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"SOLDERING AND BABBITTING"

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SOLDERING AND BABBITTING

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It is especially difficult for persons outside the health maintenance field to grasp and retain the fact that mere milligrams of inhaled lead constitute a toxic dose (one ounce = 28,350 milligrams). Since lead is accumulative to some extent in the human system, the amount absorbed each day, though it be as little as one or two milligrams, may, after a period of weeks or months, accumulate to a sufficient amount to produce the characteristic illness known as "plumbism" or lead poisoning. Men in production work are accustomed to think of lead in terms of pounds or tons and it is not easy for them to understand, for instance, that the daily inhalation of lead equivalent to that normally present in a BB shot would be in excess of the permissible limit for about 150 persons.

Experience has demonstrated that whenever the amount of suspended or "air-borne" lead appreciably exceeds 1.5 milligrams per 10 cubic meters (353 cubic feet) of air, some individuals in any group who are subjected to the exposure for eight hours per day will develop symptoms of "early plumbism". As the exposure increases the more significant will be the symptoms and the percentage of persons affected.

Solder and babbitt are used extensively throughout the Corporation and operations involving the use of these materials constitute the most serious of the exposures.

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Solder Application

Excessive concentrations of lead fume normally do not result from solder application with an electric iron. This is probably due to the small amounts of solder involved and the comparatively low heat of the metal. When an iron, heated in a small gas-fired furnace, is used, the exposure may be of greater consequence. Solder remaining on the iron will drop to the floor of the furnace and become volatilized or oxidized. The disturbances created by the flame or by removing or placing the iron in the furnace cause the oxidized lead to become air-borne. Ventilation is advisable for removing these fumes and dusts, especially where the furnace is located in a small room or where many units are in use.

The atmospheric contamination occasioned by the use of either gas or electrically heated pots containing solder is dependent on a number of factors. With higher temperatures, more volatilization will occur and the greater will be the exposure. With the higher temperature, the metal is more readily oxidized to produce a dross consisting of a high percentage of lead oxide. The dross may provide a protective coating to reduce volatilization of the lead; however, disturbance of this coating will create an exposure. As a safeguard against excessive contamination, pots containing solder are usually ventilated. Wherever possible, it is advisable to enclose the pot as completely as possible and provide sufficient air volume to overcome the thermal effects of the molten metal. Attempts have been made to use natural draft ventilation systems to control these fumes but in those instances where the ducts were not of sufficient diameter the systems were inadequate. A preferable method is the use of mechanical ventilation.

The application of solder to automobile bodies by the use of a gas-air torch does not normally produce sufficient volatilization of the lead to cause a health hazard. The temperature of the solder metal is generally at the softening or melting point and experience has shown that significant quantities of lead are not volatilized. Canopy hoods over the solder application area have been provided in many instances to remove the smoke and heat that may result when the operation is extensive.

Removal of Excess Solder

From the viewpoint of industrial hygiene perhaps the most important operation in General Motors involving lead is that of removing the excess solder applied to the welded seams of automobile bodies and truck cabs. When this excess is removed by files, rasps or routers, the particles are large enough to fall to the floor rapidly and concentrations of air-borne lead are generally not excessive. However, when power operated sanders or grinders are used, excessive concentrations are prevalent over the surrounding area. Extensive hand application of abrasive cloth or paper can produce undesirable concentrations of air-borne lead but the general contamination in the area is not so widespread.

Two methods have been used successfully in controlling excessive exposures to lead dust resulting from the removal of excess solder from automobile bodies.

a. Avoidance of discing.

Avoid or hold at an absolute minimum any power grinding, discing or extensive hand sanding of leaded surfaces. Files or similar tools may

be used as a substitute. This method, under good supervision, has proved satisfactory in a number of instances.

b. Segregation and ventilation.

Most of the body plants provide a mechanically exhausted enclosure for the discing and grinding operations involving solder. The enclosure should consist of solid side walls from the floor to the ceiling. The ends of the booth should be as complete as possible after allowing openings for entrance and removal of the bodies. Sufficient air should be exhausted from the enclosure to create a minimum inward flow of 150 lineal feet per minute through all openings (150 cfm per square foot of opening). The air from the solder booth should be discharged outdoors. Obviously, the air should be discharged in a manner which will avoid re-entry through windows or monitors.

The sole purpose of the booth is to prevent the dispersal of dust into adjacent areas and all workmen inside the booth must be provided with effective personal respiratory equipment.

The types of respiratory devices which could be used by the men are as follows:

1. Mechanical filter type which has been approved for use in lead dust. These respirators offer satisfactory protection when adjusted and worn properly, but they are not comfortable, they offer resistance to breathing, and men are careless in maintaining the air tight fit to the face necessary for efficient use.

2. Air-line respirators consisting of a half mask facepiece and compressed air supply. These devices provide reliable protection when properly used, but the attached air hose offers some impediment and men object to the tight fitting facepieces. They have not been generally accepted in General Motors.

3. Light-weight, supplied air helmets. These devices have been used extensively. However, recent studies have indicated that not all of them are providing adequate protection. Some of the helmets have been made of loosely woven fabric, others are in need of repair, and in some instances airflow into the helmet was considerably less than the recommended 6 cubic ft. per minute. Even when the helmets are of essentially air-tight construction, in good repair, and supplied with not less than 6 cubic ft. of air per minute, it is still necessary that they be styled to provide a snug fit at the neck, shoulders and chest. The primary object is to restrict the area through which the supplied air escapes and thereby provide a positive outward flow under all circumstances.

Grinding of Soldering Coppers

During the reshaping of soldering irons it is frequently the practice to grind the surfaces which have been coated with lead. The grinding wheels used for this purpose should be hooded and adequately ventilated, especially in those instances where grinding is a frequent occurrence.

Reclamation

Reclaiming of lead base metal can create significant exposures to lead dust or fume. The degree of exposure is related to a large extent to the method of reclamation.

In general the discussion pertaining to solder pots also applies to the melting of splatters. Extensive stirring or ladling of the molten metal increases the amount of lead liberated. Where the temperature is high enough to cause the formation of lead oxide or powdery dross at the surface of the metal, stirring and skimming may create an undesirable exposure.

Splatters are generally contaminated with floor sweepings, flux, oil, and other organic matter which partially decomposes upon contact with the molten metal. The resultant smoke is a source of frequent complaint although it is not known to be harmful to health. Ventilation is usually provided to alleviate this condition, to guard against excessive contamination due to overheating, and to control the exposure which results from disturbing the dross at the surface.

In some instances the lead base metal is reclaimed from mixtures which are predominately steel or iron. The procedure frequently followed is to place the material in a heated furnace or trough and the molten metal is allowed to flow by gravity into a melting pot. In most instances high temperatures are used and as a consequence appreciable quantities of lead are volatilized. The high temperature likewise promotes the formation of the lead oxides which become air-borne when the material is

stirred and removed from the furnace or trough. Mechanical ventilation is necessary for the removal of fume and dust released during heating and stirring. Ventilation should also be provided adjacent to the receptacle into which the powdered dross is dumped to exhaust the lead oxide which becomes air-borne during the emptying process.

Containers of lead oxide dross should be stored and emptied outside the plant.

Babbitting Operations

Babbitt, commonly used as bearing metal, is generally a lead base alloy and as such presents similar potential exposures to lead fume and dust as were discussed in the preceding sections.

Pots containing molten babbitt are normally ventilated to remove any volatilized lead. Tinning baths are also ventilated to remove lead and other fumes. Carry-over of the fluxing solution into the babbitt pots generally causes production of undesirable irritating fumes consisting of the ingredients used as a flux. Leakage of lead alloys into the combustion chamber not properly vented to the outside is a source of contamination by lead fumes.

Medical Control

Excessive exposure to lead is reflected in the employe by an increase of lead in his blood and urine. Although we place more confidence in blood lead, periodic analysis of either biological specimen will indicate if need for additional control measures exists.