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Engineering Controls Not Always Sufficient To Protect Workers From Overexposures

A series of field surveys conducted by the National Institute for Occupational Safety and Health found that, for some workplace processes, exposures to hexavalent chromium below accepted limits may not be achievable without respirator use, according to an article in the August issue of the *Journal of Occupational and Environmental Hygiene*.

The article compiles results from 21 field surveys NIOSH conducted to characterize workers' airborne exposures to hexavalent chromium (CrVI) and to evaluate existing controls for these exposures. The surveys were conducted under an interagency agreement with the Occupational Safety and Health Administration, which recently issued a rule covering CrVI exposure (36 OSHR 173, 3/2/06).

Hexavalent chromium is a respiratory irritant and may cause lung cancer, NIOSH said.

The field surveys included the collection of personal breathing-zone air samples, measurement of ventilation systems, and the documentation of work processes and practices. Air sampling was conducted outside of respirators in order to measure the effectiveness of engineering controls and not the efficacy of personal protective equipment.

Industries, processes, and operations for the field surveys were chosen for their potentially high worker exposures, substantial numbers of employees exposed, and the availability of controls to reduce exposures. Priority was given to areas that had limited existing exposure data.

Specific facilities visited were first contacted by the field research team to determine their suitability. Site selection, NIOSH said, was intended to generally represent specific industries, processes, and operations--not the best or worst cases.

The results, NIOSH said, are a series of case studies and not a statistically representative characterization of all U.S. workplace exposures to CrVI.

Four Categories of Exposure.

After collecting air samples, NIOSH divided the processes and operations into four categories based on NIOSH's recommended exposure limit (REL) for hexavalent chromium:

- Category one, with minimal worker exposures to airborne CrVI.
- Category two, with exposures that are easy to control to the NIOSH limit or already below the limit.
- Category three, with exposures that are moderately difficult to control to the REL.
- Category four, with the most difficult of all exposures to control to the limit.

The REL for hexavalent chromium is 1 microgram per cubic meter of air. However, the institute noted, work is currently being done on an updated criteria document that may include a revised limit.

The permissible exposure limit set by OSHA is 5 micrograms in most situations.

Worst Exposure Results.

At the five processes categorized as level four, the study found that exposures were substantially higher than the REL and existing controls were already providing reasonably substantial reductions in exposures. It was uncertain whether additional controls could have

reduced exposures to the NIOSH REL, the study said.

For example, exposures measured at a hard chromium electroplating site ranged from 3 micrograms to 16 micrograms, despite the use of a number of controls, the study said. A similar situation at two sites that conducted spray painting and resanding of chromate-containing paints was found with exposures as high as 55 micrograms, despite existing controls.

The worst scenario was found during a metalization process in which a chromium-containing alloy was melted, atomized, and sprayed onto the surfaces of industrial boiler heat-exchange tubes being rehabilitated in place within an existing very large boiler. Two airborne samples collected at that site measured more than 820 micrograms and 1,900 micrograms.

NIOSH found the ventilation at this operation inadequate, the study said, but even more effective ventilation would still require highly protective respirators.

Other Exposures.

Of the six operations placed in category three, four involved welders, one involved metal cutting in ship demolition, and one involved weighing chromate-containing inks for screen printing.

The highest airborne measurement in this category was 27 micrograms, however, the study noted, ventilation was poor, particularly for the welders. Additionally, the study said, at the shipyard, more complete removal of paints before metal cutting could have reduced exposures.

Seven operations were placed in category two, including refractor brick and chromium sulfate manufacturers and two welders. Exposures in this category ranged from 0.04 micrograms to 1.8 micrograms. The exposures found among category two sites should be easily controllable with effective ventilation, the study concluded.

The rest of the operations were placed in category one because of minimal worker exposures. The category one operations included several full-shift exposures that were below the detectable level, the study said. Such operations included chromium coating processes, some welding, precast concrete manufacturing, and foundry tasks.

The study noted that the results are the concentrations measured during the actual sampling periods and have not been mathematically converted to eight-hour time-weighted averages that the NIOSH and OSHA limits are based on. Consequently, comparisons with exposure criteria are only approximate.

Exposure Level Attainable for Most.

The study concluded that, for most operations, workplace exposures to hexavalent chromium at or below the NIOSH limit are achievable.

"However, for some processes, it is unclear whether controlling exposures to this range is consistently achievable without respirator use," the study added. Among the most difficult processes to control could be some applications of coatings and finishes.

Moderately difficult to control operations, the study said, primarily involve joining and cutting metals with high chromium content.

"Nonetheless," the study added, "exposures in a wide variety of other processes were judged more easily controllable to the current REL or below, or were found to be minimal" Some of these more easily controlled exposures, the study said, include operations similar to those in the higher categories, but with different operating parameters.

An abstract of the study, "Hexavalent Chromium Exposures and Exposure-Control Technologies in American Enterprise: Results of a NIOSH Field Research Study," is available at <http://oeh.informaworld.com/soeh/content~content=a779671523~db=all~order=page>.

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