Hexavalent Chromium: New Exposure Regulation

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Hexavalent chromium (CrVI) compounds are used in a variety of industries where potential exposures may occur. Metal plating, the use of pigments containing CrVI, and chemical synthesis where CrVI is used as a catalyst or as an ingredient can result in worker exposure. Welding on CrVI-participating weld pools can also result in the generation of CrVI. Exposure to CrVI has been shown to be associated with major health effects such as lung cancer, asthma, nasal septum perforation, and nasal and facial ulcers, as well as an agent which can produce allergic and contact dermatitis.

On February 28, 2006, the new OSHA regulation on CrVI went into effect (Final National Exposure Standard to Hexavalent Chromium, 29 CFR Parts 1910.1026). The most current version of the chromium rule was published as a Notice of Proposed Rulemaking (NPRM) in the October 4, 2004 Federal Register. The NPRM proposed three separate standards that cover exposure to CrVI in general industry, construction, and shipyards.

The financial impact of this rule will be quite significant, both from a perspective of capital investment as well as increased costs associated with additional worker training programs and an increase in time it will take to complete tasks working with materials containing chromium. This rule will have a particularly significant impact on the aerospace industry, where chromium-based primers are used extensively.

Overview of the New Regulation

There are several fundamental changes proposed in the new regulation that will affect how occupational exposure to CrVI is managed. First, OSHA dropped the permissible exposure limit (PEL) for 52 to 54 micrograms of CrVI per cubic meter (cm3) of air as an 8 hour time weighted average. However, OSHA conceded that 25 micrograms of CrVI is the lowest level that can be practically reached by employing a combination of engineering and work practice controls, protective clothing, respiratory protection, including exposure control and monitoring, engineering and work practice controls, protective clothing, respiratory protection, and skin monitoring. Housekeeping provisions are exceptionally designed to address.

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Coloimetric Determination of CVI Contamination on Surfaces and Skin

Simple, straightforward, on-the-spot tests that have been developed using coloimetric chemistry to determine CVI contamination on skin and surfaces can be used by employers to assure OSHA compliance and show that employees are not being exposed to CVI.

The surface wipes also are designed to prevent dirt or other dark substances from preventing the user from seeing a color change. The wipes are constructed with a collection matrix that can trap dirt, allowing the target substance to diffuse to the sensor chemical, allowing the user to observe the prespecified easy-to-interpret color change from the opposite side of the wiping surface, irrespective of any dirt or dark substances. To sample for contamination, the wipe is simply moistened with deionized water, wiped across the surface of interest, and in just minutes in the presence of CVI, the color will develop upon application of the developing solution. Figure 1 shows the expected color change when a CVI contaminated wipe is exposed to surface contamination of CVI.

Similarly, skin swabs can be used to determine dermal contamination of CVI. For the skin test, a wetted swipe is wiped
across the skin and the swab is then placed in a micro-
centrifuge tube to which a developing solution is added. The microcentrifuge tube is then placed in a quantitative color comparison chart and the relative mass of CrVI is read directly from the color chart. Figures 2 and 3 show the system and the color comparison between the sample and the color comparison wheel.

Both sampling techniques have been shown to be highly selective with few interferences. They have been tested with various concentrations of aluminum, calcium, cadmium, chromium II, copper, iron, mercury, magnesium, nickel, and lead. The specificity of the CrVI tests was shown to not be affected by these compounds over a relatively high mass range when compared to the detection limits for CrVI.

The wipes and swabs allow the industrial hygienist to quickly and easily evaluate the safety and health programs, assess controls’ effectiveness, determine the effectiveness of cleaning and decontamination procedures, and perform hazard assessments to comply with OSHA’s new CrVI standard. With surface and skin wipes, the industrial hygienist also can monitor non-controlled areas of the working environment and evaluate the effectiveness of gloves and protective garments.

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