



# Industry Guide

## Foundries

Foundries continue to employ many workers in the United States despite their declining numbers over the last two decades. In 1991 there were 2,650 operating foundries with the total work population of 210,000 split 60% in ferrous and 40% in nonferrous foundries.<sup>(1)</sup> Foundry workers may be exposed to numerous health hazards including:

### Chemical agents

— such as silica and other nonmetallic dust, metal dusts and fumes, and carbon monoxide

### Physical agents

— such as heat, noise, vibration, and non-ionizing radiation

The nature and magnitude of these hazards vary depending on the type of foundry and the control measures in place.

To properly assess the hazard potential in foundries, the National Institute of Occupational Safety and Health (NIOSH) recommends that an initial plant survey be done. The survey should include an inventory of all substances present along with their physical, chemical, and

toxicological properties. The survey should follow the raw materials as they are processed and should identify potentially hazardous locations.

After the plant survey, areas where significant exposures may occur should

be evaluated using the appropriate testing equipment to determine the levels of chemical and physical hazards present. This data can be used to determine medical and training needs, to select personal protective equipment, to improve engineering controls, and to determine compliance with government regulations.<sup>(2)</sup>

***This publication is designed to assist health and safety professionals in choosing the appropriate testing equipment and methodology to assess the major chemical agents found in foundries. Sources of additional information are described below.***

*The NIOSH Information Center at 800-356-4674 or [www.cdc.gov/niosh/85-116.html](http://www.cdc.gov/niosh/85-116.html) offers a document containing recommendations for control of occupational safety and health hazards in foundries (Publication 85-116).*

*SKC at 724-941-9701 or [www.skcinc.com](http://www.skcinc.com) offers equipment to evaluate noise and heat stress levels.*

## Crystalline Silica

Crystalline silica is one of the most serious and prevalent health hazards found in foundries. Quartz sand, which is composed primarily of crystalline silica, is a widely used molding material in many different types of foundries. Workers inhale crystalline silica during sand-mold preparation, while removing mold castings, and while cleaning castings. When crystalline silica enters the lung, fibrotic nodules and scarring can occur around the trapped silica particles. This fibrotic condition of the lung is called silicosis. If the nodules grow too large, breathing becomes difficult and death may result. Silicosis victims are

also at high risk of developing active tuberculosis.

NIOSH recommends that crystalline silica levels not exceed 0.05 mg/m<sup>3</sup> as an eight-hour time-weighted average (TWA). The U.S. Occupational Safety and Health Administration (OSHA) standard is determined by performing a calculation that takes into consideration the percentage of silicon dioxide (SiO<sub>2</sub>) in the sample.

For respirable dust containing quartz, this calculation is as follows:

$$\frac{10 \text{ mg/m}^3}{\% \text{SiO}_2 + 2}$$

For details on sampling crystalline silica, reference the following SKC publications:

### **Chemical Fact Files®**

#### **Silica, Crystalline, Quartz, Respirable Dust**

by OSHA Method ID 142  
**SKC Publication 1003**

#### **Silica, Crystalline by XRD**

by NIOSH 7500  
**SKC Publication 1370**

# Metal Dusts and Fumes

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Metal dusts are produced during furnace charging and the cleaning of castings. Metal fumes are formed by the vaporization of solid metal during melting and pouring processes, followed by oxidation of the vapor and condensation of the oxide. One of the most hazardous metals, found primarily in nonferrous foundries producing leaded bronze, is lead. Industrial lead poisoning can lead to a fragility of the red blood cells, causing them to be destroyed more rapidly in the body. This can lead

to anemia and other damaging effects on organs and tissues in the body.<sup>(3)</sup> Inhalation of zinc oxide fumes and other metals can lead to flu-like symptoms called “metal fume fever.”

OSHA standards require that exposures to (inorganic) lead dusts and fumes be maintained below 0.05 mg/m<sup>3</sup> as an eight-hour TWA. Other metals have individual OSHA Permissible Exposure Limits (PELs).

For details on sampling lead and other metals according to government methods, reference the following SKC publications:

## Chemical Fact Files

### Lead, Inorganic Surface Dusts (as Pb)

by OSHA ID 121

**SKC Publication 1179**

### Lead

by NIOSH 7082, 7105, and 7300

**SKC Publication 1034**

*(These methods are applicable to other metals and metalloids.)*

# Carbon Monoxide

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Carbon monoxide is a very deadly gaseous contaminant commonly found in foundries from furnace combustion processes and the decomposition of sand binder systems and carbonaceous substances. Carbon monoxide can cause asphyxiation by interfering with the oxygen-carrying capacity of blood. OSHA established an eight-hour PEL of 50 ppm for carbon monoxide.

For details on sampling carbon monoxide by OSHA Method ID 209 using a direct-reading instrument, ask for information on SKC equipment: Pac III Datalogging Instrument Cat. No. 805-30011 with software kit Cat. No. 805-300PAC and a carbon monoxide sensor.

## References

- (1) William A. Burgess, *Recognition of Health Hazards in Industry: A Review of Materials and Processes*, 2nd Ed., John Wiley & Sons, New York, 1995, pp 303-317
- (2) *Recommendations for Control of Occupational Safety and Health Hazards: Foundries*, U.S. Dept. of Health and Human Services, September 1995, DHHS (NIOSH), Publication No. 85-116
- (3) N. Irving Sax and Richard J. Lewis Sr., *Hazardous Chemicals Desk Reference*, Van Nostrand Reinhold, New York, 1987, pp 582-583

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