

# Standard Operating Procedure

## Sodium borohydride

*This SOP is not complete until it has been signed and dated by the PI and relevant lab personnel.*

Print a copy and insert into your  
*Laboratory Safety Manual and Chemical Hygiene Plan.*  
Refer to instructions for assistance.

<b>Department:</b>	Chemistry & Biochemistry - Chemical Engineering
<b>Date SOP was written:</b>	December 14, 2012
<b>Date SOP was approved by PI/lab supervisor:</b>	January 18, 2013
<b>Principal Investigator:</b>	Prof. Susannah Scott
<b>Internal Lab Safety Coordinator/Lab Manager:</b>	Stephanie Goubert-Renaudin
<b>Lab Phone:</b>	805-893-8941
<b>Office Phone:</b>	805-893-7403
<b>Emergency Contact:</b>	EH&S 24 hour line: 805-893-3194 (Name and Phone Number)
<b>Location(s) covered by this SOP:</b>	ESB 3324 and 3328 (Building/Room Number)

**Type of SOP:**     Process     Hazardous Chemical     Hazardous Class

### Purpose

Sodium Borohydride is a water reactive chemical. In contact with water releases flammable gases which may ignite spontaneously. It is both air and moisture sensitive. Sodium borohydride, *also known as sodium tetrahydridoborate*, is an inorganic compound with the formula NaBH<sub>4</sub>. By mixing it with water or an alcohol, it is more efficient at reduction. NaBH<sub>4</sub> will reduce many organic carbonyls, depending on the precise conditions, but the reductant will eventually decompose spontaneously to give hydrogen gas and borates. Hence, a written Standard Operating Procedure (SOP) is required to handle this chemical in a safe manner.

### Physical & Chemical Properties/Definition of Chemical Group

Sodium borohydride is an odorless white to gray-white microcrystalline powder which often forms lumps. It is soluble in water, with which it reacts vigorously.

Molecular Formula	NaBH <sub>4</sub>
Molar Mass	37.83 g/mol
Appearance	white crystals hygroscopic
Density	1.0740 g/cm <sup>3</sup>
Melting Point	400 °C
Boiling Point	500 °C
Solubility in Water	soluble, reacts with water
Solubility	soluble in liquid ammonia, amines, pyridine

## Potential Hazards/Toxicity

### Emergency Overview

#### OSHA Hazards

**Water Reactive, Toxic by ingestion, Toxic by skin absorption, Corrosive**

**GHS Label elements, including precautionary statements**

Pictogram



Signal word Danger

Hazard statement(s)

H260 In contact with water releases flammable gases which may ignite spontaneously.

H301 + H311 Toxic if swallowed or in contact with skin.

H314 Causes severe skin burns and eye damage.

Precautionary statement(s)

P223 Keep away from any possible contact with water, because of violent reaction and possible flash fire.

P231 + P232 Handle under inert gas. Protect from moisture.

P280 Wear protective gloves/protective clothing/eye protection/face protection.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P310 Immediately call a POISON CENTER or doctor/physician.

### Potential Health Effects

**Inhalation** May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract.

**Skin** Toxic if absorbed through skin. Causes skin burns.

**Eyes** Causes eye burns.

**Ingestion** Toxic if swallowed. Causes burns.

## Personal Protective Equipment (PPE)

### Respiratory protection

**Note:** During emergency response, wear Self Contained Breathing Apparatus (SCBA) for fire fighting. Personnel intending to use/wear SCBA respirator must be training and fit-tested by EH&S. This is a regulatory requirement.

#### **Hand protection**

Handle with [nitrile or neoprene](#) gloves.

Gloves must be inspected prior to use.

Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with Sodium Borohydride.

Wash and dry hands.

#### **Eye protection**

Safety goggles.

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US).

#### **Skin and body protection**

Fire/flame resistant lab coat (100% cotton based)

Full length pants or equivalent

Close toed shoes

#### **Hygiene measures**

Avoid contact with skin, eyes and clothing.

Wash hands before breaks and immediately after handling Sodium borohydride.

### **Engineering Controls**

- If not under the inert atmosphere of a glovebox, handle within a fume hood
- Must be stored sealed, away from moisture and water

### **First Aid Procedures**

#### **If inhaled**

If breathed in, move person into fresh air. If not breathing give artificial respiration Consult a physician.

#### **In case of skin contact**

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water.

Take victim immediately to hospital. Consult a physician.

#### **In case of eye contact**

Continue rinsing eyes during transport to hospital. Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

#### **If swallowed**

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

### **Special Handling and Storage Requirements**

#### **Precautions for safe handling**

- Avoid contact with skin and eyes.
- Avoid formation of Sodium Borohydride dust and aerosols.
- Provide appropriate exhaust ventilation at places where dust is formed.
- Keep away from sources of ignition – No open flames (Bunsen burner)

#### **Conditions for safe storage**

- Keep container tightly closed in a dry and well-ventilated place.
- Hazard communication label on the container must read 'Water Reactive'.
- Never allow product to get in contact with water/water compounds during storage.

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- Air and moisture sensitive.
- Keep in a dry place (such as a desiccator or a dry box or glove box).

#### **Materials to avoid**

Oxidizing agents, chemically active metals, acids, water & water based compounds.

### **Spill and Accident Procedure**

#### **Suitable extinguishing media**

**DO NOT EXTINGUISH WITH WATER.** Sand, sodium chloride, sodium carbonate, or a type IV fire extinguisher (type for metal fires) may be used.

#### **Extinguishing media which shall not be used for safety reasons**

Water

#### **Special protective equipment for fire-fighters**

Wear self contained breathing apparatus for fire fighting if necessary.

### **ACCIDENTAL RELEASE MEASURES**

#### **Personal precautions**

Use personal protective equipment. Avoid dust formation. Avoid breathing dust. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas.

#### **Environmental precautions**

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

#### **Methods and materials for containment and cleaning up**

Pick up and arrange disposal without creating dust. Do not flush with water. Keep in suitable, closed containers for disposal

### **Chemical Spill Dial 9-911 and EH&S (805-893-3194)**

**Spill** – Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

**Small (<1 L)** – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

**Large (>1 L)** – Dial **9-911 from campus phones (and 805-893-3446 from a cell phone)** and EH&S (893-3194) for assistance.

**Chemical Spill on Body or Clothes** – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S immediately.*

**Chemical Splash Into Eyes** – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S immediately.*

### **Medical Emergency Dial 9-911**

**Life Threatening Emergency, After Hours, Weekends and Holidays** – Dial **9-911** (or 805-893-3446 from a cell phone) or go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All Serious injuries must be reported to EH&S within 8 hours.*

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**Non-Life Threatening Emergency** – Go to the Student Health Building, Building 588 (phone number: 893-5361, hours: M, T, R, F 8am-4.30pm, W 9am - 4.30pm, R 5pm to 7pm by appointment). After hours go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) Note: All serious injuries must be reported to EH&S within 8 hours.

**Needle stick/puncture exposure** (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Page the needle stick nurse \ and then enter your extension. After hours go to the nearest emergency room: the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411). Note: All needle stick/puncture exposures must be reported to EH&S within 8 hours.

### **Decontamination/Waste Disposal Procedure**

Wearing proper PPE, collect all of the hydride in a suitable and carefully and completely quenched the hydride with isopropanol. Dispose in the appropriate waste container.

#### **Label Waste**

- Affix an hazardous waste tag on all waste as soon as the first drop of waste is added to the container

#### **Store Waste**

- Store hazardous waste in closed containers, in secondary containment and in a designated location

#### **Dispose of Waste**

- Dispose of regularly generated chemical waste within 90 days
- Call EH&S for questions (893-3194)
- Empty Containers
  - Dispose as hazardous waste

### **Safety Data Sheet (SDS) Location**

SDS can be accessed online

<http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lchemmsdsacc.htm>

### **Protocol/Procedure**

In our laboratory, sodium borohydride is used as a reducing agent and is prepared as aqueous or alcoholic solution.

Sodium borohydride is stored in a sealed container, away from moisture and water.

When handling sodium borohydride, nitrile or neoprene gloves, safety goggles and a flame retardant lab coat have to be worn.

Sodium borohydride is preferably handled in a glove box or under inert atmosphere. It can also be handled on a cleared and dry space within the fume hood.

Addition of sodium borohydride solution to the reactional mixtures is done slowly and carefully as it generates hydrogen: to avoid pressure to build up, use a pressure bubbler. As the reaction is exothermic, the flask can be placed in a cooling bath.

Sodium borohydride can be discarded in the appropriate waste container after neutralizing/dissolving slowly with isopropanol or water.

**NOTE: Any deviation from this SOP requires approval from PI.**

**Documentation of Training** (*signature of all users is required*)

- ✓ Prior to conducting any work with Sodium Borohydride, designated personnel, i.e. approved users listed below, must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
- ✓ The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of Sodium Borohydride MSDS provided by the manufacturer.
- ✓ The Principal Investigator must ensure that his/her laboratory personnel have attended appropriate laboratory safety training or refresher training as required by EH&S.

I have read and understand the content of this SOP:

Name	Signature	Trainer	Date
Prof. Susannah Scott			
Stephanie Goubert-Renaudin			
Gary Kwanyi Ng			
Alessandro Gallo			
Anthony Crisci			
Haibo Yu			
Taeho Hwang			
Bethany Wigington			
Daniel Coller			
Zachary Jones			

