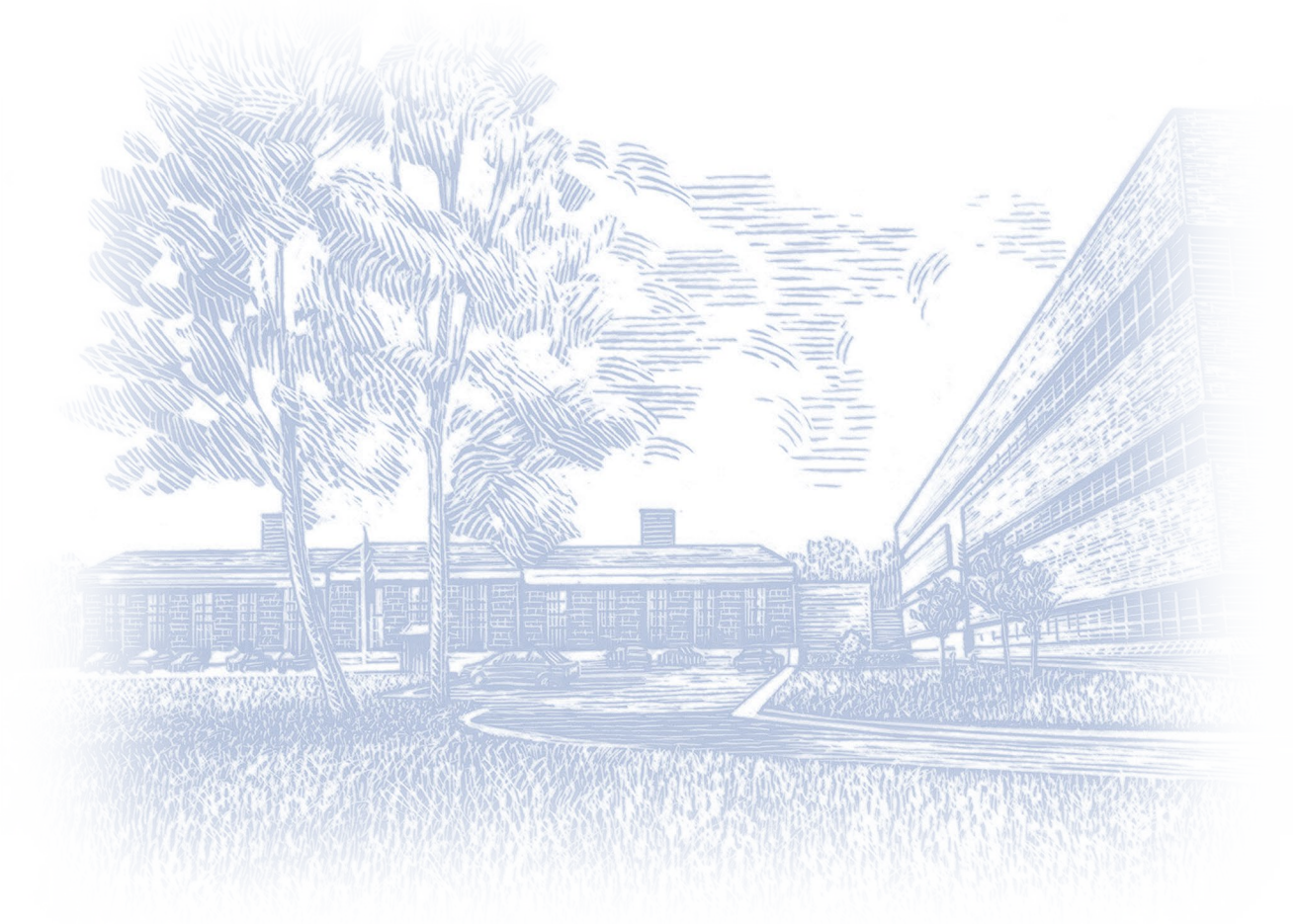


FHWA Bridge Coatings Technical Note: Personnel Protection During Bridge Paint Removal

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From: Special Projects and Engineering Division, Office of Engineering Research and Development

Topic: Personnel Protection During Bridge Paint Removal

Description: Many steel bridges are currently in need of maintenance. Maintenance operations may range from small component replacement jobs to major maintenance activities including repainting. Many steel bridges in the highway system are coated with paint that contains toxic heavy metal pigments (e.g., lead, chromate) in varying concentrations. These metals can be hazardous to human health if **inhaled** or **ingested** in relatively small quantities in the form of dusts or fumes. It is important to take appropriate measures to protect workers and inspectors potentially exposed to these hazards. Protection measures are straight forward, and when followed, can protect personnel while allowing for safe and productive work.

Description of the Hazard:

Lead is hazardous to human health when it enters the bloodstream. In the bloodstream, lead will replace other useful elements (e.g., calcium, iron) and adversely affect the effectiveness of the blood in carrying oxygen to various organs including the liver, kidneys, reproductive system, and brain.¹ In this manner, lead is particularly dangerous to small children, but can also poison adults. Once in the bloodstream, lead can concentrate in the organs or in the bones and produce long-term effects as it leaches back into the bloodstream over time.

Lead can enter the bloodstream by being breathed and absorbed through the lungs, or by being ingested and absorbed through the digestive system. Lead cannot be absorbed through the skin, but a common form of lead intake is via "hand-to-mouth" ingestion when eating or smoking with lead dust on the hands.² Only a very small amount of lead is needed in the bloodstream to exceed the current OSHA limit of 50 :g/dL (micrograms per deciliter of blood).

Regulatory Standards:

Required measures for worker protection during occupational exposure to lead are covered in the OSHA Lead-in-Construction Standard, 29 CFR 1926.62. This standard addresses the following issues in detail:

- requirements for dedicated work clothes
- controlled lead work areas and warning signs
- requirements for periodic blood lead level checks for workers
- requirements for clean break and eating areas
- hand washing station and showers
- documented respirator use and maintenance program
- proper fit testing, use and storage of respirators
- designation of a "competent person" to deal with hazards on the jobsite

Protective Measures:

Engineering Controls are any piece of equipment or modified maintenance procedure which reduces the hazardous dust exposure to workers. Examples are: ventilation equipment (dust collectors) attached to blasting containments; shrouds and vacuum attachments for power tools; and, alternative low-dusting surface preparation methods (e.g., wet abrasive blasting, high pressure water blasting, chemical stripping, etc.). All of these controls provide a benefit by reducing worker health risks. Each engineering

control also has tradeoffs in cost, productivity, or quality of surface preparation (and, hence, durability of the new coating). Engineering controls should be applied as-practical without sacrificing the quality of the work and balancing associated costs.

Respirators come in various forms. Each type of respirator has a particular assigned protection factor. This is the factor of hazard reduction associated with the particular respirator. For example, a half-face mask with proper filters and properly fitted reduces the ambient hazard by a factor of 10X. A typical continuous-flow, supplied-air abrasive blasting helmet reduces the hazard by 25X, with certain models designed to provide 1000X protection. Although exposure levels vary from job to job, for abrasive blasting inside of containment, a 1000X rated respirator is generally required.^{3, 4} For workers outside of containment and for inspection personnel, a half-face, negative pressure respirator with HEPA (high efficiency particulate air) filters (usually bright pink in color) may be sufficient. Since exposure levels for workers vary greatly depending on worker job description, containment design and operation, and other site-specific conditions, respirator selection and use should consider these factors.

Hygiene Practices - Workers removing lead-containing paint from bridges will get fine lead dust on their skin and clothes. The key to hygiene practices is to eliminate inhalation and ingestion of that dust by the worker while on the jobsite and to keep the worker from taking the lead hazard off the jobsite to expose others in their personal vehicles or homes. This is best accomplished by using dedicated work clothes which remain on the jobsite and are either disposable or laundered separately; and by supplying reasonable washing facilities for workers to use before they eat, smoke, or leave the jobsite. Specific requirements for these hygiene facilities are contained in the OSHA standard for lead-in-construction.

Administrative Controls - Exposures to lead are measured for compliance purposes using an 8-hour, full shift average. Mixing "high-exposure" activities with "low-exposure" activities may reduce a particular worker's or inspector's overall exposure.

Monitoring:

OSHA requires air and blood monitoring for workers exposed to lead. The OSHA "action level" for lead-in-air is an 8-hour average of 30 :g/m³. This action level will be exceeded by almost all abrasive blasting activities, and many power tool-cleaning and torch cutting or demolition activities. Once the action level is exceeded, the contractor must follow all of the guidance of the standard to maintain worker exposure below 50 :g/m³ (the Personal Exposure Limit).

Worker blood lead level monitoring is required. Blood levels above 50 :g/dL require removal of the worker from the hazard. Some States require contractors to report worker blood levels as a means for monitoring contractor compliance.

Supporting Data:

- Workers working inside of containment during abrasive blasting operations will be exposed to ambient lead levels above the OSHA personal exposure limit. Research data shows that levels between 2000 :g/m³ and 50,000 :g/m³ can be measured in ventilated containments during blasting.^{5, 6}
- Insufficient ventilation of containments can create lead concentration levels exceeding 50,000 :g/m³.⁷ Such conditions create difficulties in protecting workers below mandated OSHA levels. Ventilation systems should be designed specific to the cross-sectional area of the containment and the cross-sectional area should be minimized to maximize efficiency of the available ventilation equipment.⁸

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2. NIOSH ALERT, Request for Assistance in Preventing Lead Poisoning in Construction Workers, April 1992.
3. 29 CFR 1926.62, Occupational Safety & Health Administration Interim Final Standard for Lead-in-Construction, 1993.
4. FHWA-RD-94-100, *Lead Containing Paint: Removal, Containment, and Disposal*.
5. Ibid.
6. Data acquired during an ongoing FHWA-sponsored research project. Unpublished to date.
7. "Removal of Lead-based Paint from Steel Bridges in Louisiana," LADOT Rpt. 1989.
8. FHWA-RD-94-100, "Lead Containing Paint: Removal, Containment and Disposal.