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INTRODUCTION

The NCSU Manual for Chemical Waste Management was first published in February 1992, and distributed to department heads, Principal Investigators, and other individuals who had a recognized need for chemical waste management information. This procedure supersedes previous versions of the manual (1992-March 2009, and since renamed) by providing updated and additional information regarding management of materials and wastes, including:

1. Reorganization of information.
2. Requirements and restrictions for “disposal” through environmental media.
3. Clarification of waste accumulation areas and procedures.
4. Revised guidance on waste treatment in labs.
5. Template for emergency contingency plans.
6. Training guidelines

The purpose of this procedure is to provide guidance for proper management and disposal of chemical, radioactive, biological, and other environmentally-hazardous waste at North Carolina State University. Chemical wastes are generally spent or surplus chemicals, or residues from spills or various cleaning or processing operations. Most radioactive wastes are chemical or contaminated debris in nature, and therefore included with chemical waste procedures. This procedure also applies in general terms to the management of biological wastes that require management through Environmental Health and Safety.

Wastes may be regulated under the Resource Conservation and Recovery Act (RCRA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Clean Water Act (CWA), Toxic Substances Control Act (TSCA), or other Federal, State, or Local regulations. The term "hazardous waste" specifically applies to wastes regulated under RCRA, but may also be loosely applied to chemical wastes subject to any regulation because of hazard.

Questions concerning the management of hazardous materials or wastes may be directed to the Hazardous Waste Program Manager (515-6863).
SUMMARY REQUIREMENTS

Waste management should be an integral part of material management. It can become complicated, especially when analyzing each regulation, interpreting applicability to specific situations, and attempting to understand the reasoning behind the rules. The Waste Generator Manual provides the details necessary to achieve compliance without going into the regulatory language.

Minimum requirements for material and waste management include:

- Identify all materials in the work place, including wastes and products;
- Ensure materials are always under the control of responsible persons;
- Waste determination is mandatory, and may be conducted either during process design or implementation (e.g., as wastes are generated);
- Materials and wastes must be managed in a manner that minimizes the potential for fires or releases (spill, leaks), and should include measures that minimize potential for theft, contamination, and other losses or risks;
- Generators shall not evaporate, dilute, or burn wastes as a means of treatment, recycling, or disposal;
- Wastes are initially collected at the process where they are generated, and may be transferred to appropriate containers nearby under certain conditions;
- Wastes are accumulated in an area managed by the responsible Principal Investigator that can be observed by the person(s) generating the waste, i.e., in the same room as generated or, if necessary, an internally-connected adjacent room (satellite accumulation). Deviations from this must be reported to EH&S and will likely incur additional requirements (central accumulation).
- Waste containers will be appropriately identified at all times, and with few exceptions marked with the words “waste” and the date the waste was generated or first added;
- External surfaces of waste containers must be kept clean;
- Containers must be kept closed except when adding or removing materials;
- Wastes should be submitted for disposal within six months of the accumulation start date, and must be removed from central accumulation areas within 90 days;
- All persons generating or handling wastes should be aware of the potential hazards, and appropriately trained for normal and emergency procedures.

Additional considerations include:

- Rules for the handling, transportation, and disposal of wastes are far more stringent than those for materials that are not waste;
- Recognize the potential wastes that may be generated from the processes in the work place, keeping in mind that all materials may need to be discarded at some time and in some form;
- Cost for disposal is often higher than purchase cost;
- Wastes may be regulated when hazardous constituents are present at only a few parts per million.
SECTION 1
WASTE CLASSIFICATION

Material and Waste Directory

North Carolina State University purchases a significant amount of materials through the course of its varied operations. As a result, there is a need for periodically removing waste materials, unwanted or outdated equipment, and other items in a reasonable and responsible manner. To assist in this effort, a Materials and Waste Directory is presented which provides some general guidance for the disposition of unwanted materials. The directory provides general categories and examples of commonly discarded materials, and the organization to contact for information or other services regarding their management. The directory also highlights the separation of wastes for recycling and disposal, and again references departments who are primary contacts for these types of wastes.

It is important to emphasize what a waste material is, and when someone must manage it as a waste. A waste is any product, by-product, or other material that is normally discarded. The material becomes a waste (1) when it is removed from the process and is intended for discard (including disposed, dumped or discharged), or (2) when it is determined to no longer be of use, such as outdated chemicals or legacy inventories. The person responsible for the process (the generator) must determine if the material is a waste, and proceed to the subsequent classifications of solid waste, hazardous waste, universal waste, or environmentally hazardous waste (the last three coordinated with EH&S). The generator must then properly manage the waste in accordance with University policies and procedures.

General Definitions

The key terms relevant to hazardous waste management programs are found in Title 40 of the Code of Federal Regulations, Parts 260-270. Additional terms are defined in State and Local regulations, including the North Carolina Solid Waste Management Rules and the Raleigh City Code. The definitions provided here have been simplified to avoid possible confusion.

**Generator:** any person whose act or process produces "waste." At NCSU, and for the purpose of this document, this would be the Principal Investigator, Laboratory Supervisor, Manager, Facilities Operation Zone Supervisor, or other person responsible for a local area in which chemicals are used or stored. "Generator" will also be used for matters pertaining to the University as a whole.

**Operator:** any person who uses or otherwise handles chemicals in the workplace. This includes the generator, and personnel (students, staff) authorized by the generator, but not the University as a whole.

**Process:** an activity conducted in the workplace. At NCSU, and for the purpose of this document, this is generally broad categories of activities such as material storage, laboratory, maintenance, and construction.

**Discarded Material:** any unwanted material that is disposed of, burned or incinerated, accumulated, stored, or treated. This includes all materials for recycling and most process wastes.

**Solid Waste:** any discarded material, excluding domestic sewage, certain radioactive materials, irrigation return flows, and secondary materials returned to the process under specified conditions. "Solid waste" does not refer to a physical state, and may be solid, liquid, or gas.
**Hazardous Waste**: any solid waste that is ignitable, corrosive, reactive, or toxic, a listed hazardous material, or contains a listed hazardous material.

**Listed Hazardous Waste**: Listed hazardous wastes include materials that have been used in a process, generated as by-products, or are discarded commercial products. A [listing of commercial chemical products](#) has been provided on-line.

**Acute Hazardous Waste**: A class of listed hazardous wastes that are considered to pose a significant risk to human health or the environment, even in small quantities such as residues in bottles. Although most are listed for acute toxicity, some may also be listed for reactivity. A listing of these chemicals is provided at the end of Section 2, and is included in the on-line listing of commercial chemical products.

**Environmentally Hazardous Waste**: any solid waste that is technically not a "hazardous waste", but may pose a significant hazard to human health or the environment, or is unacceptable at local solid waste management facilities. Sanitary (municipal) landfills cannot accept liquids or contained gaseous wastes. Wastewater treatment plants must operate within specific limits for their sludge and treated effluent.

**Universal Waste**: hazardous waste that has been provided specific exemptions to encourage recycling. Currently, universal wastes are limited to batteries, pesticides, mercury-containing lamps, and mercury-containing equipment.

**Inherently Waste-Like**: is a term that may include outdated, degraded, or contaminated products or reagents; secondary materials; and materials in deteriorating containers. Spills that have not been properly cleaned up, unidentified materials, and materials improperly stored or no longer used are also included.

**Ignitable**: liquid with a flash point less than 140 degrees Fahrenheit, a flammable compressed gas, an oxidizer, or a flammable solid. Alcohol solutions containing less than 24% alcohol in water are not considered ignitable. Other water-miscible liquids require testing to determine ignitability (assumed to be ignitable until proven otherwise).

**Corrosive**: aqueous solution with a pH of less than or equal to 2 or greater than or equal to 12.5, or a liquid that corrodes steel at a rate greater than 0.25 inches per year.

**Reactive**: unstable under normal conditions, reacts violently with water, produces toxic gases, fumes, or vapors when heated, compressed or mixed with water, contains sulfides or cyanides which may be released at pH conditions between 2 and 12.5, or is capable of detonation or explosion.

**Toxic Material**: any material that may pose a significant threat to human health. According to hazardous waste regulations, a toxic waste is any solid waste that contains certain heavy metals, pesticides, or organic compounds.

**Radioactive Material**: any material, solid, liquid, or gas, which spontaneously emits alpha particles, beta particles, gamma rays, X-rays, neutrons, or other particles capable of producing ions. This includes radioactive source material (sealed and unsealed sources), isotopes, and naturally-occurring radioactive materials.

**Biological Waste**: waste material consisting of potentially biohazardous materials, specifically microorganisms, toxic biological substances, biological allergens, or any combination of the three. Biological wastes may be categorized as sharps, medical, or non-medical wastes. See the [NCSU Biosafety Manual](#) for more information.
**Sharps**: typically needles, syringes, cutting blades, pipettes, or broken glass.

**Non-Medical Wastes**: Biological material such as specimens and cultures, including animal carcasses and tissues used in education.

**Medical Wastes**: Waste generated in diagnosis, treatment, or immunization; in research pertaining thereto; or in the production or testing of biologicals, including animals and animal tissues used in research.

**Regulated Medical Wastes**: wastes consisting of any of the following:
- Blood and body fluids in containers greater than 20 ml;
- Microbiological waste;
- Untreated pathological waste, such as animals or animal tissues known to have been exposed to pathogens.

**Manufactured Article**: Any manufactured (man-made) item, other than a chemical product. Manufactured articles may consist of, or contain, hazardous materials and could be regulated wastes upon disposal. Examples of manufactured articles include, but are not limited to:
- Lamps and light bulbs
- Batteries
- Thermometers
- Electronics

**Satellite Accumulation Area**: Location where wastes are managed at or near the point of waste generation, under the control of the process operator. Specifically, this is the apparatus, shelf, bench, fume hood, or other narrowly-defined work area where waste is removed from a process (generated). In general terms, it may also be the specific lab, shop, or other room where the waste is generated and under the control of a Principal Investigator. This does not include a room in close proximity that requires the waste to be moved into a hallway or other common area.

**Central Accumulation Area**: A location where wastes are managed that does not meet restrictions for Satellite Accumulation Areas. Specifically, these restrictions are:
- Accumulation of more than 55 gallons of hazardous waste, or one quart of acutely hazardous waste;
- Accumulation by more than one process operator or Principal Investigator; or
- Accumulation that is not at or near the point of generation, e.g., generated in another room.

See Section 5 for further information regarding accumulation areas.
Safety Precautions

Personnel must be familiar with proper handling procedures for materials and waste and emergency procedures, relevant to their responsibilities during normal operations and emergencies.

Storage areas, including those in labs and shops, should be orderly and suitable for the types and quantities of materials in storage. Inventories should be limited to only those materials and quantities necessary for current operations. Old or expired chemicals, and chemicals or containers that have deteriorated, should be disposed. Materials no longer necessary for activities should be redistributed or disposed.

Materials must be labeled. Wastes are subject to EPA waste regulations. Products and by-products are subject to OSHA hazard communication regulations.

Materials should be stored with chemical compatibility in mind. Spills may occur, with the possibility of chemicals coming in contact with each other, resulting in potentially serious chemical reactions. Safety issues related to dispensing materials, attendance of laboratory operations, and maintenance and inspection of equipment all play a part in minimizing the potential for a serious occurrence.

Facilities must be maintained and operated to minimize the possibility of a fire, explosion, or any unplanned sudden or non-sudden release of hazardous waste. This includes management of chemicals, equipment, supplies, and other materials. What this means is work areas must be maintained in an orderly fashion. Open containers, work near sinks or drains, and handling of containers all contribute to potential for release. From chemical storage to equipment layout and housekeeping, accident prevention is a necessary consideration.

Maintain aisle space to allow the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment to any work or storage area in an emergency, unless aisle space is not needed for any of these purposes.

Initiate and maintain good housekeeping practices in your area. Properly store all hardware, tools, and process materials according to departmental and University procedure. Remove all unnecessary materials and trash, and minimize “clutter” regularly.

Spills must be cleaned up in a timely manner. Waste generated by spills are to be managed in accordance with hazardous and chemical waste procedures and guidelines.

Waste management safety and waste accumulation concerns are addressed in more detail at Hazardous Waste Inspection Guidance.
SECTION 2
WASTE DETERMINATION AND RESPONSIBILITIES

Generator Responsibilities

The waste generator (e.g., Principal Investigator, supervisor, manager) is responsible for determining if a material is spent or intended for discard, thereby a waste material. This includes determining whether materials are no longer needed, in which case they should be disposed or, if in good condition, redistributed to other campus users.

The generator is responsible for managing hazardous materials, including wastes, in accordance with the requirements provided here and in the Health and Safety Manual. This includes ensuring continued ownership of all materials and timely disposition of wastes. Generators are subject to compliance inspection by Federal and State agencies, as well as inspections by EH&S. See the document Hazardous Waste Inspection Guidance.

In the event that a generator establishes a central accumulation area, the generator is responsible for determining whether a waste material is a hazardous waste, based on constituents, hazard characteristics, and processes generating the waste. The generator shall also be responsible for the additional training, inspections, documentation, emergency preparedness, and other requirements. This manual is intended to provide sufficient guidance. The generator should contact EH&S for assistance as needed.

Generators must minimize waste generation to the degree they have determined to be practicable. Section 7 of this manual addresses waste minimization.

The generator is responsible for maintaining a safe work area.

Responsibilities for the Hazardous Waste Program Manager

The Hazardous Waste Program Manager is the authorized representative for the University's generator, treatment, and storage facilities. As the generator representative, the Program Manager is responsible for the management, including off-site treatment and disposal, of chemical wastes submitted for disposal by University generators. Under his guidance, hazardous waste personnel operate a permitted hazardous waste storage facility, and associated central accumulation areas. These operations are technically and physically separate from the generator operations.

The Program Manager, or designee, will conduct or verify the hazardous waste determination as initiated by the generator’s waste determination, and will ensure appropriate EPA waste codes are assigned based on information provided.

The Program Manager will manage wastes in a manner that minimizes liability to the University. This involves determining the appropriate methods and facilities for treatment and disposal of the University's hazardous wastes.

The Program Manager will provide assistance to generators in determining appropriate waste management procedures for special situations and/or as requested by the generator.
Waste Determination

A process may produce a product, co-product, by-product, or waste. “Waste determination” is the process of determining a material to be a “waste”, and evaluating that waste, including identifying the constituents and potential hazards prior to treatment, recovery, or disposal. Any material intended for discard (any unwanted material that is disposed of, burned or incinerated, accumulated, stored, or treated, including all materials for recycling and most process wastes) should be considered “waste.” In addition, any material may be perceived to be “inherently waste-like” based on the condition of the contents or container, or on storage conditions (e.g., stored as if it had little or no value).

The Principal Investigator, supervisor, manager, or similar University employee responsible for the management and use of materials in the work place is also responsible for the initial determination of whether a material is intended for discard, and therefore a “waste material”. Common situations warranting this waste determination include:

- Materials may be “spent” and no longer suitable for their intended purpose without reclamation, recovery, or other treatment process.
- Materials may be outdated, having been stored beyond the time recommended by the manufacturer.
- Materials may be contaminated through handling or storage. Moisture, foreign materials, and degradation products (container or contents) are common sources of contaminants.
- Materials may no longer be needed due to process changes. This may include change in vendors and products, change in instructional materials, or change in research.

Waste determinations should be conducted during all phases of the process, and documented. As part of the process design and before purchasing any materials, identify the potential wastes that may be generated. Make sure that appropriate storage is available for both the material and the waste. Purchase only what is needed, as disposal is often at a cost significantly higher than the original purchase price. Periodically inspect chemical inventories to ensure product quality and promptly discard outdated or unwanted materials. Inspection and review of chemical inventories should be conducted at least annually, and when there is a change in the processes conducted in the work area.

Common violations regarding waste determination include:

- Working with chemicals over drains with no means to collect excess or used materials;
- Discarding chemicals, either to the drain or trash, without documented evaluation or testing;
- Chemicals and/or containers in poor condition or stored “as if they have no value” may be considered “inherently waste-like”, in which case the generator is responsible for demonstrating the material has value and is not a waste.
- Waste or other unwanted materials are not appropriately marked.
- Chemicals are apparently abandoned or otherwise left behind by researchers who have either moved their labs or are no longer with the University, and not immediately controlled by a responsible person.
Detailed information for waste management is provided in other sections of the Waste Generator Manual. Local waste requirements are presented in Section 3. Waste accumulation requirements are presented in Section 5. Waste minimization considerations are presented in Section 7. Emergency issues are in Section 8.

Determination of whether a material being removed from a process is a waste must be conducted immediately. Examples of when waste determinations are conducted include:

- Laboratory analysis or extraction has been completed. Materials are “waste” unless they are to be reused as-is.
- Battery-operated device has been made operational by changing the battery. Old battery is now “waste” as it is apparently no longer suitable for its intended purpose, regardless of recycling or other disposal options.
- Equipment is taken out of service. Options include “waste” and “surplus.”
- Material is removed from surfaces. Whether it is contaminants from cleaning or paint chips, it is likely to be “waste”.
- Materials in inventory are no longer needed or suitable for use. Materials that are suitable for use and redistributed as-is (e.g., surplus) are not wastes.

It is the University’s responsibility to continue the waste determination process by identifying key parameters for determining if it is a hazardous waste as defined by EPA based on process knowledge and the identification of constituents. The generator must provide sufficient information regarding chemical constituents and the process generating the waste to complete the hazardous waste determination. EH&S will assist generators who are required to conduct their own hazardous waste determinations, such as those operating central accumulation areas.

If the material is waste, the generator must indicate whether the specific material has been used (“spent”) or if it is being discarded as unused material. “Unused material” includes materials that are outdated, no longer wanted or needed (surplus), prepared for use but not put in use (e.g., standards, buffers, stock solutions, paint mixed with thinners), contaminated or degraded in storage, container residue, or spilled material.

EH&S takes a conservative, more protective approach when classifying waste as “hazardous”. Generator knowledge, reported chemical constituents, and general verification procedures form the basis for hazardous waste determinations. Considerations for the hazardous waste determination include:

- Ignitability characteristic, including flash point, flammable solid (including metal powders), and oxidizer;
- Corrosive characteristic based on pH or corrosion rate for steel;
- Reactive characteristic, such as potential for detonation, violent reaction with water or air, and potential to release ignitable or toxic gases; and
- Specific chemical constituents, such as toxic characteristic wastes and listed wastes.

As solutions, most of the toxic characteristic waste is regulated as hazardous at only a few parts per million, some in the parts per billion range. Solid materials, including articles and debris, may warrant testing by a Toxicity Characteristic Leachate Procedure, or TCLP, to determine how much of a toxic constituent may leach out of a waste in a given time. Most of the toxic characteristic constituents are components of other chemicals, for example barium in barium hydroxide. Although powders are more likely to go into solution, many larger solids may leach sufficient toxic materials.
Listed hazardous wastes include materials that have been used in a process, generated as by-products, or are discarded commercial products.

- Wastes from specific sources are typically from specific manufacturing or other production processes. Examples of these include wastewater treatment sludges from production of specific chemicals, distillation residues from the production of specific solvents, and certain emission control wastes.
- Waste from non-specific sources include activities such as degreasing and general solvent use, along with electroplating using cyanides. Many of the common halogenated and non-halogenated solvents, such as methylene chloride, trichloroethane, acetone, methanol, ether, pyridine, xylene, and toluene are included. Unused formulations containing polychlorinated phenols, such as tri-, tetra-, and pentachlorophenol, are in both the non-specific source list and the acute hazardous waste list.
- Discarded commercial chemical products, off-specification species, such as chemicals that have become contaminated or deteriorated with age, container residues, and spills of these products make up the third group of listed wastes. There are two lists within this group—acute and toxic hazardous wastes.
  - Approximately 125 commercial chemical products are listed as acute hazardous waste, designated by EPA as P-list. These chemicals pose a significant health or environmental hazard even in small quantities. Examples include some pesticides, arsenic compounds, cyanides, and poisonous gases. The unique requirement for chemicals on this list is that the container must be triple-rinsed or managed as hazardous waste. Generation of one kilogram in a calendar month places the generator in a Large Quantity Generator status. Accumulation at the point of generation is limited to one quart. This list is provided at the end of this section.
  - Approximately 250 commercial chemical products are listed as toxic hazardous waste, designated by EPA as U-list. Other hazardous properties of these materials may include toxicity, reactivity, ignitability, and corrosivity. Links to listings of commercial chemical products, including those that may be characteristic for toxicity and constituents associated with specific and non-specific sources, are available through the EH&S home page.

A listing of commercial chemical products specifically classified as hazardous waste when designated as “waste” has been provided on-line. EH&S maintains a separate listing of chemical products, indicating whether they are likely to be hazardous wastes based on characteristics or by being listed hazardous wastes.

Citations for failing to conduct waste determinations are often based on perception. All unattended processes and/or chemical containers must have a label. An inspector entering a lab, shop, or other work area and seeing an unlabeled container has no knowledge of the hazards of the material OR what the container contains. Inspectors may deem a process or chemical that has no label as hazardous waste. Although hazard communication is required for all materials present in the work area, only products and intermediates are required to have an MSDS. The MSDS does not apply to spent materials. EPA considers unidentified materials to be explosive, reactive, flammable, corrosive, and toxic until the generator demonstrates otherwise.
Inappropriate work practices, improper disposal, inventory control issues, and poor housekeeping are common symptoms of a failure to conduct hazardous waste determinations.

- Work conducted in sinks or over drains is typically not set up to collect spills or wastes.
- Wastes must be evaluated for constituents that may be hazardous waste or otherwise pose a hazard (characteristic, non-regulated or locally regulated wastes) prior to disposal.
- Some may consider that there is only a “small amount” of a hazardous constituent or waste involved, and that it won’t have any impact if disposed with the normal trash or down drains. Many hazardous constituents are regulated at only a few parts per million.
- Unidentified containers and old chemicals are not likely to be used, yet they remain in the work area or storage area.
- Spills not properly cleaned up, whether the result of dispensing, transfer, or accident, consist of either a product or residue that may pose a hazard to personnel or the environment.
- Residues on the inside or outside of containers may warrant further cleaning. Waste containers with outside residues may be cited for failure to place waste into a container.
- Containers that once held materials listed as acute hazardous waste require triple-rinsing prior to disposal as non-hazardous waste, with the rinsates collected and managed as hazardous waste. Containers that once held other hazardous wastes or materials may be excluded from hazardous waste regulations, although they may still pose a hazard to persons handling them.

The following table lists products that are regulated as acute hazardous waste when discarded.
<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS</th>
<th>RCRa</th>
</tr>
</thead>
<tbody>
<tr>
<td>[(Dibutylamino)thio]methyl carbamic acid, 2,3-dihydro-2,2-dimethyl-7-</td>
<td>055285-14-8</td>
<td>P189</td>
</tr>
<tr>
<td>benzoazafuryl ester (Carbosulfan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-o-Chlorophenyl thiourea</td>
<td>005344-82-1</td>
<td>P026</td>
</tr>
<tr>
<td>1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8,</td>
<td>000465-73-6</td>
<td>P060</td>
</tr>
<tr>
<td>Dimethanonaphthalene, (1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-dimethanonaphthalene,</td>
<td>000309-00-2</td>
<td>P004</td>
</tr>
<tr>
<td>(1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1,2,3-Propanetriol, trinitrate</td>
<td>000055-63-0</td>
<td>P081</td>
</tr>
<tr>
<td>1,2-Benzenediol,4-[1-hydroxy-2-(methylamino)ethyl]</td>
<td>000051-43-4</td>
<td>P042</td>
</tr>
<tr>
<td>1,2-Propyleneimine</td>
<td>000075-55-8</td>
<td>P067</td>
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<tr>
<td>1,3-Dithiolane-2-carboxaldehyde, 2,4-dimethyl-, O-[(methylamino)</td>
<td>026419-73-8</td>
<td>P185</td>
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<tr>
<td>carboxyl]oxime (Tirpate)</td>
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<td>1,4,5,6,7,8,8-Heptachloro-3a,4,4a-tetrahydro-4,7-Methano-1h-indene</td>
<td>000076-44-8</td>
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<td>P004</td>
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<tr>
<td>hexahydro-, (1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-</td>
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<td>1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-</td>
<td>000465-73-6</td>
<td>P060</td>
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<td>hexahydro-, (1.alpha.,4.alpha.,4a.beta.,5.alpha.,8.alpha.,8a.beta.)-</td>
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<td>1-Acetyl-2-thiourea</td>
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<td>1-Bromo-2-propanone</td>
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<td>1-Methyl-2-(3-pyridyl) pyrrolidine and salts</td>
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<td>2-(Dimethylamino)-N-[(methylamino)carbonyl]oxy]-2-oxo-ethanimidothioic</td>
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<td>2,3,4,6-Tetrachlorophenol</td>
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<td>2,4,5-Trichlorophenol</td>
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<td>1a,2a,3,6,6a,7,7a-octahydro-, (1a.alpha.,2.beta.,2a.alpha.,3.beta.,6.beta.,6a.alph.,7.beta.,7a.alph.,7a.alpha.)-</td>
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<td>metabolites</td>
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<td>2-Butanone, 3,3-dimethyl-1-(methylthio)-, O-[methylamino]carbonyl oxime</td>
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<td>2-Cyclohexyl-4,6-Dinitrophenol</td>
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<td>2-Methyl-4,6-dinitrophenol and salts</td>
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<td>2-Methylactonitrile</td>
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<td>2-Propanone, 1-bromo-</td>
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<td>2-Propyn-1-ol</td>
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<td>3-(1-methyl-2-pyrrolidinyl) pyridine,(S)-and salts</td>
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<td>3(2H)-Isoxazolone, 5-(aminomethyl)-</td>
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<td>3-Chloropropionitrile</td>
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<td>3-Isopropylphenyl N-methylcarbamate</td>
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<td>4-(dimethylamino)-3,5-dimethylphenol, methylcarbamate (ester)</td>
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<td>4,6-Dinitro-o-cresol, and salts</td>
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<td>4,7-Methano-1h-indene, 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-</td>
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<td>5-(Aminomethyl)-3-isoxazolol</td>
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<td>7-Oxabicyclo(2,2,1)heptane-2,3-dicarboxylic acid</td>
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<td>Acetaldehyde, chloro</td>
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<td>Benzo pyran-2-one, 4-hydroxy-3-(3-oxo-1-phenylbutyl)- and salts when</td>
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<td>1,3a,8-trimethylpyrrolo[2,3-b]indol-5-yl-methylcarbamate ester</td>
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<td>(1:1)(Physoiogine salicylate)</td>
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<td>Brucine</td>
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<td>benzofuranyl ester (Carbosulfan)</td>
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<td>yl ester (Dimetilan)</td>
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<td>Cyanide solutions, n.o.s. (not otherwise specified)</td>
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<td>Cyanides (soluble salts and complexes) not otherwise specified</td>
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<td>Cyanogen</td>
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<td>Dimethylcarbamic acid, 1-[(dimethyl-amino)carbonyl]-5 methyl-1H-pyrazol-3-yl ester (Dimetilan)</td>
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<td>Endrin</td>
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<td>Endrin and metabolites</td>
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<tr>
<td>Tetraethyldithiopyrophosphate</td>
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<td>P109</td>
</tr>
<tr>
<td>Tetranitromethane</td>
<td>000509-14-8</td>
<td>P112</td>
</tr>
<tr>
<td>Tetraphosphoric acid, hexaethyl ester</td>
<td>000757-58-4</td>
<td>P062</td>
</tr>
<tr>
<td>Thallic oxide</td>
<td>001314-32-5</td>
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</tr>
<tr>
<td>Thallium (I) selenite</td>
<td>012039-52-0</td>
<td>P114</td>
</tr>
<tr>
<td>Thallium (I) sulfate</td>
<td>007446-18-6</td>
<td>P115</td>
</tr>
<tr>
<td>Thallium oxide</td>
<td>001314-32-5</td>
<td>P113</td>
</tr>
<tr>
<td>Thallium oxide Ti(2)O(3)</td>
<td>001314-32-5</td>
<td>P113</td>
</tr>
<tr>
<td>Thallous sulfate</td>
<td>007446-18-6</td>
<td>P115</td>
</tr>
<tr>
<td>Thiodiposphoric acid, tetraethyl ester</td>
<td>003689-24-5</td>
<td>P109</td>
</tr>
<tr>
<td>Thiofanox</td>
<td>039196-18-4</td>
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</tr>
<tr>
<td>Thiomidodicarbamic diamide <a href="2">(H(2)N)C(S)</a>NH</td>
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<td>P049</td>
</tr>
<tr>
<td>Thiophenol</td>
<td>000108-98-5</td>
<td>P014</td>
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<tr>
<td>Thiosemicarbazide</td>
<td>000079-19-6</td>
<td>P116</td>
</tr>
<tr>
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<td>005344-82-1</td>
<td>P026</td>
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<td>Thiourea, 1-naphthalenyl-</td>
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<tr>
<td>Thiourea, chlorophenyl-</td>
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<td>Tirpate</td>
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<td>Toxaphene</td>
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<td>P123, D015</td>
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<tr>
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<td>000095-95-4</td>
<td>F027, D041</td>
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<td>Trichloromethanethiol</td>
<td>000075-70-7</td>
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<tr>
<td>Trichlorophenol, 2,4,6-</td>
<td>000088-06-2</td>
<td>F027, D042</td>
</tr>
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<td>Vanadic acid, ammonium salt</td>
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<td>Vanadium oxide V(2)O(5)</td>
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<td>Vanadium pentoxide</td>
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<td>Vasotonin</td>
<td>00051-43-4</td>
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<tr>
<td>Vinylamine, N-methyl-N-nitroso</td>
<td>004549-40-0</td>
<td>P084</td>
</tr>
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<td>Warfarin and salts, when present at concentrations &gt; 0.3%</td>
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<td>P001</td>
</tr>
<tr>
<td>Zinc cyanide Zn(CN)(2)</td>
<td>000557-21-1</td>
<td>P121</td>
</tr>
<tr>
<td>Zinc phosphide Zn(3)P(2) when present at concentrations &gt; 10% (R,T)</td>
<td>001314-84-7</td>
<td>P122</td>
</tr>
<tr>
<td>Zinc, bis(dimethylcarbomodiithioato-S,S')-, (Ziram)</td>
<td>000137-30-4</td>
<td>P205</td>
</tr>
<tr>
<td>Ziram</td>
<td>000137-30-4</td>
<td>P205</td>
</tr>
</tbody>
</table>
SECTION 3
LOCAL REGULATORY REQUIREMENTS

Waste generated by the University is to be managed in accordance with industrial waste rules, i.e., rules for hazardous waste and industrial/institutional solid wastes. Local solid waste management rules prohibit placing any hazardous, liquid, or infectious waste, or any other waste that may pose a threat to the environment or public health, in a solid waste landfill. Federal and State environmental and workplace safety rules include air quality issues.

Chemical wastes do not belong in the trash, as this may present a hazard to personnel and the environment, and pose potential perception issues. Chemical names often raise concerns for potential hazards, and indicate disposal from a laboratory or industrial setting. Chemicals such as “sodium chloride” and “sucrose” have raised more concern than their more familiar common names of “table salt” and “sugar.” Regardless of the legal or regulatory issues, it is difficult, time-consuming, and unnecessarily expensive to identify the “mysterious powders” or other materials placed in the trash.

Drain disposal of chemical wastes poses similar issues, with potential exposures to maintenance personnel or building occupants, potential chemical reactions in pipes, and hazards to the wastewater treatment process. No one can predict the consequences of a reaction that may result from mixing wastes from several labs in a plumbing system. Corrosive materials, flammable or combustible liquids, solvents, oils, heavy metals, toxic chemicals, and biocides MUST NOT be poured down drains. Dilution, whether at the source or through campus-wide assumptions, is not an acceptable practice for meeting waste discharge requirements.

As a matter of convenience, it may be appropriate to have all wastes accumulated and evaluated for appropriate disposal. EH&S will work with waste generators to establish the appropriate management and disposal options.

Use of Sanitary Sewer

Much of the University's chemical waste originates in laboratories. Laboratory sinks discharge to the City of Raleigh sewer and are eventually treated at the waste water treatment plant prior to release to the environment. The regulation of these wastes is intended to ensure efficient treatment of sewage without creating a hazardous waste sludge, or affecting the treatment process. Not all contaminants are effectively treated or removed—some chemicals may pass through the treatment process.

Water containing non-recoverable residues, such as from washing or rinsing glassware or empty bottles, may be discharged. However, many common cleaning operations, such as acetone or alcohol washes or dichromate cleaning, require the cleaning solutions to be collected and managed as hazardous wastes. Laboratory procedures, including material storage, shall not be conducted in or over sinks or drains.

Other wastes are generated through facility maintenance and operations activities. Condensate, boiler blow-down, cleaning materials, and other materials may be accumulated as waste, or discharged to specifically-designed and maintained waste treatment systems such as silver recovery units for photographic chemicals and grease traps for cooking oils.
Discharge limits and prohibitions on sewer discharges have been established by the City of Raleigh (publicly owned treatment works or POTW), including the following specific prohibitions:

- Any flammable (flash point less than 140 degrees F) or explosive liquid, solid, or gas.
- Any solids greater than 1/4 inch in any dimension.
- Any discharge containing more than 300 mg/L of oil or grease from animal or vegetable sources, or 100 mg/L oil or grease from mineral or petroleum sources.
- Any discharge having a pH less than 5.0 or greater than 12.0.
- Radioactive wastes or isotopes except as specifically approved by the POTW Director.
- Stormwater, ground or surface water, swimming pool drainage, condensate, and noncontact cooling water except as specifically authorized by the POTW Director.
- Any medical wastes except as authorized by the POTW Director.
- Any material containing ammonia, ammonia salts, or other chelating agents which will produce metallic complexes that interfere with the municipal wastewater system.
- Any material that would be identified as a hazardous waste.

**Use of Municipal Landfills**

Hazardous waste, liquid waste, infectious waste, and any other wastes that may pose a threat to the environment or the public health are prohibited from disposal at local solid waste landfills, and must not be placed in campus dumpsters. Hazardous constituents may be present in equipment and other articles such as circuit boards and batteries. The generator is responsible for identifying the constituents of his/her waste.

See the [Solid Waste Disposal and Recycling Guidelines](#) for information about what is prohibited from dumpsters and what is recycled. Contact EHSC at 515-6863 for information regarding appropriate waste disposal methods. Contact Facilities Operations’ [Waste Reduction and Recycling](#) at 515-9421 for information regarding dumpster locations and municipal solid waste management.

**Air Issues**

Air emissions may occur for various reasons, including open or improperly closed containers, open or vented chemical processes, and chemical spills, fires or explosions. Although an empty container may be allowed to air-dry, evaporation of wastes, whether deliberate or through improper closures is prohibited. Evaporation of wastes may pose hazards to workers or the environment, and is not an acceptable practice. Evaporation of corrosives may damage fixtures and equipment. Many solvents are regulated hazardous wastes at very low concentrations, so even apparently dried rags may still be regulated hazardous waste.
SECTION 4
WASTE TYPES AND PROCEDURES

Chemical Wastes

Chemical wastes include, but are not limited to, all laboratory chemicals, paints and other coatings, sealants and adhesives, oils and lubricants, compressed gases and aerosols, cleaning compounds, and debris or materials contaminated with or otherwise containing these materials. Chemical wastes also include radioactive wastes and biological media, and may be regarded as components of manufactured articles.

The manual as a whole provides guidelines and procedures for managing chemical wastes. Additional procedures and guidelines for managing radioactive biological, manufactured article, and universal wastes are presented later in this section.

Whether reporting a chemical inventory or identifying a waste or product mixture, specific pieces of information are required:

- Identification of product(s), preferably by product name as it would appear on an MSDS;
- Identification of chemical constituents of a product, such as identified on an MSDS;
- Quantity of material;
- General hazard information;
- Whether it is “waste” or material intended for use;
- Who is responsible for the material (e.g., Principal Investigator); and
- Where the material is located.

Waste management procedures are described throughout this manual. The use of the HazTrak chemical waste application is presented in Section 6. Special waste issues are presented in Section 4, and supplement basic procedures applicable to all wastes (waste determination, accumulation, marking, and disposal).
Radioactive Wastes

Radioactive wastes are chemical wastes that include radioactive isotopes, including licensed radioactive materials and uranium or thorium compounds. Each Principal Investigator must ensure, prior to the procurement of any radioactive materials, that a satisfactory waste disposal method exists and that proper receptacles are in place.

Procedures described in this section are in addition to those in Section 5, and may supplement those provided in training for users of radioactive materials. Specific information concerning the accumulation and disposal of radioactive wastes is provided in the Radiation Safety Manual.

Essentially there are three types of Radioactive Waste commonly generated at NC State.

1. Solid radioactive wastes are solid materials contaminated during research protocols, and have less than 3% free liquid. They may include gloves, absorbent paper, pipette tips, tubing, glassware, plastic, paper, and metal. Solid radioactive waste may also include needles, razor blades, pasteur pipettes, and broken glass, commonly called “sharps”. Sharps should be collected separately from other solid wastes, in rigid containers, with further separation of metals from broken glass, and potentially infectious from non-infectious. All solid radioactive wastes should be placed in plastic-lined containers. Containers should be kept closed except when adding or removing wastes.

2. Liquid radioactive wastes are liquid materials that have become contaminated during research protocols. They include solutions, buffers, rinses, solvents or other organics. Liquid wastes are accumulated in screw-capped bottles or carboys. Stock solutions and other non-scintillation liquids should be transferred to larger liquid waste containers, with the empty vials or other small containers placed with the solid wastes. No radioactive waste is to be disposed via the trash, sanitary sewer or sink without prior approval of the Radiation Safety Officer.

Liquid wastes also include scintillation fluids in vials. All vials should be associated with scintillation counting. Scintillation vials should have caps secured, and be placed in plastic-lined containers. Containers should be kept closed except when adding or removing waste.

3. Biological radioactive wastes include animal carcasses, pathological waste, microbiological waste, and related sharps that have been subjected to radioactive material protocols. Except for sharps (see above), biological waste should be double-bagged in thick mil opaque bags and sealed with tape or tie wrap. It may be necessary to use plastic buckets or drums in conjunction with the plastic bags to prevent leakage or tearing. Absorbents should be placed in bags if there is a potential for free liquids. Any infectious agents must be clearly identified on the label. When possible, infectious wastes should be treated (disinfected or sterilized) prior to disposal. Animal carcasses should be stored in appropriate freezers until disposal arrangements are available.
All radioactive wastes must be segregated *by radionuclide* into these three groupings prior to disposal:

- **Phosphorus 32**
- **Isotopes with a Half Life less than 100 days, such as:**
  - Phosphorus 33
  - Sulfur 35
  - Chromium 51
  - Rubidium 86
  - Iodine 125
  - Iodine 131
- **Isotopes with a half-life greater than 100 days, such as:**
  - Tritium (H-3)
  - Carbon 14
  - Calcium 45
  - Cobalt 60

*For disposal of isotopes not listed above, please contact the Radiation Safety Division or the Hazardous Waste Program for details.*

Scintillation vials may not be combined with solid radioactive waste materials or other liquids, and must also be segregated by radionuclide according to same criteria as solid radioactive waste. Liquid scintillation vials containing Tritium and Carbon 14, with an activity of **less than 0.05 micro-curies per gram**, should be managed separately from other isotopes and higher activities of Tritium and Carbon 14.

Radioactive waste containers (including ‘sharps’ containers) and storage areas must be posted with a “Caution Radioactive Material” label. Radioactive waste containers must be properly shielded while storing radioactive waste to minimize the exposure to personnel to levels less than 2 milli-rem per hour.

Waste should be stored in a remote but accessible location in the laboratory where generated. Unattended waste containers must not be stored in unrestricted areas, such as offices, break areas, and hallways.

Radioactive wastes containing carcinogens, biological hazards, sharps, or hazardous chemicals must be packaged to present minimal hazards to hazardous waste management personnel.

In addition to providing a physical and chemical description, each Principal Investigator must accurately identify, quantify and label the types, quantities, and forms of radioisotopes that are placed in the radioactive waste generated under their authorization. Waste scintillation fluids must be identified, by complete brand name and active ingredient, on the waste submission form. Some scintillation fluids are regulated as hazardous waste. A completed radioactive waste disposal tag is attached to the waste container identifying the Principal Investigator, Radionuclide, Date, Activity of each isotope and other pertinent information.

Waste management personnel will provide replacement containers on request or at the time of pick-up.

Equipment containing a radioactive source, such as liquid scintillation counters, gas chromatographs, and spectrometers, or equipment contaminated by radioactive material, such as refrigerators, centrifuges, and water baths must be properly decontaminated or arrangements must be made for the source to be removed prior to transfer to surplus property, off-site, or to an unrestricted area. Specific procedures for this can be found in the [Radiation Safety Manual](#) or by calling the Radiation Safety Division during normal business hours.
**Biological Wastes**

Environmental Health and Safety provides guidance in managing biological or infectious wastes, and coordinates the management of some biological wastes. This portion of the training program is intended as an awareness overview. Training specific to managing biological and biohazard waste is incorporated as part of the University’s Biosafety Program.

Generally, biohazards are infectious microorganisms, toxic biological substances, biological allergens, or any combination of the three. Biological and biohazard wastes may be categorized as follows:

- Sharps, such as needles, syringes, pipettes, broken glass, or blades;
- Non-Medical Waste, meaning biological material, such as specimens and cultures, including animal carcases and parts used in education;
- Medical Waste, meaning wastes generated in diagnosis, treatment, or immunization; in research pertaining thereto; or in the production or testing of biologicals, including animals and animal parts used in laboratory research;
- Regulated Medical Waste
  - Blood and body fluids in containers >20 ml
  - Microbiological waste
  - Untreated pathological waste, such as animals or animal parts known to have been exposed to pathogens

Local disposal requirements effectively prohibit disposal of animals and animal parts in the normal trash, regardless of whether they are infectious or not. In addition, autoclaved biohazard bags and similar wastes must be managed in designated dumpsters.

Biological and medical wastes should be treated prior to offering for disposal, although this may not be feasible for animals and animal parts. Treatment methods include sterilization through autoclaving and disinfection using bleach or other appropriate disinfectant. Specific protocols and procedures should be in place prior to generating these wastes. Refer to the [NCSU Biosafety Manual](#) for more information.

Biohazard wastes, those that are potentially infectious, are placed in biohazard bags in the lab. The wastes are treated using an appropriate protocol. The wastes can then be placed in designated dumpsters once the markings on the biohazard bags have been defaced.

The disposal of animals and animal body parts from University areas other than the Veterinary Medicine Campus are coordinated by EH&S. Do not drop off items for disposal on the trailer dock at necropsy and leave them unattended. There are specific waste acceptance and management procedures for the service at CVM.

Waste items for disposal must be double bagged, taped closed, and labeled.

The on-line chemical waste form may be used for identifying biological wastes for disposal through EH&S. Indicate on the form whether the materials is potentially infectious or not.
Manufactured Articles

Manufactured articles include any man-made item other than a chemical product. Manufactured articles may consist of, or contain, hazardous materials and could be regulated waste, such as hazardous, locally-regulated, or other category. Examples of articles include, but are not limited to, the following:

- Equipment
- Lamps and light bulbs
- Batteries
- Appliances
- Electronics and circuit boards
- Thermometers
- Filters
- Cathode ray tubes
- PCB equipment

Many manufactured articles may be regulated as hazardous waste due to the presence of toxic materials, such as heavy metals (metallic mercury, leaded glass, solder). Other manufactured articles may be environmentally hazardous wastes due to presence of oils, refrigerants, polychlorinated biphenyls (PCBs), or other materials.

It is the responsibility of the generator and process operator to recognize the potential hazards of the manufactured articles, and manage the disposal or recycling of these materials properly.

- PCB wastes, such as light ballasts and capacitors, must be marked with the date taken out of service, and disposed within 9 months. Areas where PCB wastes are accumulated for more than 30 days are required to be posted.
- Metal scrap, whether sheet metal, solder, or filings, must be recycled or managed in accordance with chemical and/or hazardous waste rules.
- Electronic wastes, such as computer hardware and circuit boards, contain toxic metals in solder and circuitry, including lead, silver, cadmium, and chromium.
- Incandescent lamps (standard light bulbs) and many types of equipment are generally considered non-hazardous but may have recycling or local disposal requirements. For example, broken lamps may be regulated as “sharps” as the broken glass poses a hazard to personnel handling the waste.
- Used oil filters are prohibited from landfills, and must be recycled or disposed as environmentally hazardous waste.
- Many manufactured articles may also be managed under universal waste rules as described below.

Construction and Demolition Wastes

Demolition and construction wastes are addressed in the Construction Guidelines document maintained by Facilities Division and EH&S. In addition to basic waste procedures, generator and co-generator issues may factor in to waste management.
Universal Wastes

EPA established universal waste regulations to make it easier to recycle common hazardous wastes. Universal waste rules may apply to:

- Lead-acid batteries, such as car batteries and those used in emergency lighting, and rechargeable batteries, such as nickel-cadmium (NiCad), silver oxide, or mercury;
- Fluorescent (including compact), neon, high intensity discharge (metal halide, sodium, mercury vapor) lamps;
- Mercury-containing equipment such as thermostats or mercury switches;
- Recalled or cancelled pesticides

Accumulation rules are similar to those for hazardous waste, with the following exceptions:

- The waste item is marked with date taken out of service and word “Waste” or “Universal Waste”;
- Container is marked with date of the earliest item added, along with the words “Universal Waste” and the waste type (e.g., “Universal Waste Lamps”).

Persons removing universal wastes (e.g., changing fluorescent lamps, or rechargeable or lead acid batteries) and those handling or managing the wastes are required to have annual training in managing these wastes. See Section 9 for more information.

Universal waste must be disposed within one year, otherwise they are hazardous waste. Exceeding the one-year disposal requirement may require the accumulation area to meet the same rules as centralized hazardous waste storage areas. This would include annual hazardous waste training, emergency plans, on-call emergency personnel, documented weekly inspections, 90-day storage limit, and other requirements as presented in Section 5.

UNIVERSAL WASTE BATTERIES

Batteries managed under the universal waste program are managed by both EH&S and Waste Reduction and Recycling (WRR). EH&S will collect all types of batteries through the chemical waste program, with generators completing the HazTrak waste form on-line. Intact lead acid batteries, such as car batteries, may be delivered to WRR either by EH&S or the generator. Batteries or their containers must be marked with the words “Universal Waste Batteries” and the date the [earliest] battery was taken out of service.
FLUORESCENT AND MERCURY-CONTAINING LAMP PROGRAM

Lamps containing mercury must be managed as either hazardous waste or universal waste, and are not allowed in the local landfill. Lamps are nearly 100 percent recyclable. The metals, glass, mercury, and phosphors are separated by commercial recycling facilities. Although many of the fluorescent lamps now have less mercury, they are still prohibited from landfills unless specific documentation is provided demonstrating actual mercury levels.

Applicability

The following types of lamps are subject to this program and procedure:

- Fluorescent lamps, including compact, circular, U-tube, and straight tube;
- High intensity discharge (HID) lamps, including metal halide, mercury vapor, and high pressure sodium;
- Neon or other inert gas; and
- Ultraviolet lamps.

Incandescent lamps are not hazardous or universal wastes, and therefore not subject to this procedure. Although included in this procedure, broken fluorescent lamps are hazardous waste and must be managed in accordance with hazardous waste regulations.

Accumulation

Areas where lamps are accumulated are subject to inspection by EPA and its state and local counterparts. As with other universal wastes (e.g., lead-acid batteries, or mercury switches and thermostats), accumulation rules must be followed. These rules include:

- Materials must be accumulated in appropriate containers to minimize breakage or release of hazardous materials/components. Although we encourage reuse of the original boxes, EH&S can provide boxes for four-foot and eight-foot lamps, and drums for broken lamps.
- Containers (lamp boxes or drums) must be kept closed except when adding or removing lamps. This may affect the practice of reusing boxes, as many are either cut open or have the end flaps torn.
- Containers used for accumulation must be marked to identify their contents, specifically “Universal Waste Lamps”, “Used Lamps”, “Waste Lamps”, or “Hazardous Waste--Broken Waste Lamps”.
- Containers must be marked with the date the first used/waste lamp was added. Because lamps cannot be accumulated for more than one year, we require all boxes of lamps to be collected for disposal within ten months.
- Containers of mixed types of lamps must be marked as such so that EH&S contractors can handle them more safely and repackage for disposal.
- Lamps shall not be placed in boxes for laboratory glassware or other debris.

Broken Lamps

Broken lamps must be placed in drums or other appropriate containers for proper disposal as hazardous waste. Boxes containing broken lamps may require additional handling (repackaging) by EH&S contractor personnel or be subject to surcharges for disposal.
Collection

EH&S will supplement the reuse of original boxes by providing boxes for 4- and 8-ft. lamps. Boxes for all other lamps must be obtained by the lab, shop, or other user. Three networks are set up for managing mercury-containing lamps, such as fluorescents and HIDs:

1. Larger routine volumes are collected from designated collection points on a weekly basis. Participants in this are primarily Facilities Housekeeping, Phytotron, University Housing, Student Affairs (Talley) Maintenance, USDA, and zone shops. Regardless of whether lamps are put out or not, contractors will visit each of the designated collection points.

Boxes of lamps will be brought by University staff to designated collection points for collection by EH&S contractor. Lamps should be separated according to size and type (e.g., length and shape). Considerations for lamp collection include the following:

a. Lamps from construction, demolition, and re-lamping projects will be collected from the project site on an as-needed basis. Lamps from these projects are generally large volume, and shall not be included with lamps from normal operations. Contracts should include provisions for recycling or disposal of lamps and ballasts. EH&S will coordinate collection with project personnel.

b. A list of designated collection points have been provided by principal divisions within the University to EH&S, and a collection schedule has been established. Pickup locations are loading docks at the following buildings:

<table>
<thead>
<tr>
<th>Building</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watauga</td>
<td>Poe Hall Daniels Hall D. H. Hill Library</td>
</tr>
<tr>
<td>Polk Hall</td>
<td>Williams Hall Phytotron Talley Student Center</td>
</tr>
<tr>
<td>Biltmore</td>
<td>Fountain Dining Hall Central Receiving Warehouse</td>
</tr>
<tr>
<td>Textiles</td>
<td>USDA (Ligon Street) College of Veterinary Medicine</td>
</tr>
</tbody>
</table>

- Collection times will be between the hours of 8:30 a.m. and 11:00 a.m.
- With the exception of Textiles (Tuesdays) and CVM (Wednesdays), pickups are conducted every Friday. Holidays or campus closure (e.g., winter shutdown) will postpone the collection until the following week.
- Alternative scheduling may be necessary to accommodate specific locations, projects, weather, or other problems that may arise.
- University staff (e.g., area supervisors) will ensure broken lamps are not placed in boxes designated for intact lamps. Broken lamps will be managed in other appropriate containers for recycling/disposal through eH&S. Boxes of lamps will be closed, taped, labeled, and delivered to the collection point by University staff.
- Prior to loading, the EH&S contractor may inspect boxes to ensure lamps are not broken. As noted above, University staff will minimize breakage in cases delivered to the collection point. The contractor will assume responsibility for management of lamps, including any breakage discovered after acceptance.
- The contractor will maintain a record of the approximate number of lamps collected from each designated collection point.
- The contractor will deliver the lamps to EH&S for packaging and storage.
- Lamps remaining at collection points after 1 p.m. will be returned to divisional storage areas by University staff. Likely reasons for lamps to remain at a collection point include broken lamps in cases, late delivery of lamps, or scheduling/collection difficulties (e.g., dock access or time constraints).
2. Collection of lamps generated by re-lamping and construction projects is coordinated with project managers, who may request delivery of 4- and 8-ft. boxes and collection of boxed lamps.

3. Areas may generate or accumulate only a few lamps at a time, including lamps for projectors as well as the HID and fluorescents used for conventional lighting. These areas include some of the other shops in Facilities, labs, departmental offices, and Athletics. They are encouraged to use the hazardous waste system, filing waste forms online. Registrations may be associated with specific individuals or generic registrations for departments and colleges. The system is not for residential waste.

Training

Environmental Health and Safety will provide supervisors with general training in waste lamp management. Supervisors will provide personnel with procedures specific to their functions and locations. Supervisors will ensure personnel understand:

- The procedures for removal of lamps from fixtures,
- Accumulation requirements, including marking and closure of containers,
- Management of broken lamps, including cleanup procedures,
- Placement of containers at the designated collection site.

MERCURY-CONTAINING EQUIPMENT

Equipment containing mercury, such as thermometers and mercury switches, are managed in accordance with the chemical waste program. Chemical waste forms are filed on-line, and wastes collected and managed by EH&S.

RECALLED OR CANCELLED PESTICIDES

Generators are encouraged to maintain contacts with pesticide manufacturers, returning surplus, recalled, and cancelled pesticides where possible. Pesticides that are not returned to the manufacturer are managed as chemical wastes. Chemical waste forms are filed on-line, and wastes collected and managed by EH&S. NOTE: Many pesticides are regulated as acutely hazardous wastes upon disposal, which may result in a site becoming a Large Quantity Generator (generates >1 kg acutely hazardous waste in any calendar month), and subject to additional requirements.
Waste Management Guidelines

The following is a summary of common waste types and general disposal guidelines. Specific procedures for waste management and disposal for many of these wastes are included in Section 4, while general procedures are presented throughout the manual.

AEROSOL CANS--Most aerosol cans may be sprayed empty (product used or collected in a suitable container for disposal) and placed in trash. This is not always feasible, as some have defective valves or require adequate ventilation. Air emissions for volatile organics, and presence of carcinogens such as methylene chloride have reduced the viability of collecting the liquid portion in containers. Those that contain an acutely-hazardous (P-list) material must be disposed of through EHSC. Recommendation: aerosols should be completely used (emptied with no residual pressure or liquid) and placed in trash, or turned over to EH&S for disposal.

ASBESTOS--Small items (gloves, insulation, etc.) must be wetted and bagged/wrapped in heavy plastic for disposal through chemical/hazardous waste. Large items (doors, counter tops, etc.) may require EHSC coordination with Construction Management or asbestos contractors.

BALLASTS, PCB--Collect as chemical/hazardous waste for recycling/disposal. Must be managed separately from non-PCB ballasts.

BALLASTS, NON-PCB--Collect as chemical/hazardous waste for recycling/disposal.

BATTERIES WARNING: When accumulating batteries that may contact each other, electrodes must be taped to prevent short-circuits or fires. This includes batteries believed to be discharged.

BATTERIES, ALKALINE--Small quantities (preferably <20 at a time) may go in trash.

BATTERIES, CARBON-ZINC--Small quantities (preferably <20 at a time) may go in trash.

BATTERIES, GEL--Collect as chemical/hazardous/universal waste for recycling/disposal.

BATTERIES, LEAD-ACID--Recommend exchanging old batteries at time of purchase. Automotive batteries are handled by Facilities Operations as universal waste. Other lead-acid batteries may be managed by EH&S as universal waste.

BATTERIES, LITHIUM--Small lithium batteries (<9 volts) should be recycled or disposed of through EH&S when discharged. Other lithium batteries (>9 volts or <9 volts and not discharged) are hazardous/universal wastes.

BATTERIES, MERCURY--Manage as hazardous waste.

BATTERIES, NICAD--Manage as hazardous/universal waste for recycling.

BATTERIES, SILVER--Manage as hazardous/universal waste for recycling.

BATTERIES, ZINC AIR--Small quantities (preferably <20 at a time) may go in trash.

CAPACITORS--Capacitors must be evaluated for PCBs. Capacitors should be discarded through the chemical/hazardous waste program.

FLUORESCENT LAMPS--Fluorescent lamps contain mercury and must not go in the trash. Place old lamps in the boxes the new lamps were received in, or boxes provided by EH&S. Close the box and record the date lamps were first added. Lamps are collected weekly, or on request, as universal wastes for recycling by EH&S. Broken lamps must be managed as hazardous waste and collected by EH&S.
GAS CYLINDERS-- All cylinders should be purchased with a return agreement. Return cylinders through Cylinder Management/vendor. Cylinders that cannot be returned must be managed through the chemical/hazardous waste program. Cylinders are prohibited from dumpsters/landfill. Recycling is limited to non-hazardous gases, and requires removal of valves, which may pose unnecessary risk to personnel.

LAMPS, FLUORESCENT-- Fluorescent lamps contain mercury and must not go in the trash. Place old lamps in the boxes the new lamps were received in, or boxes provided by EH&S. Close the box and record the date lamps were first added. Lamps are collected weekly, or on request, as universal wastes for recycling by EH&S. Broken lamps must be managed as hazardous waste and collected by EH&S.

LAMPS, HIGH-INTENSITY DISCHARGE--Dispose of as universal waste for recycling through EH&S.

LAMPS, INCANDESCENT—Not a regulated waste, may be disposed in trash. Broken lamps must be placed in sealed boxes to protect waste handlers from broken glass.

LAMPS, MERCURY-- Dispose of as universal waste for recycling through EH&S.

LAMPS, SODIUM-- Dispose of as universal waste for recycling through EH&S.

OIL--ANIMAL, MINERAL, OR VEGETABLE—Oils must be collected for disposal through EH&S or contracted vendor.

OIL--HYDRAULIC, MOTOR OR OTHER PETROLEUM-BASED--Petroleum oils must be collected for chemical/hazardous waste or oil recycling programs.

OIL, PUMP--Pump oils must be collected for chemical/hazardous waste or oil recycling programs.

OIL, TRANSFORMER--Transformer oils must be evaluated for PCBs and collected for chemical/hazardous waste or oil recycling programs.

OIL FILTERS—Oil filters are banned from landfills, and must be recycled or disposed through Facilities Operations or EH&S.

POLYCHLORINATED BIPHENYLS (PCBs)--PCBs may be present as pure product (e.g., arochlor), mixed in oil (e.g., some transformer oils or capacitors), or in old plasticizers (old latex caulk, wire insulation). PCBs must be managed within chemical/hazardous waste or oil recycling programs. **PCB-containing equipment must have the out-of-service date recorded.**

POWER SUPPLIES AND TRANSFORMERS--Power supplies and transformers must be evaluated for PCBs. Equipment that does not contain PCB’s may be surplused through Central Stores/Surplus Property, or discarded through chemical/hazardous waste or Facilities Operations programs.
SECTION 5
WASTE ACCUMULATION

Requirements for Waste Accumulation Areas

Laboratory, shop, and chemical storage areas at NC State must be under the control of an individual, and not the broad control of a department. Hazardous wastes must be accumulated at or near the point of generation, referred to as a “satellite accumulation area”. NO ONE is permitted to accumulate hazardous waste in areas that are not under their control.

The point of generation is the fume hood, lab bench, shop table, or other location where a process generating waste is conducted. A “process” includes maintenance and repair, laboratory procedures, and storage. A satellite accumulation area is a location in the room where the waste is generated, and must meet specific requirements as listed below. A centralized accumulation area, which may also be referred to as a 90-day accumulation area, involves situations that exceed satellite accumulation area requirements such as waste from other rooms or generators, or accumulation of more than 55 gallons of hazardous waste or 1 quart of acute hazardous waste. See Figure 5-1 for illustrations and more information.

Discussions with NCDENR have resulted in tentative agreements regarding satellite accumulation areas. University procedures are in many respects more conservative than state and federal requirements to accommodate flexibility deemed necessary to maintain operations. Laboratories, shops, and other locations designated as satellite accumulation areas must meet the following requirements:

- Waste must be accumulated at or near the point of generation and under the control of the process operator. NCDENR defines “at or near” to mean that the containers are in the process area and typically readily associated with the process (equipment, bench, etc.) generating the waste, not outside the building or room where the waste is generated. NCDENR considers “under the control of the process operator” to mean the operator can see the containers, respond in an emergency and routinely inspect them. Wastes must therefore be accumulated in the specific lab or shop where generated. “Control” has been applied to both the area and the waste. Maintaining “control of the waste” involves attendance and security issues. Accumulation of hazardous wastes in a room other than where generated must be reviewed by EH&S to verify acceptability as satellite accumulation. Satellite accumulation in an adjacent room must meet the following requirements:
  - Waste may be brought from the point of generation, through one interior doorway (not a hallway or other common area), to an adjacent room under the control of the same process operator (Principal Investigator). However, the University must minimize the number of labs or shops where satellite accumulation areas are located in adjacent rooms. Labs or shops must be able to justify (to EH&S, state, and federal inspectors) accumulation in an adjacent room rather than in the room where waste is generated. Inadequate justification may result in the area’s designation as a central accumulation area.
  - Wastes and/or accumulation areas should be situated such that they may be routinely observed. Personnel can see and monitor the area, ensure security of wastes, and respond to an emergency.
  - Interior doors to satellite area locations (process area to adjacent room) must be kept open to facilitate visual inspection of satellite accumulation containers.
Access to labs or shops must be limited to personnel working in those areas.

The adjoining rooms are considered to be “one” accumulation area. Although regulations allow multiple satellite accumulation areas in the same room and each satellite accumulation area to accumulate up to 55 gallons of hazardous waste, the resulting agreement stipulates that the lab and adjoining room(s) will be regarded as a single satellite accumulation area, limiting the area to 55 gallons of hazardous waste, or one quart of acutely hazardous waste, for all rooms included.

Satellite containers must be located in chemical storage cabinets and kept under lock and key when available.

- Waste must be accumulated in containers suitable for their contents. Containers must be in good condition and compatible with the waste to be contained. If the container is not in good condition, or if it begins to leak, the contents must be transferred to a container in good condition, or the container with its contents packaged in an appropriate container in good condition. NCDENR prohibits the use of tanks for satellite accumulation areas.
- Containers must be kept closed with appropriate closures, except when adding or removing wastes.
- Containers are appropriately marked with the words “Waste (chemical name)”, “Hazardous Waste”, or similar words denoting the material to be waste and words describing the contents of the container. Oils for discard must be marked “Used Oil” (not “waste oil”).
- Containers must be marked with the date waste was first added, or the date the material (e.g., unwanted chemicals, used batteries, used lamps, etc.) was removed from service. Wastes should be removed within 6 months of initial accumulation. Specific wastes, such as universal wastes and polychlorinated biphenyls (PCBs), require removal within a specific time period.
- Containers must not be overfilled.
- Secondary containment or other protective measures must be provided to minimize releases to drains and other damages.
- Waste volumes do not exceed 55 gallons of hazardous waste, or 1 quart of acutely hazardous waste. The generator must record the date when the quantity is exceeded on the container(s). The excess must be removed within three consecutive (calendar) days (as opposed to three business days or other interpretations); and
- The area is maintained and operated to prevent fires and accidental spills. Containers must not be opened, handled, or stored in a manner which may rupture the container or cause it to leak.

A central accumulation area, such as an area where waste is brought from other locations or a satellite accumulation area that does not meet the quantity, accumulation time, or location requirements listed above, must meet the following additional requirements:

- Notify the Hazardous Waste Program Manager of the activity, including a description of waste generation and management.
- The room must meet design requirements applicable to 90-day storage areas, i.e., location (regulations say it must be on-site/contiguous, movement issues place it in same building), building codes, and containment for containers. Guidelines for EH&S to evaluate design requirements are presented in Figure 5-2.
• The area must meet container management requirements for 90-day storage areas, including:
  o The hazardous waste determination must be completed prior to accumulation in a central accumulation area, with containers appropriately marked and dated (see below). In effect, persons generating waste in a central accumulation area, or persons moving waste to a central accumulation area, must immediately determine if the waste is a hazardous waste. Assignment of EPA waste numbers is not required until the waste is prepared for shipment.
  o Documented weekly inspections of waste containers and storage area. Inspections must include looking for leaks, container integrity, and deterioration of containers, containment systems, or facilities. The recommended inspection form is presented as Figure 5-3.
  o Annual hazardous waste training for personnel removing waste from satellite accumulation areas and/or managing waste in a central accumulation area. Training records include job titles and descriptions, and descriptions of the type and amount of introductory and continuing training. See Section 9 for more information.
  o Telephone or similar external communications capable of calling for emergency assistance.
  o Be equipped with portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment (requires all four)
  o Contingency (emergency) plan, including provisions for training personnel, maintaining emergency supplies and equipment, notification and evacuation of personnel, and coordination with EH&PS. Details and a recommended template for contingency plans are addressed in Section 8.
  o Emergency coordinator on site or on call, that can respond in a short period of time.

• Waste must be removed within 90 days. Containers require dates when placed in a central accumulation area, at which time the 90-day requirement begins. Although generator size may allow longer accumulation time, all University areas will be subject to the same 90-day rule. It is recommended that wastes are scheduled for removal within 80 days.

• Hazardous wastes in central accumulation areas must be managed in portable containers—tanks shall not be used for accumulating hazardous waste. Volatile hazardous wastes must be accumulated in DOT approved containers with completely tightened closures. Containers of volatile organic liquids in laboratories that function as central accumulation areas are limited to 26 gallons capacity.

• All containers must be labeled with the words “Waste (chemical name)”, “Hazardous Waste”, or similar words denoting the material to be waste and words describing the contents of the container. The labels, including date(s), must be clearly visible during inspection. Placing the words “hazardous waste” on a container in a central accumulation area requires training for hazardous waste determination.

• When waste activity ceases, the area must be cleaned and decontaminated whereby there is no significant threat to personnel or the environment due to wastes accumulated or stored, and all wastes are removed. Requirements are presented in Figure 5-4.
Figure 5-1

Waste Accumulation Area Distinction

The University must classify the process of managing chemical waste in all areas into one of two categories:

- **Satellite Accumulation Area (SAA)** - Waste accumulated at or near the point of generation and under the direct control of the individual who created the waste.

- **Central Accumulation Area (CAA)** - An area, other than a satellite accumulation area, where waste is stored for future pickup or processing.

**Satellite Accumulation**

Chemical wastes may be managed:

- in the shop or lab where they are generated (preferred), or
- in an adjacent or adjoining lab or shop, which is directly connected to the laboratory or shop of origin and under the direct control of the same waste generator (review and approval on case-by-case basis).

“Rooms” are single spaces; for example, room 3107 A-D would be regarded as at least four rooms (A, B, C & D). “Directly connected” means that the rooms are connected by interior doorways, and waste does not enter hallways or other common areas. If present, the door in the connecting doorway must be kept open. All areas involved must be under the control of the same generator (Principal Investigator).

The following figures are acceptable for SAAs, where “G” indicates waste generated and “S” indicates waste stored or accumulated, and “GS” indicates wastes are both generated and stored/accumulated in the same room.

![Figures 1-3](image1.png)

**Central Accumulation**

A Central Accumulation Area (CAA) is created when:

- Chemical wastes are placed in a location other than the shop or lab where they are generated, or adjacent space, regardless of whether it is under control of the same person;
- Waste is moved from one satellite accumulation area to another;
- A waste accumulation area receives waste from more than one generator (Principal Investigator);
- A satellite accumulation area exceeds quantity limitations (55 gallons of hazardous waste or 1 quart of acutely hazardous) for more than three days.

Examples of situations that must be classified as Central Accumulation Areas are shown below.

![Figures 4-9](image2.png)

Figures are shown as linear, but also apply to “L” shaped and other configurations.
Figure 5-2
NCSU WASTE SURVEY (DESIGN REQUIREMENTS)
CENTRAL ACCUMULATION AREA

Wastes to be stored (waste only, does not include materials for use)
  o Flammable Liquid
  o Flammable Solid
  o Dangerous When Wet
  o Corrosive
  o Oxidizer
  o Other hazardous chemicals
  o Compressed gases
  o Hazardous debris
  o Biological material
  o Radioactive material
  o Articles (e.g., equipment, electronics, batteries)
  o Non-hazardous chemicals and debris

Containers
  o Bottles, plastic or glass, <5L capacity
  o Bottles or jugs, plastic or glass, 5-20L (up to 5 gal.) capacity
  o Cans, metal or plastic, <20L (5 gal.) capacity
  o Drums or pails, metal or plastic, 20L (5 gal.) or larger
  o Bags
  o Cylinders

Storage Units (where waste containers are stored or accumulated)
  o Floor
  o Shelves
  o Countertops
  o Fume hoods
  o Cabinets
    ▪ Flammable
    ▪ Corrosive
    ▪ Biosafety
    ▪ Standard wood or metal
    ▪ Gas cylinder storage
    ▪ Other _______________________________________
  o Refrigerators
  o Freezers

Emergency Equipment
  o Telephone
  o Fire extinguisher
  o Automatic fire suppression system
  o Spill control equipment
  o Decontamination equipment
  o Personal protective equipment
The waste survey is a tool, intended for use by EH&S, to evaluate a work area for compliance with central accumulation requirements. The survey focuses on building codes, general safety, and emergency communications and controls.
WEEKLY INSPECTION LOG
NCSU CENTRAL ACCUMULATION AREA

LOCATION: Building:______________________________________  Room:________________

<table>
<thead>
<tr>
<th>DATE INSPECTED</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECURITY: Doors and windows are locked to minimize entry by unauthorized personnel.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECONDARY CONTAINMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containment is free of cracks, and any spills have been cleaned up.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTAINER CONDITION:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containers are not corroded, do not show signs of pressure or leakage, no broken bottles, torn bags, etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTAINER MARKING:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Containers are marked with words “Waste”, “Hazardous Waste”, “Used Oil”, or “Universal Waste” as appropriate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTAINER DATES:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The earliest date—either the date waste was first added to container or date waste was placed in accumulation area—is recorded on the container.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ACCUMULATION TIME:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastes are not stored or accumulated for more than 80 days.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SAFETY EQUIPMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable fire extinguisher, spill supplies, decontamination equipment, emergency shower/eyewash, and phone are accessible and ready for use.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FACILITY SAFETY:</th>
</tr>
</thead>
<tbody>
<tr>
<td>At least 30 inches for aisle space, incompatible containers are physically separated.</td>
</tr>
</tbody>
</table>
CLOSURE REQUIREMENTS
CENTRAL ACCUMULATION AREAS

265.111 Closure performance standard.

The owner or operator must close the facility in a manner that:

(a) Minimizes the need for further maintenance, and

(b) Controls, minimizes or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere, and

(c) Complies with the closure requirements of this subpart, including, but not limited to, the requirements of 265.197 (tanks), 265.228 (surface impoundments), 265.258 (waste piles), 265.280 (land treatment units), 265.310 (landfills), 265.351 (incinerators), 265.381 (thermal treatment units), 265.404 (chemical, physical, and biological treatment units), and 265.1102 (containment buildings). (LQGs are not subject to 265.111(c))

265.114 Disposal or decontamination of equipment, structures and soils.

During the partial and final closure periods, all contaminated equipment, structures and soils must be properly disposed of, or decontaminated. By removing all hazardous waste or hazardous constituents during partial or final closure, the owner or operator may become a generator of hazardous waste and must handle that hazardous waste in accordance with all applicable requirements of Part 262 of this chapter.

The document “Closeout Procedures for Hazardous Materials in Laboratories, Shops, or Other Areas” provides sufficient guidance to comply with closure procedures for laboratories and other small central accumulation areas.

This may be supplemented by the document “Laboratory Relocation—Move-out/Move-in/Startup Procedures and Checklists”
Waste Accumulation in Containers

Hazardous wastes may be accumulated for treatment, recycling, disposal, or reuse. Wastes must be accumulated and stored at or near the point of generation, for example within the lab or shop in which it is generated. Wastes from intra-connected rooms or shops may be accumulated in a location central to the group of rooms under the control of the generator (Principal Investigator, supervisor, etc.). Wastes must not be moved from other floors or brought through hallways to a centralized area unless that area and the persons moving the waste meet specific requirements as described above.

While in the generator’s possession, containers must be compatible with their contents, in good condition, and clearly marked "Hazardous Waste" or with other words that identify the contents of the container. All wastes must be marked with the word “Waste” from the time that waste is first added. The one exception is that oil for discard is marked “Used Oil” if not mixed with hazardous wastes or listed hazardous materials.

Separate wastes into their simplest components. Wastes that are generated at several locations of a process, or removed from various steps, should be collected separately to allow for the most effective methods of recycling, treatment, or disposal.

Guidelines for container selection and use include the following:

- Store waste chemicals in appropriate containers. Put liquids in narrow-necked, screw-capped bottles or approved cans or drums. Gloves, paper, and similar dry solid wastes may be stored in sealed plastic bags. Other solid wastes may be stored in bottles, jars, or plastic-lined sealed boxes.
- Beverage and other food product containers; flasks or other containers with cork, ground glass, or rubber stoppers; and any snap-cap containers as primary containers are not appropriate for hazardous wastes.
- Do not overfill containers with liquids. Allow a "breathing space" of 10% of the container volume between the level of the material and the top of the container. 5-gallon or 20-liter cans or drums require a minimum of one inch of headspace. Three inches of headspace is required for 55-gallon drums. This is particularly important for organic solvents that very often have high coefficients of thermal expansion and possess high vapor pressures.
- Parafilm, wax paper, plastic wrap, and foil are not appropriate closures in laboratory waste accumulation areas or when wastes are offered for disposal. Low-boiling or highly volatile liquids, and those that naturally off-gas, may warrant additional controls such as vented closures.
- Whenever feasible and safe, larger containers of a given waste are preferred to many small containers of the same material. However, container sizes are limited for materials that pose certain hazards. For example, oxidizing acids, such as nitric or perchloric acid, are typically limited to containers no larger than 5 pints. Other highly hazardous materials, such as potential explosives, are limited to one pound or less. Small items, such as vials, should be accumulated in larger containers to allow proper marking of the waste and more secure containment. Environmental Affairs personnel will provide assistance in determining appropriate container types and sizes.
- Waste collection should be scheduled regularly to maintain a safe work environment and prevent the creation of unknown or unidentified wastes.
Areas must not accumulate more than 55 gallons of hazardous waste, or more than 1 quart of acutely hazardous waste, at any one time. Waste collections are largely conducted on a weekly basis to minimize the volumes accumulated. University guidelines state that wastes should not be stored in or near a work area for more than 90 days. Complete on-line chemical waste forms or notify EHSC at 515-6863 or 515-6864 to schedule removal of these materials.

Universal wastes must have the date generated (removed from service) marked on the unit or waste container. Universal wastes must be shipped for recycling or disposal within one year of generation, and therefore must be removed from accumulation areas within 10 months. Failure to ship within the one year subjects the waste to hazardous waste rules, which may affect the classification of the accumulation area. Most fluorescent lamps are addressed in a routine collection program, and may be included in the chemical/hazardous waste procedures. Complete on-line chemical waste forms or notify EHSC at 515-6863 or 515-6864 to schedule removal of materials not addressed in the fluorescent lamp program. See Section 4 for further information.

**Container Management**

Keep waste containers inside a secondary containment device, such as a dish pan or tray, so that any leaks that might develop in the primary container, or incidental spills while adding or removing materials, will not go down a drain or contaminate the laboratory. Ideally, secondary containment capacity should be large enough to contain the full volume of the largest container in the unit, or 10% of the combined volume of all containers, whichever is greater. The unit should be sufficiently compatible with the material contained to allow containment and collection of spilled material.

In practice, secondary containment capacity is a balance between containing potential releases and maintaining operational safety. Most labs use plastic or metal trays or pans for secondary containment. Larger containers, such as drums, should have either a containment sump/skid or a bermed area capable of containing the material. Placement of secondary containment units should take into consideration other safety factors, such as ventilation in fume hoods, possible tripping hazards on floors, or decreased work spaces.

Protect drains, including sinks and floor drains, to ensure wastes are not accidentally discharged. Although secondary containment is required, storage of bottles and bags on floors in or near traffic areas is discouraged.

Containers must be kept closed except when adding or removing materials. The only types of funnels allowed to remain in a waste container are those specifically designed and maintained to provide a fixed closure that will not leak should the container be tipped over. The latch must be locked for the funnel/container to be considered “closed”.

Accumulation containers connected to analytical equipment by drain lines should have a secure closure with positively connected lines. The container may be considered open if drain lines are significantly smaller in diameter than the container opening.

Containers must be free from outside contamination. Waste containers and secondary containment devices are usually contaminated by incidental spills that occur while adding wastes. Contaminants may pose an unnecessary risk to personnel coming in contact with the waste containers, whether through continued addition of waste materials, container movement within the laboratory, or collection by waste personnel. Failure to keep waste containers clean may result in citations for failure to place waste in a container.
Containers may also become contaminated by materials while in storage, such as the residues seen where hydrochloric acid or other reagents are stored. Residual contaminants may appear as a film, stain, or “crust” on the container. Inks that run or “bleed” may be indicative of waste spills. EPA may consider product containers with external residues to be inherent wastes (managed as if they had no value).

**Container Identification**

OSHA regulations require “hazard communication”, whereby all materials present in the work area are identified, and their hazards made known to employees. Consider that if it is waste, then EPA identification rules apply. If it is product, byproduct, or intermediate, OSHA identification rules apply. In either case, labels MUST be physically on the specific containers, and not solely on an accumulation area surface such as a bin or shelf.

Completely identify all waste as it is added to the waste container with its chemical name. A chemical formula, structural diagram, or abbreviation is not acceptable as the sole identifier.

Reaction vessels (e.g., flasks), or individual vials or other small containers, may be identified with a code that is readily referenced to the list of components for the materials or waste. Other containers may be cross-referenced to a chemical inventory in a similar fashion. When the material has been determined to be “waste”, the container must be properly marked as discussed below. Keep the waste inventory up to date, possibly with an inventory sheet next to each waste container. List the approximate volume added, approximate composition, date added, and initials of the person adding the waste.

Original labels must be defaced if the container is reused for waste accumulation.

Labels such as “organic waste”, “acid waste”, or “waste non-halogenated solvent” may meet minimum EPA hazardous waste requirements, but do not provide sufficient information in the event of an emergency and by themselves are not acceptable under University procedure. In many cases, two sets of labels may be necessary—a label attached to the container, and a label associated with the container. The label attached to the container provides the information required by EPA—the words “Waste” or “Hazardous Waste” and the name or type of chemical. The label associated with the container should include the date accumulation started and information sufficient to conduct a hazardous waste determination, including:

- The name and/or description of the chemical contents, or the product of the chemical reaction;
- Whether the specific material has been used or is unused (unused includes container residues and materials prepared for use but not used for intended purposes);
- A description of the manner in which the chemical was produced or process (if applicable).

A running log, documenting waste additions to the container, is recommended for containers accessed by several people, or containers receiving wastes from more than one process or activity.
Container Acceptance and Collection

Unacceptable containers for transport by hazardous waste personnel include:

- Safety cans without DOT specification
- Containers with dispensing closures
- Containers with cork, rubber, or ground glass stoppers
- Beakers, round-bottomed flasks, or similar laboratory glassware
- Containers that are physically or chemically incompatible with the contents

Transfer the contents of any containers in poor condition before transportation. Pack broken bottles or leaking containers in another container, such as a chemically resistant sealed bag, wide-mouth jar, or other sturdy container appropriate for the contents to ensure safe transport.

Waste and surplus chemicals are regularly collected from over 1000 labs, shops, offices, and miscellaneous storage areas. Scheduling for waste collection is based on building location, as identified through electronic filing of waste forms and call-in requests for waste pickup.

Regulations and permits prohibit EHSC from accepting waste materials from non-University organizations, such as corporate tenants or facilities managed by other state agencies.

Do not package waste containers prior to pickup. Every container must be inspected and compared to identification forms prior to removal by hazardous waste personnel.

Have the waste ready for removal at least one day before the collection day. We recommend having at least one person familiar with the waste available at the scheduled pick-up time to answer any questions.

Any discrepancy discovered during the collection of waste will be referred to the specific generator responsible for proper identification.

For assistance in waste identification and disposal options, contact Hazardous Waste personnel at 515-6863 or 515-6864.

Unidentified Materials

Generators of chemical wastes, or users of chemicals in the workplace, are responsible for the identification of their materials. Every effort should be made to ensure proper identification of all chemicals throughout their storage and use cycle, including laboratory procedures and dispensing of materials.

Identification of unknown materials may be through chemical analyses, contact with the manufacturer, or other method by which sufficient information may be obtained to properly complete the chemical identification form. Documentation, such as analytical results or material safety data sheets, attesting to the identification of the material shall be provided to waste collection personnel.

Unidentified materials must be labeled “Hazardous waste pending analysis”, and dated when first generated or discovered. Unidentified materials shall be considered hazardous, with the potential for being ignitable, reactive, corrosive, toxic, or any combination of these characteristics, depending on the appearance, container, source, or other preliminary information.
Special Projects and Cleanouts

Hazardous waste collection and disposal is contracted out to a qualified hazardous waste contractor. The contract identifies situations which are considered routine and within the scope of the basic service agreement. Special projects and collection of large volumes of waste from individual generators (cleanouts) are sometimes considered beyond the scope of the basic services agreement, and conducted at additional cost. To minimize the effect on the hazardous waste program, and encourage more effective management of materials, costs associated with these services may be passed on to the generator either in part or in full. Most lab cleanouts can be conducted without additional costs to the generator by filing the waste forms electronically.

Special waste-related projects conducted by EHSC involve unusual situations, typically of a corrective nature. These projects include cylinder transfers, stabilization of reactive waste materials, and unknown/unidentified waste characterization. Other waste-related projects, such as decontamination of equipment and asbestos abatement, may require other resources beyond those in the Hazardous Waste Program. The nature of these projects require review and scheduling on a case-by-case basis. Contact EHSC at 515-6863 for information or assistance with these special needs.

Occasionally, it is necessary to remove significant amounts of unused materials from work or storage areas. Before contacting EHSC for disposal, it is recommended that unused materials in good condition are offered for redistribution or otherwise diverted from becoming a waste. Options exist for removing significant quantities, especially large numbers of containers. Contact EHSC at 515-6863 for more information and scheduling services.

Waste Treatment and Recovery by Generator

Accumulation of waste prior to treatment or recovery must be in accordance with hazardous waste accumulation requirements, including labeling, accumulation dates, and management of accumulation areas. Procedures or processes can be modified to neutralize, detoxify, reduce in volume, recycle/reclaim, or otherwise minimize or render waste non-hazardous. Evaporation, dilution, and burning of waste to reduce volume or render it non-hazardous is expressly prohibited.

Treatment to meet disposal requirements (e.g., discharge standards) requires testing to ensure compliance, and a waste analysis plan. With the exception of acid-base neutralization where pH is the only hazard, the costs associated with verifying complete treatment may limit the economic feasibility of treating hazardous wastes for the purpose of disposal as non-hazardous (e.g., disposal to sanitary sewer).

Reclamation and recovery of materials from wastes, for the purpose of reuse in a process, may be conducted under specific circumstances. Products recovered or reclaimed may be used by the generator or offered to recyclers under contract. Byproducts and wastes must be managed in accordance with hazardous waste rules.

Silver recovery units are required for photographic processing units that are connected to the sanitary sewer. Silver recovery units must be properly maintained, including periodic testing of the effluent, to ensure units are not exceeding allowable silver discharge levels. Effluent testing, equipment maintenance, and documentation are the responsibility of the department using the unit.
Hazardous waste treatment, or reclamation and recovery of materials from hazardous wastes, may be conducted under the following conditions:

- Treatment and recovery residues are managed as hazardous waste;
- If treatment or recovery is conducted in accumulation containers and in the same room as the waste is generated, accumulation must meet the Waste Accumulation requirements for satellite accumulation areas listed in Section 5, and personnel must receive annual hazardous waste training.
- If treatment or recovery is conducted in a room other than where the waste is initially generated, or in treatment or recovery units regardless of location:
  - Accumulation must meet Waste Accumulation requirements for central (90-day) accumulation areas listed in Section 5;
  - The room must meet design requirements applicable to 90-day storage areas as described in Section 5;
  - The area must meet container management requirements for 90-day storage areas, described in Section 5;
  - Notify the Hazardous Waste Program Manager of the activity, including a description of waste generation and management under the recycling exemption and disposition of waste.

Contact EHSC at 515-6863 for more details on waste treatment requirements.

**Recycling, Recovery, or Disposal by University Units other than EHSC**

Individual generators may enter into agreements with contract service companies that provide new materials and collect waste. However, all such agreements must be submitted to the Environmental Health and Safety Center for review prior to being finalized. Any generator involved in such recycling services must comply with all requirements for hazardous waste generators, including the use of a manifest. For further information and assistance, contact EHSC at 515-6863.

**Procedure**

1. Generators will notify EHSC of intent to contract recycling services. Notification will include generator name and location, type of material for recycling, frequency of service, and name and address of recycler.
2. EHSC will review the notification and determine regulatory requirements for the activity.
3. Services that are subject to hazardous waste rules will be coordinated among the generator, recycler, and EHSC. Other services will remain the responsibility of the generator.
4. The recycler will provide the requested service, obtaining signatures of authorized generator representatives on work orders or service agreements.
5. The recycler will provide EHSC copies of the signed work orders or service agreements. A hazardous waste manifest and supporting documentation will be prepared and signed by authorized EHSC personnel.

The generator must keep a copy of the reclamation agreement in his or her files for at least three (3) years after termination or expiration of the agreement.
SECTION 6
HAZTRAK WASTE SUBMISSION APPLICATION

Generator Registration

All wastes submitted for disposal require identification of the generator, including name, department, and location where the waste was generated. Note that the "generator" is the Principal Investigator, Lab Supervisor, Manager, or other employee responsible for the material. Electronic (Internet/On-Line) filing of waste identification forms requires registration and approval of generators and passwords. The certification process is managed through generator identification number and password.

Accessing HazTrak on-line waste management application:

- Using a WWW browser, go to www.ncsu.edu/ehs. Select "Hazardous Waste Management", followed by "Hazardous Waste Disposal". The Hazardous Waste Disposal link is also available through “MyPack Portal”, typically following the links “For Faculty & Staff” and “Environmental Health & Safety”.
- Log in first with the Unity ID and password to access the portal, which allows access to the HazTrak main menu.
- New generators may click on the link to the generator registration form, identifying the generator (Principal Investigator, supervisor, etc.). Information should include e-mail address (for notification/confirmation purposes) and password. The registration form will be reviewed by EHSC, who will make any necessary changes and provide confirmation of registration to the generator.

HOW TO REGISTER

- From the HazTrak menu, select “Registration Information”.
- Enter and/or verify the contact information.
- Any existing registrations will be listed at the bottom of the screen.
  - Click on the underlined registration to view or edit.
  - Click on “Add New Registration” to add.
- Select college, department and building from lists. Because department names are often changed or added, select the most appropriate or inclusive name.
- Identify room number where most wastes will be accumulated prior to pickup.
- Indicate (from list) whether the waste is generated in a lab, shop or other type of area (box next to room number).
- Enter lab contact information (name, phone, and e-mail).
- Enter requested ID and password (enter password twice—password & confirm).

A generator may manage as many registrations as he/she feels appropriate. For example, a generator may wish to distinguish wastes generated by a teaching lab from those associated with grant-funded research. However, we would caution the generator that the registrations are unique; that is, registrations allow access only to those waste forms filed under that registration. Another downside is keeping accounts straight with whoever files his/her waste forms.

Registrations will be reviewed, and become “active” on EH&S approval. An e-mail confirming the registration will be sent to the generator. Retain the confirmation notice sent by
EHSC as reference to the Generator Identification Number and password to be used when submitting waste identification forms.

**Waste Identification and Form Submittal**

Federal and State regulations require proper identification of chemicals. EH&S will not accept chemicals without the minimum identification necessary for safe handling and proper disposal. This identification shall include all constituents and approximate concentrations, regardless of hazard.

Wastes shall be identified using the Chemical Waste Identification Form. The electronic form is accessed from the [EHSC Home Page](#) and following the links "Hazardous Waste Management", followed by "Hazardous Waste Disposal". Log in first with the Unity ID and password to access the portal. The generator ID and password will be required for secured links from the main menu (e.g., waste submission, pickup schedules).

Tentative waste collection schedules may be viewed the day following waste submission by logging in with the generator ID and password, and selecting "View Pickup Schedule". Collection schedules may require last-minute changes due to unforeseen circumstances. General collection schedules for chemical wastes applies to most of the wastes filed using HazTrak. Routine fluorescent lamp schedules are included in Section 4 of this manual. Biological wastes, large volume wastes, and remote facilities are scheduled on a case-by-case basis.

**INSTRUCTIONS FOR COMPLETING CHEMICAL IDENTIFICATION FORMS**

Waste submissions let EH&S know the types, quantities, and locations for wastes to be picked up. A separate form is required for each waste item (bag, bottle, box, drum, etc.). Small items, such as vials, containing essentially the same materials may be placed in a larger container, and have one form identifying the contents. Exceptions may be made on a case-by-case basis for other small items.

One on-line form addresses all wastes managed by EH&S, regardless of form or hazard. Chemicals, articles (e.g., batteries), radioactive materials, and biological wastes are identified using the same form. All wastes require completion of the basic description (location, constituents, quantity, and general hazard). Radioactive wastes require completion of the radiation section, and biological wastes require completion of the biological section.

- From the HazTrak menu, select “Waste Submission”
- Enter the HazTrak login ID and password (this is linked to the generator registration)
- Click on “Continue”
- The screen shows generator, location, lab contact, and registration ID, which should be verified by the user (no edit capability). At the bottom of the page is a waste form list, which shows waste forms that have been submitted using that registration, but not reviewed by EH&S.
  - Waste forms may be viewed by clicking on the waste form number. Forms may be edited or canceled.
  - Click on “Add New Form”
    - The form shows the user’s name based on Unity access.
    - Enter phone and e-mail
    - The building, room number, and location type are initially entered by default from the registration. If wastes are to be picked up from another location, select
the building from the list and enter the room number. Select the appropriate room type for where the waste was generated.

- Type in the constituent name. Do not use abbreviations or chemical formulas. Trade names or product names are acceptable if name is the same as appears on the MSDS and the MSDS is available or components are listed in the notes box.
- Click “add to list” and enter percentage.
  - Repeat process for each constituent (name, add, percentage)
  - To remove constituent, check box (select) and click “Remove Selected”
- Weight or Volume must be indicated along with the unit of measure
- Select flash point, pH, and physical state from the lists
- Indicate whether the material is “spent” or “unused” according to guidance provided (default is “no” (i.e., unused)).
- Enter any additional information in the “notes” box, such as whether to call first, bring replacement drums (excludes radioactive waste—see below), special instructions, or additional details about waste constituents.
- For radioactive materials, highlight the isotope, click “Add to List”, and enter the total activity in millicuries. “Remove Selected” works the same as for constituents.
  - Enter the RPO tag number (yellow tag attached to container).
  - Enter the PI Radioactive Material Permit Number (user number from HPA)
  - Indicate if the waste is liquid scintillation fluid (default is “no”).
  - Indicate if a replacement container is needed (select from list).
- If the waste is biological (human, animal, bacterial, or viral in origin), click on “yes”
- Indicate if the waste is infectious to humans, animals, or plants.
- Click on “Submit Form”. A confirmation page with control number, or an error message showing which fields are incomplete or unacceptable, will appear. Edit the form if necessary for successful submission.
- Record the control number (e.g., E2007002546) on the waste item, either using a waste label or printout of the confirmation page.

The person may add more forms or exit to the main menu. “Add Another Form” brings back the information screen just submitted. “Continue” brings the user back to the generator information page, which shows the control numbers for forms submitted and the option for adding more forms.

Submitted wastes may be viewed by the generator/campus user, allowing for corrections to be made to the form, or canceling the form. Once the waste form has been reviewed by EH&S, and a decision has been made to approve or disapprove, the form is no longer accessible for viewing or editing.
SECTION 7
WASTE MINIMIZATION

Overview
Waste minimization is "the reduction, to the extent feasible, of hazardous waste that is generated prior to treatment, storage or disposal of the waste. It is defined as any source reduction or recycling activity that results in either: (1) reduction of total volume of hazardous waste; (2) reduction in toxicity of hazardous waste; or (3) both, as long as that reduction is consistent with the general goal of minimizing present and future threats to human health and the environment." Waste minimization does not include concentration solely for the purpose of volume reduction, or dilution as a means of toxicity reduction, unless later recycling steps are involved.

Waste minimization requirements are dependent on the generator's size. Large quantity generators (by site) must certify that: (1) a program is in place to reduce the volume and toxicity of their wastes to the degree determined by the generator to be economically practicable; and (2) the proposed method of treatment, storage or disposal is that practicable method currently available to the generator which minimizes the present and future threat to human health and the environment. Small quantity generators need to certify that they have made a good faith effort to minimize their waste generation, and provide documentation of these efforts on request. Although the University includes large, small, and conditionally-exempt generator sites, all generators need to comply with the requirements for large quantity generators and minimize the volume and toxicity of wastes generated. EH&S will ensure the methods of treatment, storage, and disposal minimize the present and future threat to human health and the environment.

An effective University waste minimization program will contribute to a safer, more cost-effective workplace. Concerns that should be addressed in a waste minimization program include:

- Minimizing quantities of regulated hazardous wastes generated, thereby reducing waste management and compliance costs.
- Reducing or eliminating inventories and releases of hazardous chemicals reportable under Title III of the Superfund Amendments Reauthorization Act (annual Tier II reporting of chemicals present in quantities greater than their threshold planning quantity), chemical release reporting (spills or discharges), and Toxic Release Inventories (for manufacturing facilities).
- Lowering Superfund, corrective action, and toxic tort liabilities.
- Lowering the overall costs of doing business by managing materials more effectively.
Elements of Waste Minimization Programs

Waste minimization programs for Universities and research institutions may take many forms. Effective programs, however, require coordination and support at all levels. EPA states that effective waste minimization programs should have the following elements:

1. Top Management Support

The University designates the Hazardous Materials Committee and the Hazardous Waste Program Manager as the persons responsible for developing and implementing programs for safe and legal management of hazardous materials and wastes. The Hazardous Waste Program Manager plans, directs, and coordinates the activities of the NCSU hazardous waste program in accordance with Federal, State, and local regulations. The Hazardous Materials Committee assists in these activities, and helps implement procedures and programs throughout the University.

2. Characterization of Waste Generation

The complex nature of the University, as a major educational and research institution, justifies a centralized and comprehensive waste accounting system. The on-line Chemical Identification Form and associated system capabilities ensure better compliance with regulations and easier maintenance of waste generation records, including types, amounts, hazardous constituents, and sources.

3. Periodic Waste Minimization Assessments

Generators must periodically review their chemical management practices. Annual certifications for Safety Plans, required for all areas where hazardous materials are used or stored, include chemical inventories and waste minimization. Being most familiar with their process, they are most able to implement waste minimization techniques. Generators conducting waste minimization assessments should:

- Track their materials, from the time of receipt to the point that they are discarded as wastes.
- Identify areas within the process where materials can be prevented from becoming a waste.
- Review the scale and scope of the process, considering the size, frequency, and variation of operation.
- Determine the true costs of the waste, including all measurable costs from purchasing the chemicals, to required safety equipment, treatment and/or packaging by hazardous waste personnel, and off-site disposal.

4. Cost Allocation System

Waste minimization costs and savings appear at both the purchasing and disposal ends. There are significant savings for persons using hazardous materials if they purchase only what is needed, reduce the amount of waste generated, use products and by-products created in the workplace, and simplify or standardize procedures. All persons using hazardous materials must assist in developing methods for minimizing the hazards, risks, and costs associated with using hazardous materials.

Hazardous waste management at the University is a service offered with no immediate cost to the hazardous waste generator. Cost reports are provided to University administration on a fiscal year basis and, at their discretion, withheld from college and/or departmental budgets.
Colleges and departments may request more detailed reports focusing on specific generators and/or projects.

5. Encouragement of Technology Transfer

Generators should seek or exchange technical information on waste minimization from all sources, including other University generators and specialists, professional or trade associations, industry, or consultants. The Hazardous Waste Program may provide assistance in collecting information.

6. Program Evaluation

The waste minimization program will be periodically reviewed for effectiveness. These reviews will provide feedback and identify potential areas for improvement. The Hazardous Materials Committee, Hazardous Waste Program Manager, and affected generators should review individual waste minimization programs, and jointly consider ways of further improvement.

Waste Minimization Techniques

The following describe some common waste minimization techniques:

1. Material Purchasing

Purchase only what is needed, minimize and rotate inventories, and redistribute excess materials. Ensure gas cylinders may be returned to the vendor. “Consumer commodities” such as “power loads” for nail guns, small propane cylinders (e.g., for Coleman stoves), and helium tanks from party supply stores may be relatively inexpensive purchases, but high-cost disposal.

2. Material Substitution

Substitute non-hazardous or less toxic materials in chemical processes, experiments, and maintenance operations to reduce the toxicity if a waste. Examples include:

- Substitution of non-hazardous aqueous liquid scintillation cocktails for standard xylene or toluene-based cocktails in radioactive tracer studies.
- The use of water-based inks in printing operations.
- Detergents and enzymatic cleaners can be substituted for dichromate (chromerge) or alkaline alcohol cleaning solutions.
- The use of non-halogenated solvents with high flash points in parts washers or other solvent processes.

3. Product Substitution

The main "products" of the University center on education, research, and extension services. Some laboratory operations, most notably teaching labs, may be able to change their "products" by replacing hazardous laboratory experiments with non-hazardous. The emphasis of the laboratory work may be shifted toward a fundamental aspect of the course work, where classroom material is reinforced in a way that does not require hazardous materials. Advancements in technology and global marketing have resulted in a significant shift for using less-hazardous materials in manufacturing.
4. **Process Modification**

Many experimental and standard processes can be modified to decrease the amount of hazardous waste generated. Examples include implementing microscale techniques and recirculating materials within the system (closed loop recycling).

5. **Equipment Selection**

Equipment should be selected not only for its ability to perform a task, but with some consideration for accidents, failures, or other occurrences that could result in discarding the equipment. Mercury thermometers should not be used in ovens, refrigerators, or other areas where physical damage to the thermometer can easily occur. Temperature measuring devices, such as electronic, alcohol, or bimetallic thermometers, should be considered as substitutes for mercury thermometers. Likewise, many mercury manometers could be replaced by electronic vacuum or pressure gauges. Equipment should include consideration for types and quantities of materials and wastes produced.

6. **Inventory Control**

Effective management of chemical inventories will reduce the amount of waste generated. Chemical redistribution, reviewing shelf-life requirements, testing outdated materials, and rotating stock can reduce the amount of surplus chemicals being disposed of as waste. Spill and leak prevention programs addressing secondary containment, inspection or monitoring programs, and overflow alarms or automatic shut-off valves, will reduce the amount of good material lost, as well as the amount of waste generated from the cleanup of chemical spills.

7. **Chemical Recycling**

Unopened containers or unused chemicals may be redistributed within the University. Departments are encouraged to set up redistribution programs. Departmental programs are more effective than comprehensive University programs due in large part to the familiarity with personnel, potential for similar processes or chemical needs, and any budgetary considerations.

8. **Reclamation**

Most documented methods of reclamation center on the disposal of waste materials. Non-halogenated solvents and used oils are typically shipped off-site as hazardous waste fuels. Internally, labs may set up solvent recovery systems provided they meet specific safety and regulatory requirements. Metallic mercury is collected for distillation through a vendor. Silver can be recovered from photographic fixers by the generator (as part of the process) or outside vendor, typically using silver recovery units attached to the photographic processing equipment.

9. **Neutralization and Detoxification**

While many laboratory wastes can be rendered non-hazardous, it is usually less expensive and poses less hazard to lab personnel to have the waste disposed through EH&S. Simple acids and bases can be rendered non-hazardous in the laboratory by elementary neutralization. Toxic metals may be precipitated from aqueous streams before the waste is removed from the process. Detoxification of wastes outside of the generating process is considered treatment and requires a treatment permit. All treatment of waste requires verification that the waste meets treatment requirements. Labs are encouraged to contact the Hazardous Waste Program Manager to determine if they can process materials to render them non-hazardous.
10. Waste Segregation

Segregation of wastes simplifies treatment, provides for alternative methods for recycling and disposal, and minimizes costs. Do not mix hazardous waste with non-hazardous wastes. Keep wastes as simple as possible. Accurately label waste containers as to their exact contents.

NCSU Waste Minimization Guidelines

Waste minimization is required for all persons who generate wastes. Understanding the processes in the work area is essential to evaluating options. The following guidelines serve as a starting point for establishing a waste minimization process review.

- Always consider the safety of personnel and the work area.
- Purchase only what is needed, minimize and rotate inventories, redistribute excess.
- Substitute non-hazardous or less toxic materials in chemical processes, experiments, and maintenance operations.
- Review and modify process to minimize amount of waste generated, allow for closed-loop recycling, in-process neutralization, or other minimization activities.
- Select equipment not only for task, but potential for failure, accident, or other occurrences that could result in release of hazardous materials.
- Isolate wastes from various steps to allow more treatment options and prevent cross-contamination.
- Separate hazardous waste from non-hazardous waste.
- Neutralization of acids and bases, or recovery of toxic materials from process wastes, involve costs and safety issues that may not be acceptable at the laboratory level.

For additional information, contact Bruce Stewart at 515-6864 or Rob Pecarina at 515-6863.
SECTION 8
CHEMICAL SPILLS AND EMERGENCIES

An orientation to emergency preparedness and procedures, and specific emergency procedures, are available on-line at http://www.ncsu.edu/emergency-information/index.php

Emergency Notification

The University provides non-emergency and initial emergency response services through EHSC, Campus Police, and Facilities Operations. For any emergency, call Campus Police at 911. Campus Police provides 24-hour coverage, and will contact specific resources as needed. For non-emergency services during normal business hours, contact the appropriate department. Spill notifications to Campus Police or EHSC should include the following information:

- Caller's name and phone number
- Nature of incident (fire, chemical spill, explosion, injured person, etc.)
- Location of incident
- Location to meet caller
- Where applicable, Identity and quantity of material spilled
- Any injuries or evacuation
- Type of assistance requested (e.g., spill control, cleanup, guidance)

The University is required to report any "reportable quantity" releases of hazardous chemicals to the environment (i.e., outside the confines of a building). Releases of compressed gases, outdoor spills, and discharges to sewers are the three most likely occurrences that would require reporting to outside agencies. EHSC must be notified immediately of any release to the environment to ensure appropriate outside notifications are made.

Shutdown of Operations

Most emergencies occur on short notice, and may not offer sufficient time to shut down and secure all activities and materials. Most waste activities are done manually, typically moving containers or transferring waste from small to larger containers. Protection of personnel should be the primary concern, then protection of property. Initial shutdown procedures should be to close containers and initiate evacuation.

Shutdown procedures in advance of emergencies that have sufficient notice are provided in the Emergency Facilities Closure Checklist

Communications and Alarms

Most University buildings have alarm systems to alert occupants of hazards and the need to evacuate. Discussions of evacuation plans and procedures, shelter-in-place, and other building-wide communications and alarms are not the intent of this manual, but are addressed at the web site provided above, as well as in the Health and Safety Manual.

Internal communication for individual rooms may be voice communication, and does not require public address systems or other broadcast to the room itself. Instruction may be for evacuation or assistance in managing a release. Internal communications are supplemented by fire alarm and gas alarm systems capable of notifying all persons within a building of the need to evacuate. Alarm systems are tested and maintained by EH&PS and Facilities Operations personnel.
Phones are the most common communication devices for summoning assistance and seem to be available in most labs. Fire alarms (pull stations) are also capable of summoning emergency assistance.

Some facilities may have alarms that may be local alerts (e.g., hood flow alarms, warning devices such as high or low temperature, etc.) or emergency alarms (e.g., toxic or flammable gas alarms). The Principal Investigator is responsible for informing personnel of the purpose of the alarm and procedures to follow when an alarm is activated.

**Required Equipment**

The following equipment shall be available, tested, and maintained in all central accumulation areas:

- Internal communications or alarm system capable of providing immediate emergency instruction to facility personnel;
- Phone, two-way radio, or other communication device capable of summoning emergency assistance;
- Portable fire extinguishers, fire control equipment, spill control equipment, and decontamination equipment;
- Water at adequate volume and pressure to supply water hose streams, or foam producing equipment, or automatic sprinklers, or water spray systems.

**Chemical Spill Plans**

Spill control equipment may include absorbents, neutralizers for corrosives or toxics, and materials for protecting drains or limiting the spread/flow of a spill. Decontamination equipment is primarily for personnel decontamination, and may be a sink, emergency shower, or eyewash. Spill control equipment should be the responsibility of the lab, while responsibility for decontamination equipment may be shared between the lab and Facilities Operations.

Persons using and storing hazardous materials are responsible for chemical safety in their work areas. Central Accumulation Areas have specific requirements for contingency plans (emergency plans), which are described later in this section. The following concerns must be addressed by persons using or storing hazardous materials:

- Maintain updated inventories of chemicals in the workplace, including locations and quantities.
- Keep MSDS information readily available, preferably in a safe and conspicuous location.
- Minimize quantities of hazardous materials in storage or use.
- Develop and maintain spill prevention, containment, and control plans specific to the work area.
- Train personnel in standard operating and emergency procedures.
- Make sure someone knowledgeable about the work area is available at all times.
- Limit the variety of materials or hazards in the area.
- Maintain good housekeeping practices in work and storage areas.

Any unknown factors, such as unidentified materials, or the unavailability of persons familiar with the work area and its hazards can easily slow the response actions. Emergency personnel will likely take a defensive position, protecting life and property outside of the affected areas.
For additional information or assistance in developing chemical spill plans, please contact Environmental Health and Safety at 515-6863.

**Fire Procedures (Guidelines)**

Locations of portable fire extinguishers and fire control equipment should be verified with Fire Protection. Assuring water volume and pressure, and maintaining automatic fire suppression systems, are the responsibility of Fire Protection and Facilities Operations. In the event of a fire, the following procedures and guidelines should be implemented:

- Activate fire alarm pull station if in a building.
- Immediately leave the building – and if possible – shut off equipment, stabilize experiments if you can quickly
- Close your door, and
- Alert others
- **DO NOT USE ELEVATORS**
- Assist others in evacuating if possible. Have those you cannot assist wait in areas designated RESCUE ASSISTANCE.
- Call Campus Police
  - campus phone 911
  - activate emergency blue light phone
- Assemble at a safe place away from danger; account for others from your office, floor, etc.
- Person(s) with knowledge of the situation should meet with first responders.
- Do not re-enter the building until cleared by first responders.

Extinguishing a small fire (approx. trash-can size)

- If you are trained, the fire is small, and the alarm has sounded, you may attempt to extinguish the fire.

Surviving a building fire

- Never use an elevator
- Check closed doors before opening; if hot, choose alternative route.
- Crawl if there is smoke. Take short breaths, freshest air will be near the floor.
- If you cannot leave - stuff towel, clothing etc. under door, over vents etc. to restrict smoke and fumes.
- Open window if possible
- Notify Campus Police and give your exact location
  - campus phone 911
  - activate emergency blue light phone
- Use a towel, sheet, pillowcase or clothing to hang out the window to mark your location for first responders to see.
**Resuming Operations**

Pursuant to 40 CFR 265.56(h), the emergency coordinator must ensure areas affected by a release, fire, or explosion are sufficiently restored and in compliance with the applicable requirements under CFR 262.34 and 265 Subpart C prior to resuming operations. The following form (checklist) has been developed to document that required items have been satisfactorily addressed and in service following a fire, explosion, or chemical release:

- Released or discharged materials cleaned up
- Emergency equipment ready for service
  - Telephone
  - Fire alarm
  - Fire extinguisher
  - Other fire suppression
  - Spill supplies
  - Decontamination

All departments should have a current Business Continuity Plan addressing both short-term and long-term interruption of operations, access to alternate facilities, and restoration of current facilities as appropriate.
**Required Contingency Plan Items for Central Accumulation Areas**

A RCRA contingency plan describes the procedures that will be used to respond to emergencies related to hazardous waste. A RCRA contingency plan must be SPECIFIC TO YOUR FACILITY describing your facility, wastes, emergency equipment and procedures.

- Every Central Accumulation Area must have a written contingency plan.
- Personnel must be trained at least annually for their functions in the event of an emergency.
- The plan must be carried out immediately when there is a significant potential for hazardous waste constituents to be released, or they have already been released.
- The plan must describe actions personnel will take in the event of any release of hazardous wastes or constituents, as well as fire or explosion.
- The names of the area emergency coordinators must be listed, as well as their home addresses and phone numbers so they can be reached ANYTIME there is an emergency.
- All emergency equipment must be listed, including its location and its capabilities.
- An evacuation plan must be in the plan that includes the signals used to begin the evacuation.
- Both primary and secondary evacuation routes must be specified.
- Copies of the contingency plan must be kept at the facility and sent to Environmental Health and Public Safety (EH&PS).

The Emergency Coordinator has the direct authority and responsibility for safety and environmental issues at hazardous materials incidents. The Emergency Coordinator shall identify the source, amount, and hazards presented by released material and the areas affected. The Emergency Coordinator is responsible for notifications of facility personnel, and initial notifications of federal, state, and local agencies. Subsequent notifications of outside agencies, (e.g., after-action reports, investigations for cause and preventive measures, and long-term activities) are the responsibility of the individual or department responsible for the incident, and may include support from the Emergency Coordinator or designee.

Note: the definition of an emergency coordinator is a person that has the authority to use the resources of the University and who can respond in a timely manner to an emergency. Central accumulation areas will have area emergency coordinators designated for the purpose of maintaining the location-specific contingency plan, being familiar with the specific work area, and implementing initial containment, control, and protective measures. EH&PS will provide the emergency coordinator representing the University and coordinate emergency plans with emergency services, incident management, and notification of outside agencies.

Generators should review their contingency plan often to determine if any changes should be made and update it promptly. A contingency plan must be updated IMMEDIATELY when:

- The applicable regulations are changed,
- The plan fails in an emergency,
- The facility changes (changes in facility processes, a floor plan, etc.),
- Emergency coordinators change (including changes in address or phone number), or
- Emergency equipment changes.

EH&PS will notify and maintain documentation of agreements with the agencies that will respond to your facility in the event of an emergency. This includes hospitals, fire, police, sheriff, hazardous material responders and other agencies that would be involved in a response.
CONTINGENCY PLAN TEMPLATE

1. **General Information**

   BUILDING: ________________________________ ROOM: ________________

   STREET ADDRESS: __________________________________________________

   PRINCIPAL INVESTIGATOR: _________________________________________

   TYPE OF FACILITY: Central accumulation area for wastes generated by labs shops (circle)

   DESCRIPTION OF WASTES: ____________________________________________
   _________________________________________________________________
   _________________________________________________________________
   __________________________________________________________________
   __________________________________________________________________

2. **Area Emergency Coordinators:**

   Primary: ___________________________________________________________

   Home Address: _______________________________________________________

   Phone: Home: ______________ Work: ___________ Other: _______________

   Alternate #1: _______________________________________________________

   Home Address: _______________________________________________________

   Phone: Home: ______________ Work: ___________ Other: _______________

   Alternate #2: _______________________________________________________

   Home Address: _______________________________________________________

   Phone: Home: ______________ Work: ___________ Other: _______________

* The area emergency coordinator can deputize other employees to assist them in the event of an emergency. The area emergency coordinator will coordinate activities with the University emergency coordinator and emergency personnel. The University emergency coordinator has full authority to commit resources needed to respond to emergencies at this facility.
3. Implementation of the Contingency Plan

The contingency plan will be implemented in the event of a fire or explosion, or any chemical release that may threaten human health or the environment. The area emergency coordinator has the full authority and responsibility to make this determination.

4. Emergency Response Procedures

* Notification
- Any employee discovering a fire, explosion, or hazardous release that is not readily controllable with equipment and materials at hand must notify EH&PS by calling 911. Fires or explosions require activation of the fire alarm system, and evacuation of the building.
- All employees hearing the alarm must close down and secure equipment (if it is safe to do so) and evacuate the building. Shutdown procedures are addressed in the Safety Plan.
- The University’s Emergency Coordinator will contact the National Response Center, State Emergency Response Commission, and Local Emergency Planning Committee, if appropriate, in accordance with the University’s contingency plan.

* Containment and Control
- Evacuate the facility in the event of an emergency alarm, fire of any nature, chemical spill that cannot be controlled by persons in the work area at the time of release, leak of toxic or corrosive gases, or other incidents that may pose an unreasonable hazard to personnel. Upon arrival, EH&PS will assume control of the site and coordinate containment and control measures with emergency service agencies.
- In the event of a spill or release, absorbent material will be used to contain the flow. Recovered material will be declared waste, and undergo a hazardous waste determination, if it cannot be used as is.

* Follow-up Actions
- All hazardous wastes generated during the emergency will be managed and disposed of properly.
- All emergency equipment will be replaced or restored to full working order. The University’s Emergency Coordinator will notify the appropriate State and local authorities that cleanup procedures are completed and that all emergency equipment listed in the contingency plan is fit for its intended use before operations are resumed.
- The cause of the emergency will be investigated by the Principal Investigator. Necessary steps will be taken to prevent the recurrence of the incident.
- Within 15 days after the incident, the Principal Investigator or area emergency coordinator, together with the University Emergency Coordinator, must submit a written report of the incident to NC DENR. The report must include:
  o Name, address, and telephone number of the owner or operator;
  o Name, address, and telephone number of the facility;
  o Date, time, and type of incident (e.g., fire, explosion);
  o Name and quantity of material(s) involved;
  o The extent of injuries, if any;
  o An assessment of actual or potential hazards to human health or the environment, where this is applicable; and
  o Estimated quantity and disposition of recovered material that resulted from the incident.
5. **Emergency Equipment**

Central accumulation areas shall have emergency equipment maintained in working order. The seven primary bullets (phone, alarms, automatic and hand-held extinguishers, spill control, decontamination, and personal protective equipment) reflect required equipment, while the secondary and tertiary bullets reflect specific information for the location.

- **Communication device(s) to contact emergency services**
  - Telephone: Yes  No
  - Location (room): __________________________
  - Cell phone: Yes  No
  - Other: __________________________

- **Alarm system capable of notifying emergency services and initiating evacuation**
  - **Emergency Alarms (to Campus Police)**
    - Fire alarm pull station: __________________________
    - Toxic or flammable gas alarm: Yes  No
    - Other emergency alarms: __________________________

  - **Local Alarms (alert personnel to equipment or other possible malfunction)**
    - Hood or ventilation alarm: Yes  No
    - High temperature alarm: Yes  No
    - Low temperature alarm: Yes  No
    - Other local alarms: __________________________

- **Fire extinguisher**: See equipment list
- **Automatic fire suppression system**: Water  CO₂  Other: __________________________
- **Spill control equipment**: See equipment list
- **Decontamination equipment for personnel**: See equipment list
- **Personal protective equipment**: See equipment list

6. **Coordination Agreements**

The Department of Environmental Health and Public Safety is the primary facilitators for University emergency planning and response services. Emergency plans address all areas, including laboratories, shops, offices, classrooms, resident halls, and storage facilities. This contingency plan supplements information routinely provided, and is presented in a format consistent with EPA and NCDENR requirements for large quantity generators and central accumulation areas. Environmental Health and Public Safety maintains coordinating agreements with local emergency service providers through comprehensive emergency plans.

7. **Evacuation Plan**

The evacuation plan is provided in the Safety Plan. Plan components required for central accumulation areas include:

- **Types of evacuation**—local (room) and general (building)
- **When to evacuate**—emergency alarms, fire of any nature, chemical spills that cannot be controlled by persons in the work area at the time of release, leak of toxic or corrosive gases, and other incidents that may pose an unreasonable hazard to personnel
- **Notification to evacuate**—emergency alarms, voice communication, other communications
- **Primary and alternate evacuation routes**
- **Assembly area(s) for evacuees**
EMERGENCY EQUIPMENT AND SUPPLIES
The following list identifies and describes emergency equipment and supplies either present at the University, or recommended for emergency use. Each central accumulation area is required to have equipment for spill control, personal protection, personnel decontamination, and fire suppression consistent with the training and authorization of their personnel. Record the number/range and location for each item present, and add any additional equipment and supplies to the listing as appropriate.

<table>
<thead>
<tr>
<th>LIST OF EQUIPMENT</th>
<th>COMMENTS</th>
<th>NUMBER (or range) AND LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>* PERSONAL PROTECTIVE EQUIPMENT:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plain Tyvek /Disposable clothing</td>
<td>Suitable for protection against dusts, not recommended for splash protection or situations where there is a potential fire hazard</td>
<td></td>
</tr>
<tr>
<td>Coated Tyvek or comparable disposable clothing</td>
<td>Suitable for limited splash protection and some gases. See selection/compatibility guides before using</td>
<td></td>
</tr>
<tr>
<td>Self-Contained Breathing Apparatus, 30 minute air supply per unit</td>
<td>Use where highest level of respiratory protection is required, including where unknown yet hazardous concentrations of toxic air contaminants or an oxygen deficiency exist. Respiratory protective factor involves safety issues, such as mobility, work load, and vision</td>
<td></td>
</tr>
<tr>
<td>Air-purifying, full face respirators, total</td>
<td>Use where concentrations of air contaminants are known, or where protection from dusts is the primary concern. Not for use in oxygen deficient environments.</td>
<td></td>
</tr>
<tr>
<td>Air-purifying cartridges for respirators</td>
<td>Cartridges are to be selected for the specific type of contaminant (acid gas, organic vapor, dusts, etc.)</td>
<td></td>
</tr>
<tr>
<td>PVC Boots, pair</td>
<td>Suitable for most chemical spills personnel are authorized to manage. Verify use with compatibility charts.</td>
<td></td>
</tr>
<tr>
<td>Rubber or latex boots (over the shoe), pair</td>
<td>Suitable for some chemical spills personnel are authorized to manage. Verify use with compatibility charts.</td>
<td></td>
</tr>
<tr>
<td>Neoprene gloves, 18 inch, pair</td>
<td>Chemical resistant cloves for limited immersion and chemical handling. See selection guides for appropriate chemicals. Note loss of dexterity.</td>
<td></td>
</tr>
<tr>
<td>Nitrile gloves, pair</td>
<td>Chemical resistant cloves for limited immersion and chemical handling. See selection guides for appropriate chemicals. Note loss of dexterity.</td>
<td></td>
</tr>
<tr>
<td>Chemical splash aprons</td>
<td>Additional protection against splash while handling liquid chemicals, such as pouring or other transfer activities.</td>
<td></td>
</tr>
<tr>
<td>Chemical splash sleeves</td>
<td>Additional protection for arms against splash while handling liquid chemicals</td>
<td></td>
</tr>
<tr>
<td>Chemical goggles (fog free), total</td>
<td>Limited vapor protection while providing splash and low velocity particulate protection</td>
<td></td>
</tr>
<tr>
<td>Face shields, total</td>
<td>Provide limited splash protection, not intended for flying objects or debris</td>
<td></td>
</tr>
<tr>
<td>DETECTION AND MONITORING EQUIPMENT</td>
<td>Most monitoring equipment is battery-operated, some have power adapter cords allowing for extended use</td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Radiation survey meters</td>
<td>Primarily beta and gamma detectors, measuring mR/hr</td>
<td></td>
</tr>
<tr>
<td>Toxic gas monitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable gas monitors</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*SPILL CONTAINMENT SUPPLIES:*

<table>
<thead>
<tr>
<th>Chemical sponges</th>
<th>Primarily used for small mercury spills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kimtex towels or comparable</td>
<td>Use anywhere paper towel may be appropriate, more durable</td>
</tr>
<tr>
<td>Oil boom</td>
<td>Intended for oil spills on water, must be anchored</td>
</tr>
<tr>
<td>Drain guard mat</td>
<td>Mat made of rubber or similar material for covering drains</td>
</tr>
<tr>
<td>Liquid absorbent pillows</td>
<td>Not for use on strong oxidizers. Polysilicates are not to be used on hydrofluoric acid</td>
</tr>
<tr>
<td>Spill pads</td>
<td>Not for use on strong oxidizers, or strong acids or bases. White sorbent pads target organic liquids, yellow pads typically universal (water or organic).</td>
</tr>
<tr>
<td>Liquid absorbent (sphagsorb, vermiculite, clay)</td>
<td>Sphagsorb forms effective vapor barrier, treated so it will not absorb water. None of these are considered appropriate for water-based spills.</td>
</tr>
<tr>
<td>Oil sorbent compound</td>
<td>Clay or similar material</td>
</tr>
<tr>
<td>Acid neutralizer compound, solid</td>
<td>Some neutralizers undergo color change depending on pH. Sodium bicarbonate releases carbon dioxide (“fizzes”) under acidic conditions.</td>
</tr>
<tr>
<td>Acid neutralizer compound, liquid</td>
<td>Some neutralizers undergo color change depending on pH. Sodium bicarbonate releases carbon dioxide (“fizzes”) under acidic conditions. Liquid is more appropriate for wash (decontamination) after most of the spilled material has been cleaned up.</td>
</tr>
<tr>
<td>Caustic neutralizer compound, solid</td>
<td>Some neutralizers undergo color change depending on pH. Solid may also absorb much of a liquid spill.</td>
</tr>
<tr>
<td>Caustic neutralizer compound, liquid</td>
<td>Some neutralizers undergo color change depending on pH. Liquid is more appropriate for wash (decontamination) after most of the spilled material has been cleaned up.</td>
</tr>
</tbody>
</table>
### *TOOLS AND EQUIPMENT*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABC fire extinguisher, 10 lbs., total</td>
<td>Multi-purpose extinguisher for most fires</td>
</tr>
<tr>
<td>Carbon dioxide fire extinguisher</td>
<td></td>
</tr>
<tr>
<td>Class D fire extinguisher</td>
<td>For selected flammable solids</td>
</tr>
<tr>
<td>Shovel, 48&quot; and round blade, total</td>
<td></td>
</tr>
<tr>
<td>Shovel, 36&quot; and flat blade, polypropylene, total</td>
<td></td>
</tr>
<tr>
<td>Squeegee, total</td>
<td></td>
</tr>
<tr>
<td>Mop, total</td>
<td></td>
</tr>
<tr>
<td>Push broom, total</td>
<td></td>
</tr>
<tr>
<td>Dust pan</td>
<td></td>
</tr>
<tr>
<td>Bucket and wringer, total</td>
<td></td>
</tr>
<tr>
<td>Counter brush, 8&quot;, total</td>
<td></td>
</tr>
<tr>
<td>First aid kit, total</td>
<td></td>
</tr>
</tbody>
</table>

### *OTHER*

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency eyewash/shower, fixed (non-portable) units</td>
<td>Initial emergency decontamination of personnel</td>
</tr>
<tr>
<td>Plastic bags (ziplock or similar)</td>
<td></td>
</tr>
<tr>
<td>Plastic bags (garbage bags)</td>
<td></td>
</tr>
<tr>
<td>5-Gallon Pails with lids</td>
<td></td>
</tr>
</tbody>
</table>
SECTION 9
TRAINING REQUIREMENTS

Training is recommended for all persons generating and handling hazardous materials and waste, and required for persons working in central accumulation areas.

Training Requirements for Central Accumulation Areas

Training must include instruction which teaches facility personnel hazardous waste management procedures relevant to the positions in which they are employed. Training must be designed to ensure facility personnel are able to respond effectively to emergencies by familiarizing them with emergency procedures, emergency equipment, and emergency systems, including where applicable:

- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment;
- Communications or alarm systems;
- Response to fires or explosions
- Shutdown of operations

Personnel must successfully complete initial training within six months after their assignment to the facility, or to a new position at a facility, whichever is later. Personnel must not work in unsupervised positions until they have completed the training requirements. Personnel must take part in an annual review of the initial training.

The following documents and records must be maintained:

- Job title for each position related to hazardous waste management and the name of the employee filling each job;
- A written job description for each position that includes the requisite skill, education, or other qualifications, and duties of personnel assigned to each position;
- A written description of the type and amount of both introductory and continuing training that will be given to each person; and
- Records that document that the training or job experience has been given to, and completed by, facility personnel.

Training records on current personnel must be maintained until closure. Training records on former employees must be kept for at least three years from the date the employee last worked at the facility. Personnel training records may accompany personnel transferred within the same company.

“Facility personnel” includes employees and students working in an unsupervised research setting under the definition of “laboratory worker”. Any person performing the duties of a trained professional, such as transferring unwanted materials and waste outside of a laboratory or moving waste from a satellite to a central accumulation area, would be considered a laboratory worker working as a trained professional regardless of status as faculty, student, or staff (i.e., compensation is not a factor when considering job descriptions, etc.).
SUPPLEMENTAL JOB DESCRIPTION
NCSU HAZARDOUS WASTE

In accordance with 40 CFR 262.34(a)(4) and 265.16(a), personnel working in Central Accumulation Areas are required to meet specific training requirements. This job description supplements the employer job description, focusing on functions related to hazardous waste management.

Job Title: __________________________________________

Employee: __________________________________________

Requisite skills, education, or other qualifications:

___________________________________________________

Duties of personnel (check all that apply):

☐ Submit chemical waste forms
☐ Select waste containers
☐ Mark/Label waste containers
☐ Conduct hazardous waste determination
☐ Move waste from satellite accumulation to central accumulation area
☐ Transfer contents of waste containers
☐ Inspect central accumulation area
   ☐ Implement corrective actions
☐ Implement emergency procedures
   ☐ Emergency notification (to NCSU Public Safety)
   ☐ Shutdown of operations
   ☐ Facility-specific alarms
   ☐ Spill containment and control
   ☐ Small fires
☐ Serve in an on-call capacity as knowledgeable facility personnel

Description of the type and amount of both introductory and continuing training:
All employees shall be thoroughly familiar with proper waste handling and emergency procedures, relevant to their responsibilities during normal facility operations and emergencies.

- Regulatory Overview (Module 1)
- Conduct waste and/or hazardous waste determinations (Module 2)
- Container Management (Module 3)
  - Select waste containers
  - Mark/Label waste containers
  - Filling waste containers
  - Container handling and storage
  - Secondary containment
  - Accumulation time and quantities
- Satellite accumulation and central accumulation area (Module 4)
- Transfer, treatment, and recycling wastes (Module 5)
- Submit chemical waste forms (Module 6)
- Inspect central accumulation area (Module 7)
  - Implement corrective actions
- Implement emergency procedures (Module 8)
  - Communications or alarm systems
  - Emergency notification
  - Shutdown of operations
  - Facility-specific alarms
  - Spill containment and control
  - Response to fires or explosions
  - Technical support
- Procedures for using, inspecting, repairing, and replacing facility emergency and monitoring equipment  AREA-SPECIFIC PROCEDURE
- Key parameters for automatic waste feed cut-off systems  AREA-SPECIFIC PROCEDURE
- Response to ground-water contamination incidents  AREA-SPECIFIC PROCEDURE
MODULE 1  REGULATORY OVERVIEW
Waste Generator Manual Section 1
  General Definitions
  Safety Precautions
  Waste Inspection Concerns

MODULE 2  WASTE DETERMINATION
Waste Generator Manual Section 2
  Waste determination
  Hazardous waste determination
Waste Generator Manual Section 3
  Disposal restrictions
Waste Generator Manual Section 4
  Waste types and procedures

MODULE 3  CONTAINER MANAGEMENT
Waste Generator Manual Section 5
  Container Management
    Control
    Select waste containers
    Mark/Label waste containers
    Filling of containers
    Handling and storage
    Secondary containment
    Accumulation time and quantities

MODULE 4  SATELLITE AND CENTRAL ACCUMULATION AREAS
Waste Generator Manual Section 5
  Satellite Accumulation Area
  Central Accumulation Area
    Design requirements
    Inspection
    Closure

MODULE 5  TRANSFER, TREATMENT, AND RECYCLING WASTES
Waste Generator Manual Section 5

MODULE 6  SUBMITTING CHEMICAL WASTE FORMS
Waste Generator Manual Section 6

MODULE 7  INSPECTION OF CENTRAL ACCUMULATION AREAS
Waste Generator Manual Section 5
  Weekly Inspection Form
MODULE 8  EMERGENCY PROCEDURES
Waste Generator Manual Section 8
   Implement emergency procedures
   Required Equipment
   Communications and alarms
   Emergency notification (to NCSU Public Safety)
   Shutdown of operations
   Facility-specific alarms
   Spill containment and control
   Small fires
   Serve in an on-call capacity as knowledgeable facility personnel
   Resuming operations

ADDITIONAL WASTE-SPECIFIC TRAINING REQUIREMENTS

Universal Wastes  INITIAL, ANNUAL REFRESHER
Waste Generator Manual Section 4
   Fluorescent and other mercury-containing lamps
   Mercury-containing equipment
   Batteries
   Recalled or cancelled pesticides (see also procedures for management pesticides, maintained by individual departments)

Polychlorinated Biphenyls (PCBs)
   Procedures, including training, should be in place by individual departments handling materials containing PCBs.

Asbestos  INITIAL, ANNUAL REFRESHER
   Evaluation, handling, encapsulation, removal, and disposal of asbestos is regulated by OSHA, limiting activities to qualified personnel. Procedures, including training, should be in place by individual departments handling materials containing asbestos. EH&S may provide specific classroom training.

Biohazard  INITIAL, ANNUAL REFRESHER
Biosafety Manual

Radioactive  INITIAL, REFRESHER EVERY 4 YEARS
Radiation Safety Manual