



EOHSS

ENVIRONMENTAL AND OCCUPATIONAL
HEALTH AND SAFETY SERVICES

STANDARD OPERATING PROCEDURES FOR
Preventing Exposures to Chemicals
of High or Unknown Toxicity

INSTRUCTIONS:

All lab personnel who will be working with Substances of Unknown or High Toxicity should review this Standard Operation Procedure (SOP). Not all sections will be applicable in every situation, but It should be helpful as a guideline for preventing exposure. RI/PIs should use it as part of laboratory-specific safety training.

In Section X, the RI/PI must list personnel who will work with or have the potential of exposure to the unknown or highly toxic substance. Laboratory personnel must initial this document to indicate that he/she has read and understands this SOP. The RI/PI must print his/her name, sign and date the document. A copy of the signed document should be kept with the Laboratory Safety Plan.

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I. PURPOSE

This standard operating procedure (SOP) is intended to provide general guidance on how to prevent exposure to highly toxic materials or materials with insufficient data to characterize toxicity. Substances with unknown toxicity are to be assumed toxic to humans, and exposures must be minimized.

II. REQUIREMENTS FOR WRITTEN STANDARD OPERATING PROCEDURES

This SOP is generic in nature and does not have specific information about individual chemicals. A chemical-specific SOP is required for chemicals with very low oral, inhalation, or skin [LD₅₀](#) as defined below. The chemical-specific version should include detailed toxicological information, chemical-resistant glove material to be worn by those handling the chemical, any specific antidotes that will need to be made available by the lab, as well as any explicit decontamination/spill cleanup measures.

Type of Study	Chemical considered "Toxic"	Chemical considered "Highly Toxic"	EOHSS Review Required
Oral LD ₅₀ ¹ (albino rats)	50 - 500 mg/kg	< 50 mg/kg	< 30 mg/kg
Skin Contact LD ₅₀ (albino rabbits)	200 - 1000 mg/kg	< 200 mg/kg	<100 mg/kg
Inhalation LC ₅₀ ² (albino rats)	200 - 2000 ppm in air	< 200 ppm in air	< 100 ppm in air
Inhalation LDLO ³ (Human)	NA	NA	< 100 ppm

1. An LD₅₀ value is the amount of a solid or liquid material that it takes to kill 50% of test animals in one dose.
2. LC₅₀ (50% lethal concentration) is a related term used for gases, dusts, vapors, mists, etc. It is the concentration of a material in air that will kill 50% of the test subjects when administered as a single exposure (typically 1 or 4 hours).
3. LDLO - This is the lowest known lethal dose.

More information on requirements for SOPs for hazardous chemicals is posted at: <http://www2.umdj.edu/eohssweb/publications/sop.htm>. EOHSS will assist with the preparation of chemical specific SOPs, upon request. A number of SOPs have already been developed and are posted at: <http://www2.umdj.edu/eohssweb/publications/index.htm#Toxin>

III. GENERAL WORK PRACTICES FOR PREVENTING EXPOSURE

- A. Purchase and use the smallest amount of chemical that is consistent with the requirements of the work to be performed.
- B. General safe work practices, including no eating, drinking, chewing gum, or pipetting by mouth, must be observed at all times when working with hazardous substances. Application of cosmetics, lip balm, etc. in labs where these chemicals are used or stored is prohibited.
- C. Work must take place in a chemical fume hood or hard ducted biological safety cabinet (Class II type B) that has been inspected or certified within the past twelve (12) months. If only an unducted biological safety cabinet is available in the laboratory, contact EOHSS for assistance before beginning the procedure. Work with the chemical fume hood sash lowered to the operating height (indicated by stickers or sash stop at approximately 12 - 14" from the working surface of the hood.) If there is any indication that the hood is not functioning properly (e.g., unusual noise, odors, lack of airflow) contact EOHSS immediately for assistance.
- D. Use the following procedure for weighing solids: Tare a pre-weighed container. Add the powder in the hood. Close the container and then re-weigh.
- E. Work surfaces where the hazardous materials will be used should be covered with absorbent, plastic-backed, disposable bench liner. Contaminated bench paper and any remaining solutions should be disposed of through EOHSS as hazardous chemical waste. For general guidance regarding waste disposal and to arrange for waste disposal, refer to:
<http://www2.umdj.edu/eohssweb/publications/wastedisposal.htm>. For questions regarding chemical waste disposal contact Kyle SanGiovanni, University Environmental Coordinator, at 973-972-3411 or sangiokd@umdj.edu.
- F. Store in tightly closed containers in a cool, well-ventilated area away from heat, light, and moisture. Chemicals of unknown or high toxicity should be stored in secondary containers and locked in a cabinet or drawer.
- G. If the house vacuum will be used with these chemicals, employ a high efficiency particulate air (HEPA) filter to protect the house vacuum system from aerosols. For volatile chemicals, permission must be obtained from EOHSS prior to initiation of experiments.
- H. Drain disposal of hazardous chemicals is not permitted. See the EOHSS [Hazardous Waste Management Factsheet](#) for more information on how to properly dispose of chemical waste.
- I. In the event of an emergency (e.g., spills, splashes, inhalation) involving hazardous chemicals, follow the instructions provided in the flipchart entitled "Emergency Response Guide." This flipchart should be posted near a laboratory phone. Contact EOHSS if you require a flipchart.
- J. Do not wear sandals, flip flops or any other open-toe, -side or -back style shoe.

IV. TRAINING/ACCESS TO INFORMATION

The faculty member to whom the room is assigned to (Responsible/Principal Investigator) should ensure that all personnel who will work with hazardous materials are familiar with the hazards of the substance to be used, and with the appropriate work practices, including decontamination of work areas and emergency procedures. Written records should be maintained to indicate who has been trained on this topic. Material Safety Data Sheets and/or other health hazard information for the substance must be made available to personnel.

At a minimum, personnel should have attended laboratory safety training within the last two years as required by the current version of the UMDNJ Laboratory Safety Plan.

EOHSS is available to assist in the education and/or training of personnel concerning safe work practices.

V. DESIGNATED AREAS

The Public Employees Occupational Safety and Health (PEOSH) Laboratory Standard requires particularly hazardous chemicals identified as either **1) a [select carcinogen](#)**, **2) a [reproductive toxin](#)**, or **3) [acutely toxic](#)**, to be stored and used in [designated areas](#) which are clearly demarcated by signs that identify the name of the chemical and the type of hazard it represents. In most cases, the chemical fume hood is the most suitable designated area for use of hazardous chemicals.

Warning signs should be posted on the chemical hood(s) used for the preparation of particularly hazardous chemicals and those substances with unknown toxicity. In order to prevent a cluttered hood, do not use it for storage of hazardous chemicals. A sample of a warning sign developed for acrylamide is provided in Figure 1 below.

Figure 1. Example - WARNING Sign for Acrylamide.

<p style="text-align: center;">CAUTION: PARATHION</p> <p style="text-align: center;">Acutely Toxic/ Cholinesterase Inhibitor</p> <p style="text-align: center;">Material Safety Data Sheets are available in Room_____</p> <p style="text-align: center;">For more information, please contact:</p> <p style="text-align: center;">In the event of a chemical spill, contact Public Safety at (insert campus specific Public Safety phone number) and ask for EOHSS assistance.</p>

VI. PERSONAL PROTECTIVE EQUIPMENT

While handling hazardous chemicals and/or excreted materials, personnel must at a minimum wear the following personal protective equipment:

- Safety glasses with side shields. (Chemical-resistant safety goggles for processes where splash or spray is foreseeable.) Safety glasses and goggles must be ANSI Z87.1 approved.
- A fully fastened, long-sleeved lab coat. Protective lab clothing including coveralls or lab coats may become contaminated and shall not be worn in administrative areas or outside a laboratory facility.
- Two pairs of nitrile gloves or the appropriate glove or combination of gloves that address all the hazards present. Inspect gloves for small holes or tears before use. Discard gloves immediately if they become contaminated or if the integrity of the glove becomes compromised. Hands must be washed thoroughly after gloves are removed and before leaving the work area.

For activities with the potential to create splashes, sprays or gross contact, use goggles in conjunction with a face shield; a fully fastened lab coat with the sleeves rolled down; and a rubber apron. In addition, a different glove material may be appropriate. Charts providing information on optimal glove materials for specific chemicals are available at:

<http://www2.umdj.edu/eohssweb/aiha/technical/ppe.htm#Gloves/Chemical>.

EOHSS can also provide assistance.

Respirators may only be worn after the researcher has first consulted with EOHSS to determine their applicability to the project. If respirators are deemed necessary, laboratory employees will be required to be medically cleared by Occupational Medicine Services or Employee Health Services, trained on the use and limitations of the respirator and fit tested by EOHSS prior to use of the respirator. A written respiratory protection program will also be required before the respirator is put into use.

VII. EMERGENCY/SPILL PROCEDURES

A. Personnel Contamination

Contamination of protective equipment or clothing, or direct skin or eye contact should be treated by:

- Immediately remove any contaminated clothing or protective gear.
- Wash the affected skin with soap and water.
- Flood the affected eye at an eyewash fountain or with water or isotonic eyewash designated for that purpose, for at least 15 minutes.
- Obtain medical attention. The campus Occupational Medicine or Employee/Student Health Services can be contacted during work hours. See Section IX. for campus specific contact numbers.

- Follow the instructions on the Emergency Response Guide flipchart for off-hours incidents.
- Report the incident to your supervisor. Complete a [UMDNJ Incident Report Form](#) and fax it to Risk and Claims at (973) 972-7257. If you have any questions, you can reach Risk and Claims at (973) 972-6277.

B. Spill Kit

A spill kit that is appropriate for the material(s) being used should be available in a convenient location. It should be labeled with information about the type of materials it can be used for.

C. Cleanup of Small Spills

Small spills (less than 5mL or 5 gm) of hazardous chemicals (that are not acutely toxic) outside a biological safety cabinet or chemical fume hood should be cleaned up immediately by appropriately trained personnel wearing gowns, double nitrile gloves or the appropriate glove or combination of gloves that address all the hazards present, and splash goggles. If the chemical is acutely toxic or if use of a respirator is necessary then EOHSS will clean up the spill.

Standard approaches to cleaning up powder and liquid spills should be used and include wetting powders down; using dampened cloths to wipe up powders or the use of a HEPA-filtered vacuum cleaner; and/or applying absorbent materials/liquid traps.

Liquids should be collected with absorbent materials (e.g., pillows, mats, papers) or liquid traps. Solids should be wiped with wet absorbent gauze. If there is a possibility that an airborne powder or aerosol has been generated, clean work areas using a HEPA vacuum and/or wet wiping methods (e.g., wetting powders down using a dampened cloth). Dry sweeping or compressed air should not be used to clean work areas contaminated with hazardous chemicals.

The spill areas should then be cleaned three times using a detergent solution and paper towels, followed by clean water. A trained employee wearing two pairs of nitrile gloves or the appropriate glove or combination of gloves that address all the hazards present, proper eye protection and a fully fastened lab coat or gown should wash contaminated reusable items, (e.g., glassware and scoops) twice with detergent.

Any broken glass fragments should be picked up using a dustpan and broom, tongs or forceps (never the use your hands) and placed in a wide-mouthed plastic container. The container should then go into a hazardous waste disposal bag, along with any spent absorbent materials and any other contaminated waste.

As in the case of any material spill, handling and disposal of the waste material will comply with the [EOHSS Waste Management and Waste Disposal Program](#).

D. Cleanup of Large Spills

If a large spill occurs:

- Avoid creating aerosols.
- Evacuate the area.
- Contact UMDNJ Public Safety by dialing:
 - Newark: 973-972-4990
 - Scotch Plains: 908-889-2485
 - New Brunswick/Piscataway: 732-235-4000
 - Camden: 856-757-7777
 - Stratford: 856-566-6060
- Be prepared to provide the following information:
 - Name of chemical
 - Number injured, if any
 - Amount spilled
 - Location of Spill
 - Phone Number where a knowledgeable person can be reached in a safe location
- Public Safety will contact the on-call EOHSS staff member who will arrange for the safe clean-up and proper disposal of the spilled materials.

VIII. WORKING WITH ANIMALS

A. **Metabolic Fate of the Chemicals/Drugs being Used**

The PI should list on the IACUC form any information that is known about whether the chemical(s)/drug(s) being used will be excreted or secreted into the bedding as the original material or as toxic or non-toxic metabolites. If this information is unknown, it will be assumed that the bedding contains hazardous materials and all of the requirements in this section shall apply.

B. **Notification of Animal Facility**

The supervisor of the vivarium in which the experimental animals are being housed must be notified before the animals are dosed to ensure they are aware that the protocol is being started and have all safety items/procedures ready.

C. **Dosing animals**

1. Injection

Consider chemically or physically restraining the animal to prevent accidental injection of the chemical/drug.

Preparation of the syringe for injection of hazardous chemicals should take place in a chemical fume hood or ducted biological safety cabinet.

Work surfaces should be covered with an absorbent, plastic-backed, disposable bench liner. The liner should be changed after preparation is completed for the day, at shift change, and/or after a spill.

Safety sharps are designed to prevent needlesticks and should be considered. Smaller needles correspond to larger gauge numbers. Needle length should also be considered, as you do not want to use a needle that can pierce through to the other side of the animal.

Depending on the application, various types of needles may be required. The following are some general guidelines:

ROUTE OF DELIVERY	GAUGE	LENGTH
subcutaneous	25	Up to 1 inch
intraperitoneal	25	Up to 1 inch
intra-dermal	30	less than ½ inch
intravenous	26, 27 or 30	less than 1 inch

Examples of safety sharps can be viewed at the following EOHSS link: <http://www2.umdnj.edu/eohssweb/publications/index.htm#Needle>

Staff must receive training on the use of the safety device before performing injections with hazardous materials and documentation of training must be kept. Perform a “dry run” of the procedure with a non-hazardous substance to ensure staff members are comfortable with the safety needle device.

Air bubbles must be removed from the syringe before use. Do not express the chemical/drug into the air. Aspirate the syringe (depressing the plunger to expel air bubbles), in a chemical hood or Class II type B biological safety cabinet, whenever possible. Before aspirating, wrap the tip of the needle with a dampened gauze pad, which is to be discarded as chemical or biological waste, as appropriate.

A more effective and higher tech solution for preventing exposures while aspirating the syringe involves the use of enclosed chemotherapy delivery systems such as PhaSeal (<http://www.carmelpharma.com/phaseal.html>). The PhaSeal system consists of a set of disposable containment devices that connect the original drug vial, syringe and intravenous injection or infusion set together in a sealed pathway. A double membrane prevents drug leakage and

keeps the connections dry, while an expansion chamber equalizes the pressure in the system to prevent the release of toxic aerosols and vapors. This type of product has an integrated safety needle feature which will help prevent accidental needlesticks to the user after use. This type of enclosed system is recommended by OSHA and the CDC for hazardous drugs.

After use of the syringe, do not clip, remove, or recap the needle. Instead, place the entire used syringe directly into a conveniently placed sharps container.

Check the injection site for leaking or spilled material, and absorb with dampened gauze.

2. Food/water

If the test substance is to be administered in the feed, consider purchasing the feed pre-mixed. If this is not an option, the mixing of food and test chemical must take place under a chemical fume hood or in a ducted biosafety cabinet. The waste feed should be collected and disposed of as a hazardous waste.

If the test substance is administered in drinking water, then collect waste drinking water, and any bedding that becomes soaked with drinking water, and disposed of these materials as hazardous waste.

D. Animal Housing

Precautions are to be taken to prevent exposures to persons caring for the experimental animals during the time period where they are excreting chemicals and when the bedding may be contaminated.

For volatile commandants the use of a static microisolator cage in a ducted chemical fume hood, or a class II type B Biological Safety Cabinet is recommended.

For non volatile contaminants use of a ventilated cage rack where the exhaust from the unit is connected into an exhaust duct which leads to the outside air is acceptable, as is a static rodent cage with a microisolator top in a well-ventilated room. In some cases, personnel may be required to wear respiratory protection when entering the room during the time period when the animals are housed in contaminated bedding.

E. Handling of contaminated bedding (secretion, excretion)

Wear two pairs of nitrile gloves or the appropriate glove or combination of gloves that address all the hazards present to prevent contact with the urine and other body fluids when handling the animals or the bedding for at least 3 days post-dose unless indicated otherwise in the EOHSS review of the IACUC protocol. Disposable plastic-backed paper liner must be used under work areas, and they must be disposed of as hazardous waste.

F. Warning Signs

Warning signs that list the names of the hazardous materials as well as potential health hazard and safety precautions must be posted on the animal room door and on individual cages where the dosed animals may be excreting/secreting chemicals, drugs, metabolites of hazardous materials or other hazardous materials.

G. Cage changing

Cage changing must be done using a HEPA filtered cage change station or a ducted chemical hood or biological safety cabinet. If it is not possible to use one of these options than an N95 respirator should be worn and people not wearing respiratory protection should be kept out of the area for at least one hour.

H. Bedding Disposal

If cages must be changed during the period when the animals are excreting chemicals/drugs, bedding disposal must be performed using a High Efficiency Particulate Air (HEPA) filtered dumping station (Bedding disposal should be postponed for the first 72 hours to minimize handling of contaminated bedding. Follow EOHSS recommendations for whether the cages must be pre-cleaned or decontaminated prior to dumping or cage wash. For nanoformulations, the period of time where the animals are secreting or excreting chemicals may be different than for traditional forms of the drugs. This should be factored into decisions related to cage dumping precautions.

I. Carcass Disposal

Dispose of animal carcasses as regulated medical waste, unless the coat of the animal is grossly contaminated with a hazardous material(s). If there is gross contamination contact EOHSS to arrange for disposal.

J. Necropsy

Necropsy of animals which retain the treatment chemical/drug should be performed in a chemical hood or Class II type B Biological Safety Cabinet. If this is not practical, a combination of downdraft tables, administrative controls and respiratory protection must be discussed with EOHSS.

IX. EMPLOYEE & STUDENT HEALTH

Both laboratory and vivarium personnel working on projects involving hazardous materials are encouraged to contact their campus Occupational Medicine Services / Employee Health Services if they have a health concern (e.g., physical symptoms and/or questions about individual health concerns related to exposure).

For confidential consultation and assistance contact the following:

NEWARK/SCOTCH PLAINS

Occupational Medicine Services: 973-972-2900

Student Health Services: 973-972-8219

NEW BRUNSWICK/PISCATAWAY

Employee Health Services: 732-445-0123

Student Health Services: 732-235-5160

STRATFORD

Student/Employee Health Service: 856-566-6825

CAMDEN

Employees: Employee Health Service: 856-566-6825

Students: Cooper Hospital Internal Medicine Clinic 856-342-2434

X. PERSONNEL WORKING WITH SUBSTANCES OF UNKNOWN OR HIGH TOXICITY

Responsible/Principal Investigator(s): Use the following table to list all personnel who will work with highly toxic materials or materials with unknown toxicity. The staff member's initials indicate that the staff member has read this SOP and understands precautions to prevent exposure as detailed in this therein.

Name	Job Title	Signature

Responsible/Principal Investigator (Print): _____

Responsible/Principal Investigator (Signature): _____

Date: _____