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KLOTZ BROTHERS, INCORPORATED
STAUNTON, VIRGINIA

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I. SUMMARY

On September 4, 1987, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Agency for Toxic Substances and Disease Registry (ATSDR) to investigate employees' exposure to lead from contaminated soil at Klotz Brothers, Inc. in Staunton, Virginia. Twelve soil samples collected and analyzed by the Virginia Department of Waste Management revealed lead levels as high as 39,000 parts per million (3.9%).

NIOSH investigators conducted a site visit on September 29, 1987. At that time an environmental survey was performed, a health questionnaire was administered, and blood samples were collected for assessment of lead exposure.

Personal exposures to airborne lead were below the limit of detection of 2.0 micrograms per cubic meter of air (ug/m^3) among three employees. Likewise, six area samples were also below 2.0 ug/m^3. One area sample collected in the company courtyard did detect 2.3 ug/m^3 of lead. The Occupational Safety and Health Administration lead standard is 50 ug/m^3 as an 8-hour time-weighted average. Other less toxic metals were detected on the samples but at low concentrations. Five surface wipe samples contained detectable levels of lead.

All six workers denied any symptoms of chronic lead overexposure. Blood lead levels ranged from 4 to 33 micrograms per deciliter of blood (ug/dl) and zinc protoporphyrin (ZPP) levels ranged from 15 to 78 ug/dl. The worker with the blood lead of 33 ug/dl and a ZPP of 78 ug/dl suggests unusual (probably occupational) exposure to lead, although the blood level was within OSHA's limit for occupational exposure. The other workers had blood lead levels equal to or less than 15 ug/dl and ZPP levels less than 40 ug/dl. Lead and zinc protoporphyrin levels were within population background ranges for five of the six employees tested.

Based on these results, the investigators have concluded that at the time of this study the employees were not exposed to high concentrations of lead. However, there is a potential for exposure to lead from the contaminated soil in the courtyard and lead containing dust within the warehouse and office. Recommendations are included in Section VIII to reduce the risk of personal exposures to lead.

KEYWORDS: SIC 5093, lead, scrap metal, junk yard, battery, soil

II. INTRODUCTION

On September 4, 1987, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Agency for Toxic Substances and Disease Registry (ATSDR) for a health hazard evaluation of workers at Klotz Brothers, Inc. in Staunton, Virginia. The request concerned a possible health hazard to employees from exposure to lead from contaminated soil.

NIOSH conducted a site visit on September 29, 1987. At that time an environmental survey was performed, a health questionnaire was administered, and blood samples were collected for assessment of lead exposure. In October, 1987, a letter was sent to each participant in the study to notify them of their blood test results.

III. BACKGROUND

Klotz Brothers, Inc. has been in the scrap metal and hide tanning business since 1899. Scrap metal is repackaged for resale, and hides of cattle are covered with salt and stored for resale to tanning companies. The facility is located in the center of Staunton and occupies 18,250 square feet (Figure 1). The structures on this site consist of a three story brick office-warehouse, and a covered warehouse. The buildings, along with a brick wall and a wooden fence, enclose a courtyard. Adjacent to the office-warehouse, inside the courtyard, is a concrete floor and drive-on scale. Customers sell scrap metal to the company by driving into the courtyard and weighing their vehicle on the scales before unloading the metal at the warehouse dock. The vehicle is then re-weighed and the customer enters the office to receive payment.

According to the manager, acid from scrap batteries had been drained onto the property until approximately 1977. No collection system was utilized for retrieving the battery acids that were poured directly onto the courtyard ground.

The Bureau of Hazardous Waste Management, Commonwealth of Virginia, investigated the site on June 19, 1986. During the inspection, barrels filled with broken battery parts were observed in the storage building and unbroken batteries were seen in the courtyard. Two holes had been broken through a concrete floor of a storage building which overlies a creek that flows through a conduit underneath the property.

In response to the State Water Control Board's request, the company limed the courtyard to neutralize the acidic soil in order to slow the leaching of toxic metals into the ground. The company also plugged the holes in the floor of the storage building above the stream.

On April 21, 1987, the Virginia Department of Waste Management collected twelve soil samples in the courtyard for organic and inorganic contamination. The analysis of the soil samples revealed lead levels ranging from 101 parts per million (ppm) to 39,600 ppm (3.9%). The U.S. Environmental Protection Agency classifies soils which contain lead levels of 1000 ppm or greater as hazardous waste. Because of the high levels of lead in the courtyard soil, there is a potential health hazard to the public and the employees.

In response to the concerns of worker exposure to lead-containing dust, the Virginia Department of Occupational Safety monitored the employees for airborne lead exposure on August 28, 1987. All samples were below 2 micrograms per cubic meter of air (ug/m^3) as an 8-hour time-weighted average (TWA), except for two area samples collected in the courtyard which contained 8.1 and 19.6 ug/m^3. The OSHA standard for lead in air is presently 50 ug/m^3.

The company staff consists of three office employees, one yard-warehouse worker, two full-time truck drivers, and one part-time driver. The yard-warehouse worker handles the scrap metal by weighing and separating the various metals for shipment to the smelting firms. This person has the greatest potential for being exposed to lead dusts. The drivers spend very little time at the company site. Most of their time is

spent driving to a scrap pickup point and transporting the scrap directly to the smelting companies or other junkyards.

IV. EVALUATION DESIGN AND METHODS

NIOSH investigators visited Klotz Brothers, Inc. on September 29, 1987 to evaluate environmental exposures to lead and other elements, and to assess health effects of possible exposure to lead. The weather at the time of testing was warm (70° to 80° Fahrenheit) and slightly breezy.

A. Environmental

Three personal breathing-zone air samples for lead and other elements were collected on 0.8-um cellulose ester membrane filters, using vacuum pumps operated at a flow rate of 2.0 liters per minute for approximately 8 hours. The participants were the yard-warehouse worker and two office workers. Samples were analyzed by inductively coupled argon plasma atomic emission spectroscopy according to NIOSH Method 7300 (1). The analysis was performed for the following elements at limits of detection ranging from 1 to 10 microgram per sample.

Aluminum	Iron	Thallium
Antimony	Lanthanum	Titanium
Boron	Lead	Vanadium
Barium	Magnesium	Yttrium
Beryllium	Manganese	Zinc
Calcium	Molybdenum	Zirconium
Cadmium	Nickel	
Cobalt	Silver	
Chromium	Tin	
Copper	Tellurium	

Six area samples were also collected in the office, warehouse, courtyard, and in the trucks. Five surface wipe samples were collected in the office, warehouse, and from objects in the courtyard. Wipe samples were collected on cellulose ester membrane filters for qualitative analysis and analyzed according to NIOSH Method No. 7300 (1). Since the Virginia Department of Waste Management had collected and analyzed twelve soil samples from the property, no further soil samples were collected by the NIOSH investigators.

B. Medical

The medical portion of the evaluation consisted of conducting private interviews with six full-time company employees. Blood samples were then drawn for determination of lead and zinc protoporphyrin (ZPP) levels. The methods used to analyze these specimens were anode strip voltametry for lead blood levels and spectrofluorometry for ZPP serum levels.

V. EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available. The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial

Hygienists' (ACGIH) Thershold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLVs usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8- to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

A. Toxicological

Inhalation (breathing) of lead dust and fume is the major route of lead exposure in industry. A secondary source of exposure may be from ingestion (swallowing) of lead dust deposited on food, cigarettes, or other objects. Once absorbed, lead is excreted from the body very slowly. Absorbed lead can damage the kidneys, peripheral and central nervous systems, and blood forming organs (bone marrow). These effects may be felt as weakness, tiredness, irritability, digestive disturbances, high blood pressure, kidney damage, mental deficiency, or slowed reaction times. Chronic lead exposure is associated with infertility and with fetal damage in pregnant women. There is some evidence that lead can also impair fertility in occupationally exposed men (2).

The blood lead test is one measure of the amount of lead in the body and is the best available measure of recent lead absorption. Adults not exposed to lead at work usually have a blood lead concentration less than 30 ug/dl; the average is less than 15 ug/dl (3,4). In 1985, the Centers for Disease Control (CDC) recommended 25 ug/dl as the highest acceptable blood level for young children (5). Since the blood lead concentration of a fetus is similar to that of its mother, and since the fetus's brain is presumed to be at least as sensitive to the effect of lead as a child's, the CDC advised that a pregnant woman's blood be below 25 ug/dl (5). Recent evidence suggests that the fetus may be adversely affected at blood lead concentrations well below 25 ug/dl (6). Futhermore, there is evidence to suggest that levels as low as 10.4 ug/dl affect the performance of children on educational attainment tests, and that there is a dose-response relationship with no evidence of threshold or safe level (7). Lead levels between 40-60 ug/dl in lead-exposed workers indicate excessive absorption of lead and may result in some adverse health effects. Levels of 60-100 ug/dl represent unacceptable elevations which may cause serious adverse health effects. Levels over 100 ug/dl are considered dangerous and often require hospitalization and medical treatment.

Zinc protoporphyrin (ZPP) levels measure the effect of lead on heme synthetase, the last enzyme in heme synthesis. ZPP levels increase abruptly when blood lead levels reach about 40 ug/dl, and they to tend to stay elevated for several months. A normal ZPP level is less than 50 ug/dl (8).

B. Occupational Exposure Criteria

OSHA PEL for lead in air is 50 ug/m^3 calculated as an 8-hour TWA for daily exposure (9). In addition, the lead standard establishes an "action level" of 30 ug/m^3 TWA which initiates several requirements of the standard, including periodic exposure monitoring, medical surveillance, and training and education. For example, if an employer's initial determination shows that any employee may be exposed to over 30 ug/m^3, air monitoring must be performed every six months until the results show two consecutive levels of less than 30 ug/m^3 (measured at least seven days apart). The standard also dictates that workers with blood lead levels greater than 50 ug/dl must be immediately removed from further lead exposure. The affected employee must be removed from further lead exposure until the blood lead concentration is at or below 40 ug/dl. Removed workers have protection for wage, benefits, and seniority for up to 18 months until their blood levels decline to below 50 ug/dl and they can return to lead exposure areas.

VI. RESULTS AND DISCUSSION

A. Environmental

A summary of the airborne sampling results for 26 elements are presented in Table 1. Airborne lead concentrations for the three personal samples and six area samples were below the limit of detection of 2.0 ug/m^3. One area sample collected in the courtyard adjacent to the wooden fence did detect 2.3 ug/m^3 of lead. Five other metals were also detected on the samples but at low concentrations.
Surface wipe samples were collected from the office floor, a table in the warehouse, on top of the soft drink machine in the warehouse, on a tire in the courtyard, and on a wooden pallet in the courtyard. Some of these samples contained aluminum, barium, copper, iron, magnesium, manganese, nickel, lead, tin, and/or zinc. All five of the wipe samples contained detectable lead.

B. Medical

There were four male and two female employees, ages 24-65 (mean=40) years. Their work experience ranged from 3 months to 24 (mean=14.2) years. All workers denied any symptoms suggestive of chronic lead toxicity. There were no adverse reproductive health effects reported by the workers. One person, who did not participate in the evaluation, stated that his blood lead level was determined by his private physician prior to our visit and was reportedly normal.

Blood lead levels ranged from 4 to 33 ug/dl, and ZPP levels from 15 to 78 ug/dl. One worker had a blood lead of 33 ug/dl and a ZPP of 78 ug/dl. No other worker had a blood lead level greater than 15 ug/dl or a ZPP level greater than 40 ug/dl. Lead and zinc protoporphyrin levels were thus within population background ranges for five of the six employees tested. One worker had blood lead and ZPP levels suggestive of unusual (probably occupational) exposure to lead, although the blood lead level was within OSHA's limit for occupational exposure. This worker was advised to take precautions to reduce potential exposure to lead by eating and smoking only in clean, dust-free areas, thereby reducing exposure to lead from the workplace.

VII. CONCLUSIONS

The results of both the environmental sampling and biological monitoring of the workers indicates that unacceptable occupational exposures to lead did not occur at the time of this study. On the day of the environmental sampling, employees were not exposed to airborne lead. However, according to the Virginia Department of Waste Management, lead and other toxic metals are present in the courtyard soil. Likewise, the dust within the warehouse and office is contaminated with lead. This dust can become airborne when truck traffic in the courtyard is increased. The employees and the public can be directly exposed to this airborne lead-containing dust by inhalation or they may contaminate their vehicles, equipment, clothing, or personal items from contact with contaminated surfaces in the building.

VIII. RECOMMENDATIONS

Implementation of the following recommendations to reduce exposure of workers to lead-contaminated dust should sufficiently decrease the risk of lead exposure to obviate the need for a medical surveillance program.

1. The contaminated soil in the courtyard should be removed to a hazardous waste site or contained on site according to the specifications of the U.S. Environmental Protection Agency and the Virginia Department of Waste Management. These agencies should be consulted on the procedures to follow.

2. Pending implementation of the above recommendation, a short-term solution to reduce airborne lead is to cover the courtyard soil with at least an inch of gravel to prevent traffic from generating contaminated dust.

3. Surfaces in the warehouse and office should be cleaned by HEPA vacuuming or wet moping. [HEPA or "high-efficiency particulate air filter" means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers in diameter or larger.]

4. Employees should be discouraged from eating or drinking in the warehouse or the courtyard. Employees coming from those areas should wash their hands before eating, drinking, or smoking.

5. The soft drink machine should be moved from the warehouse to the office to discourage the tracking of lead containing dust into the office.

IX. REFERENCES

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. Agency for Toxic Substances and Disease Registry

2. Commonwealth of Virginia, Department of Labor

3. NIOSH, Atlanta, Georgia

4. OSHA, Region III

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1

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Klotz Brothers, Incorporated
Staunton, Virginia

September 1987

Airborne Concentrations of Detectable Metals

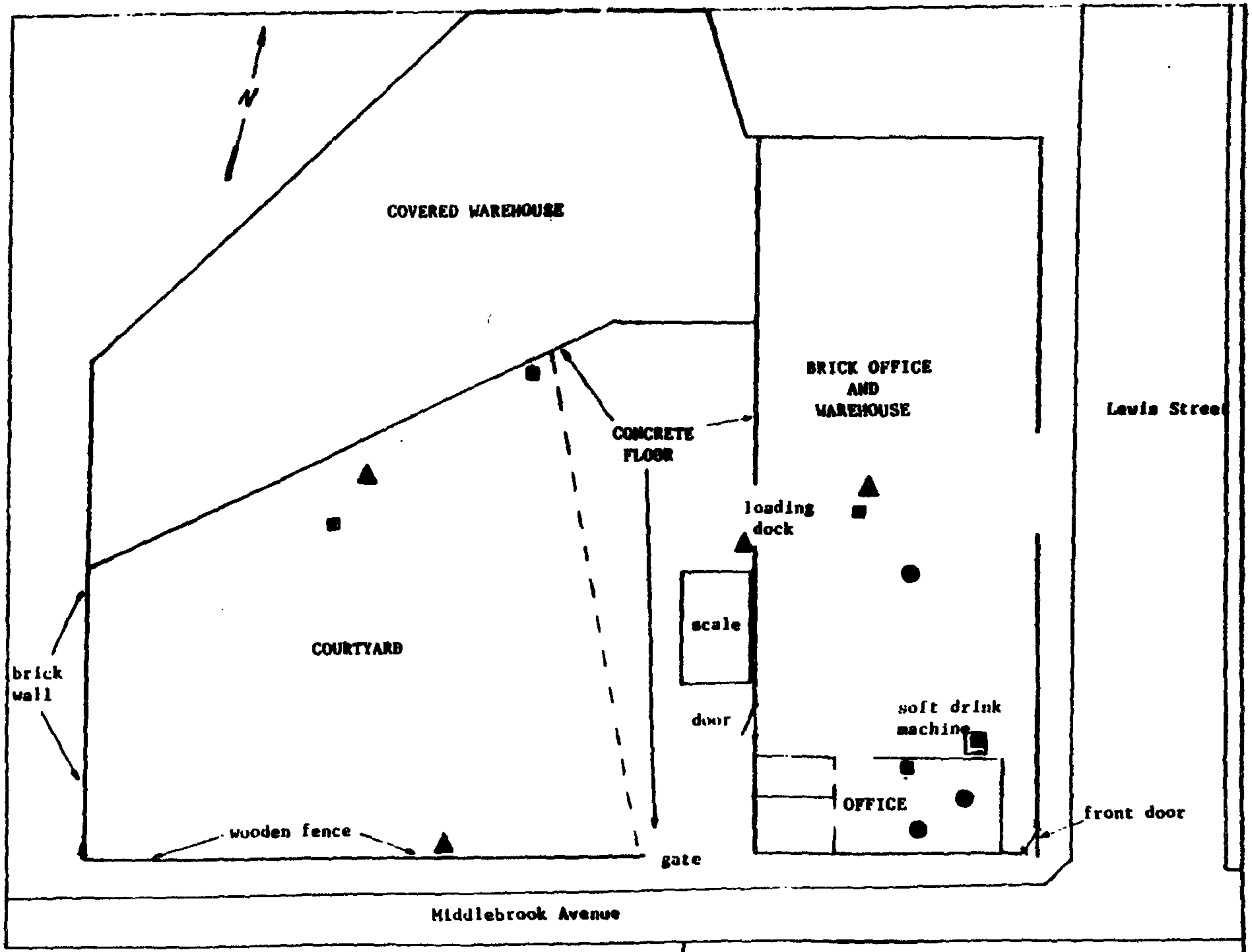
Job Title or Location	ug/m^3	Elements*
Office Worker 1	2.3	Iron
Office Worker 2	12.1	Iron
	3.3	Magnesium
	11.0	Titanium
	6.6	Zinc
Yard-Warehouse Worker	8.6	Copper **
	6.5	Iron
	1.2	Magnesium
	2.1	Zinc
Area - Truck 1	3.0	Iron
	0.8	Magnesium
Area - Truck 2	3.6	Iron
Area - Center of the Warehouse	1.5	Iron
Area - Courtyard-Loading Dock	2.3	Iron
Area - Courtyard-Storage Shed	3.0	Iron
	0.7	Magnesium
Area - Courtyard-Wooden Fence	3.1	Iron
	0.8	Magnesium
	2.3	Lead ***

Limit of Detection ranged from 1.0 to 10 ug/sample.

* = All other elements had concentrations below the limit of detection.

** = The ACGIH TLV for copper is 1,000 ug/m^3 as a 8-hour TWA.

*** = The ACGIH TLV for lead is 150 ug/m^3 as a 8-hour TWA.



● = personal sample

▲ = area sample

■ = surface wipe sample

FIGURE 1

Sampling Location Map HETA 87-410
Klotz Brothers, Inc. Staunton, Virginia

scale: 1"=20' drawn by: DWM & NIOSH