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PRIMARY AND SECONDARY LEAD SMELTERS AND LEAD-ACID BATTERY PLANTS

EPA 455/R-92-001

COMPLIANCE INSPECTION AND ASSISTANCE DOCUMENT: PRIMARY AND SECONDARY LEAD SMELTERS AND LEAD-ACID BATTERY PLANTS

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OPERATION AND MAINTENANCE PRACTICES AND GUIDANCE PRODUCTION FOR PRIMARY, SECONDARY LEAD SMELTERS AND LEAD-ACID BATTERY PLANTS

FINAL REPORT

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PREFACE

The 1977 amendments to the Clean Air Act of 1970 added lead to the list of criteria pollutants and established the primary and secondary NAAQS for lead as 1.5 micrograms per cubic meter ($\mu g/m^3$) averaged over a calendar quarter. On July 1, 1987, EPA promulgated a PM-10 specifies a 24-hour primary and secondary standard of 150 $\mu g/m^3$ and an annual primary and secondary standard of 50 $\mu g/m^3$ (calculated as an annual arithmetic mean). The lead standard still remained, now determined from the PM-10 filter. To attain and subsequently maintain the NAAQS for PM-10, each State is required to adopt and submit to EPA a plan (State Implementation Plan) providing for the implementation, maintenance, and enforcement of the standards over the entire State. Each SIP includes a major portion devoted to emission limitations and other regulations and programs to prohibit stationary sources from "emitting any air pollutant (point or fugitive) in amounts which will prevent attainment with the NAAQS or interface with measures to prevent significant deterioration of air quality." Thus, each State directs its control regulations towards its unique set of sources and circumstances as long as the end result will be attainment of the NAAQS within the required time frame.

A principal feature of the nonattainment provisions enacted in the Clean Air Act Amendments of 1977 was strengthening the permit program by requiring existing sources to install reasonably available control technology (RACT) in an effort to minimize emissions to maintain the NAAQS. That requirement is generally applicable to "major sources," i.e., those with potential to emit 100 tons per year (tons/yr) or more. The four source categories with significant nationwide emissions of lead are secondary lead smelters, gray iron foundries, primary lead smelters, and lead-acid storage battery manufacturers. In order to attain the NAAQS, further reduction in lead emissions must be obtained from both their point and fugitive source emissions within these facilities. To date, point source lead emissions have been controlled through new source performance standards (NSPS); however, fugitive lead emissions can greatly exceed point source emissions, thus further lead emission reductions are tied to the control of fugitive emissions, coupled with continued control of point emissions, through a strong permitting program. To that end, the Clean Air Act Amendment of 1990 added an entirely new permitting program. The 1990 Amendments incorporates the RACT requirements of 1977 and best available control technology (BACT) standards through source emission control programs.

On May 10, 1991, EPA published proposed rules implementing these new permit requirements, including RACT permits. This Technical Assistance Document is not intended to provide guidance directly associated with this rulemaking activity. Nevertheless, it was prepared as a tool for use by State and local agencies in developing and implementing continuous compliance monitoring requirements and oversight programs as the RACT permit program is carried out.

The objective of this Technical Assistance Document (TAD) is to provide guidance to State/local permit writers on implementation of a source emission minimization program (SEMP) as part of the Agency RACT/BACT permit program, involving operation and maintenance (O&M) procedures for point and fugitive emission control, "baselining" source emissions, and proper recordkeeping and reporting practices. The development of an SEMP ensures continued compliance of lead emission standards after initial compliance as part of the Agency's continuous compliance program.

Specifically, the TAD identifies permit requirements for proper O&M procedures for both process and fugitive control systems and defines operating parameters of control equipment and programs such as vehicular usage on paved/unpaved roads, pH for scrubber systems, pressure drop for baghouses, and visual observations for opacity for area sources as indicators of proper plant O&M practices. Where applicable, "baseline" technology is incorporated into the TAD to define specific relationships between initial facility control program performance operating in compliance with continued emission levels. Incorporating these requirements in future RACT/BACT permit regulations will enable the Agency to detect shifts in source emission control programs and control equipment operating parameters as early signs of their performance deterioration as part of the Agency "continuous compliance" strategy in maintaining the lead NAAQS.

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1.0 INTRODUCTION

1.1 SOURCES AND CONCENTRATION

Lead and its compounds enter the atmosphere from industrial activities and combustion of fuels, especially leaded gasoline.

Lead emission sources can be categorized into three groups:

1. Combustion sources, which emit lead by volatilization of fuels and refuse;

2. Metallurgical sources through volatilization or mechanical action from smelting and processing of metallic ores and materials; and

3. Manufacturing sources to produce a lead containing product.

By far, the major sources of lead emissions have been associated with production of lead ackyl and storage batteries and primary and secondary lead smelting operations. Tables 1-1, 1-2, and 1-3 document the locations of primary, secondary and lead-acid battery manufacturing facilities in the United States, respectively. Table 1-4 documents the location of the facilities with EPA regions.

Whether the lead emissions are volatiles or particles depends upon their origin and mechanism of formation. Smelting operations usually provide submicron particles, while material handling and mechanical attrition, as in battery manufacturing, consist of larger dust particles. The main chemical forms of lead emission include elemental lead (Pb), oxide of lead (PbO, PbO_2, PB_2O_3, etc.), lead sulfates and sulfides ($PbSO_4$, PbS) alkyl lead [$Pb(CH_3)_4$, $Pb(C_2H_5)_4$], and lead halides. Some or all of these forms of lead emissions occur at primary, secondary and lead-acid battery manufacturing facilities.

Recent EPA data has shown a substantial decrease in lead emissions, from both point source and transportation, as recorded in Figure 1-1. A major drop in lead emissions occurred between 1978 and 1981, as the effects of increased use of unleaded gasoline in catalyst-equipped cars and the reduction of lead content in leaded gasoline was observed. From 1983 to 1987,

TABLE 1-1. PRIMARY LEAD SMELTING FACILITIES

Facility	Location
St. Joe	Herculaneum, MO
AMAX - Homestake	Boss, MO
ASARCO	East Helena, MT Glover, MO Omaha, NE

TABLE 1-2. SECONDARY LEAD SMELTING FACILITIES

Facility	Location
<u>Region II</u>	
RSR	Middletown, NY
Roth Brothers	Syracuse, NY
<u>Region III</u>	
East Penn	Lyons Station, PA
Exide (General Battery)	Reading, PA
Master Metals	Cleveland, OH
<u>Region IV</u>	
Chloride Metals	Tampa, FL
General Smelting and Refining	College Grove, TN
Interstate Lead Co. (ILCo)	Leeds, AL
Pacific Chloride Metals	Columbus, GA
Refined Metals	Rossville, TN
Ross Metals	Rossville, TN
Sanders Lead	Troy, AL
Schuylkill Metals	Baton Rouge, LA
<u>Region V</u>	
Gopher	Eagan, MN
RSR-Quemetco	Indianapolis, IN
<u>Region VI</u>	
Exide (Dixie Metals)	Dallas, TX
GNB	Frisco, TX
RSR	Dallas, TX
<u>Region VII</u>	
Schuylkill Metals	Mound City, MD
<u>Region IX</u>	
Alco Pacific	Gardena, CA
GNB	Los Angeles, CA
RSR-Quemetco	City of Industry, CA

TABLE 1-3. LEAD-ACID BATTERY MANUFACTURING FACILITIES

Facility	Location
Battery Builders, Incorporated	Naperville, IL
C&D Power Systems, Incorporated	Conyers, GA Hugeunot, NY Leola, PA
Douglas Battery Manufacturing Company	Winston-Salem, NC
East Penn Manufacturing Company	Lyon Station, PA
Exide Corporation	City of Industry, CA Visalia, CA Logansport, IN Burlington, IA Manchester, IA Salina, KS Allentown, PA Muhlenberg/Laureldable, PA Greer, SC Sumter, SC
Gates Energy Products, Incorporated	Warrensburg, MO
GNB Incorporated	Fort Smith, AR Columbus, GA
Johnson Controls, Incorporated	Middletown, DE Tampa, FL St. Joseph, MO Winston-Salem, NC Holland, OH Milwaukee, WI
Trojan Battery Company	Santa Fe Springs, CA Lithonia, GA
U. S. Battery Manufacturing Company	Evans, GA
West Kentucky Battery Incorporated	Benton, KY

TABLE 1-4. NUMBER AND PERCENTAGE OF PRIMARY, SECONDARY AND LEAD-ACID BATTERY MANUFACTURING FACILITIES IN EPA REGIONS

	Process					
	Primary lead smelters,		Secondary lead smelters,		Lead-acid battery,	
EPA Region	#	%	#	%	#	%
I						
II			2	8.7	1	3.2
III			2	8.7	8	25.8
IV			7	30.4	10	32.2
V			4	17.4	3	9.7
VI			4	17.4	1	3.2
VII	4	80	1	4.3	5	16.1
VIII	1	20				
IX			3	13.0	3	9.7
X						
Total	5		23		31	

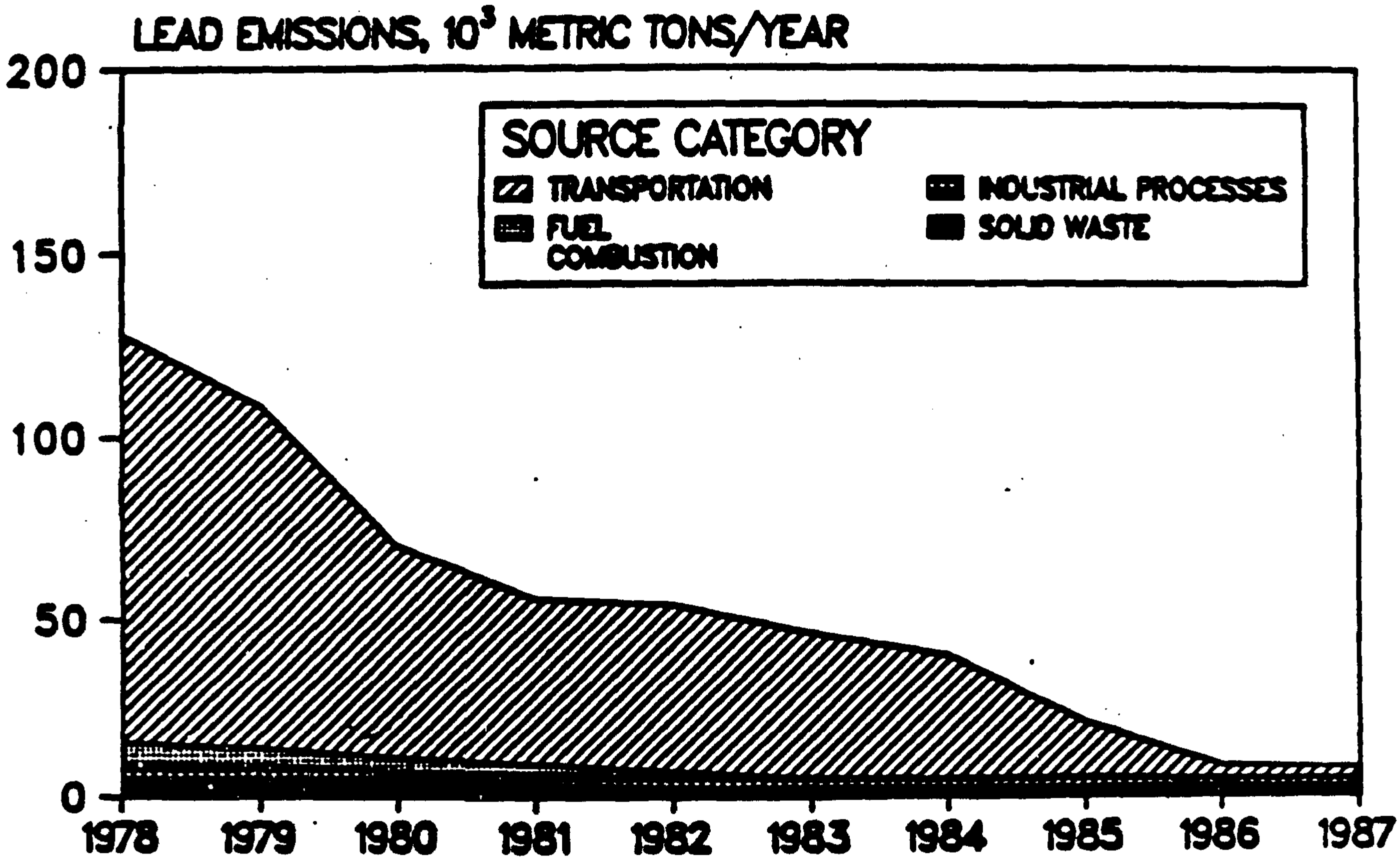

Figure 1-1. National trend in lead emissions, 1978-1987.

there was a 71 percent decrease of total lead emissions during this 5-year period. As expected, ambient concentrations of lead decreased during this same time period, as illustrated in Figure 1-2. For example, during the period 1980 to 1986, the maximum quarterly averages for ambient lead for all monitoring stations dropped from 0.91 to 0.26 $\mu g/m^3$, and annual averages for ambient lead concentrations fell from 0.64 to 0.17 $\mu g/m^3$. Much of this reduction was due to the decrease in the use of leaded gasolines. To achieve further reductions in lead emissions, other sources must be targeted.

Although total nationwide lead emissions have been reduced, exceedances of the lead NAAQS often occur. In 1989, 18 of 530 lead monitors included in the Aerometric Information Retrieval System (AIRS) data base recorded at least one exceedance of the 1.5 $\mu g/m^3$ standard. However, this fraction of exceedances is likely to be an underestimation of the magnitude of the problem. Many of the major lead-emitting industries do not have fenceline monitors to record NAAQS exceedances. For example, of the 26 operating primary and secondary lead smelters, only 12 have fenceline monitors for which data are recorded in the AIRS database. Of these 12 lead smelters, 11 reported at least one exceedance during the period 1987 to 1989.

In order to attain the lead NAAQS at the fencelines of a number of facilities, further emission reductions may be possibly only through the control of fugitive emissions with continued control of source emissions. Furthermore, because fugitive emissions are typically emitted closer to ground level than stack emissions, fugitives can have a much greater impact on ambient concentrations at the fenceline. In many cases, however, the magnitude of fugitive emissions is unknown.

1.2 REGULATORY MANDATE FOR STRENGTHENING SOURCE PERMIT

The Clean Air Act Amendments of 1977 specified lead as a criteria pollutant, for which a primary and secondary NAAQS was established at 1.5 micrograms per cubic meter ($\mu g/m^3$) averaged over a calendar quarter at the industry fenceline. During that regulatory period, major lead emissions were from automobiles

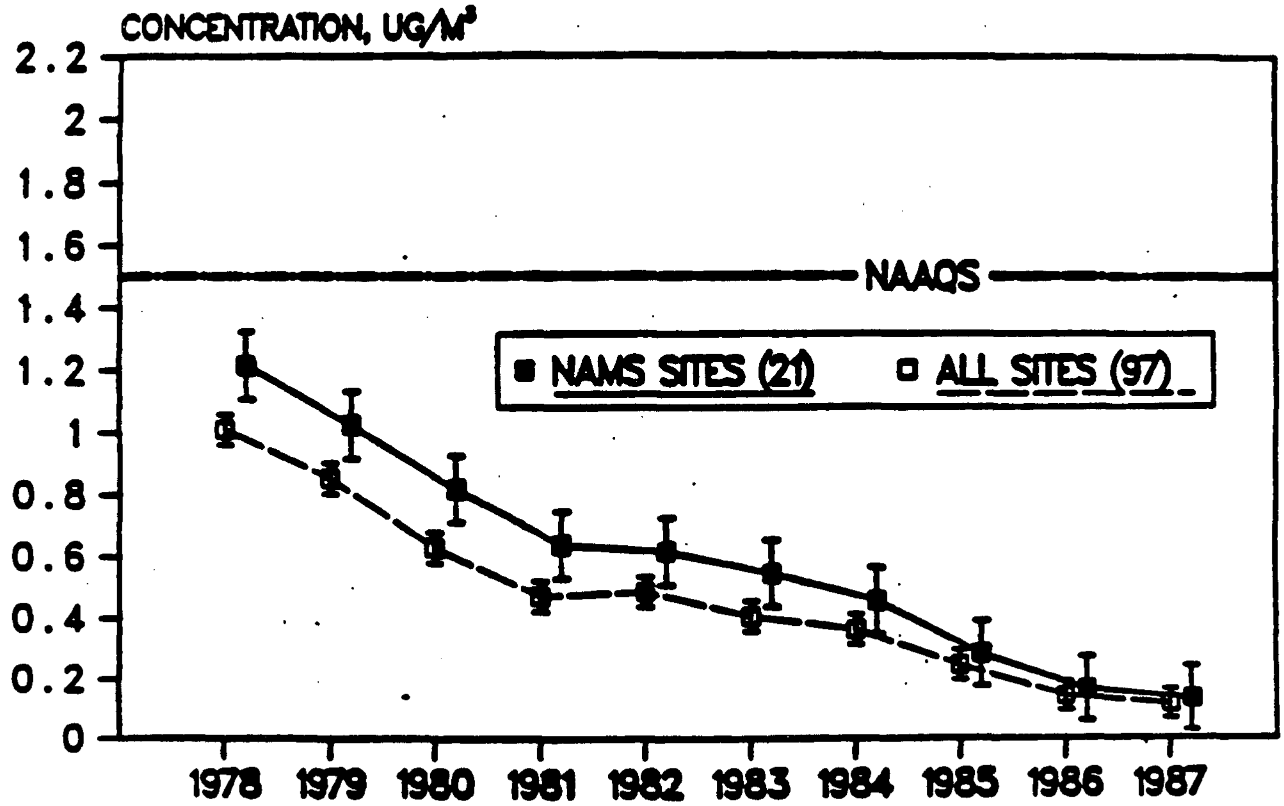

Figure 1-2. National trend in the composite average of the maximum quarterly average lead concentration at 118 sites with 95 percent confidence intervals, 1978-1987.

using leaded gasoline and point sources. However, a review of the AIRS data base indicates that the automobile is no longer the primary source of lead in the urban air. Major lead-emitting industries, involving both point and fugitive sources, have recorded exceedances of the NAAQS at the fenceline within the last 3 years.

A principal feature of the nonattainment provisions enacted in the Amendments of 1977 was a requirement that existing sources must install reasonably available control technology (RACT) in an effort to minimize emissions to maintain the NAAQS. That requirement is generally applicable to "major sources," i.e., those with potential to emit 100 tons per year (tons/yr) or more. The four source categories with significant nationwide emissions of lead are secondary lead smelters, gray iron foundries, primary lead smelters, and lead-acid storage battery manufacturers. As part of the Amendments of 1977, EPA controlled point sources emissions from secondary, primary and lead-acid battery manufacturing facilities through NSPS, as outlined in Table 1-5. While lead was not specified as a part of the regulations, it was believed that controlling mass emissions would reduce lead emissions.

Historically, control of lead emissions from point sources have been achieved through the use of high-efficiency fine particulate controls such as electrostatic precipitators (ESP's), fabric filters, and wet scrubbers. Few processes incorporate control devices specifically for lead control, but to comply with State or Federal particulate emission limits. For fugitive emissions control, the Agency has required source specific fugitive emission control program involving vacuuming, watering and surface improvements, enclosures of storage piles, and ventilation engineering, to name only a few control options.

Another objective of the 1977 Amendments to the CAA was to improve air quality standards through "best available control technology (BACT)" and "lowest achievable emission rates (LAER)." A major purpose of these amendments was to provide additional and stronger thrust in the direction of the prevention of significant

TABLE 1-5. NEW SOURCE PERFORMANCE STANDARDS (NSPS)

Subpart	Source category	Year of promulgation	Affected unit	Pollutant	Emission units	Compliance federal reference methods (RM)
L	Secondary lead smelters	1974	Blast or recovery furnace	Particulate matter Opacity	50 mg/dscm (0.022 gr/dscf) 20%	RM 5 RM 9
	Pot furnace		Pot furnace	Opacity	10%	RM 9
R	Primary lead smelters	1976	Blast/dross furnace or sintering machine	Particulate matter Opacity	50 mg/dscm (0.022 gr dscf) 20%	RM 5 RM 9
			Sintering machine, electric smelting furnace or converter gases	Sulfur dioxide	0.065% by volume	Continuous emission monitor (CEM)
KK	Lead-acid battery manufacturing plants	1982	Grid casting	Gases containing lead	0.40 mg/dscm (0.000176 gr/dscf)	RM 12
				Opacity	0%	RM 9
			Pastemaking	Gases containing lead	1.00 mg/dscm (0.00044 gr dscf)	RM 12
				Opacity	0%	RM 9
			Three processes	Gases containing lead	1.00 mg/dscm (0.00044 gr dscf)	RM 12
				Opacity	0%	RM 9
			Lead oxide manufacturing	Gases containing lead	5.00 mg/kg lead feed (0.010 lb ton)	RM 12
				Opacity	0%	RM 9
			Lead reclaiming	Gases containing lead	4.50 mg/dscm (0.00198 gr/dscf)	RM 12
				Opacity	5%	RM 9
			Other	Gases containing lead	1.00 mg/dscm (0.00044 gr/dscf)	RM 12
				Opacity	0%	RM 9

deterioration (PSD) for area which had attained the standards, and to improve the air quality in nonattainment areas where the pollutant concentrations exceeded the standards. There was a general shift from implementation to planning. Under the prior legislation the major emphasis was on controlling obvious and major sources of air pollution. The newer philosophy was that a broader attack on the problem was needed. More importantly, change were introduced into the SIP procedures, and all SIP's require revision to accommodate these changes. For example, an acceptable SIP must now include a permit program for enforcement of the new PSD and nonattainment provisions, now part of the Act itself rather than part of the regulatory framework.

As part of the 1977 CAA Amendments, the Federal government was given the added responsibility of reviewing all permits for major sources constructing in PSD and nonattainment areas. Federal review applied to:

1. The PSD areas for any source have a potential emission greater than 250 tons per year or 100 tons per year for 28 specified sources; and

2. Nonattainment areas for any source which has a greater potential emission than 100 tons/yr.

The permit, therefore, became an integral part of an Agency enforcement program. It provided the vehicle by which Agency emission control objectives were implemented and enforced. The permit provided:

1. Engineering review prior to construction so any necessary changes in emission control systems could be incorporated;

2. Notification if proposed facility could not comply with emission limitations, then agency could prevent construction;

3. Mechanism for requiring implementation of a source emission minimization program (SEMP) to insure continued performance of emission control (point and fugitive) program;

4. Deny operating permit if source does not meet compliance limitations;

5. A format for notification of source modification; and

6. Provided a "document" in which all conditions/ specifications to operate under a emission reduction program are stated.

The Clean Air Act Amendments of 1990 further strengthened the permit system by incorporating the RACT requirements of 1977 and implementation of BACT standards through emission control programs for both point and fugitive sources.

2.0 LEAD EMISSION SOURCES

2.1 INTRODUCTION

Lead emission sources can be divided into two broad categories--process (point/equipment) fugitive emission sources and nonprocess, or open, fugitive dust emission sources, as illustrated in Figure 2-1. Process fugitive emissions sources include emissions from mechanical and metallurgical operations that alter the physical or chemical characteristics of the feed materials. Open fugitive dust emission sources relate to the transfer, storage, and handling of materials and include those sources from which particles are entrained by the forces of wind or machinery acting on exposed materials. Following is a general discussion of the various types of fugitive emission sources at lead manufacturing facilities.

2.2 INDUSTRY SPECIFIC POINT EMISSION SOURCES

2.2.1 Primary Lead Smelting

Lead is usually found naturally as a sulfide ore (Galena-PBS) containing small amounts of copper, iron, zinc and other trace elements. At the mine, the naturally occurring Galena containing 3 to 8 percent lead is concentrated to 55 to 70 percent lead, also containing 13 to 19 percent by weight of free and uncombined sulfur. The main objective of the primary lead smelting process is to separate the lead from its impurities to produce lead pigs and ingots. The smelting process involves four distinct operations, as outlined in Figure 2-2. They are: sintering, reduction, drossing, and refining. Point source emissions are associated with each phase of the primary lead smelting process, as indicated in Figure 2-2.

The primary purpose of the sintering process is to prepare the lead ore for the reduction process in the blast furnace. In the sintering process the ore is roasted (see Figure 2-3) to remove the sulfur and form a strong porous mass (clinker) that is suitable for the blast furnace smelting. Chemically, the lead sulfide is converted to lead oxide and sulfur oxide. Additionally, sintering converts metallic sulfides to oxides,

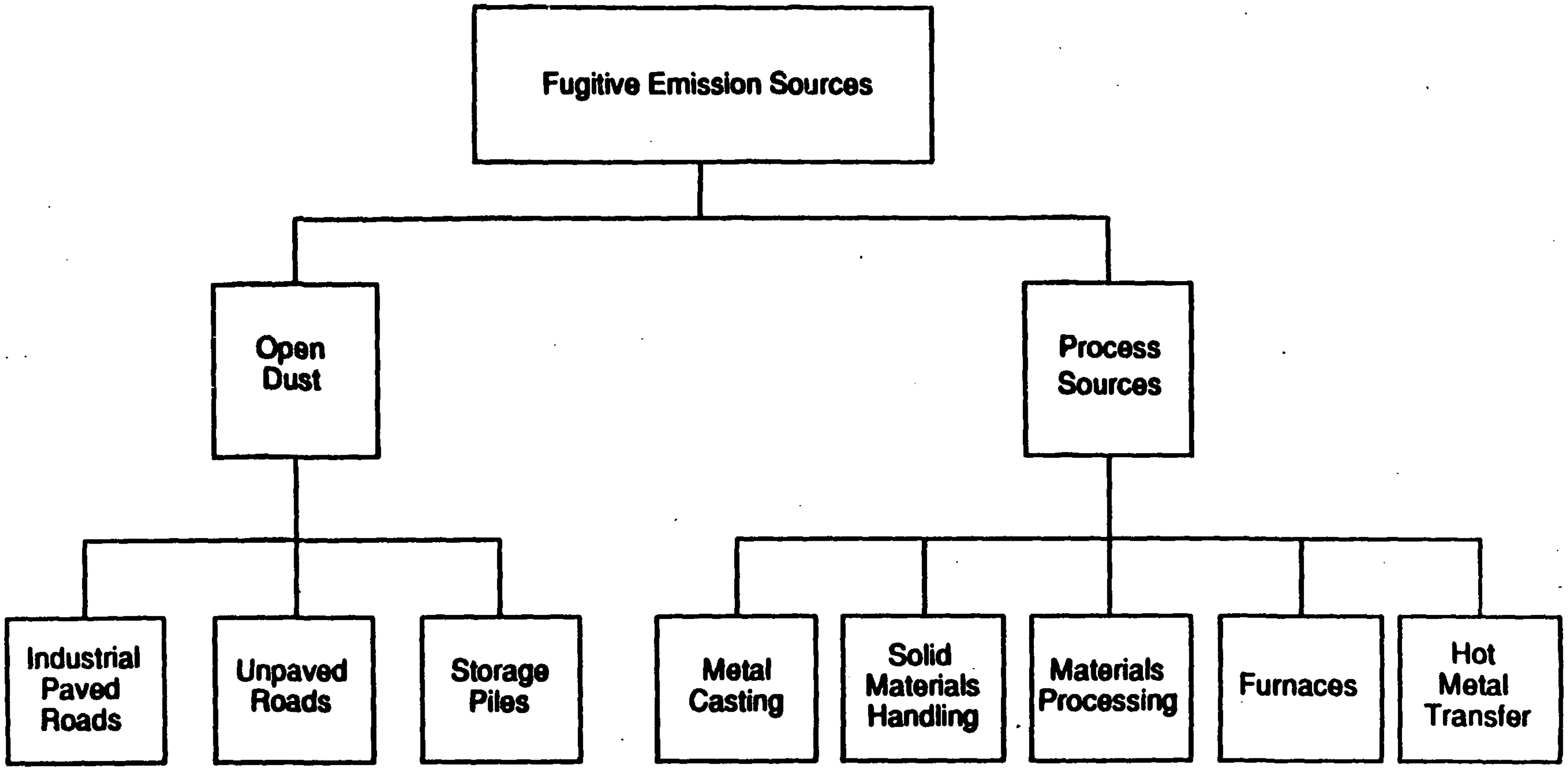

Figure 2-1. Fugitive emission sources.

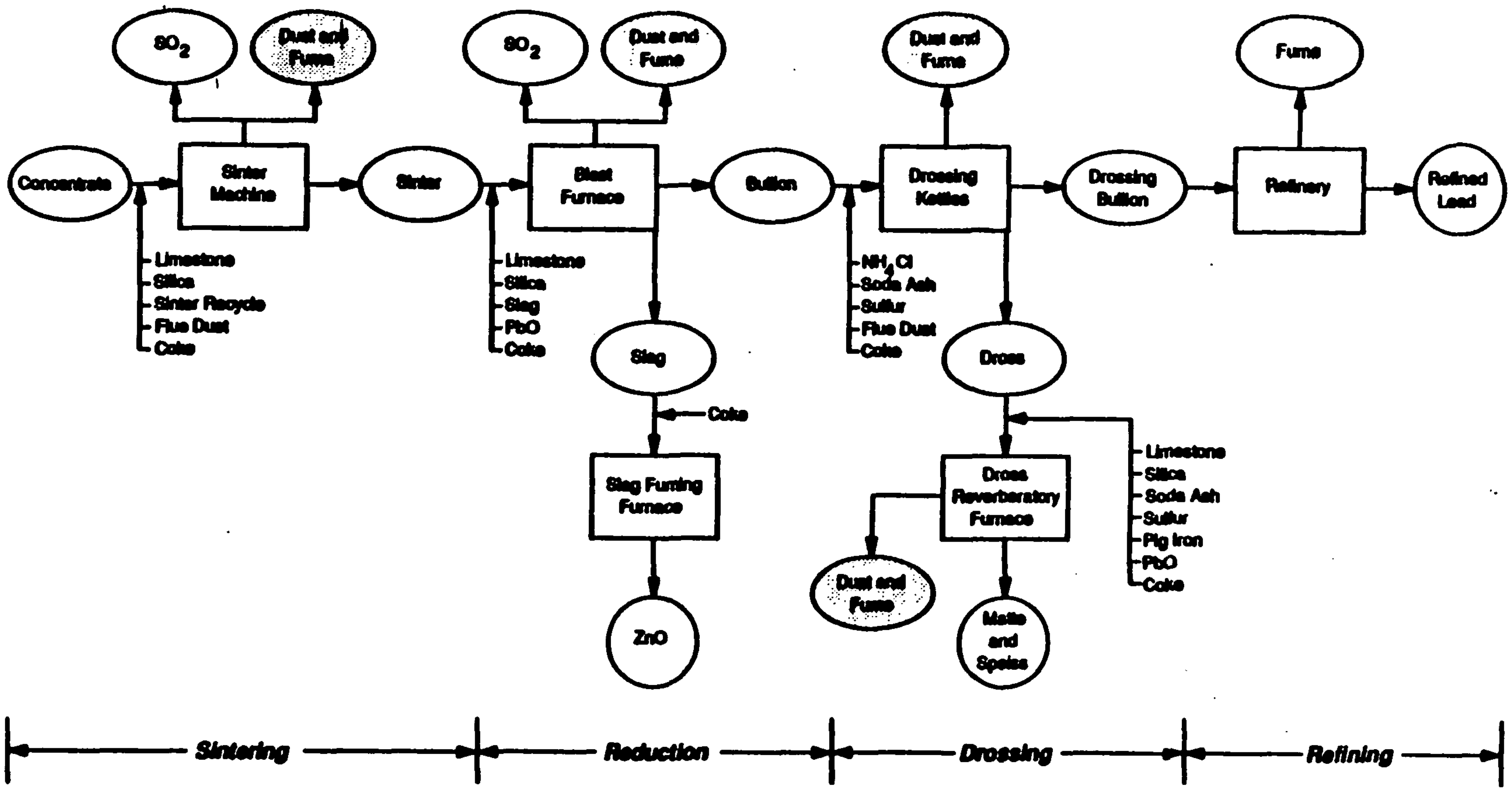

Figure 2-2. Typical primary lead processing scheme.

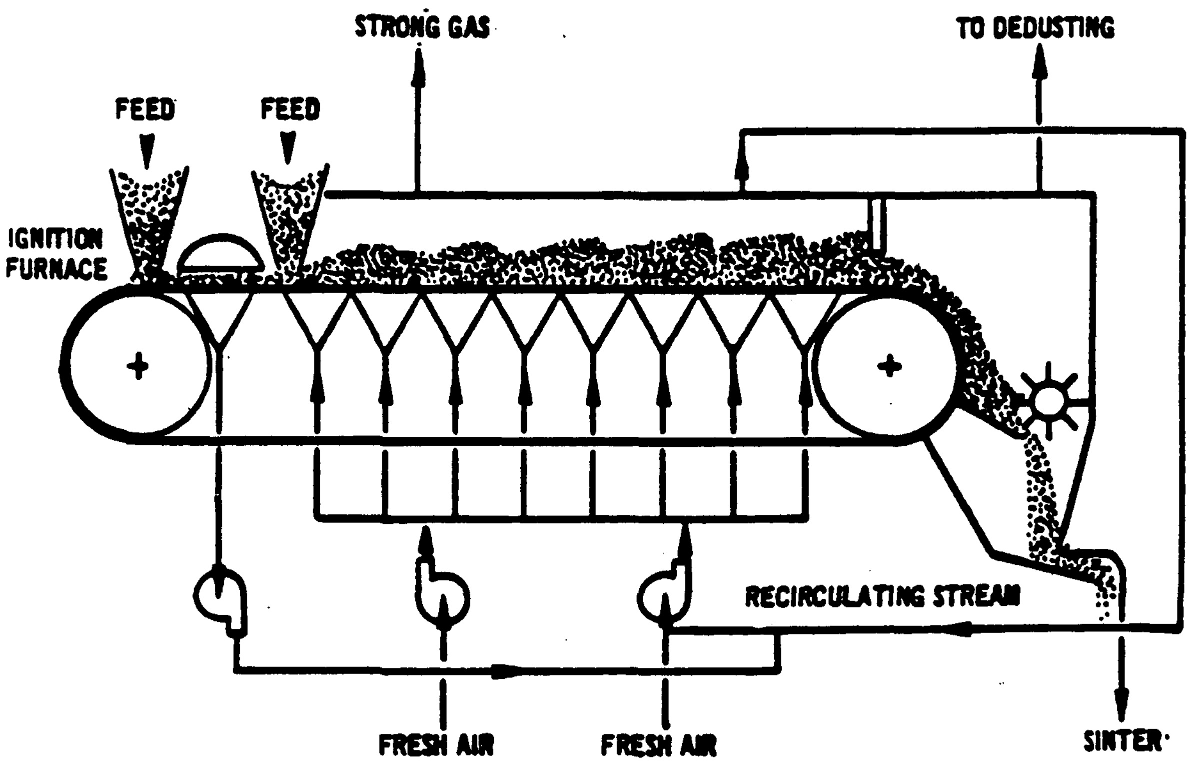

Figure 2-3. Sintering process.

removing contaminants such as arsenic and antimony. In operation, the lead ore concentrate, recycled sinter and smelting residues are combined with adequate sulfide-free flukes to maintain a sulfur content of 5 to 7 percent by weight. The charged materials are fed in controlled amounts onto a common belt conveyor where they are crushed, moistened and pelletized.

These materials are then split into an ignition portion (10 percent of total) and a main feed portion (the remaining 90 percent) and fed into the sinter machine. As the feed material moves through the machine, it burns, fuses and cools before dropping off as a cake at the discharge end of the machine. The sinter then drops through a grating and is crushed and screened. The large fraction is conveyed to bins prior to the reduction process.

In the reduction process, the blast furnace reduces the lead oxide to metallic lead utilizing high pressure combustion air, introduced near the bottom of the water-jacketed shaft furnace. The charge to the blast furnace consists of coke (8 to 14 percent of the charge), sinter (80 to 90 percent of the charge), and other materials such as limestone, silica and recycled materials to maintain the temperature below 1400°F in preventing volatilization of the metals. The charge is introduced to the top of the furnace by means of either conveyors or dumping from charge cars. During the melting process, the charge may separate into as many as four layers in the blast furnace. From lightest to heaviest, the layers are: slag, speiss, matte and lead metal. Impurities are partitioned between the matte (copper sulfide and other metal sulfides), speiss (arsenic and antimony), and the slag (silicates). The slag is removed periodically and conveyed hot to a fuming furnace for recovery of lead and zinc. Some slag may be granulated and recycled to sintering. The lead bullion (heaviest) is tapped and goes to the refining process. The matte and speiss go to the dross furnace for further lead recovery.

The tapped lead bullion is transferred by overhead crane in a 10- to 20-Mg ladle to the drossing process, where the molten lead is cooled to 370°F. At this temperature, additional impurities of copper, sulfur, arsenic, antimony and nickel collect at the surface as a dross, which is removed for further refinement and recovery of lead.

Finally, the purified lead bullion is refined in a series of iron casting kettles that, typically, are heated with gas-fired burners. Final removal of impurities (antimony, tin, arsenic, zinc, and bismuth) provides a final product of refined lead, commonly 99.990 to 99.999 percent pure, that is casted and readied for shipment.

2.2.2 Secondary Lead Smelting

Secondary lead smelting begins with lead-bearing materials including scrap batteries, battery plant scrap, lead sheathes cast and high lead content scrap. The principal function of the secondary lead industry is reclamation of the lead from lead-bearing scrap metal. The product of secondary smelting include semisoft lead (few impurities), hard or antimonial lead, and soft lead bullion. These products are used to make battery plates, lead oxide, and a variety of miscellaneous items (solder, pigment, etc.).

Typical secondary lead smelting and refining scheme involves four distinct processes, as illustrated in Figure 2-4. They are: scrap receiving and preparation, smelting, refining and casting. Similar to the primary lead smelting process, point source emissions are associated with each distinct area, as illustrated in Figure 2-4. Because the final product from each secondary lead smelter may vary, there are differences within each of the distinct processes between facilities. Major factors that affect the plant's specific configuration include scrap sources, intermediate and final products, and type of smelting furnace. Since batteries constitute nearly 84 percent by weight of starting materials in the secondary lead smelting operation, the description of the process will involve lead batteries as the starting material.

Batteries are received at the facility either by truck or rail, unloaded and stored temporarily in a receiving area. Prior to smelting, the acid in the batteries is drained. Most plants

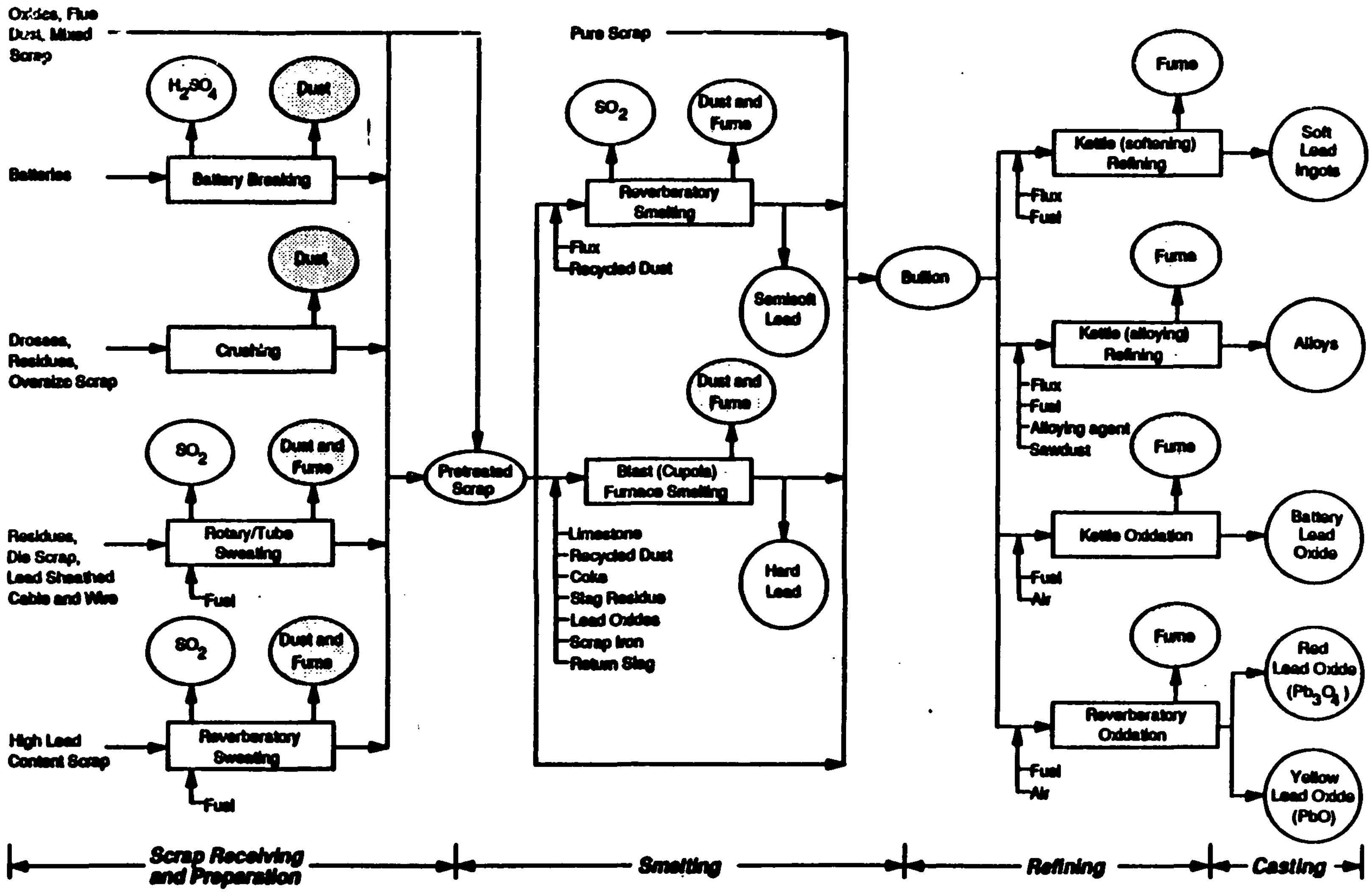

Figure 2-4. Typical secondary lead smelting and refining scheme.

break or saw scrap batteries to remove the battery covers for recycling and retrieve the battery acid. This operation is usually accomplished through an automatic feed conveyor systems and a slow-speed saw. To separate the plastic covers from the lead terminals, lead oxide paste and ribbon, a float/sink separation system is usually employed. The crushed plastic is recovered for recycling and the rubber cases are landfilled.

The lead content of the batteries consisting of the lead oxide paste (60 percent) and lead alloy plates (40 percent) is transferred to the charge storing and preparation area where it is combined with other materials prior to the smelting operation. Other lead-bearing materials charged to the smelting furnace are slags from the smelting furnace, drosses from the refining kettles, and flue dust collected by the facilities' air pollution control systems. Other charge materials include coke, which is used as a heat source and reducing agent, and limestone, sand, and scrap iron which are used as fluxing agents.

Secondary lead smelters employ one of four types of smelting furnaces for refining the lead. The four types of configuration are blast furnace, blast furnace/reverberatory furnace combination, reverberatory furnace and a rotary furnace. The source of lead in the scrap and the purity of lead to be produced determine the smelting operation. For the production of hard lead (containing 12 percent antimony and 3 percent arsenic), the blast furnace is utilized in the smelting process. For the production of semisoft lead (0.3 percent antimony and 0.05 percent arsenic), the reverberatory or rotary furnace is utilized. In the reverberatory furnace, the charge material is heated by radiation from the flame and from the furnace walls to temperatures up to 1260°C (2300°F); consequently, reverberatory furnaces provide purer lead than blast furnaces. As the molten metal rises in the furnace, it is tapped into molds for distribution or for further refinement.

Refining and alloying are done in pot furnaces (refining kettles). The process is a batch operation and may take from a few hours to 2 to 3 days, depending upon the degree of purity or alloy type required. Refining kettles are gas- or oil-fired with typical capacities of 23 to 136 Mg (25 to 150 tons) lead. Refining and alloying activities are conducted at temperatures ranging from 320° to 700°C (600° to 1300°F).

Following the final refining step, a sample of the refined metal is collected and the alloying specifications are verified by chemical analysis. When the desired composition is reached, the molten metal is pumped from the kettle into the casting machine and cast into lead ingots, rectangular bars that weigh approximately 25 kg (56 lb) each.

2.2.3 Lead-Acid Battery Manufacturing

The production of lead-acid batteries consists of four main steps, as illustrated in Figure 2-5. The four main steps are: grid casting, paste mixing, three-process operation and formation. Point sources lead emissions are associated with each of these steps. As part of the grid casting process, lead alloy ingots are melting in an electric or gas-fired pot and then poured into molds. Grids can be cast in pairs or on a continuous casting machine. Once the grids have solidified they are ejected from the molds, trimmed and stacked.

The paste that is applied to the grids is composed of lead oxide, water and sulfuric acid mixed in a batch process. To make a negatively charged paste, expander is added. For positive paste, no expander is used and the paste contains slightly more sulfuric acid and less water. After mixing , the paste is applied to the grids, flash dried, stacked and cured. Lead oxide is received at the manufacturers in ingots. The ingots are tumbled in a ball mill process to produce metallic lead particles. Lead oxide dust and unoxidized lead particles are drawn off by a circulating air stream from the ball mill and are further ground in a hammermill. The lead oxide and metallic lead particles are then stored in bins.

Formation of the lead battery in the three-process operation consists of plate stacking, burning and assembling of elements in the battery case. Plates are first stacked in alternating positive and negative order, and separated by insulators.

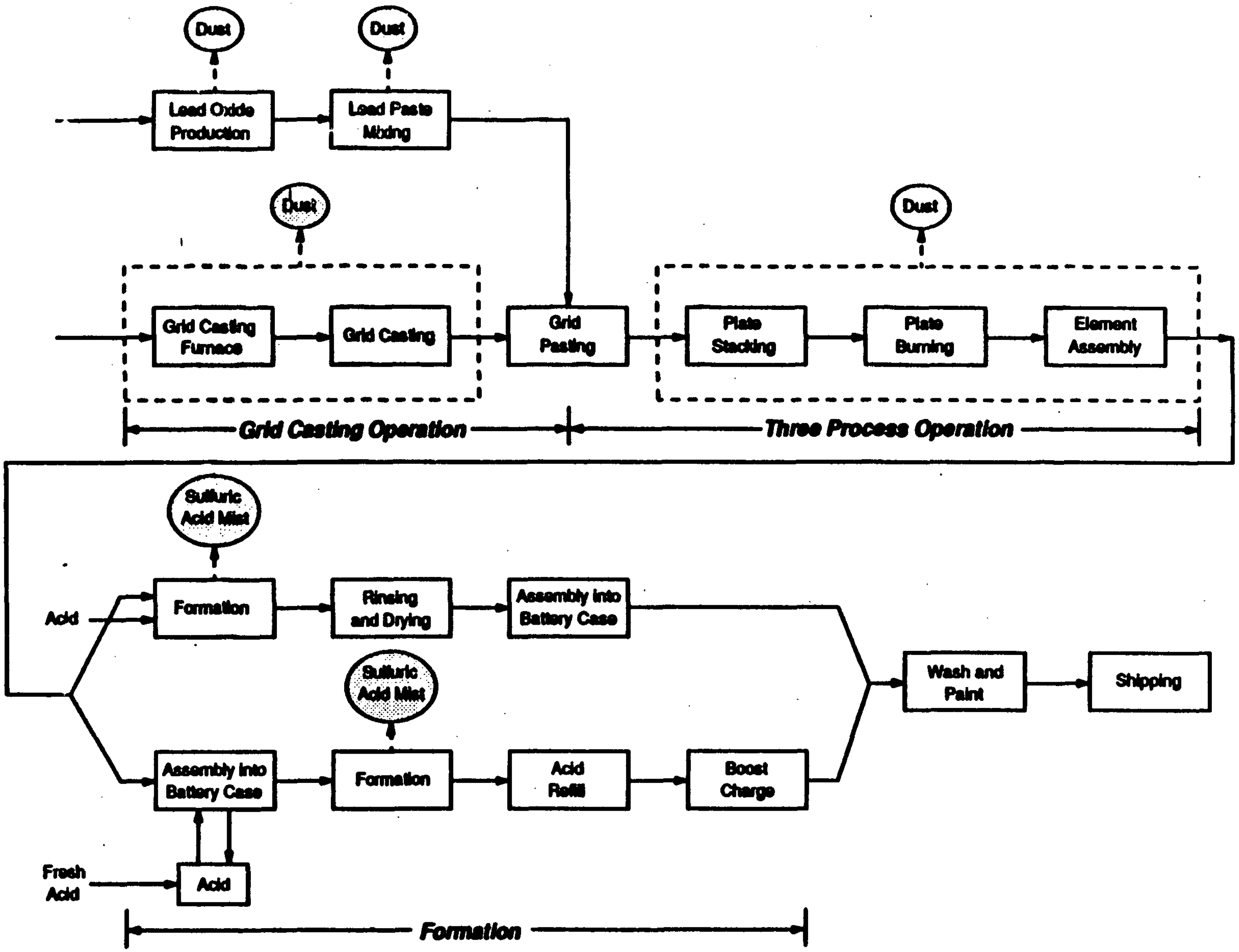

Figure 2-5. Process flow diagram for storage battery production.

Burning consists of connecting the plates by welding leads to the tabs of each positive and negative plate. The completed elements are then assembled in the battery cases either before formation ("wet" formation) or after formation ("dry" formation). An alternative to this operation is the "cast-on-strap" process in which molten lead is poured around the plates and tabs to form the connection.

The formation process chemically converts the inactive lead oxide-sulfate paste into an active electrode. The unformed plates are placed in a dilute sulfuric acid solution, the positive plates are connected to the positive pole of a direct current (dc) source, and the negative plates are connected to the negative pole of the dc source. The formation process may be wet or dry. In the wet formation process, the elements are assembled in the case before forming. In the dry process, the elements are formed in a tank of sulfuric acid and then assembled in the case.

2.3 OPEN DUST FUGITIVE EMISSIONS

Open dust fugitive sources include paved and unpaved traffic areas and storage piles. Particulate emissions are released from these sources when previously deposited material is reentrained by vehicle traffic, by the loading and unloading equipment, or by the action of the wind. For most industrial plants, paved and unpaved roads are the primary sources of open dust fugitive emissions. Fugitive dust emissions from storage pile materials handling operations are usually insignificant in comparison to road sources, unless the moisture content of the storage pile materials is extremely low. Emissions from wind erosion of storage piles are likewise insignificant unless wind speeds are unusually high.

2.3.1 Industrial Paved Roads

Open dust fugitive emissions from paved roads depend upon the loose surface material and traffic characteristics of the road. These emissions have been determined to vary directly in proportion to the surface material loading and silt content of the road. The surface material loading is the amount of loose dust on the road surface and is measured in units of mass of material per unit area. (Surface material loading for a specific road is typically expressed in units of mass per unit length of road, however.) The silt content is the percentage of silt (i.e., particles less than or equal to 75 microns in diameter) in the loose surface dust. Other factors that affect industrial paved road fugitive emissions include the volume of traffic, number of traffic lanes, average vehicle weight, and the degree to which vehicles travel in nearby unpaved areas (thereby allowing more dust to be deposited on the paved road). This last factor is known as the industrial augmentation factor and ranges in value from 1.0 to 7.0. Higher values indicate greater fugitive dust emissions. The magnitude of fugitive lead emissions is directly proportional to the percentage by weight of lead in the silt fraction.

2.3.2 Unpaved Roads

Particulate emissions occur whenever a vehicle travels over an unpaved surface. Unlike paved roads, however, the road surface itself is the source of the emissions rather than any "surface loading." Unpaved roads and travel surfaces historically have accounted for the greatest share of particulate emissions at a number of industries. In addition to roadways, many industries often contain other unpaved travel areas. These areas may often account for a substantial fraction of traffic-generated emissions from individual plants.

Fugitive dust emissions from unpaved roads also are directly proportional to the silt content of the surface material, and fugitive lead emissions are direct proportional to the lead content in the silt fraction. Unpaved road fugitive dust emissions are also proportional to the mean vehicle speed, mean vehicle weight, and mean number of wheels. Fugitive emissions from unpaved roads are also affected by the rainfall frequency.

2.3.3 Storage Piles

In most industrial settings, materials are stored uncovered in outside locations. Although this practice facilitates transfer of materials into and out of storage, it also subjects the storage to several forces that can introduce dust into the air. In general, there are three mechanisms by which storage piles can act as sources of fugitive dust emissions:

1. Equipment traffic in the storage area;
2. Materials handling operations; and
3. Wind erosion of pile surfaces and surrounding areas.

Open dust fugitive emissions from storage piles are generally insignificant in comparison to fugitive emissions from paved and unpaved traffic areas. However, under worst case conditions, storage pile emissions can be significant and therefore should be taken into consideration as a source of fugitive emissions. On the other hand, fugitive emissions from partially or fully enclosed storage piles generally will be much less than the emissions that would originate from the same storage pile without the protection of the enclosure.

Equipment traffic between, in the vicinity of, or on storage piles is a source of fugitive emissions. Similar to the unpaved/paved road, the lead emissions associated with this source are directly proportional to the silt content of the storage pile.

Material handling is another fugitive emission source of lead emissions. Material handling involves either adding to or extracting material from the storage pile. Transfer operations involving storage piles can be classified as either continuous or batch operation. An example of a continuous operation is adding material to a pile by conveyor; an example of a batch transfer operation is the dumping of a load of material onto a pile by a truck.

Dust emissions may be generated by wind erosion of open aggregate storage piles and exposed areas within an industrial facility. Once again, lead emissions from both active and inactive storage piles are proportional to the silt content of the material stored, along with wind speed and rainfall frequency.

2.4 PROCESS FUGITIVE EMISSIONS

Process fugitive emissions are released from industrial operations to the atmosphere either directly from the process or through building openings such as windows, doors, or roof monitors rather than through well-defined stacks or vents. Sources of process fugitive emissions include both processing operations, such as furnaces and crushing and screening operations, as well as intermediate material handling operations, such as hot metal transport and solids conveying.

As a class of sources, it's difficult to generalize about process fugitive emission sources as compared to open fugitive dust sources. The process operations that lead to fugitive emissions vary substantially for the different industries and for different plants with the same industry. Further, characteristics of the emissions that affect control vary much more from source to source for process fugitive emissions than they do for fugitive dust sources. In particular, process fugitive emissions vary widely with respect to configuration of the release point, plume geometry and temperature, and particle size distribution of particulate matter.

Although process fugitive emission sources vary greatly, they can be grouped into five general categories of sources that have comparable characteristics. These five categories are solid materials handling operations, materials processing operations, furnaces, hot metal transfer and processing, and metal casting.

2.4.1 Solid Materials Handling Operations

Solid materials handling operations, as associated with process fugitive emissions, includes handling and transfer of solid materials as intermediate steps in a process. Examples of materials handled within these industries include coke and coal, limestone fluxing materials, sinter, slag and air pollution control device dust. Each of these materials contains fines that are emitted during handling and transfer operations. These handling and transfer operations differ from the fugitive dust sources in that they occur after the material leaves the raw material storage areas and often are enclosed within process buildings. The handling operations themselves and the characteristics of the emissions are comparable to those described in the section on fugitive dust.

Within these industries, the handling of solid materials can be accomplished either mechanically with a conveyor system or manually using front-end loaders. In either case most emissions are generated at points where material undergoes some type of drop, such as a conveyor transfer point or a front-end loader dump station. Generally the emissions are at ambient temperature and comprise relatively large size particulate matter. The plume configuration and flow properties generally are controlled by ventilation airflows in the vicinity of the transfer point.

2.4.2 Materials Processing Operations

Many of the raw materials used must undergo further processing before they can be used in the primary manufacturing process. Typical materials processing operations include crushers and hammermills, which are used to reduce the size of feedstock such as coke ore, sinter, and batteries; screening operations, which are used for both sizing (e.g., sinter in lead smelters) and cleaning; and mixers, which are used to blend materials (particularly core and mold materials in foundries). Each of these processes modifies the material being processed by applying mechanical energy to the material. This mechanical energy exacerbates fugitive emissions via two mechanisms. First, these processes increase the amount of fines in the material through fracturing and abrasion. Second, the mechanical energy imparts high velocities directly to the fine materials and generates high-velocity air streams within the process equipment and, in doing so, increases the potential for emissions.

These processes all have similar emission characteristics and, in general, each of the processes is enclosed. However, because of the high energy involved in the processes, significant quantities of fugitive emissions can be generated from process leaks. Fugitive particulate matter is also emitted during charging and discharging of the processes. Typically these emissions are discharged at ambient temperatures (with sinter crushing and screening as the exceptions). As with materials handling operations, the particle size distribution is relatively coarse, and the plume behavior is strongly influenced by ventilation patterns in the vicinity of the process equipment.

2.4.3 Furnaces

High-temperature metallurgical furnaces are used for melting, reducing, and refining metallic compounds in the lead industries. In addition, sinter machines are used in the primary lead industry to transform lead sulfide to lead oxide and to produce a feed material with suitable physical properties for charging to the blast furnace. Both of these processes are major sources of fugitive lead emissions. However, due to the configuration of the furnace in the secondary lead industry (reverberatory vs. blast), fugitive emission quantities and emission release characteristics differ widely. The size, material processed, operating temperature and cycle all affect fugitive emissions. During the operation of the metallurgical furnaces, fugitive emissions are generated during charging of raw materials and discharging (tapping) of product and slag. Fugitive emissions are also generated via process leaks during normal operations and from process upsets such as blast furnace slips.

The magnitude of fugitive emissions from the charging operation depends upon type of material charged, size of the charge, configuration of the charge opening, and characteristics of the material remaining in the furnace when changing is initiated.

The material charged to the furnace can be raw material feedstock (e.g., blast furnaces in primary lead smelters), scrap (e.g., blast furnaces or cupolas in secondary lead smelters), or a combination of molten metal and scrap. Emissions are affected bv cleanliness and temperature of the material. For example, if a scrap load to an electric furnace contains high concentrations of lead, fugitive lead emissions will increase when this load hits the molten bath in the furnace. Also, fugitive emissions generally are high when molten metal is charged.

Generally, fugitive furnace emissions have two common characteristics. First, emissions are released in a high-temperature, buoyant plume, which complicates capture and emission reduction. Second, the emissions tend to be fine particles, increasing opacity and difficulty of control.

Finally, routine tapping of the furnace is another source of fugitive emissions. In stationary-type furnaces such as reverberatory furnaces, cupolas, and blast furnaces, tapping is accomplished through a "tap hole" located at the bottom of the furnace where the molten metal (or slag) is routed through a series of runners to a ladle. In nonstationary furnaces, the furnace is tilted and molten metal is poured directly into a ladle. In either case, as soon as the molten metal is exposed to the air, volatile metal oxides are released from the surface of the stream. As these volatilized metals move away from the surface in a high-temperature buoyant plume, they cool and condense to form a very fine fugitive metal fume. Again, the buoyant plume, the fine particle size, and the complex geometry of the release complicates control.

2.4.4 Hot Metal Transfer and Processing

In the metallurgical operations under study, molten metal is transported between furnaces or from the furnace to a casting operation to ladles. These ladles are typically moved by rail or overhead crane. In some cases, final refining is also accomplished in these ladles.

Both the transport and refining operations are conducted with the metal still in a high-temperature, molten state. Metals volatilize from the surface of this molten metal and subsequently condense to form a fine fugitive metal fume. As with furnace charging and tapping, the buoyancy of the plume, the fine particulate matter, and the source mobility complicate control.

2.4.5 Metal Casting

Metal casting can be one of the more significant sources of fugitive emissions in metallurgical process. Casting processes vary significantly in different plants. In nonmechanized facilities, the molds are generally placed in a large, open area.

The hot metal ladle is then moved by an overhead pulley system to the mold, and the casting is poured and cooled in place. In more mechanized facilities, the mold is placed on a conveyor and moved to the pouring station and then moved to a cooling area. Emissions problems are comparable for both mechanized and nonmechanized processes: the emissions are contained in a relatively high-temperature, buoyant, moist stream. The constituents of concern are fine metal oxides that volatize from the hot metal surface. The damp buoyant stream adds to the difficulty of controlling these sources.

3.0 LEAD EMISSION CONTROLS

3.1 INTRODUCTION

Lead emissions can be minimized through proper control of fugitive and point sources at industrial facilities. The objective of this chapter is to discuss the traditional control strategies for open dust emissions from paved/unpaved roads and storage piles. Additionally, specific control devices for reducing point source emissions will be discussed. Review of this technology will enable the permit written to better incorporate required lead emission control programs as part of the source permitting process.

While not all fugitive dust contains appreciable quantities of lead, our discussion will cover fugitive dust with the assumption that at a lead facility, the concentration of lead in the fugitive dust will be above traditional ambient concentrations. Therefore, by controlling fugitive dust emissions, we likewise control lead emissions.

3.2 INDUSTRY-SPECIFIC CONTROLS FOR POINT SOURCES AND PROCESS

3.2.1 Baghouses

Fabric filtration is one of the most common control techniques utilized in the primary and secondary lead smelting industry. In the fabric filter system, particulate is collected within a dust cake supported on either a woven or felted fabric. The five basic mechanisms by which particulate matter can be collected on the fabric are: (1) inertial impaction; (2) Brownian diffusion; (3) direct interception; (4) electrostatic attraction; and (5) gravitational settling. By far the most common is inertial impaction. Impaction of a dust particle occurs when the gas stream goes around the fabric, but the particle is so large that it cannot follow the gas streamlines, therefore impacting into the stationary fabric. Particles entering a new fabric initially contact the individual fibers and are collected by the filtration mechanism. The particles are lodged within the fabric structure, thus promoting the capture of additional particles. As these particles build up, particle aggregates form, bridging of the interweave and interstitial spaces occurs, thus developing a continuous deposit. Finally, as more particles build up, a surface dust cake is developed.

Periodically, the dust cake must be removed either by shaking or utilizing compressed air (reverse air on pulse jet). Once cleaned, the bag is once again subjected to the dirty gas stream. After a few cleaning cycles, a steady-state dust cake forms on the bag, thus increasing its efficiency. The dust cake remains with the bag until it is damaged, replaced or washed.

A typical baghouse consists of the following components:

1. Filter medium and support;
2. Filter cleaning device;
3. Collection hopper;
4. Shell; and
5. Fan.

The heart of the baghouse, as illustrated in Figure 3-1, is the bag or fabric material that usually represents the highest maintenance component in the filter system. The effective selection of the fabric in a baghouse can substantially reduce maintenance and replacement cost. When selecting a fabric, the user must consider fabric characteristics as percent dust penetration, power requirements associated with operation pressure losses, fabric cleaning procedures, capital replacement cost, corrosivity and reactivity of the gas stream and gas temperature. Bag life, which varies greatly with operating conditions, is on the order of 1 to 3 years.

Operational problems with fabric filters include fluctuations in gas flow and dust loading, high temperature and humidity, condensation, and reactivity of gas and/or dust particles with system components. These problems affect pressure drop, efficiency, and bag life. Maintenance includes regular inspection, greasing of mechanical parts, disposal of solid waste and replacement of worn bags. Fabrics are available that permit operation at temperatures of up to 290°C (550°F) and provide chemical resistance against constituents in the gas stream.

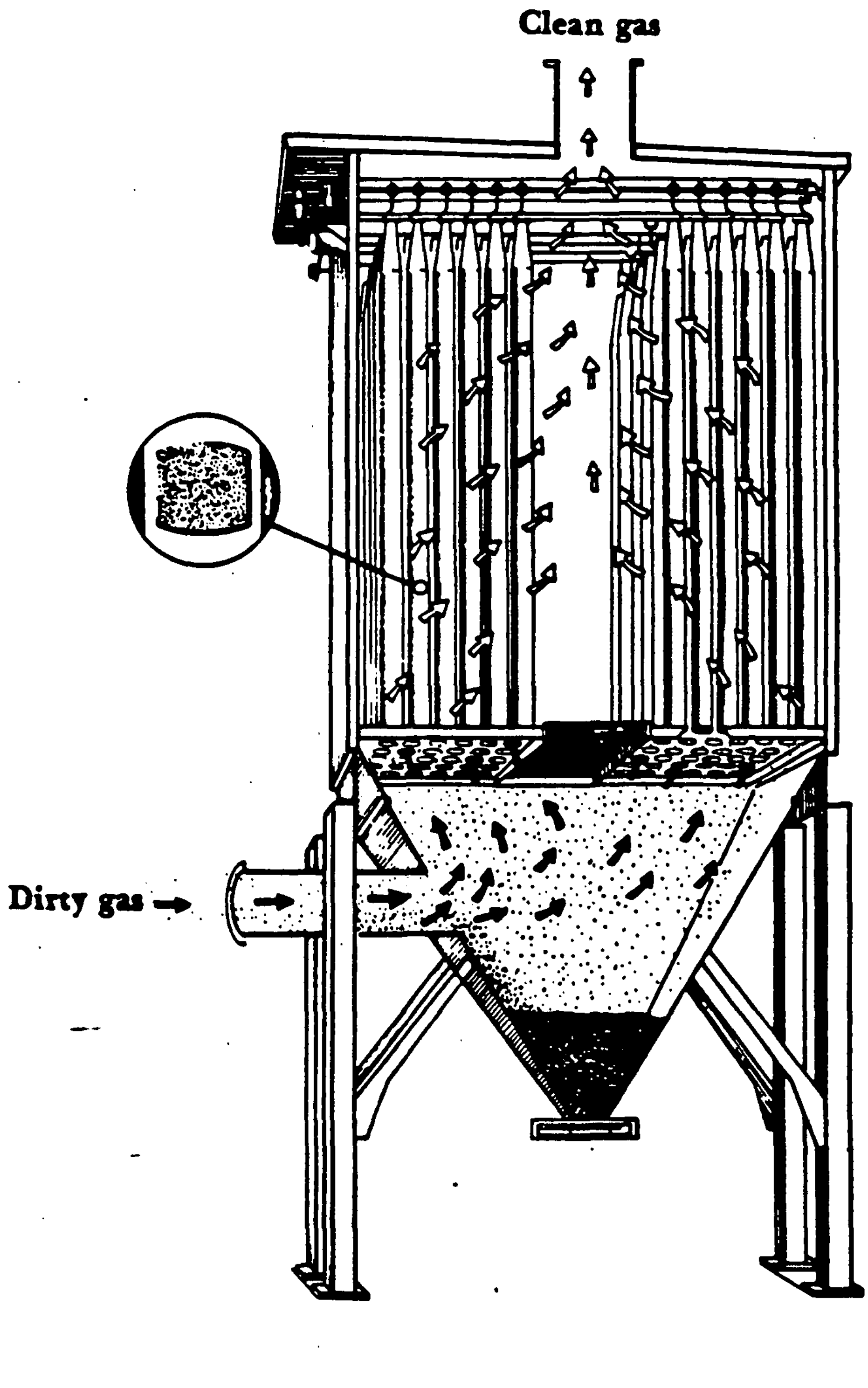

Figure 3-1. Typical baghouse configuration.

The gas flow rate and dust concentration, in conjunction with specific flow-resistance properties of the dust deposited on the fabric, determine the required cloth area for operation at a specified pressure drop. Pressure drop is generally selected in the range of 0.75 to 1.0 kPa (3 to 4 in. H_2O), although some systems operate well in excess of 2.5 kPa (10 in. H_2O). Superficial filter velocity, $m^3/s \cdot m^{-2}$ cloth (acfm/ft^2 cloth), commonly called the air-to-cloth ratio, generally ranges from 5.0 to 7.5 x 10^{-3} $m^3/s \cdot m^{-2}$ cloth (1 to 15 acfm/ft^2 cloth) depending on gas stream and particle characteristics and on the cleaning mechanism.

A variety of cleaning mechanisms are used to remove dust from the filter media: (1) mechanical shaking; (2) air shaking; (3) air bubbling; (4) jet-pulse; (5) reverse air flexing; (6) reverse jet; and (7) repressuring. Very small baghouses, less than 93 m^2 (1,000 ft^2) of cloth, are frequently cleaned by manual rapping. This method is unreliable to the extent that it depends on the operator's work habits. Manometers are recommended to indicate pressure drop when cleaning is done manually. Mechanical shakers, which are most common, are driven by electric motors that provide a gentle but effective cleaning action. In the jet-pulse method, a jet of compressed air released through a venturi section at the top of the bag cause the bags to pulse outward; jet pulse cleaning provides for automatic, continuous cleaning with uniform pressure drop and permits higher air-to-cloth ratios. Reverse air flexing is achieved by a double or triple cycle deflation of the bags followed by gentle inflating through low-pressure reverse flow. Reverse jet cleaning is done with a traveling ring of compressed air, which moves up and down the outside of the tubular bag. Repressuring cleaning is accomplished a low-pressure, high-volume, reverse flow of air through the bags.

3.2.2 Venturi Scrubbers (Low/High Energy)

Venturi scrubbers and other types of wet collectors are available in a wide range of cost and performance characteristics. Scrubbers gain much of their popularity because they are able to remove both solid and gaseous components from effluent gases with high temperatures, high moisture content, and high corrosivity.

Particulate matter is collected by making the particles larger through combining them with liquid droplets and then trapping them in a liquid film. Collection efficiency is related to particle size, particle density, turbulence, and liquid-to-gas ratio. Collection efficiency is also related to pressure drop for a given particle size.

A venturi scrubber forces flue gases through a venturi throat where water is injected, as illustrated in Figure 3-2. Gas velocities through the throat can range from 75 to 100 meters per second (m/sec) (15,000 to 20,000 ft/min). Pressure drops can range from 2.5 kPa (10 in. H_2O) to over 20 kPa (80 in. H_2O). The venturi provides the necessary solid-liquid contact for high collection efficiencies. Liquid to gas ratios range from 0.4 to 2 litre/m^3 (3 to 15 gal/min/10^3 acfm). The wetted particles and droplets are collected by a cyclone spray separator after they exit the venturi.

High-energy venturi scrubbers are made of 316-stainless steel. These high energy scrubbers also collect and remove particles by injecting water, but the gas stream is accelerated to much higher velocity while water is injected to create more turbulence and solid-liquid contact. Pressure drops of 15 kPa (60 in. H_2O) can produce collection efficiencies up to 99.5 percent.

Though wet scrubbers have attained collection efficiencies of 95 to 98 percent when treating lead fumes with particles smaller than 0.5 μm, their efficiencies for smaller particles are lower. Achieving a high-efficiency collection of submicron particles requires a much higher energy input. For good cleanup results, pressure differences from 7.5 to 24.9 kPa (30 to 100 in. H_2O) are required.

Water scrubbing may also bring about corrosion problems. The scrubbing water will absorb SO_2 in the gas stream, forming a

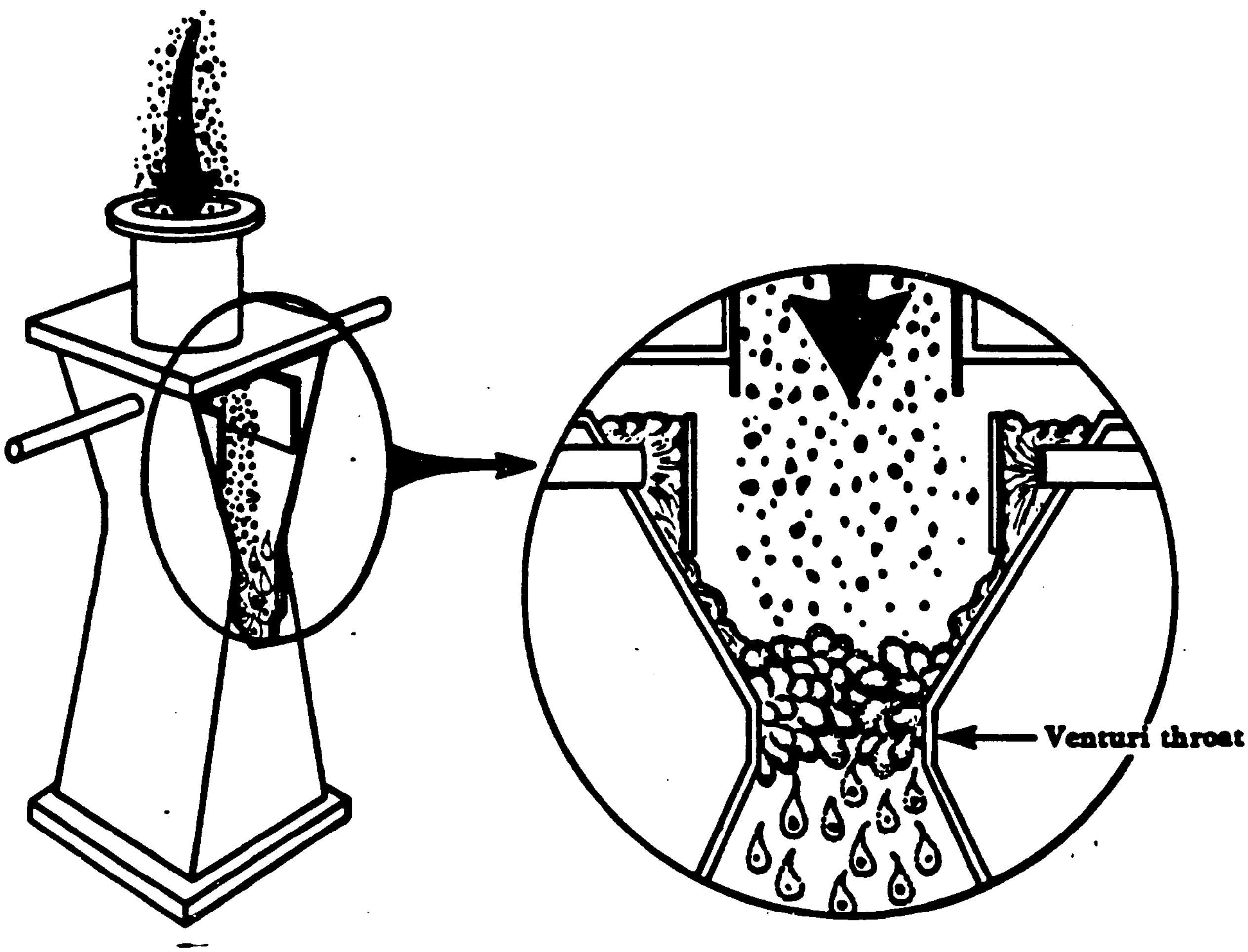

Figure 3-2. Venturi scrubber system.

dilute sulfurous acid. Adding lime, caustic soda, or similar chemical to the water may be necessary to minimize corrosion.

Further, the dust is recovered as a dilute slurry. In order to recover the lead oxide in the dust, some type of separator is required. The dry collection of the lead oxide in a fabric filter allows simple recycling of the dust, as opposed to the more complicated process of recovering the lead dust from the scrubber catch.

When the sulfur content of the initial charge is relatively high (as in secondary lead smelters where the primary source of scrap fed into the furnace is old battery plates contaminated with sulfuric acid), the scrubber has an advantage over a fabric filter because it can be designed strictly for the absorption of SO_2. Sulfur will be released from the furnace fuel charge and from the lead sulfate as sulfuric acid from the lead storage batteries.

3.2.3 Cyclones/Multicyclones

Cyclones have been utilized for years as a relatively low-cost method for removing particulate matter from exhaust gas streams. While they provide a simplistic approach to gas cleaning, they are not as efficient as baghouses, wet scrubbers or electrostatic precipitators. They are traditionally used as precleaners before the more efficient devices.

The common cyclone, as illustrated in Figure 3-3, consists of four major components: inlet, cyclone body, dust discharge system, and outlet. The inlet helps to direct the gas into the cyclone body, forming the vortex circular pattern. It is important that the gas enters the body of the cyclone with minimum disturbance and pressure drop. It takes more power to move the gas through the system with increased pressure drop. If the inlet is poorly designed, turbulence can occur and more energy is needed to incorporate the incoming gas with the vortex gas already in the body, thus decreasing its efficiency and increasing pressure drop across system.

The cyclone body design is very important to the overall efficiency of the system. The overall length of the cyclone

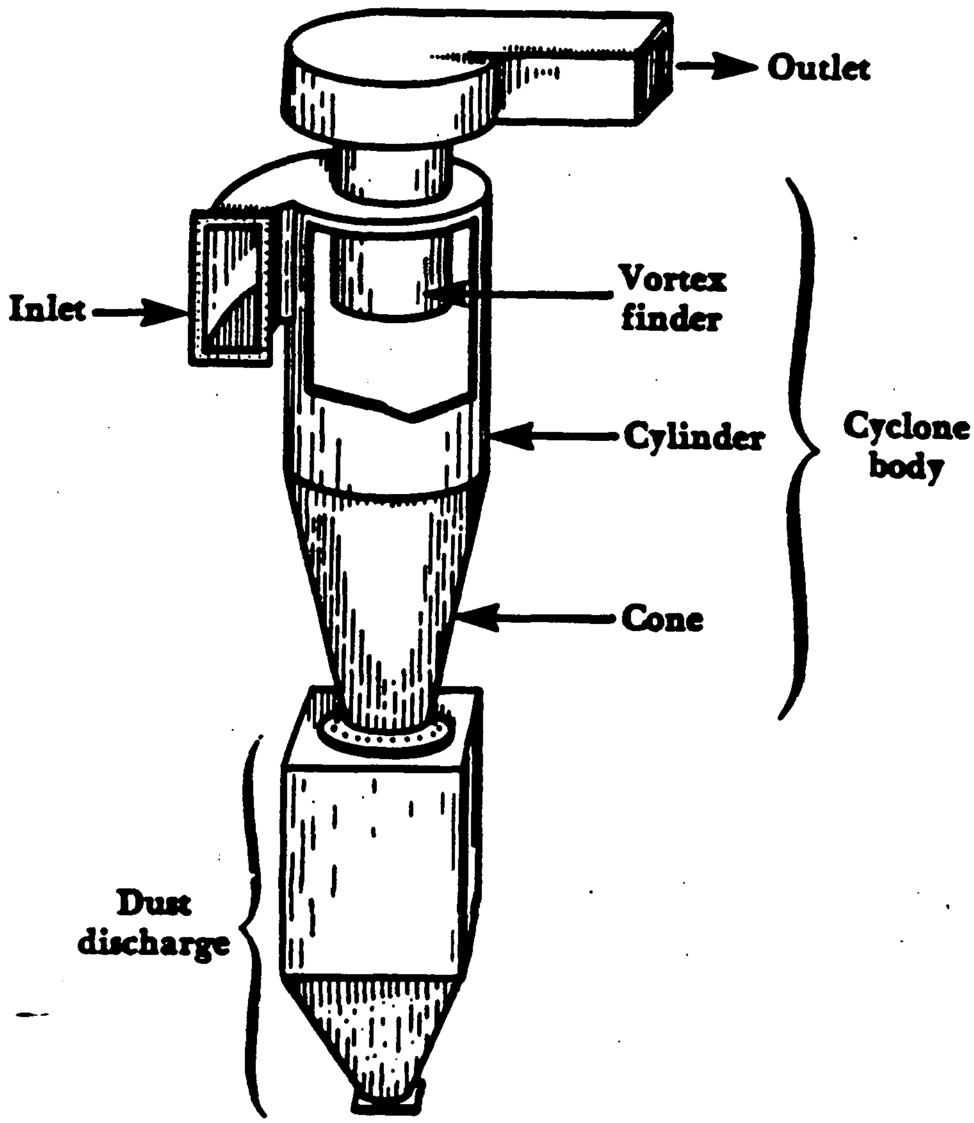

Figure 3-3. Typical components of a cyclone.

determines the number of turns of the vortex, thus the efficiency of the system. As the vortex flows through the cyclone body, particulate matter is thrown too the sides of the walls of the cyclone and moves down to the dust discharge hopper. Consequently, by varying the length and width of the cyclone, different efficiencies can be achieved. High efficiency cyclones generally have smaller inlet and exit areas with a smaller body diameter and longer overall length. A conventional cyclone will be from 4 to 12 feet in diameter, having a pressure drop from 2 to 5 inches. A high efficiency cyclone will be less than 3 feet in diameter with a pressure drop of from 4 to 6 inches of water.

The dust discharge system collects the entrained particles from the walls of the cyclone body. To prevent reentrainment of particulate matter back into the vortex stream, straightening vanes, rotary vanes and flaps have been utilized successfully.

Finally, the cyclone gas outlet serves to move the gas stream away from the collected particles. The exit tube must be long enough to extend beyond the inlet so the eddies do not mix particles up in the exit tube.

Consequently, smaller cyclones are more efficient than larger cyclones. Small cyclones, however, have two major limitations: higher pressure drop and limited volumetric flow rates. Smaller cyclones can be arranged either in series or parallel to increase efficiency at lower pressure drops. Multicyclone arrangements tend to plug more easily and have reentrainment problems. However, for the cost and considerably lower maintenance, the multicyclone and cyclone have been utilized in the smelter industry as either precleaners or as the primary pollution control device.

3.3 GENERAL OPEN DUST FUGITIVE CONTROL

3.3.1 Introduction

The control of open dust fugitive emissions fall within three general categories:

1. Preventive measures;
2. Removal of surface dust; and
3. Dust suppressant measures.

Emissions of fugitive dust occur from paved roads, unpaved roads and storage piles associated with primary and secondary lead smelting operations, as illustrated in Figure 3-4. This section discusses the control techniques applied to these sources of open dust fugitive emissions.

3.3.2 Paved Roads

Paved roads do not present as great of a source of fugitive emissions as do unpaved roads. The level of emissions depend upon the surface loading. The control technology associated with the surface loading involves either preventing material from being deposited on the surface or to remove the material from the surface once deposited. The control techniques include:

Deposition

Preventive measures

Removal

1. Broom sweeping;
2. Vacuum sweeping; and
3. Water flushing.

Under preventive measures, the control approach involves preventing the deposit of additional materials on a paved surface. Historically, sources of deposition on paved roads are influx from unpaved roads, storage piles, parking lots and vehicle entrainment and carryover. The source specific fugitive emission control program would involve preventive measures to limit outside influence. As outlined in Table 3-1, measures include covering trucks or washing to prevent carryover when going from-an unpaved surface to a paved surface, limited traffic or road use, and the use of wind breaks/vegetation stabilization to minimize erosion. Preventive measures can have a significant impact on deposition of fugitive lead dust emissions on paved roads.

Of the three removal methods, water flushing has been documented as the most effective technique for controlling fugitive emissions from paved roads, as illustrated in Table 3-2. Broom sweeping, involving a rotary boom, removes only approximately 30 percent of the surface loading. Indeed, a

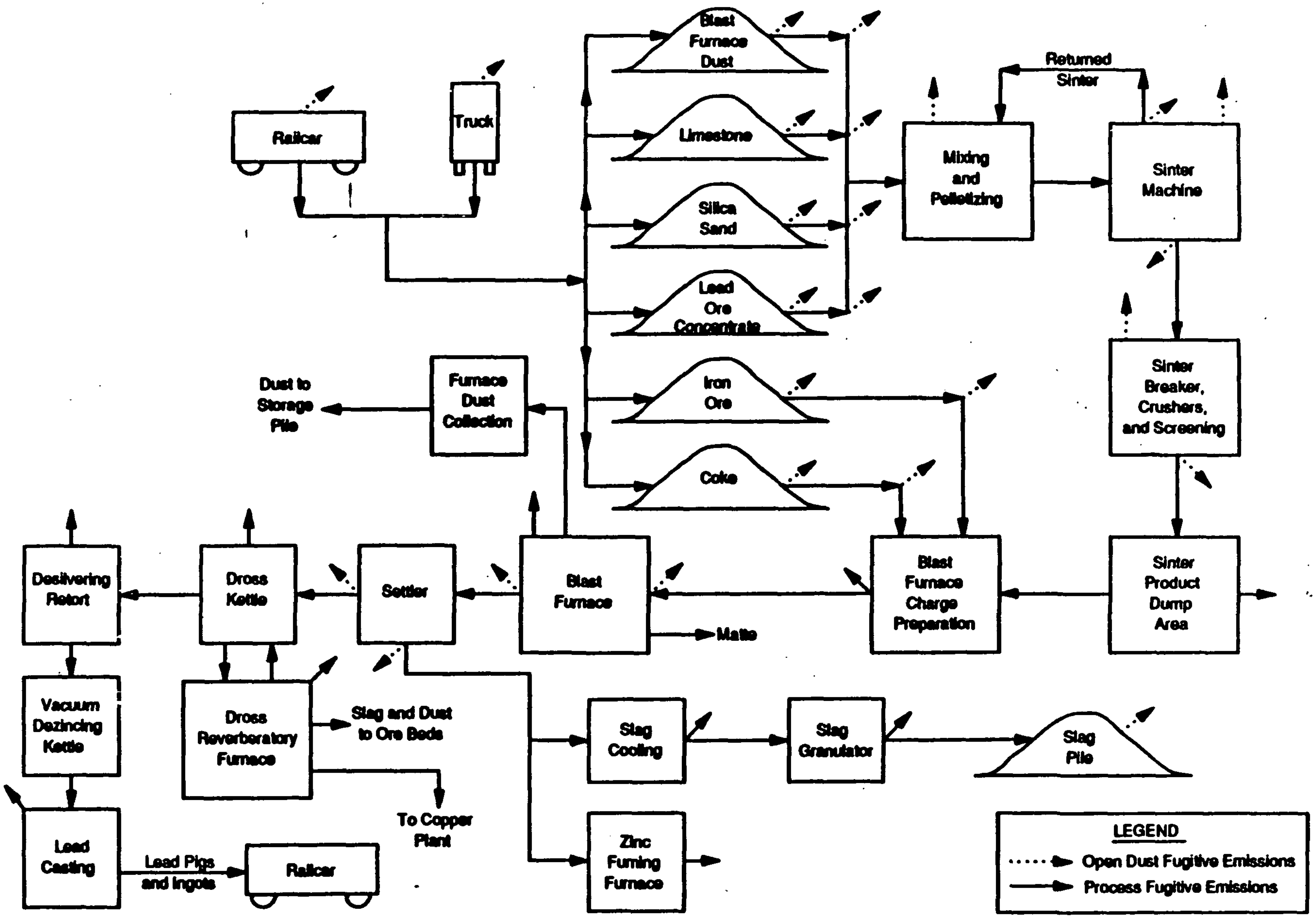

Figure 3-4. Process diagram for primary lead smelting showing potential industrial fugitive and process particulate emission points.

TABLE 3-1. NONINDUSTRIAL PAVED ROAD DUST SOURCES AND PREVENTIVE CONTROLS

Source of deposit on road	Recommended controls
• Spills from haul trucks	• Require trucks to be covered • Require freeboard between load and top of hopper • Wet material being hauled
• Construction carryout and entrainment	• Clean vehicles before entering road • Pave access road near site exit • Semicontinuous cleanup of exit • Limit number of access points to/from the area
• Vehicle entrainment from unpaved adjacent areas	• Pave/stabilize portion of unpaved areas nearest to paved road
• Entrainment from stormwater washing eroded soils onto streets	• Improve storm water control • Vegetative stabilization • Rapid cleanup after event
• Wind erosion from adjacent areas	• Wind breaks • Vegetative stabilization or chemical sealing of ground • Pave/treat parking areas, driveways, shoulders • Limit traffic or other use that disturbs soil surface

TABLE 3-2. MEASURED EFFICIENCY VALUES FOR PAVED ROAD CONTROLS

Methods	Cited efficiency
Broom sweeping	0-30 percent
Vacuum sweeping	0-58 percent
Water flushing	69-0.231 V[a,b]
Water flushing	96-0.263 V[a,b]

[a]Water applied at 0.48 gal/yd^2.
[b]Equation yields efficiency in percent, V = number of vehicle passes since application.

substantial fraction of the original surface loading is emitted during operation, thus broom sweeping may not be very effective as a removal technique. Vacuum sweeping, however, provides a more effective technique in the removal category. Vacuum sweeping removes material from paved surfaces by entraining particles in a moving air stream. Traditionally, a hood moves over the surface, removing the material to a hopper while the air is exhausted through a filter system. As illustrated in Table 3-2, the reported efficiency of this system is up to 60 percent for total particulate matter.

The most effective removal technique is water flushing and/or water flushing followed by sweeping. Water flushing involves high-pressure water sprays directed to the paved surfaces to remove deposits. Some systems supplement the cleaning with broom sweeping after flushing. Unlike the two sweeping methods, flushing faces some obvious drawbacks. The most serious drawback to water flushing in this industry is the potential to create ground water and soil lead contamination problems if the water is not contained and treated.

1. Unpaved Roads

The reduction of fugitive emissions from unpaved roads fall within three general categories. They are:

1. Source activity;
2. Source improvement; and
3. Source treatment
    a. Watering
    b. Chemical treatment.

The specific control measures associated with each of the categories are outlined in Table 3-3.

For unpaved roads, reduction of fugitive emissions associated with source activity involves limiting the amount of traffic on the road or lowering speeds to minimize emissions because emissions are proportional to vehicle speed. The reduction may be obtained by banning certain vehicles or strictly enforcing speed limits.

TABLE 3-3. CONTROL TECHNIQUES FOR UNPAVED TRAVEL SURFACES

Type of control	Specific control measures
Source extent reduction	• Speed reduction • Traffic reduction
Source improvement	• Paving gravel surface
Source treatment	• Watering • Chemical stabilization -- Asphalt emulsions -- Petroleum resins -- Acrylic cements -- Other

Surface improvement control measures consist of paving or replacing aggregate with one of lower silt (consequently lower lead) content. Paving should be considered for those roads which have the highest traffic volume. Aggregate improvement reduces total suspended particulate emissions by reducing the silt content of the road surface. However, lead emissions may not be reduced due to infiltration from other sources.

Surface treatment involves application of water or chemical treatment. Watering is a temporary measure, and periodic reapplications are necessary to achieve any substantial level of control efficiency. The control efficiency of unpaved road watering depends upon (a) the amount of water applied per unit area of road surface; (b) the time between reapplications; (c) traffic volume during that period; and (d) prevailing meteorological conditions during the period. Wetting agents, such as surfactants that reduce surface tension, may be added to increase the control efficiency of watering.

Chemical treatments for unpaved roads fall into two general categories: (1) chemicals that simulate wet suppression by attracting and retaining moisture on the road surface; and (2) chemical dust suppressants that form a hard cemented surface. Treatments of the first type, typically salts, are usually supplemented by watering. Included in the second category are petroleum resins, asphalt emulsions, acrylics, and adhesives. These are the treatments most commonly used.

3.3.4 Storage Pile

The reduction of fugitive dust emissions from storage piles are related to controlling material handling operations and wind erosion. Control can be achieved through the following available activities, as outlined in Table 3-4:

1. Minimizing activity at source;
2. Source improvement; and
3. Surface treatment.

Work practices play a major role in minimizing fugitive emissions from storage piles. Reducing the frequency of disturbing the pile, cleaning up spills during material

TABLE 3-4. CONTROL TECHNIQUES FOR STORAGE PILES

Type of control	Specific control measures
Material handling	
• Source activity	• Minimize activity at source
• Source improvement	• Reduction in storage pile • Wind sheltering (enclosures) • Moisture retention
• Surface treatment	• Wet suppression
Wind erosion	
• Source activity	• Area reduction • Cleanup
• Source improvement	• Spillage reduction • Area reduction
• Surface treatment	• Wet suppression • Chemical stabilization

extraction and reducing the exposed area of the pile can all reduce fugitive emissions. These "good operating" practices should be part of a source specific control program with minimum investment.

Source improvement activities involve reduction in storage pile area, moisture retention and enclosure. By far the most effective activity is enclosure. Enclosure can either be fully or partially designed. Enclosures traditionally used for open dust control include three-sided bunkers for storing bulk materials, storage silos for various types of aggregate materials, open-ended buildings, and similar structures. Practically any means that reduces wind entrainment of particles produced either by erosion of a dust-producing surface (e.g., storage silos) or by dispersion of a dust plume generated directly be a source (e.g., front-end loader in a three-sided enclosure) is generally effective in controlling fugitive particulate emissions.

Partial enclosures used to reduce windblown dust from large exposed areas and storage piles include porous wind fences and similar types of physical barriers (e.g., trees).

Wet suppression systems have also been employed to minimize fugitive emissions. These systems use liquid sprays or foam to suppress the formation of airborne dust. The primary control mechanisms are those that prevent emissions through agglomerate formation by combining small dust particles with larger aggregate or with liquid droplets.

Liquid-spray wet suppression systems can be used to control dust emissions from materials handling at conveyor transfer points and storage piles. The wetting agent can be water or a combination of water and a chemical surfactant. The surfactant, or surface active agent, reduces the surface tension of the water. As a result, the quantity of liquid needed to achieve good control is reduced. For systems using water only, adding surfactant can reduce the quantity of water necessary to achieve a good control by a ratio of 4:1 or more. Petroleum resins have also been used to control dust emissions from storage piles in similar fashion to application of wetting agents.

3.4 INDUSTRY SPECIFIC PROCESS FUGITIVE EMISSIONS

As discussed in Chapter 2, the primary and secondary lead smelting operations provide numerous sources of fugitive lead particulate emissions, both inside and outside the facility, as previously illustrated in Figure 3-4. Specifically, process source fugitive emissions are associated with the pulverizing, smelting and refining operations. Process hooding and ventilation of these process points are required to capture and transport the emissions to a control device to meet regulatory emission limits and to eliminate potential industrial hygiene problems to employees associated with the process.

There are three basic components of a ventilation system. The first component, the air intake, serves to capture the emissions. The second component, the ductwork, serves to transport the gas stream to the vent or control device, while the last component, the fan, serves to move the gas stream through the system. Ventilation systems must be uniquely designed to specific process conditions to allow access, yet conform with facility configuration. The design of the hood should allow for maximum enclosure while allowing the natural buoyancy or mechanical forces of the plume into the hood. Finally, the hood design must be sufficient to allow exhaust ventilation to maintain recommended face velocities at all hood contacts. Inadequate design of a ventilation system can compromise overall performance. In all cases, the hood must be sized and oriented to capture the maximum quantity of emissions without requiring excessive gas volumes. The hood should be as close as possible to the emission point without interfering with equipment movement and process operation. It should be optimized, to take advantage of thermal drafts and minimize cross-drafts.

Within the nonferrous smelting industry, there are three major hood designs utilized to capture fugitive emissions from process points: (1) enclosure; (2) receiver; and (3) exterior hood design.

As the name implies, the enclosure hood envelops the process, insuring maximum control of fugitive emissions. Example location and application of enclosure hoods in the nonferrous smelting industry include lead tapping, pulverizing and smelting operations. These applications serve to contain the fugitive emissions and remove them from within the enclosure rather than to capture the emissions. Consequently, the enclosure hood requires the least air flow, utilizing the natural buoyancy of the plume. Figure 3-5 demonstrates an example of an enclosure hood version of a lead-tapping hood system. Figure 3-6 illustrates a successful application of an enclosure hood on a rotary furnace. In this configuration, hot flue gases from the furnace are exhausted through the brick flue. The connection between the furnace body and the brick flue is totally enclosed. Additionally, an arched hood is utilized to capture fugitive emissions produced during charging and tapping operations. Exhaust draft to this hood is controlled by an electrically controlled damper. The damper is opened automatically during charging and tapping.

Receiving hoods operate from the principle of receiving emissions into the hood by inertial force. These hoods are usually associated with small processes that impart a velocity to the stream, such as grinding, blasting and pulverizing operations. This type of hood has also been applied to capture fugitive emissions during blast furnace tapping and emission leaks at access doors at the top of blast furnaces. Figure 3-7 illustrates several applications of enclosure and receiving hoods as part of a local exhaust ventilation system.

The external hood (canopy) is mounted some distance (up to 100 feet) from the emission source and can be used in conjunction with receiving and enclosure hoods. This type of hood is usually associated with hot processes. Similar to the receiving hood, the canopy hood depends upon the buoyancy of the plume to carry emission into the hood. Particular application of the external hood involves a swing design configuration where the hood is

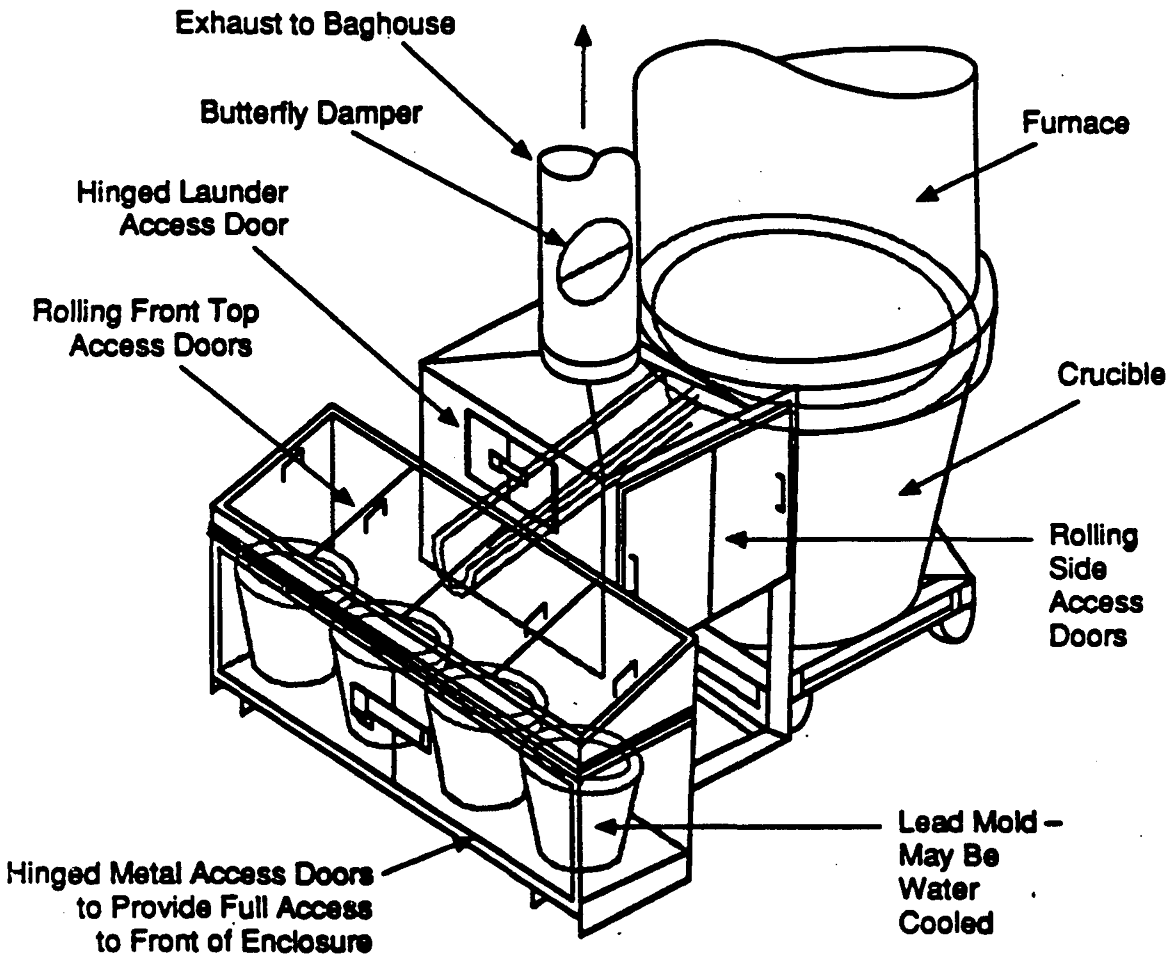

Figure 3-5. Enclosed hood for lead-tapping system.

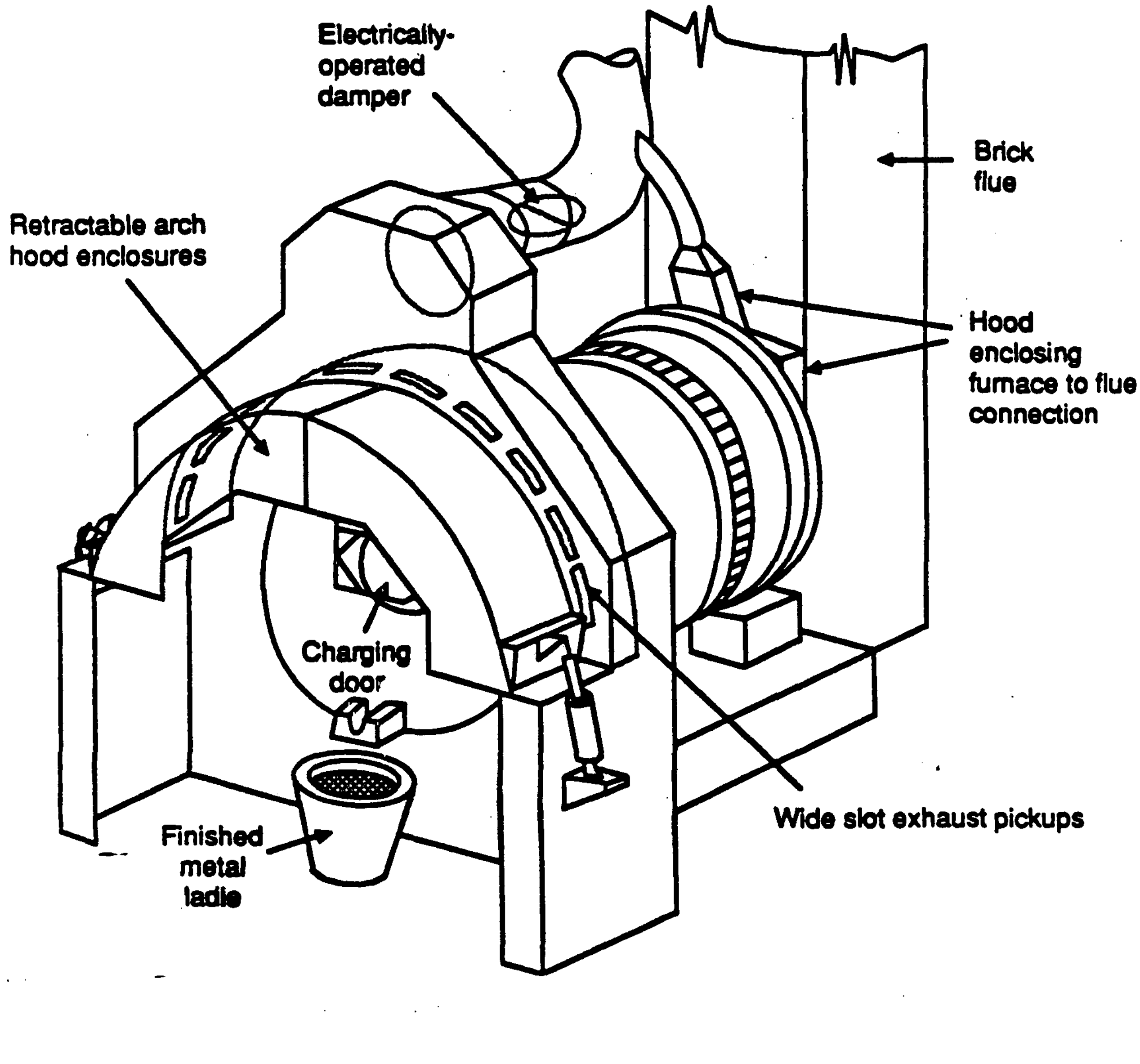

Figure 3-6. Rotary furnace charging and tapping hood controls.

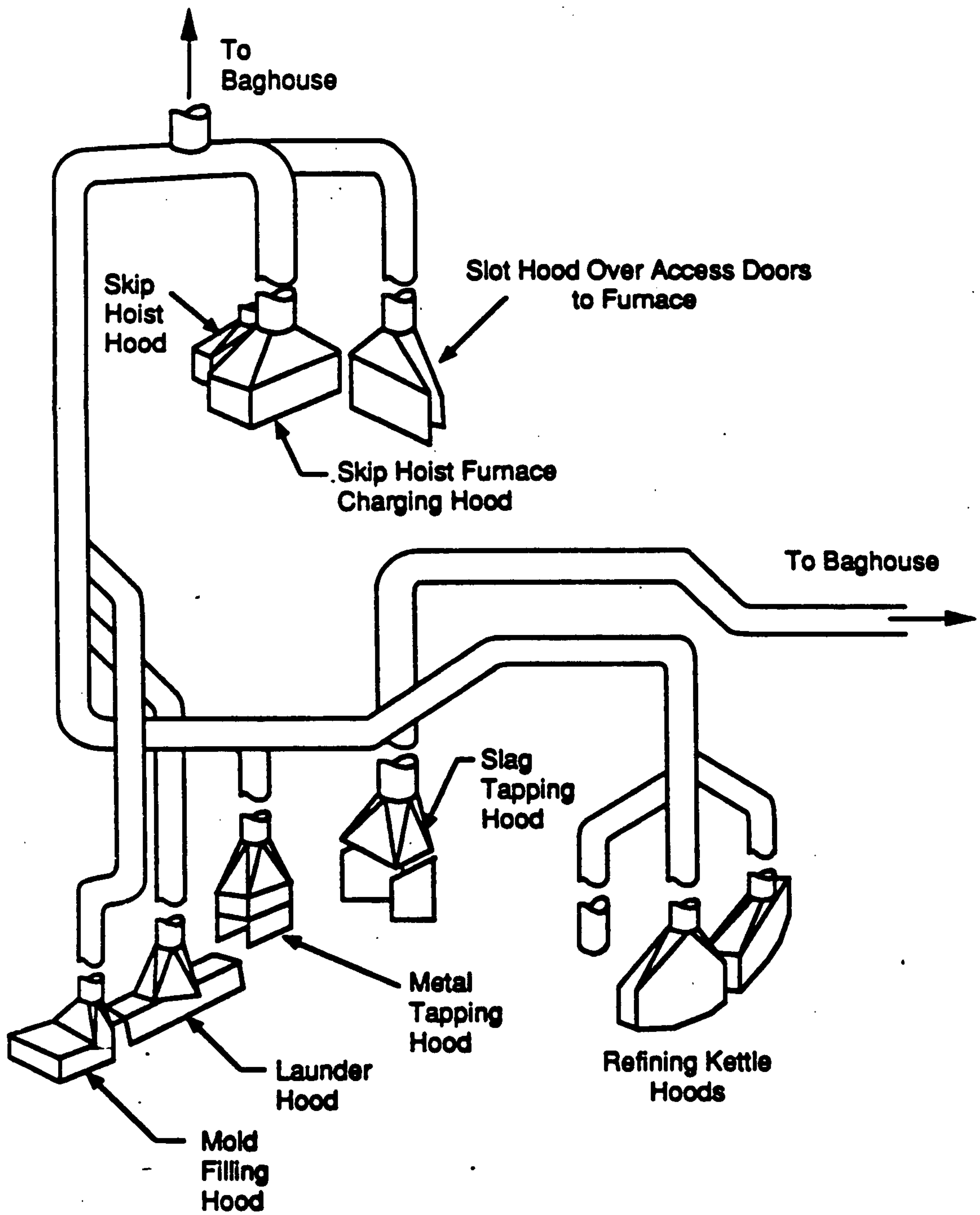

Figure 3-7. Overview of modified local exhaust ventilation system.

placed over metal ladles or slag pots during cooling to capture the buoyant plumes, as illustrated in Figure 3-8. Typically, these containers are left at the hood for a short time and then moved to a holding area for further cooling. The hood can be positioned over the ladle, then removed. Lead fumes and other relatively volatile metals which are emitted during cooling are captured by the external hood.

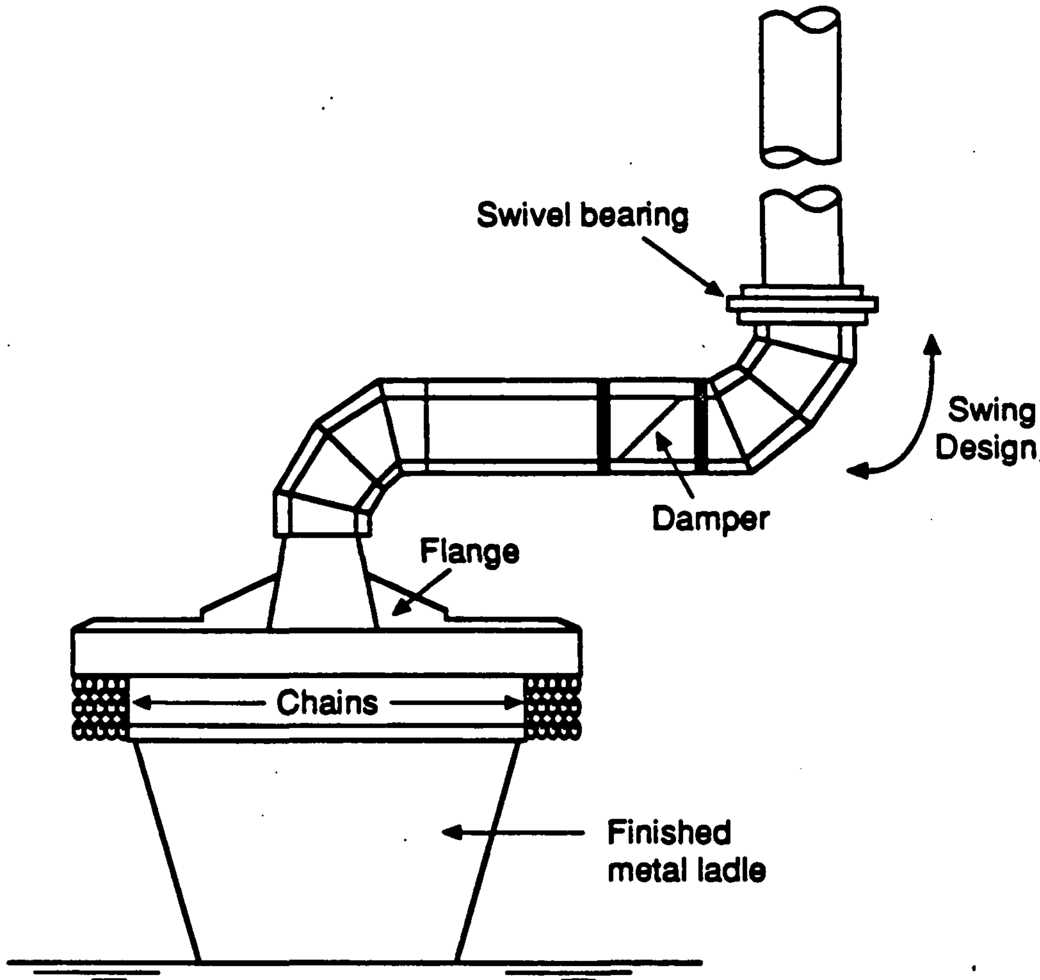

Figure 3-8. Swing design finishing metal ladle cooling hood.

4.0 RECOMMENDED OPERATION/MAINTENANCE AND RECORDKEEPING PRACTICES FOR LEAD EMISSION CONTROL

4.1 INTRODUCTION

A successful source emission minimization program (SEMP) associated with pollution control ultimately depends upon an effective design, operation and maintenance (O&M), and recordkeeping program. Regardless of how well an air pollution control system is designed, poor O&M will lead to the deterioration of its various components and a resulting decrease in its efficiency.

Effective O&M affects equipment reliability, on-line availability, continuing regulatory compliance, and regulatory agency/source relations. Lack of timely and proper O&M leads to a gradual deterioration in equipment, which in turn increases the probability of equipment failure and decreases both the reliability and on-line availability of the equipment.

Maintenance of the pollution control and emission minimization program is a vital component of a source continuous compliance program. Maintenance at industrial facilities can be divided into two basic categories: (1) preventive maintenance and (2) breakdown maintenance. The objective of preventive maintenance is to minimize future failure of the emission minimization program through a scheduled source program. The source preventive maintenance program can be driven by a schedule, where distinct activities, observations and records are acquired for a particular piece of equipment. Source emission minimization maintenance program activities range from simple observations to actual measurements performed to evaluate status of pollution control equipment. The evaluator records his findings on an inspection data form, which becomes part of the source recordkeeping program. The inspection form serves to identify problem areas that may be imminent for which maintenance will become necessary. This provides lead time for the source to assemble the necessary spare parts and for scheduling personnel so maintenance will be quickly and effectively performed during routine plant shutdowns. The records, therefore, help to determine what action is needed and when.

Breakdown maintenance occurs when the equipment fails, demanding an immediate response. Recordkeeping performed during the preventive maintenance program may serve to identify key parameters which would indicate proximity to a component breakdown. Records of breakdown maintenance may reduce downtime during subsequent breakdowns of the same equipment. Recordkeeping, however, is normally associated with the source preventative maintenance program rather than the breakdown maintenance program.

4.2 SPECIFIC CONTROL DEVICES

An O&M program should be part of a larger preventive maintenance program that enhances the long-term performance of the associated equipment (process and/or control). Unfortunately, most preventive maintenance programs must be site-specific and consider a number of factors such as adequacy of the design (redundancy), instrumentation, access for maintenance, and personnel requirements and availability.

Tables 4-1, 4-2, and 4-3 outline general maintenance schedules for baghouses, venturi scrubbers, and cyclone/ multicyclone systems, respectively. As mentioned earlier, preventive maintenance schedules must be site-specific, and as such, the tables which follow are meant to serve only as a basis from which the maintenance schedules for specific sites can be developed. Each source should develop their own maintenance schedule based on their combination of processes and control devices.

4.3 PROCESS FUGITIVE EMISSIONS

Recommended O&M and recordkeeping practices for documenting process fugitive emissions involve visual observations and equipment inspection of the ventilation system. As discussed in Chapter 3, the ventilation system involves three basic components. The air intake incorporates the hood which serves to capture process fugitive emissions. In all cases, the hood must be sized and oriented to capture the maximum quantity of systems

TABLE 4-1. TYPICAL MAINTENANCE SCHEDULE FOR A FABRIC FILTER SYSTEM

Inspection frequency	Component	Procedure
Daily	Stack and opacity meter	Check exhaust for visible dust.
	Manometer	Check and record fabric pressure loss and fan static pressure. Watch for trends.
	Compressed air system	Check for air leakage (low pressure). Check valves.
	Collector	Observe all dials, meters, charts, and gauges, etc. on control panel and listen to system for properly operating subsystems.
	Damper valves	Check all isolation, bypass, and cleaning damper valves for synchronization and proper operation based upon manufacturer guidelines.
	Rotating equipment and drives	Check for signs of jamming, leakage, broken parts, wear, etc.
Weekly	Filter bags	Check for tears, holes, abrasion, proper fastening, bag tension, dust accumulation on surface or in creases and folds.
	Cleaning system	Check cleaning sequence and cycle times for proper valve and timer operation. Check compressed air lines including oilers and filers. Inspect shaker mechanisms for proper operation.
	Hoppers	Check for bridging or plugging. Inspect screw conveyor flighting for proper operation and lubrication.
Monthly	Shaker mechanism	Inspect for loose belts.
	Fan(s)	Check for corrosion and material buildup and check V-belt drives and chains for tension and wear.
	Monitor(s)	Check accuracy of all indicating equipment.
Quarterly	Inlet plenum	Check baffle plate for wear; if appreciable wear is evident, replace. Check for dust deposits.
	Shaker mechanism	Tube type (tube hooks suspended from a tubular assembly): inspect nylon bushings in shaker bars and clevis (hanger) assembly for wear. Channel shakers (tube hooks suspended from a channel bar assembly): inspect drill bushings in tie bars, shaker bars, and connecting rods for wear.
Semi-annually	Motors, fans, etc.	Lubricate all electric motors, speed reducers, exhaust and reverse air fans, and similar equipment.
Annually	Collector	Check all bolts and welds. Inspect entire collector thoroughly, clean, and touch up paint where necessary.

TABLE 4-2. TYPICAL MAINTENANCE SCHEDULE FOR A VENTURI SCRUBBER SYSTEM

Inspection frequency	Component	Procedure
Daily	Air flow system	Check for air leakage (low pressure). Check valves.
	Collector	Check inlet and outlet gas temperature, pressure drop, liquor recirculation rate and pH, makeup rate, nozzle pressure, purge rate, chemical addition rate and liquor turbidity.
	Fan(s), pumps and drives	Check for signs of jamming, leakage, broken parts, wear, etc. Check fan motor current.
Weekly	Fan(s) and pump(s)	Check for vibration, oil levels and bearing lubrication.
	Damper valves	Check all isolation, bypass and cleaning damper valves for synchronization and proper operation based upon manufacturer guidelines.
Monthly	Fan and motor bearings	Check for leaks, cracks or loose fittings.
	Drive mechanisms	Check chain tension, oil level, sprocket wear and sprocket alignment.
	Duct work	Check for leakage and excessive flexing.
	Dampers	Check ease of operation and leakage.
	Clarifier pipeline	Check for plugging.
	Spray bars	Check for nozzle plugging and wear.
	Pipes and manifolds	Check for plugging and leaking.
	Gauges	Check all gauges for accuracy.
	Scrubber body	Check for material buildup, abrasion, corrosion, leakage.
Semi-annually	Fan, pump and motor bearings	Check for clearances, wear, pitting, scoring and leakage. Lubricate.
	Drag chain bearings and gear reducers	Check for lubrication, wear, pitting, scoring, clearances, leaks, cracks or loose fittings.
	Damper seals	Check for wear.
	Damper drive	Check operation and alignment.
	Damper bearings, blades and blowers	Check for wear and leakage. Lubricate bearings.
Annually	Collector	Check all bolts and welds. Inspect entire collector thoroughly, clean and touch up paint where necessary.

TABLE 4-3. TYPICAL MAINTENANCE SCHEDULE FOR A CYCLONE/MULTICYCLONE SYSTEM

Inspection frequency	Component	Procedure
Daily	Stack and opacity meter	Check exhaust for visible dust.
	Air flow system	Check for air flow leakage (low pressure).
	Collector	Check inlet and outlet gas temperature, and pressure drop.
	Fan(s)	Check for signs of jamming, broken parts, wear, etc. Check fan motor current.
	Hopper	Check for plugging. Inspect sealing device and conveying system for proper operation and lubrication.
Weekly	Fan	Check for vibration, oil level and bearing lubrication.
	Damper valves	Check all isolation, bypass and cleaning damper valves for synchronization and proper operation based upon manufacturer guidelines.
Monthly	Fan and motor bearings	Check for leaks, cracks or loose fittings.
	Duct work	Check for leakage and excessive flexing.
	Dampers	Check for ease of operation and leakage.
	Gauges	Check all gauges for accuracy.
	Collector	Check for material buildup, abrasion, corrosion and leakage. Check for tube wear and pluggage.
Semi-annually	Fan and motor bearings	Check for clearances, wear, pitting, scoring and leakage. Lubricate.
	Damper seals	Check for wear.
	Damper drive	Check operation and alignment.
	Damper bearings, blades and blowers	Check for wear and leakage. Lubricate bearings.
Annually	Collector	Check all bolts and welds. Inspect entire collector thoroughly, clean and touch up paint where necessary.

emissions without requiring excess gas volumes. The second component, the ductwork, serves to transport the gas stream to the vent or control device, while the last component, the fan, serves to move the gas stream through the system.

Two of the most important factors affecting the performance of a ventilation system is hood design and capture velocity. For hood design, the basic design principles involve:

1. Whenever possible, an enclosure hood should be employed.

2. If an enclosure hood cannot be used, the hood should be placed as close to the source as possible and aligned with normal contaminant flow.

3. To improve hood performance, duct take-offs should also be placed in-line with normal contaminant flow.

Adherence to these basic principles will result in a hood system that gives high capture efficiency while utilizing the minimum air flow necessary.

Effective capture of contaminants by a hood system relies on velocity toward the hood face. This velocity must be sufficient to maintain control of the contaminants until they reach the hood. Of particular concern is external air motion that may disturb this flow and cause loss of the contaminant or require higher than normal air velocities to maintain control. Sources of air motion that must be considered when designing and placing hoods include:

1. Room air currents associated with the workspace ventilation system. These can become quite large when windows and doors are opened. Currents of as little as 50 feet/min may be enough to affect the performance of some hoods.

2. Thermal air currents from heat generating equipment and processes. Even low heat releases, such as those from an electric motor, may be enough to disturb hood performance.

3. Machinery motion. Rotating or reciprocating machinery can be a source of significant air currents.

4. Material motion. Downward motion of material, for example, will create a downward air current that will make the upward motion of contaminants more difficult to achieve.

5. Operator movements. Rapid movements of an operator can create air currents of 50 TO 100 feet/min.

Capture velocity is defined as that air velocity at a point in front of a hood or at the hood face that is necessary to overcome existing air currents and cause the contaminated air to move into the hood. The needed capture velocity will depend on both the direction and velocity of the contaminants at the desired point of capture, as well as the level of disturbing air currents that must be overcome. An overhead canopy that relies primarily on plume buoyancy to convey the contaminants to the hood will require little capture velocity, generally just enough to match the plume velocity at the hood face. Contaminants generated by a high energy process that results in rapid and random contaminant motion will require quite high capture rates. A general guide for appropriate capture velocities is provided in Table 4-4. Values at the low end of the range would be appropriate when disturbing air currents are low, the toxicity of the contaminants is low, or the hood is large, resulting in a large air mass in motion. The higher end of the range would be more appropriate when air currents are high, the toxicity of the contaminants is high, or the hood is small.

Both the ventilation system and the hood design involve activities prior to operation. The O&M activities after installation centers around visual inspection and minimum physical measurements. Table 4-5 outlines specific source emission minimization maintenance timetable for process fugitive ventilation system.

4.4 OPEN DUST FUGITIVE EMISSIONS

As discussed in Chapter 2, open dust fugitive sources include paved and unpaved traffic areas and storage piles. Fugitive dust emissions occur from those sources. When previously deposited material is reentrained by vehicle traffic, by the loading and unloading equipment, or by the wind. Historically, roadways are the primary source of open dust fugitive emissions, while emissions from storage piles are insignificant.

TABLE 4-4. RANGE OF CAPTURE VELOCITIES

Type of material release	Capture velocity, ft/min
With no velocity into quiet air	50-100
At low velocity into moderately still air	100-200
Active generation into zone of rapid air motion	200-500
With high velocity into zone of very rapid air motion	500-2,000

TABLE 4-5. SOURCE EMISSION MINIMIZATION MAINTENANCE TIMETABLE FOR VENTILATION SYSTEMS

Activity/Checks	Frequency					
Description	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually
Ventilation system						
Visible emissions at hood	X					
Physical inspection of hood for corrosion/damage		X				
Evaluate gap distance from hood to source			X			
Hood capture efficiency to specifications				X		
Balancing dampers positioned properly		X				
Static pressure to maintain proper conveying velocities to dust collector		X				X
Sized properly to maintain proper conveying velocities to dust collector					X	
System balanced according to pressure drop					X	

Operation and maintenance practices associated with open dust fugitive emissions involves evaluation of wet suppression system for storage piles and vehicle control pattern for paved/unpaved roads. Table 4-6 outlines the suggested maintenance timetable for open dust fugitive emissions.

TABLE 4-6. SOURCE EMISSION MINIMIZATION MAINTENANCE TIMETABLE FOR OPEN DUST FUGITIVE EMISSIONS

Activity/Checks	Frequency					
Description	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually
Fugitive Dust Piles--Water and Surfactant Wet Suppression System						
Check operation of level control valve	X					
Check operation of surfactant pump	X					
Check level of surfactant in drum	X					
Check operation of inlet water filter	X					
Visually check spray pattern and direction of spray jets	X					
Clean stainer basket in each flow controller		X				
Clean strainer basket in the proportioner		X				
Check operation of all automatic spray controls			X			
Clean all spray nozzles				X		
Check heating equipment				X		
Lubricate all equipment					X	
Level III inspection evaluation						X
Meteorological log updated	X					
Equipment maintenance log updated		X				
Storage piles location evaluated			X			
Wind breaks effective			X			

TABLE 4-6. SOURCE EMISSION MINIMIZATION MAINTENANCE TIMETABLE FOR OPEN DUST FUGITIVE EMISSIONS (continued)

Activity/Checks	Frequency					
Description	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually
Paved roads						
Number of vehicles limited to program levels	X					
Speed of vehicles limited to program levels	X					
Broom/vacuum sweeping concur with road activity	X					
Truck washing implemented	X					
Meteorological log updated	X					
Evaluate daily maintenance activities and adjust accordingly		X				
Localized prevention controls effective		X				
Vegetation stabilization program effective			X			
Wind breaks effective			X			
Equipment maintenance log updated		X				
Storm water control evaluated				X		
Preventive control program review updated						X
Emergency cleanup program review updated						X
Unpaved Roads						
Number of vehicles limited to program levels	X					
Speed of vehicles limited to program levels	X					

TABLE 4-6. SOURCE EMISSION MINIMIZATION MAINTENANCE TIMETABLE FOR OPEN DUST FUGITIVE EMISSIONS (continued)

Activity/Checks	Frequency					
Description	Daily	Weekly	Monthly	Quarterly	Semi-annually	Annually
Broom/vacuum sweeping concur with road activity	X					
Truck washing implemented	X					
Meteorological log updated	X					
Evaluate daily maintenance activities and adjust accordingly		X				
Localized prevention controls effective		X				
Vegetation stabilization program effective			X			
Wind breaks effective			X			
Equipment maintenance log updated		X				
Storm water control evaluation				X		
Preventive control program review						X
Emergency cleanup program review updated						X
Watering and chemical stabilization concur with program levels	X					
Surface improvement evaluated					X	
Traffic patterns evaluated	X					
Spray patter uniform		X				

5.0 INDUSTRY CONTINUOUS COMPLIANCE PROGRAM

5.1 INTRODUCTION

To attain and subsequently maintain the National Ambient Air Quality Standards (NAAQS), the Agency and many State governments have required industrial sources to develop a continuous compliance strategy for both source and fugitive emissions. The objective of the continuous compliance strategy is for sources to maintain compliance of sources and fugitive emission standards after initial compliance. Initial compliance is achieved through strict adherence to permit conditions outlined by Agency directives. The facilities permit, therefore, is the major vehicle for translating Agency requirements into specific enforceable measures at the facility. Through the permit, emission standards for both source and fugitive emissions are identified along with requirements of implementation of a source emission minimization program (SEMP) to insure compliance with the emission standards on a continuous basis.

At a minimum, the SEMP should contain three major categories addressing minimization of emissions from point and fugitive sources within the facility. They are:

1. Source Management Plan (SMP). The source management plan outlines management commitment to minimizing point and fugitive emissions within the facility. The SMP identifies lines of communication and chain of authority through a tier structure.

2. Source Recordkeeping Plan (SRP). The SRP plan outlines the sources performance on meeting RACT/BACT standards and what control measures will be implemented ensuring continuous compliance. The SRP plan outlines parameters to be monitored as part of the sources O&M plan. As part of this plan, the source provides to the regulatory agency guidelines, documentation, checklist, control charts and reporting forms used in it's continuous compliance program. The plan outlines daily documentation requirements and proper O&M documentation through mandatory evaluation. The checklist/documentation insures that the SMP is operational and that proper measurements are acquired

and reported as ventilation of an active source continuous compliance program.

3. Source Measurement Plan. The source measurement plan identifies those measurement activities which establishes "baseline" conditions and verifies continued compliance. Through the levels of inspection, the plan utilizes such measurement tools as visible emission (VE) observations, portable instrumentation and scrubber parameter monitoring as a means of verifying compliance with RACT/BACT emission standards.

The following section discusses each of these topics as part of a SEMP.

5.2 SOURCE MANAGEMENT PLAN (SMP)

A major category of the SEMP is the SMP. The management plan outlines administrative procedures applicable to all management system and assigns responsibility for all phases of the SEMP. Management commitment is one of the keys to developing and implementing a successful SEMP program. In addition to typical management considerations such as performance and personnel requirements, management must be supportive and understanding of the program. Corporate management should be apprised of all program activities, from the identification of the need to monitor emissions to receiving daily emission reports. Monitoring activities, such as those described in the QA Plan, should not be committed to without first being reviewed and approved by corporate management. The management plan must make the necessary corporate commitments as well as provide the necessary departmental staff to implement a comprehensive SEMP. Furthermore, the commitment made up by the source management plan provides the chain of custody that is necessary to ensure complete and responsive implementation of all activities specified in the QA Plan.

A source management plan involves a three-tier structure, as outlined in Table 5-1. Tier I involves management of the source's environmental engineering programs. The Director of Tier I, Manager of Environmental Engineering, has the overall responsibility for the development and incorporation of the plan.

TABLE 5-1. MANAGEMENT PLAN PROGRAM PARTICIPANTS AND RESPONSIBILITIES[a]

Tier	Level	CEM program participant	Name, title, address, telephone number	Responsibility
I	1	Plant manager	Mr. Bob Timson Primary Lead Smelter Plant Pine Bluff, North Carolina (919) 877-3611 (ext. 923)	Responsible for total plant operation
I	2	Plant operations supervisor	Mr. Jim Limb Primary Lead Smelter Plant Pine Bluff, North Carolina (919) 877-3611 (ext. 813)	Data review and verification Maintain compliance status (modify operations if necessary)
I	3	Environmental engineering	Mr. Jerry Figure Primary Lead Smelter Plant Pine Bluff, North Carolina (919) 877-3611 (ext. 714)	Ensures compliance with environmental regulations Directs activities over engineering department, including implementation of quality assurance (QA) program
II	1	QA coordinator	Mr. Tom Electron Primary Lead Smelter Plant Pine Bluff, North Carolina (919) 877-3611 (ext. 622)	Responsible for all operation and maintenance activities for emission reduction and control Responsible for implementation of the QA Program May also be responsible for QA activities Responsible for all QA source activities associated with the pollution control and CEM program Implements and performs weekly, monthly and quarterly QA checks
III	1	O&M supervisor	Mr. Scott Work Primary Lead Smelter Plant Pine Bluff, North Carolina (919) 877-3611 (ext. 400)	Maintenance and calibration Maintain instrument logs Report instrument problems

[a]The program includes an activities associated with each major element of the SEMP (O&M, QA/QC, data validation) shall be prepared. Included with this description, each activity shall have corresponding documentation and communication responsibilities defining what information is to be recorded, where it will be filed, and the individual whom must verbally or in writing be informed of the activity results. The frequency of scheduled activities such as preventive maintenance and QA audits shall be included. Malfunction initiated activities such as repair maintenance, QA audits following maintenance, and operating alternative measurement methods shall be ordered or requested. The requesting person or party shall be specified within the description.

The Environmental Engineering Manager is responsible for ensuring that the source is in compliance with all applicable rules and regulations.

The efficient and effective implementation of a management plan rests with the individuals assigned to the program. The Environmental Engineering Manager supervises a department of trained and equipped technical specialists who monitor all plant facilities and surrounding areas, and who conduct tests necessary to obtain sufficient data for assessing continuous compliance with all environmental requirements.

Their qualifications and capabilities are indispensable in carrying out a successful plan. Thus, the program is supported by an adequately sized staff such that individuals are not overcommitted; and the staff has training and experience that are commensurate with assigned duties and responsibilities. Staffing details are reviewed and revised, as necessary, by the Environmental Engineering Manager. The following briefly describes the position and the responsibilities of the Environmental Engineer necessary for the day-to-day implementation of the source continuous compliance program.

The Environmental Engineering Manager is responsible for the following general duties: (1) ensuring that the source complies with all environmental regulations, (2) directing the overall activities of the Environmental Engineering Department, including implementation of the SEMP to meet regulatory continuous compliance initiatives, and (3) providing corporate and regulatory agencies with all required reports and documentation of activities. This position also entails more detail functions such as corporate local assistance, strategy development, system study, promulgation of permit requirements and liaison between source and regulatory agencies.

Tier II of the management plan involves coordination of the source quality assurance program. The quality assurance (QA) Coordinator is responsible for developing and carrying out all QA/QC activities and for keeping the Environmental Engineering Manager (Tier I Director) informed of all pertinent QA/QC results. The QA Coordinator directs all statistical procedures and techniques, that will enable the source to comply with permit requirements. In addition, the QA Coordinator plans and performs periodic and quarterly audits of the monitoring system and control equipment, evaluates data quality, and documents this information in the form of reports and quality control charts. It is the responsibility of the QA Coordinator to respond to quality control problems and coordinate those activities with Tier I Director. The QA Coordinator should prepare monthly and quarterly reports summarizing the following information:

1. Emission data (reduced and validated);
2. QA audit results (periodic and quarterly);
3. CEM performance history, after last report (e.g., CEM malfunctions, corrective action, preventative maintenance);
4. Quarterly reports; and
5. Process and open-dust VE occurrences.

This information is submitted to the Environmental Engineering Manager for approval and distribution.

Tier III of the management plan involves daily operation and maintenance of all monitoring and control systems. The Director of Tier III, O&M Supervisor, is responsible for implementing QA activities (e.g., alignment checks, daily zero/span of the instruments, maintenance of necessary spare parts inventory, etc.) specified in the permit and in source SEMP. In addition, the O&M Supervisor is responsible for all manual sampling (e.g., source sampling, performance specification testing, accuracy audits, etc.). Table 5-2 summarizes the quality assurance responsibilities associated with each tier of the management plan. The Environmental Engineering Manager (Tier I Director) should develop a table which establishes program participants, name, title, and responsibilities.

Organization of participants and activities is one of the most important functions of a properly operated system. Personnel should be delegated duties which they can proficiently complete. The SOP manual should define all QA/QC, maintenance, data validation and reduction, documentation and communication

TABLE 5-2. RESPONSIBILITIES OF TIER I, II, III IN A SOURCE MANAGEMENT PROGRAM

Tier I and II Manager, Environmental Engineering and QA Coordinator	Tier II and III QA Coordinator and O&M Supervisor	Tier III O&M Supervisor
Document source control performance corrective action	Corrective action	Preventative and schedule maintenance
QA plan and purpose	Control equipment and CEM quality control	Data reporting
Control management system	Monthly and quarterly reports to Tier I coordinator	Calibration of pollution control equipment
Quality planning	Periodic and quarterly audits of emission control program	Document control for fugitive control program
Training		Sample collection
Emission control monitoring system budget and cost		Fugitive control coordination
Audit procedures		
Data validation and verification		
Quality report to corporate management and regulatory agency		

activity responsibilities and personnel assigned (job category and by name) each of these responsibilities.

5.3 SOURCE RECORDKEEPING PLAN

A plant specific recordkeeping program should be designed to provide the level of useful information with a minimum amount of personnel resources to complete the necessary checks and paperwork. A plant recordkeeping program should contain five basic items. They are:

1. Equipment record;
2. Inspection checklist;
3. Baseline logbook;
4. Control system logbook; and
5. Equipment maintenance/work order.

5.3.1 Equipment Record

Equipment record involves the cataloging of all equipment used in the control of both point and fugitive lead emissions from the source, thus enabling periodic review of information when needed to compare design specifications to permit conditions.

In general, a centralized filing and retrieving system is preferred. However, in small operations, an office, with a bookshelf of the operating manuals, accompanied by drawings and blueprints is satisfactory. As plants get larger, however, the number of manuals and specifications that need to be maintained becomes very large and a more sophisticated storage and retrieval system is needed. In these situations, a "catalog" system works well where documents are given a file number for later retrieval. The catalog can consist of cards kept in a filing system according to process or control equipment grouping. The catalog may be further subdivided into major subassembly groups. To locate the necessary data, one must locate the major grouping and subgroup, obtain the file number, and then go to that file location to obtain the necessary data.

A variation in this procedure is to list all major components and subassemblies under a category either on paper or by computer. Again, all that is necessary is to look up the major heading and then the subcategory to find the appropriate file number. In fact, either system allows the addition of basic design information in the catalog that might save time and effort in finding the appropriate file.

The equipment record should be kept up-to-date. If modifications to a system are made (e.g., changing the number and size of tubes in a multicyclone) this information should be reflected in the equipment record. Old or out-of-date information should be removed from the system and either placed in a dead file or discarded.

5.3.2 Inspection Checklist

Inspection checklist provides a record of specific inspection points to be performed by the source operator. These inspection points have been selected as primary indicators as to the overall performance of the control equipment and program to ensure compliance with emission limitations. The inspection check list provides numerical information along with a narrative of the findings, so a corrective course of action can be selected.

Outlined below are basic inspection parameters which must be evaluated for each control equipment as part of a source specific operation and maintenance program for the permit condition.

5.3.2.1 Multicyclones. The multicyclones are the least complicated control device. There are two limiting factors:

1. Plugging; and
2. Gas volume through control device.

The performance of a multicyclone is closely tied to the volume of gas passing through it. The following parameters provide information on the performance of multicyclones:

1. Pressure drop;
2. Temperature;
3. Fan motor current; and
4. Dust discharge operation.

5.3.2.2 Baghouses. All baghouses rely on the same method of operation to remove particulate matter from the gas stream. The fabric filter of the baghouse provides the support material for the establishment of a dust layer or dust cake that performs most of the filtration. During operation, this dust layer increases in thickness and, thus, increases pressure drop across the fabric filter. Periodically the dust cake must be removed by the cleaning system, which may be categorized as either pulse cleaning, reverse air, or shaker. The low energy systems (shaker and reverse-air) require low air-to-cloth ratios (4 to 12 $acfm/ft^2$). All fabric filters are sensitive to the process operation and dust characteristics. As such, the records obtained must be coordinated with appropriate process data.

The list of operating and maintenance related data and records that may be used is limited. Although the data are limited, the information provided is very useful in evaluating performance and maintenance considerations. These data include:

1. Pressure drop;
2. Temperature;
3. Opacity;
4. Fan motor current;
5. Bag replacement location.

5.3.2.3 Venturi Scrubbers. The most commonly employed scrubber for the control of particulate matter emissions is the venturi scrubber. Even within the classification of venturi scrubber there are several different design types: circular throats, rectangular throats, and fixed and variable throat designs. Although there are a number of different designs, the basic operating principles remain the same.

A number of parameters are available to monitor scrubber performance and some even used to control scrubber operation. The records associated with these operating and maintenance parameters include:

1. Pressure drop;
2. Water flow rates (recirculation, makeup and blowdown);
3. pH of scrubber liquid;
4. Temperature;
5. Solids content of recirculated scrubber water;
6. Solids removal from settling tanks or ponds;

7. Fan motor current;

Maintenance

1. Nozzle replacement;
2. Throat replacement or adjustments; and
3. Pump impeller wear.

5.3.3 Baseline Logbook

The baseline log is a set of records of pertinent operating parameters of the equipment. The fundamental principle of this log requires the source operator to document the comparison of observed values of the control equipment with site-specific baseline data. Operators record these values at specified intervals and chart them to document performance. By comparing the present value with the baseline value obtained during compliance, the operator can evaluate the effectiveness of the system. As illustrated in Figure 5-1, the observed value is plotted against the baseline data. By developing the graph, the user is able to document performance, therefore enabling the observer to develop possible reasons for deviation from the baseline value.

The principle of baselining is that control device performance diagnosis is most accurate when observed operating conditions are compared with site-specific baseline data. The specific "historical" data implicitly take into account the numerous subtle factors which can influence emissions (see Figure 5-2). Baseline assessments avoid the errors potentially introduced by extrapolation of published literature values to a given facility.

Control device instruments and field measurements are sometimes subject to error; therefore, baseline diagnosis is based on sets of data comparisons rather than reliance on just one parameter. Even when some of the data is unavailable or suspect in quality, it is still possible to reach meaningful and accurate conclusions using the remainder of the data.

The purpose of baselining is to rapidly identify significant changes in performance and the possible reasons for the changes. The technique does not necessarily provide definite evidence of

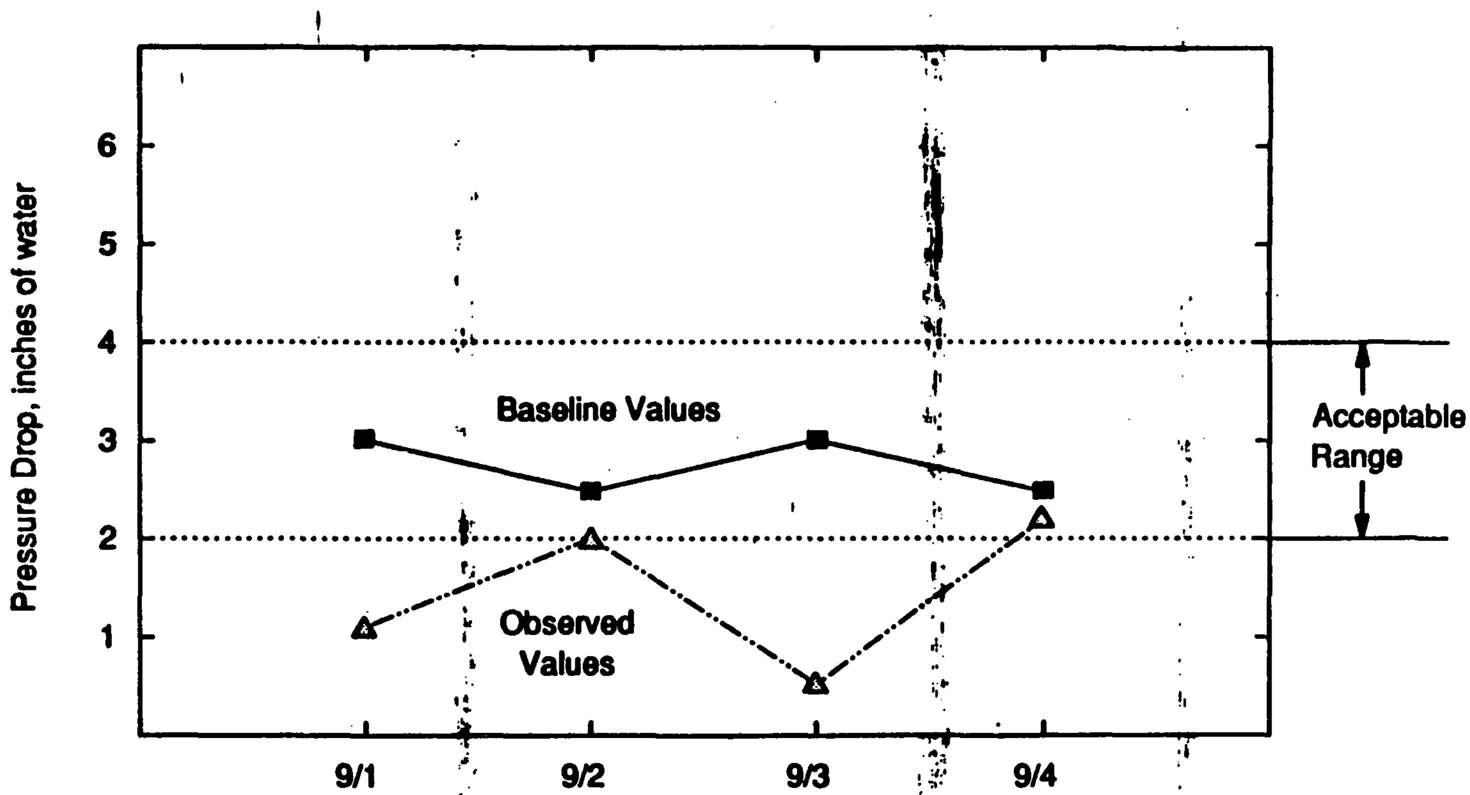

Figure 5-1. Baseline data for Unit No. 1 of baseline

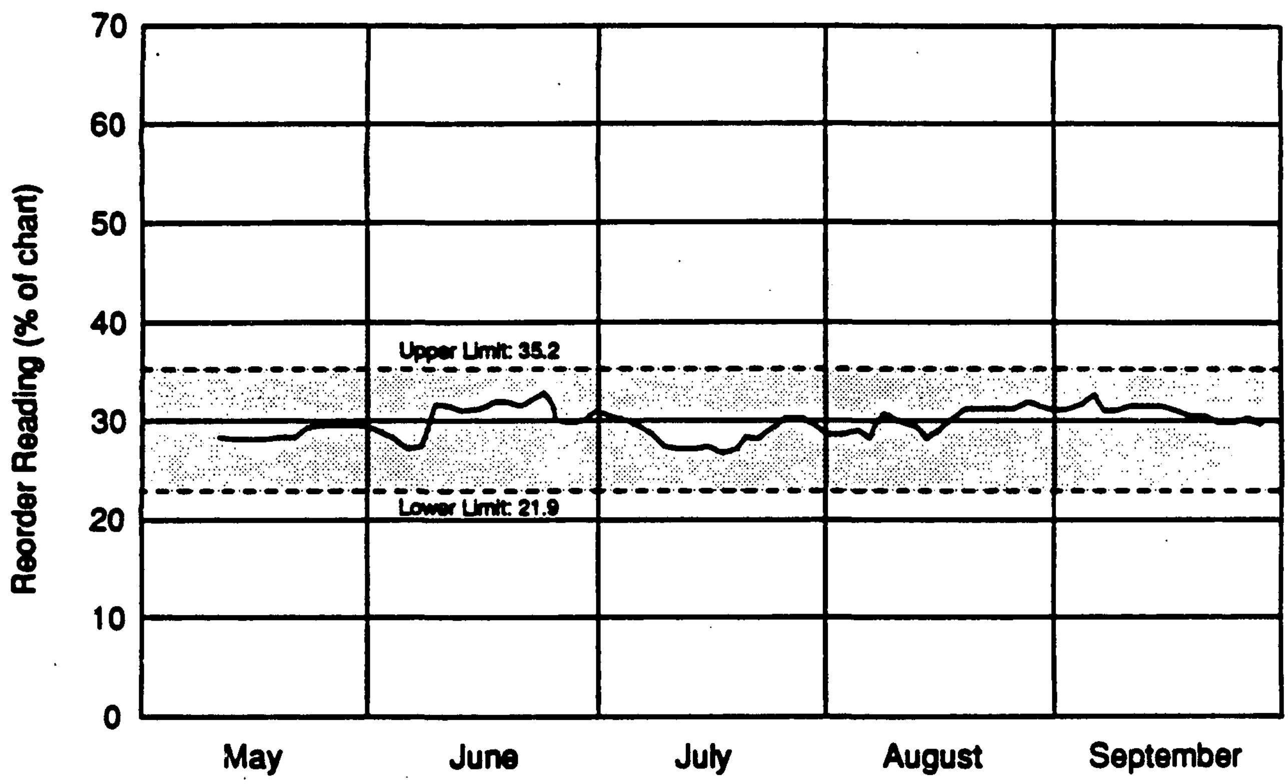

Figure 5-2. Baseline data within control limits

noncompliance with regulations, nor does it necessarily provide a specific list of the repairs required.

5.3.4 Control Monitor Logbook

A control monitor logbook should be maintained for each piece of lead emission control equipment used at the facility. All activities related to the control system (maintenance, calibration, etc.) should be recorded on the logbook form, as illustrated in Table 5-3. Each entry in the logbook should include the date, a brief description of the activity performed, as outlined in Chapter 4, and the individual's initials.

If corrective action is needed, then a problem communication memo is completed, as illustrated in Table 5-4. This, then, is submitted to the operation and maintenance (O&M) supervisor for corrective action. The O&M supervisor should maintain these records chronologically in a three-ring binder. This provides documentation on when a problem was first detected and the need for corrective action to resolve the problem.

5.3.5 Equipment Maintenance/Work Order

Once the pollution control equipment has been inspected, it may require additional adjustments or maintenance to return it to baseline conditions. To assist sources with their operation and maintenance programs, the work order has been established as a tracking system. As illustrated in Figure 5-3, the work order is divided into three parts. Part I addresses the initiation of the activity, indicating that maintenance has been requested. Part II assists the plant in the scheduling of maintenance personnel to address the deficiencies of the control system. Finally, Part III provides space for reporting the activities performed, if any action was taken to correct the problem, or whether further action is required (and scheduled).

For example, in a baghouse, if a broken bag was suspected of causing increase in opacity, a work order might specify that the cause of the increase opacity should be found and removed. Then during a short outage, maintenance personnel would be scheduled to repair the unit. If they found the cause was a broken bag, they would remove the bag, possibly replace it, note its

TABLE 5-3. CONTROL MONITOR LOGBOOK

DATE	ACTIVITIES OR MAINTENANCE	BY

TABLE 5-4. PROBLEM COMMUNICATION MEMO

From: ______________________________

To: ______________________________

Date: ______________________________

Problem Definition &
Recommendation

____

____

____

____

____

Signed ______________________

Corrective Action Taken

____

____

____

____

____

____

Completion Date ______________

Signed ______________________

TROUBLE REPORT/WORK REQUEST

CRN

4

8-8-83

8-8-83

13932

PART I INITIATION

OPACITY & GEM | STACK | 3A

OPACITY AND GAS EMISSIONS MONITORS WERE APPARENTLY STRUCK BY LIGHTNING. INVESTIGATE AND REPAIR. GO TO GEM FIRST AS WE ARE SUPPOSED TO CHECK IT TODAY AGAINST [illegible]

NO 8-8-83 [illegible]

PART II PLANNING

8-8-83

PART III JOB COMPLETION REPORT

OPACITY MONITOR - FOUND ICB IN TIMING CKT BAD. REPLACED.

GAS EMISSIONS MONITOR - FOUND ICB IN NO_x CHANNEL BAD - SHORTING +15V SUPPLY TO GND. REPLACED. ES/DM 8-8-83

8-10-83

8-10-83

Figure 5-3. Source equipment maintenance and work order.

location, and document on the work order. If some other cause was found (e.g., overload of hoppers, improper cleaning of bags), these would be recorded as well as any additional maintenance performed or scheduled for a later date. Lastly, work orders can be sorted several ways for accounting purposes. They can be sorted by labor craft, equipment type, process, and by type of problem. Whether done by hand or computer, the work orders can summarize the results of a preventive maintenance plan by showing if failures are occurring "randomly" or if the maintenance and corrective maintenance are not addressing the proper causes of problems. The cost of such problems would also be available to estimate the cost of changing the preventive maintenance program.

5.4 SOURCE MEASUREMENT PLAN

Source measurement plan involving baseline inspection techniques have been developed to assist both Agency and source operators with the periodic and systematic inspection of a source emission control program to determine its effectiveness to achieve continuous compliance regulatory objectives. The fundamental principle of source measurement plan involves the comparison of observed values with site-specific baseline data in the source emission control program. This enables the subtle changes of control program elements to be average over a period of performance, thus avoiding the error of extrapolation of data from a single observation to a compliance determination. Baseline diagnosis involves a set of data comparisons rather than comparison of single observations. This approach enables determination of control program effectiveness to be based upon many parameters, even when a single important observation cannot be acquired. By observing many parameters, changes in control equipment performance and possible reasons for these changes can possibly be identified.

Baseline inspection involves characterization and observation of both process and control equipment. Visible emission observations of ventilation systems, auxiliary equipment inspection, process equipment evaluation, storage pile maintenance and records review are all part of the baseline inspection program. The operation characteristics and performance of each of these systems is unique unto itself. As process variables and control devices change over time, the performance decreases. Baseline inspection involves comparison of present operating conditions against historical baseline levels for that visit. Consequently, these changes can be identified, enabling the source to implement control measures to insure continuous compliance. Each variable which has shifted may signify a symptom of possible operation problems.

5.4.1 Levels of Inspection

The levels of inspection are designated at 1 through 4 with Level 4 being the most intense.

5.4.1.1 Level 1. Level 1 inspection is usually limited to records review and visible emission evaluation. It is a field surveillance tool intended to provide incomplete indication of compliance status. The source personnel makes visible emissions observations on all stacks, ventilation equipment, storage piles and outside facilities which can be properly observed. Level 1 inspection requires a minimum of time and manpower. Utilizing Federal Reference Method 9 and 22, proper observations are made.

5.4.1.2 Level 2. Level 2 inspection by plant personnel involves determination of compliance by inspection of current control device and process operating conditions utilizing installed meters and charts in addition to visible emission observations taken during Level 1. This level of inspection includes the observation of operating conditions by plant personnel and comparing to unit specific baseline data. It also includes a review of existing records and logbooks on source operations, particularly for the intervening period following the last inspection.

5.4.1.3 Level 3. Level 3, a thorough and time-consuming inspection, is designed to provide a detailed engineering analysis of source compliance using actual measured operating parameters by the source operator such as pressure drop, fan static pressure and current, gas stream temperature, pH of scrubber, flue gas conditions, oxygen level, and water flow rates. The measured data are reduced and used to calculate flue gas volume, superficial velocity, specific collection area, inlet velocity, air-to-cloth ratio, hood inlet volume and velocity, liquid-to-gas ratio, throat velocity, etc. Because many of these are control device and source specific, they must be adjusted to the individual source being inspected.

There are two major purposes for this type of inspection:

1. To establish baseline operating conditions; and
2. To verify whether the source is experiencing O&M problems that result in less than continuing compliance with the emission standards.

The inspection may also include an internal inspection of the control device. For fabric filters, an internal inspection is required to determine bag condition or integrity of the baghouse. For scrubbers, an inspection of the condition of the nozzles is required if the water flow rate or pressure data indicate the possibility of pluggage. A periodic internal inspection of mechanical collectors is required where the collection of abrasive dust is likely to cause abrasion-induced failure.

Because this level of inspection requires the monitoring of equipment conditions and, in some cases, an internal inspection, the plant coordinator must be sure that all safety requirements are met prior to entry. In all cases, lockout procedures should be used and applicable safety equipment employed.

In a typical application, the source inspector may record such process items as feed rates, temperatures, raw material compositions, process rates, and such control equipment performance parameters as water flow rates, water pressure, and static pressure drop across baghouse. The source inspector could then use these values to determine any significant change since the last observation or any process operations outside normal or permitted conditions, particularly when coupled with the aforementioned records check.

A significant change in operating conditions could require that the source upgrade the inspection to a Level 4 involving a stack test or other methods to verify compliance.

The basic type of equipment necessary to perform a Level 3 baseline inspection is listed below.

Fugitive Emissions

Stopwatch

Method 22 field observation data sheet

Control Equipment

Method 9 field observation data sheet

Tape measure

Stopwatch

Differential pressure gauge

Pilot tubes

Velometer

Thermocouples

pH paper/meter

Combustion gas analyzer (O_2/CO_2/CO)

Process

Flow chart

Production schedule

5.4.1.4 Level 4. The Level 4 inspection prepares an actual emissions baseline for the source through the use of a stack test or visible emission evaluation. This inspection requires that the source inspector monitor all process and control device operating parameters during a stack test for use during future inspections. The Level 4 inspection is typically applied to sources with baghouses or wet scrubbers needing compliance emission data. The inspection may require documentation of control equipment conditions through the use of an internal inspection before the stack test.

5.4.2 Activity Associated with Levels of Inspection

The purpose of the increasing level of inspection is to concentrate the resources on those sources that have the greatest potential to exceed the emission limits. For instance, initial results of the Level 1 inspection may indicate that specific sources are not experiencing deficiencies in performance and, therefore, do not warrant a higher level of inspection. In these cases, the frequency or level of inspection may be adjusted downward consistent with the results of the Level 1 inspection, as illustrated in Table 5-5.

TABLE 5-5. ACTIVITIES ASSOCIATED WITH LEVELS OF INSPECTION

Component	Level 1	Level 2	Level 3	Level 4
Baghouses	Method 9 observation Visible emission spikes Structural corrosion High settleble solids in discharge area Records review of bag failure and maintenance	Observe pressure drop across baghouse using installed meters Observe inlet/outlet gas temperatures Observe solid discharge area	Pressure drop across baghouse Inlet/outlet gas temperatures. Corrosion of fabric filter and shell Inlet/outlet oxygen concentration	Federal Reference Method 5 test
Wet scrubbers	Method 9 observation Plume color and dimensions Droplets adjacent to stack Structural corrosion	Observe scrubber liquid turbidity and pH Observe pressure drop across scrubber Observe liquid discharge area Observe plume color and dimensions	Method 9 observation Scrubber liquid turbidity and pH Structural corrosion Pitot traverse of inlet/outlet Liquid flowrate	Federal Reference Method 5 test
Ventilation	Method 22 observation Position of ventilation system to discharge Corrosion problems Air balancing problems	Observe position of intake to discharge areas Observe visible emissions around doors, hatches, enclosures, etc.	Method 22 observation Static pressure check Gap distance between hood and duct system measured/verified Temperature of gas stream at duct Flow rate calculation	Method 22 observation
Cyclones/multicyclones	Method 9 observation Accumulation of dust in vicinity of stack Structural corrosion	Observe pressure drop across cyclone Observe visible emissions Observe solid discharge area	Static pressure across cyclone Inlet gas flowrate Inlet/outlet oxygen concentration	Federal Reference Method 5 test
Storage piles	Method 22 observation Records review of O&M practices	Observe visible emissions Review fugitive dust minimization program	Method 22 observation Review of fugitive dust minimization program Sampling of piles for moisture and silt content	Method 22 observation Sampling of piles for moisture, silt and lead content
Paved/unpaved roads	Method 22 observation Review of fugitive dust minimization program Traffic patterns	Observe traffic pattern Observe visible emissions	Method 22 observation Sample of roads for chemical analysis	Method 22 observation Sample of road for chemical analysis

6.0 AGENCY CONTINUOUS COMPLIANCE PROGRAM

6.1 INTRODUCTION

Implementation of an effective continuous compliance program requires a concerted effort on the part of both the regulatory agency and the major lead emitting sources. Section 5.0 provided guidance on the development of source a SEMP. This chapter describes steps that can be taken by an air pollution regulatory agency to ensure that these measures are implemented and maintained.

In general terms, the regulatory agency's role in a continuous compliance program is first to define in clear and enforceable terms the requirements that must be followed at each facility and, once these requirements are put into place, to conduct a compliance oversight program that ensures that these requirements are met. Section 6.2 below describes the general framework for such a program.

Although the definition of requirements is based on the agency's regulations, the facility's permit is the major vehicle for translating agency requirements into specific enforceable measures to be taken at each facility. Development of enforceable terms and conditions in the permit is therefore critical to a successful program. In addition to defining the emission standards to be met, the permit must also spell out the measures that must be taken by the permittee to ensure compliance with these standards on a continuous basis. Section 6.3 suggests an approach for incorporating operational and maintenance and associated recordkeeping requirements into the facility's permit. An important aspect of this approach is the use of parameter monitoring as a tool for continuous compliance monitoring of flue gas emissions and fugitive emissions. Section 6.4 provides guidance on parameter monitoring requirements to be included in facility permits.

6.2 PHASED APPROACH TO CONTINUOUS COMPLIANCE IMPLEMENTATION AND OVERSIGHT

The main objective of an agency continuous compliance program is to ensure that all sources come into compliance with applicable requirements and maintain compliance. The major tools available to the agency include:

1. Enforceable regulations and permits;
2. Compliance inspection authorities;
3. Authorities to require continuous emission monitors (CEM's) and visible emission (VE) observations;
4. Recordkeeping and reporting authorities; and
5. Enforcement authorities.

Effective use of these tools to achieve implementation of continuous compliance programs at lead smelting and lead-acid battery recycling facilities can often be best accomplished by initiated a multiphase compliance approach, consisting of the following:

Phase I. Definition of the facility's continuous compliance requirements in the terms and conditions in the facility's permit, including requirements for performance specification testing of continuous emission monitors (CEM's) and control equipment evaluation. Additionally, preparation of a source emission minimization program describing the specific steps proposed by the permittee to maintain continuous compliance (as explained in Section 6.3) from point and fugitive source emissions;

Phase II. Observation of performance specification testing of the installed control monitoring systems and control systems baselining;

Phase III. Review of the baselining testing report, with final approval or disapproval. If approved, information from the testing will be incorporated in the facility's SEMP; and

Phase IV. Review of the source emission minimization program submitted by the permittee, with final approval or disapproval.

Phase I involves the preparation of a permit that clearly states all of the enforceable requirements applicable to the facility. The permit is the foundation for the facility's continuous compliance program. It provides requirements for the facility in specific, enforceable terms and conditions. It is therefore extremely important that enforceable technical standards and monitoring, operation and maintenance, and recordkeeping and reporting requirements be provided in the facility's permit. It should be recognized, however, that it is not always possible or desirable for the permit writer to include specific requirements for all of the necessary components of a comprehensive continuing compliance management program into the permit, particularly for compliance measures that rely heavily on management practices at the facility, such as may be needed to ensure continuing compliance with fugitive emission standards.

As an alternative to numerous specific requirements, it is recommended that the permit writer require that the permittee develop and submit for agency approval a source emission minimization control program that defines the specific measures that comprise the facility's continuous compliance program. Under this approach, the permit includes a compliance schedule for development, submittal, and implementation of a SEMP that provides a clear plan for achieving and maintaining continuous compliance with the permit terms and conditions. The lack of an approved SEMP would not provide a "shield" for the permittee from enforcement actions over the failure to comply with all of the terms and conditions in the permit.

The permit should also identify the emission points where continuous emission monitors are to be employed, and require that specification performance testing be performed (Phase II). Agency staff should observe the testing. The performance test is then submitted to the agency for review and approval (Phase III), under a schedule provided in the permit. In addition, all emission control programs are performance tested to verify their effectiveness in lead emission reduction. Once approved, the measurement parameters provide the "baseline" against which compliance will be measured and therefore should be included in the facility's SEMP.

In Phase IV, the agency reviews the source emission minimization program submitted by the permittee to determine whether it meets the requirements spelled out in the permit. The plan should incorporate the results of the Performance Specification Test, and demonstrate that the proposed compliance measures are adequate to maintain all emission sources, control equipment, and monitors within acceptable ranges identified during the test. When approved, the SEMP provides a "blueprint" for compliance at the facility. The plan will greatly facilitate subsequent compliance oversight activities conducted by the agency, including review of reports, records reviews at the facility, and inspections.

6.3 INCLUSION OF PLANT SPECIFIC OPERATION AND MAINTENANCE AND RECORDKEEPING PRACTICES IN A SOURCE PERMIT

Given the wide range of point sources and fugitive emissions at lead emitting facilities, the preparation of terms and conditions governing each facility's continuous compliance program poses a major challenge to the permit writer. Permits should identify all regulated emission sources and the emission standards to be met for each source. However, continuous compliance with the emission standards requires that the permittee conduct a range of activities requisite to meeting these standards on a continuing basis, such as proper operation and maintenance of control and monitoring equipment, good housekeeping practices, sound recordkeeping and reporting practices and implementation of clear management controls at the facility. Therefore, the scope of an effective permitting strategy must extend well beyond simply specifying the emission standards to ensure that all necessary components of a continuous compliance system are implemented by the permittee. An effective permitting strategy calls for a permit that includes the following components, at a minimum:

1. Identification of every emission source at the facility that is regulated under the permit;

2. Specification of the emission standards to be met by each source;

3. Compliance monitoring requirements for each source;

4. Recordkeeping and reporting requirements for each source;

5. Operation and maintenance requirements for each source; and

6. A requirement for submittal of a SEMP.

6.3.1 Identification Of All Process and Fugitive Sources Regulated Under The Permit

The permit should identify unambiguously all emission sources that are to be regulated as outlined in Chapter 3. Examples of such sources at primary and secondary lead smelters are summarized in Tables 6-1 and 6-2 respectively. While the numbers and types of sources requiring regulation must be determined on a facility-specific basis, it is important that every potential source be carefully evaluated prior to the final permitting decision. Each regulated source should be identified as specifically as possible in the permit, including identifying all emission streams of concern and ancillary equipment and operations associated with these sources. For example, a blast furnace at a primary lead smelting facility which has a known emission control system installed may be identified in the permit as:

> Blast Furnace with Maximum Charge Rate of One Hundred Tons Per Day. Primary (Smelt) Emissions Capture and Control System consists of Hooding, a Gases Incinerator, Serpentine Cooling Loops, Ductwork, Fan and 12,000 Square Foot Cloth Area Four-Compartment Baghouse. Secondary (Sanitary) Emissions Capture and Control System consists of a Charging Hood, Slag Tapping Hood, Ductwork, Fan and 4,000 Square Foot Cloth Area Single Compartment Baghouse. Metal Tapping Emissions Capture and Control System consists of a Tapping Hood, Ductwork and 4,000 Square Foot Cloth Area Single Compartment Baghouse (shared with the Reverberatory Secondary (Sanitary) Emissions Capture and Control System).

Nonprocess fugitive emission sources at the facility, including materials storage piles and roadways, should also be identified as specifically as possible. If the permitting strategy calls for requiring that materials handling be limited

TABLE 6-1. POTENTIAL EMISSION SOURCES AT PRIMARY LEAD SMELTERS AND THEIR CONTROL PROGRAMS

Source	Specific Activity	Type(s) of emissions	Type(s) of controls(1)
On-site transportation of feedstocks	Movement of feedstocks by truck or rail car	Open dust fugitive	1
	Unloading/handling operations	Open dust fugitive	1
Storage of feedstocks	Storage	Open dust fugitive	1,2
Sinter machine	Mixing/pelletizing	Process fugitive	1,2
	Sinter machine loading/unloading	Process fugitive	1,2
	Sintering operation	Flue gas	3
	Sinter breaker, crushers, screening	Process fugitive	1
	Sinter product storage	Open dust fugitive	1
Blast furnace	Blast furnace charge preparation	Open dust fugitive	1
	Blast furnace charging	Process fugitive	1,2
	Blast furnace operation	Flue gas	3
		Process fugitive	2
	Blast furnace discharging	Process fugitive	1,2
Settler	Settler discharging	Process fugitive	1,2
	Slag cooling	Process fugitive	1,2
	Slag granulating	Process fugitive	1,2
	Slag storage	Open dust fugitive	1
Dross kettle	Kettle operation	process fugitive	1,2
	Dross reverberatory furnace	Flue gas	3
		Process fugitive	1,2
	Slag and dust storage	Open dust fugitive	1
Lead casting	Casting operation	Flue gas	3
		Process fugitive	1,2

(1) Key: 1 = Management controls
2 = Fugitive emission capture and control devices
3 = Flue gas emission control devices

TABLE 6-2. POTENTIAL EMISSION SOURCES AT SECONDARY LEAD SMELTERS AND THEIR CONTROL PROGRAMS

Source	Specific activity	Type(s) of emission	Type(s) of controls
Scrap receiving and preparation	Battery breaking	Open dust fugitive	1
	Dross/residue crushing	Open dust fugitive	1
	Rotary/tube sweating	Process fugitive	1,2
		Flue gas	3
	Reverberatory sweating	Process fugitive	1,2
		Flue gas	3
Reverberatory smelting	Charging	Process fugitive	1,2
	Smelting operation	Process fugitive	1,2
		Flue gas	3
	Discharging	Process fugitive	1,2
Refining	Smelting furnace	Process fugitive	1,2
		Flue gas	3

(1) Key:
1 = Management controls
2 = Fugitive emission capture and control devices
3 = Flue gas emission control devices

to designated areas, the areas should be specifically named (e.g., "Lead Ore Concentrate Storage Bin," or "Railroad Car Unloading Area"). As discussed below, for new facilities or facilities where the permitting strategy calls for the permittee to develop a fugitive dust control plan as part of a facility SEMP, the permit may use more general terms such as "Areas Designated in SEMP for Storing Lead Ore Concentrate" or "Roadways at the Facility Designated in the SEMP for Hauling Lead-Bearing Materials".

6.3.2 Emission Standards to be Met for Each Source

The permit should very precisely state the emission standards applicable to each source. For process sources, the standards may be stated in terms of mass rates and/or visible emission standards and should address both flue gas emissions and fugitive emissions. The standards should be as specific as possible in terms of the types of emissions regulated and the stages in the production process to which the standards apply. For example, for the blast furnace used in the example above, emission standards might be stated as:

1. The exhaust from the blast furnace primary (smelt) baghouse shall meet the following requirements:

   a. Particulate matter emissions shall be emitted at a concentration not to exceed ___ grains per dry standard cubic foot of exhaust, as measured by Method 5 of Appendix A of 40 CFR 60, or any equivalent method approved by the Director;
   b. Opacity shall be less than ___ percent, as determined by Method 9 or Method 22 of Appendix A of 40 CFR 60;
   c. A continuous opacity monitor shall be operated and maintained consistent with the requirements contained in Parts 60.7, 60.11, and 60.13. and in Table 1-1 of 40 CFR 60.

2. The exhaust from the blast furnace secondary (sanitary) baghouse shall meet the following requirements:

   a. Particulate matter emissions shall be emitted at a concentration not to exceed ___ grains per dry standard cubic foot of exhaust, as measured by Method 5 of Appendix A of 40 CFR 60, or any equivalent method approved by the Director; and

b. Opacity shall be less than ___ percent, as determined by Method 9 of Appendix A of 40 CFR 60.

3. Dust collected by each baghouse and underneath cooling loops shall be handled so that the dust will be completely enclosed during removal and transfer. Emissions escaping from dust handling equipment shall not exceed ___ percent opacity, as determined by Method 9 of Appendix A of 40 CFR 60, excluding Section 2.5 therein.

4. Visible emissions escaping from the blast furnace and blast furnace primary (smelt) capture system equipment shall have an opacity less than ___ percent, as determined by Method 9 of Appendix A of 40 CFR 60.

5. Visible emissions escaping the capture system for blast furnace charging shall not exceed ___ percent opacity when charging the furnace, nor ___ percent when the furnace is not being charged, as determined by Method 22 of Appendix A of 40 CFR 60, excluding Section 2.5 therein.

6. Visible emissions escaping the capture system for blast furnace slag tapping shall not exceed ___ percent, as determined by Method 22 of Appendix A of 40 CFR 60.

7. Visible emissions escaping the capture system for blast furnace metal tapping shall not exceed ___ percent, as determined by Method 22 of Appendix A of 40 CFR 60.

It is generally not feasible to state emission standards for fugitive emissions from material storage and handling areas, and from roadways at the facility, in mass rate terms. Therefore, the standards must usually be stated in terms of visible emissions citing either Method 9 or 23. For certain sources, it may be appropriate to provide an operational standard as well, such as a requirement that the material be kept wet at all times or that it never be stored in areas exposed to the atmosphere. For example, for fugitive emission standards from material storage piles the emission standards might be stated as:

> Roadways at the facility designated in the facility's source emission minimization program shall be kept wet at all times so that no visible emissions emanate from the roadway.

6.3.3 Compliance Monitoring Requirements for Each Source

The permit should include specific requirements for measures to be taken by the permittee to monitor compliance. The term "compliance monitoring" in this context refers to monitoring both direct compliance with the applicable emission standards for the source and monitoring the range of O&M activities that must be conducted to ensure that emissions are kept within allowable limits. This comprehensive definition of compliance monitoring applies to both point sources and fugitive emission sources.

For point sources controlled by scrubbers or baghouses, compliance monitoring should involve the use of continuous emission monitors in the outlet stack, where feasible, as well as control equipment (and process) parameter monitoring to ensure proper operation of the control equipment. Performance specification testing is necessary to determine the baseline set of parameter values that will result in compliance with emission standards applicable to the source. The permit conditions should be written in a manner such that operation of the equipment outside of the acceptable range above and below the baseline value, as determined by the performance specification test and approved by the regulatory authority, constitutes noncompliance. Section 6.4 provides additional guidance regarding performance parameters for control equipment used at primary and secondary lead smelters.

If data from performance specification testing of CEMS and emission control systems through parameter monitoring acceptable to the regulatory agency are provided in the permit application, specific operating parameters may be designated in the permit. In many cases, however, acceptable performance testing will not be completed prior to permit issuance. In these cases, the permit should include requirements for conducting the test and submitting the results to the regulatory agency for review and approval. Based on these results, the agency can establish enforceable performance standards and include them in the facility's requirements through modifying the permit or by requiring them to be included in the facility's SEMP. For example, the permit might state:

For the 4,000 square foot cloth area single compartment baghouse, the Permittee shall submit to the Director, within ___ days of the effective date of this permit, the results of performance specification testing, sufficient to develop a performance baseline of the baghouse compared with the following operating parameters:

1. pressure drop;
2. temperature;
3. opacity; and
4. fan motor current.

The Permittee shall notify the Director at least seven days prior to conducting the performance specification test. Based upon the results of the test, the Director will determine the acceptable range of each parameter and will notify the Permittee in writing of this finding. The Permittee shall record each parameter on a daily basis and shall include in the facility's source emission minimization program measures to be taken in the event that any parameter that is outside the acceptable range determined by the Director.

For sources where compliance will be monitored with continuous emission monitors (CEM's), the permit should include at least the following CEM requirements:

1. Maintenance, calibration, and operation in accordance with State agency requirements, 40 CFR 51 and (where applicable) 40 CFR 60;

2. Excess emission reports (EER's) submitted to the Director every quarter;

3. Certification of the CEM's;

4. Emission measurement data tabulated and recorded daily;

5. Tabulation of 30 day rolling averages;

6. Maintenance of quality assurance/quality control requirements;

7. Continuous operation of 90 percent operating time;

8. Reporting of percentage down time to the Director; and

9. Daily zero/span drifts checks and corrective action program if exceeds acceptable ranges.

For fugitive sources, major control options are dependent on maintaining good housekeeping practices as discussed in Chapter 3.0. As explained in Chapter 3, there are two generic approaches for monitoring compliance for these types of sources:

(1) recordkeeping; and (2) indirect performance measurement based on sampling and analysis of the source materials. Under the first approach, compliance is confirmed by maintaining records documenting that management measures, such as spraying roadways in accordance with schedules approved by the regulatory agency, are being maintained. Under the second approach, performance measurements, such as analyzing roadway materials to determine whether they have sufficient moisture content, is used. Under either approach, the permit should state the requirements for compliance monitoring. If the permitting strategy calls for requiring the submittal of a Monitoring Plan as part of the facility's SEMP, the permit can state this requirement by reference to the Plan, such as:

> For roadways designated in the permittee's approved SEMP, the permittee shall maintain a compliance monitoring program in accordance with that Plan.

6.3.4 Recordkeeping and Reporting Requirements for Each Source

Accurate and timely recordkeeping and reporting is critical to an effective continuous compliance program. For every regulated source, the permit should specify recordkeeping requirements, including the types of records to be maintained and the frequency of recording. For example, for air pollution control devices, the results of parameter monitoring should be recorded on at least a daily basis and should include the following types of data, at a minimum:

1. Malfunctions/exceedances;
2. Preventative or corrective maintenance performed;
3. Zero/span calibration results, including the recording of zero/span check values versus time; and
4. Recorder review.

For fugitive emission sources, the permit should include requirements that recordkeeping be conducted to verify that management practices that are necessary to meet the technical standards of the permit (e.g., keeping roadways wet at all times, daily sweeping, etc.) are conducted under the schedule that is stipulated in the permit an as discussed in Chapter 3. If sampling and analysis of source materials for lead content is the method used to verify compliance (see below) the sampling records, analytical results, and QA/QC records should be maintained to a level of detail enabling a compliance inspector to trace the samples from point of origin through analysis.

Reporting requirements should also be stipulated in the permit. As a minimum, these requirements should include submitting EER's to the regulatory agency every quarter and reporting noncompliance that could endanger public health within 24 hours of discovery.

The permit should clearly describe the recordkeeping and reporting standards applicable to each source at the facility, to a level of specificity that ensures their enforceability. The specific content and format of records and reports can be described in the facility's SEMP. It is particularly important that the permittee conducts an aggressive quality assurance/quality control (QA/QC) program to ensure the accuracy of results and documentation. In a well-written permit, inaccurate recording or reporting constitute noncompliance, therefore providing the basis of an enforcement action by the regulatory agency. The implementation of an effective QA/QC program, as detailed in the permittee's SEMP, greatly reduces the likelihood of noncompliance.

6.3.5 <u>Operation and Maintenance Requirements for Each Source</u>

The permit should specify O&M requirements for each source, including requirements on source operations, air pollution control devices and parameter monitoring equipment. The permit should establish the standards to be met in the O&M program, and should specify the types of O&M measures to be taken, frequency of these activities, and recordkeeping requirements to confirm that O&M is being conducted as required. Specific O&M measures can be established in the facility's SEMP, the permit should establish the standards to be met for the O&M program. The following example illustrates the definition of such standards:

> The Permittee shall maintain and operate the 4,000 square foot cloth area single compartment baghouse to prevent any

malfunction or breakdown of the system. A daily inspection of the unit shall be conducted to check overall operating performance to ensure continuous compliance, to inspect all parameter monitoring devices, to record parameters as measured by these devices, and to perform routine maintenance to prevent any malfunction or breakdown of the system. The daily inspection shall be conducted in accordance with the Permittee's approved SEMP.

6.3.6 A Requirement for Submittal of a Source Emission Minimization Plan (SEMP)

It is extremely important that enforceable technical standards, management practices, operation and maintenance procedures, and recordkeeping and reporting requirements be specified in the facility's permit. It is not always possible or desirable for the permit writer to include all of the specific components of a comprehensive continuing compliance management program in permit terms and conditions. Compliance measures that rely heavily on management practices at the facility, such as may be needed to ensure continuing compliance with fugitive emission standards are particularly difficult to address generally.

To the extent that a compliance management plan can be put into place that is both compatible with existing practices at the facility and sufficient to ensure compliance on a continuous basis with the terms and conditions in the permit, it may be advantageous to both the permittee and to the permit writer for the facility manager to prepare such a plan. Under this approach, the facility's permit includes requirements for the development and submittal for agency approval of a SEMP under a schedule provided in the permit. During the interim period prior to approval of SEMP, the facility would be obligated to meet all of the terms and conditions in the permit. The permit would provide detailed specifications of the SEMP, which should include at least five components:

1. Management Plan;
2. Engineering Plan;
3. Measurement Plan;
4. Reporting Plan; and
5. Implementation Plan.

The details of each of these SEMP components are facility-specific. However, the requirements should be spelled out in the permit in sufficient detail to ensure the development and implementation of an effective plan. These requirements are described in the following sections.

6.3.6.1 Management Plan. The purpose of the Management Plan is to define staff member's roles and responsibilities in the facility's proposed continuous compliance program, the chain of command under the program, and management procedures to be followed to the extent that these procedures are not provided in other sections of the SEMP. The Plan should be very specific in describing responsibilities that each person has in the program and their authority in carrying out these responsibilities, as illustrated in Chapter 5.0.

The Management Plan should include all facility personnel whose jobs and responsibilities can impact compliance. This clearly includes those who have direct responsibility for compliance management, such as persons designated to inspect pollution control and management equipment. It is equally as important, however, to include other facility personnel whose responsibilities include activities that can indirectly affect compliance of the facility with the permit, such as production personnel who need to know their responsibilities in the event of an upset that could degrade emission control equipment and materials handlers who need to understand their obligations in minimizing fugitive emissions. While every facility's Management Plan will-be unique, the following types of information should, at a minimum, be provided in the Management Plan:

1. A description of the organization of the facility's continuous compliance program, describing the specific responsibilities and authorities of each person participating in the program, should be provided. The chain of command should be described, including an organization chart.

2. The Manager, Environmental Engineering, responsible for ensuring continuing compliance with the facility's permit should be designated, and a description of duties and authorities

provided. All alternate Managers, Environmental Engineering that may be designated for each production shift and/or as substitutes for the designated facility Manager during his/her absence should also be identified.

3. The facility's Quality Assurance (QA) Coordinator should be designated, and a description of duties and authorities provided. The Management Plan should demonstrate that the QA Coordinator has the responsibility and authority to report QA audit findings directly to the corporate or company management.

4. Job descriptions for every position at the facility related directly to compliance activities (e.g., inspectors, pollution control maintenance personnel, etc.) should be included in the plan. The descriptions should provide a clear delineation of duties, and include by reference those sections of the SEMP for which individuals in these positions are responsible. For example, one of the duties of personnel in the position of O&M supervisor might be spelled out in the job description as "Responsible for inspecting, recordkeeping, and reporting on all parameter monitoring devices as prescribed in the Measurement Plan;"

5. For every other position involving responsibilities that are relevant to maintaining facility compliance (production staff, materials handlers, security staff, etc.), a description of obligations under the SEMP should be provided. This component of the Management Plan is particularly important, because it clearly delineates the relationship between the facility's environmental obligations and the production and environmental control activities. For example, production staff may be responsible for reporting malfunctions of fan motors for fugitive emission hoods immediately to the O&M supervisor, or security staff may be responsible for ensuring that haul trucks drive only on designated roadways at the facility. A delineation of these responsibilities will help reduce the potential for misunderstanding.

6. Procedures for reporting the results of inspections and operation and maintenance activities to the Manager,

Environmental Engineer, should be described. The Plan should provide for immediate notification of appropriate facility personnel in the event of malfunctions or breakdowns of process, monitoring, or air pollution control equipment that could affect compliance.

6.3.6.2 Engineering Plan. The engineering plan describes all of the emission sources regulated under the permit; identifies specific technical, operational, and management controls that the facility proposes to put into place to meet the emission standards prescribed in the permit; and demonstrates the effectiveness of these controls under the range of conditions under which they are to be used.

For the agency, the plan provides the information required to make a determination regarding the appropriateness of proposed emission controls, their capability to achieve the applicable standards. It also provides the agency with a clear understanding of the technical parameters and management measures that are critical to continuing compliance, thus providing a basis for the implementation of an effective compliance oversight program.

For the permittee, the plan provides in unambiguous terms the specific technical measures that must be taken under the facility's permit, thus reducing the potential for misunderstanding in negotiations between the regulatory agency and facility personnel. It can also be a valuable tool for training compliance personnel and for providing them with a clear understanding of the necessary procedures for maintaining compliance.

The plan should address every emission source regulated under the facility's permit, including point sources and fugitive emission sources. The specific types of information to be included will vary for each facility and for each specific emission source at the facility. In general, the information must be sufficiently detailed to demonstrate that the proposed control measures for each source are technically sufficient to ensure that the standards in the permit applicable to each source will be met, can be implemented on continuing basis, and are specific enough that compliance can be monitored effectively by the agency.

The types of information that should be provided include, at a minimum:

1. General facility information. The engineering plan should provide a clear overview of the operations at the facility that are important to the facility's continuing compliance program, including a general description of the materials flow at the facility, an identification of the location and size of every source regulated under the permit, and the production history of the facility. The types of information should include, at a minimum:

a. A process flowchart as illustrated in Chapter 3, showing schematically the flow of lead-bearing materials at the plant. The flowchart should trace the movement, handling, storage, and processing of these materials from initial transportation to the facility through final processing and offsite transportation of products and residuals. This should include materials flow in flue gases, indicating the volumes of materials expected to be captured by emission control devices and indicate how the captured residuals are to be managed. The flowchart should indicate the average and maximum design capacity of each storage, process unit and emission control unit.

b. A facility map that clearly indicates the location of every point and fugitive emission source that is proposed to be included in the Engineering Plan.

c. A summary of the production history of the facility, including a summary of the volumes and types of feedstocks and products managed annually.

d. Operating schedule for the facility (daily and weekly).

2. Proposed controls for every regulated process source. For each process source, the plan should address both flue gas emissions and fugitive emissions in sufficient detail to demonstrate that employment of the proposed controls under the conditions described in the plan will attain compliance with all

applicable standards. For each process source, the plan should include, as a minimum:

a. A complete description, including engineering drawings, of each process unit (e.g., blast furnace, sinter machine, etc.), including associated ductwork and ancillary equipment (e.g., hoods for fugitive emission capture, etc.) and access ports for maintenance and performance monitoring.

b. For each process unit, relevant operating parameters obtained from manufacturers, that could effect emission rates (e.g., for blast furnaces--maximum and average production capacity, frequency and size of charging, operating temperature range, etc.).

c. A detailed characterization of emissions from each unit, and results of any studies to quantify and characterize flue gas and fugitive process emissions.

d. Specific control measures to be taken for each process emission source, including the control of flue gases and process fugitive emissions. For flue gas sources, this would include providing the results of the Performance Specifications Test report and a description of the procedures that will be taken to ensure that the process unit and associated control device will be operated within the boundaries established during the test. The air pollution control device should be fully described in the plan, including: manufacturer, age, design operating temperature, model, and capacity.

e. For fugitive emissions, the Plan should describe the equipment and procedures that will be used to maintain compliance at all times. For example, the control strategy for fugitive emissions during charging of the blast furnace as outlined in Chapter 3 at the facility might involve the capture of emissions with hoods and control of capture emissions with a baghouse. The Plan should describe in detail the proposed procedures that are to be followed by production personnel during the charging operation to ensure that the charging of feed materials and operation of capture devices are operated within the same range of operating conditions as those used during the Performance Specifications Testing and documented through baseline evaluation.

3. Proposed controls for every regulated nonprocess source. For nonprocess fugitive dust sources, including product and waste storage piles, roadways and transfer areas, the plan should provide for each source a description of emissions, and a detailed description of the emission controls that the facility proposes to meet the emission standards prescribed in the permit. For each source, the plan should include at a minimum:

a. A source description should be provided. For storage units, this should include engineering drawings of the unit, including emission control devices if applicable, the maximum storage capacity of the unit, and a description of materials handling operations. For roadways, a description of the roadway materials, the types of vehicles that use the roadways, and average and maximum traffic (e.g., number of trucks per day).

b. For each source, a description of specific controls to be employed should be provided. Control options for nonprocess fugitive emission sources are generally more dependent on housekeeping and operational practices than on the use of emission control devices. The plan should clearly describe the specific measures that will be taken, and include all data that has been developed by the facility to demonstrate the effectiveness of the proposed measures. Examples of the types of controls for these sources were fully described in Section 3.0 of this document.

For roadways and transfer areas, one control option is to designate roadways and materials handling areas that are to be used for transporting and handling of charge or raw materials. If this option is proposed, the plan should include the onsite enforcement procedures that will be used to ensure that these restrictions are followed. If surface cleaning is proposed as discussed in Chapter 3 (e.g., vacuuming for paved roads; sweeping and/or watering for unpaved roads), the Plan should specify the frequency of these operations proposed to maintain compliance travelled areas designated for transportation or handling of lead-bearing materials, this may require that surfaces be kept wet at all times. For undesignated roadways/areas, the frequency proposed for cleaning and/or watering should also be specified, although it does not necessarily have to be as frequent as for designated roadways/areas (e.g., twice daily).

For storage areas, the Plan should describe management controls to be maintained during materials handling. Examples include performing all handling operations in fully enclosed areas, or alternatively, applying stabilization agents to materials while they are being handled and/or using physical controls to minimize emissions to the ambient air during storage (e.g., storing all materials in fully enclosed bins, using wind screens at all times, or keeping open piles covered at all times).

6.3.6.3 Measurement Plan. The measurement plan describes the specific types of monitoring practices, including monitoring devices, that will be used to measure the performance of each of the emission controls proposed in the Engineering Plan and the steps that will be taken at the facility to ensure that these practices are effectively maintained on a continuing basis. For flue gas emission control devices (i.e., baghouses or scrubbers), the Measurement Plan should be based on parameter monitoring, as described in Section 5.0 of this document. For fugitive emission sources, the measurement approach may involve recordkeeping, indirect performance measurement based on sampling and analysis of source materials or visible emission observations employing Reference Method 9 or 22.

1. Flue gas emission control devices. Results of the Performance Specification Test, provided in the Engineering Plan, will provide a baseline for measuring the performance of baghouses or scrubbers. The Measurement Plan should therefore demonstrate that a parameter monitoring program will be implemented that can effectively monitor the performance of the control device against the baseline control limits on a continuing basis. This includes a detailed description of each

continuing basis. This includes a detailed description of each monitoring device and data demonstrating the effectiveness of the device, recordkeeping and internal reporting procedures, and quality assurance/quality control (QA/QC) procedures to ensure the integrity of the data. As a minimum, the plan should include the following types of information for every regulated emission source:

a. The complete Performance Specification Test report, including descriptions, specifications, and locations of all monitoring devices.

b. A description of the operation and maintenance program to be implemented to ensure the integrity of monitoring instruments on a continuing basis, including troubleshooting procedures when malfunctions are found. The proposed schedule for routine maintenance should be included that lists daily, weekly and monthly checks of each maintenance item.

c. A description of all records to be kept and the frequency with which they are to be recorded, as specified in the permit. Copies of all standardized forms to be used should be provided in the plan. The results of all zero and span checks of instruments should be maintained on a control chart showing zero/span check values versus time. Examples of the types of recordkeeping to be performed include:

- Monitor logbooks that provide documentation of inspections and maintenance performed for each monitor. Each entry of the logbook should include the date, a brief activity description, and the inspector's initials.

- Calibration forms that document when monitor calibrations are performed and whether adjustments are made to correct the monitor operation.

- Precision assessment forms that document the QA Coordinator periodic calculations of the precision of the monitoring system.

- Audit forms documenting the independent monitoring audits conducted periodically by the QA Coordinator.

- A description of the QA/QC procedures to be used. Examples of the kinds of procedures that should be addressed in the Measurement Plan include:

- Procedures to be used to determine the accuracy and precision of all data.

- Data validation and reporting procedures to be used for emission calculations, including permittee's proposed criteria for validation.

- Data validation and reporting procedures to be used when monitoring devices are in a state of breakdown or are malfunctioning out of control (e.g., when excessive span drifts and errors in relative accuracy are found). QA procedures in the Measurement Plan should define criteria for determining when a monitor is considered to be malfunctioning.

- Independent audit procedures to be carried out by the designated QA Officer.

2. Process fugitive emission sources. The measurement plan should describe in detail the procedures proposed for monitoring the performance of systems for capturing and controlling fugitive emissions from process sources. Since it is generally not possible to measure the rate of emissions from these sources, the basis for measurement will have to be observation of visible emissions utilizing such methods as Reference Method 22, parameters that indicate the performance of capture and control devices (e.g., fan motor currents for capture hoods), and/or recordkeeping to confirm that operation and maintenance activities are performed in accordance with the schedule in the plan (e.g., inspection and repair of sinter machine doors). The specific activities to be monitored should be in accordance with the standards prescribed in the permit (e.g., visible emission standards, operation limitations, maintenance requirements).

The plan should clearly describe the procedures to be used for ensuring that plant operating procedures and equipment prescribed in the Engineering Plan for minimizing process fugitive emissions are maintained at all times. It should describe the schedules and types of inspections of process operations and controls to be performed, and corrective actions to be taken if problems are identified as identified in Chapter 4.0. The plan should provide for documentation of findings and any required corrective actions should be recorded in an inspection logbook.

Operation and maintenance measures and schedules should also be provided in the plan. All operation and maintenance activities should be documented in a logbook that is maintained for each process source.

3. Nonprocess fugitive emission sources. For nonprocess fugitive dust sources, including product and waste storage piles, roadways and transfer areas, the plan should describe the methods to be used to monitor compliance. The plan shall demonstrate that the proposed methods are sufficient to ensure maintenance of compliance on a continuing basis. There are two generic approaches for monitoring compliance for these types of sources: (1) recordkeeping; and (2) indirect performance measurement based on sampling and analysis of the source materials. Under the first approach, compliance would be confirmed by maintaining records documenting that management measures included in the Engineering Plan are conducted in compliance with the schedule and the technical conditions stated in the Engineering Plan. For example, if the Engineering Plan calls for controlling roadway emissions by daily sweeping and spraying as outlined in Chapter 3.0, the Measurement Plan may require that a recording be made in a-logbook of the times and locations of each sweeping/spraying operation and that each entry be initialled by the operator. Any operational anomalies, such as a breakdown in cleaning or watering equipment, should also be recorded, and documentation of contingency measures taken should be made. In accordance with the management plan, the designated Manager, Environmental Engineering should inspect the logbook and initial it to confirm that compliance verification has been performed.

For sources where the proposed compliance monitoring technique is sampling and analysis of source materials, the

Measurement Plan should indicate the sampling locations, frequency, and techniques, the analytical methods, QA/QC measures, and records to be maintained. Sampling of road surface material generally involves the collection of a composite sample from each road segment being analyzed. For paved roads, samples must be collected across the width of the travel lane using a portable, stick-type vacuum cleaner with tared collection bags, while for unpaved roads, a whisk broom and dust pan is used in a similar fashion. For sampling of aggregate materials, samples from storage piles should be collected from the top, middle, and bottom of the piles.

If the Engineering Plan calls for control of fugitive emissions from aggregate storage by maintaining a minimum moisture content in materials prior to storage, an alternative sampling approach would be to collect samples from the process flow. In all cases, sampling should be documented in a logbook, stating at a minimum the date, time, and locations of sampling, volumes of material taken (if required in the Engineering Plan), and confirmation that samples were handled in accordance with the QA/QC requirements of the Measurement Plan. The person(s) conducting the sampling should initial the logbook.

The Measurement Plan should include a method for tracking the samples through completion of the analysis. Analytical methods should be specified, and should include measures to ensure the integrity of the samples, such as keeping samples in sealed containers until analysis and ensuring that holding times specified in the plan are met. The analytical methods to be used should be included in the Plan.

6.3.6.4 Reporting Plan. The facility's SEMP should include procedures for meeting the reporting requirements specified in the permit. The types of reports in this plan should include both regularly scheduled reports and reports on unanticipated events, such as malfunctions. Examples of the types of reports that may be required include:

1. Continuous emission monitor system upsets and malfunctions;

2. Control system malfunctions;

3. Excess emission reports for process, fugitive and point sources;

4. Visible emission reports from fugitive sources; and

5. Process equipment breakdowns or shutdowns that result in noncompliance with emission standards;

If standardized reporting forms are to be used, the forms should be included in the plan. For nonroutine reporting, such as reporting of monitor or control system malfunctions as outlined in Chapter 5.0, the criteria proposed by the permittee for determining when to file such reports should be provided.

6.3.6.5 Implementation Plan. The SEMP should describe the specific steps to be taken to implement each set of activities laid out in the plan, including schedules for completion of each significant milestone. Examples of items that may need to be included are:

1. Hiring of personnel to fill positions proposed in the Management Plan;

2. Training of personnel as required to assure implementation of the SEMP, such as operation and maintenance procedures for production and emission control equipment, recordkeeping and reporting requirements, sampling and analysis procedures, and QA procedures; and

3. Acquisition, testing, and deployment of equipment.

6.4 PARAMETER MONITORING PERMIT CONDITIONS

Parameter monitoring provides an important tool to source operators and agency personnel in the number of ways, including:

1. As a guide to arriving at an optimum maintenance schedule;

2. As a diagnostic tool capable of detecting/preventing malfunctions;

3. As a performance guideline;

4. As a process optimization guide;

5. As a way of assuring that appropriate corrective action has been taken in the event of malfunction;

6. As a means of assuring considerations in future designs; and

7. As a tool for assessing compliance on a continuing basis.

When properly managed, a parameter monitoring program can provide a high degree of assurance that compliance with applicable emission standards will be maintained on a continuous operational basis. "Proper management" means not only proper operation and maintenance of monitoring equipment, but also the employment of a management system that involves appropriate recordkeeping, performance evaluation, and response in the event of significant changes in monitoring results.

The preceding section provided guidance for including requirements in the facility's permit for the development and implementation of a SEMP to ensure proper management of compliance-related activities for all regulated sources at the facility. A critical component of such a plan is the establishment of an effective parameter monitoring system for air pollution control equipment. Given the importance of parameter monitoring at lead smelting and lead-acid battery reclamation facilities, additional attention to the factors that should be considered in implementing and overseeing compliance with requirements for a parameter monitoring system is warranted.

This section therefore provides a summary of parameters that the facility should be required to include in its continuous parameter monitoring program. The focus is on parameter monitoring systems for baghouses and scrubbers. More details on the technical aspects of implementing a parameter monitoring program have been previously discussed in Section 5.0 of this document. A brief review is provided here to emphasis the importance of parameter monitoring as part of a facility's SEMP.

6.4.1 Fabric Filters

For fabric filters, the parameters that should be included in the continuous monitoring requirements of the facility's permit should include, at a minimum:

1. Pressure drop;

2. Temperature;

3. Opacity;

4. Fan motor current; and

5. Dust removal system operating checklist.

In addition to these parameters, which should be monitored on a continuous basis, the permit and/or the facility's SEMP should call for the documentation of periodic inspection and maintenance activities for each fabric filter unit, including bag replacement records, a cleaning system operating checklist, and maintenance records for the cleaning and dust removal system.

Pressure drop is one of the more useful parameters that can be monitored on a fabric filter. When taps are provided for the inlet and outlet static pressure, the pressure drop across the bags provides an indication of the resistance to gas flow and a relative indication of bag cleanness. Therefore, permit requirements calling for monitoring and recordkeeping of pressure drop data are extremely important.

Larger, multicompartmented fabric filters equipped with shaker, reverse air, or plenum pulse cleaning may be equipped with continuous strip chart recorders for overall recording of pressure drop. These charts are useful for diagnostic confirmation that each compartment is isolated for cleaning. As each compartment is isolated, the pressure drop should increase and as it is returned to service the pressure drop should decrease. The charts also provide a useful tool for compliance inspectors to determine filter performance and compliance with maintenance schedules.

Temperature limitation is one of the most important characteristics of the fabric filter. The potential to operate the fabric filter above the maximum allowable fabric temperature can cause concern about fabric life. The loss of fabric integrity may result in pinholes, tears, or destruction of part or all of the fabric in the bags.

Temperature indicator/recorders should be located to measure gas temperature on the inlet of the fabric filter. Measurement downstream of the collector may result in a false sense of security because bags may be subjected to excessive temperature although there may be no indication of problems.

Opacity measurements are extremely useful indicators of fabric filter performance, and are a powerful continuous compliance monitoring tool. As long as there are particles in the 0.2 to 0.8 micron range to scatter light, the gas stream will be capable of exhibiting opacity if there are problems within the fabric filter. The opacity measurement can be used to determine the presence of bag leaks and, if analyzed carefully, the measurements can also identify the rows or compartments where the leaks may be occurring.

Opacity monitors should be used to record data on a "real-time" basis and not a 6-minute average for at least one complete cleaning cycle once per day. The presence of spikes should be correlated with compartments or rows of bags if they are present on the strip chart recorder.

Fan motor current provides an indication of the gas volume being moved through the exhaust system. Since there is a relationship between fan motor current (and horsepower computed from the fan motor conditions), where more current means more energy and (usually) more gas volume through the system, it is a simple procedure to obtain a relative indication of gas flow.

It is important to note that density changes in gases (e.g., changes due to gas temperature variations) will influence the fan motor horsepower use. Cooler gas stream density causes an increase in the required fan motor horsepower to equivalent volumes of gas. Therefore, comparisons of fan motor current must be normalized to some reference temperature.

Fan motor parameters provide confirming data when combined with fabric filter pressure drop. The facility's parameter monitoring plan should provide for data on fan motor current to be obtained whenever pressure drop is recorded. Plant personnel can then use the combined data to determine the degree of bag blinding or the presence of pinhole leaks, tears, or excessive gas flow that could lead to noncompliance with the emission standards defined in the permit.

Dust removal system operating checklists can be used to check operation of the system. Fabric filter that do not return captured dust directly to a bin or silo are usually equipped with hoppers that need some method of removing the captured dust from the fabric filter. Unless equipped with manual dust removal, the dust discharge system should be checked periodically. Because it is generally recommended that dust discharge systems be operated on a continuous basis, the finding of items such as stopped conveyors or airlocks on the dust discharge will usually indicate that there is some sort of a problem.

A periodic check of the quantity of dust being removed from the fabric filter is helpful, since any gross variation from normal quantities would indicate problems. Alternative methods of evaluating performance include weighing material discharged or measuring the conveyor drive motor current.

6.4.2 Venturi Scrubbers

Parameters that should be included in the facility's continuous compliance monitoring requirements are:

1. Pressure drop;
2. Water flow rates (Recirculation, makeup, and blowdown);
3. pH;
4. Temperature;
5. Solids content of recirculated scrubber water; and
6. Solids removal from settling tanks or ponds.

Note that, unlike fabric filters, opacity is not an operating parameter to be monitored because wet plume characteristics typically interfere with proper transmissometer operation. In addition to these parameters, which should be monitored on a continual basis, period inspection and maintenance records, including nozzle replacement, throat replacement or adjustments, or pump impeller wear should be documented.

Pressure drop is one of the most useful operating parameters to be monitored. To be most useful, the pressure drop should be monitored across the throat of the venturi scrubber and not across the entire scrubber train (presaturater, scrubber, and separator). Pressure drop is the parameter monitored and used to control the operation of variable throat scrubbers (opening and closing the throat as needed with constant water flow rate). It is also one of the first parameters available to indicate problems in scrubber operation. Use of continuous chart recorders is recommended.

Water flow rate is the second most useful parameter in monitoring scrubber operation. Unfortunately, it is difficult to monitor due to limitations in monitoring equipment. Orifice and venturi meters are subject to wear and buildup from suspended solids in the water that changes meter calibration. The same problem can occur in rotameters; turbidity problems also make reading of the meter very difficult. Ultrasonic meters are usually noncontact devices and are not subject to the wear problems associated with these other meters. However, they are very expensive and generally do not handle shocks well. In addition, special maintenance is required. A potential alternative to these techniques is to monitor pump motor current to monitor flow indirectly. However, on all but the largest pumps the horsepower requirements are low and subtle differences between power input may be difficult to distinguish.

In addition to scrubber water flow rate, the makeup to and/or blowdown rates of water from the scrubber system should also be monitored. This is important to the solids buildup rate and amount of evaporative losses in the scrubber. Given the problems of monitoring water flow rates, it is particularly important that a QA program that includes routine calibration of flow meters be required. Calibration should be conducted at least once a month.

The pH monitoring is rarely needed in many of today's scrubber applications. The use of pH monitoring is typically limited to carbon steel scrubbers that are susceptible to acid attack and to applications where gaseous emission control is part of the scrubber's function. The pH monitor helps operators maintain the proper pH to limit corrosion or to operate in the most effective absorption range for the scrubber. Generally, pH monitors require a substantial amount of maintenance to remain operational. Most successful applications of pH meters for continuous monitoring employ sidestream monitors where only a small portion of the flow is monitored rather than the total water flow through the scrubber.

Gas temperature, including gas before and after the scrubber, is an important indicator of scrubber operation. Water loss by evaporative cooling may account for 5 to 10 percent of the total water flow in high temperature application. This may cause an increase in emission rate if the solids levels are high in the scrubber water.

The inlet temperature is important since high temperature gas streams may contain components that are gaseous until cooled into the scrubber. These materials may form in particle size ranges that are difficult to capture. The outlet temperature can be used to determine if saturated conditions are being achieved. Temperatures higher than saturation usually indicate maldistribution of gas and/or water within the scrubber.

Solids content of scrubber water is an indicator of the extent to which resuspension and regeneration of particulate matter into the gas stream due to excessive solids levels is occurring. Periodic samples of scrubber water should be collected, particularly when little blowdown of scrubber water occurs. Buildups of 5 to 10 percent dissolved solids can occur and cause significant problems with opacity and, in some cases, erosion of scrubber components. Weekly grab samples should be considered minimum for sampling from the scrubber sump return.

Solids removal from settling tanks or ponds should be monitored by recordkeeping. Part of the operation of a scrubber involves the settling and removal of solids captured by the water droplets. Although automatic clarifier systems exist, most scrubbers use settling ponds that have to be emptied manually (usually draining and removing sludge with a front-end loader). Each time the pond is cleaned, it should be noted in the operating records to establish representative operation. In this way the representativeness of a stack test may be determined if the scrubber was operated with clean water and a clean setting pond.

6.4.3 Control Equipment/Paramater Monitoring Permit Review Checklist

Implementation of an effective continuous compliance program requires a permit that provides clear and enforceable terms that outline management and program source objectives. In addition to defining the emission standards to be met, the permit must also spell out the measures that must be taken by the permittee to ensure compliance with the standards on a continuous basis. Parameter monitoring plays a major role in the Agency continuous compliance program. The main objective of the Agency's continuous compliance program is to ensure that all sources come into compliance with applicable requirements and maintain compliance. To assist the permit writer, Table 6-3 provides a permit review checklist to minimize noncompliance incidences as part of the Agency's continuous compliance program.

6.5 PERMIT FOLLOWUP AND RENEWAL

6.5.1 Introduction

The basic goal of the permit writer is to provide a tool that insures the long-term continued compliance and protection of the environment. The permit does not guarantee compliance with emission standards and may not provide the "real-time" picture of a source's compliance status. As part of an agency's continuous compliance program, the permit is the initial step to compliance. For continued compliance, the agency must rely on other tools in conjunction with the permit to help achieve continuing compliance. These include source inspections, performance tests, emission reporting and data tracking and handling systems. These tools are part of an integral process of which permit review and writing is only one part of the overall process.

A distinction must be made between whether the permit is a "new" or modified permit. The distinction between the two is that a new source will not have an operating history of a baseline established, whereas an existing source will. For the new source, performance testing and inspection provide a time to

TABLE 6-3. SOURCE PERMIT REVIEW CHECKLIST

Component	Potential malfunction problem	Permit review check to minimize noncompliant incidences
Baghouse	Leaking bags	Will the air to cloth ratio be less than 15 to 1 ft/min? Can the outside of the baghouse be reached via caged ladder or, preferably, steps, for inspection and maintenance? Is the baghouse equipped with a manometer or magnehelic gauge to monitor pressure drop? Can the baghouse be entered easily for bag inspection and repair? Is inlet air properly baffled from bags? Will an opacity monitor be installed for continuous compliance application?
	Bag blinding	Is the system equipped with a high pressure alarm? For pulse or reverse air cleaning systems, is the air line equipped with dryer and filter? Are outdoor baghouses properly insulated? Is the system equipped with electrical interlock so that one cleaning cycle is completed and hopper is cleared after the process and blower is shut down? Is the system accessible for bag inspection and repair?
	Dust buildup in hopper	Is the dust handling system sized to handle the maximum expected load? Do hopper walls have a 55 to 60 degree slope?
Fan	Insufficient air volume due to fan wear	Can fan amperage, rpm, and static pressure be easily monitored? Are the fan blades accessible for inspection and replacement? (If the fan is on the dirty side of the control device, a straight blade centrifugal fan should be used.) Is fan meter accessible for routine inspection and maintenance?
Ventilation system	Deposition of dust and duct plugging from insufficient flow in branch caused by – Improper system balance – Leakage through holes in the duct	Is the system designed to maintain a velocity of 3,500 ft/min in all ducts? Is the system design balanced with respect to pressure drop? Are the branch ducts equipped with ports to check static pressure? If blast gates are used to balance system, does the design inhibit adjustment by untrained personnel? Do the ducts have provisions for access for cleaning, especially at gates and entries?
	Excessive wear of ducts and control devices from high transport velocities in some branches	Is the system designed to keep duct flows below 4,500 ft/min? Is the system design balanced with respect to pressure drop? Can "high wear" sections be easily replaced?

TABLE 6-3. SOURCE PERMIT REVIEW CHECKLIST (continued)

Component	Potential malfunction problem	Permit review check to minimize noncompliant incidences
Cyclone	Reduced efficiency due to insufficient flow	Is the cyclone equipped with ports to check pressure drop and statis pressure between fan and cyclone?
	Updraft of air through dust outlet causing reduced flow through cyclone and reentrainment	Is the cyclone accessible via stairs or caged ladder? Is the discharge valve accessible for inspection and maintenance?
	Cyclone or hopper plugging	Is the cyclone physically accessible for periodic inspection and maintenance? Is access available to clean plugged cyclones and hoppers? Is the dust removal system sized to handle the maximum expected load?
Wet scrubber	Corrosion and erosion of scrubber shell	Can the outside of the scrubber be reached by carge ladder or, preferably, steps, for inspection and maintenance?
		Will the liquid feed rate system equipped with flow meter?
		Can the internal components of the system be evaluated periodically
	Nozzle damage	Will the scrubber be equipped with a manometer or magnohelic gauget to monitor pressure drop? Will the scrubber be equipped with high pressure gauges to evaluate water pressure to nozzles? Will the inside of the scrubber be accessible for nozzle evaluation?
	Heat exchange failure	Will the scrubber be equipped with temperature gauges on inlet/outlet of system?
	Low scrubber efficiency	Will pH be monitored continuously? Will the turbidity of the liquor stream be monitored?
		Has the source calculated the proper liquid-to-gas ratio and is that comparable to design specifications?
		Will the scrubber be equipped with a continuous O^2/CO^2 analyzers at outlet?
Storage piles	Fugitive dust	Will the source be required to submit a dust suppressant management plan? Has the source proposed a backup dust suppressant system?
Unpaved/paved roads	Fugitive dust	Will the source be required to submit a dust suppressant management plan?

compare actual equipment and performance with that proposed in the application. For modifying or renewal, however, these data are used for refinement and adjustment of the permit conditions. Although the underlying purposes may differ, the tools available to the agency are the same and so is the overall goal of continuing compliance.

4.3.1 Role of the Agency Inspection in the Permit Process

One of the major weaknesses of the permitting system is that often the permit writer is part of an agency permit section, while the inspector, who has the ability to "baseline" the source, is part of the source inspection section. These two sections rarely compare notes. The source inspection is often the individual with the most resource concerning the day-to-day operation of the facility.

A good Agency inspector can provide a wealth of information to the permit writing and review process with first-hand knowledge of processes and control equipment, operation and maintenance procedures, source line and management personnel, and source history (including compliance strengths and deficiencies). As indicated earlier, this valuable resource is often overlooked. The Agency inspector can also verify that conditions outlined in the permit have been implemented.

It is therefore vital that the first-hand knowledge and experience of the inspector be used to improve the permit-writing process and to help achieve continuing compliance goals.. Inspection of a new source or modification can verify that the capital equipment and process conditions required in the permit are the same as those actually occurring after startup.

Combining the regulatory knowledge and engineering skills of the permit engineer with the first-hand observations and informed conclusions of the inspector produces a more complete and accurate assessment of actual conditions at the source and, it is hoped, a better permit.

4.3.1.1 Agency Inspection Involving New Sources. The use of the Agency inspector in the role of a source's permit application is most evident between new and existing permit considerations. The overall goal of an agency permit program remains the same (i.e., the determining of the permit requirements are being achieved and to assess the compliance status of the source), the type of information needed to be gathered is different.

Prior to startup, inspection should occur of a new source to verify that permit conditions have been met. In particular, the inspection should include:

1. A check to see if installed control equipment is the same as that proposed in the application and for which the permit was issued;

2. Insure that drawings/specifications provided in the permit application reflect "actual" situation;

3. Insure location of any required continuous emission monitors is concurrent with permit conditions/specifications;

4. Check to see that all instrumentation for process or control equipment parameters have been installed and operational; and

5. Verify establishment of a source emission minimization program (SEMP) involving source management and maintenance activities, and quality assurance/quality control activities to insure data collected is of highest quality.

The initial inspection serves to gather data to establish both baseline and representative conditions for future references.

6.5.2.2 Agency Inspection Involving Old Sources. Inspection of existing source for permit renewal should provide up-to-date operating characteristics and operating history of the source. This information, when combined with previous inspections, excess emission reports, compliance test and periodic audits of operating conditions of control equipment and fugitive emission programs can help the inspector make appropriate recommendations to the permit writer which can be incorporated into the "new" permit to "fine tune" the source's operating characteristics and source SEMP. The inspection of existing sources, therefore, should include:

1. Observation of changes in operation that have occurred over time;

2. Changes in maintenance practices;

3. Changes in the source SEMP program associated with regulated emission control activities;

4. Changes in reporting requirements; and

5. Clarification of state/federal regulations

The permit renewal process allows the agency to evaluate all aspects of the source's emission control program and relying on previous experience, to update areas of historical weakness.

This updating clarification process may also reflect changes in Agency policy that have occurred since the permit was issued. Information from previous inspections and the inspection results should be a valuable resource for the permit review engineer. In this way, data from actual operating experience are recycled through the system to improve the permit writing process.

6.5.3 Permit Followup Inspection Tools

Whether the permit issued is a permit to construct/operate or a renewal permit, the contractual agreement between the issuing agency and the source is binding for the life of the permit. Therefore, the source must comply with the conditions set forth in the permit at all times and under all conditions except for those expressly granted in the permit (malfunction, startup, shutdown, etc.). The performance test provides a comparison of actual emissions and operating practices with the emission limitations contained in the permit and with the conditions (process and control equipment) under which the emission occurred. Regardless of the purpose of the emission test, the results must be representative of actual operating practices and demonstrate the capability of the source to comply with the emission limitations under these conditions.

6.5.3.1 Stack Testing/Continuous Emission Monitor Documentation. Historically, stack testing has been used as part of the source's initial compliance determination. As NSPS standards developed, continuous emission monitors became a part of EPA's compliance program for those sources required to monitor their emission on a continuous basis. Historically, continuous emission monitors have played a limited role in the regional Stationary Source Compliance Programs. With the passages of the 1975 regulations requiring CEM's as a means of monitoring a source's "continuous compliance" status, it has taken 15 years to identify CEM data as an enforcement tool and bring it to national attention. Limited application may have been contributed to early problems with monitor reliability, accuracy, and long-term performance. However, many of these earlier problems have been resolved and CEM data now provides valuable information for enforcement decisions. Consequently, the agency is increasing its reliance upon CEM data in its permit, compliance and surveillance programs. Eventually, CEM's will become part of all NSPS, NESHAP and State permits.

As a means of ensuring that emission test results are actual indicators of compliance with the emission limits, the emission units to be reported (pounds/ton, pounds/hour, etc.) from the emission test should be expressly cited in the permit. The enforcement agency should exercise care to see that the source does not report test results in inappropriate values. Where more than one emission limit exists, reported test results should be compared with the permit limits value by value.

The goal of continuing compliance also dictates strict adherence to quality assurance procedures, not only to laboratory quality assurance procedures for periodic emission testing, but also to continuous monitoring requirements. Particular care should be given to examining the source's quality assurance procedures for continuous emission monitoring data. Factors such as precision, accuracy, frequency, reliability, quarterly audits and data omissions with and without justifiable cause (i.e., malfunction, lapses in data reporting, etc.) should be reviewed.

Specific test procedures, variations from accepted test methods, and specific operating conditions of the process and control equipment are important parts of the performance test protocol. The emission test protocol is a step-by-step plan by which the emission test is to be conducted. The Plan designates specific process and control equipment parameters to be followed during the test as well as actual testing procedures. Because new sources have no operating history on which to base representative or typical operating conditions, such conditions may have to be estimated in the test protocol. These conditions should be confirmed as source history develops. In the case of existing sources, however, previous operating conditions and test results can be used to establish a case-by-case determination of representative conditions for each performance test.

6.5.3.2 Control Equipment Monitoring Testing. One of the most important considerations in determining whether a source remains in compliance with permitted emission limits on a continuous basis is the source's ability to maintain control equipment efficiency and related process conditions. Initial engineering analyses conducted to determine both potential uncontrolled and controlled emissions will most likely not represent actual contemporary conditions at the source because of "normal" variations in process conditions, control equipment, age, maintenance, and modifications. As changes occur, the issuing/enforcement agency must be aware of the influences these changes will have on potential emissions. So that the necessary flexibility will be retained to determine compliance under these conditions, emission testing must be able to accommodate changes in the process and in control equipment efficiency. Accurate emission testing is very helpful in correlating process and control equipment variances with changes in actual point and fugitive emissions and thereby establishing grounds for future permit modifications or permit renewal conditions.

The role of emission testing may also change as the goals of the issuing/enforcement agency change. The permit should enable the agency to modify the test protocol and reporting requirements of the source in order to reflect any such changes. Source operating history, for example, may require the agency to redefine test goals for the following reasons: (1) to reestablish representative conditions, (2) to establish the uncontrolled emission rates of specific process units vented,

(3) to establish baseline conditions for proposed modifications, (4) to determine current control device efficiency, (5) to cross-check continuous monitoring emission results, or (6) to correlate actual emissions with surrogate emission indicators (mass vs. opacity, etc.).

Finally, any emission testing program is only as good as its documentation. Whether the emission testing is performed by the issuing/enforcement agency or by the source, legal enforcement of permit emission limits and conditions depends on accurate, adequate, and retrievable documentation. Because considerable time may elapse between actual testing and any potential legal action or redress, proper documentation is critical.

It is the responsibility of the permit writer to ensure that the emission limits, general permit conditions, and specific permit conditions be constructed in such a way as to allow the agency the flexibility to ensure continuing compliance and to give the source to understand exactly what is expected in terms of its responsibility with respect to the specific permit conditions.

6.5.3.3 Excess Emission Report Monitoring. Sources subject to the requirements of using continuous emission monitors as a compliance determination are generally required to submit quarterly excess emission reports (EER's). The EER contains information on number of excess emission over a standard, time and duration of those excess emissions, reason codes for excess emissions and corrective/preventive action taken to reduce those emissions. As personnel and money limits the feasibility of onsite inspections, the EER becomes an important "feedback" system for both the source and the regulatory agency. The EER becomes a tracking tool by which agency personnel can evaluate both the control equipment and continuous emission monitor performance. The EER provides a useful function for both the sources being regulated and the regulatory agency. For the source, the benefits are:

1. To help ensure upper management attention through the formal requirement for source submittal of a summary of

excursions. This increases the likelihood of timely attention and reduces the risk of sanctions; and

2. As a tool in preventive maintenance/risk management/cost control programs, to flag deteriorating process or control equipment performance. In cases such as fuel burning, CEM data can be used to optimize the process and control system performance, thus saving money and preventing pollution at the same time.

For the regulatory agency, the benefits are:

1. As a screening tool, to identify sources experiencing frequent or continual excursions. Such sources can be subjected to additional attention in the form of phone calls, inspections, etc., rather than allocating scarce inspection resources largely at random;

2. To help pinpoint specific source components for special attention during an inspection;

3. To document the severity (e.g., duration, magnitude, and frequency) of a source's excess emissions. For example, EER data can provide supporting evidence of the long-term nature of violations, negating source claims of isolated problems;

4. To document that a compliance test was performed during "nonrepresentative" operating conditions;

5. To support issuing a "Notice of Violation (NOV)";

6. To establish a data base in the development of Agency policies and strategies;

7. To assess "good air pollution control practices";

8. To provide a less resource intense alternative to Agency inspections of sources; and

9. To monitor the emission and performance of a source subject to specific permit, consent decree, or administrative order requirements.

Data from the excess emission report can be entered into the Agency's Automated Compliance Data System (CDS). The CDS system forms the basis by which EPA tracks compliance status of regulated sources.

In recent years, the standardized EER report has not only been used to report excess emissions, but also other information associated with both control equipment and monitor performance. Such information as:

Continuous Emission Monitors

1. "Out-of-control" situations;
2. Excess drift determination;
3. Quarterly audit results;
4. Relative accuracy test;
5. Appendix F, Procedure 1, QA/QC reporting requirements;

Control Equipment

1. Average control device parameters (pressure drop, flow rates, etc.);
2. Control equipment "baseline" information;

Fugitive Emissions

1. Observation of visible emissions; and
2. Housekeeping and operational practices.

6.5.4 Onsite Inspection to Verify Permit Conditions

The primary objectives of a regulatory agency onsite inspection and excess emission review is to minimize air pollution through adherence to regulations and permit stipulations. The inspection provides the determination of compliance and helps identify causes of excess emissions. Because of manpower and resource constraints, the EPA has included onsite inspections and excess emission review procedures as part of its "Level" inspection program. Levels of inspection have been incorporated into the Agency's stationary source compliance program to give regulatory agencies the opportunity to allocate inspection resources to those facilities needing most attention. The levels of inspection extend from source agency records review (lowest level) to stack test compliance determination (highest level). The intensity and thoroughness of the inspection increases numerically. The type of activity associated with each level, as outlined in Section 5.4 and abbreviated here, are:

Level 1. Records review involving excess emission reports, previous inspection reports, source "working" file and permit review.

Level 2. Onsite inspection involving review of monitoring recordkeeping (maintenance, monitor fugitive emission logs and control equipment logs), control fault light indicator review, strip chart review, and review of source SEMP.

Level 3. Evaluation of source emission reductions utilizing field instrumentation through external audit techniques and comparison to "baseline" data.

Level 4. Comparative evaluation of installed control program monitor indicators through performance check utilizing Federal Reference Methods or portable instrumentation.

The purpose of the increasing level of inspections is to concentrate the resources of the Agency personnel on those facilities that have the greatest potential to exceed the emission limits.

To assist the Regions in identifying these sources with potential to violate the emission limits, the Agency has developed a "significant violator" program. The "significant violator" program identifies the Agency's highest priority sources for enforcement action, other than emergency actions. In addition, the Agency has identified sources presently without SEMP but for which the use of SEMP could be fruitful. This could include long-term violators and large SEMP emitters. For these sources, the Agency has broadened its use of SEMP in its permits, consent degrees, administrative orders, and continuous compliance activities.

6.5.5 Summary

Post-permitting efforts such as performance testing, onsite inspections utilizing field instrumentation, excess emission report, data management systems and SEMP's are necessary to the achievement and maintenance of the Agency's continuous compliance goals. Whereas such activities may occur independent of the permit review process, their effectiveness may depend on how the permit was originally written and the degree of specificity included in the permit conditions. The permit writer should rely on the actual experiences of the Agency inspector and on performance test data for the further refinements and upgrading of individual permits and the permit-writing procedures.

The actual process of permit review and permit construction is not simple. It requires a knowledge of the regulations and the ability to interpret them. It also requires the ability to review technical data, to locate available resources of information when needed, to draw appropriate conclusions to make recommendations, and to write a permit with conditions that are enforceable and meaningful and represent a balanced approach to continuous compliance. A good permit is an important tool for meeting various program requirements and for maintaining source compliance. As a tool, however, it can only be as effective as the quality of its construction.

7.0 LEAD EMISSION CONTROL INSPECTION EVALUATION CHECKLIST

7.1 INTRODUCTION

Lead emission control inspection evaluation checklists have been developed to assist both Agency and source operators with the periodic and systematic inspection of a source emission control program to determine its effectiveness to achieve Agency continuous compliance regulatory objectives. The objective of the evaluation checklist is to provide evaluation procedures at different levels of intensity. As was discussed in Section 5, the field levels of inspection are designated as Levels 1 through 4, with Level 4 being the most intense.

Level 1. Records reviewed and visible emission evaluation;

Level 2. Field observation of source's process instrumentation and source emission minimization program;

Level 3. Field measurements of process and control parameters and visible emission observations; and

Level 4. Performance testing utilizing Federal reference methods.

A brief review of the levels of inspection is provided here to emphasis there importance to both an Agency and source emission reduction program.

7.2 LEVELS OF INSPECTION

Level 1 inspection is usually limited to records review and visible emission evaluation. It is a field surveillance tool intended to provide incomplete indication of a source compliance status. The source personnel makes visible emissions observations on all stacks, ventilation equipment and outside facilities which can be properly observed. Level 1 inspection requires a minimum of time and manpower. Utilizing Federal Reference Method 9 and 22, proper observations are made.

Although fugitive dust control measures are generally implicit in federal air quality regulations, the regulations generally do not explicitly include readily enforceable standards of performance. However, a number of states have (as part of their State Implementation Plans [SIPs] for PM_{10}) developed and adopted rules to control fugitive dust emissions. These rules are enforceable by either state, local, or federal air pollution control officials. Clearly, a portion of a general air compliance inspection should be devoted to identifying potential sources of fugitive dust emissions and the collection of data indicative of a source's compliance status with regard to applicable permit conditions and regulations.

As is the case for other types of emission sources, the inspector should be familiar with potential sources of both point and fugitive emissions at the plant and applicable State/local/Federal regulations and permit requirements. Pre-entry evaluation from outside the plant (i.e., Level 1 inspection) is particularly important in regard to fugitive sources. During this evaluation, the inspector should identify and note any visible fugitive emissions at or near plant boundaries and their source(s); conditions around feed, product, and/or waste storage piles; and any other obvious sources of fugitive emissions. Notations of any visible emissions and photographs should be taken at this time, as appropriate.

Level 2 inspection involves the Agency inspector observing and documenting source measured operating parameters such as pressure drop, fan static pressure and current, gas stream temperature, water flow rate, traffic patterns on paved/unpaved roads, storage pile orientation, gas stream temperature and flue gas conditions. Visible emission evaluation, utilizing Federal Reference Method 9 and 22 are performed. The observed evaluation of both process monitors and fugitive emission indicators are recorded and plotted against source specific baseline data. During the Level 2 inspection, no actual field measurements are acquired. The inspector is utilizing onsite instrumentation in evaluating continuous compliance.

Level 3, a thorough and time-consuming inspection, is designed to provide a detailed engineering analysis of source compliance by the inspector performing onsite measurements with his instruments for operating parameters such as pressure drop, fan static pressure and current, gas stream temperature, ESP power levels, flue gas conditions, oxygen level, and water flow rates. The measured data are reduced and used to calculate flue gas volume, superficial velocity, specific collection area, inlet velocity, air-to-cloth ratio, hood inlet volume and velocity, liquid-to-gas ratio, throat velocity, etc. Because many of these are control device and source specific, they must be adjusted to the individual source being inspected.

There are two major purposes for this type of inspection:

1. To establish baseline operating conditions; and

2. To verify whether the source is experiencing O&M problems that result in less than continuing compliance with the emission standards.

The inspection may also include an internal inspection of the control device. For fabric filters, an internal inspection is required to determine bag condition or integrity of the baghouse. For scrubbers, an inspection of the condition of the nozzles is required if the water flow rate or pressure data indicate the possibility of pluggage. An internal inspection of ESPs may be required if power data indicate a problem with ash buildup or plate alignment. A periodic internal inspection of mechanical collectors is required where the collection of abrasive dust is likely to cause abrasion-induced failure.

Because this level of inspection requires the monitoring of equipment conditions and, in some cases, an internal inspection, the inspector must be sure that all safety requirements are met prior to entry. In all cases, lockout procedures should be used and applicable safety equipment employed.

The portion of the fugitive emissions inspection which is conducted within the plant boundaries (Level 2, 3 and 4 inspections) generally consist of four phases:

1. Visual inspection of the facility in order to observe fugitive sources and controls (including photographs to document).

2. Examination of the source's control equipment.

3. Observations of any spraying or other dust control operations undertaken by source during the inspector's visit.

4. Examination of the source's records relating to the controls used.

A general checklist should be used as a reminder of key information to be collected by the inspector during evaluation. This list should be refined according to the specific goals of the inspection during subsequent visits and can be arranged in chart formats, if desired. Also, the compliance formats described below should be incorporated into the inspection, as applicable.

Finally, the Level 4 inspection prepares an actual emissions baseline for the source through the use of a stack test of source emissions and field measurements for fugitive emissions. This inspection requires that the inspector monitor all process and control device operating parameters during a stack test or field measurement for use during future inspections. The Level 4 inspection is typically applied to sources with baghouses or high-energy wet scrubbers. The inspection may require documentation of control equipment conditions through the use of an internal inspection before the stack test or a chemical analysis of process material of fuel that is being burned (e.g., percent sulfur, percent ash, heat content, or percent moisture).

The purpose of the increasing level of inspection is to concentrate the resources on those sources that have the greatest potential to exceed the emission limits. For instance, initial results of the Level 2 inspection may indicate that specific sources are not experiencing deficiencies in performance and, therefore, do not warrant a higher level of inspection. In these cases, the frequency or level of inspection may be adjusted downward consistent with the results of the Level 2 inspection.

7.3 CHECKLIST FOR EVALUATING SPECIFIC CONTROL DEVICES

Field evaluation checklists have been developed to assist both Agency and source operators with the periodic and systematic inspection of a source emission control program, both point and fugitive sources, to determine its effectiveness to achieve continuous compliance regulatory objectives. The fundamental principle of these checklists involves the comparison of observed values with site-specific baseline data from the source emission control program. This enables the subtle changes of control program elements to be average over a period of performance, thus avoiding the error or extrapolation of data from a single observation to a compliance determination. Baseline diagnosis involves a set of data comparisons rather than comparison of single observations. This approach enables determination of control program effectiveness to be based upon many parameters, changes in control equipment performance and possible reasons for these changes can possibly be identified.

Inspection involves characterization and observation of both process and control equipment. Visible emission observations of ventilation systems, auxiliary equipment inspection, process equipment evaluation, storage pile maintenance and records review are all part of the baseline inspection program. The operation characteristics and performance of each of these systems is unique unto itself. As process variables and control devices change over time, the performance decreases. Baseline inspection involves comparison of present operating conditions against historical baseline levels for that visit. Consequently, these changes can be identified, enabling the source to implement control measures to insure continuous compliance. Each variable which has shifted may signify a symptom of possible operation problems.

To assist the Agency and source operators in the field inspection program, a series of industry specific checklists have been developed. Field inspection procedures have been developed for:

1. Wet scrubbers;
2. Baghouses;
3. Cyclones and multicyclones; and
4. Fugitive emissions.

Each inspection procedure is divided into four parts to insure that the inspector is focused at each part as to needed information in order to determine a continuous compliance status of the source. The individual parts of the inspection procedure are:

Part I - General Plant Information;

Part II - Process Data;

Part III - Control Equipment Data; and

Part IV - Inspection Overview.

Following are recommended field evaluation checklists applicable at lead smelting and lead-acid battery manufacturing facilities.

FIELD INSPECTION PROCEDURES
WET SCRUBBERS

PART I - GENERAL PLANT DATA

Company	Report for period Year
Street address	Furnace - company designation
City State	Furnace permit number or NEDS number
Official providing information	Furnace type
Title of official	Furnace rated capacity (charge rate)
	Allowable emission rate and opacity

PART II - PROCESS DATA

A. FACILITY DATA

Type ☐ Furnace No. of furnaces ___

☐ Other Specify ___

Charging method ☐ Batch ☐ Continuous

Control devices ☐ Fabric collector Specify type ___

☐ Scrubber Specify type ___

☐ Other

Operating schedule ____ hrs/day ____days/wk ____ wks/yr

B. Operating Parameters

PERIOD OF RECORD			PRODUCT SPECIFICATIONS-PERCENT								PRODUCT tons/hour	POUR TEMP. °F	RAW MATERIALS			
begin day hour	end day hour	total hours	Pb	As	Sb	Cu	Ni	Bi	Ag	Fe			fuel, 10^6 Btu	oxygen, ft^3	air, ft^3	flux, lb.

PART III - CONTROL EQUIPMENT DATA

A. General information
Process equipment ducted to this control equipment:
Unit manufacturer:______________________________ Model no./type:________________________
Utilized for removal of: particulate ___________ acid gases ___________ organic solvents ___________
Type of scrubber: wet ______, dry ______, electrofuluidized ______
Mode of action: gravel bed ______, venturi, ______, flooded disk ______, spray tower _____, quench tower ______, packed tower ______, sieve tray ______
Medium: water _____, limestone slurry ______, dual aklali ______, lime slurry ______, adipic acid ______, sodium hydroxide ______, organic solvent ______, gravel ______, other ______, recirculated ______, once through ______
Demister: cyclone separator ______, brinks ______, chevron ______, other ______
Modules: Total no. ______, No. of modules in normal operation ______
By Pass: Is flue gas normally bypassed ______ % ______
Sketch scrubber system: show CEM's locations, ΔP measuring points, etc.
Scrubber system sketch:

B. Control equipment evaluation		
Parameter	Design	Actual
1. Pressure drop across module, - in.H_2O		
2. Medium flowrate to module, gal, lb/min, hour		
3. Nozzle pressure, psig		
4. Recirculation of scrubbing medium, %		
5. Gas temperature, °F, inlet		
outlet		
6. Recycle tank medium, pH		
7. Wash tray mist eliminator, ΔP in. H_2O		
8. Classifier feed pump discharge pressure, psig		
9. Mist eliminator, ΔP in. H_2O		
10. Wash slurry to wash tray flow, gal/min		
11. Recycle slurry to wall wash, flow, gal/min		
12. Raw water to mist eliminator, flow, gal/min		
13. Supernate to mist eliminator, flow, gal/min		
14. Inlet plenum static pressure, in. H_2O		
15. Bypass damper, open		
closed		
16. Gas bypass, %		
17. Liquid to gas ratio		
18. Scrubber inlet		
CO_2, %, wet		
O_2, %, dry		
CO, ppm		
SO_2, ppm		
Opacity, %		
19. Scrubber outlet		
CO_2, %, wet		
O_2, %, dry		
CO, ppm		
SO_2, ppm		
Opacity, %		

PART IV - INSPECTION OVERVIEW*

CONCLUSIONS/RECOMMENDATION	
1.	Compliance status: ______________________________ ______________________________
2.	Need for further action: ______________________________ ______________________________
3.	Corrective actions to be taken: ______________________________ ______________________________
4.	Time required to rectify problems: ______________________________ ______________________________
5.	Special waivers or review of compliance criteria required: ______________________________ ______________________________
6.	Need for follow-up inspection: ______________________________ ______________________________
7.	Inspectors signature: ____________________ Date: ____________________ Approved by: ____________________ Title: ____________________

*OTHER NOTES, COMMENTS, SKETCHES (ATTACH ADDITIONAL PAGES, IF NECESSARY). Schematic drawings showing locations of process and dust control equipment should be prepared, particularly so, where verbal descriptions may lead to misunderstandings. Locations should be noted for observed leak sites, evidence of corrosion, warped panels, and other mechanical defects.

FIELD INSPECTION PROCEDURES
BAGHOUSES

PART I - GENERAL PLANT DATA

Company	Report for period Year
Street address	Furnace - company designation
City State	Furnace permit number or NEDS number
Official providing information	Furnace type
Title of official	Furnace rated capacity (charge rate)
	Allowable emission rate and opacity

PART II - PROCESS DATA

A. FACILITY DATA

Type ☐ Furnace No. of furnaces ___

☐ Other Specify ________

Charging method ☐ Batch ☐ Continuous

Control devices ☐ Fabric collector Specify type ________

☐ Scrubber Specify type ________

☐ Other

Operating schedule ____ hrs/day ____days/wk ____ wks/yr

B. Operating Parameters

PERIOD OF RECORD			PRODUCT SPECIFICATIONS-PERCENT								PRODUCT	POUR TEMP.	RAW MATERIALS			
Begin day hour	End day hour	total hours	Pb	As	Sb	Cu	Ni	Bi	Ag	Fe	tons/hour		fuel, 10^6 BTU	oxygen, ft^3	air, ft^3	flux, lb.

PART III - CONTROL EQUIPMENT DATA

A. General Information

Process equipment ducted to this control equipment:			
Quantity of dust collected	____ tons	Static pressure in collection system	
Gas flow rate @ collector inlet	____ afcm	Stack	_____ "H_2O
Gas flow rate @ collector outlet	____ afcm	Before fan	_____ "H_2O
Temperature @ collector inlet	____ °F	Collector outlet	_____ "H_2O
Temperature @ collector outlet	____ °F	Collector inlet	_____ "H_2O
		Before radiant coolers	_____ "H_2O
Fan speed	____ rpm	Before water sprays	_____ "H_2O
		Duct after hood	_____ "H_2O
Capture velocity of hoods			
Over furnace	____ fpm		
Charging doors	____ fpm		
Pouring spout	____ fpm		

B. <u>Collection System(s)</u>

1. Baghouse	Sections #1	#2	#3	#4
a. Manufacturer				
b. Type or trade name				
c. Model No.				
d. No. of compartments				
e. Bags/compartment				
f. Bag 1 x d				
g. Total cloth area				
h. Pressure drop,"H_2O				

2. <u>Fabric</u>

   a. Manufacturer__________
   b. Material__________
   c. Woven or felted__________
   d. Operating temp. range__________
   e. Surface treatment__________

3. <u>Cleaning system</u>

   a. Method__________
   b. Frequency__________
   c. Actuated by__________
   d. Anticollapse rings__________
   e. Wire mesh cages__________

C. <u>Dust Handling System(s)</u>

1. Do baghouse hoppers have:
   a. Heaters
   b. Insulation
   c. Level indicators
   d. Vibrators

2. Type of dust transport system__________

3. Fate of collected material__________

PART IV - OPERATING PARAMETERS (DESIGN AND ACTUAL)

A. Control Equipment Evaluation

	Design	Actual
1. Flow rate		
2. Pressure drop		
3. A/C, gross		
4. Temperature, °F		
5. Efficiency, %,		
6. Emission rate, lbs/hr,		
7. Opacity, %,		

B. Operating Experience/Maintenance Aspects

1. Percent of time baghouse fully operational when process is in operation ____________
2. Has a detailed maintenance schedule been instituted? ____
3. Is maintenance schedule as recommended by baghouse manufacturer or by plant? ____________
4. Are maintenance records available for inspection? ______
5. How long are records kept on file? ____________

C. Problem Areas

Which of the following problem areas have led to periods of excess emissions or caused the process to be shut down?		
Problem area	**Duration**	**Frequency**
Insufficient dust pickup and/or transport (fugitive emissions)		
Duct abrasion or corrosion		
Temperature excursions, high or low		
Moisture		
Fan abrasion, vibration, etc.		
Gross bag failure		
Inadequate bag tension		
Bag chafing or abrasion		
Pressure loss		
Compartment isolation dampers		
Cleaning mechanism		
Visible emissions		
Plugged hoppers		
Hopper fires		
Dust discharge system		

PART V - INSPECTION OVERVIEW*

CONCLUSIONS/RECOMMENDATION	
1.	Compliance status:
2.	Need for further action:
3.	Corrective actions to be taken:
4.	Time required to rectify problems:
5.	Special waivers or review of compliance criteria required:
6.	Need for follow-up inspection:
7.	Inspectors signature: ______ Date: ______ Approved by: ______ Title: ______

*OTHER NOTES, COMMENTS, SKETCHES (ATTACH ADDITIONAL PAGES, IF NECESSARY).
Schematic drawings showing locations of process and dust control equipment should be prepared, particularly so, where verbal descriptions may lead to misunderstandings. Locations should be noted for observed leak sites, evidence of corrosion, warped panels, and other mechanical defects.

FIELD INSPECTION PROCEDURES
CYCLONES AND MULTICYCLONES

PART I - GENERAL PLANT DATA

Company	Report for period Year
Street address	Furnace - company designation
City State	Furnace permit number or NEDS number
Official providing information	Furnace type
Title of official	Furnace rated capacity (charge rate)
	Allowable emission rate and opacity

PART II - PROCESS DATA

A. FACILITY DATA

Type	☐ Furnace		No. of furnaces ___
	☐ Other		Specify ___
Charging method	☐ Batch	☐ Continuous	
Control devices	☐ Fabric collector		Specify type ___
	☐ Scrubber		Specify type ___
	☐ Other		
Operating schedule	____ hrs/day	____days/wk	____ wks/yr

B. Operating Parameters

PERIOD OF RECORD			PRODUCT SPECIFICATIONS-PERCENT								PRODUCT	POUR TEMP.	RAW MATERIALS			
Begin day hour	End day hour	total hours	Pb	As	Sb	Cu	Ni	Bi	Ag	Fe	tons/hour		fuel, 10^6 BTU	oxygen, ft^3	air, ft^3	flux, lb.

PART III - CONTROL EQUIPMENT DATA

A. General Information

Process equipment ducted to this control equipment:

Quantity of dust collected	____ tons	Static pressure in collection system	
Gas flow rate @ collector inlet	____ afcm	Stack	____ "H_2O
Gas flow rate @ collector outlet	____ afcm	Before fan	____ "H_2O
Temperature @ collector inlet	____ °F	Collector outlet	____ "H_2O
Temperature @ collector outlet	____ °F	Collector inlet	____ "H_2O
		Before radiant coolers	____ "H_2O
Fan speed	____ rpm	Before water sprays	____ "H_2O
		Duct after hood	____ "H_2O
Capture velocity of hoods			
Over furnace	____ fpm		
Charging doors	____ fpm		
Pouring spout	____ fpm		
Unit manufacturer		Model No./Type	
Cyclones	No: ____	Interconnection: Series ____	Parallel ____
Multicyclones:		No. of banks ____ Multiclones per bank ____	
		Sootblowers of base of multiclone ____	Quantity ____
		Sequential blowing ____	Blow period ____ frequency ____

Are there dampers for sectionalization for control of ΔP (based on load and airflow)?

Where are they located?

B. Collection System

1. System of ΔP design:

Load	ACFM	$\Delta P(H_2O)$
MCR	____	____
75%	____	____
50%	____	____
25%	____	____

Primary collector ______________________

Secondary collector ______________________

2. Hopper ash removal:

   Automatic ____, Manual ____, Pressure activated ____, Level activated ____, timer ____, screw conveyer ____, water slurry ____, continuous ____, intermittent ____, frequency ____

3. Hopper ash removal sequence ______________________
   ____

4. Hopper ash removal frequency: ______________________

5. No. of sections damped off ______________________

6. Fan motor, amps: ______________________

7. Gas volume flowrate, acfm: ______________________

8. $\%O_2$ across collector ______________________

C. Operating Experience/Maintenance Aspects

1. Percent of time scrubber fully operational when process is in operation ______________________

2. Has a detailed maintenance schedule been instituted?
   ____

3. Is maintenance schedule as recommended by scrubber manufacturer or by plant? ______________________
   ____

4. Are maintenance records available for inspection?
   ____

5. How long are records kept on file? ______________________
   ____

PART IV - INSPECTION OVERVIEW*

CONCLUSIONS/RECOMMENDATION
1. Compliance status: ____________________ ____________________
2. Need for further action: ____________________ ____________________
3. Corrective actions to be taken: ____________________ ____________________
4. Time required to rectify problems: ____________________ ____________________
5. Special waivers or review of compliance criteria required: ____________________ ____________________
6. Need for follow-up inspection: ____________________ ____________________
7. Inspectors signature: ____________________ Date: ____________________ Approved by: ____________________ Title: ____________________

*OTHER NOTES, COMMENTS, SKETCHES (ATTACH ADDITIONAL PAGES, IF NECESSARY).
Schematic drawings showing locations of process and dust control equipment should be prepared, particularly so, where verbal descriptions may lead to misunderstandings. Locations should be noted for observed leak sites. evidence of corrosion, warped panels, and other mechanical defects.

FIELD INSPECTION PROCEDURES
FUGITIVE EMISSIONS

PART I - GENERAL PLANT DATA

Company	Report for period Year
Street address	Furnace - company designation
City State	Furnace permit number or NEDS number
Official providing information	Furnace type
Title of official	Furnace rated capacity (charge rate)
Fugitive emission contact person	Source SIC code
Facility telephone number	Allowable emission rate and opacity

PART II - SOURCE FILE DATA

	Yes	No	N/A
1. Does the source have the current permit (and emissions control plan, if applicable) on file and available for inspection?			
2. Is source operator aware of applicable regulations, permit conditions, and/or control plan specifications under which operation is permitted?			
3. Has a regular staff member been assigned to implementation of the control plan?			
4. Are permanent facility records being kept in accordance with permit or control plan? If not, what are the deficiencies?			
5. Is ambient air monitoring being conducted near the facility? How is the monitoring equipment cited relative to fugitive sources? ______			

6. For each source, note the type of control being applied (reference to map or plot plan and/or process diagram).
• Source ID:
Type of material processed:
Type of control:
• Source ID:
Type of material processed:
Type of control:
• Source ID:
Type of material processed:
Type of control:
• Source ID:
Type of material processed:
Type of control:

PART III - VISUAL INSPECTION

A. FACILITY DATA

Type	☐ Furnace		No. of furnaces ___
	☐ Other		Specify ________
Charging method	☐ Batch	☐ Continuous	
Control devices	☐ Fabric collector		Specify type ________
	☐ Scrubber		Specify type ________
	☐ Other		

Operating schedule ____ hrs/day ____days/wk ____ wks/yr

Sketch Facility Diagram

B. Fugitive Source Data

GENERAL	Yes	No	N/A
1. Are all points listed in current permit/control plan still existent?			
2. Are there additional points that are not noted in the files? If so, please note each new point.			
3. Does control equipment and/or control measure(s) match the information in the current permit file? If not, specify.			
4. Does control equipment appear to be well maintained? If not, note that equipment which does not.			
5. Is there evidence that the source can and does make repairs to control equipment? Specify.			
STORAGE PILES			
6. Any new storage piles since last inspection?			
7. Have any storage piles been deleted since last inspection?			
8. Have any storage piles been left dormant since last inspection?			
9. Has any of the source extent associated with storage piles changed since last inspection (i.e., reduced transfer operations, material drops heights, material throughput, and vehicular traffic on or around piles)?			
10. Have any changes been made in storage pile control program since last inspection?			
11. Any equipment downtime associated with watering since last inspection?			
ROADS			
12. Have any roads been eliminated/blocked off since last inspection?			
13. Have any roads been paved since last inspection?			
14. Any new roads?			
15. Have traffic volume or vehicle characteristics on road changed because of process changes, shutdown, etc.?			
16. Have any changes been made in control program since last inspection?			
17. Any equipment downtime associated with watering or chemical application since last inspection?			
18. Any treated roads been repaired (e.g., bladed, filled in, etc.)?			
19. Any supplemental cleaning (e.g., flushing) since last inspection?			

GENERAL	Yes	No	N/A
HOODS			
20. Any fugitive losses based upon visual evaluation as indicated by escaping dust or refraction lines?			
21. Any damage to hood or modifications since last inspection that could affect performance?			
22. Evidence of corrosion?			
23. Gap distance between hood and duct system to specifications?			
24. Hood positioned properly relative to point of contamination generation?			
25. Estimation of flowrate [$v = 1096.7 (VP/p)^{0.5}$] to manufacturer specification?			
DUCTS			
26. Any visible emissions or indication of corrosion, erosion or physical damage?			
27. Position of emergency by-pass dampers closed and not leaking?			
28. Pocition of balancing dampers same as previous inspection?			
29. Balancing dampers in good operating conditions with no signs of erosion on blades?			
30. Temperature of gas stream at duct same as previous inspection, thus indicating no air infiltration?			
31. Static pressure measurement (ΔP) same as previous inspection, thus indicating no deposit buildup?			
32. Estimating of flowrate [$v = 1096.7 (VP/p)^{0.5}$] to manufacturer specification?			
33. Any visible emission or indication of corrosion, erosion or physical damage to process equipment?			
34. Indications of air balancing problems due to material buildup?			
35. Good operation and maintenance practices being utilized to minimize fugitive emissions?			

PART IV - FUGITIVE OR SMOKE EMISSION INSPECTION

1. Outdoor Location

Sky conditions	Wind direction
Precipitation	Wind speed
Industry	Unit
Sketch process unit; indicate observer position relative to source and sun; indicate potential emission points and/or actual emission points.	

2. Indoor location

Industry	Process unit
Light type (fluorescent, incandescent, natural)	
Light location (overhead, behind observer, etc.)	
Illuminance (lux or footcandles)	
Sketch process unit; indicate observer position relative to source; indicate potential emission points and/or actual emission points.	

PART IV - INSPECTION OVERVIEW*

CONCLUSIONS/RECOMMENDATION
1. Compliance status: ______________________ ______________________
2. Need for further action: ______________________ ______________________
3. Corrective actions to be taken: ______________________ ______________________
4. Time required to rectify problems: ______________________ ______________________
5. Special waivers or review of compliance criteria required: ______________________ ______________________
6. Need for follow-up inspection: ______________________ ______________________
7. Inspectors signature: ______________________ Date: ______________________ Approved by: ______________________ Title: ______________________

*OTHER NOTES, COMMENTS, SKETCHES (ATTACH ADDITIONAL PAGES, IF NECESSARY). Schematic drawings showing locations of process and dust control equipment should be prepared, particularly so, where verbal descriptions may lead to misunderstandings. Locations should be noted for observed leak sites, evidence of corrosion, warped panels, and other mechanical defects.

APPENDIX A.

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APPENDIX B.

Federal Reference Method 9

Where:

K_3=0.003464 mm Hg-m³/ml-°K for metric units.

=0.002676 in. Hg-ft³/ml-°R for English units.

6.7.2 Calculation from Intermediate Values.

$$I=\frac{T_s V_{m(std)} P_{std} 100}{T_{std} v_s \theta A_n P_s 60 (1-B_{ws})}$$

$$=K_4 \frac{T_s V_{m(std)}}{P_s v_s A_n \theta (1-B_{ws})}$$

Equation 8-5

where:

K_4=4.320 for metric units.

=0.09450 for English units

6.8 Acceptable Results. If 90 percent <I <110 percent, the results are acceptable. If the results are low in comparison to the standards and I is beyond the acceptable range, the Administrator may opt to accept the results. Use Citation 4 in the Bibliography of Method 5 to make judgments. Otherwise, reject the results and repeat the test.

6.9 Stack Gas Velocity and Volumetric Flow Rate. Calculate the average stack gas velocity and volumetric flow rate, if needed, using data obtained in this method and equations in Sections 5.2 and 5.3 of Method 2.

6.10 Relative Error (RE) for QA Audit Samples. Same as in Method 6, Section 6.4.

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METHOD 9—VISUAL DETERMINATION OF THE OPACITY OF EMISSIONS FROM STATIONARY SOURCES

Many stationary sources discharge visible emissions into the atmosphere; these emissions are usually in the shape of a plume. This method involves the determination of plume opacity by qualified observers. The method includes procedures for the training and certification of observers, and procedures to be used in the field for determination of plume opacity. The appearance of a plume as viewed by an observer depends upon a number of variables, some of which may be controllable and some of which may not be controllable in the field. Variables which can be controlled to an extent to which they no longer exert a significant influence upon plume appearance include: Angle of the observer with respect to the plume; angle of the observer with respect to the sun; point of observation of attached and detached steam plume; and angle of the observer with respect to a plume emitted from a rectangular stack with a large length to width ratio. The method includes specific criteria applicable to these variables.

Other variables which may not be controllable in the field are luminescence and color contrast between the plume and the background against which the plume is viewed. These variables exert an influence upon the appearance of a plume as viewed by an observer, and can affect the ability of the observer to accurately assign opacity values to the observed plume. Studies of the theory of plume opacity and field studies have demonstrated that a plume is most visible and presents the greatest apparent opacity when viewed against a contrasting background. It follows from this, and is confirmed by field trials, that the opacity of a plume, viewed under conditions where a contrasting background is present can be assigned with the greatest degree of accuracy. However, the potential for a positive error is also the greatest when a plume is viewed under such contrasting conditions. Under conditions presenting a less contrasting background, the apparent opacity of a plume is less and approaches zero as the color and luminescence contrast decrease toward zero. As a result, significant negative bias and negative errors can be made when a plume is viewed under less contrasting conditions. A negative bias decreases rather than increases the possibility that a plant operator will be cited for a violation of opacity standards due to observer error.

Studies have been undertaken to determine the magnitude of positive errors which can be made by qualified observers while reading plumes under contrasting conditions and using the procedures set forth in this method. The results of these studies (field trials) which involve a total of 769 sets of 25 readings each are as follows:

(1) For black plumes (133 sets at a smoke generator), 100 percent of the sets were read with a positive error[1] of less than 7.5 percent opacity; 99 percent were read with a positive error of less than 5 percent opacity.

(2) For white plumes (170 sets at a smoke generator, 168 sets at a coal-fired power plant, 298 sets at a sulfuric acid plant), 99 percent of the sets were read with a positive error of less than 7.5 percent opacity; 95 percent were read with a positive error of less than 5 percent opacity.

The positive observational error associated with an average of twenty-five readings is therefore established. The accuracy of the method must be taken into account when determining possible violations of applicable opacity standards.

1. *Principle and Applicability*

1.1 Principle. The opacity of emissions from stationary sources is determined visually by a qualified observer.

1.2 Applicability. This method is applicable for the determination of the opacity of emissions from stationary sources pursuant to § 60.11(b) and for qualifying observers for visually determining opacity of emissions.

2. *Procedures*

The observer qualified in accordance with paragraph 3 of this method shall use the following procedures for visually determining the opacity of emissions:

2.1 Position. The qualified observer shall stand at a distance sufficient to provide a clear view of the emissions with the sun oriented in the 140° sector to his back. Consistent with maintaining the above requirement, the observer shall, as much as possible, make his observations from a position such that his line of vision is approximately perpendicular to the plume direction, and when observing opacity of emissions from rectangular outlets (e.g., roof monitors, open baghouses, noncircular stacks), approximately perpendicular to the longer axis of the outlet. The observer's line of sight should not include more than one plume at a time when multiple stacks are involved, and in any case the observer should make his observations with his line of sight perpendicular to the longer axis of such a set of multiple stacks (e.g., stub stacks on baghouses).

2.2 Field Records. The observer shall record the name of the plant, emission location, type facility, observer's name and affiliation, a sketch of the observer's position relative to the source, and the date on a field data sheet (Figure 9-1). The time, estimated distance to the emission location, approximate wind direction, estimated wind speed, description of the sky condition (presence and color of clouds), and plume background are recorded on a field data sheet at the time opacity readings are initiated and completed.

2.3 Observations. Opacity observations shall be made at the point of greatest opacity in that portion of the plume where condensed water vapor is not present. The observer shall not look continuously at the plume, but instead shall observe the plume momentarily at 15-second intervals.

2.3.1 Attached Steam Plumes. When condensed water vapor is present within the plume as it emerges from the emission outlet, opacity observations shall be made beyond the point in the plume at which condensed water vapor is no longer visible. The observer shall record the approximate distance from the emission outlet to the point in the plume at which the observations are made.

2.3.2 Detached Steam Plume. When water vapor in the plume condenses and becomes visible at a distinct distance from the emission outlet, the opacity of emissions should be evaluated at the emission outlet prior to the condensation of water vapor and the formation of the steam plume.

2.4 Recording Observations. Opacity observations shall be recorded to the nearest 5 percent at 15-second intervals on an observational record sheet. (See Figure 9-2 for an example.) A minimum of 24 observations shall be recorded. Each momentary observation recorded shall be deemed to represent the average opacity of emissions for a 15-second period.

2.5 Data Reduction. Opacity shall be determined as an average of 24 consecutive observations recorded at 15-second intervals. Divide the observations recorded on the record sheet into sets of 24 consecutive observations. A set is composed of any 24 consecutive observations. Sets need not be consecutive in time and in no case shall two sets overlap. For each set of 24 observations, calculate the average by summing the opacity of the 24 observations and dividing this sum by 24. If an applicable standard specifies an averaging time requiring more than 24 observations, calculate the average for all observations made during the specified time period. Record the average opacity on a

[1] For a set, positive error = average opacity determined by observers' 25 observations—average opacity determined from transmissometer's 25 recordings.

record sheet. (See Figure 9-1 for an example.)

3. *Qualifications and Testing*

3.1 Certification Requirements. To receive certification as a qualified observer, a candidate must be tested and demonstrate the ability to assign opacity readings in 5 percent increments to 25 different black plumes and 25 different white plumes, with an error not to exceed 15 percent opacity on any one reading and an average error not to exceed 7.5 percent opacity in each category. Candidates shall be tested according to the procedures described in paragraph 3.2. Smoke generators used pursuant to paragraph 3.2 shall be equipped with a smoke meter which meets the requirements of paragraph 3.3.

The certification shall be valid for a period of 6 months, at which time the qualification procedure must be repeated by any observer in order to retain certification.

3.2 Certification Procedure. The certification test consists of showing the candidate a complete run of 50 plumes—25 black plumes and 25 white plumes—generated by a smoke generator. Plumes within each set of 25 black and 25 white runs shall be presented in random order. The candidate assigns an opacity value to each plume and records his observation on a suitable form. At the completion of each run of 50 readings, the score of the candidate is determined. If a candidate fails to qualify, the complete run of 50 readings must be repeated in any retest. The smoke test may be administered as part of a smoke school or training program, and may be preceded by training or familiarization runs of the smoke generator during which candidates are shown black and white plumes of known opacity.

3.3 Smoke Generator Specifications. Any smoke generator used for the purposes of paragraph 3.2 shall be equipped with a smoke meter installed to measure opacity across the diameter of the smoke generator stack. The smoke meter output shall display instack opacity based upon a pathlength equal to the stack exit diameter, on a full 0 to 100 percent chart recorder scale. The smoke meter optical design and performance shall meet the specifications shown in Table 9-1. The smoke meter shall be calibrated as prescribed in paragraph 3.3.1 prior to the conduct of each smoke reading test. At the completion of each test, the zero and span drift shall be checked and if the drift exceeds ±1 percent opacity, the condition shall be corrected prior to conducting any subsequent test runs. The smoke meter shall be demonstrated, at the time of installation, to meet the specifications listed in Table 9-1. This demonstration shall be repeated following any subsequent repair or replacement of the photocell or associated electronic circuitry including the chart recorder or output meter, or every 6 months, whichever occurs first.

TABLE 9-1—SMOKE METER DESIGN AND PERFORMANCE SPECIFICATIONS

Parameter	Specification
a. Light source	Incandescent lamp operated at nominal rated voltage.
b. Spectral response of photocell.	Photopic (daylight spectral response of the human eye—reference 4.3).
c. Angle of view	15° maximum total angle.
d. Angle of projection	15° maximum total angle.
e. Calibration error	±3% opacity, maximum.
f. Zero and span drift	±1% opacity, 30 minutes
g. Response time	5 seconds.

3.3.1 Calibration. The smoke meter is calibrated after allowing a minimum of 30 minutes warmup by alternately producing simulated opacity of 0 percent and 100 percent. When stable response at 0 percent or 100 percent is noted, the smoke meter is adjusted to produce an output of 0 percent or 100 percent, as appropriate. This calibration shall be repeated until stable 0 percent and 100 percent readings are produced without adjustment. Simulated 0 percent and 100 percent opacity values may be produced by alternately switching the power to the light source on and off while the smoke generator is not producing smoke.

3.3.2 Smoke Meter Evaluation. The smoke meter design and performance are to be evaluated as follows:

3.3.2.1 Light Source. Verify from manufacturer's data and from voltage measurements made at the lamp, as installed, that the lamp is operated within ±5 percent of the nominal rated voltage.

3.3.2.2 Spectral Response of Photocell. Verify from manufacturer's data that the photocell has a photopic response; i.e., the spectral sensitivity of the cell shall closely approximate the standard spectral-luminosity curve for photopic vision which is referenced in (b) of Table 9-1.

FIGURE 9-1
RECORD OF VISUAL DETERMINATION OF OPACITY

PAGE___of___

COMPANY________________
LOCATION________________
TEST NUMBER________________
DATE________________
TYPE FACILITY________________
CONTROL DEVICE________________

HOURS OF OBSERVATION________________
OBSERVER________________
OBSERVER CERTIFICATION DATE________________
OBSERVER AFFILIATION________________
POINT OF EMISSIONS________________
HEIGHT OF DISCHARGE POINT________________

	Initial			Final
CLOCK TIME				
OBSERVER LOCATION Distance to Discharge				
Direction from Discharge				
Height of Observation Point				
BACKGROUND DESCRIPTION				
WEATHER CONDITIONS Wind Direction				
Wind Speed				
Ambient Temperature				
SKY CONDITIONS (clear, overcast, % clouds, etc.)				
PLUME DESCRIPTION Color				
Distance Visible				
OTHER INFORMATION				

SUMMARY OF AVERAGE OPACITY

Set Number	Time	Opacity	
	Start--End	Sum	Average

Readings ranged from ____ to ____ % opacity

The source was/was not in compliance with ____ at the time evaluation was made.

FIGURE 9-2—OBSERVATION RECORD

Page —— of ——

Company ________________
Location ________________
Test Number ________________
Date ________________
Observer ________________
Type facility ________________
Point of emissions ________________

Hr.	Min.	Seconds				Steam plume (check if applicable)		Comments
		0	15	30	45	Attached	Detached	
	0							
	1							
	2							
	3							
	4							
	5							
	6							
	7							
	8							
	9							
	10							
	11							
	12							
	13							
	14							
	15							
	16							
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	25							
	26							
	27							
	28							
	29							

L=the distance from the photocell to the limiting aperture. The limiting aperture is the point in the path between the photocell and the smoke plume where the angle of view is most restricted. In smoke generator smoke meters this is normally an orifice plate.

3.3.2.4 Angle of Projection. Check construction geometry to ensure that the total angle of projection of the lamp on the smoke plume does not exceed 15°. The total angle of projection may be calculated from: $\theta=2\tan^{-1}d/2L$, where θ= total angle of projection; d= the sum of the length of the lamp filament + the diameter of the limiting aperture; and L= the distance from the lamp to the limiting aperture.

3.3.2.5 Calibration Error. Using neutral-density filters of known opacity, check the error between the actual response and the theoretical linear response of the smoke meter. This check is accomplished by first calibrating the smoke meter according to 3.3.1 and then inserting a series of three neutral-density filters of nominal opacity of 20, 50, and 75 percent in the smoke meter pathlength. Filters calibrated within ±2 percent shall be used. Care should be taken when inserting the filters to prevent stray light from affecting the meter. Make a total of five nonconsecutive readings for each filter. The maximum error on any one reading shall be 3 percent opacity.

3.3.2.6 Zero and Span Drift. Determine the zero and span drift by calibrating and operating the smoke generator in a normal manner over a 1-hour period. The drift is measured by checking the zero and span at the end of this period.

3.3.2.7 Response Time. Determine the response time by producing the series of five simulated 0 percent and 100 percent opacity values and observing the time required to reach stable response. Opacity values of 0 percent and 100 percent may be simulated by alternately switching the power to the light source off and on while the smoke generator is not operating.

4. *References.*

4.1 Air Pollution Control District Rules and Regulations, Los Angeles County Air Pollution Control District, Regulation IV, Prohibitions, Rule 50.

4.2 Weisburd, Melvin I., Field Operations and Enforcement Manual for Air, U.S. Environmental Protection Agency, Research Triangle Park, NC. APTD-1100, August 1972, pp. 4.1-4.36.

4.3 Condon, E.U., and Odishaw, H., Handbook of Physics, McGraw-Hill Co., New York, NY. 1958, Table 3.1, p. 6-52.

Alternate Method 1—Determination of the Opacity of Emissions From Stationary Sources Remotely by Lidar

This alternate method provides the quantitative determination of the opacity of an emissions plume remotely by a mobile lidar system (laser radar; Light Detection and Ranging). The method includes procedures for the calibration of the lidar and procedures to be used in the field for the lidar determination of plume opacity. The lidar is used to measure plume opacity during either day or nighttime hours because it contains its own pulsed light source or transmitter. The operation of the lidar is not dependent upon ambient lighting conditions (light, dark, sunny or cloudy).

The lidar mechanism or technique is applicable to measuring plume opacity at numerous wavelengths of laser radiation. However, the performance evaluation and calibration test results given in support of this method apply only to a lidar that employs a ruby (red light) laser [Reference 5.1].

1. *Principle and Applicability*

1.1 Principle. The opacity of visible emissions from stationary sources (stacks, roof vents, etc.) is measured remotely by a mobile lidar (laser radar).

1.2 Applicability. This method is applicable for the remote measurement of the opacity of visible emissions from stationary sources during both nighttime and daylight conditions, pursuant to 40 CFR § 60.11(b). It is also applicable for the calibration and performance verification of the mobile lidar for the measurement of the opacity of emissions. A performance/design specification for a basic lidar system is also incorporated into this method.

1.3 Definitions.

Azimuth angle: The angle in the horizontal plane that designates where the laser beam is pointed. It is measured from an arbitrary fixed reference line in that plane.

Backscatter: The scattering of laser light in a direction opposite to that of the incident laser beam due to reflection from particulates along the beam's atmospheric path which may include a smoke plume.

Backscatter signal: The general term for the lidar return signal which results from laser light being backscattered by atmospheric and smoke plume particulates.

Convergence distance: The distance from the lidar to the point of overlap of the lidar receiver's field-of-view and the laser beam.

Elevation angle: The angle of inclination of the laser beam referenced to the horizontal plane.

Far region: The region of the atmosphere's path along the lidar line-of-sight beyond or behind the plume being measured.

APPENDIX C.

Federal Reference Method 22

liquid leakage. Sources that have these conditions present must be surveyed using the instrument techniques of 4.3.1 or 4.3.2.

Spray a soap solution over all potential leak sources. The soap solution may be a commercially available leak detection solution or may be prepared using concentrated detergent and water. A pressure sprayer or a squeeze bottle may be used to dispense the solution. Observe the potential leak sites to determine if any bubbles are formed. If no bubbles are observed, the source is presumed to have no detectable emissions or leaks as applicable. If any bubbles are observed, the instrument techniques of 4.3.1 or 4.3.2 shall be used to determine if a leak exists, or if the source has detectable emissions, as applicable.

4.4 Instrument Evaluation Procedures. At the beginning of the instrument performance evaluation test, assemble and start up the instrument according to the manufacturer's instructions for recommended warmup period and preliminary adjustments.

4.4.1 Response Factor. Calibrate the instrument with the reference compound as specified in the applicable regulation. For each organic species that is to be measured during individual source surveys, obtain or prepare a known standard in air at a concentration of approximately 80 percent of the applicable leak definition unless limited by volatility or explosivity. In these cases, prepare a standard at 90 percent of the saturation concentration, or 70 percent of the lower explosive limit, respectively. Introduce this mixture to the analyzer and record the observed meter reading. Introduce zero air until a stable reading is obtained. Make a total of three measurements by alternating between the known mixture and zero air. Calculate the response factor for each repetition and the average response factor.

Alternatively, if response factors have been published for the compounds of interest for the instrument or detector type, the response factor determination is not required, and existing results may be referenced. Examples of published response factors for flame ionization and catalytic oxidation detectors are included in Section 5.

4.4.2 Calibration Precision. Make a total of three measurements by alternately using zero gas and the specified calibration gas. Record the meter readings. Calculate the average algebraic difference between the meter readings and the known value. Divide this average difference by the known calibration value and mutiply by 100 to express the resulting calibration precision as a percentage.

4.4.3 Response Time. Introduce zero gas into the instrument sample probe. When the meter reading has stabilized, switch quickly to the specified calibration gas. Measure the time from switching to when 90 percent of the final stable reading is attained. Perform this test sequence three times and record the results. Calculate the average response time.

5. *Bibliography*

5.1 DuBose, D.A., and G.E. Harris. Response Factors of VOC Analyzers at a Meter Reading of 10,000 ppmv for Selected Organic Compounds. U.S. Environmental Protection Agency, Research Triangle Park, NC. Publication No. EPA 600/2-81-051. September 1981.

5.2 Brown, G.E., et al. Response Factors of VOC Analyzers Calibrated with Methane for Selected Organic Compounds. U.S. Environmental Protection Agency, Research Triangle Park, NC. Publication No. EPA 600/2-81-022. May 1981.

5.3 DuBose, D.A., et al. Response of Portable VOC Analyzers to Chemical Mixtures. U.S. Environmental Protection Agency, Research Triangle Park, NC. Publication No. EPA 600/2-81-110. September 1981.

METHOD 22—VISUAL DETERMINATION OF FUGITIVE EMISSIONS FROM MATERIAL SOURCES AND SMOKE EMISSIONS FROM FLARES

1. *Introduction*

This method involves the visual determination of fugitive emissions, i.e., emissions not emitted directly from a process stack or duct. Fugitive emissions include emissions that (1) escape capture by process equipment exhaust hoods; (2) are emitted during material transfer; (3) are emitted from buildings housing material processing or handling equipment; and (4) are emitted directly from process equipment. This method is used also to determine visible smoke emissions from flares used for combustion of waste process materials.

This method determines the amount of time that any visible emissions occur during the observation period, i.e., the accumulated emission time. This method does not require that the opacity of emissions be determined. Since this procedure requires only the determination of whether a visible emission occurs and does not require the determination of opacity levels, observer certification according to the procedures of Method 9 are not required. However, it is necessary that the observer is educated on the general procedures for determining the presence of visible emissions. As a minimum, the observer must be trained and knowledgeable regarding the effects on the visibility of emissions caused by background contrast, ambient lighting, observer position relative to lighting, wind, and the presence of uncombined water (condensing water vapor). This training is to be obtained from written materials found in References 7.1 and 7.2 or from the lecture portion of the Method 9 certification course.

2. *Applicability and Principle*

2.1 Applicability. This method applies to the determination of the frequency of fugitive emissions from stationary sources (located indoors or outdoors) when specified as the test method for determining compliance with new source performance standards.

This method also is applicable for the determination of the frequency of visible smoke emissions from flares.

2.2 Principle. Fugitive emissions produced during material processing, handling, and transfer operations or smoke emissions from flares are visually determined by an observer without the aid of instruments.

3. *Definitions*

3.1 Emission Frequency. Percentage of time that emissions are visible during the observation period.

3.2 Emission Time. Accumulated amount of time that emissions are visible during the observation period.

3.3 Fugitive Emissions. Pollutant generated by an affected facility which is not collected by a capture system and is released to the atmosphere.

3.4 Smoke Emissions. Pollutant generated by combustion in a flare and occurring immediately downstream of the flame. Smoke occurring within the flame, but not downstream of the flame, is not considered a smoke emission.

3.5 Observation Period. Accumulated time period during which observations are conducted, not to be less than the period specified in the applicable regulation.

4. *Equipment*

4.1 Stopwatches. Accumulative type with unit divisions of at least 0.5 seconds; two required.

4.2 Light Meter. Light meter capable of measuring illuminance in the 50- to 200-lux range; required for indoor observations only.

5. *Procedure*

5.1 Position. Survey the affected facility or building or structure housing the process to be observed and determine the locations of potential emissions. If the affected facility is located inside a building, determine an observation location that is consistent with the requirements of the applicable regulation (i.e., outside observation of emissions escaping the building/structure or inside observation of emissions directly emitted from the affected facility process unit). Then select a position that enables a clear view of the potential emission point*(s)* of the affected facility or of the building or structure housing the affected facility, as appropriate for the applicable subpart. A position at least 15 feet, but not more than 0.25 miles, from the emission source is recommended. For outdoor locations, select a position where the sun is not directly in the observer's eyes.

5.2 Field Records.

5.2.1 Outdoor Location. Record the following information on the field data sheet (Figure 22-1): company name, industry, process unit, observer's name, observer's affiliation, and date. Record also the estimated wind speed, wind direction, and sky condition. Sketch the process unit being observed and note the observer location relative to the source and the sun. Indicate the potential and actual emission points on the sketch.

5.2.2 Indoor Location. Record the following information on the field data sheet (Figure 22-2): company name, industry, process unit, observer's name, observer's affiliation, and date. Record as appropriate the type, location, and intensity of lighting on the data sheet. Sketch the process unit being observed and note observer location relative to the source. Indicate the potential and actual fugitive emission points on the sketch.

5.3 Indoor Lighting Requirements. For indoor locations, use a light meter to measure the level of illumination at a location as close to the emission source*(s)* as is feasible. An illumination of greater than 100 lux (10 foot candles) is considered necessary for proper application of this method.

5.4 Observations. Record the clock time when observations begin. Use one stopwatch to monitor the duration of the observation period; start this stopwatch when the observation period begins. If the observation period is divided into two or more segments by process shutdowns or observer rest breaks, stop the stopwatch when a break begins and restart it without resetting when the break ends. Stop the stopwatch at the end of the observation period. The accumulated time indicated by this stopwatch is the duration of the observation period. When the observation period is completed, record the clock time.

During the observation period, continuously watch the emission source. Upon observing an emission (condensed water vapor is not considered an emission), start the second accumulative stopwatch; stop the watch when the emission stops. Continue this procedure for the entire observation period. The accumulated elapsed time on this stopwatch is the total time emissions were visible during the observation period, i.e., the emission time.

5.4.1 Observation Period. Choose an observation period of sufficient length to meet the requirements for determining compliance with the emission regulation in the applicable subpart. When the length of the observation period is specifically stated in the applicable subpart, it may not be necessary to observe the source for this entire period if the emission time required to indicate noncompliance (based on the specified observation period) is observed in a shorter time period. In other words, if the regulation prohibits emissions for more than 6 minutes in any hour, then observations may (optional) be stopped after an emission time of 6 minutes is exceeded. Similarly, when the regulation is expressed as an emission frequency and the regulation prohibits emissions for greater than 10 percent of the time in any hour, then observations may (optional) be terminated after 6 minutes of emissions are observed since 6 minutes is 10 percent of an hour. In any case, the observation period shall not be less than 6 minutes in duration. In some cases, the process operation may be intermittent or cyclic. In such cases, it may be convenient for the observation period to coincide with the length of the process cycle.

5.4.2 Observer Rest Breaks. Do not observe emissions continuously for a period of more than 15 to 20 minutes without taking a rest break. For sources requiring observation periods of greater than 20 minutes, the observer shall take a break of not less than 5 minutes and not more than 10 minutes after every 15 to 20 minutes of observation. If continuous observations are desired for extended time periods, two observers can alternate between making observations and taking breaks.

5.4.3 Visual Interference. Occasionally, fugitive emissions from sources other than the affected facility (e.g., road dust) may prevent a clear view of the affected facility. This may particularly be a problem during periods of high wind. If the view of the potential emission points is obscured to such a degree that the observer questions the validity of continuing observations, then the observations are terminated, and the observer clearly notes this fact on the data form.

5.5 Recording Observations. Record the accumulated time of the observation period on the data sheet as the observation period duration. Record the accumulated time emissions were observed on the data sheet as the emission time. Record the clock time the observation period began and ended, as well as the clock time any observer breaks began and ended.

6. *Calculations*

If the applicable subpart requires that the emission rate be expressed as an emission frequency (in percent), determine this value as follows: Divide the accumulated emission time (in seconds) by the duration of the observation period (in seconds) or by any minimum observation period required in the applicable subpart, if the acutal observation period is less than the required period and multiply this quotient by 100.

7. *References.*

7.1 Missan, Robert and Arnold Stein. Guidelines for Evaluation of Visible Emissions Certification, Field Procedures, Legal Aspects, and Background Material. EPA Publication No. EPA-340/1-75-007. April 1975

7.2 Wohlschlegel, P. and D. E. Wagoner. Guideline for Development of a Quality Assurance Program: Volume IX—Visual Determination of Opacity Emissions From Stationary Sources. EPA Publication No. EPA-650/4-74-005-i. November 1975.

FUGITIVE OR SMOKE EMISSION INSPECTION
OUTDOOR LOCATION

Company ____________	Observer ____________
Location ____________	Affiliation ____________
Company representative ____________	Date ____________
Sky Conditions ____________	Wind direction ____________
Precipitation ____________	Wind speed ____________
Industry ____________	Process unit ____________

Sketch process unit; indicate observer position relative to source and sun; indicate potential emission points and/or actual emission points.

OBSERVATIONS

	Clock time	Observation period duration, min:sec	Accumulated emission time, min:sec
Begin Observation	______	______	______
	______	______	______
	______	______	______
	______	______	______
	______	______	______
	______	______	______
	______	______	______
	______	______	______
	______	______	______
End observation	______		

Figure 22-1

Fugitive Emission Inspection Indoor Location Table

FUGITIVE EMISSION INSPECTION
INDOOR LOCATION

Company ______________________ Observer ______________________

Location ______________________ Affiliation ______________________

Company Representative ______________ Date ______________________

Industry ______________________ Process unit ______________________

Light type (fluorescent, incandescent, natural ______________________

Light location (overhead, behind observer, etc.) ______________________

Illuminance (lux or footcandles) ______________________

Sketch process unit; indicate observer position relative to source; indicate potential emission points and/or actual emission points.

OBSERVATIONS

	Clock time	Observation period duration, min:sec	Accumulated emission, time, min:sec
Beginning observation	______		
		______	______
	______		
		______	______
	______		
		______	______
	______		
		______	______
	______		
		______	______
End observation	______		

Figure 22-2