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| **Brueckner Lab-Specific Standard Operating Procedure (LSOP)****Chromium Reagents (Particularly Hexavalent Chromium)** |
| **Principal Investigator(PI):** Christian Brueckner |
| **Building:** Chemistry | **Lab(s) Covered by LSOP:** R413/R415 |
| **Department:** Chemistry | **Lab Phone Number(s):** 6-6596/6-6598 |
| **SECTION 1 – HAZARDOUS CHEMICAL(S) or PROCESS(ES) and HAZARDS INVOLVED** |
| Chromium powder will explode spontaneous in air and is explosive in atmospheres of CO2. Heating in the presence of ammonium nitrate will cause violent reactions. Chromium will emit toxic and poisonous gases in a fire. Avoid exposure with strong oxidizers such as chlorine, fluorine, bromine, and hydrogen peroxide. Chromium (VI) is much more toxic than chromium (III) for acute and chronic exposures. The respiratory tract is the major organ affected by chromium (VI) inhalation exposure, which can lead to shortness of breath, coughing and wheezing. Chromium (VI) may also lead to gastrointestinal and neurological effects while dermal exposure causes skin burns. Chromium (VI) has also been classified as a human carcinogen leading to an increased risk of lung cancer upon inhalation. Chromium (III) and (VI) have been found to be particularly harmful to aquatic environments, so extra care must be taken to avoid exposure to the water supply. |
| **SECTION 2 – ADMINISTRATIVE CONTROLS** |
| * Anyone using the chemicals and procedures described herein needs to have undergone the annual EH&S: [Chemical Hygiene Training](http://www.ehs.uconn.edu/Chemical/?p=training)
* Be aware of the applicable safety data sheets (SDS): <http://www.msds.com>
* [Working Alone](http://policy.uconn.edu/2012/07/30/working-alone-policy/) is not permitted when using chemicals or processes described in this LSOP.
* Any reaction flask containing chromium reagents needs to be clearly labelled as such.
* Hexavalent chromium involved reactions should be performed during normal business hours (i.e., 8:00 am-5:00 pm Mon-Fri), especially when they involve larger than (>2).
* All work with chromium is to be done in the fume hood.
* An eyewash and safety shower must be in the immediate work area where chromium is used.
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| **SECTION 3- ENGINEERING CONTROLS** |
| * All work with chromium reagents must be conducted in a chemical fume hood, under dry conditions, with the sash at the lowest working height and with sliding sash panels (if applicable) aligned to form a barrier between the researcher and the experiment.
* Chemical fume hoods must have been tested by EHS within the last year. If the hood is not working properly, contact Facilities (486-3113) to repair the hood or EHS to retest (486-3613).
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| **SECTION 4 – WORK PRACTICES** |
| Chromium based reagents must be handled and stored in a dry place. Keep cool and protect from sunlight.All containers must be clearly labeled with the chemical name and hazard classes and kept tightly-sealed.* All laboratory equipment (such as beakers, pipettes, etc.) used in for chromium are to be labeled as "chromium contaminated" and are not to be removed from the area without first being decontaminated.
* Empty containers of chromium reagents must be handled carefully since product residues may still be harmful.
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| **SECTION 5 – PERSONAL PROTECTIVE EQUIPMENT (PPE)** |
| * At a minimum, a lab coat, long pants as well as closed-toed footwear and chemical safety glasses that meet ANSI standard Z-87.1 must be worn when handling chromium-based reagents.
* Chemical splash goggles are required when chromium-based reagents.
* Nitrile Gloves must be worn while handling chromium-based reagents and gloves should be changed frequently.
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| **SECTION 6 – STORAGE** |
| * Store as indicated in safety data sheets (SDSs): <http://www.msds.com/>
* Ensure labels on original bottles remain legible and prominently displayed to identify contents.
* Ensure both original and secondary containers remain intact and are stored with tight-fitting caps or lids.
* Store away from incompatible chemicals including the following: arsenic, ammonia gas, hydrogen sulfide, phosphorus potassium; sodium and selenium will produce incandescence.
* Corrosive to metals.
* Store away from any combustible, organic or other readily oxidizing material (paper, wood, sulfur, aluminum or plastics) and strong oxidizers such as nitric oxide, potassium chlorate, acids and strong alkalis.
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| **SECTION 7 – SPILL AND ACCIDENT PROCEDURES** |
| * Evacuate the laboratory immediately
* In case of a spill in the hood cover spill with sand, earth inert material or vermiculite. Wipe up and dispose of the contaminated material in a solid waste container.
* Close door(s) to lab and post a “**NO ENTRY**” sign(s) explicitly mentioning the type of hazard.
* Activate the fire alarm and call **911** in case of a large (>1 L) spill outside the fume hood.
* Do not re-enter area until instructed to do so by an emergency personnel.

**Report any incident to the PI and fill out the** [**accident form**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiF3bPe1dPXAhVRRN8KHX4wDf4QFggmMAA&url=https%3A%2F%2Fchemistry.uconn.edu%2Fwp-content%2Fuploads%2Fsites%2F1259%2F2015%2F09%2FIncident-Report-Form.doc&usg=AOvVaw3Uov8IQ2Z-Kan) |
| **SECTION 8 – FIRST AID PROCEDURES** |
| *Eyes** Immediately move to the eyewash station, hold eyelids open and flush with water. Remove contact lenses while flushing (if applicable).
* Have another person from the lab dial **911** and specifically mention chromium exposure.
* Continue flushing the eyes until emergency personnel arrive.

*Skin** Immediately move to safety shower or other water source and begin rinsing affected area(s). Remove contaminated clothing (if applicable) while flushing; treat affected areas with corn oil.
* Have another person from the lab dial **911** if intense skin irritation is observed and specifically mention chromium exposure.
* Keep rinsing affected area(s) until emergency personnel arrive.

*Ingestion** Immediately rinse the mouth with cold water.
* Do NOT induce vomiting.
* Have another person from the lab dial **911** and specifically mention chromium exposure.

*Inhalation** Move to fresh air
* Dial **911** and inform emergency responders that the accident involved chromium.

**Report any incident to the PI and fill out the** [**accident form**](https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=0ahUKEwiF3bPe1dPXAhVRRN8KHX4wDf4QFggmMAA&url=https%3A%2F%2Fchemistry.uconn.edu%2Fwp-content%2Fuploads%2Fsites%2F1259%2F2015%2F09%2FIncident-Report-Form.doc&usg=AOvVaw3Uov8IQ2Z-Kan) |
| **SECTION 9 – WASTE MANAGEMENT** |
| * All waste must be labeled with “Hazardous Waste” stickers or tags, use full chemical names to describe the waste (i.e., no chemical abbreviations or symbols), be stored in sturdy containers with tight-fitting caps or lids, and be stored alone or with other compatible chemicals.
* Hazardous wastes must be stored at or near a green “Satellite Accumulation Area” sign prior to disposal by EHS. Once the containers are 80% filled, fill our EH&S chemical [waste pickup form](http://ehs.uconn.edu/Regulated%20Waste%20Management/index.php)
* The [Chemical Waste Disposal Manual](http://ehs.uconn.edu/Chemical/ChemWasteDisp.pdf) must be used as a reference.
* No chromium should be placed down the drain. Any aqueous layer with chromium.
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| **SECTION 10 – DECONTAMINATION PROCEDURES** |
| Work Area | * Equipment can be decontaminated through rinse with copious amounts of water; use of surfactants is recommended.
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| Personal Hygiene | * Use standard chemical hygiene practices regarding PPE (see above).
* Wash hand thoroughly after handling chromium containing reagents.
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| **SECTION 11 – SPECIFIC PROCEDURE** |
| A specific procedure has been described in following work: Hewage, N.; Zeller, M.; Brückner, C. ‘Oxazolochlorins 17. Oxidation of Chromene-annulated Chlorin’ *Org. Biomol. Chem.* **2017**, *15*, 396–407.***(meso*-Tetrakis(pentafluorophenyl)porpholactone ) –** **CrO3 Oxidation of Diolchlorin**5,10,15,20-Tetrakis(pentafluorophenyl)-2,3-*cis*-dihydroxychlorin(100 mg, 9.92 × 10‑5 mol) was dissolved in pyridine (5 mL) in a 50 mL round-bottom flask equipped with a stir bar. The mixture was treated with CrO3 (~10 equiv, 100 mg, 1.01 × 10‑3 mol). The flask was stoppered, shielded from light with aluminum foil, and stirred at ambient temperature. The disappearance of the starting material and appearance of the product was monitored by TLC. Once no further progress of the reaction was detectable (after ~30 min), CH2Cl2 (25 mL) was added and the mixture was transferred into a 125 mL separatory funnel and washed with water (25 mL × 3). The organic phase was separated and filtered through a short plug of diatomaceous earth (Celite®) and dried over anhydrous Na2SO4. The solvent was removed to dryness by rotary evaporation. |

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| **SECTION 12A. APPROVAL** |
| I have reviewed, understand and agree to follow this lab-specific standard operating procedure (LSOP) for the use of chromium reagents*.* Failure to follow this LSOP or lab-specific training guidelines is a violation of the [*University Health & Safety Policy*](http://policy.uconn.edu/2011/05/19/health-and-safety-policy/) and [*University Code of Conduct*](http://policy.uconn.edu/2011/05/17/employee-code-of-conduct/).Further approval and/or review of this LSOP by the PI is required if any of the following events occur:* A significant change in amount (i.e., doubling of the scale of reaction) or substitution of the chemicals in the procedure is planned.
* A major change in the agreed-upon experimental set-up is planned (heating instead of room T, etc.)
* Any signs of a failure in safety design or equipment are observed.
* Any signs or symptoms of a chemical exposure to any personnel are observed.
* Unexpected and/or potentially dangerous experimental results occur (e.g., fire, uncontrolled buildup of heat and/or pressure, etc.)
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| **Researcher Name/Signature** | **Trainer Name/Signature** | **Training Date** |
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| **SECTION 12B. PRINCIPAL INVESTIGATOR CERTIFICATION** |
| I approve the contents of the lab-specific standard operating procedure listed above. |
| **PI Signature:** | **Date:** |
| **A HARD OR ELECTRONIC COPY (https://bruckner.research.uconn.edu/safety-resources/) OF EACH LAB-SPECIFIC STANDARD OPERATING PROCEDURE MUST BE READILY AVAILBALE IN THE LAB.** |