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Safety and Waste Management Practices in the Organic Analysis Groups (Volatile, Semi-Volatile and Pesticide Laboratories)

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

CHEMISTRY PROGRAM

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Safety and Waste Management Practices in the Organic Analysis Groups (Volatile, Semi-Volatile and Pesticide Laboratories)

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1. SCOPE AND APPLICATION

1.1 This document details safety and waste management practices in the volatile, semi-volatile, and GC/HPLC pesticide laboratories. Because most of these practices are common to all of these groups and because personnel are often shared between groups, the routine practices are presented together. NOTE: Most of this information is also common to the Inorganic Groups.

1.2 For more information on safety and waste management see Section 15 for the Safety and Waste Management SOPs of the Chemistry Section. All personnel are required to read, thoroughly understand, and follow these SOPs. In particular, personnel must thoroughly familiarize themselves with the routine emergency procedures.

2. GENERAL SAFETY GUIDELINES

2.1 Keep bench tops and floors clean of spills, broken glass, and clutter. Do not store items on top of wall cabinets, flame cabinets, or in front of flame cabinets. Do not store items inside, on top of, or around the SAFETY STATIONS except the equipment and supplies that are part of the safety station.

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2.2 Hallways and exit doors must be kept clear of equipment, boxes, and clutter. Under no circumstance may these areas be used for storage. Electrical cables, communication wires or plumbing must also not obstruct walkways and exits.

2.3 Do not bring any food or drink into the laboratory area at any time. Smoking is prohibited in the laboratory facility and loading docks.

2.4 Visitors to the laboratory must be issued safety glasses and be accompanied by a Chemistry Section employee at all times. Visitors are not allowed to interrupt or disturb the lab work of employees, handle any lab equipment, come into contact with chemicals or access our computer systems. (Service engineers may access equipment and computers as needed to perform service contract repairs, installations, or upgrades.)

3. APPAREL

3.1 Glasses- Laboratory glasses/goggles must be worn at all times when in the laboratory. This is a mandatory, section-wide requirement and if not adhered to can result in disciplinary action. Samples that pose a risk of chemical splash, glass breakage or flying objects must be handled using a full-face shield in a chemical hood.

3.2 Coats- Lab coats must be worn when working with solvents, acids/bases and when preparing samples and standards. Tyvek lab coats are also required while working in the clean lab rooms. It is strongly recommended to wear a lab coat at all times while working in the lab. It is preferable to store lab coats in the lab areas to lessen the chance of exposing hazardous substances to co-workers and visitors outside of the lab environment.

3.3 Gloves- Appropriate gloves (i.e., latex, nitrile, rubber, etc.) must be worn while preparing samples, standards and when working with solvents, acids/bases, or when dealing with broken glass. Use oven gloves when removing hot items from the ovens. Check the glove material index in the Fisher catalog to see which gloves are appropriate for the solvent/chemicals being used. Change disposable gloves when you handle different samples or change to another task to minimize cross contamination. Remove the gloves before handling door knobs or exiting the lab. Keep gloves in the laboratory and do not wear/take used gloves into the office areas. NOTE: Use blue nitrile gloves when working with methylene chloride.

3.4 Shoes- Wear closed-toed and full-heel shoes at all times while in the lab! DO NOT wear sandals or open toe shoes. These shoes do not offer adequate protection from chemical spills, broken glass or dropped items.

3.5 Clothing- It is mandatory to wear either long-pants or skirts when working in the lab. Shorts are not allowed in the laboratory, because they do not provide adequate protection.

3.6 Respirator- Wear an appropriate respirator while making standards, preparing

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samples or disposing of waste. Respirators must be used whenever a noxious, toxic, or organic solvent vapor is present at a concentration greater than the permissible exposure level (PEL), as noted in the Material Safety Data Sheets (MSDS). The respirator may be optionally used when a vapor is present at below the PEL. Select the proper respirator cartridge type based on the type of vapor present (i.e., organic solvent, acid, etc.)

3.7 Ear Protection- Earplugs or muffs are provided in each of the major lab working areas. Wear earplugs, as needed, to protect your hearing when working in or near noisy environments. Hearing protection may be needed, for example, when working near the laboratory service areas containing large motors and pumps. Also, wear earplugs when working near the high pitch sound from ultrasonic bath/probes.

4. HANDLING AND STORAGE OF CHEMICALS/SOLVENTS

4.1 All reagents must be treated as a potential health hazard. Hence, exposure to these chemicals must be reduced to the lowest possible levels. Use gloves, respirators and lab coats as the situation requires. Prepare standards in a ventilated hood. Always wash your hands when leaving the lab area.

4.2 Material Safety Data Sheets (MSDS) for each chemical in the lab are kept in a binder at the entry point to each laboratory. The MSDS information is also maintained on file with the safety officer and may also be accessed on the Internet. Read the MSDS for each chemical used in order to become familiar with its properties and health hazards. Keep the updated MSDS forms that come with new reagents or chemicals to provide the Safety Officer for distribution and filing.

4.3 Place a sheet of bench paper under balances and on work areas before weighing out any reagents, neat standards or samples. This will serve to collect any spills. Discard the paper when you are finished.

4.4 Label all containers you are using and always clean up and properly dispose of the contents when you are finished. Make sure that all spills are neutralized and cleaned up BEFORE you leave your work area. Only you are 100 % sure of what you were using! Do not allow co-workers to inadvertently harm themselves by cleaning up after you.

4.5 When preparing or working with acids and bases, use the following precautions:

4.5.1 In the preparation of acid solutions from the concentrated acid, ALWAYS remember to add the acid to the water. For both acid and base preparations, work in the fume hood and wear safety glasses, lab coat and acid/base resistant gloves. Place the container in which you are making a base solution on a hot plate and add a stir bar. A great amount of heat is generated when preparing a base solution, so it is best to allow the solution to stir until it has cooled to room temperature.

4.5.2 For acids and bases, remember to clean up all spills on bench top,

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including any powders or pellets that may have fallen during preparation. After preparation, wash hands thoroughly and neutralize or dispose of acid and base waste properly.

4.6 When preparing pesticide standards, use the following precautions:

4.6.1 Always work in the Toxic Weighing Room in the fume hood.

4.6.2 Wear the proper glove type, glasses, and lab coat. Use a respirator, as required.

4.6.3 After you have weighed out the standard, rinse all glassware/spatula into the proper hazardous waste bottle using the solvent in which you are preparing the standard.

4.6.4 Wash hands thoroughly when complete.

4.7 Store all chemicals and solvents properly.

4.7.1 Flammable solvents (methanol, acetone, acetonitrile, etc.) are segregated and stored in a flameproof cabinet.

4.7.2 Non-flammable solvents (methylene chloride, water) may be stored in regular lab cabinets.

4.7.3 Store bases (ammonium hydroxide, sodium hydroxide, etc.) and acids (sulfuric, nitric, hydrochloric, etc.) in separate cabinets! Store any reactive substances (e.g., peroxides) by themselves, away from any other chemicals. Store all cyanide waste separately from acids.

4.8 Any chemical spills must be handled and disposed of in the prescribed manner as given in the MSDS. Significant spills must be reported immediately to the Safety Officer in order to minimize risk of injury, exposure, and further contamination. The Safety Officer will mobilize the spill clean-up and document the event.

5. DISPOSAL OF CHEMICALS, SOLVENTS AND WASTES

5.1 Collection and In-Lab Disposal of expired chemicals and solutions:

5.1.1 Neat standards must be sealed and labeled.

5.1.2 All stock standards, working standards and unused sample extracts must be emptied into a properly labeled (listing contents- use the official waste storage labels) 4-L solvent bottle.

NOTE: Any waste standards/samples containing SILVEX (2,4,5-TP) 2,4,5-T or PCBs must be stored separately from other waste standards. These compounds are potential DIOXIN wastes. To be safe, store all acid herbicide standard/sample waste separately from other standard waste.

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5.1.3 HPLC/GC vials containing solvents, standards and extracts may be stored in a labeled 4-liter empty solvent bottle.

5.2 Waste may be temporarily stored in the lab, but must be disposed of in the waste storage drums located in the waste storage room within 3 days. DO NOT ACCUMULATE WASTE IN THE LABORATORY! Once a week, check all lab waste bottles and insure that dated waste is disposed of in drums.

5.2.1 Each drum is labeled according to contents, i.e., chlorinated, non-chlorinated solvents, acid and mercury waste, etc. Acid wastes are stored in the acid waste room, which is separate from the solvent waste room.

5.2.2 ALWAYS bring another person with you to the waste room when discarding waste. One person should stand at the door while the other staff member disposes of the waste. A person may be overcome by vapors and, if alone, may be unable to get help.

5.2.3 When disposing of waste always use appropriate safety equipment, e.g., respirator, gloves, lab coat and lab glasses.

5.2.4 If any spills or leaks are noticed, immediately contact the Safety Officer.

5.2.5 All waste must be disposed of in the proper waste drum. The waste drums available are:

- Chlorinated Waste
- Non-Chlorinated Waste
- Metals without Mercury
- Metals with Mercury
- TKN Waste
- TP Waste
- Phenol Waste
- Cyanide Waste

5.2.6 Auto sampler vials of sample waste may be placed in a properly-labeled empty 4-liter solvent bottle and stored in the waste room.

5.3 If a large amount of waste is spilled:

- Inform your coworkers in the lab that a spill has occurred.
- Minimize the extent of the spill, if possible.
- Limit access to contaminated area.
- Contact the Safety Officer.

5.4 All spent sodium sulfate; glass wool filter papers and solvent- extracted solid samples must be treated as hazardous waste. Place the used materials immediately after extraction into designated closed-metal containers maintained within the laboratory. Once complete, transfer the waste materials to the designated solid-waste drum in the waste room to be disposed as hazardous

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waste**.**

6. WORKING IN THE CHEMICAL HOODS

6.1 All sample extractions, solvent transfers, concentrations, sample preparations and cleanups must be performed in an operating hood.

6.2 At any time, no more than two people should work in one hood. Make sure that you are aware of what other staff members are doing around you to avoid cross contamination of chemicals or samples.

6.3 Turn on the air fan and wait for adequate airflow before using a hood.

6.4 The hood sash must be pulled down to the mark posted on edge of sash while working in the hood. This mark designates the maximum sash height at which the hood can properly evacuate vapors.

6.5 Do not store anything within 8 inches of the airfoils located in the back of the hood. Keep the hood area clean and uncluttered. The hoods must not be used as a storage area.

6.6 If you are preparing samples and the power goes off then check with the supervisor. Never work in a fume hood where the airflow is not adequate.

6.7 Clean the working area when you are finished. Close the sash and turn off the hood once your work is complete.

7. TCLP TUMBLER USAGE

7.1 Check all caps and latches for proper closure before turning on the tumbler. Make sure separatory funnels are seated properly and securely.

7.2 During the tumbling process, carefully release excess pressure in the separatory funnels by venting stopcock while tumbler is at rest before resuming tumbling after every half turn, one full turn, 2 full turns, 4 full turns etc., until there is no more pressure.

7.3 After venting carefully pull the hood sash down completely. Leave the sash down until the tumbler comes to a complete stop.

7.4 Keep hands clear of the tumbler until it is safe to raise the hood sash.

8. GLASSWARE

8.1 Inspect all glassware prior to use for chips, cracks, etching or scratches.

8.2 Dispose of all unwanted or broken glassware in the "GLASS DISPOSAL" box. One should discriminate between "unwanted, broken" glassware and slightly

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damaged glassware that can be reasonably repaired.

8.3 Hold a pipette near the bulb when placing a pipette bulb onto a volumetric pipette end. Do not hold the pipette in the middle or near the tip, as the pressure may cause the pipette to snap and cut your hand.

8.4 Wear heavy gloves when picking up broken glassware.

9. SAFETY STATIONS

9.1 A safety station is located in most laboratory rooms. The station contains the Emergency Shower, Emergency Eye Wash, and a first aid kit. Acid/base spill kits and absorbent pillows for solvent spills are typically stored in the cabinet underneath the safety station.

9.2 Do not use the safety station for storage of lab equipment, chemicals or personal belongings. Maintain a clear, unobstructed path to the safety station at all times.

10. GAS CYLINDER SAFETY

10.1 Never roll a cylinder to transport it from one place to another. Always use a suitable hand truck with a lock chain or strap to transport. The gas cylinder must be secured to the hand truck with a strap or chain before transporting. Make sure the cylinder has a cap over the valve head before moving. If the cylinder should fall and there is no cap to protect the valve, the valve may break off, rapidly releasing the gas at once and transforming the cylinder into a missile.

10.2 Inspect the equipment attached to the gas cylinder to insure that the instrument will not be damaged by removal of the tank. Follow the instrument manufacturer recommendations for changing the instrument conditions prior to removal of the gas cylinder. Also make a note of the pressure gauge settings.

10.3 Close the main valve before changing a cylinder. After putting the cylinder in place, secure to a firm support (such as a bench table or the floor with a cylinder strap or cylinder floor stand. Never use a cylinder that is not secured to a fixed support!

10.4 Check the pressure gauge setting after the valve has been reopened.

10.5 Check the cylinder connections for leaks.

10.6 Label the used cylinder as "EMPTY" and return it to the cylinder storage area for recycling.

10.7. Perform a leak check on the newly installed cylinders.

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11. HPLC SAFETY

11.1 As the HPLC systems are under high pressure (600-18,000 psi) during operation NEVER open a system while it is pressurized!

11.2 There is a lot of electrical equipment in use in close proximity to water and flammable solvents in the HPLC lab. Be sure that spills are cleaned up immediately and are not allowed to contact electrical connections or outlets. Keep a constant look out for developing leaks that may be hidden and will allow liquid to seep into electrical connections.

12. ERLN/BNA/PESTICIDE SAMPLE PREPARATION

Refer to SOPs ERLN-001 and ERLN-002 for details on handling CWA samples and standards. Also, all ERLN/BNA laboratory users must receive on-line Chemical Agent (CA) Training. The laboratory CA Training is available on the DEP Intranet as part of our laboratory safety program at https://www.fldepnet.org/content/dear. Under the Laboratory Quick Links tab, click on the Health and Safety tab for training access.

12.1 Separatory Funnel Extractions:

When extracting samples by separatory funnel, remember the following:

12.1.1 Always wear protective glasses, lab coat and methylene chloride-resistant gloves!! Work in the hood at all times!!

12.1.2 When adjusting the pH of a water sample during the BNA extraction be aware of what you are doing. If the sample's initial pH is basic (i.e., high pH), be cautious when adding acid. Likewise, if the sample is initially acidic (i.e. low pH), be especially cautious when adding base. There will be a rapid build-up of vapors from the acid-base reaction. Always swirl the funnel gently after adjusting the pH and allow it to sit uncapped for several minutes before beginning initial tumbling/venting procedures.

12.1.3 When venting the separatory funnels pull down hood sash as far as possible and ALWAYS vent away from your face. During tumbling, the hood sash should be completely DOWN! Any un-vented pressure can cause the separatory funnel to explode.

When using the sodium sulfate/glass wool glass drying columns, always use a metal rod (not glass) to force the sodium sulfate from the column. Do this immediately after use. This is to insure the sodium sulfate does not harden in the column and increase the chance of glassware breakage while you are trying to remove it from the column. Spent sodium sulfate, glass wool, filter papers and filter cake must be treated as hazardous waste. Place the spent materials immediately after extraction into designated closed-metal containers in laboratory, and transfer them later to the designated solid-waste drum in the waste room to be disposed as hazardous waste.

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12.2 KD Apparatus:

When working with the KD apparatus, remember the following:

12.2.1 It is essential that the Snyder columns be inspected prior to use. Check to insure that the balls are freely moving within their columns by holding them sideways and gently shaking. If any balls are stuck in position, DO NOT USE COLUMN. Always pre-wet columns prior to placing them on the KD flask. Insure that all balls are moving freely in their chambers. If the balls are not all moving, the pressure inside the KD flask will build up and cause the flask to explode.

12.2.2 Always have the fume hood operating when using the KD apparatus.

13. VOC SAMPLE AND STANDARD PREPARATION

Always read the appropriate preparation SOP before attempting any sample preparation. Ask the supervisor about any aspects of the preparation that you do not understand.

13.1 Zero Headspace Extractor (ZHE)

Since the ZHE units operate under pressure, they must be assembled and handled with care by trained personnel only.

13.1.1 Always wear protective glasses, lab coat and gloves. Use a respirator as needed. Only handle the ZHEs in an operating fume hood.

13.1.2 When pressurizing or venting the ZHE, pull down the hood sash as far as possible and vent away from the opening of the hood.

13.2 VOC Standard Ampoules

Stock standard solutions for the VOC laboratory are purchased in flame sealed ampoules. The glass ampoules typically contain concentrated mixtures of up to 60 VOC compounds. The compound concentrations in the ampoules typically range from part-per-million to neat.

13.2.1 Always work in the fume hood with the sash pulled down as far as possible.

13.2.2 Wear the proper glove, glasses, and lab coat. Use a respirator as needed.

13.2.3 When opening an ampoule, use a folded paper towel to wrap around the neck of the ampoule to prevent potential injury from glass and to minimize exposure in the event of a spill.

13.2.4 Immediately dispose of the empty ampoule in the solid hazardous waste container after transferring the contents.

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13.2.5 Dispose of your gloves and wash your hands thoroughly when complete.

14. GENERAL SAMPLE GUIDELINES

14.1 Carefully inspect each sample, before opening, for leakage, breakage, odors, bubbling or other unusual characteristics. Immediately report to your supervisor any unusual observations, before opening the sample.

14.2 Check the Backlog Report in order to make an initial assessment of which samples may be more hazardous and note the customer ID and the test requested.

14.3 Samples from Emergency Response, Site Investigation Services, and Superfund clean-up sites, for example, are usually more contaminated than typical samples. However, all samples received by the laboratory must be considered and handled as potentially hazardous.

15. REFERENCES

15.1 "Laboratory Health and Safety Plan", Florida Dept. of Environmental Protection, Chemistry Section, February, 2017.
15.2 "Emergency Action Plan", Florida Dept. of Environmental Protection, Chemistry Section, February, 2017.
15.3 "Tornado Safety Plan", Florida Dept. of Environmental Protection, Chemistry Section, February, 2017.
15.4 "Laboratory Complex Security Plan and Procedures", Florida Dept. of Environmental Protection, Chemistry Section, February, 2017.
15.5 "Chemical Hygiene Plan & Safety Manual", Florida Dept. of Environmental Protection, Chemistry Section, 4th Edition, July 2010.

16. EMERGENCY CONTACTS

16.1 Contact your supervisor immediately if you are involved in a lab accident, witness a lab accident, see a problem with waste materials, or notice improper safety/waste disposal practices. If the supervisor is unavailable, contact one of the following:

Contact Person	Work Phone	Home Phone
Nhon Vo (Safety Officer)	245-8137/GIC: 5137	850-877-6671
Colin Wright	245-8057/GIC: 5057	850-570-9014
Liang Lin	245-8088/GIC: 5088	850-942-2888
Kerry Tate	245-8309/GIC: 5309	850-668-5234
Police/Ambulance/Fire	**911**	
Poison Control Center	**1-800-282-3171**	

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17. APPENDIX OF CHANGES

The following updates have been made to this version of the SOP.

- Incremented SOP version number.
- Updated references and contacts

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