Wake Forest Baptist Health	**Standard Operating Procedure (SOP) Template**	

PEROXIDES FORMING CHEMICALS

Effective Date:	**12/9/2011**	**Revised Date:**	**2/1/2012**

INTRODUCTION

A Standard Operating Procedure (SOP) describes how your lab will handle a hazardous chemical safely, including the amount and concentration you will use, how you obtain or create the working solution, and special handling procedures, engineering controls, and personal protective equipment. Chemical-specific SOPs are found on the EH&S website.

Wake Forest Baptist Medical Center has created Standard Operating Procedures (SOPs) for several chemical hazard categories and some commonly-used chemicals. The SOP provides only standard information and requires customization for each lab.

The Occupational Safety and Health Administration (OSHA) requires a written SOP for any work with hazardous chemicals in laboratories. There are additional requirements for SOPs for particularly hazardous substances, or PHSs. These SOPs are an important part of the Chemical Hygiene Plan.

This SOP applied to the various chemicals that can cause PEROXIDES. The peroxide forming chemicals should be tested every three to six months to ensure that PEROXIDES have not formed. Various peroxide forming chemicals are listed in the table below.

Acetaldehyde diethyl acetal (acetal)	Cumene (isopropylbenzene)
Chloroprene (2-chloro-1,3-butadiene)	Cyclopentene
Cyclohexene	Diisopropyl ether (Isopropyl Ether)
Divinyl Acetylene(DVA)	Diacetylene (butadiene)
Dioxane	Diethyl ether (ethyl ether)
Dicyclopentadiene	Decalin (decahydronaphthalene)
Diethylene glycol dimethyl ether (diglyme)	Ethylene glycol monoethers (cellosolves)
Ethylene glycol dimethyl ether (glyme)	Methylcyclopentane
Methylacetylene	Potassium Amide
Methyl isobutyl ketone	Potassium metal
Sodium Amide (sodamide)	Tetrahydrofuran (THF)
Stryene	Tetralin(tetrahydronaphthalene)
Vinyl acetate	Vinyl ethers
Vinylidene Chloride	Vinyl pyridine

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GENERAL LAB RULES

1. No eating, drinking, smoking, handling contact lenses, or applying cosmetics in the laboratory.
2. Persons shall wear buttoned lab coat, long pants, safety glasses or goggles and appropriate gloves when working with hazardous chemicals.
3. Mouth pipetting is prohibited; mechanical pipetting devices are to be used at all times.
4. All procedures are performed carefully to minimize the creation of splashes or aerosols.
5. Wash hands
    - after handling chemicals materials,
    - after removing gloves, and
    - before leaving the laboratory.
6. Plastic ware should be substituted for glassware whenever possible

Add Lab Specific Rules Here

PURPOSE

Add Lab Specific Purpose Here

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PHYSICAL HAZARDS

- Peroxide forming chemicals are flammable.
- May form explosive PEROXIDES.

HEALTH HAZARDS

- Harmful if swallowed.
- Irritating to eyes and skin.
- Vapors may cause drowsiness and dizziness. Aspiration hazard if swallowed - can enter lungs and cause damage.
- May cause irritation of respiratory tract.
- Repeated exposure may cause skin dryness or cracking.
- Hygroscopic

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

- Safety glasses, goggles or face shields shall be worn during operations in which PEROXIDES FORMING CHEMICALS might contact the eyes (e.g., through vapors or splashes of solution).
- Ordinary (street) prescription glasses do not provide adequate protection. Adequate safety glasses must meet the requirements of the Practice for Occupational Education Eye and Face Protection (ANSI Z87.1-1989) and must be equipped with side shields.
- Wearing contact lenses under some circumstances provides workers with a greater choice of eye and face protection (such as goggles or full-facepiece respirators without prescription inserts) as well as better visual acuity. However, the risk is unknown for contact lens wearers compared with nonwearers working with chemicals listed in the NIOSH Pocket Guide to Chemical Hazards [NIOSH 2004]. OSHA recommends against contact lens use when working with acrylonitrile, methylene chloride, 1, 2 dibromo-3-chloropropane, ethylene oxide, and methylene dianiline." NIOSH Publication No. 2005-139: Current Intelligence Bulletin 59, Contact Lens Use in a Chemical Environment.

HAND PROTECTION

- Use disposable nitrile gloves when working with chemicals.
- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.

LAB COATS, ETC.

- Button lab coats, closed toed shoes, long pants and long sleeved clothing shall be worn

when handling PEROXIDES FORMING CHEMICALS. Protective clothing shall be worn to prevent any possibility of skin contact with PEROXIDES FORMING CHEMICALS.

SAFETY SHOWER / EYEWASH

- Where the eyes or body of any person may be exposed to peroxide forming chemicals, suitable facilities for quick drench or flushing of the eyes and body must be provided within the work area for immediate emergency use.
- Bottle type eyewash stations are not acceptable.

DESIGNATED AREA FOR USE AND CONTAINMENT DEVICES

- All PEROXIDES FORMING CHEMICALS work shall be done in the laboratory fume hood. When working with volatile, toxic chemicals, in limited amounts, Biological Safety Cabinets (BSC) Class II, Type A2 exhausted or Class II, Types B1and B2 BSCs exhausted to the outside can be used.
- The fume hood's sash must be in the position where a face velocity of 100 feet per minute is achieved. The BSC must be certified annually by a qualified outside vendor.
- Environmental Health and Safety certifies fume hoods annually and places a yellow sticker to indicate the date of certification and the proper sash height for achieving proper fume hood face velocity.
- Contact Engineering (716-4351) immediately if fume hood is malfunctioning.

SPECIAL HANDLING PROCEDURES AND STORAGE REQUIREMENTS

- If Applicable - Store PEROXIDES FORMING CHEMICALS in a flammable storage cabinet.
- If Applicable - Peroxide hazard on concentration—do not distill or evaporate without first testing for the presence of PEROXIDES—discard or test for PEROXIDES after 6 months. EM QUANT Peroxide test strips can be ordered through Fisher Scientific, catalogue #M100111 for testing for the presences of PEROXIDES.
- Store peroxide forming chemicals in a flammable liquids storage cabinet.
- Peroxide hazard on concentration—do not distill or evaporate without first testing for the presence of PEROXIDES—discard or test for PEROXIDES after 6 months. EM QUANT Peroxide test strips can be ordered through Fisher Scientific, catalogue #M100111 for testing the peroxide for the presences of PEROXIDES.
- The following precautions and procedures shall be taken when handling PEROXIDES.
  - The quantity of peroxide forming chemical used and stored shall be limited to the minimum amount required. Unused PEROXIDES shall not be returned to the container.

- Label peroxide forming chemicals when received and first opened.
- Store peroxide forming chemicals away from heat and light.
- Use the peroxide forming compounds on a first-in, first out basis.
- To minimize the rate of decomposition, PEROXIDES shall be stored at the lowest possible temperature consistent with their solubility or freezing point. Liquids or solutions of PEROXIDES shall not be stored at or lower than the temperatures at which the PEROXIDES freeze or precipitate because PEROXIDES in these forms are extremely sensitive to shock and heat.
- Periodically check materials for peroxide formation using peroxide test strips from Fisher Scientific, part number M100111. See **TABLE 1** for interpretation of the results
- Chemicals that form hazardous PEROXIDES on storage (**TABLE 2 - LIST A**) shall be checked every 3 months.
- Chemicals that form peroxide hazard on concentration (**TABLE 3 - LIST B**) or chemicals that are a hazard due to peroxide initiation of polymerization (**TABLE 4 - LIST C**) shall be checked every 6 months.
- Gases that should be discarded after 12 months are listed in **TABLE 5**.

TABLE 1 - INTERPRETATION OF THE PEROXIDE TEST STRIPS

If	Then
Less than 80 ppm peroxides	Solution is okay to use, redate and store for use.
Between 80 ppm to 400 ppm	Call WFUHS EH&S for packaging and removal
Greater than 400 ppm	Call WFUHS EH&S for removal as potentially explosive material

TABLE 2 - COMMON PEROXIDE FORMING CHEMICALS

Divinyl Acetylene(DVA) (dangerous)	Diisopropyl ether (Isopropyl Ether)
Potassium metal	Potassium Amide
Sodium Amide (sodamide)	Vinylidene Chloride

TABLE 3 - PEROXIDE HAZARD ON CONCENTRATION

Acetaldehyde diethyl acetal (acetal)	Cumene (isopropylbenzene)
Cyclohexene	Cyclopentene
Diethylene glycol dimethyl ether (diglyme)	Decalin (decahydronaphthalene)
Dioxane	Diacetylene (butadiene)
Dicyclopentadiene	Diethyl ether (ether)
Ethylene glycol dimethyl ether (glyme)	Ethylene glycol monoethers (cellosolves)
Methylacetylene	Methylcyclopentane

Methyl isobutyl ketone	Tetrahydrofuran (THF)
Tetralin(tetrahydronaphthalene)	Vinyl ethers

TABLE 4 - HAZARD OF RAPID POLYMERIZATION

Chloroprene (2-chloro-1,3-butadiene)
Stryene
Vinyl acetate
Vinyl pyridine

TABLE 5 -NORMAL GASES

Butadiene
Tetrafluoroethylene (TFE)
Chlorotrifluoroethylene
Vinyl acetylene (MVA)
Vinyl chloride

- It may be dangerous to assume that a compound can be used for any procedure out of an unopened bottle. Tests have shown that 0.008 percent or more of peroxide (tested as H_20_2) in any compound might be dangerous. According to the catalogs of several suppliers, no tetrahydrofuran presently sold by them is guaranteed to have less than 0.015 percent peroxide. Thus, even unopened containers might have dangerous quantities of PEROXIDES for a distillation or refluxing experiment. All containers shall be tested for PEROXIDES prior to a use that might concentrate a hazard, such as a distillation procedure.
  - The sensitivity of most PEROXIDES to shock and heat can be reduced by dilution with inert solvents, such as aliphatic hydrocarbons. However, toluene is known to induce the decomposition of diacyl PEROXIDES.
  - Solutions of PEROXIDES in volatile solvents shall not be used under conditions in which the solvent might be vaporized because this will increase the peroxide concentration in the solution.
  - Metal spatulas shall not be used to handle PEROXIDES because contamination by metals can lead to explosive decomposition. Ceramic or wooden spatulas may be used.
  - Smoking, open flames, and other sources of heat shall not be permitted near PEROXIDES.
  - Friction, grinding, and all forms of impact shall be avoided near PEROXIDES (especially solid ones). Glass containers that have screw cap lids or glass stoppers shall not be used. Polyethylene bottles that have screw-cap lids may be used.
  - Polymerizable monomers shall be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use. Although common acrylic monomers such as acrylonitrile, acrylic acid, ethyl acrylate, and methyl

methacrylate can form PEROXIDES, they have not been reported to develop hazardous levels in normal use and storage. The hazard from PEROXIDES in these compounds is substantially greater when they are stored in the liquid phase, and if stored without an inhibitor they shall be considered as in Table 3 - List A.

- Although air will not enter a gas cylinder in which gases are stored under pressure, these gases are sometimes transferred from the original cylinder to another in the laboratory, and it is difficult to be sure that there is no residual air in the receiving cylinder. An inhibitor shall be put into any such secondary cylinder before one of these gases is transferred into it; the supplier can suggest inhibitors to be used. The hazard posed by these gases is much greater if there is a liquid phase in such a secondary container, and even ignited gases that have been put into a secondary container under conditions that create a liquid phase shall be discarded within 12 months.
- Carry out distillation behind shields.
- Do not leave ethers for long periods of time (about six months) in a half-filled container or in the light.
- Many chemicals form PEROXIDES when allowed access to air over a period of time. Enough air can be introduced upon opening the container for PEROXIDES to form. Some PEROXIDES become explosive upon concentration, as happens in distillation experiments. Others cause potentially explosive polymerization reactions to occur. Organic PEROXIDES are extremely sensitive to shock, heat, friction, light, strong oxidizers or reducers, or other forms of ignition.
- Some organic chemicals that are prone to peroxide formation are ethers, acetals, olefins, vinyl monomers, dienes, acrylates and methacrylates, secondary alcohols, and ketones. While aldehydes, ureas, amides, and lactams readily peroxidize, the products are degraded and do not accumulate to a hazardous level. Some inorganic chemicals that form PEROXIDES are alkali metals, metal amides, and organometallic compounds with a metal atom bounded to carbon, and metal alkoxides.
- Pure compounds are more likely to have peroxide formation. Volatile compounds usually present greater hazard, as the PEROXIDES become concentrated when evaporation occurs.

Add Lab Specific Special Handling/Storage Procedures

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EMPLOYEE EXPOSURE MONITORING

- Users of PEROXIDES FORMING CHEMICALS are required to notify EH&S at 716-9375 so air sampling/monitoring may be performed to determine exposure level.
- Individuals planning a family or pregnant can contact EH&S for exposure determination, consultation, and recommendations.
- Exposure monitoring through EH&S is free of charge.

CHEMICAL USE WITH ANIMALS

Click here to enter text. Please consider other routes of exposure when handling animal (e.g., cage sign) and animal bedding.

WASTE DISPOSAL

- Chemicals shall not be drain disposed unless prior approval is given by EH&S.
- Excess PEROXIDES FORMING CHEMICALS and all waste material containing PEROXIDES FORMING CHEMICALS must be placed in an unbreakable secondary container labeled with the following **"HAZARDOUS WASTE PEROXIDES FORMING CHEMICALS"**.
- Full containers of PEROXIDES FORMING CHEMICALS waste must be disposed of according to the EH&S Hazardous Waste Program.
- A Waste Ticket must be completed and submitted prior to disposing of PEROXIDES FORMING CHEMICALS through EH&S.

EMERGENCY PROCEDURES

Emergency Numbers:

Fire and Medical Emergencies	716-9111 (9 + 911 for Friedburg campus)
Principal Investigator's Emergency Number	Click here to enter text.
Employee Health	716-4801
Hospital Emergency Room	716-9008
Environmental Health and Safety	716-9375

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Laboratory Contact Information:

Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.
Click here to enter text.	Click here to enter text.

FIRST AID

- The nearest safety shower station is located: Insert text here
- The nearest safety eyewash is located: Insert text here

  If chemical exposure occurs, flush exposed area for 15 to 20 minutes using emergency eyewash station and/or safety shower.

- Call 716-9111 and describe the extent of injuries, chemical spilled and the amount.
- Keep people out of the area.
- Report all accidental exposures to Employee Health Services.
- Complete an online injury/illness report if there is an over-exposure to the chemical or if there is an accident involving the chemical.

SPILL AND ACCIDENT PROCEDURES

If the chemical spilled is considered a carcinogen, reproductive toxin or highly toxic chemical, contact 716-9111 and evacuate area immediately, regardless of spill amount. If you are unsure of type of chemical, contact 716-9111. For all other spills use the chart below for spill reporting and response: Chemical Spill Procedures

SPILL QUANTITY	PROPER SPILL RESPONSE
Spill less than 300 mL	**Contact Environmental Health and Safety (716-9375) and clean up spill using spill kit.**
Spill greater than 300 mL	**Do not attempt to clean up spill. Leave the Area and immediately report to WFBMC Security (716-9111).**

CERTIFICATION OF APPLICATION
PLEASE READ
THESE ITEMS AUTOMATICALLY BECOME A PART OF YOUR SOP

1. I understand that it is my responsibility to assure that all personnel working in my laboratory with any of these hazards are fully informed about their specific dangers, proper actions for safe use, steps to take in case of accidents, and are provided with all necessary safety equipment and instructions in its use.
2. I agree to follow the provisions of the Chemical Hygiene Plan.
3. I will ensure that all of my personnel attend Basic Lab Safety Training by EH&S prior to using chemical materials.
4. I agree to permit Representatives of WFSM Environmental Health and Safety to inspect the facilities where this work is being conducted.
5. All chemical waste will be disposed of through EH&S Chemical Waste Program. I understand that **drain disposal is NOT allowed**.
6. Chemical materials will be transported in closed containers.
7. Sharps and/or breakable plastic solid waste items will be placed in approved puncture-resistant container, i.e., a sharps container.
8. As soon as possible, the Chemical Occupational Hygiene Officer will be notified in writing of any proposed changes in locations where chemical materials are stored or used.
9. Additional chemicals or changes in possession limits will be requested in writing from the Chemical Occupational Hygiene Officer.
10. Chemical materials will not be transferred to other Authorized Users without prior approval of the Chemical Occupational Hygiene Officer.
11. Chemical materials will not be shipped anywhere off campus without prior approval of the Chemical Occupational Hygiene Officer.
12. Secure chemicals (including waste) to prevent unauthorized access or removal. In addition, you must control and maintain constant surveillance of chemicals that are not in storage or are in use. This can be achieved by: 1) Locking refrigerators and/or storage cabinets, 2) Locking the laboratory when no one is present, and 3) Challenging unknown persons entering the laboratory.
13. I will notify the Chemical Occupational Hygiene Officer of my intent to leave WFUHS at least **60 days** in advance. I will be responsible for disposing of my chemical materials inventory through EH&S Chemical Waste Program.

First	Last	Signature
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