WALK-THROUGH SURVEY REPORT:

CONTROL TECHNOLOGY FOR METAL RECLAMATION INDUSTRIES

AT

Sanders Lead Company Inc.
Troy, Alabama

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National Institute for Occupational Safety and Health
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PLANT SURVEYED:	Sanders Lead Company P.O. Box 707 Troy, Alabama 36081
SIC CODE:	3341
SURVEY DATE:	December 9, 1992
SURVEY CONDUCTED BY:	Ronald M. Hall, DPSE John W. Sheehy, DPSE Janie L. Gittleman, DSHEFS
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INTRODUCTION

The National Institute for Occupational Safety and Health (NIOSH), a federal agency located in the Centers for Disease Control and Prevention (CDC) under the Department of Health and Human Services (DHHS), was established by the Occupational Safety and Health Act of 1970. This legislation mandated NIOSH to conduct research and education programs separate from the standard setting and enforcement functions conducted by the Occupational Safety and Health Administration (OSHA) in the Department of Labor. An important area of NIOSH research deals with methods for controlling occupational exposure to potential chemical and physical hazards.

The Engineering Control Technology Branch (ECTB) of the Division of Physical Sciences and Engineering has been given the lead within NIOSH to study and develop engineering controls and assess their impact on reducing occupational illness and injury. Since 1976, ECTB has conducted a large number of studies to evaluate engineering control technology based upon industry, process, or control technique. The objective of each of these studies has been to document and evaluate control techniques and to determine their effectiveness in reducing potential health hazards in an industry or at specific processes.

This study of metal reclamation is being undertaken by ECTB to provide control technology information for preventing occupational disease in this industry. This project is part of a NIOSH special initiative on small business.

The goal of this research study is to identify, evaluate, and disseminate practical and cost effective control methods which reduce exposures to lead. The study will be accomplished by identifying and evaluating existing control methods used in metal reclamation industries. The results of these field evaluations will be presented in-depth survey reports. The information on control methods will be disseminated in scientific journal articles, trade journal articles, and in handbooks for use by workers, owners, and operators, OSHA consultation program, and other safety and health professionals.

As part of this overall study, a walk-through survey was conducted at Sanders Lead Company The purpose of this survey was to identify potentially effective control systems including work practices and to familiarize NIOSH researchers with the processes and potential exposures and health risks in secondary lead smelters (battery reclamation).

PLANT DESCRIPTION

Sanders Lead Company is a secondary lead smelter. Sanders Lead Company operates 365 days a year 24 hours a day. The facility is capable of recycling up to 40,000 batteries a day but is presently recycling 1,000 to 5,000 batteries a day. Spent batteries are purchased by Sanders Lead Company and brought to the recycling facility by commercial trucks.

Batteries recycled by the plant consist mainly of automobile batteries. Some industrial batteries also are reclaimed. Lead and plastic from spent batteries is reclaimed on site by Sanders Lead Company and K&W Plastics (plastic recycling facility located at this site). The reclaimed lead and plastics (polypropylene) are sold to industries that use the reclaimed material in manufacturing various products.

PROCESS DESCRIPTION

Trucks are backed up to the battery cutting building where they are unloaded. Batteries are removed from trucks by hand and placed on a roller conveyor which feeds the batteries to the battery cutter. The battery cutting operation is automated. Batteries are conveyed into a totally enclosed battery cutting booth where the tops are cut off. Electrolyte drains from the batteries into a metal trough which carries the electrolyte to tanks for neutralization. The cut batteries then proceed to a tumbler which separates the lead plates from the battery cases. Lead plates fall from the tumbler and are collected in battery decasing bins. The tops and empty battery cases are fed to a crusher for separation and classification. The tops and battery cases are separated into three groups: plastics, hard rubber, and lead bearing material by a flotation separator. If the plastic floats, it is recyclable, and it is sent to the plastic recycling area.[1] The rubber pieces are fed to the blast furnace.

Lead plates are sent to the production plant for recycling. Lead plates make up 70 to 90 percent of the raw materials used. The plates are sent to a blast furnace with a temperature of approximately 1400 to 1800 degrees fahrenheit to be melted down into elemental lead. The elemental lead is poured out of the blast furnace into pots. Slag is poured off the back of the blast furnace into slag collection pots. Elemental lead is then taken to a casting and alloy area were it is placed in one of the seven drossing and alloy pots which each have a capacity of 150 tons. The elemental lead is then drossed and alloyed in one of these pots. Dross material is scraped off the top of the drossing and alloy pots with a shovel and is placed in one of the dross collection drums located at each pot. Dross material collected in the drums is recycled back to the blast furnace to be melted down again. After the lead has been drossed and alloyed it is poured into ingots, pigs, or sows and taken to a storage area where it is loaded into trucks by forklifts.

POTENTIAL HAZARDS

Workers in this secondary lead smelter are potentially exposed to lead and arsenic.

Lead

Lead adversely affects a number of organs and systems. The four major target organs and systems are the central nervous system, the peripheral nervous system, kidney, and hematopoietic (blood-forming) system.[2] Inhalation or ingestion of inorganic lead can cause a range of symptoms and signs including loss of appetite, metallic taste in the mouth, constipation, nausea, colic, pallor, a blue line on the gums, malaise, weakness, insomnia, headache, irritability, muscle and joint pains, fine tremors, and encephalopathy. Lead exposure can result in a weakness in the muscles known as "wrist drop," anemia (due to shorter red blood cell life and interference with the heme synthesis), proximal kidney tubule damage, and chronic kidney disease.[3-4] Lead exposure is associated with fetal damage in pregnant women.[2-4] Finally, elevated blood pressure has been positively related to blood lead levels.[5-6]

The current occupational exposure criteria for inorganic lead in air is the OSHA permissible exposure limit (PEL) 50 $\mu g/m^3$ and the NIOSH Recommended Exposure Limit (REL) of <100 $\mu g/m^3$; the OSHA action level is 30 $\mu g/m^3$. In addition, workers with blood lead concentrations higher than 60 micrograms per deciliter ($\mu g/dl$) of whole blood must be immediately removed from the work environment.[7-8] The National Health Promotion and Disease Prevention Objectives specifies a target level of 25 $\mu g/dl$ for the year 2000.[9]

Inorganic Arsenic

Inorganic arsenic is strongly implicated in respiratory tract and skin cancer and has been determined to be a potential occupational carcinogen by NIOSH.[10-11] Inorganic arsenic has caused peripheral nerve inflammation (neuritis) and degeneration (neuropathy), anemia, reduced peripheral circulation, and increased mortality due to cardiovascular failure in workers who have been exposed to inorganic arsenic through inhalation, ingestion, or dermal exposure.[4]

The current occupational exposure criteria for inorganic arsenic is the NIOSH REL of 2 $\mu g/m^3$ ceiling and the OSHA PEL of 10 $\mu g/m^3$.[8,12]

CONTROL TECHNOLOGY

PRINCIPLES OF CONTROL

Occupational exposures can be controlled by the application of a number of well-known principles including engineering measures, work practices, and personal protection. Engineering measures are the preferred and most effective means of control. These include material substitution, process and equipment modification, isolation and automation, and local and general ventilation. Control measures also may include good work practices and personal hygiene, housekeeping, administrative controls, and use of personal protective equipment such as respirators, gloves, goggles, and aprons.

ENGINEERING CONTROLS

Sanders Lead Company employs local exhaust ventilation, partial enclosures, and enclosed ventilation systems in the battery cutting area, blast furnace operations, and casting and alloy area. In addition, HEPA-filtered half-mask respirators are worn in production areas of the plant.

The battery cutting operation is an automated system and performed in a totally enclosed ventilated booth. There are 6 separate battery cutting booths presently at Sanders Lead Company. At the time of the walk-through survey, the company was only operating four of the battery cutting units. The blast furnace has a partially enclosed hood on the metal pouring operation where elemental lead is poured into pots. The slag from the blast furnace is captured in a pot located in an enclosed ventilated booth. During furnace operations flue dust is captured by a vacuum fan system that operates at an air volume of approximately 12,000 cfm on each furnace. The captured flue dust is collected in a bag house. In the casting and alloy area, canopy hoods cover the top of each of the drossing and alloy pots. Dross is scraped off the top of the pots with a shovel and placed in a drum (located at the pot) that is enclosed in a ventilated booth. After the lead has been drossed and alloyed, it is poured into ingots, pigs, or sows. Pouring operations have ventilated hoods located over the flow areas.

RESPIRATOR PROTECTION PROGRAM

A respirator protection program, that has been set up according to the Occupational Safety and Health Administration's (OSHA) lead standard, is in place at the facility.[7] This program was set up to reduce employee exposure to lead to below the mandated PEL.

The following guidelines for respirator protection requirements are outlined in the plant's General Health and Safety Program (section III).[13] Employees in the plant that are exposed to air lead levels less than 500 $\mu g/m^3$ are required to wear half-mask air-purifying respirators with HEPA filters. Employees exposed to air lead levels greater than 500 $\mu g/dl$ and less than 2500 $\mu g/m^3$ are required to wear full-face air-purifying respirators with HEPA filters. Employees exposed to levels greater than 2500 $\mu g/m^3$ and less than 50,000 $\mu g/m^3$ must wear a powered air-purifying respirator with HEPA filters or a supplied air half-mask respirator operated in the positive pressure mode. Employees exposed to greater than 50,000 $\mu g/m^3$ but less than 100,000 $\mu g/m^3$ must wear supplied air respirators (equipped with full facepiece, hood, helmet or suit) operated in a positive pressure mode. Employees with exposures greater than 100,000 $\mu g/m^3$ or unknown concentrations or during fire fighting must wear a full facepiece Self Contained Breathing Apparatus (SCBA) operated in positive pressure mode.

All new employees that have the potential to be exposed to lead receive a qualitative fit test. Quantitative fit testing is performed on all employees that wear negative pressure air purifying respirators. A TSI Portacount (TSI, St. Paul, MN) instrument is used to quantitatively fit test employees. An initial fit test is performed for all employees and each employee receives a semi-annual test thereafter.[13] Employees required to wear respirators receive respirator protection training. Respirator protection training elements are outlined in the companies General Health and Safety Program.[13]

WORK PRACTICES AND HYGIENE

Ingots, pigs, and sows are taken to a storage area where they are eventually loaded on a truck for shipment. Forklifts are used to load the trucks. At the time of the survey there was a considerable amount of dust on the floor of the storage area. The floor of this area is cleaned with a dry sweeper to avoid the slipping hazard of a wet floor.

Sanders Lead Company has strict policies on personal hygiene. When employees arrive at work they enter the clean area of the locker room where they are supplied clean coveralls and a clean respirator for the day. After the work shift, employees enter the dirty side of the locker room where they remove the dirty coveralls and respirator. Coveralls are laundered on site everyday so that clean ones are provided for each shift. Respirators are also cleaned after each shift. Mandatory showers are taken by each employee before entering the clean side of the locker room. No eating or smoking is permitted in the work areas. Employees must roll their sleeves up above the elbow and wash their hands and face thoroughly before entering the break room.

At the plant, a program for monitoring workers with elevated blood lead levels is in place. Before receiving pay checks employees must sign a form stating that they have seen their blood lead results for the period indicated on the form. If an employee has a blood lead at 30 μg/dl it is a warning signal for the plant. If the blood lead level reaches 40 μg/dl the employee is given a red hard hat and moved to another area of the plant where lead exposures are lower. Red hard hats signify employees with elevated blood lead levels throughout the plant. Employees with red hard hats are monitored and corrected if their work practices or hygiene are not at an acceptable level. If an employee has a blood lead level of 50 μg/dl or higher they are removed until the level is reduced to acceptable limits.

In an effort to reduce blood lead levels and promote good personal hygiene and work practices among employees, Sanders Lead Company is starting an incentive program in 1993. Employees that have blood lead levels below 30 μg/dl will receive bonus pay.

AIR MONITORING

The company has implemented their own air monitoring program that consists of personal air sampling conducted in production areas of the plant. An independent consultant is used once a year to oversee the sampling activities. Company records show that personal air lead levels (in the first quarter of 1993) ranged from 33 to 453 $\mu g/m^3$ for employees working in production areas of the plant including maintenance employees.

Medical Monitoring

Evaluation of company blood lead level (BLL) data indicate employee blood lead levels (measured 7/92 to 12/92) were highest among workers in **welding** operations (mean = 34.7 μg/dl); s.d.= 10.4) followed by **furnace** operations (mean = 33.1 μg/dl; s.d = 11.3), **sawing** operations (mean = 29.7 μg/dl; s.d. = 11.7), **cleanup** operations (mean = 29.3 μg/dl; s.d. = 11.5), **alloy** operations (mean = 28.1 μg/dl; s.d. 9.3), **shipping** operations (mean = 25.8 μg/dl s.d. = 8.6), and **break room** operations (mean = 14.8 μg/dl; s.d. = 6.3). Figure 1 shows average worker BLLs and standard deviations by job category.

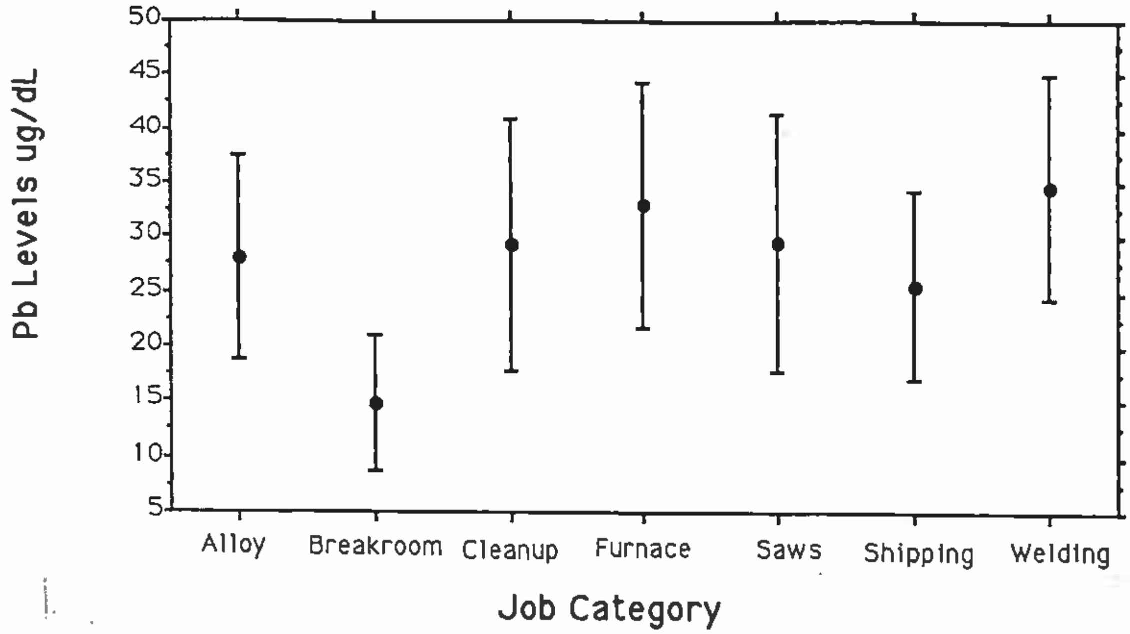

Figure 1. Average Blood Pb Levels and Standard Deviations by Job Category (7/92-12/92).

Of the three hundred and twenty-seven employees for whom BLL data were available for this time period, 73 (22 percent) had Blls <= 24 μg/Dl, 44 (13 percent) ranged from 25 to 39, 136 (42 percent) ranged from 40 to 49, 66 (20 percent) ranged from 50 to 59, and 8 (2 percent) were ≥ 60 μg/Dl.

The distribution of BLLs across job categories is summarized in Table I. Of the seven departments studied, furnace workers had the highest percentage of increasing BLLs (increases were noted where there were three or more measurements per worker) (34 percent), followed by cleanup workers (20 percent), welders (19 percent), and alloy and sawing operators (17 percent). Break room and shipping area workers had the lowest percentage of workers with increasing BLLs (15 percent and 13 percent, respectively).

The highest percentage of decreasing BLLs for the time period was observed among cleanup workers, followed by saw operating workers, and welders. Fluctuating BLLs (defined as three or more measurements per worker increasing and decreasing over time) ranged from a high of 23 percent in welders, to a low of 6 percent among alloy area workers. For each job category many of the workers had only one measurement, these percentages are also noted by job category in Table I.

Table I. Distribution of Worker Blood Lead Levels by Job Category.					
	No. of Workers (%)				
Department	<=24(μg/Dl)	25-39	40-49	50-59	>=60
Alloy	14 (29)	13 (27)	17 (35)	3 (6)	1 (2)
Breakroom	12 (92)	1 (8)			
Cleanup	15 (31)	5 (10)	21 (43)	8 (16)	
Furnace	13 (14)	11 (12)	48 (51)	19 (20)	
Sawing	17 (29)	6 (10)	23 (39)	12 (20)	4 (4)
Shipping	3 (38)	2 (25)	3 (38)		1 (2)
Welding	13 (19)	6 (9)	24 (35)	24 (35)	2 (3)
Totals	73	44	136	66	8

PERSONAL PROTECTIVE EQUIPMENT

Half-mask respirators (with HEPA filters) and coveralls are worn by employees in all production areas of the plant. In addition, hearing protection, hard hats, safety shoes, and safety glasses are worn by employees in production areas. Rubber aprons, gloves, and face shields are worn during battery handling activities. Face shields and gloves are also worn during blast furnace operations and casting and alloy pot operations.

CONCLUSIONS AND RECOMMENDATIONS

Workers throughout the production areas of the plant are potentially exposed to lead. Sanders Lead Company employs local exhaust ventilation, enclosed ventilated booths, and partial enclosures through-out production areas of the plant. Various occupational and safety programs are in place at the plant including occupational and safety training, respirator protection program, various hygiene programs, and blood lead monitoring programs. Despite all these programs some workers' blood lead levels are elevated. Since engineering controls in the plant have recently been improved and appeared to control visible dust and fume, it suggests that housekeeping and hygiene programs may need further evaluation in order to reduce workers' blood lead levels.

Although company health and safety policy indicates BLLs are drawn on workers with elevated BLLs (a single level of ≥60 μg/Dl or three measurements ≥ 50 μg/Dl averaged over a 6 month period) the data does not always reflect bi-monthly measurements for workers whose BLL is ≥ 40 μg/Dl. Workers in welding and furnace operations appear to have the highest six month BLLs. Targeting these areas with additional education and training may be useful in reducing BLLs. This facility would be a suitable site for an in-depth evaluation because of the engineering controls, training programs, and occupational programs in place.

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The following are keywords for inclusion in DIDS:

Company Name: Sanders Lead Company

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Materials Sampled For:

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