CHAPTER 10
HAZARDOUS MATERIAL DISPOSAL

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2.1 Chemical Wastes

Chemical waste includes unused chemicals, material to be discarded from an experiment, and characteristic material (hazardous waste by definition). A regulated chemical waste is defined as a waste with strict regulations due to its quantity, concentration, or characteristics and may cause or significantly contribute to threatening human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

The U.S. Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ) regulate the disposal of hazardous waste and unwanted chemicals in Texas. The purpose of this section is to assist you in designating a waste as hazardous and provide a disposal manner consistent with legal requirements.

The Resource Conservation and Recovery Act (RCRA) found in the Code of Federal Regulations (40 CFR 261.20 – 261.24) defines the four fundamental characteristics of regulated chemical waste.

2.1.1 Ignitability

Solid waste exhibits ignitability if a representative sample of the waste has any of the following properties:

- It is a liquid, other than an aqueous solution containing less than 24 percent alcohol by volume and has a flash point less than 60ºC (140ºF).

- Material is not a liquid and is capable, under standard temperature and pressure, of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard.

- Ignitable compressed gases and oxidizers.

Examples of ignitable chemical waste include ethanol, ether, acetone, xylene, and most non-halogenated solvents.

2.1.2 Corrosivity

Corrosivity applies to highly acidic (pH less than, or equal to 2) or highly basic (pH greater than, or equal to 12.5) aqueous solutions. UTMB sanitary sewer system is discharged to the City of Galveston Wastewater Treatment plant; the University is regulated by city pretreatment permits.

- An aqueous solution that has a pH less than or equal to 2 or greater than or equal to 12.5 will be collected and managed as hazardous waste.
• Any aqueous solution that has a pH less than or equal to 5.0 or greater than or equal to 9.5 will need to be neutralized to (6 – 9) pH or collected for disposal.

Examples of corrosives include hydrochloric acid and sodium hydroxide or mixtures that meet the above criteria.

2.1.3 Reactivity

• Chemicals that are normally unstable and readily undergoes violent change without detonating.

• Reacts violently with water, potentially forms explosive mixtures with water.

• It is a cyanide or sulfide bearing waste which, when exposed to pH conditions between 2 and 12.5, can generate toxic gases.

• Materials which are capable of detonation or explosive decomposition at standard temperature and pressure.

Examples of reactive chemical waste include metallic sodium and picric acid.

2.1.4 Toxicity

Waste is considered to exhibit the characteristic of toxicity if it is in solution in amounts greater than the regulatory levels listed in Table 1 or, if the leachate using Toxicity Characteristics Leaching Procedure (TCLP) meets or exceeds these regulatory levels. For liquids, the TCLP result is approximately the same as the actual mass concentration.

2.1.5 Listed Chemical Wastes

In addition to defining the characteristics of regulated waste, RCRA also defines (or lists) certain specific waste materials as being regulated. These materials are listed in 40 CFR sections 261.31 (the F List), 261.32 (the K list), and 261.33 (the P and U lists). Should you have questions about identifying listed chemical wastes contact EHS at 747-0515.

**F list** addresses wastes from nonspecific sources such as spent solvents and their mixtures. An example is a spent solvent mixture which contained, before use, a total of ten percent or more (by volume) of one or more of the following non-halogenated solvents: xylene, ethyl acetate, ethyl ether, n-butyl alcohol, methanol, acetone, ethyl benzene, methyl isobutyl ketone or cyclohexanone.
**K list** addresses wastes from specific sources and is generally not applicable to wastes generated in laboratories.

**P list** addresses unused *acutely hazardous materials* (e.g., laboratory chemicals having an LD50 of less than 50 mg/kg (oral-rat)). It is applicable to many surplus chemicals that are disposed of by research laboratories. Some examples are nickel tetracarbonyl, phosphine, and osmium tetroxide.

**U list** addresses unused hazardous materials (e.g., toxic laboratory chemicals). Like the P list, this is applicable to many surplus chemicals that are disposed of by research laboratories. Some examples are pharmaceuticals, aniline, benzene, and acetone.
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<thead>
<tr>
<th>EPA HW No.</th>
<th>Contaminant</th>
<th>CAS No.</th>
<th>Regulatory Level (mg/L)</th>
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<td>D019</td>
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</tr>
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<td>m-Cresol..................</td>
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</tr>
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</tr>
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<td>Silver...................</td>
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<td>D039</td>
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<tr>
<td>D043</td>
<td>Vinyl chloride...........</td>
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</tbody>
</table>
2.2 Generator Knowledge

Generator knowledge is a hazardous waste evaluation method commonly accepted and defined by the EPA and TCEQ to determine how wastes should be managed. A generator of hazardous chemical waste may use their knowledge of processes and materials to determine whether a waste must be managed as hazardous waste. This is referred to as using "generator" knowledge to characterize a waste. The generator is in the best position to know all the chemicals used in the process of generating the waste, as well as the quantities and concentrations of chemicals used in the process.

Generators should obtain information to identify the concentrations and types of ingredients that are used in their processes. Information from safety data sheets are available from chemical manufacturers and on-line sources.

2.3 Analytical Testing

Generators may also use analytical testing to classify waste as hazardous or non-hazardous. The more information that generators have about the materials used in their processes, the more information they can use to limit the amount of analytical testing and costs.

2.4 Apply Generator Knowledge of the Process or Materials that Produced the Waste

Generator knowledge can be used to meet all or part of the waste analysis requirements and can be defined broadly to include "process knowledge." Process knowledge may be information on the wastes obtained from existing published or documented waste analysis data or studies conducted on hazardous wastes generated by processes similar to that which generated the waste. For example, listed wastes are identified by comparing the specific process that generated a specific waste to those processes described in the listings rather than conducting a chemical/physical analysis of the waste.

If existing or historical records are used for generator knowledge, an evaluation must be performed to ensure the information reflects the current processes and materials being used and that no differences exist between the process in the documented data and waste being considered.

If you use generator knowledge alone or in conjunction with sampling and analysis, you must maintain detailed documentation that clearly demonstrates the information is sufficient to identify the waste. Documenting both the generator knowledge and any analytical data is essential. Documentation used to support generator knowledge may include, but is not limited to:

- Safety data sheets or similar documents,
- A thorough process description, including data on all raw materials used in the process, and or
- Other forms of detailed documentation.
2.5 Biological Wastes (Medical Waste)

UTMB owns and operates a medical waste processing facility; procedures are implemented under the requirements of the Medical Waste Permit MSW-2232A for a Type V solid waste processing facility, the operational staffing component and also the day-to-day operational items such as general operating structure, waste handling and tracking, general plant procedures and maintenance, and safety.

Operation and maintenance of the UTMB medical waste processing facility is regulated by the TCEQ and the EPA. Accordingly, plant operators and supervisors must be trained and certified to operate the processing systems in accordance with the training and certification requirements of 40 CFR 60 Subpart Ce. Also, as defined in 30 TAC §330.5(a), this Type V MSW facility (i.e., a separate solid waste processing facility encompassing processing plants that transfer, incinerate, and/or provide other processing of solid waste) must comply with the Operational Standards for Solid Waste Processing prescribed in 30 TAC §330.201-330.249. Certain regulations enforced by the Occupational Safety and Health Administration (OSHA) also apply.

Biological (medical waste) waste has been identified by the Texas Department of State Health Services (TDSHS) as waste which requires special handling to protect human health or the environment. It is further defined as a solid waste which if improperly treated or handled may serve to transmit an infectious disease(s).

Biological waste is regulated by the TCEQ and the TDSHS and includes pharmaceutical, microbiological, pathological, sharps, and animal waste.

2.5.1 Pharmaceutical waste includes unused medications not deemed as hazardous by RCRA definitions:

- All medications dispensed to inpatient areas and clinics utilize the unit does system as a primary method of drug distribution and must be properly labeled in accordance with state and federal regulations.
- Pharmaceuticals and trace chemotherapy are treated by incineration.

2.5.2 Microbiological waste as listed unless deactivated:

- Cultures and stock of infectious agents and associated biologicals.
- Cultures of specimens from medical, pathology, research, and clinical laboratories.
- Discarded live, and attenuated vaccines.
- Disposable culture dishes and devices used to transfer, inoculate, and mix cultures.
Microbiological waste is treated by sterilization and maceration with final disposal in the landfill.

2.5.3 **Pathological waste** includes but is not limited to, human materials removed during surgery, labor and delivery, autopsy, or biopsy including:

- Organs, bulk human blood and body fluids removed during surgery, labor and delivery, autopsy, or biopsy (100ml or more).
- Products of spontaneous or induced abortion regardless of age of gestation.
- Laboratory specimens of blood and/or tissues after completion of examination.
- Pathological waste is treated by incineration.

2.5.4 **Sharps wastes** include, but are not limited to, the following materials, *when contaminated*:

- Hypodermic needles
- Hypodermic syringes with attached needles
- Scalpel blades
- Razor blades and disposable razors used in surgery, labor and delivery, or other medical procedures
- Glass pasteur pipettes
- Broken glass from laboratories

2.5.4.1 **Sharps wastes** also include, but are not limited to, the following material, *regardless of contamination*:

- Hypodermic needles
- Hypodermic syringes with attached needles
- Sharps are treated by sterilization and maceration with ultimate disposal in the landfill with the exception if placed inside of a yellow bag it will be treated by incineration.

2.5.5 **Animal waste**: when animals are intentionally exposed to pathogens, animal waste includes the following materials:

- Carcasses of animals
Body parts

Bulk whole blood, serum, plasma, and/or blood components from animals

Bedding, saliva, urine and feces of animals

Animal waste is treated by incineration.

2.6 Radioactive Waste

Radioactive waste is considered to be any waste product that contains or is contaminated with radionuclides. Texas Regulations for Control of Radiation sets forth the guidelines for handling and disposal of such materials. Please refer to the Radiation Safety Manual and Basic Radiation Safety in the Laboratory for more information on radioactive materials and waste.

2.7 Multi-Hazardous Waste

Multi-hazardous waste contains any combination of chemical, biological, or radioactive hazard. These wastes require special consideration because the treatment method for one of the hazards may be inappropriate for the treatment of another. In general, if all the hazards cannot be removed by eliminating or substituting the materials that generate the mixed waste, then the goal is to reduce the multi-hazard waste to a waste that presents a single hazard.

Chemical-Radioactive (mixed) waste is defined by the Environmental Protection Agency as "wastes that contain a chemically hazardous waste component regulated under the Resource Conservation and Recovery Act and a radioactive component consisting of source, special nuclear, or byproduct material regulated under the Atomic Energy Act." Examples of laboratory mixed wastes include:

- Used flammable liquid scintillation cocktail.
- Phenol-chloroform mixtures from extraction of nucleic acids from radiolabelled cell components.
- Certain gel electrophoresis waste (e.g., methanol or acetic acid containing radionuclides).
- Uranium compounds used in electron microscopy.

Mixed waste is typically a mixture of a low-level radioactive waste and chemically hazardous waste. Disposal options for mixed waste are expensive. For many types of mixed waste, there are no management options other than indefinite storage on site.

If you plan to generate multi-hazardous wastes, please contact EHS – Environmental Protection Management (EPM) at ext. 70515 to review potential management options.
2.8 Chemotherapy Waste

Chemotherapy is the therapeutic chemical treatment of cancer with drugs that can destroy cancer cells by impeding their growth and reproduction. These drugs often are called "antineoplastic" or "cytotoxic" drugs. Chemotherapy drugs are given intravenously, by injection or by mouth. All empty vials, syringes, IV bags and tubing, gloves, wipes and other material associated with routine handling, preparation, and administration of chemotherapy, are managed as trace chemotherapy waste. Trace chemotherapy items are disposed of in a yellow bag, which is designated as Regulated Medical Waste for incineration.

Chemotherapy treatment, such as unused or partially used IV bags are managed as hazardous chemical waste. Chemo medicines and medicine prepared for patient care or research that has not been used (partially used IV bags) are considered listed RCRA waste. Any materials used to clean up hazardous waste spill, such as the contents of chemotherapy, must be managed as hazardous waste in designated containers for disposal through EHS.

2.9 RCRA Pharmaceutical Waste

The Federal Resource Conservation and Recovery Act (RCRA) require special handling for specific waste materials, including some medication wastes. Pharmaceuticals that are regulated under the RCRA regulations are found on the P and U lists or meet the criteria used to define characteristic wastes. Hazardous pharmaceuticals are not discarded through the sanitary sewer or placed in biohazard waste containers. Environmental Protection Management (EPM) is responsible for chemical waste pick up and disposal services. On-line pick up request is available at: http://www.utmb.edu/bof/epm/input.asp

2.9.1 RCRA “P-Listed” Wastes – There are two necessary conditions for determining “acutely toxic” P-listed medications: if the discarded medication contains a sole active ingredient that appears on the P list and; the medication has not been used for its intended purpose. Also there are no concentration limits or dilution exclusions for P-listed wastes. Ingredients that serve ancillary functions, such as mobilizing or preserving the active ingredient, are not considered when determining the sole active ingredient. If saline or another solvent is added to a P-listed chemical, additional P-listed waste is generated. The phrase “has not been used for its intended purpose” refers to medication and their associated containers or dispensing instruments that have not been given to a patient and need to be discarded.

Containers that once held P-listed wastes are treated as hazardous waste.
RCRA P-Listed medications (Chemical and RCRA waste number)

- Arsenic trioxide, P012
- Nicotine, P075
- Nitroglycerine, P081 (Nitroglycerine patches, pills, tablets, capsules, creams, and inhalers are now exempted.)
- Phentermine (CIV), P046
- Physostigmine, P204
- Physostigmine salicylate, P188
- Sodium Azide, P105
- Strychnine, P108
- Warfarin >.3%, P001

2.9.2 RCRA “U-Listed” Wastes – The U-list chemicals are listed for their toxicity and are similar to a P-listed waste, when a drug containing one of these chemicals is discarded, it must be managed as hazardous waste if the following two conditions apply: the discarded drug waste contains a sole active ingredient that is U-listed, and; it has not been used for its intended purpose. There is no concentration limit or dilution exclusion. The difference between the P and U listed wastes; if a container that held a U-listed waste is emptied by normal means, such as drawing liquid out with a syringe and no more than 3% by weight remains then the container itself is not considered hazardous. If both of these criteria are not met, the container itself is considered hazardous waste.

RCRA U-Listed medications (Chemical and RCRA waste number)

- Acetone, U002
- Chlora hydrate (CIV), U304
- Chlorambucil, U035
- Chloroform, U044
- Cyclophosphamide, U058
- Daunomycin, U059
- Dichlorodifluoromethane, U075
- Diethylstilbestrol, U089
- Formaldehyde, U122
- Hexachlorophene, U132
- Lindane, U129
- Melphalan, U150
- Mercury, U151
- Mitomycin C, U010
- Paraldehyde, U182
- Phenacetin, U187
- Phenol, U188
- Reserpine, U200
- Resorcinol, U201
- Saccharin, U202
- Selenium sulfide, U205
- Streptozotocin, U206
- Trichloromonofluoromethane, U121
- Uracil mustard, U237
- Warfarin <.3% (Coumadin), U248
2.9.3 *RCRA Characteristic Drug Formulations* – Medication formulations containing the following D-listed chemicals or heavy metals and exceed a regulatory level concentration are managed as hazardous waste.

2.9.3.1 *Ignitable*

Aqueous drug formulation containing 24% or more alcohol by volume and having a flashpoint of less than 140°F must be managed as ignitable hazardous waste.

Examples of ignitable classified medications, D001

- Rubbing Alcohol
- Cleocin T Topical Solution
- Retin A Gel
- Listerine Mouthwash
- Erythromycin Topical Solution
- Potassium Permanganate (oxidizer)
- Silver Nitrate (oxidizer)
- Collodion Based Preparations
- Topical Preparation
- Some wart-removal medications
- Come cough syrups
- Some inhalers, aerosols, and compressed gasses with flammable propellants

2.9.4 *Corrosivity*

Generation of corrosive (includes liquids with a pH ≤ 2, or pH ≥ 12.5) pharmaceutical waste is generally limited to compounding chemicals in the pharmacy (e.g., glacial acetic acid, sodium hydroxide)

2.9.5 *Reactivity*

Reactive wastes are unstable under "normal" conditions. They can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Medications are not classified as reactive.

2.9.6 *Toxicity*

Medication formulations containing the following D-listed chemicals or heavy metals and exceed a regulatory level concentration are managed as hazardous waste.

Chemical, regulatory concentration, RCRA waste number
- Arsenic, extract ≥ 5.0 ppm, D004
- Barium, extract ≥ 100 ppm, D005
- Cadmium, extract ≥ 1 ppm, D006
- Chloroform, extract ≥ 6 ppm, D022
- Chromium, extract ≥ 5 ppm, D007
- Lead, extract ≥ 5 ppm, D008
- Lindane, extract ≥ 0.4 ppm, D013
- m-Cresol, extract ≥ 200 ppm, D024
- Mercury, extract ≥ 0.2 ppm, D009
- Selenium, extract ≥ 1 ppm, D010
- Silver, extract ≥ 5 ppm, D011

Examples of RCRA Metal and Toxic medication wastes

- Solutions preserved with Thimerosal or other forms of mercury (such as nose-, eye-, and eardrops, contact lens solution, eye ointments, topical medications, antiseptic sprays, vaccines, antitoxins, tuberculin tests, some homeopathic remedies, and desensitization solutions)

- M-Cresol is used as a preservative in human insulins

- phenylmercuric acetate

- mercurochrome

- Silver sulfadiazine (or Silvadene)

- barium sulfate (unused or un-administered barium enemas)

- Some pills and tablets containing chromium, selenium and cadmium
A container that has held a characteristic waste is defined as empty in the same manner as a U-listed waste, if all of the contents have been removed as possible through normal means and no more than 3% by weight remains.

### 2.9.7 Hazardous Waste Combinations

This section provides guidance on how to manage combinations of hazardous waste and:

- Personal Protective Equipment (PPE) and spill materials
- Regulated Medical Waste (RMW),
- Sharps, and
- Controlled substances

#### 2.9.7.1 Contaminated Personal Protective Equipment and Spill Materials

**Listed Waste**

PPE worn to protect employees from exposure to hazardous chemicals, materials used to perform routine cleaning or decontamination of Biological Safety Cabinets and glove boxes, and spill cleanup materials may become contaminated with hazardous waste. According to EPA, the resulting waste has the same regulatory status as the original listed component. For example, personal protective equipment such as gloves and gowns that are known to be or suspected of having been contaminated with P- or U-listed hazardous waste must be managed as hazardous waste. If PPE is routinely worn but does not appear to have come into contact with listed waste, it is acceptable for it to be discarded either as trace chemotherapy waste, if its use involved chemotherapy agents, or in the trash as solid waste.

Any materials used to clean up a hazardous waste spill, such as the contents of an IV bag of Cytoxan (cyclophosphamide), must be managed as hazardous waste and cannot be discarded in a trace chemotherapy or solid waste container.

For characteristic wastes, PPE and spill material that is contaminated with flammable waste or a highly corrosive waste is managed as hazardous waste.

#### 2.9.7.2 Regulated Medical Waste

Regulated Medical Waste refers to infectious or potentially infectious waste. UTMB’s Medical Waste Processing Facility permit specifically refers to “regulated medical wastes” to be treated by incineration only in accordance with the TCEQ and UTMB Policy. Regulated Medical Waste includes
pharmaceutical wastes, trace chemotherapy wastes, pathological wastes consisting of human body parts, tissues, fetuses, and organs and human anatomical remains.

In the event that the chemotherapy is not administered to the patient and needs to be discarded it is classified as hazardous waste. In many cases, luerlock fittings enable the safe disconnection of the tubing or sharps from the IV bag. Disconnecting the tubing or sharps from the IV bag avoids the generation of a waste that is both RMW and hazardous waste and instead enables the management of the tubing or sharps and IV bag individually as RMW and hazardous waste, respectively.

2.9.7.3 Sharps

As a safety consideration, UTMB Pharmacy Policy requires uncapped or used needles to be discarded in the nearest Sharps container. As a rule needles shall not be discarded into a RCRA Pharmaceutical container.

Any unused and unopened pharmaceuticals purchased/issued by campus pharmacy shall be returned to Pharmacy for disposal.

2.10 Disposal of Controlled Substances

Expired controlled substance disposal is coordinated through the EHS office in accordance with DEA requirements for reverse distribution. Disposal logistics such as chain-of-custody and complete destruction of the material must be carried out between the DEA Registrant and an approved reverse distribution company. EHS is not permitted to take possession, handle or destroy controlled substances. EHS will facilitate the required paperwork between the DEA Registrant and disposal company which includes payment of disposal fees.

DEA Registrants may submit an online request to initiate the paperwork for reverse distribution of expired controlled substance through the EHS online chemical pickup request system at: http://www.utmb.edu/bof/epm/input.asp

EHS will initiate an account for reverse distribution which includes obtaining appropriate disposal forms and payment of the destruction fees. The Registrant is responsible for providing an account number with either Fed Ex or UPS for shipment of the controlled substance. EHS and the Registrant will package the controlled substance and complete shipping manifest together.

The reverse distribution company will provide Proof of Destruction and/or a disposal manifest to EHS upon receipt of the controlled substance. EHS will maintain copies of the destruction documentation as well as provide copies to each Registrant. EHS will maintain all records for period of five years.
In situations when “orphaned” or abandoned DEA substances are discovered, a collaborative effort should be made within the department to determine who is responsible for the controlled substance disposal and associated record keeping.

All non-registered personnel in possession of a controlled substance may request assistance by submitting a letter to the DEA Special Agent in Charge of the Administration in the area in which the person is located for authority and instructions to dispose such controlled substances.

The Special Agent in Charge can be determined by contacting the local area DEA Office. The locations can be found at: http://www.deadiversion.usdoj.gov/

Please remember the Special Agent in Charge can only authorize disposal. The Department of Environmental Health and Safety is not permitted to take possession, handle or destroy controlled substances.

The Drug Enforcement Agency’s (DEA) Office of Diversion Control in accordance to 21 CFR 1304, (www.deadiversion.usdoj.gov) regulates the disposal of DEA controlled substances. UTMB researchers follow DEA’s registration process in conformance with UTMB institutional policy 10.02 Controlled Substances for Animal Research Areas. This registration grants the Principal Investigator (PI) or Department the authority to purchase and use, for research purposes, DEA controlled substances. Once a PI or Department obtains a controlled substance, they have the responsibility to track, secure, and dispose of these substances in accordance with all state and federal regulations.

The Department of Pharmacy maintains a Reverse Distribution Registrant on contract services for the disposal controlled substances according to UTMB Policy 6.45 Controlled Substance Destruction. In situations when “orphaned” or abandoned controlled substances are discovered in a patient care area, EHS will notify Pharmacy to ensure appropriate measures are taken for final destruction.