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## Occupational Health Programs Manual – Chapter 5

# Lead w/Change 2 (9/30/2015)

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### Change Record

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*\*\*Include all information for each revision. Do not remove old revision data. Add new rows to table when space runs out by pressing the tab key in the last row, far right column.*

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## Chapter 5—LEAD

*Note: The current version of this chapter is maintained and approved by the Safety and Health Division (SHeD). The last revision date for this chapter was March 2012. If you are referencing paper copies, please verify that it is the most current version before use. The current version is located on the Glenn Research Center intranet within the BMS Library. Approved by Chief of Safety and Health Division.*

### 1.0 PURPOSE

This chapter establishes minimum requirements for handling, use, removal, and disposal of all lead-containing materials at the NASA Glenn Research Center (GRC).

### 2.0 APPLICABILITY

This chapter is applicable to all personnel at GRC Lewis Field and Plum Brook Station (PBS) including, but not limited to, civil servants, students, and contractor personnel. Construction contract personnel shall comply with the contents of this program. Onsite support service contractors and construction contractors are responsible for developing and implementing their own lead compliance programs in accordance with OSHA and NASA requirements.

### 3.0 BACKGROUND

Lead exposure is one of the oldest known occupational hazards. It is harmful when inhaled or ingested, and the absorption of large amounts of lead causes diseases of the kidneys as well as peripheral and central nervous system damage. The effects of lead on the nervous system range from mild behavioral changes to fatal brain damage. Lead exposure can also result in impotence and sterility in men and decreased fertility in women. Without proper workplace hygiene practices, the lead taken home on workers' clothing may expose their families. There have been instances of lead poisoning among children whose parents work in a high-lead environment.

Employees at GRC may be exposed to lead through construction and maintenance activities that disturb lead-based paints (LBPs) or other lead-containing materials. Exposures may also occur where lead-containing products are used, including soldering and brazing operations and certain research operations. Airborne lead exposures are not a problem during soldering operations when the temperature remains below 450 °C (840 °F). Good housekeeping and personal hygiene practices are required in these operations to minimize the ingestion of lead. Local exhaust ventilation may be needed to control exposure to other contaminants generated by these operations and to minimize lead exposures during grinding and polishing operations. Since extremely high exposures to lead occur during welding, cutting, and brazing of materials with LBPs and abrasive blasting or grinding of these materials, controls shall be used to protect workers and prevent lead contamination of the workarea.

Strict occupational and environmental regulations govern the use, handling, and disposal of lead-containing materials. The Occupational Safety and Health Administration (OSHA) occupational airborne exposure limit is 50 µg/m<sup>3</sup> of air as an 8-hr time-weighted average (TWA). At the action level (AL) of 30 µg/m<sup>3</sup>, a lead compliance plan, employee training, exposure monitoring, and medical monitoring are required.

Environmental regulations require controlling and permitting releases of lead to the air and water, testing of lead-containing materials before disposal, and proper disposal of any lead-containing materials meeting the definition of hazardous waste.

### 4.0 POLICY

It is the policy of GRC to comply with all applicable regulations regarding lead and to prevent illness to workers and damage to the environment from the use, removal, and disposal of lead. To accomplish this, all personnel shall comply with the requirements of this chapter. GRC shall follow the requirements of NPR 1800.1C.

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Many paints contain trace contaminants of other heavy metals other than lead. These other heavy metals may have more restrictive clean-up levels than lead. Because of this fact, it is GRC policy that no painted surface will be grinded, welded, or abraded without first removing the paint.

Lead-related work in construction and maintenance activities ranges from large lead remediation projects to small maintenance operations. In all cases, lead-related operations shall be done within a controlled area using engineering and work practice controls that minimize worker exposure and limit contamination of surrounding areas. The area will be posted with signs meeting OSHA requirements to restrict access to workers with the required PPE.

Regulations governing worker protection shall be strictly followed, including requirements for

- A competent person, defined by OSHA as someone capable of identifying existing and potential lead hazards in the surroundings or working conditions, who has authority to take prompt corrective measures
- A written lead compliance program that describes each lead activity, the engineering, work practice, and administrative controls, the air monitoring to procedures, and inspection schedules

## **5.0 RESPONSIBILITIES**

It is the responsibility of all civil servants, researchers, construction contractors and support service contractors to ensure that LBP is removed or handled only by properly trained and licensed personnel.

### **5.1 SHeD**

SHeD provides guidance on the requirements of Federal, state, and local occupational health regulations. Specific responsibilities are listed below.

- Maintains the Lead Compliance Program for civil servant operations
- Develops and manages the Lead Compliance Program according to OSHA 29 Code of Federal Regulations (CFR) 1926.62 and 1910.1025
- Evaluates civil servant employee exposures, recommends procedures to minimize exposures, and recommends employees for inclusion in a medical surveillance program
- Provides sampling and analysis support to identify lead and lead-containing materials
- Provides guidance on the requirements of Federal, state, and local environmental regulations on any air, water, or soil pollution issues
- 
- Reviews all contractor health and safety plans and hot work permits for issues associated with lead

### **5.2 Medical Director, Occupational Medicine Services**

- Maintains medical surveillance programs for civil servant and contractor employees exposed to hazardous chemicals that require medical monitoring
- Maintains complete, accurate records of all medical examinations for personnel in the medical surveillance program (Records are to be retained for at least 30 years. Results of examinations are to be discussed with employees as needed.)
- Notifies employees of medical surveillance results
- Notifies SHeD about employees who may require an exposure evaluation, based on clinical findings

### **5.3 Facilities Division Project Managers**

- Identify lead-containing materials and materials that may be disturbed in any renovation or maintenance activities

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- Ensure that bid specifications identify lead that may be disturbed in any renovation or maintenance activities and include requirements that the contractor comply with all applicable regulations and this instruction
- Ensure that the contractor submittals include a site-specific health and safety plan that provides for an OSHA competent person, includes a Lead Compliance Plan, and meets all requirements of the OSHA lead standard

#### **5.4 Contracting Officer’s Technical Representative (COTR)**

- Attends training necessary to meet the OSHA and Environmental Protection Agency (EPA) competent person requirements
- Identifies suspected lead-containing materials not identified in the scope of work during renovation and construction activities; arranges for testing of the suspect material and, if the material does contain lead and will be disturbed during the project, ensures its removal by a qualified lead abatement contractor
- Ensures that lead-related work is performed in accordance with the contractor’s site-specific health and safety plan, all applicable regulations, and SHeD guidance
- Ensure that contractor exposure monitoring data meets the information requirements of SHeD lead task and exposure database and is submitted to SHeD

#### **5.5 Support Service Contractors**

- Develop a health and safety plan that includes a lead compliance program for contractor operations
- Provide copies of air monitoring results and task data to SHeD (Note: Lead air monitoring data sheets are available from SHeD and may be used as a data sheet for adequate documentation.)

#### **5.6 Research Personnel**

- Shall note the use of lead on safety permit applications and contact SHeD when lead is to be used in projects that do not require a safety permit

#### **5.7 Supervisors**

- Notify SHeD of operations involving potential exposure to lead and enforce the use of engineering and work practice controls and PPE prescribed for the job

#### **5.8 Employees**

- Shall properly use engineering and work practice controls and PPE specified for their operations

#### **5.9 Energy and Environmental Management Office (FE)**

- Provides guidance and oversight on the disposal of lead-containing materials

Provides guidance and oversight of lead contaminated soils

### **6.0 REQUIREMENTS (OSHA 29 CFR 1926.62 AND OSHA 29 CFR 1910.1025)**

It is the responsibility of all civil servants and support service contractors to ensure that lead-containing materials are removed or handled only by employees who are properly trained. Contractors shall develop their own lead compliance plan.

#### **6.1 The following regulations apply, as per OSHA 29 CFR 1926.62 and OSHA 29 CFR 1910.1025:**

##### **6.1.1 Exposure limits**

The following exposure limits indicate the maximum permissible exposure limit (PEL) and AL for airborne lead:

AL.—30 µg/m<sup>3</sup>, 8-hr TWA

PEL.—50 µg/m<sup>3</sup>, 8-hr TWA

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### 6.1.2 Exposure assessment

Air monitor monitoring shall be in accordance with the National Institute for Occupational Safety and Health (NIOSH) or OSHA methods. Initial air monitoring shall be done to determine if any employee is exposed to lead above the PEL or AL.

### 6.1.3 Monitoring frequency

The following are lead monitoring frequencies as required by OSHA:

- None, if initial monitoring demonstrates exposures are less than the AL
- Quarterly, if exposures are above PEL
- Every 6 months, if exposures are greater than the AL but are less than the PEL; that frequency may be reduced if two consecutive samples, 7 days apart, are below the AL

Additional monitoring is required if there has been a change of equipment, process, control, or personnel. Also, additional monitoring is required if a new task may result in more employees being exposed to lead at or above the AL or may result in employees already exposed at or above the AL being exposed above the PEL.

### 6.1.4 Presumed exposure

Per OSHA, and until sampling shows otherwise, employees performing certain tasks will be presumed to be exposed above the PEL and shall be protected.

### 6.1.5 Personal protective equipment

OSHA requires protective equipment when engineering controls and work practices are not sufficient (or not yet implemented) to reduce exposures to or below the PEL or where employees are exposed to lead containing compounds, the following PPE is required:

- Respiratory protection (selection of the respirator is based on the SHeD hazard assessment of a specific task) (Note: A respirator will be provided whenever an employee requests one, but anyone who wears a respirator shall be included in the Respiratory Protection Program in accordance with OHPM Chapter 4.)
- Disposable protective coveralls and head covering
- Gloves, hats, and shoes
- Safety eyewear

### 6.1.6 Housekeeping

All surfaces shall be maintained free of lead accumulation. Use a high-efficiency particulate air (HEPA) vacuum or wet wipe where possible. Do not use compressed air to remove lead from dusty surfaces.

### 6.1.7 Hygiene facilities

Employees who are exposed to lead levels above the PEL will be provided with a change area and shower, and, where feasible, lunchroom and hand-washing facilities.

### 6.1.8 Hygiene practices

The following hygiene practices shall be conducted:

- No food or beverages, tobacco products, or cosmetic application shall be used or present in regulated areas.
- Hands shall be washed immediately at end of shift and before eating, drinking, using tobacco, or applying cosmetics.
- No protective clothing shall be taken from the regulated areas.
- When showers are not provided, workers shall wash their hands and face at the end of the work shift.
- Protective clothing shall be HEPA vacuumed prior to removal.

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### 6.1.9 Administrative controls

If administrative controls are used as a means to reduce an employee's exposure time to lead, a job-rotation schedule will be established and implemented.

#### 6.1.10 Medical surveillance

Employees who are or may be exposed to lead above the AL for more than 30 days in any 12 consecutive months will be included in the medical surveillance program. Also, employees who are occupationally exposed on any day above the AL may be included, upon request, in the medical surveillance program and employees may request multiple physicians review if they feel it is necessary. Employees will be notified of the results of tests and examinations as part of the medical surveillance program.

Medical surveillance includes, but is not limited to

- Annual medical examination blood test to establish lead level
- Physician's written opinion

The first medical examination under the surveillance program consists of biological monitoring and includes blood lead level and zinc protoporphyrin level.

A worker will be removed from the task causing the lead exposure when blood lead level is greater than 50 µg/dl and will not be returned to exposure until blood lead level is less than 40 µg/dl.

6.1.10 - SHeD shall verify requirements for this section to ensure compliance with the Chapter. SHeD verification shall be accomplished by reviewing medical records by a qualified individual, as required.

#### 6.1.11 Signs

Warning signs will be posted in each work area where lead abatement is being conducted and when the likelihood that employees will be exposed to lead levels above the AL. The wording on the signs shall include

- WARNING
- LEAD WORKAREA
- POISON
- NO SMOKING OR EATING

#### 6.1.12 Disposal

Waste Management representatives shall be contacted for assistance on proper disposal.

#### 6.1.13 Training

Employees who work with lead but are exposed to less than the AL are required to attend the general lead awareness training that meets the requirements of the GRC Hazard Communication Program.

Employees exposed to lead at or above the AL on any day require further training on the following subjects:

- Content of the lead in construction standard
- Nature of operations that may result in lead exposure
- Purpose and description of the medical surveillance program
- Awareness of medical removal program and protection
- Routes of exposure
- Toxicity, health effects, and chelation therapy
- Possible engineering controls and work practices for tasks in which employees are involved

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- Proper disposal methods
- Training is required annually

All employees who are required to use a respirator shall be enrolled in the GRC Respiratory Protection Program, Occupational Health Programs Manual, Chapter 4.

6.1.13 - SHeD shall verify requirements for this section to ensure compliance with the Chapter. SHeD verification shall be accomplished by reviewing SATERN records or other personnel training records, as required.

#### 6.1.14 Recordkeeping

A database of task descriptions, control techniques, and associated exposure levels will be maintained by SHeD. This database ensures worker protection by identifying procedures that minimize worker exposures, minimize costs by identifying tasks and procedures that do not result in employee exposure to lead, and help identify lead abatement methods that provide high-production levels without jeopardizing worker health and safety.

In accordance with the requirements of the 29 CFR 1910.1020 OSHA, Employee Access to Medical and Exposure Records Standard, both medical and industrial hygiene sampling records will be made available to affected employees or their representatives. Occupational Medical Services and/or SHeD will maintain copies of these records.

6.1.14 - SHeD shall verify requirements for this section to ensure compliance with the Chapter. SHeD verification shall be accomplished through a combination of review processes (HASP's Safety Permits, design reviews, etc.) and/or worksite/building inspections.

## 6.2 Welding, Grinding, and Cutting

In addition to OSHA regulations, the following are GRC's requirements for conducting lead abatement:

Although a paint may be determined by analytical testing not to be an LBP (<600 ppm), the paint may still provide a significant exposure risk if it is significantly disturbed. It is the policy of GRC that no painted surface will be disturbed by activities such as welding, grinding, or abrasive cutting. All painted surfaces that will be disturbed by abrasive activities will have the paint removed by an OSHA competent person.

Lead paint abatement will be conducted following OSHA, EPA, and Ohio Department of Health regulations. In addition, the following GRC procedures and controls will be conducted.

- All painted surfaces will be abated at least 4 in. on either side of any cutline. This will include the inside and outside of any vessel or piece of equipment that is painted on both sides.
- The abatement contractor will isolate the work area using a regulated area that restricts access to the work area.
- The contractor shall provide for a wash station at the worksite. Workers will follow proper hygiene procedures, including washing hands before breaks, eating, smoking, or using the restroom, and at the end of the shift.
- Respirators will be provided during grinding or welding operations or SHeD air monitoring data will be provided, documenting a negative exposure assessment.
- The contractor shall provide mechanical ventilation that is HEPA filtered during all welding and grinding operations.
- The contractor shall provide HEPA-filtered "Smoke Eater" ventilation in occupied areas or areas that have multiple trades. All ventilation will be directed to an outside atmosphere.
- The contractor shall collect from surfaces any residue or dust generated by the grinding and welding operations. The contractor shall use wet methods or HEPA vacuums, and dispose of any residue waste through Waste Management.

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6.2 - SHeD shall verify requirements for this section to ensure compliance with the Chapter. SHeD verification shall be accomplished through a combination of review processes (HASPs's Safety Permits, design reviews, etc.) and/or worksite/building inspections.

## 7.0 RECORDS

SHeD shall maintain the following records:

- Hazard assessments
- Air monitoring data
- Medical records retained by Medical Services
- Lead training presentation
- Hazard exposure assessment database

## 8.0 REFERENCES

Document Number	Document Name
29 CFR 1910.1025	U.S. Department of Labor, Occupational Safety and Health Administration - Lead
29 CFR 1926.62	U.S. Department of Labor, Occupational Safety and Health Administration – Lead exposure in Construction
1926.353 and 1926.354	Ventilation and protection in welding, cutting, and brazing
Title 10	Housing and Community Development Act of 1992
40 CFR 261	U.S. Environmental Protection Agency, Identification and Listing of Clean Air Act Amendments of 1990, Title III, Toxic Air Pollutants
GLM-QS-1800.1	GRC Occupational Health Programs Manual,

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## APPENDIX A.—DEFINITIONS AND ACRONYMS

### American Conference of Governmental Industrial Hygienists (ACGIH)

**Action level (AL).**—Airborne concentration or level of an agent at which it is deemed that some specific action should be taken. In general the action level is set at one-half of the occupational exposure limit. The AL for lead is 30 µg/m<sup>3</sup> averaged over an 8-hour period.

### Code of Federal Regulations (CFR)

### Contracting Officer’s Technical Representative (COTR)

### Environmental Protection Agency (EPA)

### Glenn Research Center (GRC)

### High-efficiency particulate air (HEPA)

### Housing and Urban Development (HUD)

**Lead-based paint (LBP).**—Any paint containing greater than 0.06 wt% (600 ppm).

### National Institute for Occupational Safety and Health (NIOSH)

**Occupational exposure limit (OEL).**—A health-based workplace standard to protect workers from adverse exposure (e.g., permissible exposure limits, threshold limit values, etc.).

### Occupational Safety and Health Administration (OSHA)

**Permissible exposure limit (PEL).**—The Occupational Safety and Health Administration term that establishes maximum allowable concentrations in air of substances in which nearly all workers may be repeatedly exposed 8 hr a day, 40 hr a week, for 30 yr without adverse effects. There are three different categories of PELs.

- **PEL–Ceiling (C)** is the limit that cannot be exceeded at anytime during the work shift.
- **PEL–Short-Term Exposure Limit (STEL)** is a 15-min time-weighted average (TWA) exposure that shall not be exceeded at any time during the workday unless another time limit is specified.
- **PEL–8-hr TWA** is the maximum allowable concentration in air of a substance averaged over an 8-hr period.

The PEL–8-hr TWA for lead is 50 µg/m<sup>3</sup>.

### Personal protective equipment (PPE)

### Plum Brook Station (PBS)

### Safety and Mission Assurance Directorate (SMAD)

### Safety and Health Division (SHeD)

**Skin notation.**—Denotes the possibility that dermal absorption may be a significant contribution to the overall body burden.

### Short-Term Exposure Limit (STEL)

**Systemic effect.**—Adverse effects other than at the site of contact.

**Target organs.**—Organs of the body most affected by exposure to a particular substance.

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**Threshold limit value (TLV).**—Exposure limits recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) under which it is believed that most people can work 8 hr a day, day after day, with no harmful effects. There are three different categories of TLVs.

- **TLV–Ceiling (C)** is the concentration that shall not be exceeded during any part of the working exposure.
- **TLV–Short-Term Exposure Limit (STEL)** A 15-min time-weighted average (TWA) exposure that shall not be exceeded at any time during a workday even if the 8-hr TWA is within the TLV–TWA. Exposures above the TLV–TWA up to the STEL shall be less than 15 min, occur less than 4 times/day, and there shall be more than 60 min between successive exposures. An averaging period other than 15 min may be recommended when warranted.
- **TLV–8-hr TWA** is the maximum allowable concentration in air of a substance averaged over an 8-hr period.

**Time weighted average (TWA).**—8-hr average concentration for an 8-hr workday for a 40-hr workweek.

**Toxicity.**—Inherent property of a chemical agent, its harmful effects on some biologic systems, and the conditions under which the effects occurs.

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## APPENDIX B.—RECOMMENDED CLEARANCE CRITERIA GUIDELINES AFTER LEAD ABATEMENT

The following table represents clearance criteria after a lead abatement project. Although there are no clear-cut cleanliness criteria for an industrial environment, this table represents a compilation of Housing and Urban Development (HUD) guidelines, Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) regulations, and industry “best practices.” Many paints contain trace contaminants of other heavy metals other than lead. These other heavy metals may have more restrictive clean-up levels than lead. Because of this fact, it is GRC policy that no painted surface will be grinded, welded, or abraded without first removing the paint.

TABLE I.—CLEANLINESS CRITERIA FOR LEAD AND SELECT HAZARDOUS METALS

Location	Metal			
	Lead, $\mu\text{g}/\text{ft}^2$	Cadmium, $\mu\text{g}/\text{ft}^2$	Chromium, $\mu\text{g}/\text{ft}^2$	Zinc, $\mu\text{g}/\text{ft}^2$
Limited traffic or skin potential	400	40	40	16,000
Heavy traffic areas (aisles and walkways)	250	25	25	10,000
Workstations with high skin contact potential	100	10	10	4,000
Eating areas	40	4	4	1,600
OSHA permissible exposure limit	0.05 $\text{mg}/\text{m}^3$	0.005 $\text{mg}/\text{m}^3$	0.005 $\text{mg}/\text{m}^3$ (Cr VI)	15 $\text{mg}/\text{m}^3$ total 5 $\text{mg}/\text{m}^3$ resp.
ACGIH <sup>a</sup> threshold limit value	0.05 $\text{mg}/\text{m}^3$	0.01 $\text{mg}/\text{m}^3$ TLV 0.002 $\text{mg}/\text{m}^3$ resp.	0.01 $\text{mg}/\text{m}^3$	2 $\text{mg}/\text{m}^3$ 10 $\text{mg}/\text{m}^3$ resp.

<sup>a</sup>American Conference of Governmental Industrial Hygienists (ACGIH).

For further assistance and guidance with Table I, contact the lead industrial hygienist at SHED.

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