

Hexavalent Chromium Sampling Strategy

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1. Hexavalent Chromium (Cr(VI)) Background.

a. Army policy mandates the use of the American Conference of Governmental Industrial Hygienists (ACGIH®) Threshold Limit Values (TLVs®) as the Occupational Exposure Limit (OEL) criteria when the Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) is less protective or when no OSHA PEL exists. As a result, industrial hygienists must ensure that air sampling exposure assessments align with the particle size-selective sampling methodology (i.e., inhalable, thoracic, and respirable) delineated in the applicable OSHA standard and/or Army policy.

b. Traditionally, Army elements have conducted airborne monitoring in the workplace following methods for total fraction sampling. In May 2019, OSHA approved the Department of Defense to compare the results of the Institute of Medicine (IOM) samples to the OSHA PEL. Therefore, total fraction sampling in addition to IOM sampling is no longer required. The IOM results can be compared to the OSHA PELs and the ACGIH TLVs. In cases where the ACGIH standard is more stringent than the OSHA standard, the TLV is used as the OEL.

c. In 2018, the ACGIH adopted lower TLVs for Chromium (Cr)/Cr compounds, expressed as an inhalable fraction. Due to the ACGIH Cr/Cr compounds TLVs being the more conservative, they now apply as the Army OEL. Additionally, ACGIH established a short-term exposure limit (STEL) for Cr(VI). See Table 1 for a review of the 2018 ACGIH TLVs for Cr/Cr compounds.

Table 1. 2018 American Conference of Governmental Industrial Hygienists Threshold Limit Values

Substances	Time Weighted Average	Short Term Exposure Limit
Metallic Chromium Cr(0)	0.5 mg/m ³ (I)	-n/a
Trivalent Chromium Cr(III)	0.003 mg/m ³ (I)	-n/a
Hexavalent Chromium Cr(VI)	0.0002 mg/m ³ (I)	0.0005 mg/m ³ (I)

Legend:

mg/m³ = milligram per meter cubed

Note:

(I) Measured as inhalable fraction of the aerosol.

<p>Use of trademarked name(s) does not imply endorsement by the U.S. Army but is intended only to assist in identification of a specific product.</p>

2. Sampling Plan Overview.

a. Air sampling will be performed, at each installation, throughout all identified buildings/hangars/areas (as outlined in Headquarters, Department of Army (HQDA) Executive Order (EXORD) 031-19). These areas should include (but are not limited to) welding, metal machining, airframe body work, rotor maintenance, engine maintenance, painting/priming, and plating. Personal breathing zone (and potentially general area) air samples will be collected during the entire work shift to assess for potential exposure to Cr(VI).

b. Inhalable fraction sampling, using the IOM sampler for Cr(VI) particulates, is required by the HQDA EXORD.

(1) Inhalable Particulate Matter Sampling: Sampling is conducted full-shift using an IOM personal sampler to assess the 8-hour time weighted average to the 2018 ACGIH TLV. The IOM cassettes arrive preloaded with a 5-micrometer (μm), 25-millimeter (mm) Polyvinyl Chlorate (PVC) filter. When sampling is complete, the IOM cassette is placed in a transport clip, capped, and shipped back to the U.S. Army Public Health Center (APHC) Laboratory Sciences Directorate (LAB). Samples must be shipped via overnight shipping, within 24 hours of sampling, to ensure receipt within the analytical holding times. The APHC LAB will provide directions with the shipment of IOMs. See Figure 1 for the configuration of the conductive plastic IOM sampler and cassette.

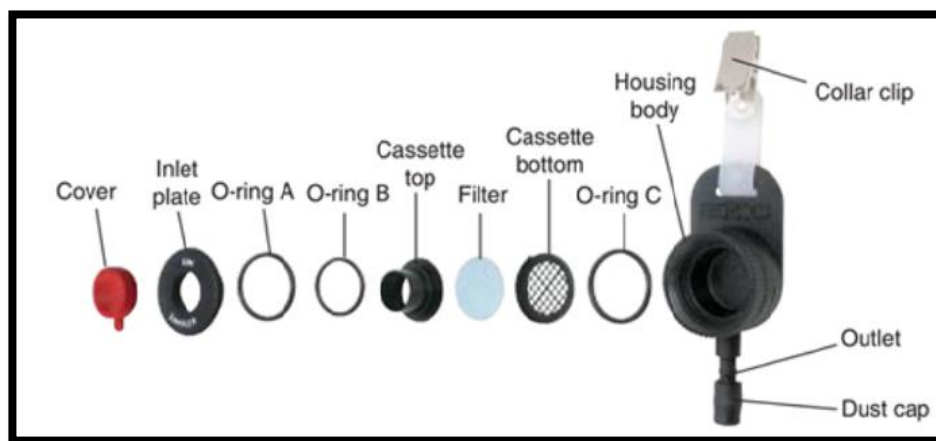


Figure 1. Configuration for Conductive Plastic IOM Sampler and Cassette

(2) STEL sampling: Currently, the APHC LAB is unable to meet the analytical requirements to attain the limit of detection (LOD) for the 2018 ACGIH Cr(VI) STEL. This inability is due to the volume of air needed to obtain the required LOD is too great for the current sampling pumps. When the STEL is obtainable, APHC will provide an update.

c. Wipe sampling. Army workplaces are neither required, nor advised to collect surface dust wipe samples as a method to evaluate personal exposure. Wipe sampling may be performed in non-production work spaces throughout the identified areas to determine if controls are effective in keeping Cr(VI) out of break and other “clean” areas.

d. Ventilation Assessment. A ventilation assessment should be performed in local industrial hygiene identified areas with active controls in-place.

e. Defense Occupational Health Readiness System – Industrial Hygiene (DOEHRS-IH). All air sampling, wipe sampling and ventilation assessment data must be entered in the installation's DOEHRS-IH program office. When entering Cr(VI) data into DOEHRS-IH, select OSHA ID 215 (Air) AIPH Air/FILTER (5-um PVC Membrane) as the sampling method for air sampling and OSHA ID 215 (Wipe) AIPH (Wipe/FILTER) (5-um PVC Membrane) for wipe sampling. When sampling using the IOM, select "inhalable" for the inspirability level of the task. The final pages of this strategy provide DOEHRS screen shots.

3. Sampling and Media.

a. The APHC LAB will provide all sampling media. Requests for IOMs should be sent to APHC LAB at: usarmy.apg.medcom-aphc.list.industrial-hygiene-lab-analysis-inqu@mail.mil. Provided IOMs will only be distributed during the installation's designated month (found in the HQDA EXORD). Use of the APHC Laboratory Information Documentation System (LIDS) 9 submission protocol is required.

b. 25mm PVC Filters preloaded in the IOM Plastic Cassette.

(1) Sampling media used to assess exposure to Cr(VI) for Army compliance sampling (following ACGIH).

(2) Gilian Pumps (example), Sample Flow Rate = 2.0 LPM; Minimum Volume = 300 L (which is 150 minutes at 2 LPM).

(3) Reference Method OSHA ID-215 (Version 2).

(4) Sample Shipment: Samples must be shipped back overnight for the following operations:

- Welding – hold time is 8 days.
- Plating – hold time is 6 days.
- Painting – hold time is 14 days.
- All other operations – hold time is 14 days.

(5) Submit 1 field blank for every 20 samples.

(6) APHC LAB will provide media blanks.

(7) IOM Calibrator Adapter will be supplied with IOMs. Ensure a snug fit; DO NOT OVER TIGHTEN or it will crack the IOM plastic housing.

Note: Sampling should be paused during lunch/dinner breaks when employees change-out of their uniforms and/or leave the production area. Upon return from those breaks, re-start sampling pumps. If an employee is a smoker, the sampling pump must be paused and removed during these breaks and re-started upon return. During breaks, which do not involve changing uniforms, sampling should continue as scheduled.

d. Heat stress can occur during any season, especially during the summer months, and if personal protective equipment is utilized. Therefore if heat stress is of concern, use the following procedures to collect Wet Bulb Globe Temperature (WBGT) readings:

- During the entire shift, log data using the QuestTemp® WBGT.
- Collect data using two meters. One in a non-obstructive but centralized location within the operations area, and a second outside of the production area.

4. Team Member Task List (Example).

a. Follow all safety guidelines and protocols set by the area/installation.

b. Daily heat stress monitoring: Record the location of the WBGT each testing day and download/record these readings.

c. If required, collect wipe samples—no duplicate wipe sampling locations.

d. Take photographs to document sampling locations and to reference in reports.

e. Record observations to include (but not limited to)—

- Any important information regarding the aircraft maintenance process.
- Notable exposed skin and potential/actual contact with surfaces (i.e., break area, work table, etc.).
- Personal hygiene practices (good and bad).
- Noticeable particle generation within breathing zone.
- Presence of odors/settled particulates.
- Worker not wearing sampling pump.
- Sampling Pump Errors/Faults.

f. Record pertinent employee comments and daily work activities.

g. Record PPE Usage.

(1) Document the type of PPE worn by employees during each of the specific tasks.

(2) Note the condition of the PPE and the change out frequency.

(3) Record how much skin is exposed to the elements (i.e., how much skin is not covered by PPE).

5. For further information or clarification please contact the APHC Industrial Hygiene Field Services Program at (410) 436-3118 or usarmy.apg.medcom-phc.list.org-ohs-ihfs@mail.mil.

DOEHRS-IH Cr(VI) Sample Entry

When using Institute of Medicine (IOM) Sampler:

Create Sampling Task - Select Sampling Type

* Indicates Required Field Other Actions: -Master Schedule-

Sampling Type Information

Sampling Type * Air Breathing Zone

Continue

Create Sampling Task - Step 6 of 7 - Select Sampling Method

Inhalation Ingestion

Select the sampling method for the the sampling task.
Only the sampling methods associated with the selected inspirabilities will appear for selection
The matching hazard and analytes are listed for each hazard and sampling method combination.

Other Actions: -Master Schedule-

Cancel

Inspirability for Sampling Task

Inspirability	Respirable Thoracic Total	Add Selected >	Inhalable
		Remove Selected <	

Sampling Methods for Selected Inhalation Hazards

Continue

Select	Sampling Methods	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7600 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7604 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 9101 Bulk/dust sample size of small pea in 15 mL clear plastic centrifuge tube	CHROMIUM(VI)
<input type="radio"/>	OSHA 206 Navy Air/FILTER (0.8-um MCEF membrane, 37mm diameter)	CHROMIUM(VI)
<input type="radio"/>	OSHA 215 Navy Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7300 Air/FILTER (0.8-um MCEF membrane, 37mm diameter)	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 Navy Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 /FILTER, (0.8-um, cellulose ester membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7300 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Wipe/PVC filters	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Bulk	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 (Wipe) AIPH Wipe/FILTER (5-um PVC membrane) as Wipe	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 Air Force Air/AirFilter 5 um PVC membrane	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Air/PVC air cassette	CHROMIUM(VI)
<input checked="" type="radio"/>	OSHA ID 215 (Air) AIPH Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Wipe/Whatman 41/42 filter paper (<55 mm)	CHROMIUM(VI)
<input type="radio"/>	No Sampling Method	

When Wipe Sampling: NO INSPIRABILITY

Create Sampling Task - Select Sampling Type

* Indicates Required Field Other Actions -Master Schedule-

Sampling Type Information

Sampling Type * General Swipe

Continue

Create Sampling Task - Step 6 of 7 - Select Sampling Method

Inhalation
Ingestion

Select the sampling method for the the sampling task.
Only the sampling methods associated with the selected inspirabilities will appear for selection
The matching hazard and analytes are listed for each hazard and sampling method combination.

Other Actions -Master Schedule-

Cancel

Inspirability for Sampling Task

Inspirability	Inhalable Respirable Thoracic Total	Add Selected »		« Remove Selected
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Sampling Methods for Selected Inhalation Hazards

Continue

Select	Sampling Methods	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7600 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7604 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 9101 Bulk/dust sample size of small pea in 15 mL clear plastic centrifuge tube	CHROMIUM(VI)
<input type="radio"/>	OSHA 208 Navy Air/FILTER (0.8-um MCEF membrane, 37mm diameter)	CHROMIUM(VI)
<input type="radio"/>	OSHA 215 Navy Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7300 Air/FILTER (0.8-um MCEF membrane, 37mm diameter)	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 Navy Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 /FILTER, (0.8-um, cellulose ester membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7300 Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Wipe/PVC filters	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Bulk	CHROMIUM(VI)
<input checked="" type="radio"/>	OSHA ID 215 (Wipe) AIPH Wipe/FILTER (5-um PVC membrane) as Wipe	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 Air Force Air/Air/Filter 5 um PVC membrane	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Air/PVC air cassette	CHROMIUM(VI)
<input type="radio"/>	OSHA ID 215 (Air) AIPH Air/FILTER (5-um PVC membrane)	CHROMIUM(VI)
<input type="radio"/>	NIOSH 7605 Air Force Wipe/Whatman 41/42 filter paper (<55 mm)	CHROMIUM(VI)
<input type="radio"/>	No Sampling Method	