A Lead Program For XYZ Company

by

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ABSTRACT

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Lead is an element that has been used for over two thousand years. It was accepted for use because of its pliability, low melting point, and durability as an anti-corrosive (Ashley et al., 1997). Ingestion and/or inhalation of lead can have very serious health consequences. Chronic lead poisoning can cause a variety of health problems. Children and fetuses are more susceptible to lead poisoning because of the great absorption rate of their growing bodies (Gross, 1974). Most of the lead in our environment (ground contamination) has come from the leaded gasoline used in our cars (Rowchowdhury, 1998). Kaufman, Burt, and Silverstein (1994) stated that most occupational exposures to lead occur when lead painted homes and other structures need to be repaired, remodeled or demolished. Removal of structural surfaces painted with

lead based products cause lead to become air-born. Certain controls are needed to ensure employee protection as well as not contaminating the homes and automobiles from occupational exposure to lead.

The purpose of this study is to educate company XYZ on the effects of disturbing lead by creating a lead abatement program for them. This study will demonstrate the various ways that lead can become a hazard. It will also show the various options on how lead exposure can be minimized. The final aspect of this study will be to lay out a program for company XYZ to follow and achieve regulatory compliance with the governmental laws pertaining to occupational/construction lead exposure.

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Chapter I: Introduction

Many companies have difficulty understanding how to manage all of their safety issues. Smaller companies that do not employ a safety professional may not even be aware of a potential loss until it occurs. From strains and sprains to ergonomic and industrial hygiene, there are a plethora of issues to deal with when controlling potential loss.

The Code of Federal Regulations 29 Part 1926.20 (2002) states that requiring employees to work in conditions that are unsanitary or hazardous to their health and safety is illegal. In addition, employers must teach employees about recognizing and avoiding unsafe situations and any applicable regulations in order to reduce or remove any dangers or risks in the work environment. These are legal requirements by which contractors need to abide. However, not all contractors recognize all of the hazards or understand the seriousness associated with certain tasks. This research study will examine one hazardous work condition: disturbing lead painted structures.

Purpose

The focus of this research study will be to explore the effects of disturbing lead painted structures. It will emphasize the seriousness of occupational lead poisoning and the importance of minimizing/eliminating lead residue (take home lead) from work tasks. This study will clarify the legal requirements (Occupational Safety and Health Administration [OSHA] laws and program development) when performing this type of work. Goals of this study include the following: (1) to educate managers about the effects of working with lead painted products, (2) to educate the workers involved in disturbing lead paint of ways that can reduce the secondary ramifications of elevated blood lead levels at home, including instruction in good hygiene controls at work, (3) to provide a written lead program that contractors can use to achieve compliance with OSHA standards.

Background and Significance

Lead paint was used extensively throughout the 1970s and is especially prevalent on steel structures as a protective coating from rust accumulation (Bowker, 1996). According to Katauskus (1990), there are an estimated 90,000 bridges in the United States coated with paints containing lead. Lead compounds are used for rust prevention and red lead paint is still used as a primer on structural steel (Frumkin, Gerr, & Castaneda, 1992). The greatest exposure to lead comes when the paint is disturbed. Disturbance can occur by sand blasting, cutting, or grinding. Demolition of such structures by the use of oxyacetylene torches has resulted in many documented cases of lead poisoning.

Lead poisoning is an occupational risk for workers who repair, replace, and dismantle lead painted bridges/structures. In adults, lead usually enters the body through inhalation and ingestion (Roychowdhurdy, 1998). Gordon, Taylor, and Bennett (2002) found that lead usually enters through the respiratory tract in adults. They also state that 30-70% of inhaled lead gets into the circulatory system and particle size is the most important factor in absorption (smaller particle size equals a greater rate of absorption.). Gastrointestinal ingestion accounts for approximately 10% of the absorption factor. Whether through the lungs or the gastrointestinal tract, lead is taken up by the blood and moves into the organs and tissues.

According to Robinson (1989), minority groups are at higher risk for occupational lead exposure because they often lack training and do not have access to proper protective equipment. The contractor involved in this study is a minority contractor whose crews are almost all Hispanic.

According to the Code of Federal Regulations (2002), monitoring, or taking an initial assessment, is necessary to know what level of potential lead exposure is present. Currently the OSHA action level is 30ug/m_3. This is the level at which a person can work without implementing a full-blown lead program.

From the National Institute of Occupational Safety & Health (NIOSH) Alert: April 1992, Publication No.91-116a: found that it is extremely difficult to stay below this action level while disturbing lead paint by sanding, grinding, or cutting with a torch. It is safe to say that any contractor working on demolition/refurbishment of these types of structures/bridges will have to deal with lead issues above the action level of 30ug/m_3. A lead program would be necessary to address this. Variations of its involvement depth will depend on exposure levels, amount of lead being disturbed, method of disturbance, etc.

Limitations

This study will address the general problem of potential for exposure to occupational lead. There will not be any interviews or specifics on what the contractor is or is not currently doing. Employee blood lead levels will not be checked. The costs associated with training, personal protective equipment, cleaning equipment, vacuums, shower/washing facilities, medical evaluations, on site monitoring, etc., will not be calculated.

Definitions

The following definitions are from the Code of Federal Regulations (2002).

Action Level: "Employee exposure, without regard to the use of respirators, to an airborne concentration of lead of 30 micrograms per cubic meter of air (30 *ug/m3)* calculated as a time-weighted average (TWA) over an eight hour work day" (p. 85).

Competent person: "One who is capable of identifying existing and predictable lead hazards in the surroundings or working conditions, and who has authorization to take prompt corrective measures to eliminate them" (p. 85).

Lead: "Metallic lead, all inorganic lead compounds and organic lead soaps. Excluded from this definition are all other lead compounds" (p. 85).

OSHA: "Occupational Safety and Health Administration, which was created by the Occupational Safety and Health Act of 1970. Construction lead standard passed in 1993" (p. 85).

Permissible Exposure Level: "Lead concentration level of < 50 ug/m3 per cubic meter of air averaged over an eight-hour period" (p. 85).

Chapter II: Literature Review

Lead is a naturally occurring element that has been mined for over two thousand years (Encyclopedia Britannica, 2000). It is valued because of its anti-corrosiveness, pliability, and its low melting point, as well as being durable and easy to work with (Ashley et al., 1997). Lead is also a very toxic substance. Physicians Hippocrates and Nikander recognized occupational lead exposure more than two thousand years ago (Schwartz, 2001). These two practitioners were the first to recognize the symptoms of anemia, colic, neuropathy, sterility, and coma in workers as indicative of exposure to lead (Stauding & Roth, 1998). While lead was known to be hazardous, the health and welfare of the Grecian workers was not considered important because most of these workers were slaves (Encyclopedia Britannica, 2000).

The Encyclopedia Britannica (2000) states that in 1700 Dr. Bernardino Ramazzini, who is considered to be the father of occupational medicine, identified 54 different occupational diseases. He believed that in order to know what was making a person ill, you needed to know his or her occupation.

Lead products have been used for hundreds of years, but during the 1900's the use of lead based products increased dramatically with the industrial revolution (Ashley et al., 1997). Lead was used for plumbing solders, food cans (soldered seams), in batteries and gasoline for automobiles, and was added to the paint used in homes, businesses and other structures/bridges.

Lead particles from smelters, autos, and dumpsites began polluting our surroundings. According to Roychowdhury (1998), lead dusts were in the air, collecting on the ground, and settling wherever water runoff deposited it. Lead in the soil began contaminating our food (Millstone, 1997). Small children playing in the dirt were ingesting it as well.

By the 1980's automobiles accounted for 90% of the lead released into our atmosphere (Roychowdhury, 1998). Humans were exposed to lead from air, food, beverages (lead soldered cans), water, soil, and dust. The blood lead level (bll) was the highest it had ever been (Rose, 1999). The geometric mean of 13.1 micrograms per deciliter (ug/dl) was three points higher than the Center for Disease Control and Prevention (CDC) had set as a level for concern (Ashley et al., 1997). The human skeleton lead levels were one thousand times higher than levels experienced by the ancient Indians who lived one thousand years prior to industrialization (Cohen, 1982).

Lead poisoning had been considered an occupational hazard for many years, but in the 1900's lead was affecting even those outside the work environment. Children and infants were impacted the most. In 1980, 88.2% of children tested between the ages of one and five had lead levels above 10 kg/dl (Rabinowitz, Kopple, & Wetherill, 1991). Hearing deficiency, vitamin metabolism, and deficits in growth have all been linked to low levels of lead in the blood. Children with blood lead levels as low as 10 to 15 kg/dl display decreased intelligence and slowed neurological development.

Exposure to lead can create a wide variety of problems. Schwartz (2001) states that exposure to lead can cause behavioral effects such as irritability; physical effects like fatigue, headache, and reduced sex drive; and neurological effects such as intelligence loss. Lead interferes with the transport of oxygen in the red blood cells, and can cause renal and other organ failure. Chronic exposure to lead can result in hypertension and cardiovascular disease. NIOSH studies have indicated that lead is a known carcinogen in animals.

Lead was in the water, on/in the soil, and in the air. The adverse affect on children prompted a strong regulatory response. In 1991, the Department of Health and Human Services (DHHS) set a goal for complete elimination of childhood lead poisoning by the year 2011 (Rabinowitz et al., 1991). The Environmental Protection Agency (EPA) passed laws regarding emissions of lead. Laws were also passed to eliminate the use of lead soldering in food cans. The paint industry, which had already reduced lead additives, was forced to eliminate lead in residential paint. The automobile industry switched to autos that ran on unleaded gasoline. OSHA enacted the lead standard for general industry in the 1980's. The construction industry followed in the 90's.

Overexposure to lead was an occupational problem that was also poisoning children in the home. Lead, a product that had been used extensively, was being phased out of use in this country. Minimizing the use of lead was possible, but completely eliminating its effects is not possible. Lead is a natural element, so it does not decompose and disappear.

Health Issues Resulting From Lead Exposure

As previously indicated, lead affects fetuses, infants, and children the most. There are several reasons for this. First, the growing bodies of fetuses, infants, and children absorb lead at a greater rate than adult bodies (Gross, 1975). Second, lead is introduced into most infants and children through the process of ingestion. Because infants and children lack good hygiene skills and because they tend to put anything and everything into their mouths, like fingers, objects, dirt and sand, this results in a direct path for lead poisoning (Ziegler, 1978). Small children may also get lead poisoning by ingesting lead based paint chips from their homes. Studies have also shown that lead contaminated construction workers can bring high levels of lead dust home (Whelan, Piacitelli, Gerwel, & Schnoor, 1997). High blls in children can cause brain damage, nerve disorders, and appetite loss, as well as learning and behavioral problems (Rabinowitz, 1991).

It is noteworthy that 40% of all lead entering the body ends up in the bones and, even after bone growth and maturation, people retain approximately 33% of their childhood bone mass into adulthood (Rabinowitz et al., 1991). The half-life of lead in the cortical bone is 20 years or more (Bogden & Oleske, 1997).

Studies have shown that iron and calcium deficiencies can increase the absorption of lead (Bogden & Oleske, 1997). As noted by Han and colleagues (1999), losing weight, especially if done quickly, can result in lead toxicity in people who have been previously exposed to lead and have a high bone lead level. A decrease in food intake results in more lead being released into the body. This is a result of the body using its existing resources when food intake is reduced. One of the side effects of lead poisoning is decreased appetite which will, ironically, result in more body burden lead being released into the body organs. The bones are not only the final storage site for lead in the body, but a place from which lead can be reintroduced when the body is under stress.

In adults, the effects of lead are the same whether inhaled or ingested (Goyer, 1993). Lead interferes with cell function and various physiological processes. Acute toxicity does not happen very often, but the affects may be nausea, abdominal pain, tingling sensations and muscle weakness (Hammond, 1977). It is possible to have brain and/or kidney damage if exposure is severe enough. This can lead to convulsions, coma, and even death. Mild but chronic exposure can produce more subtle symptoms. Exposures of 30 to 50 ug/dl may cause fatigue or gradual behavior changes, as well as mild slowing of nerve conduction velocity which can lead to wrist or ankle drop (Bogden & Oleske, 1997). This could also involve the inability of the body to make hemoglobin.

One of the more noticeable signs of long term exposure to lead is kidney dysfunction (Rodriguez, 1997). This is generally very gradual and results in irreversible damage usually ending with complete kidney failure. It should be noted that in terms of toxicology, the exact cause of kidney failure is often difficult to determine because of the length of time involved with this type of disease. Recent studies have indicated a possible correlation between Parkinson's disease and Alzheimer's disease and lead in the body (Bogden & Oleske, 1997).

There are two tests that can be administered to ensure that the body is not being poisoned by lead. The first is a blood draw. This will provide evidence of any recent exposure to lead (Bennett, Bennett, Sokas, & Schwartz, 1998). The second test is called a zinc protoporphyrin check. This is an accurate indication of how much lead is in the bones, or what is referred to as the total body burden from long-term, chronic exposure.

Calcium in high quantities has been shown to reduce absorption and limit the toxicity of lead (Bogden & Oleske, 1997). Children ages one to eleven with relatively high calcium intakes had lower blood lead concentrations. Calcium can not prevent lead from entering the body, nor can it reverse any harmful effects of lead poisoning; increasing the amount of calcium ingested by the body decreases the amount of lead ending up in the bones. Having low levels of iron in the body can increase the rate at which lead is passed through the gastrointestinal system and not absorbed into the bones. Iron enhances the flow of oxygen in the red blood cells whereas lead interferes with the bonding of oxygen to red blood cells. By eating a well balanced diet people can reduce the harmful effects of lead.

Chelation therapy is a process used to remove lead from the body (Bogden & Oleske, 1997). Chelation therapy can be used when the bll is above 45 ug/dl. While there are several types of Chelation treatments, the most common is calcium disodium edetate ($CaNa_2$); (Grimsley & Adams, 1994). These agents bind themselves to the lead and prevent the lead from adhering to other cells. They are then extracted in the urine. This procedure can be hard on the kidneys and extracts other essential metals, such as zinc and copper. The side affects can be considerable, and include nephrotoxicity or kidney poisoning (Bogden & Oleske, 1997). After the initial Chelation therapy resulting in a bll drop, there may be a return or spike in the bll a few days later. This is called a rebound effect. The rebound effect is a result of the body drawing the lead from the bone and redistributing it back into the blood stream. It is important to monitor the bll's after Chelation therapy and respond with additional Chelation therapy.

Occupational Hazards

Ninety to ninety-five percent of adult lead exposures occur in the workplace (Rose, 1999). General industry exposures include smelting operations, battery manufacturing/recycling and radiator repair. Even those in law enforcement, when discharging their weapons, may be exposed to lead (Nelson & Kaufman, 1998). These types of occupations are covered under OSHA's lead standard for general industry. The construction industry, however, has been slower to devise a lead abatement plan in response to lead problems. In 1993 OSHA enacted the lead standard for the construction industry. This covered such occupations as remodeling/repair of lead painted structures, bridges, buildings and homes.

The state of Washington conducted a survey to identify the number of construction employees exposed to lead. They estimated that about 18,970 workers were exposed to lead (Nelson & Kaufman, 1998). Nationally, there is estimated to be over one million construction workers risking lead exposure annually (Bennett et al., 1998). There are approximately 90,000 bridges with lead paint on them (Katauskus, 1990). Studies show that lead dust, when brought home from occupational exposures, is carried on the seats and floors of cars, and on the clothing and skin of those exposed to lead (Whelan et al., 1997). Studies also indicate that those who are exposed to lead based activities, but do not work directly with lead, take fewer precautions and consequently have higher bll's. The OSHA laws have been in effect for 22 years in general industry and 11 years in the construction industry. The Washington study found only 45% of the employers surveyed were familiar with this lead standard (Whittaker, 2003). Over 75% of the employers who were aware of the lead standard did not do any air sampling or blood draws because they felt that the exposures were too infrequent and low to warrant any testing (Nelson & Kaufman, 1998). Those who did do testing did so out of obligation to fulfill their legal and governmental requirements.

The OSHA standards govern the amount of lead a person can be exposed to before certain protective procedures must be taken. The permissible exposure limit (PEL) of lead is set at 50-ug/m3 (Code of Federal Regulations, 2002). This is the maximum amount of lead particulate allowed in the air surrounding an employee over an eight-hour period. If exposure levels exceed the permissible exposure limit, employers must engineer ways to keep these levels down. If engineering methods are not effective, employers must provide the necessary means to ensure protection from lead. Any level exceeding 30-ug/m3 requires a company to have a comprehensive plan to keep employees aware and protect them from the effects of lead intoxication.

When properly followed, OSHA's guidelines for both general industry and construction play a critical role in protecting workers and the containment of lead at the work site (Kaufman et al., 1994). As required by the Worker Family Protection Act of 1992 (29U.S.C. 671a), NIOSH prepared a comprehensive report to Congress documenting incidents of para-occupational or "take-home" exposure to toxic substances, for the purpose of developing a strategy to reduce such exposures. There were 64 investigations of take-home lead exposures. In the majority of these studies, the employees' children had high blls. High levels of lead were on the employee's skin and clothing, as well as in their vehicles and homes. Due to the results of this study, protective clothing and hygiene facilities should be available for those employees who are frequently exposed to lead, even when the lead levels are below the permissible exposure level.

Education is an important element to preventing employee lead exposure. This is especially true in the construction industry where the lead standard has not been around for very long. Construction sites seldom offer appropriate washing facilities and employees are constantly dealing with changing weather and site conditions, which can affect exposure levels. It is important to note that this lead hazard/awareness training is the responsibility of the employer. It is also important to note that medical facilities are required to report any elevated blood lead levels to the state. The bll reporting levels vary from state to state, however. This will trigger further investigation by government officials like OSHA.

Prevention Measures

It is estimated that 64 million housing units in the United States still contain lead based paint and are in need of repainting or remodeling (Ashley et al., 1997). Approximately 3,700 bridges containing lead based paint are being repainted or removed each year, and there are over 13,000 painting jobs involving lead based paint on water tanks, storage tanks, fuel tanks, and industrial steel structures.

The most common method for preparing these structures for refurbishment is abrasive blasting (Ashley et al., 1997). In addition to the hazards created by sand blasting, EPA regulations are requiring containment of the spent lead, which has been shown to increase lead exposure to the employees. Lead exposures during dry, abrasive blasting have been reported as high as 600 times the OSHA PEL.

The most popular method for removing/demolishing a bridge is by using the cutting torch (Roychowdhury, 1998). NIOSH HETA #99-0113-2853 states that open flame/torch cutting has a high lead level of area air and dust settling lead but relatively low personal exposure levels. These areas of high lead dust levels range from six to twenty feet. NIOSH attributes this low level of personal exposure to the distance from "flame to face" with the long handled torch head. With over one million construction workers working with lead and the majority involved in the disturbing of lead based paints, all methods of reducing exposures should be analyzed.

There are several alternatives to the high lead exposure caused by abrasive blasting (Ashley et al., 1997). One of these is called over-coating. This is a method of applying a primer over the lead-based paint and then adding a top coat(s), thus sealing in the lead based paint. This method allows no lead exposure due to blasting and no environmental waste. However, a major disadvantage of this method is when the structure is removed at some point in the future, the lead will still be there and will have to be disturbed.

Another alternative is chemical stripping (Ashley et al., 1997). In this process a chemical is applied and then the existing paint is scraped off. The surface is then washed and blasted before repainting. The main disadvantage of this method is the addition of another chemical to which employees are exposed. Besides the collection of that chemical, the disposal of lead base paint in the water solution from the surface and the final cleaning with abrasive blasting can produce significant quantities of air-born lead. Despite the obvious hazards of this type of procedure, the lead exposure is about 500 times lower than that of conventional sand blasting.

A third alternative is called wet blasting (Ashley et al., 1997). In this procedure, water and grit advantages are blasted at a lead-based surface. This method will reduce lead exposure to employees, but not below the pel. This method is difficult to carry out because there is no effective way to collect the lead contaminated water before it soaks into the ground and contaminates the soil.

Power tools are also used to strip lead based paint (Roychowdhury, 1998). There are a variety of tools on the market today. Most of them reduce the levels of lead exposure significantly. Electric wire brushes are significantly higher in lead particle displacement than pneumatic chisels. Vacuum guns appear to be the most effective in reducing air-born lead, but they are 33% slower than other forms of lead removal (Ashley et al., 1997). Also, vacuum blasting requires the use of precision tools to be effective, and these tools have ergonomic problems such as vibration, static positioning, awkward wrist/hand positions and they lack the mobility to get into hard to reach places. When using these types of tools it is very critical that they are used properly to be most effective.

Another form of lead removal is isolation/automation abrasive blasting. This form of blasting is done by automation in an enclosure, which isolates the lead allowing 80% of the blasting to be completed without human contact (Ashley et al., 1997). The disadvantage of this method is that it is not very accessible to most construction sites.

Another type of blasting involves a negative air enclosure system using a dilution ventilation system (Ashley et al., 1997). When set up correctly, the fresh air flowing to employees during lead removal makes this system quite effective. However, the constantly changing conditions of a construction site make it nearly impossible for this system to remain efficient over a long period of time.

In order to be effective in reducing employee's exposure to lead during removal, proper administrative procedures need to be followed. This involves using the best possible methods for lead removal as well as personal protective equipment for all employees exposed to lead (Roychowdhury, 1998). Good hygiene practices play a critical role in reducing employee exposure as well as take home exposure. Employees should wash their hands thoroughly before eating, drinking, or smoking (Kaufman et al., 1994). Also, employees should be provided with a safe place in which to store contaminated and uncontaminated clothing. Changing rooms will allow employees to change from lead contaminated clothing to uncontaminated clothing whenever they leave the work site. Finally, there needs to be a thorough cleaning of all changing areas daily to reduce any contamination of the clean areas (Nelson & Kaufman, 1998).

Effectiveness of Regulations

Heightened awareness of leads harmful effects, especially to children, marked the beginning of strong regulations to reduce the environmental and occupational exposures to lead. The average blood lead level in 1976 was 14.6 (mu) g/dl (Rabinowitz et al., 1991). There were over four million children with elevated blood levels (Bogden & Oleske, 1997). One of the biggest changes to reduce the exposure to environmental lead was the "unleaded" automobile engine (Roychowdhury, 1998). In 1977 the Consumer Product Safety Commission reduced the amount of lead allowed in paints to .06 percent. This regulatory trend continued on through the 1980's. Leaded gasoline consumption was down 73% from 1975. Paint lead was reduced even more and eventually eliminated from inside paint altogether (D'Orazio & Guszkowski, 1996). The Safe Water Drinking Act of 1986 banned the use of lead solder on water pipes. The Lead Contamination Control Act of 1988 recalled lead-containing public water coolers, screened school tap water, and aided testing and abating of lead in school drinking water (Roychowdhury, 1998). By 1991 lead soldered food cans were no longer manufactured in the United States (Ashley et al., 1997). In 1991 the EPA set a level of 15 (mu) g/liter of lead in tap water (Decker, Malkin, & Kiefer, 1999). The 1992 Housing and Community Development Act (Public Law 102-550) which included as Title X the "Residential Lead-Based Paint Hazardous Reduction Act of 1992" forced the nation to deal with the problem of lead based paint in homes (Ashley et al., 1997). In 1993 OSHA developed the lead standard for the construction industry. This was directed at the many projects that had been previously painted with lead based paint and would need renovation, remodeling, or demolition.

Conclusion

The effects of these regulations have been favorable. From 1980 to 1991 the blood lead level above 10 kg/dl dropped 79.3% (Rose, 1999). However, there is still a problem regarding the abatement and exposure of lead in the ground and in buildings or structures painted with lead based paint. We have made tremendous progress in reducing childhood lead poisoning as well as employee, family, and public risk of lead poisoning (Bogden & Oleske, 1997). Unfortunately, there are still over one million employees who will be exposed to lead annually and 1.7 million children (ages one to five) remain at risk (Roychowdhury, 1998). It is important to continue to train both employers and employees on the risks of working with lead and lead based products (Sarkis, 2000). It is also essential that we continue to educate the general public in the understanding of the seriousness of lead poisoning as well as the proper precautions needed to avoid the entrance of lead into the body. Education is the key to our health.

Chapter III: Methodology

The purpose of this chapter is to introduce the method used to conduct the research for a lead program. Company XYZ did not have a formal lead program and they did not understand the importance of a lead abatement program. The purpose would be to educate company XYZ on the effects of lead and then achieve compliance with OSHA laws. This would be done through the development of a lead program. The review of literature in chapter II assisted the research effort because facts were found that supported the need for a lead prevention program. The Code of Federal Regulations (2002) states that construction work

> includes but is not limited to (a) demolition or salvage of structures where lead or materials containing lead is present; (b) removal or encapsulation of materials containing lead, (c) new construction, alteration, repair, or renovation of structures, substrates, or portions thereof, that contain lead, or materials containing lead, and (d) transportation, disposal, storage, or containment of lead or materials containing lead on the site or location at which construction activities are performed. (p. 85)

Procedures

The following procedures were used to conduct the study developing a lead abatement plan for company XYZ. First, the need for a lead program was determined with the objective of ensuring compliance with OSHA laws, using the 1926.62 lead standard as a guide. A personal interview was conducted with the project manager to define the work structure, expectations, standard operating procedures, and to determine if they had any type of lead abatement plan. A physical inspection of the site was performed to assess the conditions and geographic layout of what employees would be exposed to. This helped determine the most effective way to minimize exposure.

Chapter IV: Results

The purpose of this study was to provide a lead program for a demolition company, which would achieve legal compliance with OSHA and prevent occupational injury to its employees. This guide will provide the necessary information to understand the basic requirements of lead demolition and the requirements to achieve compliance. There are many different tasks during which lead can be disturbed. The contractor involved in this study only does demolition, which will be the focus of this study. The objective is to provide a lead program template, which, if followed, will provide protection from illness and achieve compliance with OSHA.

Phase I: Exposure Assessment

Before starting any work, a site evaluation needs to be conducted to determine if lead based paint will be disturbed. The designated competent person will perform this task. Because of the propensity of lead based paint on steel structures, all paint is assumed to be lead based until tested. After testing, all material found to contain lead will be considered to be a lead material hazard and handled as such, regardless of the percentage of lead found. After verification that the material is a lead based hazard, it will be the responsibility of the competent person to advise all workers and any other contractors in the area of this lead hazard. This can be done with signs or verbally (with documentation). The competent person shall determine how the material will be handled by determining the following:

A. Will the task reach or exceed the Action Level (AL) and/or the Permissible Exposure Level (PEL)?

B. Is there historical data to support the expected air levels and the worker exposure levels? (This data is required to be less than twelve months old.)

C. If using previous data, will the expected levels exceed the AL or the PEL?

Based on this information, the competent person will decide the appropriate level of protection. If historical data shows that a lead painted structure can be disturbed without raising the lead level, or that a certain method of paint removal/disturbance does not show a history of elevated air lead level (under 30 ug/m3), work may be performed by using Level I lead handling techniques. If historical data shows that this task has been performed and the air lead concentration is expected to be between the AL (30 ug/m3) and the PEL (50ug/m3), and all existing conditions have been evaluated and considered, work may be performed using Level II lead handling techniques. If historical data indicates that the air lead level is expected to be greater than 50 ug/m3, Level III lead handling techniques will be required. If there is no historical data available, the air lead concentration level will be assumed to be at or above the PEL and Level III lead handling techniques will be used. If for some reason the exposure levels are thought to be lower than the historical data, there needs to be a minimum of two air sample tests with results below the PEL to use Level II lead handling techniques.

There will be no work performed without an exposure assessment performed and documented. Any changes in site conditions or procedures will result in further exposure assessment and/or monitoring. The employer will notify all employees in writing with the results of the exposure assessment within five working days after they are received.

Definitions of Lead Handling Techniques

Following are Level I lead handling techniques which are utilized if lead levels are below the airborne action level of 30 ug/m3:

- Employees will be informed of the existing presence of lead.
- All other contractors on site will be informed of the lead hazard.
- A hand/face washing facility will be provided and required to be used before eating, smoking, applying cosmetics, and at the end of each shift.
- "Lead Present" warning signs will be posted, clearly visible to all who are in the area.
- A HEPA vacuum will be on site and available for use.
- Wetting agents will be used to keep lead dust to a minimum.

Following are Level II lead handling techniques which are utilized between the action level of 30 ug/m3 and the permissible exposure level of 50 ug/m3.

- Employees will be informed of the existing presence of lead and the history of lead air sampling
- All contractors on site will be informed of the presence of lead.
- Critical barriers will be installed using the "Lead Present" signs.
- Only lead trained, task essential personnel will be allowed in the "lead zone."
- There is no eating, smoking, or applying cosmetics in the "lead zone."
- Biological monitoring and medical exams need to be performed by employer.
- Personal air monitoring will be performed.
- All employees entering the "lead zone" will use Personal Protective Equipment (PPE). This will include coveralls, respiratory protection, gloves,

eye protection, and other necessary PPE required as job conditions are evaluated.

- Wetting agents will be used to minimize excessive lead dusts.
- A designated decontamination site will be established for employees to clean up, change clothes, wash hands and face.
- Employees can not leave the decontamination area wearing their PPE.
- A HEPA vacuum will be used for initial cleaning when leaving the lead zone.
- Employees will wash hands and face each time they pass through the decontamination station.
- The respirator will be the last PPE item removed when in the decontamination station.
- The decontamination station will be cleaned washed and vacuumed (using a HEPA vacuum) daily.
- Documentation of all related activities in the form of a Lead Compliance Plan.
- Re-assessment must be performed by the competent person whenever there has been a change in site conditions, equipment, process, personnel, task, or control.

Following are Level III lead handling techniques which are utilized when lead levels are greater than the permissible exposure level (50ug/m3)

- Employees will be informed of the existing presence of lead and the history of lead air sampling
- All contractors on site will be informed of the presence of lead.

- Critical barriers will be installed using the "Lead Present" signs
- Only lead trained, task essential personnel will be allowed in the "lead zone."
- There is no eating, smoking, or applying cosmetics in the "lead zone."
- Biological monitoring and medical exams need to be performed by employer.
- Personal air monitoring will be performed.
- At a minimum, a half mask Powered Air Purifying Respirator (PAPR) with HEPA filters will be used.
- Disposable PPE will be contained and disposed of in 6 mil polyethylene bags.
- All employees entering the "lead zone" will use necessary PPE. This will include coveralls, respiratory protection, gloves, eye protection, and other necessary PPE required as job conditions are evaluated.
- Wetting agents will be used to minimize excessive lead dusts.
- A designated decontamination site will be established for employees to clean up, change clothes, wash hands and face.
- Employees can not leave the decontamination area wearing any of their PPE.
- A HEPA vacuum will be used for initial cleaning when leaving the lead zone.
- Employees will wash hands and face each time they pass through the decontamination station.
- The respirator should be the last PPE item removed when in the decontamination station.
- The decontamination area will be washed and vacuumed daily.

- A change area will be provided and equipped with storage facilities for protective work clothing and for street clothing and to prevent cross contamination.
- Where feasible, there should be a shower facility in the decontamination area, a minimum of a wash station to clean hands and face after each shift or when exiting out of the "lead zone."
- The decontamination station will be cleaned washed and vacuumed (HEPA) daily.
- Documentation of all related activities in the forrm of a Lead Compliance Plan
- Re-assessment must be performed by the competent person whenever there has been a change in site conditions, equipment, process, personnel, task, or control.
- A final wipe sample should be conducted in the decontamination area, before mobilization to the next site.

This chapter has outlined a lead abatement plan for a demolition company.

Chapter V: Discussion

The focus of this study was to develop a lead program for a bridge demolition contractor. When contractors disturb painted steel structures, they need to be aware of the potential for lead exposure. This paper was designed to provide education regarding the hazards of lead and how to eliminate occupational lead poisoning. By using the information provided in the study regarding the disturbance of lead based paint, company XYZ would be able to comply with OSHA requirements and provide a safe and healthy work environment.

Conclusions

After completing the literature review and developing the lead abatement plan for Company XYZ, the following conclusions can be drawn:

- Any painted iron structure should be analyzed for lead before disturbing the paint.
- The percentage of lead in paint varies with painted structures. Even though lead percentages vary it is very difficult to stay below the action level when disturbing the lead based paint with a torch or abrasive blasting.
- The disturbance of lead should be kept at a minimum. This means that all options should be explored before disturbing lead based paint.
- There needs to be an investment of time/money in the form of training, special tools, medical evaluations, special PPE, etc to develop a lead abatement program.

Recommendations for Contractors Disturbing Lead

First, each site should develop a written Lead Safety and Health Program using the information provided in this study and that from 29 CFR 1926.62. A comprehensive plan addressing all aspects of lead exposure should be created. In addition, every site with demolition of painted iron should have a lead assessment done, unless they have historical data that is less than 12 months old, to determine what level of protection is necessary to protect the workers.

Each site should complete a site specific Lead Compliance Plan. This plan would include and show documentation for the following issues:

Engineering controls. What methods will be used to keep air-borne lead levels at a minimum? Describe how, show plans, and include drawings on how this will be accomplished. It will include reasons for certain types of procedures.

Administration controls. Rotate high exposure tasks as much as possible, reducing the exposure times for those tasks that the airborne concentrations cannot be reduced.

Competent person. Establish the person who can ensure full compliance with all aspects of the Lead Compliance Program. This person will be able to recognize potential hazards, understand how to correct them, and have the authority to make corrections/changes.

Personal protective equipment. Provide employees with all the necessary PPE to provide protection from lead.

Personal hygiene. Hand washing facilities are required wherever occupational lead is found. When the PEL is exceeded, showers should be provided where feasible. Clean, lead free lunch rooms should be provided where food and cigarettes can be consumed. Employees must wash their hands and face when leaving the lead zone and before eating, smoking, or applying cosmetics.

Medical surveillance program. Medical evaluations along with blood work are needed to identify baseline and elevated blood lead levels. Medical files must be open for employee inspection and blood testing should be done by an OSHA approved laboratory.

Medical removal plan. Employees with excessive blood lead levels must be removed from the task until their levels decrease to appropriate levels. Employees will not lose pay or other job related benefits because of elevated blood lead levels.

Training. Ensure that Hazard Communication and complete Lead Program training is completed and documented in personnel file.

Respirator program. A respirator program was not covered in this study, but a complete respirator program is necessary to achieve compliance with a Lead Program. The respirator selection can be found in Table 1 1926.62. The respirator program requirements can be found in 29 CFR 1910.134.

Documentation. Everything related to lead should be documented. Using the Lead Compliance Plan will assure documentation of all pre task plans. Any changes regarding illness or elevated medical lead reports should be documented according to OSHA's requirements and filed in employee and/or job files. Exposure assessments and medical records should be kept at least 30 years after employment ceases.

Good documentation will assist a company in multiple ways. As previously stated the law requires it. Documentaion helps when other jobs need assessments and data. Information can be used for other projects with similar levels of lead. Finally good documentaion can assisit in any legal matters that may arise years later. Employees who were well protected from the harmful effects of lead will not be successful in future lawsuits regarding lead.poisioning. Having a well documented program can assist with current work,. bidding and planning future work, and protecting the company's assets in the future.

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