

# Welding Applications under the New Hexavalent Chromium Standards

This article was authored by

**CHRISTOPHER J. COLE, MS, CIH, CSP** • Welding Health and Safety Coordinator  
 Automation Division • The Lincoln Electric Company • Cleveland Ohio

**E**mployers are under continuous pressure to: improve quality, increase productivity, provide a safe work environment and control costs! The key to determining the level of effort needed to comply with the new standard is to understand how Occupational Safety and Health Administration ([www.osha.gov](http://www.osha.gov)) has intentionally structured its standard for exposure to hexavalent chromium [CR(VI)].

## What you need to know

*Does the New Standard apply to my welding operations?*

Are you welding on stainless steel, alloy steel, or hardfacing alloys that contain chromium? Is there any surface coating or plating in your shop that contains chromium? Do the consumables you use contain chromium?

If the answer is “yes” to any of these questions, then the standard applies to you.

What is the exposure of each potentially exposed worker?

Before you can determine the requirements that apply to you, you have to determine each employee's exposure level.

You have time to evaluate and plan the best permanent engineering controls for your operations. In the interim, you can use personal protective equipment to protect your employees until May 31, 2010.

Determine the financial burden of not being able to permanently control exposures.

Increased personal protective equipment usage, on-going medical surveillance, and increased sampling costs are direct costs that hit you every year, whereas the cost of engineering controls can be spread out over many years.

Hazard communications and recordkeeping requirements demonstrate your compliance.

Regardless of the level of requirements with which you must comply, you must perform and maintain these requirements properly.

## OSHA's Hexavalent Chromium Standards

There are three standards:

- General Industry 29 CFR 1910.1026.
- Shipyards 29 CFR 1915.1026.
- Construction 29 CFR 1926.1126.

These standards are the same with the exception that the standard for general industry has additional housekeeping and regulated area requirements.

## Exposure Determination

There are two options for determining each employee's potential exposure:

◆ A performance-oriented option based on a company's historical monitoring data or objective data that includes material composition and industry-wide exposure data.

◆ The second option is based on performing scheduled monitoring, in which the frequency of sampling is specified and an incentive is offered to discontinue monitoring, if you demonstrate that an employee's exposure level is below the action limit.

As each employee's exposure has to be determined; there is an incentive to group employees into “similar exposure groups,” for which OSHA specifies the worst case exposure be determined.

For the construction and shipbuilding industries, a task-based exposure assessment might be used to develop exposure classes. Because so many judgments and decisions are based on these “numbers,” it is in an employer's best interest to use a Certified Industrial Hygienist to establish exposure groupings and to characterize employees' exposure.

Professional industrial hygiene monitoring services can be obtained through OSHA's free state consultation service.

This is a service that is run by professional consultants who will work fairly with you. The American Industrial Hygiene Association maintains a "consultants listing" for professional industrial hygiene services. ([www.aiha.org](http://www.aiha.org)).

Alternately, some employers may have sampling provided as part of their worker compensation premium.

### The Regulatory Triggers: Permissible Exposure & Action Limits

OSHA determined that a Cr(VI) Permissible Exposure Limit (PEL) of 5.0 µg/m<sup>3</sup> as an 8-hour time-weighted average (TWA) could be achieved through engineering and work practice controls with <5 percent respirator usage.

The Action Limit (AL) is 2.5 µg/m<sup>3</sup> as an 8-hour time-weighted average.

OSHA considers personal sample results at one half the permissible exposure limit as sufficient to assure an employee's exposure would not exceed the permissible exposure limit on days not sampled. As a performance standard, the permissible exposure limit and action limit trigger the standards' regulatory requirements. Conversely, if you control personal exposures below these triggers, then you do not incur their requirement and cost. (see Table 1.)

### Methods of Control

For welding applications, the primary route of exposure is direct inhalation of the welding fume.

Secondary routes of exposure could occur through surface contamination and poor hygiene. Evaluation of the primary route of exposure is determined by air sampling. Evaluations of the secondary routes of exposure are based upon a qualitative assessment using "reasonable" judgment.

### Engineering & Work Practice Controls

OSHA requires that "Employers ... use engineering and work practice controls as the primary means to reduce and maintain employee exposures to Cr(VI) below the permissible exposure limit" (OSHA Small Entity Compliance Guide for the Hexavalent Chromium Standards, Page 9, OSHA 3320-10N 2006).

Engineering and work practice controls consist of: substitution, isolation, ventilation and work practices.

OSHA believes that 60 percent of the current stainless steel SMAW operations may need to switch to gas metal arc welding (GMAW) as the "cheapest and most effective method" to reduce Cr(VI) exposures (U.S. Department of Labor; OSHA. Occupational Exposure to Hexavalent Chromium, Final Rules, Fed. Reg. 71:10336, February 28, 2006).

There are two cautions here:

One is that welding fume generation is dependent upon more than the consumable used. In fact, the total impact of the welding process, consumable, amperage, shielding gas, and other advanced technology on fume generation needs to be considered.

The second is that one engineering control may not be enough to reduce employee exposure below the permissible exposure limit or below the action limit. In that case, a systems approach to permanent fume control may require not only a reduction in fume generation but also the use of ventilation and complementary work practices.

Depending upon the application, source extraction, local exhaust and general mechanical ventilation can all provide good permanent solutions.

OSHA has determined that ... "local exhaust systems that capture airborne Cr(VI) near its source and remove it from the workplace ... is generally preferred to dilution ventilation because it provides a cleaner and healthier work environment."

The greatest challenge is in construction and ship building where temporary ventilation solutions involve more high-vacuum/low-volume-type systems and require a larger degree of employee involvement to frequently move the ventilation hood (OSHA Small Entity Compliance Guide for the Hexavalent Chromium Standards, Page 9, OSHA 3320-10N 2006).

OSHA recognized that applications such as welding need to be thoroughly investigated to determine the most feasible and practical engineering solutions, so the agency extended the implementation date for adopting new engineering controls until May 31, 2010.

Work practices independent of engineering controls, such as keeping your head out of the fume plume, should be implemented now.

There are two reasons to not put off exploring solutions:

- 1) It will take time to thoroughly explore all of the options.

2) And, there are significant costs now, including hidden productivity costs, associated with not being able to permanently control exposures with engineering controls below the action limit.

**The Regulatory and Financial Burden of Not Permanently Controlling Exposures**

OSHA has determined that “if feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer must use them to reduce the exposure to the lowest level achievable. Respirators must then be used to reduce employee exposure to or below the permissible exposure limit.” Note respirators can be used between now and May 31, 2010, while employers are exploring engineering options (OSHA Small Entity Compliance Guide for the Hexavalent Chromium Standards, Page 10, OSHA 3320-10N 2006).

Increased personal protective equipment costs, hygiene facilities, restricted areas, medical surveillance, ongoing monitoring costs and all of their direct and productivity losses are incurred by not being able to use engineering and work practiced controls to reduce exposures below the action limit.

Whereas the cost of engineering controls can be spread out over years, personal compliance costs hit in the current fiscal year and are incurred per worker year after year.

**Hazard Communications and Recordkeeping Requirements**

Follow the requirements of the Hazard Communication standard; 29CFR 1910.1200, and medical surveillance.

**Table 1. Exposure Monitoring Triggers for:**

No Initial monitoring = Objective or Historic Data < 0.5 µg/ m <sup>3</sup>
No follow-up monitoring = < Action Limit
Monitor every 6 months = > Action Limit < permissible exposure limit
Monitor every 3 months = > Permissible Exposure Limit
Regulated Area = > Permissible Exposure Limit
Exposure Controls = > Permissible Exposure Limit for > 30 days/year
Respirator = > Permissible Exposure Limit and engineering controls not available or adequate
Medical Surveillance = > Action Limit for > 30 days/ year
Housekeeping, Hygiene and Other PPE = Qualitative Assessment
<i>permissible exposure limit = 5 µg/m<sup>3</sup> Action Limit = 2.5 µg/m<sup>3</sup></i>

Regardless of the requirements with which you must comply, you must perform and maintain these standards properly to be able to demonstrate that you are in compliance.

If you come to OSHA’s attention, it will most likely be through the filing of an employee complaint.

**Conclusion**

Determining the “best” welding solution for your application includes consideration of production and quality specifications; process, consumables and procedure choices; and cost constraints, welder skills, infrastructure support as well as other factors.

Inevitably, in making choices and balancing different demands, the “best” solution may not be one overarching solution but rather a set of overlapping solutions.

Contact your welding technical sales representative to help you in this investigation as they can bring expertise and resources to assist you.

Your best solution should not result in less acceptable quality, productivity or worker protection. ■