Water Sensitive Chemicals

Standard Operating Procedure

Revision Date: 09/08/22

Laboratory Director (LD) Approval is Required Prior to Performing this Procedure

This standard operating procedure (SOP) outlines the handling and use of water-sensitive chemicals. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling water-sensitive chemicals. All laboratory workers must read and understand the Laboratory Emergencies SOP prior to commencing any work in a laboratory. All laboratory workers must read and understand the [*Laboratory Emergencies SOP*](https://ehs.umich.edu/wp-content/uploads/2022/05/LaboratoryEmergencyProceduresSOP.docx) prior to commencing any work in a laboratory.

# Description [Provide additional information as it pertains to your research protocol]

Water-sensitive chemicals are those that react violently with water to produce heat and flammable gas, which can ignite or combine explosively with atmospheric oxygen.

Chemicals that present this hazard will be indicated by one of the following Globally Harmonized System (GHS) hazard classifications:

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| **Pictogram** | **Hazard Classification** | **Hazard Statement** |
| https://www.drs.illinois.edu/site-documents/images/Flame.png  | Substances and mixtures which, in contact with water, emit flammable gases.Category 1 | In contact with water releases flammable gases, which may ignite spontaneously |
| https://www.drs.illinois.edu/site-documents/images/Flame.png | Substances and mixtures which, in contact with water, emit flammable gases.Categories 2 and 3 | In contact with water releases flammable gas |

| *Some Classes of Water Reactive Chemicals* | *Examples of class* |
| --- | --- |
| Grignard reagents | RMgX |
| Alkali metals | Li, Na, K |
| Alkali metal amides |  |
| Alkali metal hydrides | Lithium aluminum hydride |
| Metal alkyls | Lithium and aluminum alkyls |
| Halides of nonmetals | BCl3, BF3, PCl3, PCl5, SiCl4, S2CL2 |
| Inorganic acid halides | POCl3, SOCl2, SO2Cl2 |
| Anhydrous metal halides | AlCl3, AlBrx, TiCl4, ZrCl4, SnCl4 |
| Organic acid halides and anhydrides of low molecular weight |  |

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

Water-sensitive chemicals are materials which react violently with water to produce heat and flammable, corrosive, or toxic gas.

Water sensitive chemicals often exhibit pyrophoric properties (igniting upon contact with oxygen). Water reactive materials may also present other hazards such as corrosivity, teratogenicity, peroxide formation, or systemic effects.

Though not categorized by GHS, some chemicals produce toxic or corrosive gases when in contact with water. See the Department of Transportation’s list of [Water Reactive Materials which Produce Toxic Gases](https://www.phmsa.dot.gov/sites/phmsa.dot.gov/files/docs/ERG2016.pdf) when spilled in water.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

Many water-sensitive chemicals will liberate hydrogen or other flammable/toxic gas when they react with water. The use of a fume hood is recommended to prevent the buildup of such gases. A glove box may be used to handle water-sensitive chemicals when a dry atmosphere is required. Outside of a glovebox, air free technique should be used is a dry or inert atmosphere is required. A safety shower and eyewash must be available and accessible when working with water-sensitive chemicals.

Use a blast shield when there is potential for splashes, explosion potential, or highly exothermic or energetic reaction.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

* Before working with these compounds, read and follow the SDS and other reference material carefully.
* Purchase minimal amounts of water-sensitive materials.
* Have a class D fire extinguisher accessible for emergency use.
* Set up a designated area for storage and work with water-sensitive chemicals.
* Before conducting the actual procedure, always perform a dry run (without the water-sensitive material) to identify and resolve possible safety hazards.
* Work within sight and/or hearing of at least one other person who is familiar with the hazards and written procedures.
* Never work alone with extremely hazardous materials/operations.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

* Wear a fully buttoned, flame-resistant lab coat (Nomex material or equivalent) with sleeves extended to the wrists, closed toe shoes, long pants, safety goggles and standard nitrile laboratory gloves.
* Avoid potentially flammable clothing materials (nylon, polyester). Natural fibers like wool or cotton are preferable.
* If large quantities will be used, a chemical-resistant apron is also required.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Store in a cool, dry location (never under a sink), off the floor, in a water-tight secondary container.
* Use a desiccator and/or air free storage device.
* Store alkali metals under mineral oil to prevent reaction with moisture in the air.
* Monitor storage areas and periodically check container integrity, desiccant condition, and mineral oil levels where applicable. Dispose of containers if compromised, abnormally bulging, or expired.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Quenching of reaction vessels may be necessary for some water sensitive reagents. Perform a risk assessment for each quenching procedure and review relevant literature for your reagent. Many reagents can be collected without quenching. Contact EHS-HMM for more information.

Because most spent, unused, and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. **Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers, unless authorized by Environment, Health & Safety (EHS), Hazardous Materials Management (HMM)**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

# Training of Personnel

All personnel are required to complete the ***General Laboratory Safety Training*** session (**BLS025w** *or equivalent*) via the [EHS My LINC](http://ehs.umich.edu/education/) Web page. Furthermore, all personnel shall read and fully adhere to this SOP when handling water-sensitive chemicals.

# Certification

I have read and understand the above SOP. I have received prior approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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| Lab Director | Revision Date |

### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

03-26-2018 Put into EHS format, changed department name, and fixed links.
 Revised Spill Procedure section (AKJ).

04-09-18 Revised formatting (AKJ).

05-02-18 Added “specific” to text box for Exposures/Unintended Contact (AKJ).

03-04-19 Updated links, certification and format (DML).

09-08-22 Revised content, moved emergency procedures to separate SOP (JMW)