# University of Arizona

## Chromium (VI / Hexavalent) Compounds Standard Operating Procedure

*[This is a template. Fill in all necessary blanks and delete all highlighted areas when complete. Add any sections necessary for your laboratory. This will be appended to your Laboratory Chemical Hygiene Plan.]*

**Title:**  **Click here to enter the title of your SOP.**

**Approval Holder (AH):** Click here to enter text **Approval #:** Click here to enter text

**Approval Holder Phone Number(s):** Click here to enter text

**Approval Safety Coordinator (ASC):** Click here to enter text

**Approval Safety Coordinator Phone Number(s):** Click here to enter text

**Department:** Click here to enter text

1. **Purpose**

This standard operating procedure (SOP) is intended to provide guidance on how to safely store, handle, use, and dispose of chromium (VI) compounds in Enter AH’s name’s laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before Describe the procedure or process this SOP will address. If you have questions concerning the requirements within this SOP, contact your Approval Holder (AH) or Approval Safety Coordinator (ASC).

1. **Scope**

*[Describe when this SOP applies and to whom this SOP applies.]*

1. **Hazard Description**

*[Describe the hazards presented by the procedure or process this SOP addresses. What makes it hazardous? Provide an example, if applicable.]*



Chromium (VI) compounds are mostly lemon-yellow to orange to dark red in color. They are typically solid (i.e., crystalline, granular, or powdery) although one compound (chromyl chloride) is a dark red liquid that decomposes into chromate ion and hydrochloric acid in water. Chromium (VI) is the second most stable oxidation state of chromium. Chromium (III) is a less toxic form of chromium that still requires caution. Rarely occurring naturally, most chromium (VI) compounds are manufactured (products or by-products).

Chromium compounds are destructive to the tissues of the mucous membrane and upper respiratory tract and may cause ulceration and perforation of the nasal septum. Symptoms include sore throat, coughing and shortness of breath. Ingestion causes severe burns of the mouth, throat and stomach and may lead to death. Symptoms include sore throat, vomiting, diarrhea, coma, abnormal bleeding, fever, liver damage and respiratory failure. Skin contact causes redness, pain and severe burns, which may result in ulcers, systematic poisoning affecting kidney and liver functions and may cause skin sensitivity. Eye contact results in blurred vision, redness, pain and severe tissue burns may occur causing corneal injury or blindness.

OSHA Permissible Exposure Limits (PEL): 5 ug/m3

1. **Process & Hazard Controls**

*[Describe the steps needed to set up and complete the procedure or process in safe manner following the* [*hierarchy of controls*](https://www.cdc.gov/niosh/topics/hierarchy/default.html)*. Use as much detail as is necessary to ensure all laboratory workers can complete the procedure or experiment safely.]*

* 1. **Elimination/Substitution**

*[Describe any eliminations of hazardous chemicals or processes; alternatively, any substitutions with less hazardous alternatives that could be used to accomplish the task.]*

* If able to, substitute chromium (VI) with chromium (iii); this reduces the toxicity.
	1. **Engineering Controls**

*[Describe any engineering controls (e.g. fume hoods, gas cabinets, local exhausts, blast shields, etc.) that are used to safely accomplish the task.]*

* All operations involving chromium should be carried out in a certified chemical fume hood, glovebox, or a hard-ducted biosafety cabinet to keep airborne level below recommended exposure limits. Contact RLSS for assistance in choosing the correct ventilated device for your specific application.
* Laboratory rooms must be at negative pressure with respect to the corridors and external environment. The laboratory/room door must be kept closed at all times.
* Vacuum lines are to be protected by HEPA (high efficiency particulate air) filters or higher efficiency scrubbers.
	1. **Work Practices**

*[Describe any work practices (e.g. staggering schedules, additional cleaning measures for particulates, etc.) that are used to safely accomplish the task.]*

**Housekeeping and cleaning**: As with other metals and powders, the use of wet cleaning methods and disposable mats are recommended to prevent contamination of the use and surrounding areas when working with chromium compounds.

* Place a disposable mat under all chromium use and storage areas.
* Dispose of mats after uses of chromium.
* Always use a pre-wetted, disposable cloth to wipe down chromium use areas once work has concluded for the day.
	+ Also wipe the floor in front of and/or around the use area to prevent general laboratory contamination.
* Use a specific lab coat for chromium compound work; clean regularly via professional dry cleaning service. Chromium and other metals compounds easily cling to clothing and can be taken home to expose workers and relatives in the home.
* Wash hands rigorously and regularly to prevent accidental ingestion after working with chromium compounds.
	1. **Personal Protective Equipment**

*[Describe the personal protective equipment needed to adequately protect laboratory workers when performing the process or procedure addressed by this SOP. Ensure to specify any personal protective equipment beyond the minimum (i.e. safety glasses, lab coat, gloves, long pants and closed-toed shoes).]*

* **Hand protection**: For heavy or extended use, recommend double gloving using nitrile gloves.
* **Eye and face protection**: Safety glasses or goggles.
* **Lab coat**: Use a specific lab coat for chromium compound work; clean regularly via professional dry-cleaning service. Chromium and other metals compounds easily cling to clothing and can be taken home to expose workers and relatives in the home.
* **Respiratory Protection**: Respirators may be required if exposures are not able to be adequately controlled by the use of engineering controls or other means. All uses of respiratory protection require RLSS assessment and consultation (for assessment of work, selection of respirator and filtration, and OSHA-mandated medical clearance and fit testing).
	1. **Transportation and Storage**

*[Describe how to safely transport and/or store (e.g. ventilated cabinet, flammable cabinet, under inert blanket, etc.) the hazardous chemical(s) or processes.]*

* All work with chromium is to be done in the "chromium" designated area in order to keep contamination to a minimum.
* All chemicals containing chromium must be secondarily contained with proper signage. Containers of chromium and designated areas, including storage cabinets, and container must be labeled. Any persons in this area are required to wear personal protective equipment. Safety shower and eye wash stations must be easily accessible (<10 seconds travel time) where chromium is used.
* All laboratory equipment (such as beakers, pipettes, etc.) used in the "chromium" designated area are to be labeled as " chromium contaminated" and are not to be removed from the area without first being decontaminated.
* Store away from incompatible chemicals including the following: arsenic, ammonia gas, hydrogen sulfide, phosphorus potassium; sodium and selenium will produce incandescence.
* Store away from any combustible, organic or other readily oxidizable material (paper, wood, sulfur, aluminum, or plastics).
1. **Spills, Cleanup & Disposal**

*[Describe how to safely end the procedure or process, clean up the process or spills, and/or dispose of any waste generated.]*

**Spills** should always follow the [University Chemical Hygiene Plan](https://rgw.arizona.edu/sites/default/files/cs-univeristy_chemical_hygiene_plan.pdf) Section 8.2.

**Exposure Response**

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| --- | --- | --- | --- |
| **Inhalation** | **Ingestion** | **Skin Contact** | **Eye Contact** |
| If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician. | Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician. | Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediatelyto hospital. Consult a physician | Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes duringtransport to hospital. |

**Disposal**

* All solid chromium contaminated waste shall be disposed of into waste containers specifically designated for chromium waste. Examples of solid chromium waste material include gloves, pipette tips, and paper towels.
1. **Enter Additional Section Title**

*[Add as many sections as necessary to adequately describe how to safely perform the procedure or process addressed by this SOP.]*

References:

* <https://www.ncbi.nlm.nih.gov/books/NBK304377/>
* <https://ntp.niehs.nih.gov/ntp/roc/content/profiles/chromiumhexavalentcompounds.pdf>
* <https://www.safework.nsw.gov.au/hazards-a-z/hazardous-chemical/priority-chemicals/chromium>
* <https://www.osha.gov/sites/default/files/publications/OSHA-3373-hexavalent-chromium.pdf>
* <https://www.osha.gov/sites/default/files/2018-12/fy11_sh-22248-11_Hexavalent_Chromium_Leaders_Guide.pdf>
* <https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910.1026>
* <https://www.ncbi.nlm.nih.gov/books/NBK519246/>