

Laboratory Standard Operating Procedure

Name of Procedure: Alkali Metals

Lab Location Chem. Sci. 409

1. Type of SOP: (Select what the SOP addresses)

Procedural Hazardous Material Equipment Specific Other

Prepared by: M. Tanasova Date Established 05/12/2015 Revision date: 08/27/15

2. **Prior Approval Required:** This procedure is considered hazardous enough to warrant prior approval from the laboratory supervisor. Yes No

Supervisor Signature _____

Hazards- The following materials and equipment associated with this procedure present exposure or physical health hazards. Safety precautions are prudent and mandatory:

Pure alkali metals are shiny, soft and ductile at room temperature and silver in color, except Cs, which has a golden color. They can be easily cut with a knife due to their softness and then the shiny surface will readily oxidize, turning grey in color. All alkali metals are highly reactive and must be handled with great care; new users should work under the close supervision of an experienced co-worker. This SOP and relevant MSDS must be consulted before any work with alkali metals is attempted.

- MSDS for lithium (Li) metal [[LINK](#)]
- MSDS for sodium (Na) metal [[LINK](#)]
- MSDS for potassium (K) metal [[LINK](#)]
- MSDS for rubidium (Rb) metal [[LINK](#)]
- MSDS for cesium (Cs) metal [[LINK](#)]

Procedures for the safe handling of alkali metals

C1. General: Before commencing any experiment involving an alkali metal ensure that the fume hood to be used is clear of clutter and that any unnecessary potentially combustible materials have been removed (REMEMBER, fume hood space should never be used for solvent storage). Appropriate PPE must be worn and other safety equipment as detailed above should be in place and in good working order (Section B).

C2. Storage: Alkali metals are usually stored under an inert atmosphere and/or mineral oil. Keep them away from heat and sources of ignition.

C3. Handling: Due to their high reactivity towards air and water, all equipment, solvents and chemicals need to be dry. Avoid contact with incompatible materials; oxidizing agents, acids, moisture. Conduct all experiments on a small scale (generally < 2 g scale). Control the reaction rate by addition of the alkali metal in small increments. Handle alkali metals with care under

an inert atmosphere (Ar or N₂; note, however, that lithium metal will corrode under N₂).

C4. Disposal of residual reagents: To dispose of alkali metals safely, isopropanol is used to dissolve small quantities (< 2 g) of the metal in a fumehood (hydrogen gas will be slowly evolved). Good ventilation should be provided. EH&S should be contacted if larger amounts of alkali metal (>1-2 g) are to be disposed of. If in any doubt whatsoever as to the proper and safe manner with which to quench a given reagent, contact OSU Environmental Health and Safety and request a waste chemical pick-up. Representatives from EH&S will remove and dispose of any PROPERLY LABELED chemicals without direct charge upon completion of the following web request form [[LINK](#)].

Small amounts (< 1 g) of Li metal (ONLY Li, NOT any other alkali metals!) can be safely destroyed by holding small pieces under cool water with tongs so that the metal is completely submerged until it fully reacts with the water.

Engineering Controls- Prior to performing this procedure, the following safety equipment must be accessible and ready for use: (Chemical fume hoods, laminar flow hood, chemical spill kits)

All manipulation of alkali metals must be conducted inside a well vented fume hood with the sash level at the lowest height possible to perform the required operations. Before starting work, clear the fume hood of any unnecessary equipment or chemicals. An eyewash/safety shower station should be within a ten second travel time of the site of the experiment. Familiarize yourself with the location of this important safety equipment and check that the eyewasher is functioning (pass water through it until it runs clear) and that the safety shower passed a recent inspection (within last 12 months). Also before starting work, know the location of the nearest fire extinguisher and fire alarm pull station and check that the fire extinguisher passed recent inspection and that it is not empty.

Emergency response: Fire is the most likely accident, be well prepared for this eventuality and also know the correct response in the event of a reagent spill. Small fires caused by the ignition of alkali metals are best tackled with an ABC-type (powder based) fire extinguisher. DO NOT use a carbon dioxide or a water based units; alkali metals react violently with these media. As with any incident involving fire, raise the alarm as soon as possible (engage pull station alarm, call, or have someone else call, 911), and escape the vicinity of the fire if you have any doubts whatsoever that you will be unable to quickly extinguish the blaze successfully. Pull down the fume hood sash, close the door of the laboratory (but do not lock it), as you exit.

Protective Equipment-Prior to performing this procedure, the following personal protective equipment must be obtained and ready for use: (ex. Acid resistant gloves, safety eyewear, lab coat, chemical splash apron)

Appropriate eye and skin protection must be worn during all stages of any experiment involving an alkali metal, as follows:

(a) Eye protection: chemical splash goggles or safety glasses that meet [ANSI](#) standard Z-87.1 must worn whenever handling alkali metals. Ordinary prescription eye glasses will not provide the necessary level of protection unless they also meet the same ANSI standard. A face shield,

worn over safety eye wear, is required in addition if there is a possible risk of explosion.

(b) Skin and body protection: chrome leather gloves or appropriate rubber gloves should be worn when handling alkali metals. MSDS for specific chemicals to be used should be consulted for direction on which glove type is recommended. A fire resistant fully-buttoned knee-length laboratory coat must be worn to protect the body. In addition, fully enclosed shoes which cover the entire foot (with no holes in the top) must be worn.

Waste disposal-This procedure will result in the following regulated waste which must be disposed of in compliance with environmental regulations:

The quality of any pyrophoric reagent will deteriorate over time and with usage; for example, precipitates of metal oxides/hydroxides often become visible in hydrocarbon solutions of alkylmetal reagents. Titration methods should be used to establish the molarity of a reagent before disposal is considered; however, if activity has diminished below a chemically useful threshold, or if too little of the compound is left to be worth using, then disposal is recommended. Even in small quantity or at low molarity, pyrophoric reagents present a fire hazard and a container with any residual material within it **MUST NEVER** be opened directly to the atmosphere. The last traces of reagent should be washed out under an inert atmosphere using an appropriate dry carrier solvent (using either a syringe or cannula transfer), and the washings quenched via a suitable neutralization process conducted under inert gas and with sufficient cooling. Most alkylmetal solutions (≤ 2.0 M) can be safely quenched by their controlled addition to a 0.5 M solution of isopropanol in anhydrous tetrahydrofuran below -40 °C and under an atmosphere of Ar. If in any doubt whatsoever as to the proper and safe manner with which to quench a given reagent, contact OSU Environmental Health and Safety and request a waste chemical pick-up. Representatives from EH&S will remove and dispose of any **PROPERLY LABELED** chemicals without direct charge upon completion of the following web request form [\[LINK\]](#). Further guidance on the disposal of pyrophoric liquids can be found in Aldrich technical bulletin AL-164 [\[LINK\]](#).

Non-toxic waste is generated upon quenching of reactions (Lithium hydroxide, tert-butanol, low molecular weight alkanes (volatiles))

Accidental Spill- In the event that a hazardous material spills during this procedure, be prepared to execute the following emergency procedure:

DO NOT expose to water (flammable upon reaction with water).

Remove all sources of ignition. Soak up with inert absorbent material. Take precautionary measures against static discharges. Keep in suitable and closed containers for disposal.

Prior Approval- This procedure is considered hazardous enough to warrant prior approval from the laboratory director. **Yes**

Certification- I have read and understand the above SOP. I agree to contact my Supervisor if I plan to modify this procedure.

Signature _____ Name (print) _____

Date _____ Room _____