



*Topic Summary:*

## Fatal Hazard – Thermal Metal Spraying

**Employers:** Protect yourself and your workers from hazards caused by thermal metal spraying. In 2003, a worker died in Oregon shortly after spending two days applying chromium- and nickel-based thermal sprays at a worksite in Washington State. The victim had been applying thermal metal sprays using portable equipment at a temporary worksite with inadequate ventilation. He was not wearing an appropriate respirator and other personal protective equipment when he did the work.

The victim developed progressive symptoms of fatigue, shortness of breath and coughing. He was later found dead in his home. A post-mortem examination revealed lung damage consistent with toxic exposure.

Following an investigation by Oregon-OSHA, the employer was cited for multiple violations related to the overexposure, personal protective equipment, respirators and engineering controls.

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### What is thermal metal spraying?

The term “thermal metal spraying” refers to a process in which metals are melted and sprayed on a surface to form a coating. The metals may be melted using a variety of heating processes, and sprayed metals can be pure metals or alloys in the form of powders, wires, or rods. Other names for thermal metal spraying include flame spraying, metal spraying, plasma spraying, electric arc spraying, metallizing, and hardfacing.

Thermal metal spraying may be used to build up worn parts, apply a corrosion-resistant layer or to apply soldering or brazing filler metals. The process is used in many industries including aerospace, agriculture, automotive, electronic, machine shops, marine, pulp and paper, and transportation.

### Why is thermal metal spraying hazardous?

There are multiple health and safety hazards for the operator and anyone else in the vicinity of the work:

- **Metal fumes.** Harmful levels of chromium, cobalt, nickel, lead, cadmium and other toxic metals may be generated.
- **Gases:** The spray may contain asphyxiating gases (argon, nitrogen, hydrogen, and helium), water/steam, nitrogen oxide, ozone, carbon monoxide, and carbon dioxide or fuel gases such as acetylene, methane and propylene, depending on the process.
- **Metallic dusts:** Fine metallic powders are both an explosive and inhalation hazard.
- **Noise:** The process generates a significant noise hazard, which can cause hearing loss.
- **Non-ionizing radiation:** Ultraviolet and infrared radiation can damage the eyes and skin.
- **Other hazards include:** Electrical, burns, mechanical, fire, compressed gases, and infrasound (sub-audible sound).

## How do I protect my workers and myself?

You should contact your equipment manufacturer and spray-material suppliers to ensure that the equipment is being used according to recommended operating guidelines.

Due to the numerous hazards associated with this process, it is not possible to describe here all the control measures that apply to thermal metal spraying. Prior to thermal metal spraying, you must assess the hazards and take appropriate precautions, which may include training workers, providing adequate ventilation, establishing programs for respiratory protection and hearing conservation, providing additional personal protective equipment, etc.

The L&I publication [“How to Protect Workers While Thermal Metal Spraying”](#) provides detailed information about exposure controls. Additionally, there are many other resources below:

### Books:

- “Handbook of Thermal Spray Technology”, edited by J.R. Davis. September 2004. Thermal Spray Society and ASM International.
- “Recognition of Health Hazards in Industry: A Review of Materials Processes,” 2nd Edition by William A. Burgess. Chapter 14: Metal Thermal Spraying. January 1995. John Wiley & Sons.
- “Welding Health and Safety: A Field Guide for OEHS Professionals” by Michael K. Harris. Chapter 24: Thermal Spraying. September 2002. The American Industrial Hygiene Association.

### Online Resources:

- American Welding Society [Safety & Health Fact Sheets](#)
- American Welding Society Fact Sheet No. 20: [“Thermal Spraying Safety”](#)
- California Air Resources Board Fact Sheet: [“Thermal Spraying”](#)
- Haz-Map database entry for [“Metal Thermal Spraying”](#)
- National Institute for Occupational Safety and Health (NIOSH) Health Hazard Evaluation Report No. HETA-88-136-1945, [“Miller Thermal Technologies, Inc., Appleton, Wisconsin”](#)
- [L&I Safety and Health web site](#)
- L&I publication [“How to Protect Workers While Thermal Metal Spraying”](#)
- OSHA Safety and Health Topics: [“Welding, Cutting, and Brazing”](#)
- Thermal Spray Society [Safety Guidelines](#)

## How can I get assistance from Labor and Industries?

L&I offers free safety and health consultations. Please contact one of the regional offices listed on the L&I web site at [www.LNI.wa.gov](http://www.LNI.wa.gov) and ask for the WISHA (Washington Industrial Safety and Health Act) Consultation Supervisor.