.

Potentially applicable SIC codes

Facilities where the metal melting operation is the primary activity (determined by the principle product) should fit into one of the following SIC code categories:

3341 Secondary Smelting and Refining of Nonferrous Metals
Facilities primarily engaged in recovering nonferrous metals from new and used scrap and dross or in producing alloys from purchased refined metals.

3351 Rolling, Drawing, and Extruding of Copper
Facilities primarily engaged in rolling, drawing, or extruding copper, brass, bronze, or copper based alloy basic shapes such as plate, sheet, strip, bar, and tubing.

3353 Aluminum Sheet, Plate, and Foil
Facilities engaged primarily in flat rolling aluminum and aluminum based alloy basic shapes such as sheet, plate, and foil, including facilities producing welded tube and facilities producing similar products by continuous casting.

3354 Aluminum Extruded Products
Facilities engaged primarily in extruding aluminum and aluminum based alloy basic shapes, such as, rod and bar, pipe and tube, and tube blooms, including facilities producing tube by drawing.

3355 Aluminum Rolling and Drawing, Not Elsewhere Classified
Facilities primarily engaged in rolling, drawing, and other operations resulting in the production of aluminum ingot, including extrusion ingot, and aluminum and aluminum alloy basic shapes not elsewhere classified such as rolled and continuous cast rod and bar

3356 Rolling, Drawing, and Extruding of Nonferrous Metals, Except Copper and Aluminum
Facilities primarily engaged in rolling, drawing, or extruding nonferrous products, except copper and aluminum, in the form of basic shapes, such as, plate, sheet, strip, bar, and tubing.

3364 Aluminum Die-Casting
Facilities primarily engaged in die casting aluminum and aluminum alloys

3364 Nonferrous Die-castings Except Aluminum
Facilities primarily engaged in manufacturing nonferrous die-castings, except aluminum.

3365 Aluminum Foundries
Facilities primarily engaged in manufacturing aluminum castings, except die-castings.

California Air Resources Board
1991 Survey of Foundry and Smelter Operations

Facility Name: |
Facility Mailing Address: |
City/State/Zip: |
Facility Street Address: |
City/State/Zip: |
Company Name (if different): |
Company Address: |
City/State/Zip: |
Contact Name/Phone #: |
Contact Title: |

Please make corrections to or supply label information as necessary

SECTION ONE:

General Information

1.1 SIC code: _____ (If the district has assigned an SIC code in connection with any permitting or inventory function please use that. If not, please consult the attachment to the instructions for potentially applicable codes.)

1.2 Please indicate all types of operation at the facility (e.g. lead smelter, brass foundry, shipyard,etc.):_____
_____

1.3 Specify how many of each type of furnace is operating at this facility.

[ ] Reverberatory [ ] Blast or Cupola [ ] Rotary [ ] Kettle
[ ] Electric Arc [ ] Electric Induction [ ] Other (please specify) _____

1.4 Type of organization:

[ ] Profit [ ] Non-profit [ ] Government agency: Type_____

Company information for designation of small businesses:

1.5 Is the facility independently owned and operated? (yes/no) _____

1.6 Number of employees at facility:_____

Pre-treatment of Feed Materials

1.7 Are feed materials pre-treated at this facility? (yes/no)_____
If yes, please specify the methods of pre-treatment used:

[ ] Chemical Methods (specify): _____
[ ] Mechanical Methods (specify): _____
[ ] Other methods (please specify)_____

1.8 If this facility uses a pre-treatment process for feed material, does this process have a fume collection/ventilation system? (yes/no) _____

2.11 Furnace Feed

Please list the feed material composition for this furnace.
If available, include copies of the Material Safety Data Sheets (MSDS) on each material listed below.

	ASM Alloy Designation or Scrap Description of Feed Material	Quantity Used in 1990. (Tons)	Nominal Composition (%)	Arsenic or Cadmium Concentration (If Known)
A)				
B)				
C)				
D)				

2.12 Please indicate the method used for determining the composition for the feed material:

_____

_____

2.13 Furnace Output

Please list the output material composition.

	Output Material Name of Metal or Alloy	Form of Metal After Processing	Quantity Output in 1990. (Tons)	Nominal Composition (%)	Arsenic or Cadmium Concentration (If Known)
A)					
B)					
C)					
D)					

2.14 Please indicate the method used to determine the composition for the ouput material:

_____

_____

4.3 Air Pollution Control Device Data

Please identify each emission control device with a unique two-digit ID #, then list these control devices with the ID #'s of the hoods and furnaces that are vented to each device. Please use the identification numbers for the furnace and vents from previous sections.

	Control Device ID #	Device Type	Furnace ID #	Hood or Vent ID #
A)				
B)				
C)				
D)				
E)				

4.4 For each emission control device identified above, please complete the following information:

	Control Device ID #	Flow Rate (CFM)	Approximate Installation Cost	Year Installed	Years of Remaining Usefulness	Yearly Maintenance Cost	For Dust Collectors, Amount of Dust Collected (lbs/yr)
A)							
B)							
C)							
D)							
E)							

SECTION FIVE:

Exhaust Stack(s)

5.1 Are there exhaust stack(s) present at this facility? (yes/no):_____
If no, go to SECTION SIX. If yes, please answer the following questions:

5.2 How many stacks are in use at the facility? _____

5.3 Please identify each stack with a unique two-digit ID #, then complete the following information:
Once again, please use the identification numbers for hoods and control devices from the previous sections.

	Stack ID #	ID # of All Vents or Hoods Feeding Into The Stack	ID # of Each Control Device Exhausted By The Stack
A)			
B)			
C)			
D)			

APPENDIX B

OTHER METAL EMISSIONS IN CALIFORNIA

TABLE B-1

ESTIMATED INORGANIC ARSENIC EMISSIONS IN CALFIFORNIA

Source	Emissions (tons/year)	
Residual Oil Combustion	0.17-14	(Watkins, 1991)
Distillate Oil Combustion (non-transportation)	0.04-12	(Watkins, 1991)
Arsenic-Containing Pesticide Use	2.3	(ARB, 1990)
Cement Production	0.004-0.76	(ARB, 1990)
Geothermal Steam Use	2.7	(ARB, 1990)
Waste Oil Combustion	0.05-0.65	(Watkins, 1991)
Glass Manufacturing	0.16	(ARB, 1990)
Waste-to-Energy Facilities	0.15	(Weintraub,1991)
Residential Wood Burning	0.15	(Nguyen, 1991)
Secondary Lead Smelting	0.13	(ARB, 1990)

TABLE B-3

ESTIMATED CADMIUM EMISSIONS IN CALFIORNIA
(ARB 1991)

Stationary Source	Emissions (lbs/year)	Year of Estimate
Fuel Combustion (Agid, 1989)		
Residual Oil	6,700	1985
Distillate Oil	377	1985
Diesel Oil	395	1985
Coal	39	1985
Coke	9	1985
Cement Manufacturing	60-4,600 (Agid, 1989)	
Municipal Sewage Sludge Incineration	100 (Agid, 1989)	
Hospital Incinerators[a]	1.27	1991
Cadmium Plating	<1	1991

[a]Estimate of emission remaining after statewide adoption of Airborne Toxic Control Measure for Medical Waste Incinerators

APPENDIX C

SMELTER/FOUNDRY DISPERSION MODELING

:ate of California

E M O R A N D U M

: Cliff Popejoy, Manager
Process Evaluation Section
Stationary Source Division

Date : July 15, 1991

Subject : Generic Smelter/
Foundry Emission
Dispersion Modeling

Andrew J. Ranzieri, Manager
Modeling Support Section
Technical Support Division
m : Air Resources Board

As requested by the Process Evaluation Section, the Modeling Support Section performed a screening air quality modeling analysis for cadmium, arsenic, and nickel for a unit emission rate from a generic secondary smelter/foundry. The generic facility was considered in two different locations within the SCAB: South Gate and Ontario. Stack emissions were considered separately from fugitive emissions. The maximum annual average concentrations and the population weighted annual average concentrations were requested.

The analysis and results are attached. All predicted concentrations are above ambient conditions. The results from this analysis are for a hypothetical facility. A detailed analysis of an individual facility should be used to determine a better estimate of the impacts of emissions from that particular facility.

If you have any questions please call me at 4-4069 or Tony Servin of my staff at 3-5122.

Attachment

cc: Gretchen Bennitt (SSD)
Tony Servin (TSD)
File #1613

ans//S10573

facility. The effects of fugitive emissions will be examined separately from the effects from the stack emissions.

Meteorological data from Lynwood for 1981 were used to analyze the South Gate location. Meteorological data from Uplands for 1981 were used to analyze the Ontario location. The SCAQMD has determined 1981 to be a worst-case year for air quality. Also these meteorological sites are the closest to the facilities and best represent the meteorology at these locations. In addition, 1981 is the only year preprocessed meteorological data are available for these locations. Since this is a generic screening analysis, multiple years of data were not used to average the predicted concentrations. If it is necessary to do further analysis on a particular facility, then multiple years of meteorological data should be used.

For this analysis, ISCST version 3.4 was used to predict above ambient average concentrations for a 30 km by 30 km gridded array of receptors spaced 1 km apart. ISCST is a flat terrain model and is appropriate for this application since the generic facilities are located in flat terrain.

In addition, a 3 km by 3 km fine scale receptor grid with 100 m spacing was modeled to obtain a higher resolution of the concentration near the facility. For the concentration estimates, the population contained in each 1 km grid cell is assumed to have the potential of being subjected to either the annual average concentration estimated for the receptor located in the center of the cell (if the 1 km cell is outside the fine grid), or the averaged 100 m receptor annual average concentrations of the fine grid taken in 1 km cell intervals. Figure 1 shows the 1985 population distribution plotted on the 30 km by 30 km domain for South Gate. Figure 3 shows the 1985 population distribution plotted on the 30 km by 30 km domain for Ontario.

Figure 2 shows the annual average concentration isopleths using 1981 Lynwood meteorological data for the South Gate location, the point source stack configuration, the 1 km receptor spacing, and the 30 km by 30 km domain. Figure 4 shows the annual average concentration isopleths using 1981 Uplands meteorological data for the Ontario location, the point source stack configuration, the 1 km receptor spacing, and the 30 km by 30 km domain.

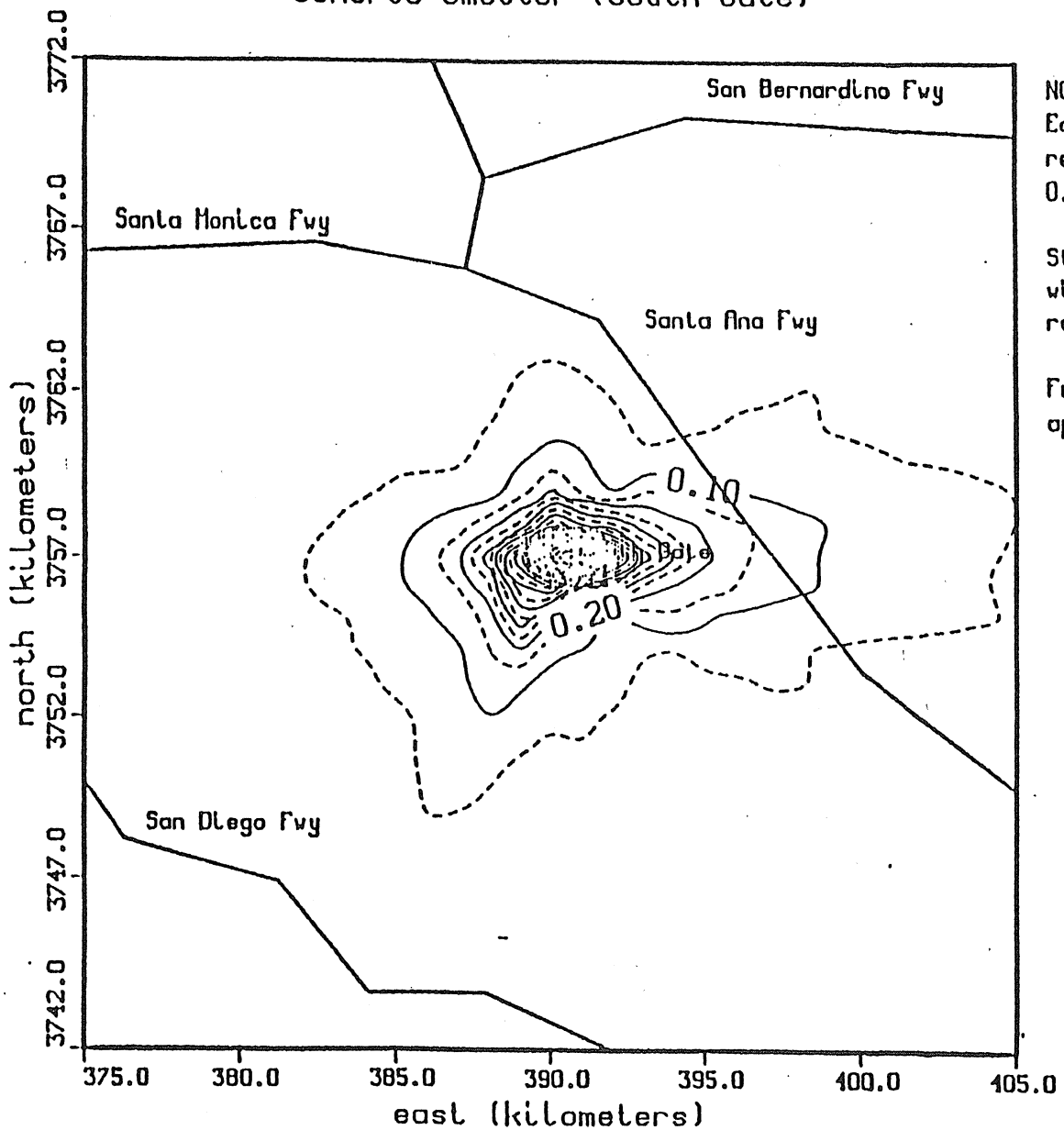
Table 2 shows the population weighted annual average concentrations for each type of emission source and location considered. These values are based on estimates of the 1985 residential population extrapolated from 1980 census data. Census track growth factors are only available for 1985. Therefore this estimate may not be representative of the 1991 population. Furthermore, the population weighted average concentration is a function of the grid size. Increasing the area of the grid will generally increase the population within the modeling domain. As a result, the population weighted

The results from this analysis are for a hypothetical facility. A detailed analysis of an individual facility should be used to determine a better estimate of the impacts from emissions from that particular facility.

FIGURE 2

Above Ambient Annual Average Concentration Isopleths

Generic Smelter (South Gate)



(30 X 30 KM grid).

NOTES:
Each isopleth represents a change of 0.05 (ug/mxx3)/(g/s).

-X-

Stack point source with a unit emission rate.

-X-

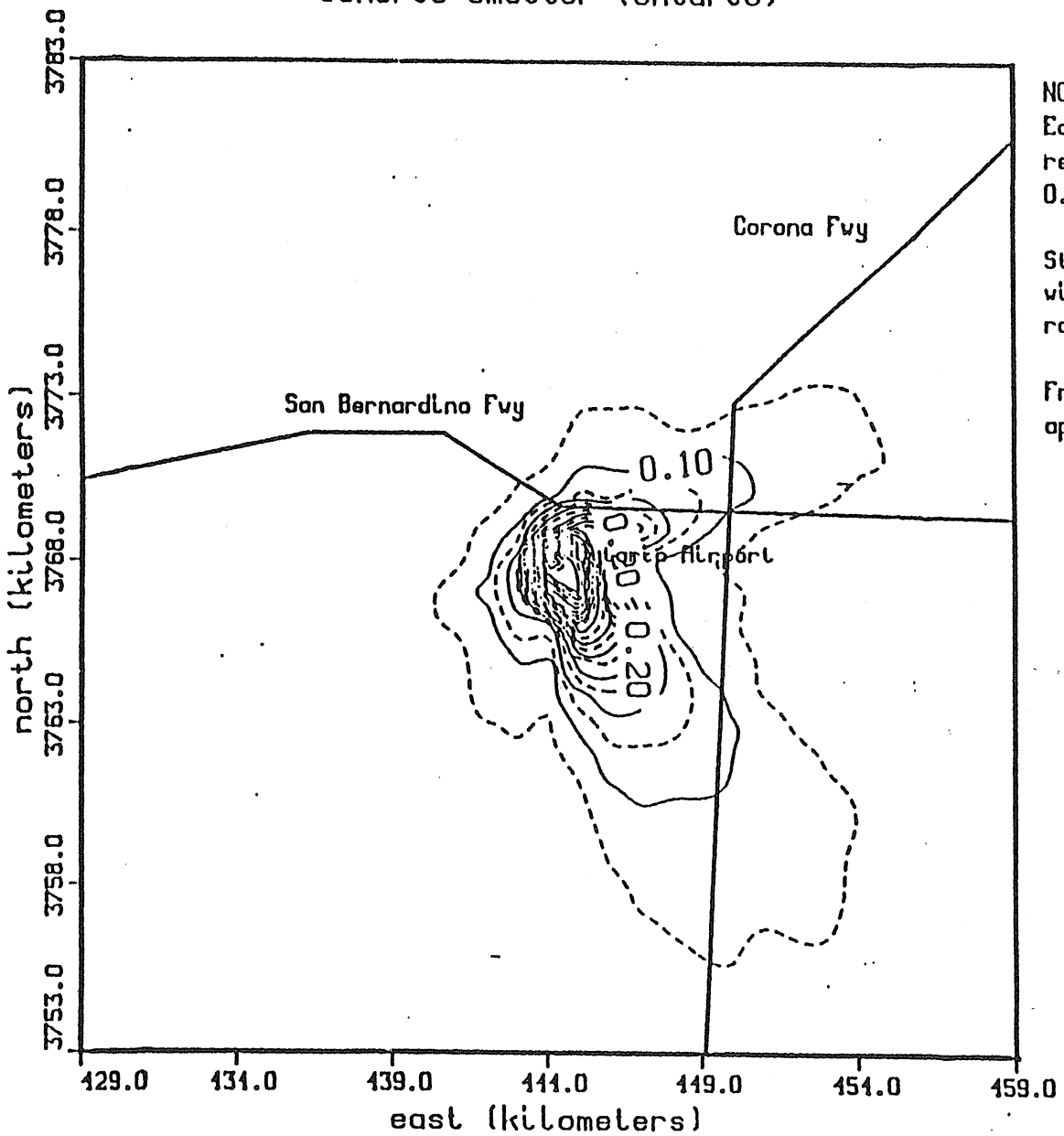
Freeway locations are approximate.

PLOT 1 16.49.56 THUR 11 JUL, 1991 JOB-SERVIN , ISSCO DISSPLA 10.0

FIGURE 1

Above Ambient Annual Average Concentration Isopleths

Generic Smelter (Ontario)



(30 X 30 KM grid)

NOTES:
Each isopleth represents a change of 0.05 (ug/mxx3)/(g/s).

-X-

Stack point source with a unit emission rate.

-X-

Freeway locations are approximate.

PLOT 1 16.41.15 THUR 11 JUL, 1991 JOB-SERVIN , ISSCO DISSPLA 10.0

APPENDIX D

DISTRICT PARTICULATE EMISSION REGULATIONS

REGULATION 6

PARTICULATE MATTER AND VISIBLE EMISSIONS

INDEX

required by District regulations, be equal to a greater than 40% opacity, from the following sources:

303.1 Internal combustion engines of less than 25 liters (1500 in^3) displacement, or any engine used solely as a standby source of motive power;

303.2 Laboratory equipment used exclusively for chemical or physical analyses or experimentation;

303.3 Portable brazing, soldering or welding equipment;

303.4 Deleted July 11, 1990

(Amended January 5, 1983, July 11, 1990)

6-304 **Tube Cleaning:** During tube cleaning, and except for three minutes in any one hour, a person shall not emit from any heat transfer operation using fuel at a rate of not less than 148 GJ (140 million BTU) per hour, a visible emission as dark or darker than No. 2 on the Ringelmann Chart, or of such opacity as to obscure an observer's view to an equivalent or greater degree, or equal to or greater than 40% opacity as perceived by an opacity sensing device in good working order. The aggregate duration of such emissions in any 24 hour period shall not exceed 6.0 minutes per 1055 GJ (one billion BTU) gross heating value of fuel burned during such 24 hour period.

6-305 **Visible Particles:** A person shall not emit particles from any operation in sufficient number to cause annoyance to any other person, which particles are large enough to be visible as individual particles at the emission point or of such size and nature as to be visible individually as incandescent particles. This Section 6-305 shall only apply if such particles fall on real property other than that of the person responsible for the emission.

6-306 **Diesel Piledriving Hammers:** Piledriving hammers powered by diesel fuel shall comply with one of the following standards:

306.1 A person shall not emit from any diesel piledriving hammer for a period or periods aggregating more than four minutes during the driving of a single pile, a visible emission which is as dark or darker than No. 1 on the Ringelmannn Chart, or of such opacity as to obscure an observer's view to an equivalent or greater degree.

306.2 A person shall not emit from any diesel piledriving hammer for a period or periods aggregating more than four minutes during the driving of a single pile, a visible emission which is as dark or darker than No. 2 on the Ringelmann Chart or of such opacity as to obscure an observer's view to an equivalent or greater degree provided that the operator utilizes kerosene, smoke suppressing fuel additives and synthetic lubricating oil, and the requirements of Section 6-503 are satisfied. (Adopted July 11, 1990)

6-310 **Particulate Weight Limitation:** A person shall not emit from any source particulate matter in excess of 343 mg per dscm (0.15 gr. per dscf) of exhaust gas volume.

310.1 Incineration or Salvage Operations. For the purposes of 6-310, the actual measured concentration of particulate matter in the exhaust gas from any incineration operation or salvage operation shall be corrected to the concentration which the same quantity of particulate matter would constitute in the exhaust gas minus water vapor corrected to standard conditions, containing 12% CO_2 by volume, and as if no auxiliary fuel had been used.

310.2 Gas-fired Pathological Waste Incinerators. The particulate emissions from gas-fired pathological waste incinerators, where emissions are not mingled with emissions from incineration of general wastes, shall be corrected as specified in Section 6-310.1 except that correction for auxiliary fuel shall not be required.

310.3 Heat Transfer Operation. For the purposes of 6-310, the actual measured concentration of particulate matter in the exhaust from any heat transfer operation shall be corrected to the concentration which the same quantity of particulate matter would constitute in the exhaust gas minus water vapor, corrected to standard conditions, containing 6% oxygen by volume.

6-500 MONITORING AND RECORDS

6-501 **Sampling Facilities and Instruments Required:** Persons subject to this regulation shall provide sampling facilities and install instruments as required pursuant to the provisions of Sections 1-501, 1-520 and 1-521 of Regulation 1.

6-502 **Data, Records and Reporting:** Persons monitoring emissions in accordance with the requirements of Sections 1-520 and 1-521 of Regulation 1 shall keep records, report emission excesses and provide summaries of data collected as required by Regulation 1.

6-503 **Records:** A person responsible for the operation of a diesel pile-driving hammer who chooses to comply with subsection 6-306.2 shall maintain and have available for inspection records which establish the use of kerosene, smoke suppressing fuel additives and synthetic lubricating oil. (Adopted July 11, 1990)

6-600 MANUAL OF PROCEDURES

6-601 **Particulate Matter, Sampling, Sampling Facilities, Opacity Instruments and Appraisal of Visible Emissions:** The MOP contains the testing temperature for the determination of the presence of particulate matter, procedures relating to the siting of sampling facilities, source test procedures, opacity instrument specifications, calibration and maintenance requirements, and the procedure for appraising visible emissions.

4. Table I.

ALLOWABLE RATE OF EMISSION
BASED ON PROCESS WEIGHT RATE[1]

Process Weight Rate Lbs/hr.	Process Weight Rate Tons/hr.	Emission Rate Lbs/hr.
100	0.05	0.551
200	0.1	0.877
400	0.2	1.4
600	0.3	1.83
800	0.4	2.22
1,000	0.5	2.58
1,500	0.75	3.38
2,000	1.0	4.1
2,500	1.25	4.76
3,000	1.5	5.38
3,500	1.75	5.96
4,000	2.0	6.52
5,000	2.5	7.58
6,000	3.0	8.56
7,000	3.5	9.49
8,000	4.0	10.4
9,000	4.5	11.2
10,000	5.0	12.0
12,000	6.0	13.6
16,000	8.0	16.5
18,000	9.0	17.9
20,000	10.0	19.2
30,000	15.0	25.2
40,000	20.0	30.5
50,000	25.0	35.4
60,000	30.0	40.0

or more

[1] Interpolation of the data in this Table shall be accomplished by the use of the equation:

$$E = 4.10\ P^{0.67}$$

E = rate of emission in lbs/hr.

P = process weight rate in tons/hr.

* * * * *

SCAQMD

TABLE 404(a)

Volume Discharged Calculated as Dry Gas At Standard Conditions		Maximum Concentration of Particulate Matter Allowed in Discharged Gas Calculated as Dry Gas at Standard Conditions		Volume Discharged Calculated as Dry Gas At Standard Conditions		Maximum Concentratic of Particulate Matter Allowed in Discharged Gas Calculated as Dry Gas at Standard Conditions	
Cubic Meters Per Minute	Cubic Feet Per Minute	Milligrams Per Cubic Meter	Grains Per Cubic Foot	Cubic Meters Per Minute	Cubic Feet Per Minute	Milligrams Per Cubic Meter	Grains Per Cubic Foot
25 or less	883 or less	450	0.196	900	31780	118	0.0515
30	1059	420	.183	1000	35310	113	.0493
35	1236	397	.173	1100	38850	109	.0476
40	1413	377	.165	1200	42380	106	.0463
45	1589	361	.158	1300	45910	102	.0445
50	1766	347	.152	1400	49440	100	.0437
60	2119	324	.141	1500	52970	97	.0424
70	2472	306	.134	1750	61800	92	.0402
80	2825	291	.127	2000	70630	87	.0380
90	3178	279	.122	2250	79460	83	.0362
100	3531	267	.117	2500	88290	80	.0349
125	4414	246	.107	3000	105900	75	.0327
150	5297	230	.100	4000	141300	67	.0293
175	6180	217	.0947	5000	176600	62	.0271
200	7063	206	.0900	6000	211900	58	.0253
250	8829	190	.0830	8000	282500	52	.0227
300	10590	177	.0773	10000	353100	48	.0210
350	12360	167	.0730	15000	529700	41	.0179
400	14130	159	.0694	20000	706300	37	.0162
450	15890	152	.0664	25000	882900	34	.0148
500	17660	146	.0637	30000	1059000	32	.0140
600	21190	137	.0598	40000	1413000	28	.0122
700	24720	129	.0563	50000	1766000	26	.0114
800	28250	123	.0537	70000 or more	2472000 or more	23	.0100

TABLE 405(a)

Process Weight Per Hour		Maximum Discharge Rate Allowed for Solid Particulate Matter (Aggregate Discharged From All points of Process)		Process Weight Per Hour		Maximum Discharge Rate Allowed for Solid Particulate Matter (Aggregate Discharged From All points of Process)	
Kilograms Per Hour	Pounds Per Hour	Kilograms Per Hour	Pounds Per Hour	Kilograms Per Hour	Pounds Per Hour	Kilograms Per Hour	Pounds Per Hour
100 or less	220 or less	0.450	0.99	9000	19840	5.308	11.7
150	331	0.585	1.29	10000	22050	5.440	12.0
200	441	0.703	1.55	12500	27560	5.732	12.6
250	551	0.804	1.77	15000	33070	5.982	13.2
300	661	0.897	1.98	17500	38580	6.202	13.7
350	772	0.983	2.17	20000	44090	6.399	14.1
400	882	1.063	2.34	25000	55120	6.743	14.9
450	992	1.138	2.51	30000	66140	7.037	15.5
500	1102	1.209	2.67	35000	77160	7.296	16.1
600	1323	1.340	2.95	40000	88180	7.527	16.6
700	1543	1.461	3.22	45000	99210	7.738	17.1
800	1764	1.573	3.47	50000	110200	7.931	17.5
900	1984	1.678	3.70	60000	132300	8.277	18.2
1000	2205	1.777	3.92	70000	154300	8.582	18.9
1250	2756	2.003	4.42	80000	176400	8.854	19.5
1500	3307	2.206	4.86	90000	198400	9.102	20.1
1750	3858	2.392	5.27	100000	220500	9.329	20.6
2000	4409	2.563	5.65	125000	275600	9.830	21.7
2250	4960	2.723	6.00	150000	330700	10.26	22.6
2500	5512	2.874	6.34	175000	385800	10.64	23.5
2750	6063	3.016	6.65	200000	440900	10.97	24.2
3000	6614	3.151	6.95	225000	496000	11.28	24.9
3250	7165	3.280	7.23	250000	551200	11.56	25.5
3500	7716	3.404	7.50	275000	606300	11.82	26.1
4000	8818	3.637	8.02	300000	661400	12.07	26.6
4500	9921	3.855	8.50	325000	716500	12.30	27.1
5000	11020	4.059	8.95	350000	771600	12.51	27.6
6000	13230	4.434	9.78	400000	881800	12.91	28.5
7000	15430	4.775	10.5	450000	992100	13.27	29.3
8000	17640	5.089	11.2	500000 or more	1102000 or more	13.60	30.0

RULE 52. PARTICULATE MATTER (Rev.Effective 9/21/83)

(a) APPLICABILITY

(1) In those instances where Rule 53 or 54 is applicable the requirements of this rule shall not apply.

(2) The provisions of this rule shall not apply to stationary internal combustion engines.

(b) STANDARD

A person shall not discharge into the atmosphere from any source particulate matter in excess of 0.1 grain per dry standard cubic foot (0.231 grams per dry standard cubic meter) or gas.

RULE 52.1. NSPS AND NESHAPS PARTICULATE MATTER REQUIREMENTS (Effective 11/8/76)

A person owning or operating any source subject to the provisions of any federal New Source Performance Standard (NSPS) or National Emission Standard for Hazardous Air Pollutants (NESHAPS) which has been delegated to the Air Pollution Control District of San Diego County must, in addition to complying with Rule 52, comply with Regulation X and XI, respectively.

Rule 52. Particulate Matter - Concentration (Grain Loading) (Adopted 7/2/68, Revised and Renumbered 10/22/68, Revised 5/23/72)

A person shall not discharge into the atmosphere from any source particulate matter in excess of the concentration shown in the following table (see Rule 52 Table).

Where the volume discharged falls between figures listed in the Table, the exact concentration permitted to be discharged shall be determined by linear interpolation.

The provisions of this Rule shall not apply to emissions resulting from the combustion of liquid or gaseous fuels in steam generators or gas turbines.

For the purposes of this Rule "particulate matter" includes any material which would become particulate matter if cooled to standard conditions.

CONCENTRATION
(Grain Loading)

TABLE FOR RULE 52

VOLUME DISCHARGED — Cubic Feet Per Minute Calculated at Standard Conditions	MAXIMUM CONCENTRATION OF PARTICULATE MATTER ALLOWED IN DISCHARGED GAS — Grains Per Cubic Foot of Dry Gas at Standard Conditions	VOLUME DISCHARGED — Cubic Feet Per Minute Calculated at Standard Conditions	MAXIMUM CONCENTRATION OF PARTICULATE MATTER ALLOWED IN DISCHARGED GAS — Grains Per Cubic Foot of Dry Gas at Standard Conditions
DCFM	GR/DCF	DCFM	GR/DCF
1000 or less	0.200	20000	0.0635
1200	.187	30000	.0544
1400	.176	40000	.0487
1600	.167	50000	.0447
1800	.160	60000	.0417
2000	.153	70000	.0393
2500	.141	80000	.0374
3000	.131	100000	.0343
3500	.124	200000	.0263
4000	.118	400000	.0202
5000	.108	600000	.0173
6000	.101	800000	.0155
7000	.0949	1000000	.0142
8000	.0902	1500000	.0122
10000	.0828	2000000	.0109
15000	.0709	2500000 or more	.0100

APPENDIX E

SAMPLE CALCULATIONS

EMISSION CALCULATIONS:

In general, the emission factors for each type of facility are based on the amount of baghouse dust captured as indicated in the responses to both the survey and follow-up investigations we conducted. The quantity of particulate matter captured in the emission collection system from the processes being vented was estimated from the quantity of dust collected in the baghouse by assuming that the baghouse was 95% effective at removing the dust from the emission stream. A particulate matter emission factor was derived by dividing the dust generated by the quantity of metal being fed to the furnaces associated with that baghouse. This emission factor does not include the fugitive emissions.

Formula for Calculating Emission Factors:

Emission Factor (EF) = PM / Feed, in lb/ton

where:
PM = Particulate Matter = baghouse catch, lb/yr /0.95
EF = Emission Factor = (lb. PM/ton feed)
Feed = Quantity metal, tons per year (TPY)

Example calculation of pre-control furnace emission rate:

Given 400,000 lbs/yr baghouse dust catch and 12,600 TPY furnace feed

(400,000) /.95 = 421,000/12,600 = 33.4 lb. PM /ton feed

Adjustment for Current Levels of Control:

Stack emissions for current levels of control were calculated using the following control factors:

TABLE E-2

CONTROL EFFICIENCIES

Device Type	Percent Control
Baghouse	95
Baghouse with Scrubber	97.2
Electrostatic Precipitator	90
Wet Scrubber	50
Packed Tower Scrubber	50
Carbon Adsorption	50

Formula for Calculating Post-Control Emissions:

(Pre-control stack emissions) X (1-control factor) = post-control stack emissions

Example Calculation:

Assumed level of control for a baghouse :95%

Post-control stack emissions = (421,000) X (100% - 95%)
= 21,050 lbs/yr

Estimating Emissions of As, Cd, Ni, Pb

Baghouse dust analyses were used to calculate emissions of cadmium, arsenic, nickel, and lead.
Given the following dust analysis:

	Cd	As	Ni	Pb
Dust	.16%	0.0014%	.012%	4.27%

Formula for Calculating Emissions of Toxic Metals:

PM emissions X Cd Fraction = Cd Emissions

Where:

CF = Conversion Factor 0.0000144 (g/s)/(lb/yr)

MF= Modeling factor (ug/m^3)/(g/s) (CFMF, CSMF, IFMF, or ISMF as appropriate to the facility location and type of emissions).

RF = Risk factor for cadmium, nickel, or lead (risk/million)/(ug/m3)

Example calculations:

Risk due to stack emissions of cadmium =

33.68 lb./yr cadmium X 0.0000144 X 6.49 X 4200 = 13/million risk of contracting cancer due to these emissions

Risk due to fugitive emissions of cadmium =

33.68 lb./yr cadmium X 0.0000144 X 178 X 4200 = 360/million risk of contracting cancer as a result of these emissions

<u>Formula for Calculating Risk Due to Emissions of Arsenic:</u>

Emissions (lb/yr) X CF X MF X RF X MPF = risk per million

Where:

CF = Conversion Factor 0.0000144 (g/s)/(lb/yr)

MF = Modeling factor ug/m^3 per g/s (CFMF, CSMF, IFMF, or ISMF as appropriate to the facility location and type of emissions).

RF = Risk factor for arsenic = 3300 (cancers/million)/(ug/m3)

MPF = Multipathway exposure factor to account for increased exposure due to multiple pathways of exposure = 5.6

Example calculations:

Risk due to stack emissions of arsenic

0.2947 lb./yr arsenic X 0.0000144 X 6.49 X 3300 X 5.6 = 0.5/million risk of contracting cancer due to these emissions

Risk due to fugitive emissions of arsenic

0.2947 lb./yr arsenic X 0.0000144 X 178 X 3300 X 5.6 = 14/million risk of contracting cancer as a result of these emissions

Formula for Calculating Potential Cancer Cases Due to Emissions of Cd, Ni, Pb:

Emissions (lb/yr) X CF X MF X RF = potential cancer cases per million

Where:

CF = Conversion Factor 0.0000144 (g/s)/(lb/yr)

MF= Modeling factor ug/m^3 per g/s (CFMF, CSMF, IFMF, or ISMF as appropriate to the facility location and type of emissions).

RF = Risk factor for cadmium, nickel, or lead (cases/million)/(ug/m3)

Example calculations:

Cases due to stack emissions of cadmium =

33.68 lb./yr cadmium X 0.0000144 X .0131 X 4200 = 0.0267 cases per million persons exposed to these emissions

Cases due to fugitive emissions of cadmium =

33.68 lb./yr cadmium X 0.0000144 X .0191 X 4200 = 0.389/million cases per million people exposed to these emissions

Formula for Calculating Cases Due to Emissions of Arsenic:

Emissions (lb/yr) X CF X MF X RF X MPF = risk per million

Where:

CF = Conversion Factor 0.0000144 (g/s)/(lb/yr)

MF = Modeling factor ug/m^3 per g/s (CFMF, CSMF, IFMF, or ISMF as appropriate to the facility location and type of emissions).

RF = Risk factor for arsenic = 3300 (cancers/million)/(ug/m3)

MPF = Multipathway exposure factor to account for increased exposure due to multiple pathways of exposure = 5.6

Example calculations:

Cases due to stack emissions of arsenic =

0.2947 lb./yr arsenic X 0.0000144 X 0.0131 X 3300 X 5.6 = 10.3 cases per million people exposed to these emissions.

APPENDIX F

COSTS OF COMPLIANCE

TABLE F-1

SAMPLE CALCULATION FOR ESTIMATE OF COMPLIANCE COST
(Lead and Zinc Foundry)

Direct Cost		
Hoods	$ 1,900	Material and Fabrication
Ducts	$ 4,100	Material and Fabrication
Baghouse	$ 19,000	Pulse Jet, 2250 sq.ft. area, 4:1 A/C ratio
Fan/Motor	$ 5,400	40 BHP motor, 65% Eff.,
Stack	$ 2,400	30 feet
Equipment Cost Total	$ 32,800	
Taxes (7.75% of Eq. Cost)	$ 2,500	
Freight (6% of Eq. Cost)	$ 2,000	
Taxes, Freight and Equipment Cost	$ 37,300	
Installation Adder	$ 19,700	(60% of Equipment Cost)
Indirect Cost Adder	$ 3,900	(12% for engineering)
Contingencies	$ 1,000	(3% of Eq. Cost)
Portable Baghouse System	$ 10,000	To control emissions from holding containers
Total Capital Cost	$ 71,900	
Permit fees		
One time evaluation	$ 2,000	
Start up source test	$ 4,000	

APPENDIX G

PROPOSED CONTROL MEASURE FOR METAL MELTING FACILITIES

PROPOSED

AIRBORNE TOXIC CONTROL MEASURE FOR EMISSIONS OF TOXIC METALS FROM NON-FERROUS METAL MELTING

Adopt new section 93107, Title 17, California Code of Regulations to read as follows:

93107 Airborne Toxic Control Measure for Emissions of Toxic Metals from Metal Melting

(a) Definitions. For the purposes of this section, the following definitions shall apply:

(1) "Aluminum and aluminum-based alloys" means any metal that is at least 80% aluminum by weight.

(2) "ARB Test Method 5" means the test method specified in Title 17, California Code of Regulations, section 94105.

(3) "Copper or copper-based alloy" means any metal that is more than 50 percent copper by weight, including but not limited to brass and bronze.

(4) "District" means the air quality management district or air pollution control district with jurisdiction over the facility.

(5) "Dust forming material" means any material containing more than 15 percent by weight of particulate matter less than 0.84 millimeter (mm) equivalent diameter as determined by ASTM C136-84a "Standard Method for Sieve Analysis of Fine and Coarse Aggregates" using a number 20 U. S. Bureau of Standards sieve with 0.84-mm square openings or an alternate method deemed acceptable by the district Air Pollution Control Officer or Executive Officer.

(6) "Emission collection system" means equipment which is installed for the purpose of directing, taking in, confining, and conveying an air contaminant and which conforms to specifications for design and operation given in Industrial Ventilation, Manual of Recommended Practices, 20th edition, 1988, published by the American Conference of Government and Industrial Hygienists, which is incorporated by reference herein.

(7) "Emission point" means any location where molten metal is or can be exposed to air, including but not limited to, furnaces, crucibles, refining kettles, ladles, tap holes, pouring spouts, and slag channels. A mold or die in which metal is cooling is not considered an emission point.

(16) "Non-ferrous metal" means lead, copper, zinc, cadmium, arsenic, aluminum, and their alloys.

(17) "Particulate matter" or "PM" means any solid material, except uncombined water, which exists in a finely divided form at standard conditions of temperature and pressure (293 K and 760 mm mercury).

(18) "Particulate matter control system" means any device or series of devices designed and operated in a manner intended to remove fine particulate matter (< 10 um) from an air or gas stream.

(19) "Person" shall have the same meaning as defined in Health and Safety Code section 39047.

(20) "Process emission control" means any equipment installed and operated to control emissions of toxic metals from any emission point as defined in subsection (a)(7).

(21) "Pure Lead" means any alloy that is at least 90 percent lead and contains no more than 0.001 percent cadmium by weight and 0.001 percent arsenic by weight.

(22) "Ringlemann Chart" means the Ringlemann Chart published in the United States Review of Mine Information Circular No. 1C8333, (May 1967), as specified in Health and Safety Code section 41701(b).

(23) "Scrap" means any metal or metal-containing material that has been discarded or removed from the use for which it was produced or manufactured and which is intended for reprocessing. "Scrap" does not include sprues, gates, risers, foundry returns, and similar material intended for remelting that has been generated at the facility as a consequence of casting but has not been coated or surfaced with any material containing cadmium, arsenic, or nickel.

(24) "Solder" means any metal in which the sum of the lead and the tin is greater than 50 percent by weight and which is used for the purpose of joining two metals or of joining a metal to any other material.

(25) "Type Metal" means any lead-based alloy used for linotype machines.

(B) The temperature of the gas stream entering any particulate matter control device that is part of an emission collection system shall not exceed 360 degrees F. A device to be used for making this measurement shall be maintained at the facility and shall be made available to a district representative upon his or her request.

(C) The owner or operator of the facility shall demonstrate compliance with subsection (b)(2)(A), by conducting an initial source test to verify the 99 percent reduction in particulate matter as determined by means of an emissions test conducted in accordance with ARB Test Method 5. The district Air Pollution Control Officer or Executive Officer may require additional source testing to verify continued compliance or when the process is changed. Particulate matter reduction shall be calculated using the following equation:

$$\left[\frac{\text{Mass in} - \text{Mass out}}{\text{Mass in}}\right] \times 100 = \text{particulate matter reduction}$$

where:

Mass in = Mass of particulate matter at the inlet to the control device

Mass out = Mass of particulate matter at the outlet of the control device

Mass = Sum of filter catch, probe catch, impinger catch, and solvent extract.

(D) Testing Access

The owner or operator of any facility subject to subsection (b)(2) of this regulation shall provide access and sampling ports sufficient to perform testing in accordance with ARB Test Method 5. Ducts and stacks shall have sampling ports so placed as to satisfy minimum requirements for method 5 testing with regard to flow disturbances, or acceptable alternative requirements as approved by the Air Pollution Control Officer or Executive Officer of the district.

(c) Exemptions

(1) Small Quantity Exemptions. Facilities are exempt from subsections (b)(1), (b)(2), and (b)(3) if they meet either of the following conditions:

(A) melt a total of no more than one ton per year of all metals, or

(B) melt no more than the listed quantities of any one of the specific metals listed in Table I.

Table I

Metal	Exemption Limit (tons per year)
Pure Lead	400
Hard Lead	200
Aluminum Scrap	125
Aluminum Ingot containing more than 0.004 percent cadmium or 0.002 percent arsenic	125
Solder	100
Zinc Scrap	30
Copper or copper-based alloys (except scrap) containing more than 0.004 percent cadmium or 0.002 percent arsenic	30
Type Metal (lead for linotype machines)	25

(i) For facilities melting more than one of the metals listed in Table I, eligibility for exemption shall be determined using the following calculation:

For each metal listed in table I, divide the quantity melted by the specific exemption limit listed.

Sum the resulting fractions for all the metals.

If the sum does not exceed 1.0, the facility qualifies for exemption under subsection (c)(1).

(e) Recordkeeping

(1) Facilities subject to subsection (b) shall maintain on site for a period of two years, and make available to a district representative upon request, a record of:

(A) The results of any source testing required by the district to demonstrate that the particulate matter control device(s) are operating as required by subsection (b)(2)(A).

(2) Facilities seeking exemption under subsections (c)(1) or (c)(2) or both shall maintain for two years a record of the amount and type of metal processed in those furnaces including results of analyses as required to support exemption under subsection (c)(2). These records shall be made available to a representative of the district upon request.

(f) Applicable Material Testing Methods.

One of the following methods or an alternate method deemed acceptable by the district Air Pollution Control Officer or Executive Officer and by the Executive Officer of the Air Resources Board shall be used.

Sampling for these methods shall comply with ASTM E 88, "Standard Practice for Sampling Nonferrous Metals and Alloys in Cast Form for Determination of Chemical Composition".

(1) To determine the composition of alloys defined in section (a)(1) and to determine the cadmium content of aluminum alloys to evaluate eligibility for exemption under section (c)(2) one of the following:

(A) ASTM E 227, "Standard Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique";

(B) ASTM E 607, "Standard Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Point-to-Plane Technique, Nitrogen Atmosphere"; or

(C) ASTM E 1251, "Standard Test Method for Optical Emission Spectrometric Analysis of Aluminum and Aluminum Alloys by the Argon Atmosphere, Point-to-Plane, Unipolar Self-Initiating Capacitor Discharge".

ATTACHMENT A

Digestion of Metal Aluminum Sample for Determining As

1. Introduction:

Metal Aluminum cannot react with nitric acid or concentrated sulfuric acid. It can dissolve in dilute sulfuric acid or hydrochloric acid. Active hydrogen, generated during the acid digestion process, will reduce arsenic to AsH_3, which will escape from solution, resulting in a low or negative arsenic value. The proposed method sets up a protocol to dissolve metal alumina without loss of arsenic.

2. Reagent:

3M NaOH , 10% $HgSO_4$ Solution, 30% H_2O_2

1:1 H_2SO_4, Concentrated HNO_3, Tiling Copper.

3. Procedure:

3.1. Dissolve

3.1.1. Dissolve using NaOH (Method 1).

Weigh 0.5g of metal aluminum sample to a 125ml Erlenmeyer flask, add 15ml of 3M NaOH solution, allow to react and dissolve about 20 min. Again add 10ml of 3M NaOH, continue reaction until no gas bubbles are present and the sample is dissolved completely.

3.1.2. Dissolve using $HgSO_4$. (Method 2)

Weigh 0.5g of metal Aluminum sample to a 125ml Erlenmeyer flask, add 10ml of 10% $HgSO_4$ solution and 5ml of 30% H_2O_2. After 20 min, add appropriate amount of $HgSO_4$. Allow reaction to continue until no gas bubbles are present. Add metal copper strips (large surface area) into the sample solution. After 10 min, withdraw the copper strips and add new copper strips. Repeat until the surface of copper strips in sample solution do not change to a silver color. Withdraw all copper strips from sample solution.

3.2. Digestion:

Add 3ml of concentrated HNO_3, 5ml of 1:1 H_2SO_4 into the sample solution obtained from 3.1.1 or 3.1.2. Heat slowly and evaporate the sample solution until SO_3 fumes are present for 5min. Cool and dilute the sample to 50.0ml.

Determined As by Atomic Absorption method.

APPENDIX H

TEST METHODS