

Enforcement Procedures for Occupational Exposure to Chromium (VI)

Purpose: This instruction provides uniform inspection procedures and guidelines to be followed when conducting inspections and issuing citations for workers potentially exposed to Chromium (VI) in general industry and construction.

Scope: This instruction applies MN-OSHA-wide. Exposure to chromium (VI) is covered by separate standards; 1910.1026 and 1926.1126.

This Directive provides policy and guidance for enforcement of the construction and general industry Cr(VI) standards.. The current Cr(VI) standards have a permissible exposure limit (PEL) of 5 $\mu\text{g}/\text{m}^3$ and an action level of 2.5 $\mu\text{g}/\text{m}^3$.

References: Federal OSHA Instruction CPL 2-2.74, "Inspection Procedures for the Chromium (VI) Standard," issued January 24, 2008

OSHA Website, Booklet 3373-10 "Hexavalent Chromium," issued 2009,
<http://www.osha.gov/Publications/OSHA-3373-hexavalent-chromium.pdf>

Federal OSHA Instruction CPL 2-2.76, "National Emphasis Program- Hexavalent Chromium," issued February 23, 2010

Federal OSHA Interpretation "Clarification of the Chromium (VI) Standard- Change Rooms and Hygiene Practices," issued September 2, 2011 and other related interpretations

Federal Register, Occupational Exposure to Hexavalent Chromium - 71:10099-10385
OSHA Website, OSHA Safety and Health Topics: Hexavalent Chromium,
<http://www.osha.gov/SLTC/hexavalentchromium/index.html>.

Cancellations: This instruction cancels CPL 2-2.60, dated September 23, 2009.

Background: The current Chromium (VI) standards which went fully in effect on May 31, 2010 for all employers, 29 CFR 1910.1026, 29 CFR 1926.1126, and 29 CFR 1915.1026, have lowered the permissible exposure limit (PEL) by a factor of ten to 5 micrograms of Cr(VI) per cubic meter of air (5 $\mu\text{g}/\text{m}^3$) as an 8-hour time-weighted average (TWA). In addition, the standards establish an action level for airborne concentrations of Cr (VI) at 2.5 $\mu\text{g}/\text{m}^3$.

Prior to the issuance of these three substance-specific standards, enforcement of occupational exposures to hexavalent chromium was based on three general Air Contaminants standards, 29 CFR 1910.1000 Air Contaminants, 29 CFR 1915.1000 Air Contaminants, and 29 CFR 1926.55 Gases, Vapors, Fumes, Dusts, and Mists. Each of these standards formerly listed a PEL for airborne chromic acid and chromates, i.e., various chemical compounds containing hexavalent chromium trioxide or CrO_3 , and all three standards formerly listed this PEL as 100 $\mu\text{g}/\text{m}^3$ of CrO_3 , which is chemically equivalent to 52 $\mu\text{g}/\text{m}^3$ of hexavalent chromium. The PEL for chromic acid and chromates in the general industry standard was a ceiling limit, while the PEL in the construction and shipyard standards was an 8-hour TWA. These three Air Contaminants standards also formerly listed a ceiling PEL for airborne tert-Butyl chromate, an organic Cr(VI) compound, as 100 $\mu\text{g}/\text{m}^3$ of CrO_3 . All these Cr(VI) entries in the Air Contaminants standards have now been changed (by the Final Rule for Hexavalent Chromium) to reference the new applicable Cr(VI) standards, with footnotes to indicate that the formerly listed PELs still apply to any operations or sectors for which the new Cr(VI) standards are stayed or otherwise not in effect. (See 71 FR 10099-10385, Feb. 28, 2006, and 71 FR 36008-36010, June 23, 2006.)

Settlement Agreements (Federal):

- A. On October 25, 2006, federal OSHA settled with the Surface Finishing Industry Council (SFIC), resulting in special enforcement policies and procedures for participant electroplating facilities in Federal states. States are encouraged to honor and implement the terms of the SFIC Settlement Agreement, including the standard's amendment, or to enter into separate arrangements with surface- and metal-finishing job shops (or their representatives) in their jurisdiction. No electroplating facilities opted into this program in Minnesota.
- B. On April 6, 2007, OSHA settled with the Building and Construction Trades Department (BCTD), AFL-CIO, Laborers' International Union of North America, and International Brotherhood of Teamsters, resulting in special enforcement procedures for construction site inspections where employees are exposed to portland cement.
- C. On May 21, 2007, OSHA settled with the National Association of Manufacturers (NAM) and the Specialty Steel Industry of North America 6 (SSINA). The NAM Settlement Agreement resulted in a letter of interpretation concerning, among other issues, the feasibility of implementing engineering controls for welding on stainless steel inside confined and enclosed spaces. (State interpretations are expected to be at least as effective as the Federal letter of interpretation.)

ACTION:

- A. Training for MNOSHA Personnel: For all inspections on a site where Cr(VI) exposures are expected, OSHIs are expected to be knowledgeable of:
 - 1. Potential hazards which may be encountered at the site, including the potential hazards of Cr(VI), including skin irritation and lung cancer.
 - 2. Contents of the Cr(VI) standards and this Directive.
 - 3. Appropriate PPE to be worn. Each OSHI who will be expected to use PPE shall be trained in the proper care, use, and limitations of the PPE. Use of respiratory protection by OSHIs and other Agency personnel is addressed in the *MNOSHA Field Safety and Health Manual – Chapter 4*.
 - 4. Emergency procedures.
 - 5. Disposal of Cr(VI) waste generated by the OSHI, housekeeping practices, and hygiene provisions.

B. Medical Examinations for OSHA Personnel

Many of the hazards that OSHIs may encounter are specifically addressed by the medical surveillance requirements in OSHA standards. In accordance with MNOSHA personnel policy in the *MNOSHA Field Safety and Health Manual – Chapter 6*, the OMT Director is responsible for implementing a medical examination program for employees with duties of OSHIs.

The *MNOSHA Field Safety and Health Manual – Chapter 4*, includes medical evaluation requirements for MNOSHA personnel required to wear respiratory protection. The instruction requires that OSHIs be medically evaluated and found eligible to wear the respirator selected for their use prior to fit testing and first-time use of the respirator in the workplace.

C. Protection of OSHA Personnel

OSHIs are reminded to use appropriate personal protective equipment when they are exposed to a hazard. OSHIs shall not enter a Cr(VI)-regulated area, or other area where exposures are likely to exceed the PEL, unless it is absolutely necessary. For inspection and air sampling activities, remote operations are encouraged when practical.

1. Personal Protective Equipment (PPE).

The Respirator Program Coordinator shall ensure that appropriate PPE is available for OSHIs.

- a. OSHIs shall wear appropriate respiratory protection when entering a Cr(VI)-regulated area, or other area where exposures are likely to exceed the PEL.

In many cases, an OSHI may find that an employer's exposure determination is inadequate or has not been performed at all, so professional judgment may be needed in anticipating exposure during a brief entry into a regulated area for inspection. OSHIs shall comply with the *MNOSHA Field Safety and Health Manual – Chapter 4*, as it may require the use of respiratory protection during even brief entries into Cr(VI)-regulated areas (or any other areas with carcinogenic or acute inhalation hazards).

Respirators shall be selected in accordance with the respirator selection procedures in the *MNOSHA Field Safety and Health Manual – Chapter 4*. Respirators shall also meet OSHA's assigned protection factors (APFs), as set forth in 1910.134.

- b. Besides respiratory protection, OSHIs shall wear appropriate protective work clothing and equipment as needed to avoid skin and eye contact from Cr(VI) compounds. Such clothing and equipment may include disposable coveralls with hood, foot coverings or boots, gloves, safety goggles and/or face shield.
- c. Whenever handling Cr(VI) materials, such as when collecting wipe or bulk samples, OSHIs shall wear PVC or nitrile gloves with sufficient chemical resistivity and degradation resistance as per the manufacturer's performance specifications. Do not wear powdered gloves. Additionally, if 1% NaOH-coated, binderless quartz fiber filters are used for wipe sampling, gloves must provide sufficient protection from the caustic NaOH coatings on the filters.

2. OSHI Exposure Determination.

The OMT Director shall ensure that Cr(VI) exposure determinations, in accordance with the provisions of 29 CFR 1910.1026(d), are made for OSHIs who may be required to enter regulated areas for significant durations or who may otherwise be significantly exposed or potentially significantly exposed to Cr(VI) during worksite inspections or sampling activities.

3. Cleaning, Hygiene, and Waste Disposal.

Prior to site entry, OSHIs shall determine if hygiene facilities and disposal containers exist, whether they are adequate for the expected conditions at the site, and if they will be available for the OSHI's use.

- a. When an OSHI enters areas at a worksite where skin or eye contact with Cr(VI) compounds is likely, the OSHI shall use the employer's change rooms, washing facilities, and disposal containers for donning, doffing, and disposing of protective clothing and removing Cr(VI) from the skin.
- b. If washing facilities are nonexistent, inadequate, or not available for use, the OSHI shall determine if adequate hygiene can be provided. If it is determined that cleaning and hygiene cannot be adequately provided, a supervisor shall be contacted for guidance.

D. Air, Bulk, and Wipe Sampling Procedures

Air, wipe, and bulk samples should be shipped overnight to the assigned analytical laboratory. Studies show the loss for a welding fume sample exceeded 10% after 7 days, showing that the samples should be shipped by overnight delivery service to the analytical laboratory within 24 hours of sampling, and that they must be analyzed within 8 days of collection. For plating operations sampling, the loss began after five days and should be analyzed within 6 days of collection. The assigned analytical laboratory should be contacted when sampling chrome plating operations for the appropriate media. Bulk samples shall be shipped to the analytical laboratory separately from wipe or air samples.

1. Air Sampling Procedures.

Unfortunately, there are no colorimetric detector tubes or any other simple devices to quickly and inexpensively screen for airborne Cr(VI). For conventional air sampling and laboratory analysis, OSHA Analytical Method OSHA ID-215 is specifically designed for hexavalent chromium. This method was revised in April 2006 to improve its accuracy and is listed as OSHA ID-215 (version 2). This method samples air through a 37-mm diameter polyvinyl chloride (PVC) filter (5- μ m pore size) contained in a polystyrene cassette.

Air samples from chromium electroplating operations should be collected using a binderless quartz fiber filter coated with sodium hydroxide (NaOHqz), and contained in a 37-mm diameter polystyrene cassette. This NaOHqz media should only be used for sampling at plating operations. Alternatively, PVC filters with cellulose back-up pads in polystyrene cassettes can be used to sample chromium plating operations but these samples require special treatment after receipt at the analytical laboratory. For plating operations, the coated quartz fiber filters are preferred over the PVC filters for sample stability.

For any air sampling performed by OSHIs, if they must enter a regulated area or other areas where anticipated exposures are above the PEL or expect to have contact with Cr(VI), they shall wear the personal protective equipment and clothing required by the employer or as appropriate for the OSHI's inspection or sampling activity. Since OSHIs have no instrumental method for screening airborne concentrations of Cr(VI), they should be conservative about time spent in areas where high concentrations exist or are suspected. Still, when OSHIs are sampling employee exposures, they should frequent the work areas often enough to keep the sampling under surveillance. Also, see Section C for specific policies and precautions to minimize exposures of OSHA personnel.

2. Wipe and Bulk Sampling Procedures.

For wipe samples, use a 37-mm diameter polyvinyl chloride (PVC) filter to carefully wipe all removable dust from the surface being tested within an area of approximately 100 cm². The filters can be removed from a cassette or ordered directly from the lab. Carefully fold the wipe sample with the exposed side in, and then place the folded wipe inside a 20-ml vial. Depending on the media selected, the sample vials may need to be pre-loaded by the laboratory with extraction reagent (mainly for chrome plating operations). If wipe samples are not pretreated or not immediately digested with prescribed buffering solutions, then significant errors may occur due to interferences and the high reduction potential of Cr(VI). Complete wipe sampling procedures may be found through the SLTC CSI. OSHA Analytical Method W4001 is specifically designed for wipe sampling and analysis for hexavalent chromium.

Bulk samples may be collected for a variety of reasons, such as to determine the presence of Cr(VI) in paint removed by abrasive blasting, to determine the presence of Cr(VI) in waste or debris, or to confirm a suspicion that a product's material safety data sheet is not accurate concerning the presence of a Cr(VI)-containing ingredient. Cr(VI) bulk sampling procedures may be found within the original method OSHA ID-215 (June, 1998), which is still posted on the OSHA website because the bulk sampling procedures were not included within the revised method OSHA ID-215 (April, 2006).

Wipe and bulk samples collected for laboratory analysis are to be placed in 20-ml glass scintillation vials, one for each sample. Bulk solid samples should be approximately 20 grams in weight. Bulk liquid samples should be approximately 20 milliliters in volume. Note that quantities are approximate, so bulk or liquid samples placed in 20-ml glass vials do not need to be filled to the brim. Send samples to the lab under contract for analysis.

Whenever handling Cr(VI) materials, such as when collecting wipe or bulk samples, OSHIs shall wear protective gloves. For many Cr(VI) compounds, nitrile or polyvinyl chloride (PVC) gloves will provide sufficient protection, but it is suggested to first check the MSDS for the compound, if available, or check the glove manufacturer's performance specifications. Do not wear powdered gloves.

E. Inspection Procedures for the Chromium (VI) Standards

This section of the directive works in conjunction with the general industry Cr(VI) standard (1910.1026). As an example, Section E (4) of this directive and 1910.1026 (d) focus on the Exposure Determination.

1. Scope.

Industries/Operations:

See Appendix A for examples of Cr(VI) compounds and typical industries/operations with Cr(VI) exposures.

Health Effects:

Based on the best available evidence in the agency's record on Cr(VI), Federal OSHA determined that workers who breathe hexavalent chromium compounds at their jobs for many years may be at increased risk of developing lung cancer. OSHA considers all Cr(VI) compounds to be carcinogenic. In addition to lung cancer, Cr(VI) is also capable of causing airway sensitization or asthma, nasal ulcerations and septum perforations.

Prolonged skin contact can result in dermatitis and skin ulcers. Some workers develop an allergic sensitization to chromium. In sensitized workers, contact with even small amounts can cause a serious skin rash.

Exclusions:

There are certain exclusions from these standards. (See Appendix B of this Directive for more information on these excluded work operations.)

- a. These standards do not apply to exposures to Cr(VI) in the application of pesticides for wood treatment, such as chromated copper arsenate (CCA) and acid copper chromate (ACC). Application of pesticides is instead regulated by the Environmental Protection Agency (program administered by the Minnesota Pollution Control Agency). These standards do apply where Cr(VI) exposures occur either in the manufacture of Cr(VI) pesticides or while using or otherwise handling wood products treated with Cr(VI) pesticides. These standards would also apply to employees working adjacent to or inside work areas where Cr(VI) pesticides are being or have recently been applied.
- b. These standards exclude all exposures to Cr(VI) in portland cement. The Air Contaminants standards already list a PEL for portland cement that effectively limits Cr(VI) exposures from Cr(VI)-contaminated cement to levels below the new Cr(VI) PEL.

Whenever performing an inspection where there are exposures to portland cement, the OSHI shall determine the employer's compliance with the applicable existing standards for air contaminants, personal protective equipment, general hygiene, and training. (See Appendix B, Section B-1)

- c. These standards do not apply where the employer has objective data demonstrating that a material containing chromium or a specific process, operation, or activity involving chromium cannot release dusts, fumes, or mists of Cr(VI) in 8-hour TWA concentrations at or above $0.5 \mu\text{g}/\text{m}^3$ under any expected conditions of use. When this provision applies, the material, process, operation, or activity shown not to result in Cr(VI) exposures above the $0.5 \mu\text{g}/\text{m}^3$ threshold falls outside the scope of the Chromium (VI) standards. This exemption from the scope of the standard is based on total Cr(VI) exposures from all sources, and must take into account all conditions that may add or contribute to the employees' overall exposure levels. See Appendix B, Section B-3.

OSHIs presented with an employer claiming exclusion from the standard on the basis of objective data shall determine sufficiency by evaluating whether the data meet the standard's three key requirements:

- i. First, the data must demonstrate that a material containing chromium or a specific process, operation, or activity involving chromium cannot release dusts, fumes, or mists of Cr(VI) in 8-hour TWA concentrations at or above $0.5 \mu\text{g}/\text{m}^3$ under any expected conditions of use. When using the phrase "any expected conditions of use" OSHA is referring to situations that can reasonably be foreseen. For instance, variation in exposures even in well controlled workplaces requires that typical exposures be below $0.25 \mu\text{g}/\text{m}^3$ in order for an employer to be reasonably sure that exposures will consistently be below $0.5 \mu\text{g}/\text{m}^3$. An industry survey showing typical exposures below $0.25 \mu\text{g}/\text{m}^3$ might be

used to show that exposures for a given operation would be below 0.5 $\mu\text{g}/\text{m}^3$ under any expected conditions of use.

- ii. Second, the data must reflect workplace conditions closely resembling the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

For example, if an employer's objective data indicate that a Cr(VI) welding process that uses argon as an inert shielding gas does not release Cr(VI) in concentrations exceeding 0.5 $\mu\text{g}/\text{m}^3$, but the OSHI finds that the employer's current welding process uses carbon dioxide as the shielding gas (which is known to produce far higher amounts of welding fume), then this requirement is not met.

- iii. Third, the data must be sufficient to *accurately characterize* employee exposures to Cr(VI), that is, the data must provide the same degree of assurance that employee exposures have been correctly characterized as air monitoring would.

When the OSHI determines that an employer's objective data meet the above requirements and appear sufficient to support its determination that the facility and/or construction operation is exempt from the Cr(VI) standard, the OSHI is not required to collect any air samples to confirm the objective data.

If the OSHI determines that the employer's objective data fail to meet any of the above requirements, then air sampling shall be performed to evaluate Cr(VI) exposures. If air sample results identify Cr(VI) exposures, then the OSHI shall cite, at a minimum, a violation of (d)(3) because the employer's objective data were not "sufficient to accurately characterize employee exposure to Cr(VI)." Additional violations may be citable, depending on what level of Cr(VI) exposure is found. See Sections E (3) and (4), below, for further inspection and citation guidelines for air sampling and exposure determinations.

2. Definitions.

- a. "Chromium (VI) [hexavalent chromium or Cr(VI)]" means chromium with a valence of positive six, in any form or chemical compound in which it occurs. This term includes Cr(VI) in all states of matter, in any solution or other mixture, even if encapsulated by other substances. The term also includes Cr(VI) created by an industrial process, such as when welding of stainless steel generates Cr(VI) fume. See Appendix A for examples of Cr(VI) compounds and typical industries/operations with Cr(VI) exposures.
- b. All other definitions in the standards are for terms previously used by OSHA in its other health standards, and the terms are similarly defined and used in the new Cr(VI) standards. See the standard for these terms including "action level," "emergency," "employee exposure," "high-efficiency particulate air (HEPA) filter," "historical monitoring data," "objective data," "regulated area," and "housekeeping." These last two terms, "regulated area," and "housekeeping," are only found in the general industry Cr(VI) standard, as they are not defined or used in the construction or shipyards Cr(VI) standards.

3. Permissible Exposure Limit (PEL).
 - a. Paragraph (c) of the standards establishes an 8-hour TWA permissible exposure limit of $5 \mu\text{g}/\text{m}^3$. The new limit applies to Cr(VI), in contrast to the previous PEL, which was measured as CrO₃.
 - b. Inspection Guidelines. The OSHI shall review the employer's air monitoring records, or other data used by the employer to characterize exposures, to determine what levels might be expected before entering the work area. If review of the employer's air monitoring records shows that overexposures have occurred, then the OSHI shall document these overexposures by obtaining copies of the employer's exposure data, plus any related attachments or separate documents, such as laboratory analytical results or chain of custody sample forms, and place them into the case file.

If the OSHI believes that the employer's exposure data may not be representative (i.e., new or different operations are occurring in the workplace that do not closely resemble the operations represented by the employer's exposure data), or if there is no exposure data, and operations may be likely to exceed the PEL, the OSHI shall collect personal samples to measure the 8-hour TWA for one or more of the Cr(VI) operations likely to exceed the PEL. A violation is established if the measured exposure exceeds the PEL after applying corrections for possible sampling and analytical error (SAE) and applying a 95 percent confidence limit (refer to SAE instructions in the OTM, TED 01-00-015). The OSHI shall document Cr(VI) exposures by ensuring that all available exposure data – whether provided by the employer or obtained during the inspection – are copied to the case file.

See Section D for air sampling procedures.

- i. Since welders represent nearly half of the employees covered by the new Cr(VI) standards, the OSHI may often have to develop an air sampling strategy for welding operations where Cr(VI) exposures are expected. The OSHI shall assess the expected contaminants from the operation to be sampled. Cr(VI) can be specifically air sampled and analyzed using method OSHA ID-215, as mentioned above.

Welding fumes can be air sampled and analyzed using OSHA ID-125G, however, this method does not distinguish the different valence forms of chromium, such as Cr(VI), in the sampled fume; all forms will simply be identified as chromium metal so the results cannot be used to cite for overexposure to Cr(VI). However, this method is useful in that with one sample it can distinguish multiple metal elements in the fume, such as iron, lead, and aluminum.

For some workplace exposures involving welding, it may be useful to use the pre-weighed cassettes that will measure Cr(VI) and welding fumes in one cassette.

When collecting an air sample on a welder wearing a protective helmet, the sampling cassette shall be positioned inside the helmet. If the free space inside the hood precludes the use of a 37-mm diameter cassette and filter, 25-mm diameter sampling filters and cassettes can be used instead (using OSHA ID-125G and/or OSHA ID-215). In some cases, a welder's helmet may be integrated into a respirator, such as a hooded, powered air purifying respirator (PAPR). If this is the case, the sampling cassette shall be positioned outside the helmet and respirator assembly.

Note: When placing a sampling cassette for monitoring *abrasive blasting* exposures where an employee is wearing an abrasive blast respirator with hood/helmet, the cassette shall be placed outside of the helmet/hood, i.e., outside the abrasive blasting shroud, but as near as practicable to the employee's breathing zone.

If an air sampling filter becomes overloaded with dusts or other air contaminants while sampling, the result will not be valid. To avoid this situation where high loading of the filter is likely (such as when sampling abrasive blasting or paint grinding operations), the OSHI should conduct the exposure monitoring using consecutive air samples over shorter sampling periods.

Note: When OSHIs air sample "dusty" operations, such as abrasive blasting, paint grinding, or welding, they should periodically inspect their sampling apparatus. If a sampling pump begins to sound different because of heavy loading of the filter, or if the filter appears fully brown or gray with particulates, then the sampling cassette should be replaced. Such overloading may occur in as short a time as 30 minutes for blasting operations, or within a few hours for some types of welding operations, such as shielded metal arc welding (SMAW or "stick" welding).

If welding exposures are due to multiple maintenance and repair jobs throughout a worksite, and the employee during a typical work shift performs several welding tasks at different locations on different materials under different conditions, then a representative exposure determination is more complex. The employer or OSHI may choose to perform monitoring by collecting a short-term (grab) sample for each welding task performed throughout the day, and then adding these measurements to determine the 8-hour TWA exposure (NIOSH *Occupational Exposure Sampling Strategy Manual*, 1977).

The OSHI collecting short-term air samples for Cr(VI) using OSHA ID-215 should run each sample a minimum of 15 minutes, or ideally 30 minutes, nominally at 2 liters per minute for a sample volume of 30 to 60 liters. A volume of 30 liters results in an analytical reporting limit of one-tenth of the PEL, while a 60 liter volume provides a reporting limit of one-twentieth of the PEL.

There are many different factors and different types of welding that will affect the exposure to hexavalent chromium. See [Appendix A](#) for a description of these factors and a brief overview of a few of the main types of welding.

- ii. At times, air sampling for Cr(VI) exposures may involve two or more chemicals with potential health effects to similar target organs, e.g., welding stainless steel, cutting structures coated with lead chromate paint, or cutting pressure-treated wood. If two or more chemical exposures are present potentially causing similar effects to the same target organ(s), samples for both chemicals should be collected.

Thus, if an exposure to a chemical mixture is found that includes Cr(VI) and another toxic chemical, and the substances have known additive effects to one or more target organs, the OSHI shall apply the mixture formula in 1910.1000(d)(2). (Note that the mixture formula is not in 1926.55.) The discussion in the MNOSHA Instruction STD 1-4.1, for handling additive effects using the mixture calculation shall be followed.

For further information on operations involving lead chromate, see Section F (1). For further information on operations involving pesticides containing arsenic and Cr(VI), see Section F (2). OSHIs are instructed to **not** apply the mixture formula in 1910.1000(d)(2)(i) to mixed exposures of lead and Cr(VI) or to mixed exposures of arsenic and Cr(VI).

- iii. If the employer has air monitoring data showing either a Cr(VI) or chromate exposure exceeding the PEL, and the employer was not adequately protecting the employees with all feasible engineering and work practice controls and appropriate use of respiratory protection, but it is not practical for the OSHI to collect air sample(s) to confirm the overexposure (such as upon arrival on site after Cr(VI) exposures occurred during prior construction operations or non-routine tasks), the employer's data may be used to support a violation of the PEL. That violation shall be grouped with any violations of applicable exposure control provisions.

- c. Citation Guidelines. Citations for violations of the PEL shall be issued as follows:

If samples collected on or after May 31, 2010, show that employees are exposed to Cr(VI) over the PEL of $5 \mu\text{g}/\text{m}^3$, and if the employer has instituted all feasible work practice and engineering controls and employees are adequately protected by an effective respiratory protection program, then no PEL violation shall be cited. However, if any deficiencies are found the OSHI shall cite the overexposure as a violation of 1910.1026(c), or 1926.1126(c), as applicable, plus whatever deficiencies are found in any requirements for engineering and work practice controls or respiratory protection, following the citation procedures for combining and grouping violations in MNOSHA Instruction STD 1-4.1

When employees are overexposed to both Cr(VI) and any other air contaminant(s), cite each PEL violation, and propose separate penalties for each citation.

Additionally, where the mixture formula is used and the calculation exceeds unity (i.e., 1.0) but exposures to the individual components do not exceed their PELs, cite only for a violation of 1910.1000(d)(2)(i). Employers shall control such mixed exposures using feasible administrative or engineering controls, or protective equipment, as per 1910.1000(e).

4. Exposure Determination.

- a. Paragraphs (d) of the standards require employers to assess their employees' exposures to Cr(VI). The purposes of requiring an assessment of employee exposures to Cr(VI) include: determination of the extent and degree of exposure at the worksite; identification and prevention of employee overexposure; identification of the sources of exposure to Cr(VI); collection of exposure data so that the employer can select the proper control methods to be used; and evaluation of the effectiveness of those selected methods.
- b. Paragraphs (d)(2) and (d)(3) provide two options for employers to follow in determining employee exposures to Cr(VI). The first option, in paragraph (d)(2), the "scheduled monitoring option," requires initial monitoring and periodic monitoring at specific intervals based on monitoring results. This approach is similar to exposure assessment requirements in previous OSHA substance-specific standards. The second option, in paragraph (d)(3), the "performance-oriented option," allows employers to use any combination of air monitoring data, historical monitoring data, or objective data to determine employee exposures to Cr(VI).

- i. If initial monitoring measures exposures below the action level of 2.5 $\mu\text{g}/\text{m}^3$, the employer may discontinue monitoring for employees represented by that initial determination. If exposures are at or above the action level, the employer shall perform periodic monitoring every six months. If exposures are above the PEL, the employer shall perform periodic monitoring at least every three months.

If periodic monitoring determines that employee exposures drop below the action level, and the result is confirmed by another monitoring at least seven days later, the employer may discontinue the monitoring of employees represented by those determinations.

If there are any changes in the production process, raw materials, equipment, personnel, work practices, or control methods that may be reasonably expected to result in new or additional Cr(VI) exposures, or when the employer has any reason to believe that new or additional exposures have occurred, then the employer shall perform additional exposure monitoring.

- ii. The performance-oriented option allows the employer to determine the 8-hour TWA exposure for each employee on the basis of any combination of air monitoring data, historical monitoring data, or objective data sufficient to accurately characterize Cr(VI) exposures. The employer's exposure determination must provide the same degree of assurance that employee exposures have been correctly characterized as air monitoring would.

For example, historical monitoring data obtained 18 or more months prior to the effective date of the standards could be used to determine employee exposures, but only if the employer is able to demonstrate that the data were obtained during work operations conducted under workplace conditions closely resembling the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations, and that the monitoring satisfies all other requirements of this standard, including the accuracy and confidence requirements. OSHA's intent is to allow employers flexibility

in methods used to determine employee exposures to Cr(VI), but also to ensure that the methods used are accurate in characterizing employee exposures.

If the historical or objective data include air monitoring samples measuring employee exposures to chromates (CrO_3), it may be possible for the employer to derive exposures to hexavalent chromium, since this is the valence (VI) of the chromium metal (Cr) in all chromate compounds. The derivation is made by performing a straightforward calculation on the CrO_3 analytical result. Simply divide the CrO_3 result by the ratio of molecular weights (i.e., gravimetric ratio) between CrO_3 and Cr, or by 1.923.

For example, an employer may have historical or objective air monitoring data that measured exposures while a representative employee painted with a chromate compound. These data were obtained using OSHA Method ID-103 (which has since been superseded by SLTC with OSHA Method ID-215) to sample and analyze for chromates, and the reported analytical result was $30 \mu\text{g}/\text{m}^3 \text{CrO}_3$, well below the former PEL of $100 \mu\text{g}/\text{m}^3$ for chromates in 1910.1000, Table Z-2.

If this employer now uses these same historical or objective air monitoring data as part of the exposure determination under the new Cr(VI) standard, the measured chromate result of $30 \mu\text{g}/\text{m}^3$ may be used. To do this the original air sampling result must be converted to an equivalent exposure for hexavalent chromium by dividing the chromate result by 1.923 to derive a Cr(VI) exposure of $15.6 \mu\text{g}/\text{m}^3$. This derived exposure now represents a Cr(VI) overexposure compared to the new PEL of $5 \mu\text{g}/\text{m}^3$ for Cr(VI).

In order to convert any monitoring data in this manner, the employer must ensure that the original sampling and analysis method meets the accuracy requirements of the new Cr(VI) standards (+/- 25%, at a confidence level of 95%, as per paragraph (d)(5) of the standards). OSHA Method ID-103 for chromates meets this accuracy requirement.

In another example, an employer may have historical or objective air monitoring data that measured exposures while a representative employee welded stainless steel on an assembly line. These data were obtained using OSHA Method ID-125G to sample and analyze for welding fumes with a resulting total chromium exposure of $2 \mu\text{g}/\text{m}^3$. The employer may use the original analytical result for total chromium of $2 \mu\text{g}/\text{m}^3$ (still representing a worst-case measure of Cr(VI)), which turns out to be below the action level ($2.5 \mu\text{g}/\text{m}^3$) of the new Cr(VI) standards.

- iii. Inspection Guidelines. The OSHI shall review the employer's monitoring data or other data used by the employer to characterize Cr(VI) exposures. The OSHI must determine whether employers have accurately characterized the exposure of each employee to Cr(VI). In cases where the employer uses air monitoring for exposure determinations, this may entail monitoring of all exposed employees. However, representative exposure sampling is permitted when a number of employees perform essentially the same job under the same conditions.

The OSHI shall review the time periods for the samples collected, and interview employees to determine whether the sample times were representative of the work hours and whether samples were collected in the employee's breathing zone.

The 8-hour TWA exposure is generally best measured by collecting at least one 8-hour air sample from the representative employee, or by collecting two consecutive 4-hour samples. Although it is preferable to sample between 7 and 8 hours of exposure, if an employee's Cr(VI) exposure is known to be limited to a small portion of the 8-hour work shift, the employer may determine exposure by sampling only during the exposure period and documenting that there was no additional Cr(VI) exposure during the remainder of the employee's work shift.

Alternatively, for any unsampled exposure time (for example, if 7 hours were sampled and 1 hour was unsampled), the employer may assume the same exposure measured by the sampled period also occurred during the unsampled period.

If the OSHI determines that the employer's assessment of an employee's full shift exposure is inadequate because of insufficient sampling time and/or insufficient documentation, then a violation of the exposure determination provision shall be cited.

Whether an employer used the scheduled monitoring option or the performance-oriented option, the OSHI shall verify that the employer has performed a new exposure assessment required by (d)(2)(vi) "when there has been any change in production process, raw materials, ... or control methods that may result in new or additional exposures." This provision also requires the employer to make a new exposure assessment when an employee performs a different operation and/or moves to a different work location unless the original determination considered these changes. The original determination can specify production variables over ranges of anticipated operation for which the determination is valid (NIOSH *Occupational Exposure Sampling Strategy Manual*, 1977).

- iv. Citation Guidelines. If no initial or historic monitoring records exist and the employer does not have objective monitoring data, and employees are exposed to Cr(VI), cite 1910.1026(d)(1) or 1926.1126(d)(1), as applicable.

If the employer is using the scheduled monitoring option, but all samples are area (environmental) samples and not personal samples, or if the employer's personal air samples do not cover the entire Cr(VI)-exposure period or all tasks (without documentation that this is the employee's only exposure to hexavalent chromium), or if the employer's samples are not representative of employees in each work area, (d)(2)(i) shall be cited.

If the employer states that it is using the scheduled monitoring option, but there is no periodic monitoring being performed, (d)(2)(iii) or (d)(2)(iv) shall be cited, as applicable.

If there has been a change in the workplace that could result in new or additional Cr(VI) exposures, and the employer has not performed additional exposure determinations, (d)(2)(vi) shall be cited for employers

using the scheduled monitoring option, or (d)(3) shall be cited for employers using the performance-oriented option.

If the employer is using the performance-oriented option and the OSHI determines that significant differences exist between the historic or objective data and current conditions which could cause the employee(s) exposure(s) to be underestimated, a violation of (d)(3) shall be cited.

- c. Paragraph (d)(4)(i) of the standards requires employers to notify each affected employee when the exposure determination indicates that employee exposure exceeds the PEL.

Where exposures exceed the PEL, general industry employers shall provide the notification within 15 working days; construction employers shall provide the notification as soon as possible, within 5 working days.

Employers shall perform this notification either by providing a personal written communication to each affected employee, or by posting the written exposure determination results in an accessible area. Affected employees who are not scheduled to work at or be near the posting location must be individually notified in writing of their exposure results.

Paragraph (d)(4)(ii) of the standards also requires employers to describe in the written notification the corrective action being taken to reduce employee exposure to or below the PEL

- i. Inspection Guidelines. The OSHI shall ask employees whether and when they were given copies of the results of their exposure determination, or when and where the results were posted.
- ii. Citation Guidelines. If employees for whom the employer has documented exposures exceeding the PEL have not seen their exposure determination results within 15 working days for general industry, or within 5 working days for construction, and the employer does not have a dated copy of the letter or posting of the results, (d)(4)(i) shall be cited. If the employer's written notification did not explain corrective action being taken, (d)(4)(ii) shall be cited.

- d. Paragraph (d)(5) requires employers to use an accurate sampling and analytical method that has the ability to measure Cr(VI) at the action level with at least the required degree of accuracy (+/- 25%). Rather than specifying a particular method that must be used, OSHA allows any method to be used, as long as the chosen method meets the accuracy specifications. One example of an acceptable method of monitoring and analysis is OSHA Method ID-215.

NIOSH has developed similar methods, including NIOSH 7600, 7604, 7605, and 7703. These NIOSH methods may meet the accuracy requirements of (d)(5) when adequate sample volumes are collected and the effects of interferences from other metals are controlled. The International Organization for Standardization (ISO) has also developed a method, ISO 16740:2005, for the measurement of airborne hexavalent chromium.

- i. Inspection Guidelines. The OSHI shall ask the employer for the analytical report(s) of Cr(VI) air monitoring samples. If a method other

than an OSHA method has been used, the OSHI may consult SLTC regarding the accuracy of the other method.

- ii. Citation Guidelines. If the laboratory reports indicate that the analytical method does not meet an accuracy of +/- 25% at a confidence level of 95%, then (d)(5) shall be cited.

- e. Paragraph (d)(6) provides for observation of monitoring and protection of the observers. This provision is consistent with OSHA's other substance specific health standards. Note that while this provision requires the employer to provide affected employees or their designated representatives with the right to observe monitoring, the observation should not seriously disrupt production or the sampling itself.

- i. Inspection Guidelines. The OSHI shall ask affected employees or their designated representative if they were given the opportunity to observe any monitoring of employee exposure.

- ii. Citation Guidelines. If an employee or the employees' designated representative were not given the opportunity to observe monitoring for personal samples, (d)(6) shall be cited.

5. Regulated Areas (not applicable to construction standards).

- a. Paragraph (e)(1) of the general industry Cr(VI) standard requires employers to establish regulated areas wherever an employee's exposure to airborne concentrations of Cr(VI) is, or can reasonably be expected to be, in excess of the PEL.

In some cases general industry work operations and environments may be comparable to those found in construction, and where the general industry employer can show compliance is not feasible, regulated areas will not have to be established.

- i. Inspection Guidelines. Determine whether the general industry employer is complying with the requirement to conduct all Cr(VI) work within regulated areas wherever an employee's exposure to airborne concentrations of Cr(VI) is, or can reasonably be expected to be, in excess of the PEL.

- ii. Citation Guidelines. If the employer is not complying and cannot demonstrate infeasibility, 1910.1026(e)(1) shall be cited.

- b. The purpose of a regulated area is to ensure that the employer makes employees aware of the presence of Cr(VI) above the PEL, and to limit Cr(VI) exposure to as few employees as possible. The number of persons given access to the area shall be limited to those employees needed to perform the job.

The employer may use any method to demarcate the regulated area as long as it effectively warns employees that they are not to enter unless authorized. The employer may use ropes, markings (such as lines, textured flooring, or warning signs), temporary barricades, gates, or more permanent enclosures to demarcate and limit access to these areas.

Access to the regulated area shall be limited to persons authorized by the employer and required by work duties to be present in the regulated area.

- i. Inspection Guidelines. If a general industry employer has established a regulated area, observe the demarcation and persons entering and exiting the area. Determine whether the employer has adequately demarcated a regulated area and whether the demarcation effectively warns employees not to enter unless they are authorized.
- ii. Citation Guidelines. If the employer is not complying with the above requirement to demarcate the regulated area, 1910.1026(e)(2) shall be cited.

If the employer is not complying with the requirement to limit access to authorized persons in an established regulated area, 1910.1026(e)(3) shall be cited.

6. Methods of Compliance.

- a. Paragraph (f)(1) of the general industry standard and paragraph (e)(1) of the construction standard establish the methods which shall be used by employers to comply with the PEL.

Paragraph (f)(1)(i) of the general industry standard and paragraph (e)(1)(i) for construction require that employers institute effective engineering and work practice controls as the primary means to reduce and maintain employee exposures to Cr(VI) to levels that are at or below the PEL unless the employer can demonstrate that such controls are not feasible. Such controls may not be feasible during some maintenance and repair operations or during emergency operations. Where the employer demonstrates that such controls are not feasible, the standards require the employer to institute engineering and work practice controls to reduce exposures to the lowest feasible level. The employer is then required to supplement these controls with respiratory protection to achieve the PEL.

Engineering controls include process or contaminant substitution, isolation, and ventilation. Work practice controls involve adjustments in the way a Cr(VI) task is performed, such as periodic inspection and maintenance of process and control equipment. If a particular engineering or work practice control not already implemented is feasible, the control shall be identified as an appropriate abatement method.

Paragraph (n)(3) of the general industry standard and paragraph (l)(3) for construction require employers to implement engineering controls required by paragraph (f) of the general industry standard and paragraph (e) of the construction. Paragraph (f)(1)(ii) of the general industry standard provides a unique exception for the painting of aircraft or large aircraft parts. For these operations, employee exposures shall be reduced to 25 µg/m³ or less using engineering and work practice controls. Respiratory protection shall then be used to achieve the PEL. The term "aircraft or large aircraft parts" refers to the interior or exterior of assembled aircraft, and to wings, tail sections, control surfaces (e.g., rudders, elevators, and ailerons), or comparably sized aircraft parts.

- i. Inspection Guidelines. The OSHI shall observe employees using (or ask the employer to describe and/or demonstrate) the engineering controls and/or work practice controls to ensure that the controls are present and appropriate. If exposures are still over the PEL (or 25 $\mu\text{g}/\text{m}^3$ for aircraft painting), and the employer claims additional engineering or work practice controls are infeasible, the burden is on the employer to support a claim of infeasibility. The employer should provide information specific to the particular operation that is relevant to its claim of infeasibility.
 - ii. Citation Guidelines. If the employer's engineering and work practice controls are not reducing employee exposures to or below the PEL (or 25 $\mu\text{g}/\text{m}^3$ for aircraft painting), and additional engineering and work practice controls are feasible, then (f)(1)(i), or (f)(1)(ii) for aircraft painting, or (e)(1)(i) for construction, shall be cited and grouped with the PEL violation, 1910.1026(c), or 1926.1126(c), as applicable.
- b. Paragraph 1910.1026(f)(1)(iii) of the general industry standard and paragraph 1926.1126(e)(1)(ii) for construction, provide an exception to the general requirement for primary reliance on engineering and work practice controls for processes or tasks that do not result in employee exposures above the PEL for 30 or more days per year (during 12 consecutive months). Thus, if a process or task causes employee exposures to Cr(VI) that exceed the PEL on 29 or fewer days during any 12 consecutive months, the employer is allowed to use any combination of controls, including respirators alone, to achieve the PEL.
- i. Inspection Guidelines. The burden is on the employer to show that exposures from a process or task do not exceed the PEL on 30 or more days per year.
 - The 30-day exception is based on the number of days a process or task results in employee exposures to Cr(VI) that exceed the PEL.
 - The exposures of all employees performing the process or task must be accounted for in determining whether the exception applies. For example, if an employer has a Cr(VI) process that involves exposures above the PEL on 40 days per year, and one employee is exposed for 20 of these days, and a second employee is exposed for the other 20 days, the employer may not claim the 30-day exception based solely on the days either employee is exposed over the PEL.
 - When an employer has two or more Cr(VI) processes or tasks within its facility, then exposure days for each process or task are to be considered separately for the purpose of the 30-day exception. However, employers may not divide or classify a single Cr(VI) process or task into two or more separate processes or tasks in order to claim the 30-day exception.
 - Days exceeding the PEL may not be counted as if they result from separate processes or tasks simply because some aspect of the process is changed, such as using a different stock of material.
 - In addition, for a *mobile* process or task, such as may be the case with welding or painting, days exceeding the PEL may not be counted as if they result from separate processes or tasks simply because they occur in different locations.

- If an employer operates multiple fixed facilities or establishments, and engineering controls for Cr(VI) exposures would need to be permanently fixed in those locations, the days of PEL-exceeding Cr(VI) exposures do not need to be added across facilities. For example, if an employer operates two facilities or establishments – one where a process or task results in exposures over the PEL on 20 days per year, and another one where the same process or task also results in exposures over the PEL on 20 days per year – the employer does not need to install permanent, fixed engineering controls in either location.
- Historical monitoring data and objective data or air monitoring data may be used to demonstrate that a process or task will not result in employee exposures above the PEL for 30 or more days per year. Other information, such as production orders showing that processes involving Cr(VI) exposures are conducted on fewer than 30 days per year, may also be used to demonstrate that employees performing a process or task will not be exposed above the PEL for 30 or more days per year.

If an employer performs exposure determinations to show that whenever a process or task is performed under certain defined conditions the PEL is not exceeded, then any days on which that process or task is performed under those conditions need not be counted for purposes of the 30-day exception.

The obligation to demonstrate that employees in a process or task will not be exposed above the PEL for 30 or more days per year is the same for general industry and construction employers.

- ii. Citation Guidelines. If a process or task results in Cr(VI) exposures above the PEL and engineering and work practice controls are feasible, but respiratory protection is the only control being used, (f)(1)(i) for general industry, or (e)(1)(i) for construction, shall be cited unless the employer demonstrates that employees in that process or task are exposed above the PEL for 29 or fewer days per year.
- c. Paragraph (f)(2) of the general industry standard and paragraphs (e)(2) of the construction standard prohibit the rotation of employees to different jobs as a means of achieving the PEL.

OSHA recognizes that employers rotate employees for a variety of reasons (e.g., an employer may rotate employees in order to provide cross-training on different tasks, or to allow employees to alternate physically demanding tasks with less strenuous activities), and OSHA does not intend for this provision to be interpreted as a general prohibition on employee rotation where there is exposure to Cr(VI).

- i. Inspection Guidelines. The OSHI shall interview employees and managers working in and supervising processes or tasks where exposures exceed or are likely to exceed the PEL to determine if employees are rotated to achieve compliance with the PEL.
- ii. Citation Guidelines. If the employer cannot demonstrate that an employee's job rotation is conducted for reasons other than compliance

with the PEL, (f)(2) for general industry, or (e)(2) for construction, shall be cited.

7. Respiratory Protection.

Paragraph (g) of the general industry standard and paragraphs (f) of the construction standard establish requirements for respiratory protection.

- a. Paragraph (g)(1) of the general industry standard and paragraphs (f)(1) of the construction standard require employers to provide employees with appropriate respiratory protection when engineering controls and work practices are not implemented or are not sufficient to reduce employee exposures to or below the Cr(VI) PEL.
- i. Inspection Guidelines. Specifically, subparagraphs (i)-(v) require employers to provide respirators when:
- Engineering and work practice controls are being installed (as demonstrated, for example, by an employer's purchase order), as provided by (g)(1)(i) for general industry, or (f)(1)(i) for construction; or
 - Engineering and work practice controls are not feasible, such as during maintenance and repair activities, as provided by (g)(1)(ii) for general industry, or (f)(1)(ii) for construction; or
 - Engineering and work practice controls are not sufficient to reduce exposure to or below the PEL, as provided by (g)(1)(iii) for general industry, or (f)(1)(iii) for construction; or
 - Engineering and work practice controls are not being used because the Cr(VI) process or task is exposing employees for fewer than 30 days per year above the PEL, as demonstrated, for example, by an employer's production order, as provided by (g)(1)(iv) for general industry, or (f)(1)(iv) for construction; or
 - An emergency exposes employees to an uncontrolled Cr(VI) exposure, as provided by (g)(1)(v) for general industry, or (f)(1)(v) for construction.
- ii. Citation Guidelines. If the employer does not provide appropriate respiratory protection for employees in the above situations, the applicable subparagraph of (g)(1) for general industry or (f)(1) for construction shall be cited and grouped with the PEL violation, 1910.1026(c), or 1926.1126(c), as applicable.
- b. Where respirator use is required, paragraph (g)(2) of the general industry standard and paragraphs (f)(2) of the construction standard require the employer to institute a respiratory protection program in accordance with OSHA's Respiratory Protection standard (29 CFR 1910.134).
- i. Inspection Guidelines. The OSHI shall verify that the employer has established and implemented an appropriate respiratory protection program that contains all of the required elements.

For guidance on inspection procedures for 1910.134, refer to the *Respiratory Protection Enforcement Procedures*, MNOSHA Instruction CPL 2-2.120A.

- ii. Citation Guidelines. If employees are required to wear respirators, then the employer shall have a respiratory protection program. If the employer has not implemented the program or elements of it are deficient or missing, (g)(2) for general industry or (f)(2) for construction shall be cited. Additionally, if elements are deficient or missing, the OSHI shall group where appropriate and cite the applicable subparagraphs under 1910.134.

8. Protective Work Clothing and Equipment.

Paragraph (h) of the general industry standard and paragraphs (g) of the construction standard set forth requirements for the provision of protective clothing and equipment. The standards require the employer to provide appropriate protective clothing and equipment at no cost to employees where a hazard is present or is likely to be present from skin or eye contact with Cr(VI). Ordinary street clothing and work uniforms or other accessories that do not protect employees from Cr(VI) hazards are not considered protective clothing or equipment under these standards. Employers are also required to ensure employee use of any clothing and equipment provided.

These requirements are intended to prevent the adverse health effects associated with dermal exposure to Cr(VI) and the potential for inhalation of Cr(VI) that would otherwise be deposited on employees' street clothing. The requirements further serve to minimize exposures to Cr(VI) that may occur as a result of improper handling of contaminated protective clothing or equipment.

- a. Paragraph (h)(1) of the general industry standard and paragraph (g)(1) of the construction standard require the employer to provide appropriate protective clothing and equipment where a hazard is present or is likely to be present from skin or eye contact with Cr(VI). To determine whether protective clothing or equipment is necessary, the employer must evaluate the workplace. This performance-oriented requirement is consistent with the general requirements for the use of PPE in general industry and construction (29 CFR 1910.132 and 29 CFR 1926.95).

OSHA is aware of instances where exposure to Cr(VI) in welding fumes has been associated with development of dermatitis. However, these situations appear to be infrequent, and additional protective clothing and equipment may not generally be required to protect employees from skin contact with Cr(VI) during typical stainless steel welding operations.

Exposures to Cr(VI) in every workplace operation must be evaluated on a case-by-case basis, taking into account the physical aspects of the process or operation and any control measures, the chemical and physical properties of the compound or mixture, and the magnitude and duration of exposure. The employer has flexibility to select the clothing and equipment most suitable for the workplace. Other factors such as size, dexterity, and cut and tear resistance should be considered in the selection process as well. The point of this performance-oriented requirement is to prevent or eliminate skin exposures to Cr(VI) where feasible, and to reduce the inhalation hazard from Cr(VI) that might otherwise be deposited on employees' street clothing if appropriate protective clothing and equipment were not used.

- i. Inspection Guidelines. The OSHI shall determine what work operations involve Cr(VI) exposures by examining the employer's exposure determination data, chemical inventories, MSDSs, job hazard analyses, injury/illness/accident data, written medical opinions of employees under medical surveillance, walkthrough observations, and conducting employer/employee interviews. Where suspected, a Cr(VI) hazard to the skin or eyes may be confirmed by collecting a wipe or bulk sample for Cr(VI) analysis (see Section D above, for specific information on wipe and bulk sampling). A wipe sample, in this case, is collected to determine whether the contaminant (i.e., hexavalent chromium) is, in fact, present; not to measure against any quantitative threshold of dust loading.

In exposures to Cr(VI) from welding fumes, employee records, OSHA 300 logs, and interviews should be conducted to determine whether dermal illnesses have occurred. Surface wipe samples should be collected to verify the presence of CR (VI). Cr(VI) must be present in the wipe samples and there must be welding fume related skin disorders for the skin exposure to be considered a hazard.

The OSHI shall assess whether appropriate protective clothing and equipment is being provided by the employer, and at no cost to employees. Although an employer may be providing work uniforms, these may not be "appropriate" protective clothing and equipment if they are not designed to protect the wearer from skin or eye contact with Cr(VI).

- ii. Citation Guidelines. Paragraph (h)(1) of the general industry standard, or paragraph (g)(1) of the construction standard, shall be cited if the employer is not providing or ensuring the use of appropriate protective clothing and equipment where there is a hazard (or likely to be a hazard) from skin or eye contact with Cr(VI), or if the employer is requiring the employees to pay for the protective clothing and equipment. If the employer is requiring the employees to pay for their respirators, then 1910.134(c)(4) shall be cited.

- b. Paragraph (h)(2) of the general industry standard and paragraph (g)(2) of the construction standard provide requirements for the removal and storage of protective work clothing and equipment.

- i. Paragraph (h)(2)(i) of the general industry standard and paragraph (g)(2)(i) of the construction and shipyard standards require the employer to ensure that employees remove all protective clothing and equipment contaminated with Cr(VI) at the completion of work shifts or tasks involving Cr(VI) exposure, whichever comes first.

For example, if employees perform tasks involving Cr(VI) exposures for the first two hours of a work shift, and then perform tasks that do not involve exposures, they must remove their protective clothing after the exposure period (in this case, the first two hours of the shift). If, however, employees are performing tasks involving Cr(VI) exposure intermittently throughout the day, or if employees are exposed to other contaminants where protective clothing and equipment are needed, this provision does not prevent them from wearing the clothing and equipment until the completion of their shift.

If the employee leaves the contaminated work area for any reason, he or she must first either remove the contaminated clothing and equipment – inside a change room if changing back into street clothes – or remove the Cr(VI) contamination from protective clothing, such as by using a HEPA vacuum, before leaving the work area. This provision limits the duration of employees' exposure, and prevents contamination from Cr(VI) residues on protective clothing reaching other areas of the workplace.

- ii. Paragraph (h)(2)(ii) of the general industry standard and paragraph (g)(2)(ii) of the construction standard require the employer to ensure that Cr(VI)-contaminated protective clothing and equipment is removed from the workplace only by those employees who launder, clean, maintain, or dispose of such clothing or equipment. This provision ensures that clothing contaminated with Cr(VI) is not carried by employees off the worksite, increasing the employees' exposure as well as exposing other individuals to Cr(VI) hazards.
- iii. Paragraph (h)(2)(iii) of the general industry standard and paragraph (g)(2)(iii) of the construction standard require the employer to ensure that Cr(VI)-contaminated clothing and equipment that is to be laundered, cleaned, maintained, or disposed of be placed in closed, impermeable containers to minimize contamination of the workplace and ensure that employees who later handle these items are protected.
- iv. Paragraph (h)(2)(iv) of the general industry standard and paragraph (g)(2)(iv) of the construction standard require the employer to ensure that warning labels are placed on containers of the Cr(VI)-contaminated clothing and equipment so that those subsequently cleaning these items will be informed of and protected from the potential hazards of exposure to Cr(VI), in accordance with the requirements of MN-OSHA's Employee Right to Know (ERTK) Act (Chapter 5206).

The label information is to include the chemical identity, the appropriate hazard warnings. (See MN Rules 5206.1000(Subp. 1)).

- v. Inspection Guidelines. Observe and interview employees involved in Cr(VI) operations to determine how, when, and by whom Cr(VI)-contaminated clothing and equipment is removed and cleaned or discarded. If clothing and equipment is disposable, inspect disposal containers for seals and labels. If Cr(VI)-contaminated clothing is laundered and reused and equipment is cleaned, ask the employer how the laundering/cleaning is performed and observe the clothing containers. Also, observe the laundry process, if conducted on-site. Interview employees to see if they have been informed about the requirements for handling Cr(VI)-contaminated clothing and equipment. Also, see the note in Section E (8)(c)(iv), below concerning employers who provide laundering/cleaning services.
- vi. Citation Guidelines. If Cr(VI)-contaminated clothing and equipment are not being removed and disposed of or cleaned properly, the appropriate subparagraph(s) of (h)(2) for general industry or (g)(2) for construction shall be cited. If the ERTK Rule, 5206.1000(Subp. 1) is cited, it shall be grouped with 1910.1026(h)(2)(iv) for general industry, or (g)(2)(iv) for construction.

c. Paragraph (h)(3) of the general industry standard and paragraph (g)(3) of the construction standard provide for the cleaning and replacement of the protective work clothing and equipment required by these standards.

i. Paragraph (h)(3)(i) of the general industry standard and paragraph (g)(3)(i) of the construction standard require the employer to clean, launder, repair and replace protective clothing as needed to ensure that the effectiveness of the clothing and equipment is maintained. This provision is necessary to ensure that clothing and equipment continue to serve their intended purpose of protecting employees. This also prevents unnecessary exposures outside the workplace.

The obligation of the employer, as always, is to keep the clothing and equipment in the condition necessary to perform its protective functions.

ii. Paragraph (h)(3)(ii) of the general industry standard and paragraph (g)(3)(ii) of the construction standard prohibit the employer from removing Cr(VI) from protective clothing and equipment by blowing, shaking, or any other means which disperses Cr(VI) into the air. Such actions would result in increased risk to employees from unnecessary exposure to airborne Cr(VI), as well as possible dermal contact.

iii. Paragraph (h)(3)(iii) of the general industry standard and paragraph (g)(3)(iii) of the construction standard require the employer to inform any person who launders or cleans protective clothing or equipment contaminated with Cr(VI) of the potentially harmful effects of exposure to Cr(VI), and of the need to launder or clean contaminated clothing and equipment in a manner that effectively prevents skin or eye contact with Cr(VI) or the release of airborne Cr(VI) in excess of the PEL. As with the provision reminding employers of their obligation for labeling under the ERTK Act, this requirement is intended to ensure that persons who clean or launder Cr(VI)-contaminated items are aware of the associated hazards so that they can take appropriate protective measures.

When laundry or cleaning services are performed by third parties, the information transmitted need not be extensive to accomplish this goal. Appropriate hazard warnings, as required on labels by the ERTK Act, will be sufficient to indicate the potentially harmful effects of exposure to Cr(VI). In addition, the language used in this provision, "the clothing and equipment should be laundered or cleaned in a manner that minimizes skin or eye contact with Cr(VI) and effectively prevents the release of airborne Cr(VI) in excess of the PEL," could be put on a label. The employer is not expected to specify particular work practices that third parties must follow.

iv. Inspection Guidelines. Inspect protective clothing and equipment in Cr(VI) operations for signs of excessive wear or evidence of inadequate cleaning, laundering, and repair. Also inspect stored clothing and equipment for excessive contamination. Interview the employer and employees to learn the frequency of and methods used for cleaning, laundering, repair, and replacement of protective clothing and equipment.

Note: Any employer providing such laundry services must determine Cr(VI) exposures for their laundry employees, in accordance with

paragraph (d) of the Cr(VI) standards, and comply with any other applicable provisions, as well.

- v. Citation Guidelines. If contaminated clothing and equipment are not being adequately or properly cleaned, laundered, repaired, or replaced, or the persons who clean or launder contaminated items were not informed by the employer of the harmful effects of Cr(VI) or of the need to prevent skin or eye contact with Cr(VI) and the release of airborne Cr(VI) above the PEL, then the appropriate subparagraph(s) of (h)(3) for general industry or (g)(3) for construction shall be cited.

9. Hygiene Areas and Practices.

Paragraph (i) of the general industry standard and paragraph (h) of the construction standard require employers to provide hygiene facilities and to assure employee compliance with basic hygiene practices that minimize exposure to Cr(VI). The standards include requirements for change rooms and washing facilities, ensuring that Cr(VI) exposure in eating and drinking areas is minimized, and prohibit certain practices that may contribute to Cr(VI) exposure.

- a. Paragraph (i)(1) of the general industry standard and paragraph (h)(1) of the construction standard restate compliance requirements for OSHA's existing general sanitation provisions, which already address:
 - i. Change rooms - Employers shall provide change rooms in conformance with 1910.141 for general industry and 1926.51 for construction;
 - ii. Washing facilities – Employers shall provide washing facilities in conformance with 1910.141 for general industry and 1926.51 for construction; and,
 - iii. Eating and drinking areas – Employers shall provide eating and drinking areas in conformance with 1910.141 for general industry and 1926.51 for construction.

The hygiene provisions of the Cr(VI) standards are intended to augment the requirements established under these other standards with additional provisions applicable specifically to Cr(VI) exposure.

- b. Paragraph (i)(2) of the general industry standard and paragraph (h)(2) of the construction standard require change rooms at all covered workplaces where employees must change their clothes (i.e., take off their street clothes) to use protective clothing and equipment. Where removal of street clothes is not necessary (e.g., in a workplace where only gloves are used as protective clothing or Tyvek suits are donned over street clothes), change rooms are not required.
 - i. Inspection Guidelines. Where employees are required to remove street clothing and don protective clothing prior to working with Cr(VI), the OSHI shall inspect the change room to ensure that it meets the requirements of this section, as well as the requirements in the applicable general Sanitation standards (1910.141 or 1926.51). These general standards require change rooms to be equipped with separate storage facilities for street clothes and protective clothing.

ii. Citation Guidelines. If a change room is required to control employee exposure to Cr(VI), and the employer has not provided one, or if the employer did not provide separate storage facilities for street clothes and protective clothing, paragraphs 1910.1026(i)(1) and/or (i)(2), shall be cited and grouped with a violation of 1910.141(e) for general industry. For construction, 1926.1126(h)(1) and/or (h)(2) shall be cited and grouped with a violation of 1926.51(i).

c. Paragraph (i)(3) of the general industry standard and paragraph (h)(3) of the construction standard contain requirements for washing facilities. The employer shall provide readily accessible washing facilities capable of removing Cr(VI) from the skin and ensure that affected employees use these facilities when necessary. Also, the employer shall ensure that employees who have skin contact with Cr(VI) wash their hands and faces at the end of the work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet.

Where the Cr(VI) standards require employers to provide washing facilities "capable of removing Cr(VI) from the skin," this means that employers must provide soap and potable water (OSHA examined scientific data related to whether moist towelettes or other waterless hand cleaners were sufficient for removing harmful contaminants and determined that these cleaners were not adequate substitutes for soap and water).

i. Inspection Guidelines. The OSHI shall interview and, if possible, observe employees who have skin contact with Cr(VI) to see if they wash their hands and faces at the end of the work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet. If the employer has not provided readily accessible washing facilities, a violation has occurred. If appropriate washing facilities are available but are not being used, then employee training should be evaluated (see paragraph (l) of the general industry standard, or paragraph (j) of the construction standard).

Where exposures to chromic acid or other acute-acting Cr(VI) compounds are identified, the OSHI shall inspect the work area to determine if facilities are provided for quick drenching or flushing of the eyes and body.

ii. Citation Guidelines. If an employer has not provided readily accessible washing facilities, paragraph 1910.1026(i)(3)(i) shall be cited and grouped with a violation of 1910.141(d) for general industry, or 1926.1126(h)(3)(i) shall be cited and grouped with a violation of 1926.51(f)(1) for construction.

If an employer is not ensuring that employees who have skin contact with Cr(VI) are washing their hands and faces at the end of the work shift and prior to eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or using the toilet, paragraph (i)(3)(ii) for general industry or (h)(3)(ii) for construction shall be cited.

If the employer has workplace exposures to chromic acid or other acute-acting Cr(VI) compounds but has not provided suitable facilities for quick drenching of the eyes and body for employees, 1910.1026(i)(3)(i) shall be cited and grouped with a violation of 1910.151(c) for general industry,

or 1926.1126(h)(3)(i) shall be cited and grouped with a violation of 1926.50(g) for construction.

- d. The employer is not required to provide eating and drinking facilities to employees. However, if an employer allows employees to eat at the worksite, paragraph (i)(4) of the general industry standard and paragraph (h)(4) of the construction standard, require the employer to ensure that eating and drinking areas and surfaces are maintained as free as practicable of Cr(VI). Employers also are required to ensure that employees do not enter eating or drinking areas wearing protective clothing, unless the protective clothing is properly cleaned beforehand. Employers may use any method for removing surface Cr(VI) from clothing and equipment that does not disperse the dust into the air or onto the employee's body. For example, if an employee is wearing coveralls for protection against Cr(VI), thorough HEPA vacuuming of the coveralls could be performed prior to entry into a lunchroom.

- i. Inspection Guidelines. When employees eat and drink at the worksite, there are often cafeterias or break rooms. Employees may not eat or drink in Cr(VI)-contaminated work areas. Any area used by employees for eating or drinking shall be maintained as free as practicable from Cr(VI).

The OSHI shall observe where employees consume food and beverages, and how employees handle their protective work clothing and equipment before entering eating and drinking areas.

When a determination has been made that an employer could reduce Cr(VI) contamination of surfaces within eating and drinking areas, or could make another area that is not contaminated available for employee consumption of food and drink, the OSHI shall collect wipe or bulk samples to provide evidence that the surface contamination is Cr(VI). The standards do not define the term, "as free as practicable," however, if a wipe sample confirms Cr(VI) surface contamination in an area used for eating and drinking, and the OSHI determines that the employer has not taken practicable measures to make a clean area available for eating and drinking, the employer is not in compliance with this provision.

See Section D of this directive for wipe and bulk sampling procedures.

- ii. Citation Guidelines. If an area for employee consumption of food or beverages is not maintained as free as practicable of Cr(VI) contamination, paragraph (i)(4)(i) for general industry or paragraph (h)(4)(i) for construction shall be cited.

If employees are observed entering areas for eating and drinking without first removing their protective clothing and equipment, or at least removing Cr(VI) surface contamination from their protective clothing and equipment, or if they may potentially disperse Cr(VI) contamination into the air in a manner that exposes an employee's body to the Cr(VI) contamination, paragraph (i)(4)(ii) for general industry or paragraph (h)(4)(ii) for construction shall be cited.

- e. Paragraph (i)(5) of the general industry standard and paragraph (h)(5) of the construction standard prohibit eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics in regulated areas or in areas where skin or eye contact with Cr(VI) occurs. Products associated with these activities, such as

food and beverages, cannot be carried or stored in these areas. Because the construction standard does not include requirements for regulated areas, reference to regulated areas is omitted in the regulatory text for this standard.

- i. Inspection Guidelines. If the OSHI observes or receives reports of any prohibited activities (eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or storing such products) in a work area where skin or eye contact with Cr(VI) occurs, or within a Cr(VI) regulated area, air, wipe, and/or bulk samples shall be collected to document exposures to Cr(VI).

Air, wipe, and/or bulk samples should be collected in the work area to verify the presence of Cr(VI). See Section D of this directive for air, wipe and bulk sampling procedures.

- ii. Citation Guidelines. If employees are permitted to conduct any of these prohibited activities (eating, drinking, smoking, chewing tobacco or gum, applying cosmetics, or carrying or storing related products) in regulated areas, or in areas where skin or eye contact with Cr(VI) occurs, as confirmed by the OSHI's positive sample(s) for Cr(VI), paragraph (i)(5) of the general industry standard or (h)(5) for construction shall be cited.

10. Housekeeping (not applicable to construction and shipyard standards).

The general industry standard includes housekeeping provisions that require employers to maintain surfaces as free as practicable of Cr(VI), promptly clean Cr(VI) spills and leaks, use appropriate cleaning methods, and properly dispose of Cr(VI)-contaminated waste.

OSHA has determined that housekeeping requirements are highly impracticable for control of Cr(VI) exposures in construction workplaces and, therefore, has not included housekeeping requirements for these industry sectors. Construction employers still need to comply with the general housekeeping requirements found in 29 CFR 1926.25.

The Agency recognizes that in some cases general industry work operations and work environments may be comparable to those found in construction, i.e., are short in duration; performed outdoors, potentially under adverse environmental conditions (e.g., wind, rain); and are done at non-fixed workstations or worksites. As paragraph (j)(1)(i) of the standard only requires surfaces to be maintained as free of the accumulation of Cr(VI) "as practicable," it provides flexibility for any general industry situations where, as in construction, it is not practicable to implement the housekeeping provisions.

- a. Paragraph (j)(1) requires the general industry employer to ensure that all surfaces are maintained as free as practicable of accumulations of Cr(VI), and that all spills and releases of Cr(VI)-containing material are cleaned up promptly.
 - i. Inspection Guidelines. The OSHI shall observe where employees perform operations involving Cr(VI) exposures to make a visual assessment of housekeeping practices. Where suspected, poor housekeeping shall be further assessed by collecting a wipe or bulk sample for Cr(VI) analysis. Refer to the inspection guidelines for wipe and bulk sampling, above, in Section D. Employers and employees shall be interviewed and mishap reports, if available, shall be reviewed for incidents of spills and releases of Cr(VI) materials. Injury/illness records

shall be checked for reports of skin exposures to Cr(VI) that could have been caused by poor housekeeping practices or improper spill response.

The standard does not provide a maximum allowable surface loading of Cr(VI) contamination in work areas as a criterion for “as free as practicable.” However, if a wipe sample does confirm Cr(VI) surface contamination in a work area, and the OSHI determines that the employer has not taken practicable measures to reduce the Cr(VI) contamination, then the employer is not in compliance with this provision.

- ii. Citation Guidelines. If general industry employers do not ensure that workplace surfaces are maintained as free as practicable of Cr(VI), paragraph (j)(1)(i) shall be cited. Spills or releases of Cr(VI) that are not cleaned up promptly shall be cited under paragraph (j)(1)(ii).
- b. Paragraph (j)(2) requires cleaning methods that best capture Cr(VI)-containing material, including HEPA-filtered vacuuming or other methods (such as wet methods) that minimize Cr(VI) exposure. If preferred cleaning methods such as HEPA-filtered vacuuming or wet methods have been tried, but are not effective, then the employer may use dry shoveling, sweeping, or brushing, or compressed air in conjunction with a ventilation system designed to capture the dust cloud. Compressed air may be used without a ventilation system to capture dust only if no alternative method is feasible, such as cleaning out-of-reach crevices within furnaces, but these circumstances are expected to be extremely rare. Caution should be exercised whenever compressed air is used as a cleaning method, since the air will spread the contamination further unless the dust is appropriately collected. Caution should also be exercised to avoid directing compressed air at employees; compressed air should not be used to clean protective clothing or equipment that employees are wearing. General industry employers shall ensure that all cleaning equipment is handled to minimize reentry of Cr(VI) into the workplace.
- i. Inspection Guidelines. The OSHI shall interview and/or observe employees who are cleaning Cr(VI)-containing materials to inspect for approved methods. The OSHI shall also observe the handling of cleaning equipment, such as HEPA-filtered vacuums. Maintenance operations to clean and/or replace vacuum filters also require effective housekeeping methods, such as using a second HEPA-filtered vacuum and a drop cloth to collect releases of Cr(VI)-contaminated dust.
 - ii. Citation Guidelines. If general industry employers do not ensure that cleaning methods, such as HEPA-filtered vacuuming, are used to minimize the likelihood of exposure to Cr(VI), paragraph (j)(2)(i) shall be cited. If an employer uses dry shoveling, sweeping, or brushing without demonstrating that HEPA-filtered vacuuming or similar cleaning methods that minimize Cr(VI) exposures were tried and found to be ineffective, paragraph (j)(2)(ii) shall be cited. If employers are allowing employees to use compressed air to remove Cr(VI) from surfaces without a ventilation system to capture the blown dust and without demonstrating that no alternative method is available, paragraph (j)(2)(iii) shall be cited. If employers are not ensuring that cleaning equipment is handled in a manner that minimizes the reentry of Cr(VI) into the workplace, (j)(2)(iv) shall be cited.
- c. Paragraph (j)(3) requires that general industry employers use proper containers and labels in accordance with the ERTK Act to dispose of waste, scrap, debris,

and other waste products contaminated with Cr(VI). The containers are to be sealed in impermeable bags or other impermeable containers. The label information is to include the chemical identity, the appropriate hazard warnings, and the employer's name and address.

OSHA intends for the waste disposal provisions to be performance oriented. The standard permits the use of any container so long as it prevents release of or contact with Cr(VI). For example, sealed barrels could be used to serve this purpose. Palletizing items and wrapping the pallet in plastic to create an impermeable barrier between workers and the Cr(VI)-contaminated waste, scrap or debris would also be acceptable.

The corresponding provisions in the ERTK Act for labeling Cr(VI) wastes are 5206.1000(Subp. 7).

- i. Inspection Guidelines. The OSHI shall observe disposal practices to ensure that employers are using sealed, impermeable bags or other closed, impermeable containers labeled in accordance with the ERTK Rule, 5206.1000(Subp. 7).
- ii. Citation Guidelines. If general industry employers do not ensure that Cr(VI) disposal containers are sealed and impermeable, paragraph (j)(3)(i) shall be cited. If disposal containers are not properly labeled to warn employees of hazardous Cr(VI) material, paragraph (j)(3)(ii) shall be cited. If ERTK Rule, 5206.1000(Subp. 7) is cited, it shall be grouped with 1910.1026(j)(3)(ii).

11. Medical Surveillance.

Paragraph (k) of the general industry standard and paragraph (i) of the construction standard set forth requirements for the provision of medical surveillance.

- a. Paragraph (k)(1) of the general industry standard and paragraph (i)(1) for construction standard require employers to make medical surveillance available at no cost, and at a reasonable time and place. If participation requires travel away from the worksite, the employer must bear the cost. Employees must be paid for time spent taking medical examinations, including travel time.

Medical surveillance must be performed by or under the supervision of a physician or other licensed healthcare professional (PLHCP).

- i. The use of 30 days of exposure at or above the action level as a trigger for medical surveillance addresses potential Cr(VI) health effects associated with repeated exposures. Even in situations where the employer elects the performance-oriented option for exposure determinations, OSHA requires that the employer sufficiently characterize all employee exposures to determine when to provide routine medical surveillance.

Employers with temporary employees who are exposed to Cr(VI) during their employment, but who are employed for fewer than 30 days, must still provide medical surveillance if those employees experience signs or symptoms of the adverse health effects associated with Cr(VI) exposure or are exposed to Cr(VI) in an emergency.

- ii. OSHA intends that employees be trained about the signs and symptoms of Cr(VI)-related adverse health effects. This information, in conjunction with the training on Cr(VI) hazards required by the ERTK Act, will help to assure that employees are able to adequately report signs and symptoms of Cr(VI)-related adverse health effects in order to receive medical attention from a licensed health care professional.
 - iii. Medical surveillance shall be made available to employees exposed in an emergency regardless of the airborne concentrations of Cr(VI) normally found in the workplace. While there are chronic effects associated with Cr(VI) exposure, there are also short-term effects such as skin ulcerations and dermatitis that might result from high exposures occurring during an emergency.
- b. Paragraph (k)(2) of the general industry standard and paragraph (i)(2) of the construction standard require employers to provide all covered employees with medical examinations whenever an employee shows signs or symptoms of Cr(VI) exposure, within 30 days after an emergency resulting in an uncontrolled release of Cr(VI), and within 30 days after a PLHCP's written medical opinion recommends an additional examination. In addition, employers are required to provide covered employees with examinations within 30 days after initial assignment (unless the employee has received a medical examination in accordance with the standards within the past 12 months), annually, and at the termination of employment (unless an examination has been given less than six months prior to the date of termination).

Although the provision requiring medical examinations whenever an employee shows signs or symptoms of Cr(VI) exposure does not specify a specific number of days within which the employee must have the exam, employers must make examinations available for injured or ill employees as soon as possible so that prompt treatment is provided.

Note: For employees working in operations covered by 29 CFR 1910.124, *General Requirements for Dipping and Coating Operations*, or 29 CFR 1926.57 *Ventilation, Section (i), Open Surface Tanks*, those standards' provisions for periodic medical examination apply even if employees would not need an examination under the Cr(VI) standards. For example, 1910.124(h)(4) and 1926.57(i)(9)(viii), require the employer to provide periodic examinations of exposed body parts, especially nostrils, to employees exposed to chromic acid in electroplating, whether or not the employees are exposed above the Cr(VI) action level for 30 or more days a year.

- c. Paragraph (k)(3) of the general industry standard and paragraph (i)(3) of the construction standard specify that the examination by the PLHCP shall consist of a medical and work history, a physical examination of the skin and respiratory tract, and any additional tests considered appropriate by the PLHCP. While additional tests, such as baseline and periodic spirometry and baseline chest x-rays, may be considered appropriate for certain affected employees, such determinations are left to the discretion of the PLHCP. Special emphasis is to be placed on the employee's medical and work history related to Cr(VI) exposure, health effects associated with Cr(VI) exposure, and smoking.
- d. Paragraph (k)(4) of the general industry standard and paragraph (i)(4) of the construction standard require the employer to ensure that the PLHCP has a copy of the standard, and to provide the PLHCP with a description of the affected employee's former and current duties as they relate to Cr(VI) exposure; the

employee's former, current, and anticipated exposure levels; a description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used that equipment; and information from records of employment-related medical examinations previously provided to the affected employee that are currently within the employer's control.

- e. Paragraph (k)(5) of the general industry standard and paragraph (i)(5) of the construction standard require employers to obtain from the examining PLHCP a written opinion containing the results of the medical examination with regard to Cr(VI) exposure, the PLHCP's opinion as to whether the employee would be placed at increased risk of material health impairment as a result of exposure to Cr(VI), and any recommended limitations on the employee's exposure or use of personal protective equipment. The PLHCP must also state in the written opinion that these findings were explained to the employee.
 - i. Under the standards, the PLHCP may not include findings or diagnoses that are unrelated to Cr(VI) exposure in the written opinion provided to the employer.
 - ii. The employer shall obtain the written opinion within 30 days of the examination and must provide a copy of the written opinion to the employee within two weeks of receiving it, to ensure that the employee is informed of the opinion in a timely manner. If a PHLCP is also providing the employer with written opinions related to other OSHA-regulated substances, the PHLCP can issue a single written opinion addressing all covered substances to which an employee is exposed.
- f. Inspection Guidelines. The OSHI shall make sure that the employer has included the appropriate employees in the medical surveillance program. Employers with dipping and coating operations also covered under 1910.124 or 1926.57 must make *periodic* examinations available to employees working with chromic acid regardless of the level of exposure, in accordance with those standards. The OSHI shall ask selected employees if they were offered medical examinations by their employer. Although OSHA's health standards require employers to provide employees an opportunity for medical examinations, employees are not required to take them. Employers should continue to offer a medical examination to each authorized employee whenever it comes due again, even if the employee has previously refused such an examination.

Where employees have been evaluated by a health care provider, the OSHI shall ask employees if the evaluation took place prior to or within 30 days of beginning their Cr(VI) work assignments. Employees shall be interviewed to determine if the employer is requiring employees to pay for the examinations or to undergo medical testing at unreasonable times or places.

Health care providers may also be contacted to determine whether the appropriate information was provided by the employer.

- g. Citation Guidelines. If Cr(VI) medical surveillance from a PLHCP was not made available by general industry employers to their employees in accordance with the exposure criteria of (k)(1) and the frequency requirements of (k)(2), or (i)(1) and (i)(2), respectively, for construction, the appropriate subparagraph(s) shall be cited.

If annual or other periodic medical surveillance was not made available to general industry or construction employees performing dipping and coating

operations involving Cr(VI) exposures, but the employer demonstrated that exposures were not above the action level on 30 or more days per year, 1910.124(h)(4) or 1926.57(i)(9)(viii) shall be cited, respectively.

Paragraph (k)(3) of the general industry Cr(VI) standard, or (i)(3) of the construction standard, or applicable subparagraphs, shall be cited if the medical examinations did not include the required element(s).

Paragraph (k)(4) of the general industry standard or (i)(4) of the construction standard shall be cited if the examining PLHCP was not provided the required information by the employer. The appropriate subparagraph shall be cited for the elements not provided.

If there is no written opinion, (k)(5)(i) for general industry, or (i)(5)(i) for construction shall be cited. If employees remember seeing the written opinion, but the employer cannot find it, the recordkeeping provision, (m)(4)(iii) for general industry or (l)(4)(iii) for construction shall be cited. If employees were not given a copy of the written opinion, (k)(5)(iii) for general industry or (i)(5)(iii) for construction shall be cited. Citations shall be issued only when it can be established that two or more employees did not receive a copy.

12. Communication of Chromium (VI) Hazards to Employees.

Paragraph (l) of the general industry standard and paragraph (j) of the construction standard set forth requirements intended to ensure that the dangers of Cr(VI) exposure are communicated to employees. The hazard communication requirements of these standards complement existing requirements of MN-OSHA's Employee Right to Know Act (ERTK) (Chapter 5206), which covers employees exposed to airborne Cr(VI) or who have skin or eye contact with Cr(VI).

5206.0700(Subp. 1)(B) of the ERTK Act requires employers to develop and implement a written Employee Right to Know program that provides for employee training, and paragraphs (G)(1) and (G)(4) requires employers to provide that training at the time of initial employment and training updates at intervals not greater than 1 year.

- a. Paragraph (l)(1) of the general industry Cr(VI) standard and paragraph (j)(1) of the construction standard make clear that the hazard communication requirements of these standards are in addition to those required by the ERTK Act. Paragraphs 5206.0700(Subp. 2)(A-J) of the ERTK Act already require employers to provide Cr(VI)-exposed employees with training.
- b. Paragraph (l)(2) of the general industry Cr(VI) standard and paragraph (j)(2) of the construction standard list three additional requirements:
 - i. The employer shall ensure that each employee can demonstrate knowledge of the contents of the Cr(VI) standard;
 - ii. The employer shall ensure that each employee can demonstrate knowledge of the purpose and description of the medical surveillance program required under the Cr(VI) standard; and,
 - iii. The employer shall make a copy of the Cr(VI) standard readily available to employees without cost.

Whether an employee can “demonstrate knowledge” requires professional judgment based on answers given during an employee interview. Employees should know that Cr(VI) is hazardous, where and how is it used and controlled in the workplace, the signs and symptoms of exposure, and that medical examinations are to be made available under certain conditions.

- c. Inspection Guidelines. The OSHI shall review the employer’s written ERTK program to determine whether it includes information and training on Cr(VI) hazards and control measures. The OSHI shall question affected employees to see if they have ever had training on the Cr(VI) standard, if they understand the Cr(VI) medical surveillance program, and if a copy of the Cr(VI) standard was made available to them.
- d. Citation Guidelines. When employees received no or partial Cr(VI) information or training as listed above, paragraph 1910.1026(l) or 1926.1126(j) shall be cited and the AVD shall list out the delinquencies of each subsection. If the employer was negligent on a single section or subsection of 1910.1026(l) or 1926.1126(j) then that specific section or subsection shall be cited.

If the employer did not provide Employee Right to Know training and did not provide Cr(VI) training, two separate citations shall be proposed following the previous paragraph and the RTK Enforcement Guidelines: CPL 2-2.38C. If the Employer was not performing yearly training updates for Cr(VI) and/or yearly ERTK training updates, a single citation shall be proposed under ERTK Rule, 5206.0700 (Subp. 1)(G) following the RTK Enforcement Guidelines: CPL 2-2.38C.

13. Recordkeeping.

Paragraph (m) of the general industry standard and paragraph (k) of the construction standard require employers to maintain exposure and medical surveillance records. The recordkeeping provisions of these standards are consistent with OSHA’s Access to Employee Exposure and Medical Records standard (29 CFR 1910.1020). These records shall be available to employees so that they can examine the determination made by the employer.

The Cr(VI) standards require that exposure monitoring and medical surveillance records include the employee’s Social Security number. Employers must grant access to exposure and medical records upon request by employees and their designated representatives, and by OSHA, per 1910.1020(e). If the employer provides other parties access to the exposure records, the Social Security numbers may be expunged from the records prior to allowing access.

The Access to Employee Exposure and Medical Records standard, 1910.1020, requires that employee exposure records be kept for at least 30 years and that medical records be kept for the duration of the employee’s employment plus an additional 30 years.

- a. Paragraph (m)(1) of the general industry standard and paragraph (k)(1) of the construction standard require employers who perform air monitoring to determine employee Cr(VI) exposures, to maintain accurate records of such monitoring that identify the monitored employee and all employees whose exposures are represented by the monitoring. The employer is required to keep records for each exposure measurement taken. Specifically, records shall include the following information:

- i. The date of measurement for each sample taken;
 - ii. The operation involving exposure to Cr(VI) that was monitored;
 - iii. Sampling and analytical methods used and evidence of their accuracy;
 - iv. The number, duration, and results of samples taken;
 - v. The type of personal protective equipment used; and,
 - vi. The name, Social Security number, and job classification of all employees represented by the monitoring, indicating which employees were actually monitored.
- b. Paragraph (m)(2) of the general industry standard and paragraph (k)(2) of the construction standard require employers who use historical monitoring data to conduct exposure determinations to maintain records of this data. The records of historical monitoring must demonstrate that the data were obtained using a method sufficiently accurate under paragraph (d)(5) of the standards. The records must also show that the work being performed, the Cr(VI)-containing material being handled, and the environmental conditions at the time the historical monitoring data were obtained closely resemble those elements of the job for which exposure is being determined. Other data relevant to operations, materials, processing, or employee exposures must also be included in the records.
- c. Paragraph (m)(3) of the general industry standard and paragraph (k)(3) of the construction standard require employers who use objective data to conduct exposure determinations to maintain records of this data. The records must include: the chromium-containing material in question; the source of the objective data; the testing protocol and results of testing, or analysis of the material for the release of Cr(VI); a description of the process, operation, or activity involved and how the data support the determination; and other data relevant to the process, operation, activity, material, or employee exposures.
- d. Paragraph (m)(4) of the general industry standard and paragraphs (k)(4) of the construction standard require employers to establish and maintain an accurate medical surveillance record for each employee subject to the medical surveillance requirements of the standards. Medical surveillance records are required to include the following information: The name, Social Security number, and job classification of the employee; a copy of the PLHCP's written opinions; and a copy of the information provided to the PLHCP. This information includes the employee's duties as they relate to Cr(VI) exposure, Cr(VI) exposure levels, and descriptions of personal protective equipment used by the employee (see paragraph (k)(4) in general industry, paragraph (i)(4) in construction).
- e. Inspection Guidelines. If the employer is following the scheduled monitoring option for exposure determinations, the OSHI shall review the employer's air monitoring data to determine whether the employer is keeping an accurate record of all measurements taken as set forth in this recordkeeping paragraph. If the employer is following the performance-oriented option, or is using objective data to support a determination that the Cr(VI) standard does not apply per paragraph (a)(4), the OSHI shall ask the employer for relevant records. (See Section E (1)(c), above, for evaluation criteria and enforcement policy where

objective data are used by the employer to support a determination that the standard does not apply.)

The OSHI shall also review the employer's medical surveillance records for employees exposed to Cr(VI).

The records shall be examined to determine if the employer is keeping employee exposure records for at least 30 years, and medical records for the duration of the employee's employment plus 30 years. Also note, 1910.1020(h)(1) requires that employers ceasing to do business shall transfer all employee exposure and medical records to the successor employer, if applicable.

- f. Citation Guidelines. If the employer is following the scheduled monitoring option of the standards, and the employer has not maintained the required air monitoring records, paragraph (m)(1) of the general industry standard or (k)(1) for construction shall be cited. If the records are missing certain required elements, the appropriate subparagraph of (m)(1) for general industry or (k)(1) for construction shall be cited.

If the employer is following the performance-oriented option but does not have the historical monitoring or objective data to support its exposure determinations, paragraph (m)(2)(i) or (m)(3)(i) of the general industry standard or (k)(2)(i) or (k)(3)(i) for construction shall be cited. If the employer's historical or objective data records are missing certain required elements, the appropriate subparagraph of (m)(2) or (m)(3) for general industry, or (k)(1) or (k)(3) for construction, shall be cited.

If the employer claims exemption from the Cr(VI) standard based on paragraph (a)(4), but the employer's objective data are not documented or maintained, the OSHI shall perform air sampling to evaluate Cr(VI) exposures. If the sampling indicates there are Cr(VI) exposures, paragraph (m)(3)(i) of the general industry standard or (k)(3)(i) for construction shall be cited, as well as any other applicable violations.

If the employer does not have any of the required medical surveillance records, paragraph (m)(4) of the general industry standard or (k)(4) for construction shall be cited. If the records are missing certain required elements (e.g., physician's written opinion), the appropriate subparagraph of (m)(4) of the general industry standard or (k)(4) for construction shall be cited.

If the employer is not maintaining employee exposure records or medical surveillance records in accordance with 1910.1020, the corresponding subparagraph (iii) of paragraph (m) in the general industry standard, or (k) in the construction standard, shall be cited and grouped with the appropriate provision of 1910.1020.

F. Interface with Other Standards.

1. 29 CFR 1910.1025, Lead; 29 CFR 1915.1025, Lead; 29 CFR 1926.62, Lead.

Occupational exposures to lead chromate (PbCrO₄) – which is a common paint formulation that contains both lead and Cr(VI) – are also regulated by the Lead standards. OSHA's enforcement policy prior to the Cr(VI) standards required OSHIs to apply the Lead standards to lead chromate exposures, and any air samples collected

where lead chromate was present were only analyzed for lead because the lead PEL - 50 $\mu\text{g}/\text{m}^3$ - was more protective than the previous PEL for chromates (CrO_3) – 100 $\mu\text{g}/\text{m}^3$.

However, the new Cr(VI) standards lower the permissible limit for Cr(VI), so that it now provides greater protection to employees exposed to lead chromate. Specifically, where airborne exposures are from lead chromate, and exposures are limited to the new Cr(VI) PEL of 5 $\mu\text{g}/\text{m}^3$, the corresponding lead exposure is effectively limited to 20 $\mu\text{g}/\text{m}^3$, which is two and a half times lower than the lead PEL of 50 $\mu\text{g}/\text{m}^3$.

Where there are lead chromate exposures, OSHA will apply both the Cr(VI) standard and the Lead standard. Current laboratory analytical methods cannot accurately measure both lead and hexavalent chromium from one air sampling cassette. Thus, where it is practical for the OSHI to collect dual air samples for operations involving exposures to lead chromate, sampling and analyses shall be performed for both hexavalent chromium and lead.

If it is only practical to collect one air sample, the OSHI should consider preferentially sampling for Cr(VI) because of its lower PEL. On the other hand, sampling for lead may be more appropriate where potential reproductive hazards of lead are present to pregnant employees or those of child-bearing age. The OSHI shall consult with his/her Director to determine the best sampling strategy in such cases.

In preparing this Cr(VI) Directive, OSHA reviewed existing toxicological studies and did not find data showing that the common effects of lead and Cr(VI) are *known* to be additive. Therefore, OSHIs are instructed to *not* apply the mixture formula in 1910.1000(d)(2)(i), or 1915.1000(d)(2)(i), until any additive health effects become known. (Note that the mixture formula is not in 1926.55.)

Where the OSHI finds overexposures to both lead and Cr(VI) in workplaces using lead chromates, violations of both the Cr(VI) PEL and the lead PEL shall be cited. Two separate penalties shall be assessed. Additionally, violations of other applicable provisions of both the Lead and Cr(VI) standards that are triggered by their PELs, such as respiratory protection and exposure monitoring, shall be cited as appropriate.

2. CFR 1910.1018, Inorganic Arsenic; 29 CFR 1915.1018, Inorganic Arsenic; 29 CFR 1926.1118, Inorganic Arsenic.

Occupational exposures to compounds containing both arsenic and Cr(VI) (such as arsenical pesticides, e.g., chromated copper arsenate, that may be used in pressure-treated wood), are also regulated by the Inorganic Arsenic standards. No specific OSHA enforcement policy has directed OSHI's to preferentially air sample for arsenic, although the OSHI is expected to apply the strictest exposure limit when measuring employee exposures.

Note that any operations involving the *application of pesticides*, such as chromated copper arsenate (CCA), are not covered by the Cr(VI) or Inorganic Arsenic standards. Furthermore, OSHA's Inorganic Arsenic standards additionally exclude employee exposures in *agriculture* and resulting from *uses of arsenically preserved wood*. Thus, industrial operations involving the *manufacture of pesticides* are covered by both the Arsenic standards and Cr(VI) standards, but construction operations *utilizing pesticide-treated products* are only covered by the Cr(VI) standards.

Current laboratory analytical methods cannot accurately measure both arsenic and hexavalent chromium from one air sampling cassette. Thus, where it is practical for the OSHI to collect dual air samples for operations involving exposures to compounds

containing arsenic and hexavalent chromium, sampling and analyses shall be performed for both chromium and inorganic arsenic. If it is only practical to collect one air sample, the OSHI should consider preferentially sampling for Cr(VI) because of its lower PEL.

In preparing this Cr(VI) Directive, OSHA reviewed existing toxicological studies and did not find data showing that the common effects of Cr(VI) and arsenic are *known* to be additive. Therefore, OSHIs are instructed *not* to apply the mixture formula in 1910.1000(d)(2)(i) until any additive health effects become known. (Note that the mixture formula is not in 1926.55.) Where exposures exceed both the arsenic and Cr(VI) PELs, violations of both the Cr(VI) PEL and the arsenic PEL shall be cited, and two separate penalties shall be assessed. Additionally, violations of other provisions of both the Arsenic and Cr(VI) standards that are triggered by their PELs, such as respiratory protection and exposure monitoring, shall be cited when appropriate.

James Krueger, Director MNOSHA Compliance
For the MNOSHA Management Team

Distribution: OSHA Compliance and WSC Director

Attachments:

- Appendix A: Cr(VI) Compounds and Typical Industries/Operations With Cr(VI) Exposures
- Appendix B: Exclusions in the Chromium (VI) Standards
- Appendix C: Acronyms

NOTICE: Minnesota OSHA Directives are used exclusively by MNOSHA personnel to assist in the administration of the OSHA program and in the proper interpretation and application of occupational safety and health statutes, regulations, and standards. They are not legally binding declarations and they are subject to revision or deletion at any time without notice.

APPENDIX A

**CR(VI) COMPOUNDS AND
 TYPICAL INDUSTRIES/OPERATIONS WITH CR(VI) EXPOSURES**

Common Cr(VI) Compounds

Acid copper chromate (ACC) - formulation of cupric oxide, CuO, and chromic acid, CrO ₃	Chromic sulfate, Cr(OH)SO ₄
Ammonium dichromate, (NH ₄) ₂ Cr ₂ O ₇	Lead chromate, PbCrO ₄
tert-Butyl chromate, [(CH ₃) ₃ CO] ₂ CrO ₂	Potassium chromate, K ₂ CrO ₄
Calcium chromate, CaCrO ₄	Potassium dichromate, K ₂ Cr ₂ O ₇
Chromated copper arsenate (CCA) - formulation of arsenic pentoxide, As ₂ O ₅ , chromic acid, CrO ₃ , and cupric oxide, CuO	Sodium chromate, Na ₂ CrO ₄
	Strontium chromate, SrCrO ₄
Chromic acid (H ₂ CrO ₄), chromium trioxide (CrO ₃), or chromium oxide	Zinc chromate, ZnCrO ₄

Typical Industries/Operations with Cr(VI) Exposures

Industry/Operation	Comment / Typical Cr(VI) Chemical Used
Manufacture of chromates	Various Cr(VI) compounds
Iron and steel foundries; steel mills; forging	Chromium metal, Cr(VI) fume
Welding ¹ of stainless steel or Cr(VI) coatings	Cr in steel oxidized to Cr(VI) fume when welded or torch-cut
Manufacture of pesticides (applications are excluded from Cr(VI) standards)	CCA and ACC
Manufacture of glass	Sodium dichromate dihydrate, Na ₂ Cr ₂ O ₇ [H ₂ O] ₂
Cleaning laboratory glassware	Potassium dichromate
Electroplating; chrome plating	Chromic acid
Construction with pressure-treated wood (manufacturing of pressure-treated wood is excluded in the Cr(VI) standards)	CCA and ACC
Operations with portland cement	Excluded from Cr(VI) standards
Manufacture of chromate pigments and dyes	Dichromates, lead chromate (chrome yellow); strontium chromate; zinc chromate
Painting (aerospace, auto body repair, traffic markings); paint removal from steel structures	Lead chromate, zinc chromate, strontium chromate
Fiberglass production	Cr(VI) contaminants formed in furnace

¹ Factors that can affect the concentration of Cr(VI) in the welding fume include the composition of the base metal and the welding consumable (electrodes or welding rods), as well as the chromium content of surface coatings on the base metal. Exposures tend to be higher for welding on stainless steel (12-30% chromium) compared with welding on carbon steel (generally 3% chromium or less). Also, the more confined the working space or the absence of effective exhaust, the higher the concentration of welding fume.

The type of welding method used can also affect the fume generation rate (FGR) and, therefore, the welder's potential exposure to Cr(VI). Welding operations such as manual metal arc (MMA) welding or stick welding, also known as shielded metal arc welding (SMAW), tend to produce higher fume rates. Most repair welding is done using SMAW due to its low cost, portability, and ease of use. Other types of welding that also tend to produce high fume rates are gas metal arc welding (GMAW), also known as metal inert gas (MIG) welding, and flux-cored arc welding (FCAW); these methods are semi-automatic or automatic welding processes. Welding methods that tend to produce lower fume rates are gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding, and submerged arc welding (SAW). (71 FR 10262)

Finally, welding parameters such as higher current/voltage and higher oxygen or carbon dioxide percentage in the shielding gas tend to increase the FGR. A suggested reference on characteristics of welding processes is Chapter III of the *NIOSH Criteria for a Recommended Standard on Welding, Brazing, and Thermal Cutting*.

APPENDIX B

EXCLUSIONS IN THE CHROMIUM (VI) STANDARDS

The function of this appendix is to present a summary of the exclusions in OSHA's standards for hexavalent chromium. This appendix also presents the OSHI with appropriate enforcement policies for portland cement operations, pesticide operations, and at electroplating job shops that opted-in to the SFIC settlement agreement.

Standard	Specific Exclusion	Typical Work Operations
1910.1026(a)(3) 1926.1126(a)(3)	Exposures in work with portland cement.	Manufacture of portland cement; mixing cement; working wet concrete, mortar, grout, bricklaying; cutting and hammering concrete; cement plant; cinder block manufacturing.
1910.1026(a)(2) 1926.1126(a)(2)	Exposures in work <i>applying</i> pesticides containing Cr(VI).	Manufacture of pressure treated wood with chromated copper arsenate (CCA) and acid copper chromate (ACC).
1910.1026(a)(4) 1926.1126(a)(4)	Where an employer has objective data showing a work operation cannot release dusts, fumes, or mists of Cr(VI) in concentrations at or above 0.5 µg/m ³ as an 8-hour TWA under any expected conditions of use.	See examples in corresponding section of text, below.

Section B-1. Portland Cement Inspection Procedures

Portland cement is one of the most widely-used formulations of cement in construction and the occupational health hazards are generally well known. These include inhalation, dermal, and eye hazards, some of which result from trace constituents generally found in portland cement, including hexavalent chromium ("Cr(VI)"). Cr(VI) is a trace constituent of portland cement not because it is an added ingredient but because it is a contaminant that enters the mixture during its manufacture. Generally there is less than 20 µg Cr(VI) per gram of cement, or 20 parts per million (ppm).

OSHA's Cr(VI) standards do not apply to operations with portland cement because OSHA determined that compliance with pre-existing OSHA general standards provides adequate protection for employees exposed to the trace amounts of Cr(VI) found in portland cement. The applicable OSHA standards are those for air contaminants, personal protective equipment, sanitation, and hazard communication. This Appendix explains how these standards, and OSHA's recordkeeping regulations, are to be enforced at workplaces, primarily construction workplaces, where employees are exposed to portland cement. A one-page checklist is also included to assist OSHIs in these inspections. In all safety and health inspections where it is determined that Portland Cement is in use, the establishment shall be coded in Item 42, Optional Information of the MNOSHD-1 form:

Block 42: Type = N ID = 11 Value = Portland

Dermal and Eye Hazards: Exposure to dry portland cement may cause drying of the skin and mild irritation, or more significant effects from the aggravation of other conditions. Wet portland cement is caustic (pH > 12) and dermal exposure may cause more severe skin effects, including thickening, cracking or fissuring of the skin. Prolonged exposure can cause severe skin damage in the form of

chemical (caustic) burns. Eye exposures to portland cement may cause immediate or delayed irritation or inflammation of the cornea. Eye contact with larger amounts of dry powder or splashes of wet portland cement may cause effects ranging from moderate eye irritation to chemical burns and blindness. Some individuals who are exposed to portland cement may exhibit an allergic response, which can result in symptoms ranging from mild rashes to severe skin ulcers. Cement dermatitis may be irritant contact dermatitis induced by the alkaline, abrasive, and hygroscopic (water absorbing) properties of portland cement, or it may be allergic contact dermatitis elicited by an immunological reaction to Cr(VI), or it may be a combination of the two.

PPE: OSHA's general standards for personal protective equipment (PPE), 29 CFR 1910.132 for general industry and 29 CFR 1926.95 for construction, require employers to ensure that appropriate PPE is provided, effectively used, and maintained. Appropriate PPE should include boots and gloves, and may also include eye protection, such as safety glasses with side shields or goggles, in some circumstances. Such equipment must be maintained in a sanitary and reliable condition when not in use, and employees must be able to clean or exchange their equipment if it becomes ineffective or contaminated on the inside with cement. In addition to long-sleeved shirts and long pants, protective clothing such as coveralls may also be appropriate to prevent the skin from coming in contact with cement. Because the general PPE standards provide protection essentially equivalent to the PPE provision in the Cr(VI) standards, compliance with them should provide adequate protection against the Cr(VI) hazards from portland cement. OSHIs must confirm that appropriate PPE is provided, used, and maintained.

Sanitation: The requirements for washing facilities in OSHA's general sanitation standards are also comparable to the hygiene provisions found in the Cr(VI) standards. For example, OSHA's Sanitation standard for general industry explicitly requires that lavatories with running water, hand soap, and individual hand towels or air-blowers be available in all places of employment. See 29 CFR 1910.141(d)(2).

In construction operations where employees may be exposed to harmful contaminants, the sanitation standard requires employers to "provide adequate washing facilities . . . in near proximity to the worksite [that must] be so equipped as to enable employees to remove such substances." 29 CFR 1926.51(f)(1).¹ In order to effectively remove portland cement, employers must provide washing facilities with clean water, non-alkaline soap and clean towels. This interpretation of 1926.51(f)(1) is consistent with the evidence in the Cr(VI) rulemaking record and with OSHA's previous interpretations of these standards.

Inhalation Hazards / PELs: Inhalation of dry portland cement may cause irritation to the moist mucous membranes of the nose, throat and upper respiratory system, or may cause or aggravate certain lung diseases or conditions. Although portland cement is not recognized as a carcinogen by NTP, OSHA, or IARC, it generally contains small amounts of substances, such as crystalline silica and Cr(VI), which are recognized as carcinogens by these organizations.

OSHA's PELs for both portland cement and particulates not otherwise regulated (PNOR) are 15 mg/m³ as total dust, and 5 mg/m³ for the respirable fraction where listed. Because there are only trace amounts of Cr(VI) in portland cement, these PELs provide greater protection against Cr(VI) inhalation hazards than the new Cr(VI) PEL of 5 µg/m³; that is, an employee exposed to 15 mg/m³ of portland cement dust with a Cr(VI) concentration below 20 µg/g, will be exposed to less than 0.3 µg/m³ of Cr(VI).

OSHIs must confirm that concentrations of portland cement dust are at or below the 15 mg/m³ PEL. If maintaining portland cement exposure levels below 15 mg/m³ is not feasible, exposed employees must wear respiratory protection in accordance with 29 CFR 1910.134. This would be most likely in construction operations such as terrazzo work, mixing mortar and jobsite mixing of concrete.

¹ Paragraph 29 CFR 1926.51(f)(3), which requires "hot and cold running water, or tepid running water," is only applicable to permanent places of employment where construction work is occurring; however, the general requirement in paragraph (f)(1) applies to all construction work.

Training / Hazard Communication: Portland cement is considered a hazardous chemical under MNOSHA's Employee Right to Know standard, MNOSHA DLI Chapter 5206. (ERTK), and should be included in the employer's ERTK program. Employers whose employees are exposed to portland cement must provide appropriate training (discussed below), maintain labels and copies of MSDSs for portland cement in their workplaces, and ensure that these documents are readily accessible during each work shift.

MSDSs for portland cement are expected to indicate the dermal and inhalation hazards described above. Because there is evidence that exposure to the Cr(VI) in portland cement could cause sensitization and allergic dermatitis, MSDSs for portland cement that is contaminated by Cr(VI) are expected to indicate the presence of Cr(VI) and to address this hazard

OSHA's general construction training standard, 29 CFR 1926.21(b), and the ERTK training standard, 5206.0700, are applicable to operations with portland cement exposure. OSHIs must verify that employers are complying with these provisions by instructing employees working with portland cement about the hazards of portland cement, including any hazards associated with the cement's Cr(VI) content.

Inspection Checklist: At every inspection site where the OSHI encounters employees working with portland cement, the officer shall determine, at a minimum, the employer's compliance with the general standards described above. A checklist is provided on the following page to assist OSHIs in these worksite inspections. This checklist sets forth the specific provisions of these general standards that employers must follow in order to control the inhalation, dermal, and eye hazards associated with exposures to portland cement.

Further health and safety information on the concrete industry is available at the OSHA website's Safety and Health Topics Page on [Concrete and Concrete Products - Manufacturing and Construction](#).

Portland Cement Inspections Checklist

Portland Cement Inspections		Y	N
I	Is Portland cement being used at the site? If no, STOP. Otherwise, continue		
II	Determine if any of the following work procedures are being done which potentially expose employees to the inhalation of Portland cement dust.		
	a terrazzo work		
	b mixing mortar		
	c jobsite mixing of concrete		
	if yes, is the employer in compliance with the permissible exposure limits standard, 1926.55? a referral to an industrial hygienist may be appropriate		
III	Determine if the employer is in compliance with the Sanitation standard, 1926.51(f)(1)	Y	N
	a is clean water provided for washing?		
	b is non-alkaline soap provided for washing?		
	c are clean towels provided?		
	d are these facilities readily accessible to exposed employees?		
	e are there enough facilities for the number of exposed employees and the size of the job?		
IV	Determine if the employer is in compliance with the PPE standard, 1926.95(a)	Y	N
	a are boots and gloves provided as necessary and appropriate for the job?		
	b are there provisions to enable employees to clean or exchange equipment if it becomes ineffective or contaminated on the inside with Portland cement while in use?		
	c are there provisions made to ensure that equipment is maintained in a sanitary and reliable condition when in use?		
V	Determine if the employer is in compliance with the RTK standard	Y	N
	a are MSDS available and products labeled for Portland cement? (note: Portland cement contaminated by Hexavalent Chromium (Cr(VI)) are expected to indicate the presence of Cr(VI) and to address this hazard.)		
VI	Determine if the employer is in compliance with the Training standards, 1926.21(b), and RTK	Y	N
	a are the employees instructed regarding the safe handling and use of caustics and other harmful substances, according to 1926.21(b)(3)?		
	b Does the employer's training meet 5206.0700 subp. 1 and 2 ? Training must include		
	i. hazards associated with Cr(VI) if present		
	ii. proper use and care of PPE		
	iii. importance of proper hygiene practices		
	iv. employee access to hygiene facilities, PPE, and information (including MSDS)		
VII	Determine if the employer is in compliance with the Recordkeeping standard, 1904.4 and 1904.7	Y	N
	a does the employer record each work-related case of occupational dermatitis that meets the recordability criteria in 1904.4?		
	b does the employer inform its employees of how to report their work-related illnesses and injuries?		

Section B-2. Operations with Cr(VI) Pesticides

The Cr(VI) standards do not apply where there are exposures to Cr(VI) in the *application* of pesticides for wood treatment, such as chromated copper arsenate (CCA) and acid copper chromate (ACC). Applications of these pesticides are instead regulated by the EPA. However, the standards do apply where Cr(VI) exposures occur either in the *manufacture* of Cr(VI) pesticides, or while *using or otherwise handling* wood products treated with Cr(VI) pesticides. These standards would also apply to employees working adjacent to or inside work areas where an exempt employer is applying or has recently applied Cr(VI) pesticides.

OSHA's exposure profile for woodworking indicated that construction work using wood treated with pesticides containing Cr(VI) involved Cr(VI) exposures above the new PEL (up to 30 percent exceeded the PEL). The OSHI should also remember that CCA is a common wood preservative chemical, which contains both Cr(VI) and inorganic arsenic, each regulated by a substance-specific standard. Refer to this Directive's Section F (1)(b), which explains OSHA's enforcement policy for application of the two standards for this exposure situation.

Where the OSHI encounters operations involving applications of Cr(VI) pesticides to wood products, and there are concerns about compliance with environmental regulations, a referral to the EPA may be made through the Regional Office.

Section B-3. Cr(VI) Operations Excluded with Objective Data

The Cr(VI) standards do not apply where the employer has objective data demonstrating that a material containing chromium or a specific process, operation, or activity involving chromium cannot release dusts, fumes, or mists of Cr(VI), under any expected conditions of use, in concentrations at or above $0.5 \mu\text{g}/\text{m}^3$.

As an example, the employer may have objective data in the form of documentation from an industry group or trade association showing that the Cr(VI) fraction of workplace dusts would be such that compliance with the PEL for nuisance particulates of $15 \text{ mg}/\text{m}^3$ yields an airborne exposure to Cr(VI) below the exclusion criterion of $0.5 \mu\text{g}/\text{m}^3$.

A similar example could involve an employer performing remediation of Cr(VI)-contaminated soil, at a Superfund site. If the employer has soil sampling data that reasonably characterize the Cr(VI) concentrations within the soil as less than 30 parts per million, and the employer has previously monitored the employees' airborne dust exposures at this worksite under all expected conditions of soil remediation work and determined with 95% confidence and +/- 25% accuracy that employee exposures to total dust do not exceed the PEL of $15 \text{ mg}/\text{m}^3$ (reference 1910.1000, Table Z-1, particulates not otherwise regulated, total dust), then the employer may perform an exposure determination for airborne Cr(VI) by multiplying the soil Cr(VI) concentration by the maximum total airborne dust exposures, yielding maximum Cr(VI) exposures that do not exceed $0.45 \mu\text{g}/\text{m}^3$. See Sections E (1)(b)(iii), (4)(b), and (13)(e-f) for specific enforcement procedures if the employer's objective data are absent or inadequate.

APPENDIX C

ACRONYMS

ACC	acid copper chromate
ACGIH®	American Conference of Governmental Industrial Hygienists®
AFL-CIO	American Federation of Labor and Congress of Industrial Organizations
APF	assigned protection factor
BCTD	Building and Construction Trades Department
BEIs®	Biological Exposure Indices®
CAA	Clean Air Act
CCA	chromated copper arsenate
CERCLA	Comprehensive Environmental Response, Compensation & Liability Act
CFR	Code of Federal Regulations
CPL	Enforcement and Compliance Directive
Cr	chromium
CrO ₃	chromium oxide, chromium trioxide, or chromic acid
Cr(VI)	hexavalent chromium
Cr+6	hexavalent chromium ion
CSI	Chemical Sampling Information
CSP	Cooperative and State Programs Directive
CTC	Cincinnati Technical Center
EPA	Environmental Protection Agency
ERTK	Employee Right to Know
FCAW	flux-cored arc welding
FGR	fume generation rate
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FIRM	Field Inspection Reference Manual
FR	Federal Register
GMAW	gas metal arc welding
GTAW	gas tungsten arc welding
HCS	Hazard Communication standard
HEPA	high efficiency particulate air
HRG	Public Citizen Health Research Group
IARC	International Agency for Research on Cancer
ISO	International Organization for Standardization
MIG	metal inert gas (welding)
MMA	manual metal arc (stick welding)
MSDS	Material Safety Data Sheet
NaOHqz	binderless quartz fiber filter coated with sodium hydroxide
NESHAP	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OHE	Office of Health Enforcement
OSH Act	Occupational Safety and Health Act of 1970

OSHA	Occupational Safety and Health Administration
OSHI	Occupational Safety and Health Investigator
OTM	OSHA Technical Manual
PAPR	powered air purifying respirator
PbCrO ₄	lead chromate
PEL	permissible exposure limit
PLHCP	physician or other licensed health care professional
PNOR	particulates not otherwise regulated
PPE	personal protective equipment
ppm	parts per million
PTFE	polytetrafluoroethylene
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
REL	recommended exposure limit
SAE	sampling and analytical error
SAVE	standard alleged violation element
SAW	submerged arc welding
SFIC	Surface Finishing Industry Council
SLTC	Salt Lake Technical Center
SMAW	shielded metal arc welding (stick welding)
STD	Standards Directive
TED	Training and Education Directive
TIG	tungsten inert gas (welding)
TSCA	Toxic Substances Control Act
TWA	time-weighted average
USC	United States Code
µg/m ³	micrograms per cubic meter.