

Respiratory Protection Guidance for Welding Applications

Warnings:

This document is not a substitute for a proper hazard assessment by a trained health and safety professional. According to OSHA regulations, the employer is responsible for the health safety of the worker.

Regulations and Standards

Safety in Welding, Cutting, and Allied Processes	ANSI Z49.1:2012
Respiratory Protection	OSHA 1910.134
Head Protection	ISEA/ANSI Z89
Eye and Face Protection	ISEA/ANSI Z87.1 and OSHA 1910.133

Respiratory Hazards

- Particulates and Fumes from metals such as Cadmium, Manganese, and Chromium
- Gases such as Carbon Monoxide (CO), Ozone, Nitrogen Oxides, Fluoride, and Phosgene

Respiratory Hazard Sources

- Flux, Solder, Electrodes, Metals, Coatings, and Finishes

Respiratory Protection

When engineering and work practices controls are not feasible, while they are being implemented or when they do not reduce exposures below OSHA Permissible Exposure Limits (PELs), employers must provide workers with respirators. Whenever respirators are used, the employer must have a respiratory protection program that meets the requirements of OSHA's Respiratory Protection Standard ([29 CFR 1910.134](#)). This program must include proper respirator selection, fit testing, medical evaluations, and training.

Proper respirator selection includes ensuring the respirator is the appropriate type for the hazard and the appropriate level of protection (Assigned Protection Factor, APF) for the hazard concentration.

- NIOSH approved respirators with HEPA Filtration are appropriate for welding applications with fumes.
- NIOSH approved respirators with Organic Vapor/Acid Gas/HEPA filtration are appropriate for welding applications with certain vapors, gases, and fumes.
- NIOSH approved supplied air respirators are appropriate for welding applications with fumes, gases, and vapors.

Determining the working environment concentrations

In each specific circumstance, air sampling should be performed to determine the appropriate level and type of respiratory protection. One of the most popular resources for this is www.airtesting.com and a list of consultants is available from the American Industrial Hygiene Association (AIHA) at www.consultantslisting.org.

Determining the necessary Assigned Protection Factor (APF)

To calculate the APF required, divide the hazard concentration by the PEL.

$APF = \text{Hazard Concentration} / \text{PEL}$

One must be careful not to use any respirator in environments where the concentration exceeds the Maximum Use Concentration (MUC). Refer to OSHA 1910.134 Table 1 for a complete list of respirator types and their corresponding APFs.

Recent Regulatory Changes that affect Respirator Selection

Hexavalent Chromium

What is the standard change?

In June 2010, the PEL was reduced by 50% from 10 micro grams per cubic meter to 5 micrograms per cubic meter. The NIOSH Recommended Exposure Limit (REL), which many consider to be the best practice limit, is actually 1 microgram per cubic meter.

Where is Hexavalent Chromium found?

- Welding and other types of "hot work" on stainless steel and other metals that contain chromium
- Use of pigments, spray paints and coatings
- Operating chrome plating baths

What are the implications?

When PELs are cut in half the level of respiratory protection required (i.e. the APF) doubles. Therefore, environments with concentrations of 90 micro grams per cubic meter, where a respirator with an APF of 10, such as an N95 mask, was adequate, now require an APF of at least 25 which could be fulfilled by a full face mask air purifying respirator or a loose fitting hood or helmet style respirator (either in SAR or PAPR configuration).

Manganese

What is the proposed standard change?

- In February 2013, the American Council of Government Industrial Hygienists (ACGIH) proposed reducing the Threshold Limit Value (TLV) by ten fold from 0.2 mg/m³ to .02 mg/m³

Where is manganese found?

- Commonly found at varying levels in many welding rods, welding wire, and filler metals, especially for those welding applications in which hardness is desired.

What are the implications?

- For those that follow the TLV, a ten fold reduction means a corresponding ten fold increase in the APF required for the respirator.
- Where an N95 with an APF of 10 used to be appropriate, an APF of 1,000 will be required, making a Supplied Air Respirator or Powered Air Purifying Respirator necessary.

What Respirators Does Bullard Offer for Welding Applications?

Respirator Name	Respirator Type	APF
SparxLift with EVA	Loose Fitting Helmet PAPR	25/1,000
SparxLift SAR	Loose Fitting Helmet SAR	25/1,000
FAMB2 with EVA	½ Mask PAPR	50
FAMB2 SAR	½ Mask SAR	50

Resources:

OSHA Fact Sheet on Controlling Hazard Fume and Gases During Welding
https://www.osha.gov/Publications/OSHA_FS-3647_Welding.pdf

OSHA Fact Sheet on Health Effects of Hexavalent Chromium
https://www.osha.gov/OshDoc/data_General_Facts/hexavalent_chromium.pdf

Sample OSHA Respiratory Protection Program (See Appendix IV)
http://www.osha.gov/Publications/SECG_RPS/secgrev-current.pdf

American Welding Society Safety and Health Fact Sheet on Fumes and Gases
<http://www.aws.org/technical/facts/fact-01.pdf>

Americas:
Bullard
1898 Safety Way
Cynthiana, KY 41031-9303 • USA
Toll-free within USA: 877-BULLARD (285-5273)
Tel: +1-859-234-6616
Fax: +1-859-234-8987

Europe:
Bullard GmbH
Lilienthalstrasse 12
53424 Remagen • Germany
Tel: +49-2642 999980
Fax: +49-2642 9999829

Asia-Pacific:
Bullard Asia Pacific Pte. Ltd.
LHK Building
701, Sims Drive, #04-03
Singapore 387383
Tel: +65-6745-0556
Fax: +65-6745-5176

