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Project Summary

Inspection and Operating and Maintenance Guidelines for Secondary Lead Smelter Air Pollution Control

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Secondary lead smelters are an important segment of the domestic nonferrous metals industry. Over the last five years they accounted for 55 to 58 percent of the total domestically supplied lead. In 1982, about 95 percent of the secondary lead was produced by 48 major operating plants with the balance supplied by a large number of very small plants.

The toxicity of lead together with its relatively high vapor pressure at operating furnace temperatures make it a serious environmental/occupational health problem that is difficult to control economically. The U.S. Environmental Protection Agency (EPA) has promulgated a National Ambient Air Quality Standard (NAAQS) for lead of 1.5$\mu g/m^3$. The Occupational Safety and Health Administration (OSHA) has promulgated a workplace standard of 50 $\mu g/m^3$ and a blood level standard of 40 μg/100 ml of whole blood. Operation and maintenance (O&M) techniques will become important tools in maintaining continued compliance with these standards.

This Project Summary was developed by EPA's Industrial Environmental Research Laboratory, Cincinnati, OH, to announce key findings of the research project that is fully documented in a separate report of the same title (see Project Report ordering information at back).

Introduction

The success of an air pollution compliance program ultimately depends upon the competence of the field inspectors and the adequacy of their inspections. The ability to identify, describe, and evaluate air pollution emissions and those factors responsible for their occurrence is a fundamental requirement of the inspection process. Both the availability of sound inspection procedures and adherence to the procedures are of vital importance to the inspection process. An air pollution control agency having adequate enforcement powers but inadequate inspection procedures would be unlikely to make significant progress towards attainment of air quality goals. Also, such an agency may even see erosion of its enforcement powers as a result of adverse court decisions arising from improperly executed inspections.

The most important aspect of maintenance of air quality is the attainment of "continuing compliance." A "continuing compliance inspection" is an inspection of sources, which have previously proved initial compliance with the regulations in that they have installed the necessary air pollution control equipment and/or modified their process(es) to be able to meet required emission limits, to determine that they remain in compliance on a continuing, long-term basis. Most agencies perform a continuing compliance inspection once or twice a year depending upon their resources or any complaints received.

Report Summary

The manual was developed as an inspection manual incorporating operation and maintenance information for secondary lead smelting. It presents an overview of secondary lead operations, describes typical emission problems associated with the material preparation, smelting, refining, and oxidation processes (Figure 1), and reviews the potential causes of the problems and possible corrective measures. It also describes types of control equipment used in secondary lead smelting operations and typical O&M problems experienced with control equipment. Topics include: (1) process description and flow diagrams for a typical secondary lead smelter and lead oxide process; (2) operating conditions typical of secondary lead smelting operations; (3) process and fugitive emissions operations and their control; (4) design considerations to improve O&M; and (5) basic operation and maintenance procedures necessary to remain in compliance, including typical O&M problems associated with the secondary lead industry, such as corrosion, proper instrumentation required for reliable operation, proper recordkeeping procedures, waste handling guidelines, and safety considerations.

The prevention of lead emissions from secondary smelters is shown to depend largely on O&M practices. Fabric filters are usually used to remove particulate matter from lead smelter process and ventilation gas streams. Because properly operated fabric filters are very efficient, little lead particulate matter is emitted in stack gases when operated under conditions of continuing compliance. Fugitive emissions, however, are a major problem. Control systems are only partially effective in capturing fugitive emissions. Also, handling of the lead particulate matter after it has been collected is a potential cause of fugitive emissions. Lead dust escapes from the material handling and smelting processes into the workplace and is continually reentrained and dispersed throughout the smelter. Emission factors for specific sources are given in Table 1. Sufficient reentrainment may occur to cause the NAAQS of 1.5 $\mu g/m^3$ to be exceeded. Continued compliance can be achieved only by applying the appropriate combination of engineering and administrative controls, and by adopting operating, maintenance, and housekeeping practices to make those controls work effectively.

The manual is heavily oriented toward an inspection approach emphasizing techniques to achieve improvements in the status of continuing compliance through operations and maintenance procedures. It has been written for use both as an educational and a reference tool by state and local enforcement field inspectors and entry-level engineers whose familiarity with secondary lead operations may be limited, and, as such, can be useful both as a training manual and as a guidebook during field inspections.

Inspection of a secondary lead smelter requires that data be recorded on site for later use in evaluating smelter emission control and compliance practices. The following items are useful to ensure that the inspection is complete and to maximize the pertinent information that can be

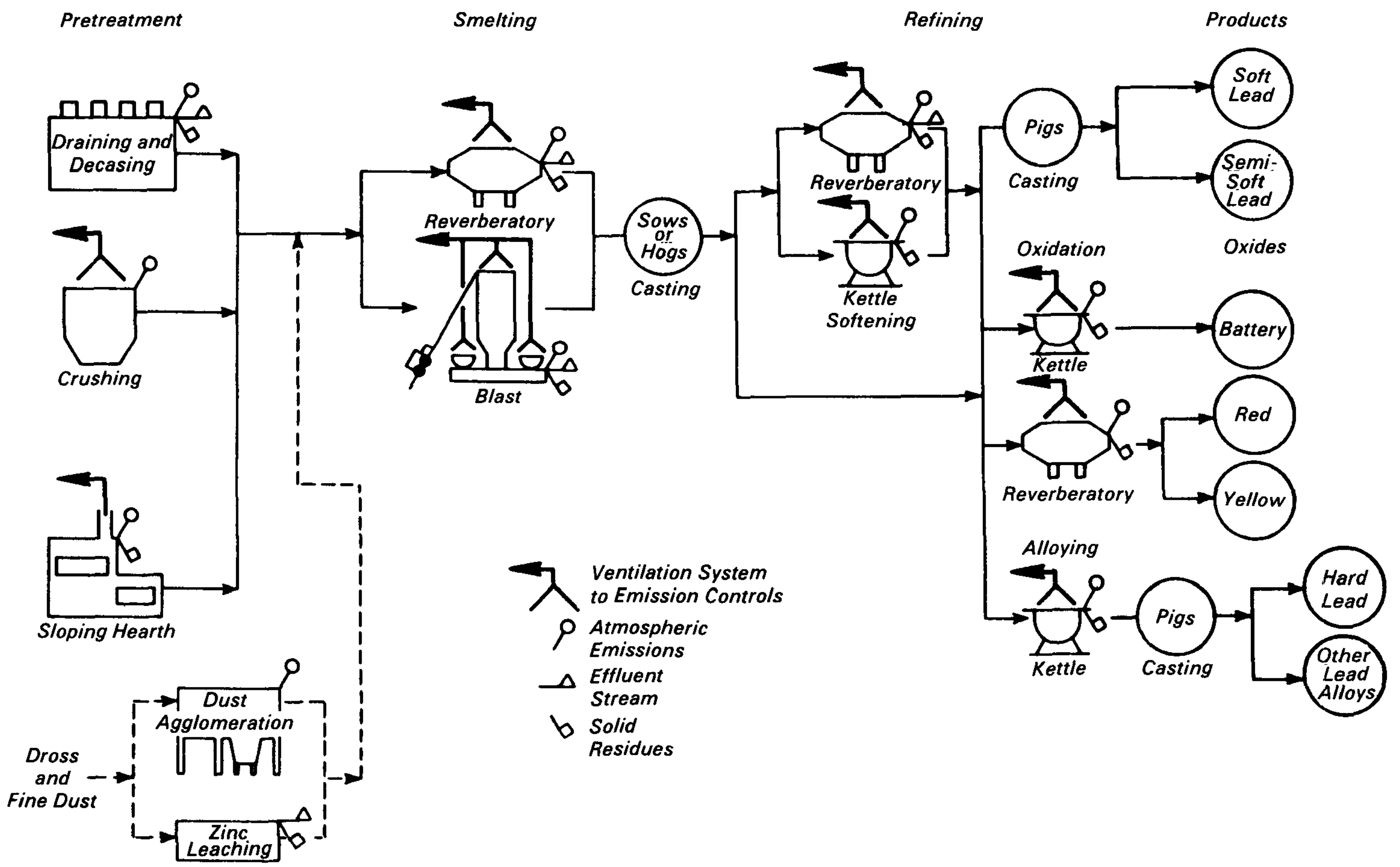

Figure 1. *Sources of air emissions from secondary lead plants.*

Table 1. *Sources and Emission Factors for Point and Fugitive Emissions from Secondary Lead Smelters*[a,b]

	Point source emissions, lb/ton			*Fugitive emissions, lb/ton*		
Source	*Particulate*	*Lead*	*Basic*[c]	*Particulate*	*Lead*	*Basic*[c]
Raw material handling and transfer (scrap lead, scrap iron, coke, limestone, etc.)	*NA*	*NA*		*NA*	*NA*	
Lead and iron scrap burning	*NA*	*NA*		*NA*	*NA*	
Battery decasing	*NA*	*NA*		*NA*	*NA*	
Crushing or shredding	*NA*	*NA*		*NA*	*NA*	
Rotary or reverberatory furnace sweating	*32-70*	*7-16*	*E*			
Charging						
Tapping				*1.6-3.5*	*0.4-1.8*	*E*
Scrap removal						
Reverberatory furnace smelting	*147*	*34*	*B*			
Charging						
Slag tapping						
Lead tapping/casting						
				2.8-15.7	*0.6-3.6*	*E*
Blast furnace smelting	*193*	*44*	*B*			
Charging						
Slag tapping						
lead tapping/casting						
Holding pot	*NA*	*NA*		*NA*	*NA*	
Reverberatory furnace softening	*NA*	*NA*		*NA*	*NA*	
Charging						
Tapping (drossing, skimming, lead removal)						
Kettle softening/refining						
Charging						
Tapping (drossing, skimming, lead removal)						
	0.8	*0.2*	*B*	*0.04*	*0.01*	*E*
Kettle alloying/refining						
Charging						
Tapping, drossing, skimming						
Kettle oxidation[d]	*<40*	*NA*	*E*	*NA*	*NA*	
Charging						
Reverberatory furnace oxidation	*NA*	*NA*		*NA*	*NA*	
Charging						
Casting (pigging)[e]	*NA*	*NA*		*0.88*	*0.2*	*E*
Flue dust handling and transfer	*NA*	*NA*		*NA*	*NA*	
Vehicular traffic	*NA*	*NA*		*NA*	*NA*	
Traffic on paved roads						
Traffic on unpaved roads						
Hooding, ductwork, control device, or furnace leaks	*NA*	*NA*		*NA*	*NA*	

NA - data not available.
[a] *Source: U.S. Environmental Protection Agency. Compilation of Air Pollution Emission Factors. 1980.*
[b] *All emission factors are based on the quantity of material charged to the furnace (except particulate kettle oxidation).*
[c] *The basis of the emission factor refers to the method from which the emission factor was obtained.*
B - Emission factor based on source test data and is rated (EPA 1980) as above average.
E - Engineering estimate supportable by visual observation and emission tests for similar sources. These emission factors are rated (EPA 1980) poor.
[d] *Factors based on amount of lead oxide produced.*
[e] *Factors based on amount of lead cast.*

obtained while the inspector is on site:

- Smelter plot plan
- Engineering drawings or sketches of equipment and specifications
- Process flowsheet and equipment checklist
- Raw material/product checklist
- Individual process worksheets
- Emission control equipment (systems) acceptance or performance test results
- Maintenance records

Most of these items can be obtained during the file review at the appropriate EPA Regional and local offices, especially results of performance tests conducted to determine compliance.

Prior to the inspection, the worksheets, process flows, and maintenance records should be reviewed with the plant's representative at the plant. Organizing these items prior to the actual inspection helps ensure that all necessary data are obtained.

The purpose of inspecting control equipment is to evaluate system performance with respect to regulatory requirements and operation and maintenance procedures. Inspections can vary in detail, depending upon the objective. For example, cursory inspections can be performed by only quick, external examination of the control equipment and recording of several temperature and static pressure readings. Thorough inspection requires more detailed analysis of the control system and perhaps an internal inspection of the equipment. Inspection requirements should be tailored to the characteristics of each facility, and the time available for each inspection.

An inspector, upon arrival at the plant to be inspected, should determine existing plant self monitoring procedures by questioning plant management. Any records that show control system operating parameters and production levels should be quickly reviewed to estimate plant "baseline values". A baseline value is the value of a given parameter (e.g., fan static pressure and temperature or fabric filter pressure drop) when all the equipment in a system is operated in a manner that provides acceptable performance. If actual operating values differ significantly from baseline values, operation of the process or control equipment has changed enough to warrant further questioning of plant personnel to determine probable reasons for these deviations.

Some parameters can indicate the performance of the control equipment. These include opacity and fan parameters.

Opacity

Observation of the opacity and comparison of this value with the baseline value provides the initial indicator of any process or control equipment performance variation.

Fan Parameters

Fan parameters are generally the parameters that plant and regulatory personnel use the least in evaluating control equipment performance. Each fan has a unique static pressure/motor current/gas volume curve at any given speed. Because fan speed is usually fixed (and must be manually and intentionally changed by plant personnel), it need not be measured each time plant personnel check the system. The gas volume through the fan may be read directly from the curve.

Fabric Filters

The most frequently used indicator for fabric filter operation is the pressure drop across the filter medium. The cleaning system operation should be confirmed, and the timing sequence should be recorded. The waste handling system (including hoppers, airlocks, and conveyors) should be checked for proper operation. Hoppers should not be used for storage of captured dust. Although hoppers may be insulated, the hopper discharge should be warm to the touch. A cold hopper discharge on a "hot source" may indicate hopper plugging.

The previous steps provide some information, but the only reliable method of evaluating fabric filter performance is internal inspection. Safety is a prime concern in performing an internal inspection. Generally, special equipment is required to enter these baghouses.

The actual internal inspection takes little time. The majority of the time required is used to prepare equipment and to isolate and open compartments. The location and nature of all bag failures should be recorded for maintenance schedule optimization. The use of a fluorescent dye and a portable UV light may be helpful in identifying problems. Pinholes and bag seal leaks are easily spotted. Figure 2 indicates the steps for internal and external inspections of fabric filters.

Wet Scrubbers

Inspection of a wet scrubber relies heavily on baseline values because internal inspection of the equipment is not usually possible. An inspector must attempt to quantify any change in efficiency based upon a change in the water flow rate, pressure drop, gas volume (throat velocity), or gas temperature. The only other parameter that can significantly affect scrubber performance is a shift in the particle size distribution. Such a shift is difficult to measure, but generally decreases collection efficiency, when the shift is to smaller sizes, when all other parameters are held constant.

Because of the low gas stream temperature, other problems with liquor solids content and evaporation are not typically encountered. Corrosion is generally limited because of construction practices (e.g., the use of 316 stainless steel). Little day-to-day variation in scrubber operation is expected.

For inspection purposes, the ventilation system is defined as the ductwork leading from the emission points to the control devices. Two major problems with ventilation systems are duct plugging and excessive air inleakage, both of which cause changes in the static pressure and temperature profiles of the ductwork system. An inspector should carefully examine the ventilation system to identify the problem. Static pressure taps are recommended throughout the length of ductwork to provide data on air inleakage and ductwork plugging.

The ventilation system inspection should include routine measurement of the temperature and static pressure at the furnace or kettle hood outlet, at the afterburner outlet (if applicable), at the inlet and outlet of the cooling loops, and at some point downstream of dilution air dampers. These parameters vary with production rate, and ambient temperature and operating logs should be examined to determine long-term baseline values, which take into account normal process variations.

In addition to the measurement of static pressure and temperature at the emission point, the face velocity and positioning of all fugitive hooding should be checked. Improper positioning of hooding or hood damage may result in the reduction of capture efficiencies. Low duct static pressures indicate an undersized or underperforming fan.

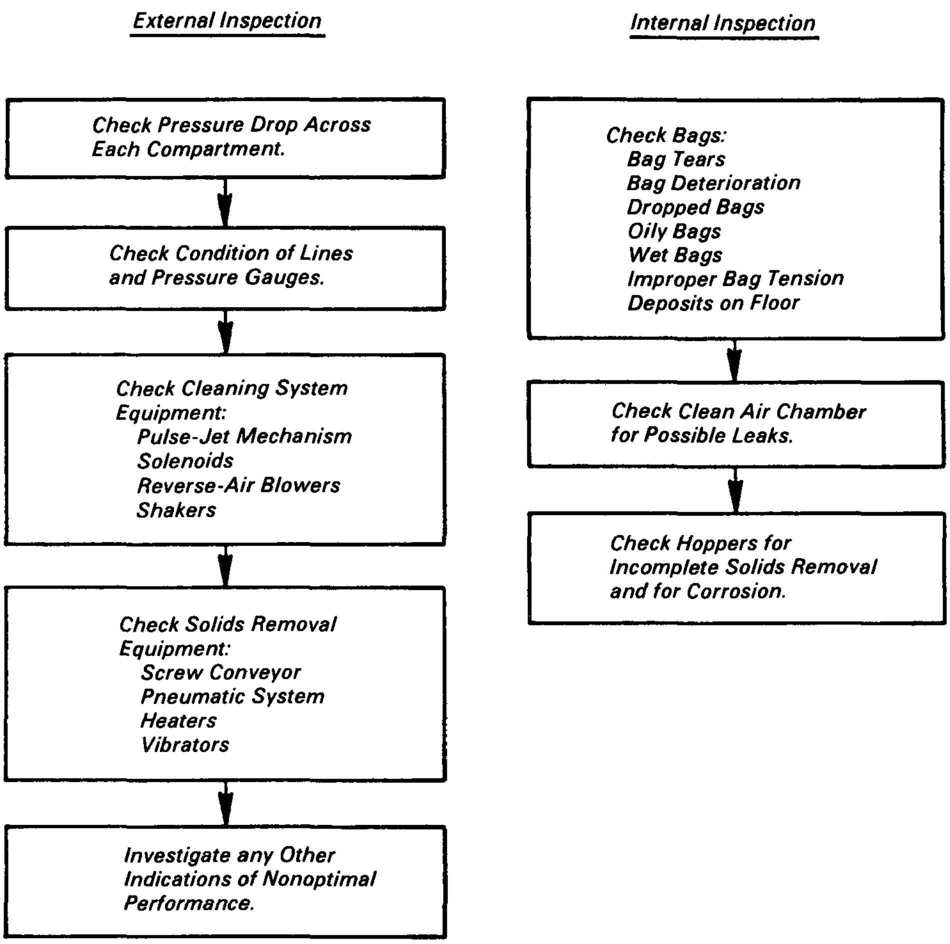

Figure 2. *Steps for external and internal inspection of fabric filters.*

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The complete report, entitled "Inspection and Operating and Maintenance Guidelines for Secondary Lead Smelter Air Pollution Control," (Order No. PB 84-149 368; Cost: $14.50, subject to change) will be available only from:

National Technical Information Service
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