EPA/600/R-10/092 October 2010

United States
Environmental Protection
Agency

Laboratory Environmental Sample Disposal Information Document

Companion to Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events (SAM) - Revision 5.0

SCIENCE

Office of Research and Development
National Homeland Security Research Center

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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Acknowledgments

This document was developed by the U.S. Environmental Protection Agency's (EPA) National Homeland Security Research Center (NHSRC) within EPA's Office of Research and Development as a companion to NHSRC's *Standardized Methods for Environmental Restoration Following Homeland Security Events* (SAM). We wish to acknowledge the external peer reviews conducted by Matthew Arduino of the U.S. Centers for Disease Control and Prevention, Larry Burchfield of the Radiochemistry Society, Jordan Peccia of Yale University, and Fred Lee of G. Fred Lee & Associates, whose thoughtful comments contributed greatly to the quality of the information. The document was prepared by Computer Sciences Corporation (CSC) under EPA Contract No. EP-W-06-046.

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Foreword

Following the events of September 11, 2001, EPA's mission was expanded to account for critical needs related to homeland security. Presidential Directives identified EPA as the primary federal agency responsible for the country's water supplies and for decontamination following a chemical, biological, and/or radiological (CBR) attack. To provide scientific and technical support to help EPA meet this expanded role, EPA's National Homeland Security Research Center (NHSRC) was established. The NHSRC research program is focused on conducting research and delivering products that improve the capability of the Agency to carry out its homeland security responsibilities.

One specific focus area of NHSRC's research is to support the Environmental Response Laboratory Network (ERLN), a nationwide association of federal, state, local, and commercial environmental laboratories, established by EPA. The ERLN can be deployed in response to a large-scale environmental disaster by providing consistent analytical capabilities, capacities, and quality data in a systematic, coordinated manner. Toward this end, NHSRC has worked with experts from across EPA and other federal agencies to develop a compendium of analytical methods to be used in support of remediation following national homeland security related incidents. For specific analytes that have been determined to be of concern during a homeland security related event, analytical methods have been chosen to measure levels of contamination in different environmental matrices. The results of these efforts have been published in EPA's *Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events* (SAM), available at http://www.epa.gov/sam.

In identifying and selecting appropriate analytical methods to be used in such instances, EPA recognized the need for guidelines regarding disposal of samples analyzed by the methods listed in SAM. This sample disposal information document partially addresses this need by **providing general guidelines for use by EPA and EPA-contracted laboratories when disposing of samples and associated analytical waste following use of the analytical methods listed in SAM.**

NHSRC has made this publication available to assist in preparing for and recovering from disasters involving chemical, radiochemical, and biological contamination; it specifically represents an important next step in supporting the ERLN. We value your comments as we move toward the development of an efficient process to manage environmental samples and move EPA one step closer to achieving its homeland security mission and its overall mission of protecting human health and the environment while supporting sustainable solutions.

Cynthia Sonich-Mullin, Acting Director
National Homeland Security Research Center

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Acronyms and Abbreviations

AEA	Atomic Energy Act
ALARA	As Low as Reasonably Achievable
APHIS	Animal and Plant Health Inspection Service
BSL	Biosafety Level
CAA	Clean Air Act
CDC	U.S. Centers for Disease Control and Prevention
CDL	Commercial Drivers License
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CWA	Clean Water Act
DAC	Derived Air Concentration
DDESB	Department of Defense Explosives Safety Board
DERP	Defense Environmental Restoration Program
DGR	Dangerous Goods Regulations
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
ESS	Explosives Safety Submissions
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FUDS	Formerly Used Defense Sites
g	Gram(s)
HAZMAT	Hazardous Materials
HDPE	High Density Polyethylene
HHS	U.S. Department of Health and Human Services
HSWA	Hazardous and Solid Waste Amendments
IAEA	International Atomic Energy Agency
IATA	International Air Transport Association
ICS	Incident Command System
LLRW	Low-level Radioactive Waste
LLRWPA	Low-Level Radioactive Waste Policy Act
LQG	Large Quantity Generator
m^3	Cubic meter
mCi	Millicurie(s)
mg	Milligram(s)
min	Minute(s)
mm	Millimeter(s)
mR	Milliroentgen(s)
mrem	Millirem(s)
MSDS	Material Safety Data Sheet
MTRU	Mixed Transuranic
N	Normal – 1 equivalent weight per liter
NARM	Naturally Occurring, and/or Accelerator-Produced Radioactive Material
nCi	Nanocurie(s)
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NHSRC	National Homeland Security Research Center
NIMS	National Incident Management System
nm	Nanometer(s)
NOS	Not Otherwise Specified

NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
NWPA	Nuclear Waste Policy Act
OSHA	U.S. Occupational Safety and Health Administration
PCB(s)	Polychlorinated biphenyl(s)
PPE	Personal Protective Equipment
ppm	Parts per million
POTW	Publicly Owned Treatment Works
psi	Pounds per square inch
PSN	Proper Shipping Name
RCRA	Resource Conservation and Recovery Act
SAM	Standard Analytical Methods for Environmental Restoration Following Homeland Security Events
SARA	Superfund Amendments and Reauthorization Act
SOP	Standard Operating Procedure
spp.	Species
SQG	Small Quantity Generator
TBq	Terabecquerel
TCLP	Toxicity Characteristic Leachate Procedure
TNT	Trinitrotoluene
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage, and Disposal Facility
µCi	Microcurie(s)
µm	Micrometer(s)
UN	The United Nations
UN ID	United Nations Identification Number
µR	Microroentgen(s)
URL	Uniform Resource Locator
UV	Ultraviolet
WIPP	Waste Isolation Pilot Plan

1.0
Background

The U.S. Environmental Protection Agency's (EPA) National Homeland Security Research Center (NHSRC) has been working with experts from across EPA and its sister agencies since 2004, to develop a compendium of procedures to be used when EPA is tasked with environmental restoration following national homeland security related incidents. Analytical methods have been selected for chemical, radiochemical, pathogen, and biotoxin analytes of concern for the environmental sample types that are anticipated in such incidents. The most recent result of this effort is published in EPA's *Standard Analytical Methods for Environmental Restoration Following Homeland Security Events* (SAM), Revision 5.0 (September 2009), and is available at: http://www.epa.gov/sam/.

During development of SAM, EPA recognized the need for companion documents, including a document to provide guidelines regarding disposal of samples analyzed by the methods listed in SAM.

This document addresses laboratory disposal of samples and associated analytical waste unique to remediation activities following a homeland security incident when SAM methods would be applied, and assumes specific environmental sample types (i.e., water, soil, particulates, and air) will be analyzed by laboratories using the methods listed in SAM.

2.0
Scope and Application

This sample disposal information document is intended to provide general guidelines for use by EPA and EPA-contracted laboratories when disposing of samples and associated analytical waste following use of the analytical methods listed in SAM.

The document includes information regarding laboratory responsibilities, waste minimization, federal and state regulations, treatment, storage, packaging, disposal, and decontamination procedures. The information provided in this document is intended only as a guide and is based on the current federal and state regulations cited; laboratories must consult and comply with these regulations prior to initiating sample disposal activities. This document is not intended to be a complete compilation of all the regulatory requirements with which the laboratory may have to comply to meet local, state, and federal mandates. It is the laboratory's responsibility to ensure that their programs and procedures are in full compliance with the applicable regulations. The World Wide Web Uniform Resource Locators (URLs) provided throughout this document provide the most currently available information at the time of document preparation. Please note that these links will be reviewed and updated periodically, following publication of updated SAM documents.

It is assumed that laboratories using this document will be handling environmental samples that contain one or more of the chemical, biological, or radiochemical analytes listed in SAM at levels that would be expected to be found in samples that are collected in support of site remediation and clearance. It is also assumed that these samples and the corresponding analytical waste are thoroughly characterized, and the hazardous components and concentration levels understood. Guidelines are provided for handling and disposal of samples that may contain SAM chemical (Section 4), radiochemical (Section 5), and biological hazards (Section 6), as well as mixed and multiple-hazards sample waste (Section 7).

Although samples received by laboratories are not considered to be regulated waste while awaiting testing, while stored after testing, or while being transported back to the sample collector (40 CFR 261.4(d)), all samples should be treated as potentially hazardous. However, once samples are analyzed and designated for disposal or decontamination, they should be treated as a regulated waste, meeting all federal and state requirements.

3.0
Overview of Laboratory Responsibilities

This section summarizes laboratory responsibilities and management strategies for disposal of chemical, radiological, or biological samples and associated analytical waste. In some cases, multiple management strategies may be required, such as when a biological laboratory uses an analytical technique with a chemical component, thus requiring a chemical disposal plan.

Waste Management

Waste Management Plan

Laboratories handling and disposing of samples and analytical waste must have a Waste Management Plan that is in compliance with all applicable local, state, and federal regulations. Laboratories also must be able to demonstrate that this plan is being followed by personnel for the safe handling and disposal of all waste materials generated. A laboratory's Waste Management Plan must include information and instructions regarding:

- Types of wastes expected to be generated at the laboratory
- Responsibilities of laboratory personnel
- Management authorization (signatures)
- Accumulation of wastes for disposal
- Identification and inspection of waste storage areas
- Waste classification and segregation
- Record keeping
- Decontamination materials (storage of unused and spent decontamination materials)
- Publicly-owned treatment works (POTW) disposal
- Permit and reporting requirements
- Waste neutralization requirements
- Waste storage
- Satellite requirements
- Storage accumulation and date requirements
- Primary containment
- Waste shipment
- Federal and state regulations
- Waste container packaging and labeling
- Arranging for shipment and preparation of shipment papers
- Packaging requirements
- Disposal options
- Landfill (land-ban restrictions, acceptable wastes, packing requirements)
- Incineration (acceptable wastes, packing requirements)
- Health and safety for storage and transportation areas
- Training requirements
- Personal protective equipment (PPE)
- Exposure monitoring
- Plan implementation
- Information accessibility by staff
- Laboratory accountability
- Audits
- Record keeping requirements
- Requirement for review and updates (e.g., at least annually)

Waste Management Administrator

In addition to a Waste Management Plan, laboratories must have a Waste Management Administrator with knowledge of all regulations concerning waste handling, shipping, and disposal. As laws and statutes are periodically updated and modified with respect to hazardous waste identification, shipment, and disposal, the administrator must frequently review regulations concerning contaminants and different levels of contamination, packaging, markings, shipping regulations, and safety requirements as prescribed by the U.S. Department of Labor Occupation Safety and Health Administration (OSHA). In most states, Waste Management Administrators are required to attend and pass a one to two day training course, and are responsible for the following:

- Identifying waste-generating processes, type of waste generated, expected contaminant concentrations, and expected amounts generated during a specified time period
- Maintaining a Waste Management Plan

and/or a Chemical Hygiene Plan, Radiological Safety Plan, and/or Biological Safety Plan

- Identifying the local POTW and ensuring proper communication and permit requirements
- Coordinating with waste brokers; waste haulers; and Treatment, Storage, and Disposal Facilities (TSDFs) approved to handle each waste identified
- Identifying proper storage containers for each waste type
- Completing waste labels for each storage and shipping container
- Tracking opening and closing dates for each storage container at satellite locations and in bulk waste storage location
- Completing required waste treatment or neutralization
- Completing Waste Profiles with the waste broker, and receiving TSDF acceptance for each waste prior to shipment
- Receiving and maintaining copies of waste hauler identification documents and certified driver's licenses, and TSDF permits as required for each waste type. Also maintaining copies of hauler and TSDF insurance
- Ensuring wastes are properly packaged and labeled for transportation using Packing Groups and proper shipping names
- Completing the Waste Manifest and Bill of Lading for each waste shipment
- Submitting copies of the Waste Manifest to each required government office
- Ensuring transportation vehicles meet placard requirements, wastes are properly segregated and secured, and vehicles are in good working condition
- Ensuring waste shipments arrive as specified and are accepted at the approved TSDF
- Receiving and maintaining disposal certificates documenting that the TSDF has completed disposal, and containing dates, batch identification, and disposal location
- Visiting TSDFs
- Reviewing laboratory procedures for waste minimization and reduction
- Completing annual reports for regulatory agencies

Generator Status

Laboratories with chemical and/or radiological waste must have a waste generator status and an understanding of the required limits and documentation to maintain this status (see Section 3.4.4 and Table 3-1). Unlike processors and manufacturers, which generate large amounts of consistent waste types, most laboratories typically generate small amounts of varying wastes and therefore face challenges in costs and planning. Although laboratories likely will be small quantity generators, disposal of highly contaminated sample wastes might alter this status for a specific period. The Waste Management Administrator must review the appropriate regulations carefully to ensure records and reporting are completed properly.

Waste Broker

Laboratories with chemical or radiological waste must have an identified waste broker who can assist in profiling, manifesting, and inspecting laboratory waste prior to shipment; a certified TSDF; and a hauler capable of properly handling the type of waste that can be expected following analysis of samples containing the SAM analytes. Many states require waste brokers to attend and pass a hazardous materials disposal training course for chemical wastes. A waste broker is not needed for disposal of treated, non-infectious biological waste. Depending on state and local regulations, a waste broker also may not be required for disposal of untreated biological waste.

Documentation

Laboratories must maintain accurate, up-to-date, and easily retrievable records of sample and waste handling. This documentation is essential for meeting state regulations, planning and tracking sample disposition, reducing liability, facilitating inspections, and responding to inquiries and information requests. Many regulations and regulatory authorities require comprehensive documentation of these activities to assure compliance. Each agency has unique and specific reporting periods and submission dates, data reporting formats, and record retention times. Documentation requirements and procedures must be included in the laboratory's Waste Management Plan.

These requirements typically include:

- Preliminary documentation of sample or site characterization
- Waste Profile acceptance
- Open/close dates for storage containers
- Shipping container purchase records
- Waste manifests and bill of lading
- Disposal certificate
- Waste minimization review findings

Guidelines for Waste Minimization

Waste avoidance and pollution prevention can significantly reduce the amount of waste a laboratory handles, and is a critical part of any laboratory Waste Management Plan. The following guidelines are suggested for waste minimization.

Waste Categorization and Segregation

Proper waste categorization can help avoid unnecessary, inappropriate, and costly waste treatment, storage, and disposal. For example, the processes and definitions that the laboratory uses to determine that a waste is radioactive or non-radioactive will have a great influence on the amount of radioactive waste that the laboratory must manage. Once a waste has been properly categorized, the laboratory can prioritize the waste options for elimination, reduction, or modification.

Laboratory waste can typically be segregated into the following categories: radioactive solid waste, radioactive liquid waste, Resource Conservation and Recovery Act (RCRA) waste, polychlorinated biphenyl (PCB) waste, biological hazards, and mixed waste. Segregating wastes by the appropriate category allows them to be managed by the most cost-effective option. Combining highly regulated waste streams with less stringently regulated waste streams usually requires the total waste stream to meet the most stringent waste management requirements. For example:

Non-hazardous waste mixed with hazardous waste is managed as hazardous waste.
Non-radioactive waste mixed with radioactive waste is managed as radioactive waste.
Hazardous waste mixed with radioactive waste (referred to as mixed waste) is managed in compliance with requirements of the Atomic Energy Act (AEA), RCRA, and Toxic Substances Control Act (TSCA).

Regulatory Exemptions

Some wastes may be exempt from regulations because of the production process, level of contaminants, volume of waste, or the waste management option chosen. For example:

Some wastes may be disposed of in a wastewater discharge if the contaminants are regulated and are below regulatory levels (see 40 CFR Parts 136 and 403)
A hazardous waste generator that produces less than 100 kg of waste in a month may be a conditionally exempt small quantity generator and thus be exempt from many of the requirements of the RCRA
Some radioactive waste may be managed as non-radioactive if the total level of radioactivity is below an exempt or *de minimis* level, or if the activity for specific radionuclides is below established levels as described in 10 CFR 61

Method Selection

The analytical method selected for sample analysis or handling determines the type and volume of waste generated. If two methods will achieve the required measurement quality objectives, the laboratory might select the method that produces the least amount or most easily managed waste. For example, biological laboratories can minimize the use of chemical disinfectants that require handling and disposal as hazardous substances by considering alternative disinfection procedures, such as autoclaving, that do not generate hazardous waste. Current laboratory guidelines for working with infectious microorganisms at Biosafety Level 3 (BSL-3) laboratories recommend that waste be decontaminated before disposal and that select agents be destroyed using a steam autoclave. Method selection is discussed in greater detail in Section 6.3.

It also may be possible to replace hazardous analytical reagents with non-hazardous reagents and still meet method requirements and data quality objectives (refer to analytical methods listed in SAM for information regarding alternative reagents and materials). In addition, substituting a short-lived radionuclide for a long-lived radionuclide may ultimately result in

reducing radioactive waste. Methods that are recommended for analysis of environmental samples for confirmatory identification and measurement of SAM analytes are listed in the SAM document (http://www.epa.gov.sam). 40 CFR Part 136 also provides guidance regarding analytical methods and discharge limitations corresponding to analytes regulated by EPA in wastewater discharges.

Sample Amounts

If possible, laboratories can request that excess sample material not be collected or received. To minimize the amount of sample waste, laboratories should receive only the amount of sample needed for sample analysis, analytical quality control, and a limited amount of excess in case of sample loss or other unforeseen problems or uses. For example, laboratories might request approximately two times the amount of sample required by the analytical method. Approximately four times the amount required may be needed if the laboratory will be analyzing matrix spikes and matrix spike duplicates. Reserve sample amounts should be minimized with up-front planning. It may also be possible to convert a method to a micro-scale method that uses significantly less sample and reagents. To optimize method sensitivity in the situation of evaluating the effectiveness of decontamination, however, it may be necessary to use large quantities of sample material.

Reagent Procurement Controls

Amounts of reagents and materials purchased by a laboratory often are determined by price discounts available on large quantities, instead of the amount required. The real cost of purchasing these materials should include the initial purchase price plus disposal costs (lifetime costs). Procurement of hazardous material should be initiated only if a non-hazardous substitute is not available. Rotating chemical stock (first in, first out) also can help avoid expiration.

Re-Use of Materials

Some materials may be recovered from the analytical process and re-used in subsequent analyses. For example, distillation of certain used organic solvents may purify them sufficiently for reuse. Glassware and some disposable equipment can often be decontaminated and re-used or disposed of as non-hazardous waste. Pre-use of materials is discussed further in Sections 4.3, 5.3, and 6.3.

Safety

Laboratories must have a Chemical Hygiene Plan and/or Radiological Safety Plan or Biological Safety Plan covering all aspects of sample and waste management specific to the target contaminants. This plan must encompass personnel responsibilities, engineering controls, monitoring, emergency response, and special handling criteria for samples containing significantly elevated contaminant levels. Many of the contaminants included in SAM are not routinely handled by laboratories, and hygiene and safety plans must address samples and analytical materials containing these contaminants.[1] These plans provide guidelines for the protection of employees from health effects associated with hazardous chemicals used in the laboratory, and include information regarding:

- Responsibilities of laboratory personnel
- Avoidance of routine exposures
- Housekeeping
- Chemical procurement and storage
- Chemical inventory
- Staff training
- Hazards identification and monitoring
- Environmental maintenance and monitoring
- Maintenance and inspections
- Medical monitoring of personnel
- Material Safety Data Sheets (MSDSs)
- Personal Protective Equipment
- Emergency equipment
- Standard operating procedures (SOPs) for health and safety
- Employee training, including dry runs for handling hazardous samples
- Waste disposal procedures (included in Waste Management Plan)
- Chemical or biological handling procedures (e.g., flammable, corrosive, reactive chemicals; compressed gases; radioactivity; carcinogens, mutagens, reproductive toxins)

[1] An example chemical hygiene plan can be found at: http://ehs.okstate.edu/statestuff/samplechp.pdf.

- Working with moderate to highly chronic toxic substances
- Working with highly acute toxic substances

All laboratory staff require training related to the tasks that they perform in relation to hazardous substances. This training will vary greatly by the tasks performed, the type(s) of hazardous substance(s), and the intensity of the hazard (e.g., low level vs. high level). Regardless of these factors, OSHA regulations at 29 CFR 1910.132(f) require that staff be trained in the use of Personal Protective Equipment (PPE). Training should be completed in a non-hazardous environment prior to PPE use, and should be repeated at the frequency required in OSHA and Superfund Amendments and Authorization Act (SARA), Title III. At a minimum, the training must include:

- Proper use and maintenance of selected protective clothing
- Nature of hazards and the consequences of not using the protective clothing
- Instructions in inspecting, donning, checking, fitting, and using protective clothing
- PPE user's responsibility (if any) for decontamination, cleaning, maintenance, and repair of protective clothing
- Emergency procedures and self-rescue in the event of protective clothing/equipment failure
- The buddy system

Primary Organizations and Acts that Dictate Waste Handling and Disposal

The guidelines provided in this document are not intended to be used without knowledge and comprehension of applicable federal, state, or local regulations. These regulations must be consulted prior to development and implementation of a laboratory's waste management activities. Summary information regarding general waste management regulations is provided in Sections 3.4.1 through 3.4.7. Summary information regarding regulations applying to chemical, radiological, biological, and multi-hazardous wastes is provided in Sections 4.0, 5.0, 6.0, and 7.0, respectively. In preparing this document, the U.S. Code of Federal Regulations (CFR) and U.S. Department of Transportation (DOT) directives were reviewed for regulations having provisions that pertain to laboratory disposal of analytical waste expected to be generated by laboratories analyzing samples during remediation activities following homeland security events. Wastes generated from samples and sample analysis must comply with EPA regulations at 40 CFR Part 260 and with DOT regulations at 49 CFR Parts 171 - 199, which regulate packaging, handling, labeling, marking, placarding, and routing of all hazardous shipments within the U.S. The location of this information in the CFR is provided in Table 3-2 (Section 3.4.7). A condensed summary of these regulations and of U.S. Department of Defense (DoD) directives is provided below. This section provides only summary information; it is the laboratory's responsibility to have a Waste Management Administrator (Section 3.1.2) who is fully aware of and familiar with federal, state, and local regulations affecting disposal of hazardous waste.

U.S. Occupational Safety and Health Administration (OSHA)

OSHA regulations (29 CFR Part 1960) provide for the safety of personnel working with hazardous materials and wastes. Training requirements for handling sample wastes and for general safety also are covered. Laboratories using this document must have an approved Health and Safety Plan and laboratory staff must be trained in procedures and requirements for handling hazardous materials, samples, and waste. The health and well being of laboratory staff is paramount in handling and disposing of these potentially hazardous environmental samples and associated analytical waste. Accordingly, OSHA regulations pertaining to PPE must be reviewed in Sections 132–138 of 29 CFR 1910, as well as Section 22 for general "housekeeping" and Section 141 for general environmental controls.

Regulations involving employee safety and emergency response under the Incident Command System (ICS) and National Incident Management System (NIMS) are covered in 29 CFR 1910.1200, 1910.120, and 1926.65. OSHA does not provide blanket exemptions or waivers to regulations involving personal safety, even during emergency conditions and operations. However, as part of the ICS, the Incident

Commander must consider the risks associated with operations that have the potential to result in exposures exceeding permissible exposure limits and manage the response accordingly.

Clean Water Act (CWA)

The Clean Water Act provides for the protection and maintenance of the chemical, physical, and biological integrity of the nation's water. CWA regulations (40 CFR Parts 112 – 503) address the control of discharges into U.S. waterways, including direct and indirect discharges, as well as the injection of wastewater into the ground. Direct discharges into surface waters are regulated by National Pollutant Discharge Elimination System (NPDES) permit conditions. Indirect discharges to a POTW is controlled under the National Pretreatment Standards (§403).

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Superfund Amendments and Reauthorization Act (SARA)

Regulations under CERCLA (40 CFR Parts 300 to 302) provide a mechanism for the federal government to respond to hazards posed by uncontrolled release of hazardous substances. By liabilities imposed on all parties connected to a release. As a laboratory may be held responsible for the entire costs associated with a cleanup of a hazardous material, all aspects of processing, handling, and disposal (e.g., selecting the proper waste transporter and disposal facility) should be undertaken with great care.

Resource Conservation and Recovery Act (RCRA)

RCRA provides for tracking of all hazardous substances from "cradle to grave" (generation to final disposal), and provides regulations at 40 CFR Parts 239 - 299. This Act is intended not only to protect human health and the environment by prohibiting open dumping, but also to conserve materials and energy resources by encouraging waste recycling, reuse, and treatment. Pursuant to RCRA, EPA developed hazardous waste management regulations for generators and for TSDFs. In 1984, Congress expanded the scope of RCRA with passage of the Hazardous and Solid Waste Amendments (HSWA), which directed EPA to adopt regulations governing small quantity generators (SQGs) of hazardous waste, such as many small laboratories. Most laboratories routinely generate hazardous waste and, therefore, are subject to RCRA hazardous waste management regulations at 40 CFR Parts 260 to 270. These regulations include requirements governing waste classification, accumulation, disposal, recordkeeping, and emergency preparedness. This Act addresses sample wastes by regulating the identification of the hazardous constituent, storage of the sample waste, and proper shipment and disposal of the sample waste.

Under RCRA regulations, there are three classes of generators: (1) Conditionally Exempt Small Quantity Generator (CESQG); (2) SQG; and (3) Large Quantity Generator (LQG). Each level has specific accumulation levels, holding times, disposal options, and reporting criteria. Information regarding these criteria, including changes needed when status is increased, is provided in Table 3-1. Laboratories accepting samples in large quantities might change generator status, requiring an increase in both reporting requirements and training of staff. Many states have modified these requirements and often have removed the lowest level (CESQG).

Table 1: RCRA Water Generator Status Requirements

Requirement (40 CFR)	CESQG	SQG	LQG
Waste Determination (262.11)	Applicable	Applicable	Applicable
Generation Rate Limits (261.5 and 262.34)	<100 kg/month	100 – 1,000 kg/month	1,000 kg/mo or greater
Accumulation Quantity Limit w/o Permit (261.5 and 262.34)	Not to exceed 1,000 kg hazardous waste or 1 kg acute hazardous waste at any time.	Not to exceed 6,000 kg at any time	No limit
Accumulation Time (261.5 and 262.34)	No limit	180 days (or 270 days if waste is to be transported over 200 miles)	90 days
EPA ID Number (262.12)	Not required*; possible state requirement	Required	Required
Mark Containers with Start Date (262.34)	Not applicable	Applicable	Applicable
Mark Containers "Hazardous Waste" (262.34(a))	Not applicable	Applicable	Applicable
Air Emission Standards (265 Subpart C)	Not applicable	Not applicable	Applicable
Satellite Accumulation (262.34(c))	Not applicable	Applicable	Applicable
Use Manifests (262, Subpart B)	Not required, possible state requirement	Required	Required
Exception Reporting (262.42)	Not required	Required after 45 days	Required after 35 days
Biennial Report (262.41)	Not required	Not required; possible state requirement	Required
Contingency Plan (265, Subpart D)	Not required, but OSHA (29 CFR 1910.38) requires emergency planning	Basic planning required in accordance with 262.34(d)(4) and (5) and 265, Subpart C as well as OSHA regulations	Full written plan in accordance with 265 Subpart D, is required by 262.34(a)(4) and OSHA regulations
RCRA Personnel Training (262.34 and 65.16)	Not required, but recommended	Basic training required by 262.34(d)(5)(iii)	Full compliance with training requirements in 265.16 is required by 262.34(a)(4)
Storage Requirements (without permit) (262.34 and 265)	None, but OSHA regulations under 29 CFR 1910, Subparts H and N, apply, particularly 29 CFR 1910.106	Compliance with technical standards in Part 265, Subparts I and J; for containers and tanks, is required by 262.34(d)(2) and (3) and OSHA regulations	Compliance with technical standards in Part 265, Subparts I, J, W, and DD, is required by 262.34(a)(1) and OSHA regulations

Requirement (40 CFR)	CESQG	SQG	LQG
Recordkeeping Requirements (262.40)	Waste determinations and generation log required (notification of regulated waste activity, training records, manifests, and land disposal restriction notifications recommended)	Notification of regulated waste activity, waste determinations, generation log, manifests, land disposal restriction notifications, exception reports, and correspondence with local emergency responders	Notification of regulated waste activity, determinations, generation, manifests, land disposal restriction, exception reports, biennial reports, correspondence with local responders, RCRA training records, and contingency plan; weekly container inspection is required; equipment maintenance logs recommended.
Waste "Designated Facility" (264 and 172)	State-approved or RCRA permitted facility or legitimate recycler	RCRA-permitted facility or legitimate recycler	RCRA-permitted facility or legitimate recycler
Land Disposal Restrictions (268.7)	Possible state requirement	Applicable	Applicable

Note:
CESQG - Conditionally Exempt Small Quantity Generator
SQG - Small Quantity Generator
LQG - Large Quantity Generator

RCRA Laboratory Wastewater

Under 40 CFR 261.3(E), wastewater that is generated by laboratory operations, and that contains toxic wastes listed in Subpart D of 40 CFR Part 261, is not considered a hazardous waste if it meets the following conditions: the annualized average flow of laboratory wastewater does not exceed one percent of total wastewater flow into the head works of the facility's wastewater treatment or pre-treatment system, or the wastes combined annualized average concentration does not exceed one part per million in the head works of the facility's wastewater treatment or pre-treatment facility. Toxic wastes used in laboratories that are demonstrated not to be discharged to wastewater are not to be included in this calculation.

U.S. Department of Defense (DoD) Directives

The DoD has been implementing an Installation Restoration Program since the mid-1970's, which was formalized by statute with the passage of SARA in 1986, amending CERCLA. Section 211 of SARA established the Defense Environmental Restoration Program (DERP) to be carried out in consultation with the Administrator of the EPA and the states. The program has three goals: (1) identification and cleanup of contamination from hazardous substances consistent with CERCLA cleanup requirements; (2) correction of environmental damage, such as detection and disposal of unexploded ordnance, that creates an imminent and substantial endangerment to public health and the environment; and (3) demolition and removal of unsafe buildings and structures, including those at Formerly Used Defense Sites (FUDS).

The DoD Explosives Safety Board (DDESB) provides an objective expert to advise the Secretary of Defense and the Service Secretaries on matters concerning explosives safety, as well as to prevent hazardous conditions for life and property (both on and off DoD installations) that result from the presence of explosives and the environmental effects of DoD munitions. The roles and responsibilities of the DDESB were expanded in 1996 with the issuance of DoD Directive 6055.9 on July 29, 1996, and modified in 2004. The directive provides the DDESB with responsibility for serving as the DoD advocate

for resolving issues between explosive safety standards (DoD-Directives) and environmental standards (EPA-RCRA regulations). DDESB is responsible for promulgating safety requirements and overseeing their implementation as necessary to protect human welfare and the environment. These requirements provide for extensive management of explosive materials.

Hazardous Materials (HAZMAT) Transportation Act

Wastes generated from samples and sample analysis must comply with EPA regulations at 40 CFR Part 260 and with DOT regulations at 49 CFR Parts 171 - 199, which regulate packaging, handling, labeling, marking, placarding, and routing of all hazardous shipments within the U.S. The location of this information in the CFR is provided in Table 3-2.

Table 2: EPA and DOT Shipping Regulations

Topics	EPA 40 CFR Regulations	DOT 49 CFR Regulations
Definitions	Section 260.10	Section 171.8
Identification and listing of hazardous materials	Part 261	Section 172.1
Characteristic of hazardous materials	Sections 261.20 to 261.24	Sections 171.8, Part 173
Compliance with manifesting	Sections 262.20 to 262.23 and 263.20 to 263.21	Section 172.205
Packaging and containers	Section 262.30	Parts 173, 178 and 179
Labeling requirements	Section 263.31	Section 172.400
Marking requirements	Section 262.32	Sections 172.300 to 172.330
Placarding requirements	Section 263.33	Sections 172.500 to 172.558
Hazardous material and waste discharge incidents	Sections 263.30 and 263.31	Sections 171.15 to 171.16
Storage	Sections 262.34 Part 370 – reporting requirements to local and state government	Section 171.1 for storage while in transit

Waste Management Administrators and other staff responsible for preparing waste for shipment must be trained in waste handling, packaging, and corresponding regulations (49 CFR 172.704). Many states offer a course and/or have a certification process. DOT regulations also require that each shipment must be certified by the person offering hazardous material for transportation (49 CFR 172), to certify that the materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to DOT. Many laboratories have a certified treatment, storage, and disposal facility pick up their hazardous waste. Thus, often laboratory staff are not certified to ship hazardous waste. In this scenario, hazardous waste shipments are certified by the shipper who picks up the waste, not a laboratory employee. Some states require certification for laboratories that store waste, but this requirement can only be detailed on a state by state basis. In this case the state offers a course and/or has a certification process for the laboratory waste management administrator. The following general practices provide a summary of DOT requirements (at 49 CFR173.24) for packaging wastes for disposal:

- Except as otherwise provided in this subchapter, there will be no identifiable (without the use of instruments) release of hazardous materials to the environment
- The effectiveness of the package will not be substantially reduced; for example, impact resistance, strength, packaging compatibility, etc., must be maintained for the minimum and maximum temperatures, changes in humidity and pressure, and shocks, loadings, and vibrations normally encountered during transportation
- There will be no mixture of gases or vapors in the package which could, through

any credible spontaneous increase of heat or pressure, significantly reduce the effectiveness of the packaging

- There will be no hazardous material residue adhering to the outside of the package during transport

State Regulations

State regulators can incorporate, and even increase, the level of compliance needed in the federal regulations. RCRA regulations in 40 CFR Parts 256 and 271 provide guidelines to states for producing acceptable waste management plans. In addition to complying with federal regulations, laboratories must comply with all pertinent state regulations impacting laboratory waste disposal. EPA listings of state Internet sites and regulation sources are provided in Appendix A for chemicals, Appendix B for radiologicals, and Appendix C for biologicals. Information also can be found at:

- Chemicals (http://www.epa.gov/osw/hazard/wastetypes/universal/statespf.htm)
- Radiologicals (http://nrc-stp.ornl.gov/stpdirectr.html)
- Biologicals (http://www.epa.gov/osw/nonhaz/industrial/medical/programs.htm)

4.0
Handling and Disposal of Samples and Analytical Waste Containing Chemical Hazards

Hazardous waste contains properties that make it dangerous or potentially harmful to human health or the environment, and is regulated under RCRA Subtitle C. A RCRA hazardous waste is a waste that appears on one of four hazardous wastes lists (F-list, K-list, P-list, or U-list), or exhibits at least one of four characteristics (ignitability, corrosivity, reactivity, or toxicity). RCRA lists are organized into three categories:

The F-list (non-specific source wastes) identifies wastes from common manufacturing and industrial processes, such as solvents that have been used in cleaning or degreasing operations. Because the processes producing these wastes can occur in different sectors of industry, the F-listed wastes are known as wastes from non-specific sources. Wastes included on the F-list can be found in the regulations at 40 CFR §261.31.

The K-list (source-specific wastes) includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. Certain sludges and wastewaters from treatment and production processes in these industries are examples of source-specific wastes. Wastes included on the K-list can be found in the regulations at 40 CFR §261.32.

The P-list and the U-list (discarded commercial chemical products) include specific commercial chemical products in an unused form. Some pesticides and some pharmaceutical products become hazardous waste when discarded. Wastes included on the P- and U-lists can be found in the regulations at 40 CFR §261.33.

Waste that does not meet any of the listings explained above may still be considered a hazardous waste if it exhibits one of the four characteristics defined in 40 CFR Part 261 Subpart C (commonly referred to as the RCRA D List).

Ignitability (D001) – Ignitable wastes can create fires under certain conditions, are spontaneously combustible, or have a flash point less than 60 °C (140 °F). Examples include waste oils and used solvents. For more details, see 40 CFR §261.21. Many military munitions are hazardous via this characteristic, even without a detonation source being present.

Corrosivity (D002) – Corrosive wastes include acids or bases ($pH \leq 2$ or ≥ 12.5) that are capable of corroding metal containers, such as storage tanks, drums, and barrels. Battery acid is an example. For more details, see 40 CFR §261.22.

Reactivity (D003) – Reactive wastes are unstable under "normal" conditions, and can cause explosions, toxic fumes, gases, or vapors when heated, compressed, or mixed with water. Examples include lithium-sulfur batteries and explosives. For more details, see 40 CFR §261.23. There are currently no test methods available.

Toxicity (D004 and D043) – Toxic wastes are harmful or fatal when ingested or absorbed (e.g., containing mercury, lead, etc.). When toxic wastes are land disposed, contaminated liquid may leach from the waste and pollute ground water. For more details, see 40 CFR §261.24.

The United Nations (UN) Chemical Weapons Convention defines a chemical warfare agent as "any chemical which, through its chemical effect on living processes, may cause death, temporary loss of performance, or permanent injury to people and animals." Nerve and blister agents are the two classes of chemical warfare agents that have been most widely manufactured and used for military purposes. Common blistering agents include mustard (HD), nitrogen mustards (HN-1, HN-2, HN-3), and lewisite (L). Common choking agents include chloropicrin (PS), chlorine, phosgene (CG), and diphosgene

(DP). Common organo-phosphorous nerve agents are GA (tabun), GB (sarin), GD (soman), GF (cyclohexylsarin) and VX (O-ethyl-S-[2-diisopropylaminoethyl]methyl-phosphonothiolate). Common chlorinated blister agents include mustard gas (HD) and nitrogen mustards (HN-1, HN-2, and HN-3).

Note: Laboratory waste containing CWAs must be handled only by trained personnel, using appropriate safety precautions. In all cases, laboratories must contact appropriate authorities identified by the EPA Project Manager and should follow procedures that have been approved specifically for handling these wastes and that are included in the laboratory's approved Waste Management Plan. Small-scale treatment of waste containing dilute chemical warfare agent is discussed in Section 4.3.6.

Regulations

In addition to the regulations summarized in Section 3.4, the laboratory must be aware of requirements included in Title III of SARA for notification of municipalities. The Emergency Planning and Community Right-to-Know Act (EPCRA or Title III of SARA) requires all facilities storing or producing hazardous materials to inform local and state communities. This requirement is necessary if the laboratory meets the quantities of any one or more chemicals on the list of "extremely hazardous substances" at 40 CFR Part 372. The owner of the laboratory must report the chemical to the state and local emergency response commission and have action plans in the event of a release.

Storage

The operator of a hazardous waste storage area must inspect areas in which waste containers are stored, at least weekly, looking for leaks and deterioration caused by corrosion or other factors (40 CFR 265.174). 40 CFR 262.34 addresses requirements for prevention and preparedness, contingency plans, and emergency procedures that may apply to a laboratory that stores RCRA waste. Laboratory management should review 40 CFR 262.34 prior to storing these wastes.

Samples and analytical wastes containing reportable levels of RCRA hazardous chemical analytes (RCRA List D) must be stored between 4 ºC and 6 ºC and segregated from lower level contaminated samples and from non-environmental samples. However, once designated for disposal by the laboratory, the samples must be treated as a regulated waste, meeting all RCRA and generator status requirements. Table 3-1 lists quantity storage limitations and reporting information for each level of generation status. A generator may store hazardous waste up to 90 days, 180 days, or 270 days depending on its status as defined by the regulations or the distance the generator is from the disposal facility (40 CFR 262.34). A generator may accumulate as much as 55 gallons of hazardous waste or one quart of acutely hazardous waste in containers at or near the point of generation where wastes initially accumulate, which is under the control of the operator of the process generating the waste (40 CFR 262.34). The storage time clock (90, 180, or 270 days) does not begin until the waste volume reaches 55 gallons (or one quart, in the case of acutely hazardous waste), or whenever waste is stored in a 90-day accumulation area. A small laboratory may require additional training, reporting, and time management if large amounts of contaminated wastes are generated during a short time period. A summary of requirements for storage of these waste materials is provided below.

All sample and sample preparation (extraction) wastes should be segregated according to chemical class. Acidic wastes should be stored separately from basic wastes, oxidizers should be stored separately from organics, and cyanide positive wastes should be stored separately from acids to reduce the possibility of inadvertent potentially dangerous releases/exposures, fires, or increased hazardous status.

Each type of waste (based on the specific chemical contamination, level, and initial generation site) must be stored in a separate, labeled container to help reduce multi-hazardous wastes and assist in source reduction.

The label must contain the chemical contaminant, the waste generation point, the date of generation, and the initials of the technician responsible for the initial generation of the waste.

The laboratory must use proper storage containers, limiting the container size to properly reflect the amount of sample and sample waste expected to be generated. The storage container must be properly designed, meeting Packing Group I, II, or III criteria (49 CFR Part 173, Subpart D), to double as the correct transport/disposal container (e.g., drum, Packing Group) to reduce handling of the waste materials. Storage containers must be made of proper materials with sealable lids.

Once samples and analytical waste are designated for disposal by the laboratory, all waste locations that have not been identified as the main storage location must meet the satellite location rules (40 CFR Part 262) and waste holding times, as described in Appendix D.

The Generator Status will determine the length of storage time allowed (see Appendix).

Storage locations must be properly labeled and documented (49 CFR 173 subpart B).

Special storage precautions must be taken for samples and wastes containing military ordnance or chemical warfare agents. These storage precautions include:

- Limiting potential contact and increased secondary containment. The secondary containment must contain an excess of absorbent that would absorb all of the liquid if spilled from the primary container.
- Refrigerating samples containing dilute chemical warfare agents
- Wearing protective covering, such as lab-coats, safety goggles/glasses, nitrile gloves, and a pair of butyl rubber gloves over the nitrile gloves
- Limiting volumes of samples and all related wastes, if possible, to those deemed non-explosive by contact or impact
- Familiarizing all employees with MSDSs and special handing requirements. For example, soils with a 12 percent or greater concentration of secondary explosives [such as trinitrotoluene (TNT)] are capable of propagating (transmitting) a detonation if initiated by flame. Soils containing more than 15 percent secondary explosives by weight are susceptible to initiation by shock. To be safe, the U.S. Army Environmental Center considers all soils containing 10 percent or more of secondary explosives or mixtures of secondary explosives to be reactive or ignitable soil.

The laboratory must designate a labeled container for wastes containing RCRA List D levels of hazardous materials. This container must be labeled with all information necessary to completely identify the original sample or site location. All solid wastes generated during the sample preparation phase of analysis must be placed in this container, and the container must be stored with the original sample(s) to reduce the amount of waste needing to comply with increased levels of sample handling requirements and disposal criteria. Sample extract waste must be contained and maintained with the original sample or, if appropriate (see Section 4.3.2), discharged to the municipal water treatment system.

For sample extract wastes, the laboratory must allow solvents to evaporate in a hood with appropriate safety considerations, leaving only a residue. This container should be placed with the solid sample waste or liquid sample for disposal (40 CFR 264.1030). Evaporation is not always a legal form of treatment. See more details at 40 CFR 264.1030.

Treatment

Aqueous and Water Soluble Waste

It may be possible to treat aqueous and water soluble wastes for disposal through discharge to a POTW. The laboratory must notify the POTW of potential discharges prior to using this option and must have gained a permit, if applicable, that meets municipality requirements. See Section 4.3.2 for approved federal pretreatment options. If the laboratory disposes of more than 15 kg of hazardous waste (or any acute wastes) per month to a POTW, the EPA, state waste authority, and POTW must be notified (40 CFR 403.12). Discharges to storm drains or septic

systems are prohibited.

To completely understand and effectively manage its wastewater program, the laboratory must develop a wastewater management system that includes:

- An inventory of wastewater (samples and contaminants) discharges
- Programs and practices for minimizing wastewater
- Operating and maintenance procedures for wastewater discharge systems (collection and treatment, if required by permit)
- Monitoring to check operations (as required by permit)
- Recordkeeping to document compliance with permits
- Procedures to respond to emergencies
- Training program to ensure operators meet regulatory requirements and operational requirements
- Procedures to assess planned changes

Liquid Waste

The treatment of liquid wastes is strictly regulated by RCRA regulations. The fine for violations is significant, and laboratory personnel must be familiar with the correct procedure for pretreatment and disposal. Liquid sample preparation wastes must be neutralized prior to disposal.

Hazardous Waste Mixed with Domestic Sewage. EPA's hazardous waste management regulations exclude from the definition of hazardous waste any wastes mixed with domestic sewage that enters a POTW (40 CFR 261.4(a)(1)). In most cases, laboratories must avoid discharging regulated hazardous waste down the drain. Generally, any laboratory that discharges down the drain more than 15 kg of hazardous waste per month (40 CFR 403.12(p)(2)), or acutely hazardous waste in any amount, is required to notify the EPA Regional Office, the state hazardous waste authorities, and the POTW of such discharges.

Neutralization. In most states, it is acceptable to neutralize acidic and caustic liquid sample wastes and dispose of the neutralized solution down the drain if it has no other hazardous characteristics. Where permissible, it is important that only elementary neutralization occurs and that it is under a RCRA exemption for hazardous waste treatment without a permit. Non-exempted treatment, without an RCRA permit, is a serious RCRA violation. The local POTW can assist with this action and provide additional resources or necessary permits.

Air Sample Waste

Some air samples with elevated contamination can be forced through carbon media to absorb contaminants. The carbon material is disposed of as a solid. Air filters also can be disposed of as solids with other samples of the same hazard class.

Solid Waste

Solid wastes should be collected and segregated. Most solid wastes cannot be treated at the laboratory and should be properly characterized and disposed of at an approved disposal facility. All free liquids should be removed prior to disposal, and treated according to Section 4.3.2 as appropriate.

Re-useable and Disposable Containers and Equipment

Empty containers that once held hazardous materials are not regulated as hazardous waste if they meet the definition of "empty." Empty means that all hazardous materials have been removed from the container and, for containers of 110 gallons or less, residue is no more than 3% by weight of the total capacity; for containers greater than 110 gallons, residue is no greater than 0.3% by weight of the total capacity. Containers that held acutely hazardous waste are considered empty only after being triple rinsed with a solvent capable of removing the acutely hazardous waste residue. Disposable laboratory equipment also can be decontaminated by triple rinsing with a solvent capable of removing residue. The solvent rinse then must be managed as acutely hazardous waste.

Laboratory glassware and other re-useable equipment can be decontaminated using the same procedures used to decontaminate empty containers, and cleaned in the same manner used to clean glassware for laboratory use. Cleaning solvents and procedures for these materials are somewhat dependent on the intended use.

Glassware intended for use during analysis of metals, for example, is cleaned differently than glassware intended for use in analyzing organic compounds.

Wastes Containing Chemical Warfare Agents

Small amounts of chemical agents and glassware contaminated with chemical agents can be neutralized prior to disposal, using a solution of 5 – 10% sodium hypochlorite (NaOCl). Reactions between NaOCl and waste, particularly solvents, can be highly exothermic and the bleach must be added to and mixed with the waste slowly in a hood. Complete neutralization may require mixing times from several hours to overnight. Approximately 200 mL 5 – 10% NaOCl solutions can be added to small amounts of waste (≤4 liters or ≤200 g solids) to result in a waste stream that is primarily an aqueous solution of NaOCl. When neutralizing waste containing chemical agents, the resulting waste should be analyzed and handled as hazardous waste as defined by the results of analysis.

Decontamination Waste

Most decontamination wastes are solvents or aqueous solutions that have been used to rinse or wash contaminated materials. This rinse material should be treated as contaminated waste. Waste that the laboratory cannot treat should be stored and segregated by contaminant (Section 4.2), and disposed of by a licensed TSDF and hauler.

Packaging

Individuals involved in packaging hazardous laboratory waste for shipment must have successfully completed DOT HAZMAT training (see 49 CFR 173.12 regarding regulations governing "lab-packs," 49 CFR 173 Subpart B regarding regulations governing packaging of hazardous materials, and 49 CFR 172 Subpart H regarding DOT training regulations). Many laboratories contract hazardous material disposal companies that have completed DOT HAZMAT training. Laboratory waste brokers (Section 3.1.4) that work in the laboratory often are required to pass a state training course. This requirement is state-specific. A summary of information provided in these regulations is provided below.

Each hazardous compound is grouped into a common characteristic hazardous class (40 CFR 172.101) for shipment. The sample wastes must be separated by hazard class and then by analyte of concern for disposal.

The laboratory should then apply for a waste profile from the selected TSDF. Waste profiles typically cover a period of one year. However, other periods may be used depending on TSDF requirements. The waste profile lists the contaminant concentration, contaminant by shipping name, frequency in shipping, generator ID, disposal method, land ban information, and selected other information. This profile helps to ensure the TSDF is capable of proper disposal. The TSDF will provide the generator with a Profile ID (Approval Code) to be listed on the shipping manifest for the specific waste. Additional waste types cannot be shipped for disposal without modifying or preparing a new profile.

Samples and sample wastes must be packaged for shipment according to the packing group criteria for the hazard class (40 CFR 173.2). Small quantities of materials that meet the definition of one or more of the following hazard classes are not subject to any special requirements when in compliance with 49 CFR 173.4:

- Class 3: Flammable and combustible liquid (see 49 CFR 173.120)
- Class 4, Division 1 (Division 4.1): Flammable solid (see 49 CFR 173.124)
- Class 4, Division 2 (Division 4.2): Packing Groups II and III: Spontaneously combustible material (see 49 CFR 173.124)
- Class 5, Division 1 (Division 5.1): Oxidizer (see 49 CFR 173.127)
- Class 5, Division 2 (Division 5.2): Organic peroxide (see 49 CFR 173.128)
- Class 6, Division 1 (Division 6.1): Poisonous materials (see 49 CFR 173.132)
- Class 7: Radioactive material (see 49 CFR 173.403)
- Class 8: Corrosive material (see 49 CFR 173.136)
- Class 9: Miscellaneous hazardous material (see 49 CFR 173.140)

The requirements for this exception are strictly

monitored and many transporters will not accept packages for shipment. Each hazard class is divided into three packing groups with Level 1 (I) being greatest degree of danger and Level 3 (III) being least degree of danger.

Packing materials and containers are manufactured to meet performance standards described in 49 CFR 173.4. The laboratory must determine that the packaging or container is consistent with the requirements for the respective packing group, and that the package has been manufactured, assembled, and marked in accordance. The manufacturer's marking requirement is contained in 49 CFR 178.503 and consists of the following:

- UN symbol
- Packaging identification code designating:
- Type of packaging
- Material of construction
- Category of packaging (when appropriate)
- A letter identifying the performance standard under which the packaging design has been tested:
- X: Packages meeting Packing Group I, II, and III tests
- Y: Packages meeting Packing Group II and III tests
- Z: Packages meeting only Packing Group III tests
- Specific gravity or mass for which the packaging design type has been tested
- Test pressure (for packaging intended to contain liquids); the letter "S" for packaging intended to contain solids
- Last two digits of the year of manufacture, and (in some cases) the month of manufacture
- Authorizing state
- Name and address, or symbol, of manufacturer or approval agency
- Packaging thickness (for metal or plastic drums or jerricans intended for reuse)
- Rated capacity

Most laboratory waste drums will be UN1A1 (Liquids) or UN1A2 (Solids) steel or stainless steel drums that resist impact and corrosion damage. Polyethylene (HDPE) should be labeled UN1H2 (Solids) or UN1H1 (Liquids), and can be incinerated without removing wastes.

Overpack drums might be required for DOT Shipments and should be sized to most closely secure the original shipping container.

Most laboratory hazardous sample wastes can be packaged in "lab packs" due to the small quantity. This process uses smaller shipping containers (30 gallons or less) that meet the specified packaging requirements (40 CFR 173.2). The initial sample containers are placed in the shipping container and surrounded with absorbent materials, and the outside container is sealed. Each lab pack must be labeled with the proper Hazard Chemical name, the UN ID, the total weight, and the closing date. An inventory containing the weight of each internal container and the proper shipping name and level of contamination of each internal container must be attached to the shipping container and shipping manifest. Each lab pack containing aqueous materials must be enclosed in a plastic bag, and contain twice the amount of absorbent material necessary to absorb the entire liquid content in the event of leakage.

Note: Although lab packs eliminate the need to transfer wastes and reduce the occurrence of dangerous reactions resulting from mixing incompatible materials, this packing procedure is also often the most expensive.

If larger containers are used, the laboratory should limit the size to 55 gallons. A solid 55 gallon drum can weigh more than 350 pounds, requiring a forklift to load it onto a truck.

Solid material requires passing a paint filter test (EPA SW-846 Method 9095B) specifying no "free liquid" is present. If the waste material fails the paint filter test, additional absorption materials should be added.

Disposal

Prior to disposal or transfer of waste to a waste hauler, laboratories must identify whether the waste is (1) a solid waste and/or (2) a hazardous waste. The term solid waste is used very broadly in RCRA and refers to both nonhazardous and hazardous waste including solids, liquids, semi-solids, sludges, and compressed gases. EPA defines hazardous waste in 40 CFR 261 as consisting of or partially containing a "listed" waste or if it demonstrates

any one or more of the following characteristics: ignitability, corrosivity, reactivity, or toxicity (see introduction to Section 4.0). The laboratory should use either documented analytical results or manufacturer's certifications of reagents to determine the hazard characteristics of samples and related waste.

The selection of a proper waste hauler is important. The laboratory is responsible for waste shipments and should expect proper documentation from the transporter for all shipments. The waste hauler should assist in properly completing the documentation for shipment, manifest, or bill of lading, and in outfitting the truck in accordance with the correct hazard class.

The selection of a proper TSDF is also important. The TSDF must forward a copy of the approved Part A or B permit (see Section 9.1.1) to the laboratory. The facility must be capable of completing the required disposal activities and associated requirements. Waste packed in a lab pack will be unpacked, checked against the manifest/bill of lading, and then placed into a disposal stream. When the waste is disposed of, the TSDF will issue a disposal certificate to the laboratory. The laboratory must maintain this documentation indefinitely.

Incineration

Waste is removed to a certified incinerator (typically in bulk shipping containers) and destroyed by burning. Each incinerator operator is certified to accept specific wastes in composition, quantity, and concentration. The laboratory will need to ensure proper disposal can be met and that the shipped material meets the requirements of the incinerator permit.

Land Disposal

Waste is removed to a certified landfill facility (typically in bulk shipping containers) and buried in a matrix system. Each landfill operator is certified to accept specific wastes in composition, quantity, and concentration. The laboratory will need to ensure proper disposal requirements can be met and that the shipped material meets the requirements of the landfill permit. Most hazardous wastes have been designated under RCRA's list of compounds that cannot be landfilled (i.e., the Land Disposal Restrictions [LDR] at 40 CFR Part 268) and cannot be buried.

Recycling

Wastes that meet specific requirements can be sent for recycling within the laboratory or off site. For example, some solvents can be purified and reused for sample extraction; mercury can be sent for recycling. This waste is then reclassified as hazardous material. This disposal option is not easily completed and often requires individual approval from permitting agencies.

Military Return

Wastes that are identified as military wastes or military explosives may need to be sent to a military facility for final disposal. The EPA Coordinator must provide additional information if this disposal option is required. Information is also provided by the EPA in the *Handbook on the Management of Munitions Response Action* (Section 10.2).

Storage

In some specific incidences, samples and sample wastes will be returned to the point of origin. This return will require interfacing with the EPA Coordinator.

5.0
Handling and Disposal of Samples and Analytical Waste Containing Radiological Hazards

Any activity that uses or produces radioactive materials generates radioactive waste. This waste can exist in gas, liquid, or solid form with varying levels of radioactivity, and can remain radioactive for a few hours, several months, or hundreds of thousands of years. The Nuclear Regulatory Commission (NRC) separates radioactive wastes into two broad classifications: high-level or low-level. High-level radioactive waste results primarily from the fuel used by reactors to produce electricity. Low-level radioactive waste (LLRW) is defined as any radioactive waste that does not belong in one of the following three categories: (1) high-level waste (spent nuclear fuel or the highly radioactive waste produced if spent fuel is reprocessed), (2) uranium milling residues, and (3) waste with greater than specified quantities of elements heavier than uranium (transuranics). Low-level waste includes items that have become contaminated with radioactive material or have become radioactive through exposure to neutron radiation. This waste typically consists of environmental samples containing radiological contamination, contaminated protective clothing, cleaning cloths, mops, filters, equipment, and tools. It is assumed that samples analyzed by laboratories supporting EPA remediation activities will not include high-level radiation, therefore, this document provides guidelines for handling samples containing low-level radioactive contamination and associated analytical waste. A radioactive sample is defined by NRC as either:

- Any sample with activity concentrations greater than the "Exemption Concentration" limits specified in 10 CFR 30.70, Schedule A
- Any sample containing a quantity of activity greater than the "Exempt Quantity" limits specified in 10 CFR 30.71, Schedule B

Laboratory samples containing radiation levels that are greater than background (i.e., ambient level of radioactivity occurring at a site or in the laboratory) must be treated as radioactive. Waste material containing licensable quantities of radioactivity (as indicated in the laboratory's radioactive materials license) must be disposed of in accordance with applicable federal and/or state regulations.

Regulations

Any person or laboratory possessing, using, storing, or transporting quantities of radioactive materials must have a radioactive materials license in accordance with applicable state and/or NRC regulations (http://www.nrc.gov/materials/miau/regs-guides-comm.html, contact number 1-800-368-5642, or 301-415-7000). Laboratories disposing of radioactive waste must have a Radiation Safety Officer on staff, as required by their radioactive materials license, with knowledge of all regulations concerning radioactivity. To obtain a license, laboratories must submit an application to NRC and/or the applicable state. This application must demonstrate how the handling of these materials will meet the safety requirements in NRC regulations found in 10 CFR Parts 19 - 21 and 30 - 39, or applicable state regulations. Guidelines for obtaining a state license can be found using the state Web site sources listed in Appendix B. Items typically addressed in a radioactive materials license include:

- Types and quantities of licensable radioactive materials
- Waste storage volume and time constraints
- Waste survey requirements
- Personnel monitoring requirements

Disposal of radioactive waste is a complex issue, not only because of the nature of the waste, but

also because of the complicated regulatory structure for managing it. There are a variety of stakeholders affected, and a number of regulatory entities involved. Government agencies involved in radioactive waste management include EPA, NRC, Department of Energy (DOE), DOT, states, and affected tribes. Responsibilities of government agencies in the management of radioactive waste include the following:

Nuclear Regulatory Commission (NRC)

The NRC has regulatory authority over storage and disposal of radiological wastes generated in the United States. Part 61 of the NRC regulations (10 CFR) sets forth the procedures, criteria, terms and conditions for licensing sites for land disposal of low-level waste. The requirements established under Part 61 also provide the basis for agreement with state regulations, since state rules must be compatible with NRC requirements. Additionally, 10 CFR 20.2002 is available for use by licensees for disposal of low-level wastes for which the extensive controls in Part 61 are not needed to ensure protection of public health and safety and the environment. Regulations require conformance with minimum acceptable criteria for waste management activities. NRC's regulations are found in 10 CFR Chapter I, which is divided into Parts 1 through 199. The following are the principal requirements governing the licensing of laboratory handling and use of nuclear materials:

- Part 19 - Notices, Instructions and Reports to Workers: Inspection and Investigations
- Part 20 - Standards for Protection Against Radiation
- Part 21 - Reporting of Defects and Noncompliance
- Part 30 - Rules of General Applicability to Domestic Licensing of Byproduct Material
- Part 32 - Specific Domestic Licenses to Manufacture or Transfer Certain Items Containing Byproduct Material
- Part 33 - Specific Domestic Licenses of Broad Scope for Byproduct Material
- Part 34 - Licenses for Industrial Radiography and Radiation Safety Requirements for Industrial Radiographic Operations
- Part 40 - Domestic Licensing of Source Material
- Part 70 - Domestic Licensing of Special Nuclear Material
- Part 71 - Packaging and Transportation of Radioactive Material
- Part 110 - Export and Import of Nuclear Equipment and Material
- Section 150.20 - Recognition of Agreement State Licenses [Reciprocity]

Additional NRC requirements at 10 CFR that are pertinent to laboratories disposing of radioactive waste include:

- Part 2 - Specifies the licensing process and requires an electronic record-keeping system to preserve data needed for licensing
- Section 20.2002 - General provision that allows for alternative disposal methods, provided that doses are maintained As Low As Reasonably Achievable (ALARA) and within the dose limits of Part 20
- Part 61 - Licensing requirements for land disposal of radioactive waste
- Part 62 - Criteria and procedures for emergency access to non-federal and regional low-level waste disposal facilities
- Part 74 - Establishes requirements for control and accounting of special nuclear material, including documentation of transfer of material

NRC also provides guidance to licensees and other stakeholders regarding transportation of packages containing radioactive material in its Standard Review Plan for Transportation Packages for Radioactive Material (NUREG-1609).

The U.S. Environmental Protection Agency (EPA)

Under Section 121(a) of the Nuclear Waste Policy Act (NWPA), EPA is required to promulgate generally applicable standards for protection of the environment from off-site releases of radioactive materials in repositories. The standards are intended to limit the amount of radioactivity entering the biosphere outside the boundaries of a facility and the radiation exposure to the public from management of waste prior to disposal, and provide criteria to be

followed for disposal of these wastes. These standards are found at 40 CFR Part 191 (Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes).

The Department of Transportation (DOT)

DOT regulates packaging and transport of all hazardous materials including nuclear waste. Packaging must meet NRC regulations, which are compatible with and generally derived from internationally developed standards (e.g., International Atomic Energy Agency, IAEA), and the package design must be reviewed and certified by NRC. DOT prescribes limits for external radiation levels and contamination, and controls the mechanical condition of carrier equipment and qualifications of carrier personnel. DOT regulations at 49 CFR 171 - 179 (Hazardous Materials Regulations) specify requirements for the transportation of radioactive materials.

Storage

Storage of low-level radioactive waste requires an NRC or agreement state license. NRC or agreement state regulations generally require that waste be stored in a manner that keeps radiation doses to workers and the public below NRC-specified levels. Licensees must further reduce these doses to levels that are ALARA. Actual doses, in most cases, are a small fraction of the NRC limits.

Waste Containers

Low-level radioactive waste is packaged in containers appropriate to its level of hazard. Some low-level radioactive wastes require shielding with lead, concrete, or other materials to protect workers and the public. Laboratory staff must be trained to maintain a safe distance from more highly radioactive materials, to limit the amount of time near the materials, and to monitor the waste to detect any releases. Radioactive waste storage areas are posted to identify the waste so that workers and the public will not inadvertently enter the area. Low-level waste may be stored to allow short-lived radionuclides to decay to innocuous levels and to provide safe-keeping when access to disposal sites is not available. The NRC believes storage can be safe over the short term as an interim measure, but favors disposal rather than storage over the long term. Waste must be stored in an appropriate container (e.g., 55-gallon drum, carboy, or DOT-approved B-12, B-25, or B-52 container) that complies with the laboratory's radioactive materials license.

In addition to DOT requirements summarized in Section 3.4.7, radiological waste containers must be labeled in accordance with requirements at 10 CFR Part 61.

Storage Areas

According to NRC regulations at 10 CFR 20.1801 and 1802, all samples containing radioactive contamination and all licensed material possessed by the laboratory must be stored in a designated storage location that is secure from unauthorized access or removal. The storage location must, at a minimum, be posted as described in Section 5.2.3. General storage requirements include:

- Waste containing gamma exposure rates > 5,000 μR/hr or with individual radioisotope activity levels > 1 μCi/gram must be segregated from waste with lesser gamma exposure rates (≤ 5,000 μR/hr or activity levels ≤ 1 μCi/gram), and must be stored in an area posted or otherwise identified for "High Activity Sample Storage."
- Radioactive and mixed wastes awaiting disposal must be segregated from non-radioactive process wastes. Liquid waste must be stored in closed containers.
- The total used volume of these containers must not exceed 55 gallons.

Time constraints for storing radioactive waste are contained in the laboratory's radioactive material license, which generally contain language similar to the following: Waste generated during sample preparation, analysis, and cleanup operations containing licensable quantities of radioactive material shall be returned to the client submitting the sample as soon as practicable, or shall be shipped to a licensed disposal facility. Waste material containing licensable quantities of radioactive material, which is to be shipped to a disposal facility, must be stored in closed containers. The activity of waste material awaiting shipment shall not exceed 100 mCi per single radionuclide

(mass number 3 through 247) or a total of 2,000 mCi for all radionuclides combined.

Storage Area Posting Requirements

Areas of radioactive material handling and contamination must be posted with appropriate caution signs in accordance with 10 CFR 20.1902 and 10 CFR 20.1904. The signs must bear the conventional radiation colors (magenta, purple, or black on a yellow background) and the three-blade tri-foil design, and postings must be the size and quantity needed to properly alert personnel of the radiological hazards. All radiological postings must be conspicuously posted so that personnel engaged in work activities in the area can readily view them. When possible, the size of the posted area will be limited to the immediate area of concern, rather than posting large non-specific areas, to provide more specific worker guidelines while limiting the chance of causing undue worker or public alarm. Table 5-1 provides a summary of area posting requirements. The following exceptions may apply to the requirements listed in Table 5-1:

- Caution signs are not required in areas or rooms containing sources of radiation for periods of less than eight hours if each of the following conditions is met:
  - sources of radiation are constantly attended by an individual who takes precautions to prevent exposure of individuals to radiation in excess of the limits established in 10 CFR Part 20
  - the area or room is under the control of the laboratory
- A room or area containing a sealed source is not required to be posted with a caution sign provided that the radiation level at 30 centimeters from the surface of the sealed source container or housing does not exceed 5 mrem per hour.

Table 3: Posting Requirements for Storage of Radioactive Samples and Waste

Area	Area Posting Requirements
Restricted Area	A Restricted Area is defined as "any area, access to which is controlled by the licensee for the purpose of protection of individuals from exposure to radiation and radioactive materials." The immediate area in which radiological activities are taking place (i.e., areas where contaminated land is being remediated or where decontamination is taking place) shall be considered Restricted Areas. The maximum dose rate allowed at the boundary of a restricted area is 2 millirem per hour (mrem/hr), or an exposure rate that could result in more than 100 millirem per year (mrem/yr), whichever is more restrictive.
Radiation Area	Areas, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 5 mrem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates, or in any 5 consecutive days a dose in excess of 100 mrem, shall be posted "Caution: Radiation Area."
High Radiation Areas	Areas accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 100 mrem in 1 hour at 30 centimeters from the source or 30 centimeters from any surface that the radiation penetrates shall be posted “Caution: High Radiation Area.”
Very High Radiation Areas	Areas, accessible to individuals, in which radiation levels could result in an individual receiving an absorbed dose in excess of 5 mR in 1 hour at 1 meter from a source of radiation or from any surface that radiation penetrates shall be posted “Grave Danger: Very High Radiation Area.”
Airborne Radioactive Materials	An area, room, or enclosure shall be posted “Caution: Airborne Radioactive Materials” when airborne radioactive materials exist in concentrations that are either: in excess of the derived air concentrations (DACs) specified in 10 CFR Part 20, Appendix A, Table I to such a degree that an individual without respiratory protective equipment could exceed, during the hours an individual is present in a week, an intake of 0.6 percent of the annual limit on intake (ALI) or 12 DAC-hours
Radioactive Materials Areas	Each area or room in which there is used or stored an amount of licensed or registered source of radiation exceeding 10 times the quantity of such source of radiation specified in 10 CFR Part 20, Appendix B shall be posted with a conspicuous sign or signs bearing the radiation symbol and the words “Caution: Radioactive Material(s).”
Hot Particle Areas	Each area, room, or enclosure which contains hot particles shall be posted with a conspicuous sign or signs bearing the radiation symbol and the words “Caution: Hot Particles” or “Caution: Hot Particle Area.”
Temporary Storage Areas	In the event the laboratory designates an area as a temporary "Radioactive Material Storage Area," the storage area shall be posted with a conspicuous sign or signs bearing the radiation symbol and, at a minimum, the words "Caution: Radioactive Materials, Restricted Area."

Monitoring and Documentation

Radioactive waste storage areas must be surveyed and personnel monitored in accordance with the laboratory’s radioactive material license which must specify requirements for surveys, personnel monitoring, and storage of radioactive material.

An inventory of analytical sources and radioactive tracers must be performed in accordance with the laboratory’s radioactive

material license, at least semi-annually, and a written inventory must be maintained. A written inventory also must be maintained of all radioactive samples received by the laboratory for analysis. This inventory must, at a minimum, include the following information:

- Date of sample receipt
- Sample origin
- Date samples returned to sample owner or shipped for disposal

Inventory records of analytical source standards, tracers, and samples received must be maintained by the laboratory for a minimum of three years.

Treatment

Both radioactive and mixed waste may require treatment to meet one or more objectives prior to final disposal (see Section 7 regarding mixed waste). Treatment involves physical or chemical processes that result in a waste form that is acceptable for disposal or further treatment. Treatment objectives include: (1) producing a waste form acceptable for land disposal; (2) volume/mobility reduction through possible solidification or sizing; (3) producing a waste more amenable for further treatment; or (4) separating radioactive components from RCRA or TSCA components. Another treatment objective is to convert a radioactive RCRA regulated waste to a radioactive non-RCRA waste. Laboratory management should determine if special permits or licenses are required from various regulatory agencies prior to the treatment of waste.

Radioactive wastes may require treatment to meet the waste characteristics provided in 10 CFR 61.56 prior to disposal. The following types of treatment may be used to meet those requirements:

- Non-solid radioactive waste may be treated with various solidification agents (such as cement, asphalt, or polymers) to immobilize waste or sludge not otherwise acceptable for disposal. Low-level radioactive waste may be absorbed onto a porous material, such as silica, vermiculite, or organic materials to reduce the liquid volume.
- Dry radioactive waste may be treated with compaction or super-compaction to reduce the waste volume.
- Glassware, disposable laboratory equipment, and other radioactive waste may be decontaminated for unrestricted release by removal of surface radioactivity through chemical (e.g., weak nitric acid rinse) or physical means. The residue from the decontamination of a surface may require disposal as a radioactive waste.
- Since the level of radioactivity decreases with time, it may be possible to store samples or materials containing a short-lived radionuclide (e.g., Se-75, Ru-103, Ru-106, Ir-192, Po-210) until the natural-decay process reduces the radioactivity to a level at which the waste can be considered non-radioactive for waste management purposes.

Packaging

Packaging of low-level radioactive waste for disposal must be in accordance with 10 CFR 20.2006(d) requirements. Each container of low level radioactive waste must be clearly labeled to identify whether it is Class A, Class B, or Class C, as defined at 10 CFR 61.55. Containers must be labeled in accordance with requirements at 10 CFR Part 71 and 49 CFR Part 172. The following minimum requirements for all classes of low-level radioactive waste are intended to facilitate handling and provide protection of health and safety of personnel at a disposal site:

- Wastes must be packaged in conformance with the conditions of the disposal site license. Where conditions of the laboratory license are more restrictive than the disposal site license, the laboratory license conditions must be followed.
- Wastes must not be packaged for disposal in cardboard or fiberboard boxes.
- Liquid waste must be packaged in sufficient absorbent material to absorb twice the volume of the liquid.
- Solid waste containing liquid must contain as little free-standing and non-corrosive liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume.
- Waste shall not be readily capable of detonation or of explosive decomposition or reaction at normal pressures and temperatures, or of explosive reactions with water.
- Waste shall not contain, or be capable of

generating, quantities of toxic gases, vapors, or fumes harmful to persons transporting, handling, or disposing of the waste.

- Waste must not be pyrophoric.
- Waste in a gaseous form shall be packaged at an absolute pressure that does not exceed 1.5 atmospheres at 20 ºC. Total activity shall not exceed 3.7 TBq (100 Ci) per container.
- Wastes containing hazardous, biological, pathogenic, or infectious material shall be treated to reduce, to the maximum extent practicable, the potential hazard from the non-radiological materials.
- Package must be sufficiently stable to ensure that the waste does not degrade and affect overall stability of the disposal site through slumping, collapse, or other failure and thereby lead to water infiltration. The following requirements should be followed to provide stability of the waste at the disposal site:
    - Waste packaging must have structural stability, allowing it to maintain its physical dimensions and its form, under the expected disposal conditions such as weight of overburden and compaction equipment, the presence of moisture, microbial activity, and internal factors such as radiation effects and chemical changes. Structural stability can be provided by the waste form itself, processing the waste to a stable form, or placing the waste in a disposal container or structure that provides stability after disposal.
    - Wastes containing liquid should be converted to a form that contains as little freestanding liquid as is reasonably achievable, but in no case shall the liquid exceed one percent of the volume of the waste when the waste is in a disposal container designed to ensure stability, or 0.5 percent of the volume of the waste for waste processed to a stable form.
    - Void spaces within the waste and between the waste and its package should be reduced to the extent practicable.

Disposal

Disposal of radioactive wastes generated by the laboratory is regulated by the NRC, regulating state, and/or other agreement state. Records of all waste disposed of must be maintained in accordance with 10 CFR 20.2108 until termination of the laboratory's license.

Sample and analytical waste generated during sample preparation, analysis, and cleanup operations containing licensable quantities of radioactive material must either be returned to the client submitting the sample (or site of sample origination) as soon as practicable, or shipped to a licensed disposal facility. Wastes containing licensable quantities of radioactive material, which is to be shipped to a disposal facility, must be stored in closed containers. The requirements of Waste Disposal (10 CFR Part 20, Subpart K) must be followed, when applicable, when solid waste material cannot be returned to a client and must be disposed. A sample of all liquid waste must be taken and analyzed for radioactive contents and activity prior to disposal. In general:

- Radioactive Solid Waste - Radioactive solid waste shall be disposed at a facility licensed by the regulatory state for such disposal, another agreement state, or the NRC.
- Radioactive Liquid Waste - Certain water-soluble liquid wastes may be disposed of by release into sanitary sewage systems in accordance with the laboratory's radioactive material license. Sewage disposal is commonly used for low-level radioactive liquid waste (usually in the form of pH-neutralized waste) as long as it is readily soluble in water and meets requirements and limits set forth in 10 CFR 20.2003.

6.0
Handling and Disposal of Samples and Analytical Waste Containing Biological Hazards

Microorganisms are a natural part of the environment and are found in soil, water, air, and on plants and animals. Most organisms are harmless or may be beneficial to humans or the environment; however, some microorganisms can cause disease (pathogens) and their dissemination in the environment and disease transmission to human and animal populations must be either reduced or eliminated. Samples and waste containing pathogenic microorganisms require treatment either with chemicals such as bleach, or use of non-chemical procedures such as autoclaving or ultraviolet radiation, to render them non-infectious prior to disposal.

EPA's Standardized Analytical Methods for Environmental Restoration Following Homeland Security Events, (SAM) recognizes the following categories of pathogens for remediation:

- Bacteria – (1 – 10 µm) single cells lacking complex internal structures (prokaryotes)
- Viruses – (0.005 – 0.300 µm) particles incapable of replicating except within a host cell
- Protozoa – (1 – 300 µm) single cells with complex internal structures (eukaryotes)
- Helminths – parasitic worms (20 µm – greater than 50 mm)

Some microorganisms produce metabolic products (biotoxins) that can cause disease even if the microorganism is not present or is no longer viable (e.g., botulinum neurotoxin). Biotoxins also can be produced by plants (e.g., ricin from castor beans) as well as animals (α-conotoxin from snails). Biotoxins can be proteins that are readily destroyed by addition of bleach, or they can be small molecules that may require an extreme treatment such as incineration.

Procedures and regulations for handling and disposal of environmental samples containing these biological contaminants and the associated analytical waste are similar to those for infectious or biomedical waste and are summarized in this section.

Regulations

In 1988, Congress passed the Medical Waste Tracking Act of 1988, which resulted in Standards for the Tracking and Management of Medical Waste (40 CFR 22 and 259) and was in effect for two years. At its expiration, individual states and localities implemented a variety of similar rules and regulations applying to non-household-generated (e.g., laboratory and hospital) biomedical waste. Currently, there are no federal biomedical waste tracking and management regulations in effect. As state and local requirements vary considerably, laboratories must consult individual agencies governing their locality. A list of the agencies governing medical and biological waste disposal for each state and supporting documents can be found in Appendix C and at: http://www.epa.gov/osw/nonhaz/industrial/medical/programs.htm. In addition to the regulations summarized in Section 3.4, the regulations summarized below must be considered by laboratories generating biological waste.

- Employee safety while handling and disposing of biological samples is addressed under OSHA regulations 29 CFR 1910. These regulations include general hazardous materials sections on employee training (29 CFR 1910.1200(h)), written hazard communication (29 CFR 1910.1200(e)), and MSDS requirements (29 CFR 1910.1200(g)). The Bloodborne Pathogens regulations (29 CFR 1910.1030) are specific for exposure to blood or other potentially infectious materials containing pathogens and do not apply to environmental samples.
- While medical and biological waste is not regulated under current federal RCRA regulations, there are federal requirements

for incineration of medical waste under the Clean Air Act (CAA Sections 129 and 130). Incineration is the method of choice for large amounts of infectious waste, and incinerator operators must comply with EPA standards for clean air and emissions. If chemicals or pesticides are used in the treatment of medical waste, the appropriate Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulations must be followed. Section 18 of FIFRA provides procedures and authorizes the Administrator to exempt state and federal agencies from provisions of the Act if it is determined that emergency conditions exist that require an exemption.

- 42 CFR Parts 72 and 73 describe the possession, use, transfer, and disposal of select agents and toxins (Section 10.4; Richmond, 2002). Select agent pathogens are handled and disposed of under BSL-2, BSL-3, or BSL-4 conditions (Section 10.4; National Committee on Clinical Laboratory Standards, 2002 and Richmond, 2002). Clinical or diagnostic laboratories that possess, use, or transfer a select agent or toxin that is contained in a specimen presented for diagnosis or verification will be exempt from the requirements of this part provided that within seven calendar days after identification, the select agent or toxin is transferred in accordance with Part 73.16 or destroyed on-site by a recognized sterilization or inactivation process. If exempted, the identified select agent or toxin is reported to the U.S. Centers for Disease Control and Prevention (CDC) or other appropriate agencies using Animal and Plan Health Inspection Service (APHIS)/CDC Form 4 within seven calendar days after identification and a copy of the form maintained for three years. Under extraordinary circumstances, such as a widespread outbreak, less stringent reporting may be required. Laboratories performing regular testing and using control stocks containing a select agent or toxin must conform to all regulations for select agents. These regulations should be consulted for the proper accounting and record keeping requirements. The following select agent pathogens are listed in SAM, Revision 5.0 (September 2009):
  - *Bacillus anthracis*
  - *Brucella* spp.
  - *Burkholderia mallei*
  - *Burkholderia pseudomallei*
  - *Coxiella burnetii*
  - *Francisella tularensis*
  - *Yersinia pestis*

Biotoxins are regulated as select agents only if the aggregate amount of the biotoxin exceeds a threshold level. Select agent toxins are handled and disposed of under BSL-2 or BSL-3 conditions (Section 10.4, Richmond, 2002). The following select agent biotoxins (with the regulated threshold in parenthesis) are listed in SAM, Revision 5.0:

- Abrin (100 mg)
- Botulinum neurotoxins (0.5 mg)
- Conotoxins (100 mg)
- Diacetoxyscirpenol (1000 mg)
- Ricin (100 mg)
- Saxitoxin (100 mg)
- Shiga and Shiga-like toxins (100 mg)
- Staphylococcal enterotoxins (5 mg)
- Tetrodotoxin (100 mg)
- T-2 toxin (1000 mg)

Storage

Prior to storage, samples and associated waste must be clearly identified and segregated by placement in leakproof bags or containers. Disposable, puncture-resistant cardboard containers and leakproof bags are commercially available, as well as reusable plastic and metal pans. Many states require that biological waste have a primary and secondary container (e.g., either a bag within a box, or double-bagged). Biological waste storage facilities or areas must have appropriate state and local permits, and must be fully enclosed, secured to prevent entry of unauthorized persons, not used for other purposes, and operated in such a manner as to minimize odor and entry by rodents and insect vectors. These areas must be conspicuously identified with signs containing the International Biological Hazard Symbol or phrases such as "Infectious Waste" or "Bio-Hazard." Waste storage containers must be handled in a manner that does not affect the integrity of the packaging. Containers or packaging must remain intact without signs of leakage. Damaged or leaking containers may be packed into appropriately labeled and constructed containers. Waste held for more than seven days must be maintained at temperatures below 10

°C. Records should contain the name and location of the waste generator, quantity of waste generated, date accepted, contact person for waste, and quantity removed.

Containerized treated solid waste can be mixed with other solid waste for storage prior to transport and disposal. Relevant health department requirements must be met for solid waste storage.

Note: Laboratory waste containing select agents must be handled separately from other biological wastes; storage of select agent samples and waste must comply with requirements at 42 CFR Parts 72 and 73 (see Section 5.2.4 and Reference 9.3.7).

Treatment

Laboratories can reach waste decontamination objectives by selecting acceptable treatment techniques and applying them diligently. Prior to decontamination, samples and associated waste (e.g., glassware or disposable equipment such as micro-pipette tips) must be clearly identified and segregated by placement in leakproof bags or containers. Disposable, puncture-resistant cardboard containers and leakproof bags are commercially available, as well as reusable plastic and metal pans. If samples are not decontaminated within 48 hours, consideration must be given to storage in appropriate containers at reduced temperatures (i.e., below 10ºC). Decontaminated disposable materials can be disposed of along with associated solid hazardous waste; decontaminated re-useable equipment can be cleaned as required for its intended used. Information regarding the effectiveness of procedures for decontamination of laboratory waste containing specific pathogens and biotoxins (i.e., listed in SAM, Revision 5.0) is provided in Tables 6-1 and 6-2 below.

Pathogens and Protein Biotoxins

Sterilization and inactivation techniques and their applicability to various pathogens, protein biotoxins, and equipment (Section 10.4) are provided in Table 6-1.

Table 4: Comparison of Decontamination Procedures

Parameter	Autoclave 15 lb/in^2	Dry-heat Oven	Incinerator	UV	Chlorine Compound	Phenolic Compound	Alcohol
Contact Time (min)	50–90	180–240	1≥60	10–30	10–30	10–30	10–30
Liquids	+	–	–	–	–	+	–
Infectious Waste	+	–	+	–	–	+	–
Glassware	+	+	–	–	+	+	–
Instruments	±	+	–	–	+	+	–
Vegetative Bacteria	+	+	+	+	+	+	+
Bacterial Spores	+	+	+	–	±	–	–
Hydrophilic Viruses	+	+	+	±	+	±	±
Lipid Viruses	+	+	+	–	+	+	+
Protein Toxins	+	+	+	–	+	+	–

\+ *Effective treatment*

± *Somewhat effective treatment*

– Non-effective or not applicable treatment

Non-Protein Biotoxins

Decontamination parameters for non-protein biotoxins are provided in Table 6-2. Do not use steam sterilization (autoclave) for destruction of non-protein biotoxins. Unless otherwise stated, contact time for chemical inactivation is 30 minutes. Some non-protein biotoxins are extremely resistant to inactivation and should be treated only by incineration (Section 10.3).

Table 5: Comparison of Decontamination Procedures for Non-protein Biotoxins

Parameter	Incinerator	2.5% NaOCl with 0.25 N NaOH	2.5% NaOCl	1% NaOCl
Aflatoxin	+	+	+	/
A-Amanitin	+	/	+	+
Anatoxin	+	–	–	–
Brevetoxin	+	+	+	+
Cylindrospermopsin	+	/	+	+
Diacetoxyscirpenol	+	+	+ (at 3 – 5% NaOCl)	–
Microcystins	+	+	+	+
Picrotoxin	+	–	–	–
Saxitoxin	+	+	+	+
T-2 Mycotoxin	+	+ (4 hr)	–	–
Tetrodotoxin	+	+	+	+

+ Effective treatment
– Non-effective or not applicable treatment
/ Treatment results unknown

Non-Chemical Treatment

- **Steam sterilization** – All laboratories handling moderate- to high-risk agents (BSL-3 and BSL-4) must have a steam autoclave within the restricted area. For low-risk agents (BSL-2), an autoclave must be available, preferably on the same floor and in the general vicinity of the laboratory. The processing time will depend upon loading factors such as the type of autoclave pan (metal versus polypropylene), the use of autoclavable waste bags, the amount of water in the waste, and the weight of the waste load. The moisture content of saturated steam at 121 °C – 132 °C is responsible for the rapid destruction of microbes. Thus, if sufficient water is not present, water should be added. Steam sterilizers must be equipped to continuously monitor and record temperature and pressure. Alternative methods of evaluating effectiveness, such as temperature-sensitive tape affixed to each container, may be used. Sterilizers must be periodically evaluated for effectiveness.
- **Dry heat** – Dry-heat ovens are used for glassware, instruments, and anhydrous materials such as oils, greases, and powders, as the moisture component of saturated steam will not adequately penetrate anhydrous materials and closed containers. Temperatures of 160 °C – 180 °C can be selected. Contact time of 180 – 240 minutes takes into account the lag time for certain materials to reach the temperature in the oven and may or may not be applicable to all situations. Good examples of the times required to decontaminate various materials are presented in Rutala, 1982 (Section 10.4).
- **Incineration** – Incineration is the method of choice for large amounts of infectious waste. Non-protein toxins that are resistant to other methods of decontamination can be disposed of by incineration. Difficulty in building, running, and meeting regulatory guidelines for incinerators prevents many laboratories from using this method for disposal. Where available, however, samples and waste can

be outsourced to commercial facilities with approved incinerators. Section 6.4.2 describes the storage conditions, containers, and labeling of untreated waste prior to pickup by the waste transport facility.

- **Ultraviolet radiation** – Germicidal ultraviolet (UV) radiation at 253.7 nm is effective against most vegetative cell microbes and some bacterial spores, but has limited penetrating power. It is thus used primarily with unprotected microbes on exposed surfaces or in the air. Germicidal UV will not penetrate accumulated organic material, opaque liquids, packaging material, soil, dust, or other solids. The intensity, or destructive power, of the lamp decreases by the square of the distance from the lamp; thus, effectiveness is related to exposure time and distance from the UV source. The intensity of the lamp will also decrease with time and should be checked yearly with a UV meter. The intensity of the lamp also is drastically affected by the accumulation of dust and dirt, and the surface of the lamp should be wiped weekly with alcohol. UV lights are not intended to replace routine decontamination processes for the interior of a biosafety cabinet and must be used in conjunction with established disinfection procedures. This restriction is especially important to note when working with unknown and/or possibly resistant microorganisms such as spores. Due to the short time for UV overexposure (e.g., 1.3 – 6.7 minutes at the face of a biological safety cabinet), it is recommended that neither laboratory nor maintenance personnel work in a room with UV lighting.

Chemical Treatment

- **Chlorine compounds** – Inexpensive treatments can be made from commercial products such as Clorox® (NaOCl, 5% or 52,500 ppm Cl_2). Non-protein biotoxins are more readily inactivated by the addition of NaOH (final concentration 0.25 N) to the chlorine solution. These compounds are quickly inactivated by organic matter, work best at pH 6.0 – 8.0, and perform most rapidly at higher temperatures. Chlorine solutions are skin irritants and corrosive to metal. Hence, these solutions should be used with caution and in well-ventilated areas.
- **Phenolic and phenolic-detergent based compounds** – These compounds have a broad microbicidal spectrum and are less affected by organic matter than are other chemical treatments. However, phenolic and phenolic-detergent based compounds can corrode some plastics and very high concentrations are needed to inactivate hydrophilic viruses. Commercially available products include Lysol® and Pine-Sol®.
- **Alcohol** – Ethyl or isopropyl alcohol (70 – 85%) is used to disinfect contaminated surfaces. Paper towels and wipes that have been used to apply and remove alcohol solutions should be decontaminated prior to disposal. As alcohol is combustible, make sure that the alcohol has evaporated if a heat treatment is used for decontaminating used towels and wipes. Alcohols are ineffective against spores, hydrophilic viruses, parasite cysts and ova, and toxins.
- **Other compounds** – Various other chemicals also are available and used for decontamination. Quaternary ammonium compounds (Roccal®, or equivalent) are odorless and non-irritating, but some formulations are inactivated by soap and soap residues. Glutaraldehyde is used as a 2% solution for re-usable instruments that cannot be autoclaved. Glutaraldehyde has been implicated as an occupational hazard due to sensitivity problems in workers using it as a high-level disinfectant. Iodine compounds are available as iodophors, which are combinations of elemental iodine and a substance that makes the iodine soluble in water. Iodine compounds are effective against many microbes, but do not work well in the presence of organic material and can stain clothing and surfaces. Bromine also is a known biocide and can be used for disinfection, sometimes as a substitute for chlorine. Stabilized bromine biocide is used for industrial water treatment to control microbiological activity. Chlorine dioxide is often used to decontaminate medical waste. Ozone has been used for treatment of both sludge and water.

Packaging

During and following analytical procedures in the laboratory, analytical solid waste and residual samples are accumulated in red leakproof bags with identifying markings such as "Bio-Hazard." Markings must be indelible and permanent. Many states require that biological wastes have a primary and secondary container such as a second bag (double-bagging), or a labeled, puncture-resistant cardboard container. Containers holding sharp objects must also be rigid and puncture-resistant. Liquid waste is accumulated in leakproof plastic, metal, or glass containers. Waste can either be decontaminated on-site or transported off-site for treatment. Disposal is the same whether the material has been treated on- or off-site. Select agents must be handled separately from other biological wastes, and handling procedures must comply with requirements at 42 CFR 72 and 73.

Preparation of Treated Waste for Off-site Disposal

Treated waste can be mixed with other solid waste for landfilling. Decontaminated biological waste containing free liquids that would prevent blade mixing at the disposal facility must be further processed to eliminate the liquids. Treated waste containers that have identifying phrases such as "Infectious Waste" or "Bio-Hazard," are red in color, or display the International Biological Hazard Symbol, must be processed by grinding, incineration, or other method to remove such markings.

Preparation of Untreated Waste for Off-site Treatment and Disposal

Small containers may be combined and placed inside larger containers as long as the identifiable markings are repeated on the exterior of the larger container. The outermost packaging must have the International Biological Hazard Symbol and an identifying phrase such as "Infectious Waste" or "Bio-Hazard," the date of packaging, and the name and address of the packager.

Single-use containers must be burnable if destined for incineration. Multiple-use containers must be smooth, cleanable, and resistant to corrosion. After pickup, emptied containers must be cleaned at a site next to the pickup area with a disinfectant-detergent, such as a phenolic or iodophor compound, followed by steam, if compatible.

Disposal

Waste disposal regulations vary from locality to locality, and laboratories must understand the applicable state and local requirements for proper disposal (Appendix C). Common procedures for disposal of treated and untreated waste are described in Sections 6.5.1 and 6.5.2, respectively.

Treated Waste

- **Transportation** – Decontaminated biological waste may be transported with other solid waste. State or local regulations may require that written certification (stating that the waste has been rendered non-infectious or inactivated) be given to the transporter on a per load, annual, or other basis.
- **Disposal** – Solid waste can be disposed of either by incineration or by landfilling. As with transportation, state or local regulations may require written certification that the waste has been rendered non-infectious or inactivated. Most sewer authorities allow appropriately treated biological wastes resulting in water-soluble liquids to be disposed of in the sanitary sewer system, with the permission of the system authorities.

Untreated Waste

- **Transportation** – Untreated biological waste must not be transported with solid waste, and must be transported to an approved storage or disposal facility. Vehicles must be enclosed to prevent escape of waste into the environment, with notification of authorities if a spill occurs. Transport vehicle surfaces must be capable of being easily cleaned and decontaminated if they come in contact with untreated waste. The vehicle must be identified with the name of the transporter, name and telephone number of a contact person, and the International Biological Hazard Symbol and/or phrase such as "Infectious Waste." Transport personnel must wear impermeable gloves and protective clothing. Transporters also must have the appropriate state and local permits and maintain applicable

records. If waste is shipped to a disposal facility, shipping regulations must be followed. Select agents must be handled separately from other biological waste, and handling procedures must comply with requirements at 42 CFR Parts 72 and 73.

Disposal – Untreated biological waste must be treated before disposal. Biological waste not treated at the point of generation can be treated by incineration or steam sterilization at an off-site facility. After incineration, all combustible waste must be reduced to ash and non-combustible waste such as metal must be processed by grinding or shredding to render the waste unrecognizable as biological waste. If steam sterilization is used, similar additional processing also may be required to render the waste unrecognizable as biological waste. After treatment, incineration ash or treated waste may be disposed of in a landfill

7.0
Handling and Disposal of Samples and Analytical Waste Containing Mixed Hazards

Multi-hazardous waste is waste that contains two or more of the following: radioactive, infectious agent(s), or hazardous chemical(s). Mixed waste is one type of multi-hazardous waste, and contains both a chemical component (regulated by the EPA as a hazardous waste) and radioactive material (regulated by the NRC). Mixed transuranic waste (MTRU) is waste that has a hazardous component and contains radioactive elements that are heavier than uranium. The radioactivity in the MTRU must be greater than 100 nCi/g, and the waste must include RCRA hazardous constituents. These wastes typically are classified according to the highest applicable hazard type, which are listed below in descending order of hazard:

- Radioactive materials, other than limited quantities (Class 7)
- Poisonous gases (Class 2, Division 3)
- Flammable gases (Class 2, Division 1)
- Nonflammable gases (Class 2, Division 2)
- Poisonous liquids (Division 6.1, Packing Group I, poisonous-by-inhalation only)
- Waste meeting the definition of a pyrophoric material in § 173.124(b)(1) (Class 4, Division 2, Packing Group 1, liquids only)
- Waste meeting the definition of a self-reactive material in § 173.124(a)(2) (Class 4, Division 1)
- Flammable liquids (Class 3), corrosive materials (Class 8), flammable solids (Class 4, Division 1), spontaneously combustible materials (Class 4, Division 2), dangerous materials when wet (Class 4, Division 3), oxidizers (Class 5, Division 1) or poisonous liquids or solids other than Packing Group I, poisonous-by-inhalation (Class 6, Division 1). The hazard class and packing group for a material meeting more than one of these hazards is determined using the precedence table in 49 CFR 173.2.
- Combustible liquids
- Class 9 (miscellaneous hazardous materials)

The NRC and DOE regulate the radioactive portion of mixed waste under Atomic Energy Act (AEA) authority, while EPA regulates the hazardous waste portion of mixed waste under RCRA authority. Therefore, all AEA and RCRA requirements for waste generation, storage, and disposal must be met for each sample or waste defined as a "mixed waste." In cases where this waste contains chemical warfare agents, laboratories must contact the EPA Coordinator for instructions.

Multi-hazardous Samples and Wastes

Multi-hazardous waste typically contains two or more RCRA contaminants and/or infectious agents and is regulated as a hazardous waste based on the higher applicable hazard class listed above. EPA regulates multi-hazardous wastes under RCRA requirements for generation, storage, and disposal for each waste component.

Handling

Samples and analytical materials designated as multi-hazardous waste must be handled as a RCRA-contaminated waste and handling procedures must follow requirements noted in Section 4 for each waste component. Each compound contained in the waste must be documented, and special notice must be made if the two (or more) chemical compounds are incompatible or if degradation products can increase the hazard or instability of the waste. This waste must be treated only with careful consideration of the impact on all components of the waste, including potential byproducts. Procedures for handling this type of waste must be included in the laboratory's Waste Management Plan. Recommended general practices include:

- If possible, generation of multi-hazardous wastes should be avoided; disposal can be difficult and expensive.
- If generation cannot be avoided, minimize volumes generated.
- If multi-hazardous waste contains an infectious agent(s), inactivation of the agent may be possible with proper consideration of other hazardous components of the waste.
- Segregate the waste as much as possible, for example: liquid from solid waste; non-water soluble waste from aqueous waste; by isotope half-life: short (≤ 120 days) or long (> 120 days); oxidizers from organic compounds, flammable, combustible, and reducing agents (e.g., zinc, alkaline metals).

Disposal

Multi-hazardous waste is disposed of using technologies that are compatible with the destruction or containment of all contaminants without increasing the hazard of the waste. Some multi-hazardous wastes may require multiple steps or increased environmental monitoring for complete disposal. Table 7-1 presents information provided by the National Institutes of Health (NIH) for disposal of multi-hazardous waste (http://orf.od.nih.gov/Environmental+Protection/Waste+Disposal/multiwaste.htm).

Table 6: Guidelines for Disposal of Multi-hazardous Laboratory Wastes

Waste Description	Disposal Method	
Hazardous chemical(s) and Radioactive material	"Mixed Waste" Use the smallest non-glass container possible. Complete and attach to container a: ·Chemical waste label ·Radioactive Waste Pickup Receipt ·Radioactive material label	
Infectious agent(s) and Hazardous chemical(s) and Radioactive material	Infectious agent inactivated	"Mixed Waste" Use the smallest non-glass container possible. Complete and attach to container a: ·Chemical waste label ·Radioactive Waste Pickup Receipt Radioactive material label.
	Infectious agent not inactivated	Contact regulatory authority.
Infectious agent(s) and Hazardous chemical(s)	Infectious agent not inactivated	Contact regulatory authority.
	Infectious agent inactivated	Treat as chemical waste. Follow chemical waste procedures.
Infectious agent(s) and Radioactive material	Infectious agent inactivated	Treat as radioactive waste. Follow radioactive waste procedures.
	Infectious agent not inactivated	Treat as radioactive biological waste. Follow radioactive biological waste disposal procedures included in Waste Management Plan.

Mixed Waste Samples and Waste

Mixed waste is composed of radioactive waste defined under the AEA and hazardous waste as defined under RCRA. As a result, treatment and regulation of these wastes is complex. In general, the requirements of RCRA and AEA are consistent and compatible. However, in cases where requirements of the two acts are found to be inconsistent, the AEA takes precedence. Laboratories should contact the NRC to develop the information that should be included in a plan to store mixed waste.

EPA's Mixed Waste Rule, finalized on May 16, 2001, provides increased flexibility to generators

and facilities that manage low-level mixed waste (LLMW) and technologically-enhanced, naturally-occurring, and/or accelerator-produced radioactive material (NARM) containing hazardous waste. LLMW is exempt from some RCRA storage and treatment regulations, and LLMW or eligible NARM are exempt from RCRA hazardous waste transportation and disposal regulations. These wastes are exempt from RCRA Subtitle C requirements, including permitting, provided they meet specific conditions (e.g., see U.S. Army Corps of Engineers (ACE) Compliance Fact Sheets at: http://www.environmental.usace.army.mil/complyfs.htm). The exempt wastes must then be managed as radioactive waste in accordance with NRC or NRC agreement state regulations.

Regulations

To remain in compliance with regulatory requirements for mixed-waste storage, the laboratory may need to obtain an EPA (or authorized state) storage permit and/or amend their NRC (or agreement state) license. Examples of instances where an NRC license amendment may be needed include:

- If the total activity of the radioactive material at the facility (in use, in storage, or in waste) would exceed the activity authorized by the facility license
- If the laboratory intends to store the waste in a portion of the facility not authorized by the license
- If the chemical or physical form of the waste is not authorized by the license
- If the storage program is not specifically included within the scope of the authorization

If a laboratory is required to amend its radioactive materials license, NRC will require the laboratory to provide sufficient information to evaluate the request and determine if the proposed amendment impacts the level of protection afforded by the existing license. If a laboratory stores mixed-waste containing special nuclear material, it must address the special properties of the fissile radioisotopes in the waste. The laboratory's mixed-waste storage program must address the spatial distribution, geometry, volume, and the concentration of this waste at the storage facility. Strict controls must be implemented and documented to assure the safe storage of mixed-waste containing special nuclear material. Appropriate security measures are to be taken, and documented, to ensure the physical security of special nuclear material at the storage facility. The laboratory must comply with all requirements stipulated in their license and with the requirements in 10 CFR Part 70, "Domestic Licensing of Special Nuclear Material."

Handling and Storage

Procedures for handling and storing mixed wastes must follow requirements for labeling, storing, packaging, and monitoring noted in Sections 4 and 5 of this document. Container labels must indicate the RCRA chemical contaminant(s) and list the associated UN ID(s). All safety concerns specific to both the radiological and RCRA chemical compounds must be observed. In general, mixed-waste must be stored in a manner that ensures the waste does not create a radiological hazard to surrounding areas, increase the potential for a release of radioactive materials to unrestricted areas, or pose an increased hazard to facility personnel. The physical, chemical, and radiological characteristics of the waste, as well as any other characteristics that could pose a potential health and safety problem in the storage area, must be identified and evaluated.

The NRC generally allows facilities to store waste containing radionuclides with half-lives of less than 65 days until 10 half-lives have elapsed and the radiation emitted from the unshielded surface of the waste (as measured with an appropriate survey instrument) is indistinguishable from background levels. The waste may then be disposed of as non-radioactive, but still RCRA waste, after ensuring that all radioactive material labels are rendered unrecognizable (see 10 CFR 35.92). Radioactive waste may also be stored for decay under certain circumstances in accordance with 10 CFR 20.2001. For mixed waste, storage for decay is particularly advantageous, since the waste may be managed solely as a hazardous waste after the radionuclides decay to background levels. Thus, the management and regulation of these mixed wastes are greatly simplified.

Before disposing of this waste after decay, the

licensee must survey the waste using an appropriate survey instrument and technique, and demonstrate that any radiation emitted is indistinguishable from background levels. Laboratories not already authorized to hold wastes for decay-in-storage, but wish to hold mixed waste for decay-in-storage, may need to obtain a license amendment from NRC prior to storing the mixed waste. Many licensees in possession of mixed waste and using decay-in-storage options will be required to obtain an amendment to store the mixed waste as hazardous waste.

The following must be included in a license amendment request to NRC:

- a description of the survey procedures to be used during storage and prior to release of the waste to a hazardous waste-only facility
- a description of the procedures for segregating and tracking waste, from storage to release to a hazardous waste-only facility
- a commitment that waste will be held for a minimum of ten half-lives prior to performing the final radiation survey before release to a hazardous waste-only facility
- a statement that the decayed radioactive waste will not be released to a hazardous waste-only facility unless the radiation emitted from the waste is indistinguishable from background radiation

While NRC licensing amendments address the management of the radioactive component of these wastes, they generally have no effect on the applicable RCRA storage provisions. Storage requirements under RCRA should be implemented in a manner that provides appropriate protection of health and the environment, without setting up undue impediments to well-conducted decay programs.

Disposal

Mixed waste and mixed transuranic wastes are disposed of in a limited number of facilities in the U.S. It is typically the responsibility of the laboratory's waste broker (Section 3.1.4) to identify appropriate disposal sites or facilities for these waste types.

If a laboratory generates a quantity of low-level mixed waste that, combined with on-site RCRA non-mixed hazardous waste generation, does not exceed 100 kg/mo (or one kilogram of acutely hazardous waste as defined in 40 CFR 261.11(a)(2) and listed in 40 CFR 261.31-33), it qualifies as a conditionally-exempt SQG. As a result, it can dispose of the low-level mixed waste as low-level radioactive waste, if these materials meet the disposal site's waste acceptance criteria (40 CFR 261.5).

RCRA disposal permit requirements are unit-specific (i.e., dependent on compound and concentration) and are described in 40 CFR Part 264 for permitted facilities and 40 CFR Part 265 for interim status facilities. Interim status requirements are self-implementing waste management requirements which are limited to facilities that were already in existence on the date that a new regulation or statutory requirement took effect and which subjected the facility to RCRA. For mixed-waste facilities in authorized states, this date generally corresponds to the date that the state received authorization for a mixed-waste program, although state requirements may differ.

Mixed waste is sent to a limited number of facilities that are licensed under both of the appropriate laws. For example, radioactive RCRA waste cannot go to a RCRA landfill that is not licensed under the Low Level Radioactive Waste Policy Act (LLRWPA) nor can it be disposed at a LLRW site that is not licensed. No treatment or disposal options exist for certain classes of mixed waste, such as a mixture of radiation and PCB wastes or radiation and long-lived warfare agents. Indefinite storage is the only option for these waste streams with no treatment or disposal capacity.

8.0
Shipping

Shippers are responsible for ensuring compliance with DOT, UN, and International Air Transport Association (IATA) regulations regarding the transfer of hazardous substances and environmental samples. These regulations (CFR 49 Parts 171 through 180 for DOT, 40 CFR Part 172 for UN, and the Dangerous Goods Regulations for IATA), provide specific details regarding proper marking, labeling, placarding, packaging, and shipment of hazardous materials, substances and wastes, and regulatory exceptions, and must be consulted prior to preparation of or planning for sample shipment.

IATA and DOT both require specific training for anyone directly involved in the shipping of dangerous goods (IATA 1.5, 49 CFR 172.700). IATA requires training and re-certification every two years, while DOT requires training and re-certification every three years. Recent changes in DOT shipping regulations (October 1, 2006) and United Nations (January 1, 2007) require retraining of personnel as of these dates under 49 CFR 172.702 (http://hazmat.dot.gov/regs/49cfr/172/172.702.htm) and 49 CFR 172.704 (http://hazmat.dot.gov/regs/49cfr/172/172.704.htm).

The laboratory is responsible for ensuring that transport drivers are properly licensed and that the route selected is correct for the type of hazard being shipped. Laboratories should obtain and keep copies of all driver endorsement licenses, and most haulers will provide this information when asked. All waste shipments must be properly documented with a manifest and bill of lading. Laboratories should file the correct manifesting forms with the appropriate state and disposal agencies.

9.0
Disposal Sites

Laboratories are responsible for the proper transport and disposal of its solid waste. If using a private hauler, laboratory staff must make sure the vehicles being used are enclosed or can otherwise prevent spills, and that they are adequately maintained. Laboratory staff also must make sure that the waste is being disposed of at a permitted facility.

Treatment, Storage, and Disposal Facilities (TSDFs)

RCRA provides direction and requirements that must be followed by chemical TSDFs. U.S. Army guidelines (based on 50 U.S.C. 1512-1521) express a preference for on-site treatment of chemical warfare munitions. A military fixed treatment and disposal facility differs from commercial TSDF, as commercial TSDFs cannot be used to treat these munitions. Commercial TSDFs, however, can accept secondary waste generated by either mobile systems or individual treatment technologies if the waste no longer contains agent (except at *de minimis* levels).

TSDF Permits

Owners and operators of hazardous waste management units must have permits (40 CFR Part 264) during the active life (including the closure period) of the unit. Each TSDF site requires an EPA ID and a Part A or Part B permit. TSDFs are authorized to accept and dispose of wastes as indicated by the facility's permit.

A Type A permit requires specification of the hazardous wastes listed or designated under 40 CFR Part 261 to be treated, stored, or disposed of at the facility; an estimate of the quantity of such wastes to be treated, stored, or disposed of annually; and a general description of the processes to be used for such wastes, along with location of facility, owner information, obtained permits, and building/construction designs for the facility. The TSDF can modify permit acceptances (quantity and concentration of chemicals accepted) with EPA approval (40 CFR 270.42).

A Type B permit requires specification of the hazardous wastes listed or designated under 40 CFR Part 261 to be treated, stored, or disposed of at the facility; an estimate of the quantity of such wastes to be treated, stored, or disposed of annually; a general description of the processes to be used for such wastes; and the location of the facility, including a full geologic assessment, plans for release prevention and containment, structural engineering studies for plant development and containment, responses to cover 100-year environmental events, groundwater evaluation and monitoring plans, owner information, and obtained permits. The TSDF can modify their permit acceptances with the approval of EPA (40 CFR 270.42).

The TSDF must maintain the ability to properly dispose of the individual waste in an EPA approved manner with completed disposal actions certified. The TSDF can apply to modify their permit with EPA when necessary. The laboratory will be responsible to meet all generator status requirements even if the selected TSDF fails to gain the modification.

TSDF Waste Acceptance Criteria

Each TSDF has criteria and limits for acceptance of wastes as delineated by the facility's EPA Part A or Part B permit. Waste profiles are approved by the TSDF prior to acceptance of the laboratory's waste for disposal at the facility. Waste Profiles typically include information regarding the following:

- Waste generator (laboratory) by proper company name, address, phone, and EPA ID
- Generator contact information, including a 24-hour phone number
- Type of waste (solid, liquid, aqueous, mixed material, etc.)
- Amount expected to be disposed of and frequency of shipment
- Chemical composition, including all UN IDs and proper shipping names
- Land ban notification

- Hazard class and shipping container regulations
- Any other information considered critical to disposal

Radiological Waste Disposal Sites

Low-level radiological wastes are commonly disposed of in a limited number of near-surface facilities rather than in geologic repositories, such are those required for high-level wastes. Once disposed of, there is no intent to recover these wastes. The waste must meet site waste acceptance criteria prior to disposal. Burial of transuranic waste is limited at all sites. In 2000, low-level waste disposal facilities received approximately 3.3 million cubic feet of commercially-generated radioactive waste. Of this, 8.2% came from nuclear reactors, 83.8% from industrial users, 7.6% from government sources (other than nuclear weapons sites), 0.2% from academic users, and the rest (0.2%) was undefined.

Biological Waste Disposal Sites

Laboratory biological wastes must be rendered non-infectious (pathogens) or inactivated (biotoxins) prior to disposal at a landfill or in a sanitary sewer. Waste must also be de-identified as infectious/medical waste. This de-identification includes using processes such as shredding and grinding to obliterate the International Biohazard Sign, intact red biohazard bags, and phrases on waste such as "Biohazard" or "Medical Waste." Generators of biological waste may be asked to provide transporters and site authorities with written certification for these steps.

10.0
References and Resources

The resources listed in this section were used in preparing this document and/or are recommended for additional information and guidelines regarding laboratory waste handling and disposal.

General Resources

- Clinical and Laboratory Standards Institute (CLSI). 2004. *Clinical Laboratory Safety; Approved Guideline—Second Edition.* Wayne, PA: NCCLS.
- Clinical and Laboratory Standards Institute (CLSI). 2005. *Protection of Laboratory Workers from Occupationally Acquired Infections; Approved Guideline—Third Edition.* Wayne, PA: NCCLS.
- Fleming, D. O. 2006. *Biological Safety, Principles and Practices.* 4th Edition. Washington, D.C.: ASM Press.
- International Organization for Standardization. 2003. *Medical Laboratories – Requirements for Safety.* ISO 15190:2003.
- U.S. Environmental Protection Agency. May 2000. *Environmental Management Guide for Small Laboratories*. EPA 233-B-00-001. http://www.montclair.edu/facilities/ehs/plans/EPA_BiologicalWaste.pdf (accessed 11/25/09)

Resources for Wastes Containing Chemical Hazards

- Armour, M.A. 2003. *Hazardous Laboratory Chemicals Disposal Guide*, 3rd Edition. Boca Raton, FL: CRC Press.
- Keegan, R.J. IV, and R.J. Keegan. 1997. *Hazardous Materials, Substances and Wastes Compliance Guide*. Kutztown, PA: Hazardous Materials Publishing Co.
- James Lieberman. 1994. *A Practical Guide for Hazardous Waste Management, Administration and Compliance*. ISBN: 9781566701150
- U.S. Environmental Protection Agency. May 2005. *Handbook on the Management of Munitions Response Action*. Interim Final. EPA 505 B-01-001. http://epa.gov/fedfac/pdf/mra_hbook_5_05.pdf (accessed 11/24/09)

Resources for Wastes Containing Radiological Hazards

- U.S. Nuclear Regulatory Commission. *Radioactive Waste*. (http://www.nrc.gov/waste.html) (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. May 2002. *Radioactive Waste: Production, Storage, Disposal*, Revision 2. NUREG/BR-0216. http://www.nrc.gov/reading-rm/doc-collections/nuregs/brochures/br0216/r2/br0216r2.pdf (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. *Low-Level Waste Disposal*. http://www.nrc.gov/waste/llw-disposal.html (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. February 2007. *Standard Review for Transportation Packages (NUREG-1609).* Supplements 1 and 2. http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1609/ (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. *NRC Regulatory Guidelines – Transportation (Division 7)*. http://www.nrc.gov/reading-rm/doc-collections/reg-guides/transportation/active/ (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. *NRC Regulatory Guides – Environmental and Siting (Division 4)*. http://www.nrc.gov/reading-rm/doc-collections/reg-guides/environmental-siting/active/ (accessed 11/24/09)
- U.S. Nuclear Regulatory Commission. *Final Rules and Policy Statements*.

- http://www.nrc.gov/reading-rm/doc-collections/cfr/
- U.S. Nuclear Regulatory Commission. *NRC Regulatory Guides – General (Division 10*). http://www.nrc.gov/reading-rm/doc-collections/reg-guides/general/active/ (accessed 11/25/09)

Resources for Wastes Containing Biological Hazards

- National Committee on Clinical Laboratory Standards. 2002. *Clinical Laboratory Waste Management; Approved Guideline—Second Edition.* Wayne, PA: NCCLS. http://www.clsi.org/source/orders/free/gp5-a2.pdf (accessed 11/24/09)
- Reddish, G. F. (ed.). 1975. *Antiseptics, Disinfectants, Fungicides, and Chemical and Physical Sterilization*. Philadelphia, PA: Lea and Febiger.
- Richmond, J.Y., and Nesby-O'dell, S.L. 2002. "Laboratory Security and Emergency Response Guidance for Laboratories Working with Select Agents." *Morbidity and Mortality Weekly Report (MMWR™).* 51(RR-19): 1–8. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5119a1.htm (accessed 11/24/09)
- Rutala, W.A., Stiefel, M.M., and Sarubbi, F.A. 1982. "Decontamination of Laboratory Microbiological Waste by Steam Sterilization." *Applied and Environmental Microbiology.* 43(6): 13311-1316.
- U.S. Department of Health and Human Services, Centers for Disease Control and Prevention and National Institutes of Health. 2007. *Biosafety in Microbiological and Biomedical Laboratories* (BMBL), 5th Edition. http://www.cdc.gov/OD/ohs/biosfty/bmbl5/bmbl5toc.htm (accessed 11/25/09)
- U.S. Centers for Disease Control and Prevention. 2000. *Laboratory Waste Disposal Guide*. http://www.cdc.gov/od/ohs/pdffiles/autoclave1.pdf (accessed 11/24/09)
- U.S. Department of Health and Human Services, Office of Inspector General, CDC. 240 FR 76886, December 13, 2002. "Possession, Use, and Transfer of Select Agents and Toxins; Interim Final Rule" (42 CFR Parts 73 and 1003). http://oig.hhs.gov/authorities/docs/SelectAgentsToxinsCMPAuthorityIF.pdf (accessed 11/29/09)
- U.S. Department of Health and Human Services. 70 FR 13294, March 18, 2005. "Possession, Use, and Transfer of Select Agents and Toxins; Final Rule." (42 CFR Parts 72 and 73 and 42 CFR Part 1003). http://oig.hhs.gov/authorities/docs/05/032905FRselectagents.pdf (accessed 10/09/09)
- U.S. Department of Labor, Occupational Health and Safety Administration 29 CFR 1910. http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910 (accessed 11/25/09)
- U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration. 2006. *Transporting Infectious Substances Safely. Federal Register: Infectious Substances; Harmonization with the United Nations Recommendations.* http://phmsa.dot.gov/staticfiles/PHMSA/DownloadableFiles/Files/Transporting_Infectious_Substances_brochure.pdf (accessed 11/24/09)
- Wannemacher, R.W. 1989. *Procedures for Inactivation and Safety Containment of Toxins*. Proceedings Symposium on Agents of Biological Origin. Aberdeen Proving Ground, MD: U.S. Army Research, Development and Engineering Center. 115–122.

Appendix A

State Regulatory Information Sources for Disposal of Waste Containing Chemical Contamination

State	State Web Address - Chemistry	State Admin. Code Location
Alabama	http://www.adem.state.al.us/Regulations/Div14/Div14effective3-31-09.pdf	Division 14
Alaska	http://www.legis.state.ak.us/basis/folioproxy.asp?url=http://wwwjnu01.legis.state.ak.us/cgi-bin/folioisa.dll/aac/query=[group+t!2E+18!3A]/doc/{@1}/hits_only	Title 18
Arizona	http://www.azsos.gov/public_services/Title_18/18-08.pdf	Title 18
Arkansas	http://www.adeq.state.ar.us/regs/files/reg23_final_080526.pdf	Regulation 23
California	http://www.dtsc.ca.gov/LawsRegsPolicies/Title22/index.cfm http://www.dtsc.ca.gov/LawsRegsPolicies/upload/LEG_HSC.pdf	Title 22 and HSC
Colorado	http://www.cdphe.state.co.us/hm/index.htm	Title 6, 1007-3
Connecticut	http://www.ct.gov/dep/cwp/view.asp?a=2704&q=323512&depNav_GID=1511&depNav=|	22a
Delaware	http://www.dnrec.delaware.gov/Info/Pages/Rules.aspx	-
District of Columbia	http://app.doh.dc.gov/services/administration_offices/environmental/services2/waste/index.shtm http://app.doh.dc.gov/services/administration_offices/environmental/services2/waste/pdf/hw_regulations.shtm	Title 20
Florida	http://www.dep.state.fl.us/waste/quick_topics/rules/documents/62-730.pdf	FAC, Chapters 62–730
Georgia	http://www.gaepd.org/Documents/rules_exist.html	Chapter 391
Hawaii	http://hawaii.gov/health/environmental/waste/hw/index.html	HAR 11
Idaho	http://www.deq.idaho.gov/inl_oversight/waste.cfm	Title 16
Illinois	http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.asp	Title 35
Indiana	http://www.in.gov/legislative/ic/code/title13/	Code 329
Iowa	http://www.iowadnr.gov/waste/policy/index.html	-
Kansas	http://www.kdheks.gov/waste/regsstatutes/hw_laws.pdf	KAR title 28

State	State Web Address - Chemistry	State Admin. Code Location
Kentucky	http://www.waste.ky.gov/branches/hw/Hazardous+Waste+Regulations+with+links.htm	Title 401, Chapters 31–39
Louisiana	http://www.deq.louisiana.gov/portal/	LAC 33:V
Maine	http://www.maine.gov/dep/rwm/hazardouswaste/	Chapters 850–857
Maryland	http://www.mde.maryland.gov/Programs/LandPrograms/Hazardous_Waste/home/index.asp	Title 26
Massachusetts	http://www.mass.gov/dep/recycle/hazwaste.htm	Title 310
Michigan	http://www.michigan.gov/deq/0,1607,7-135-3312_9280---,00.html	Rules 299.9101–299.11107
Minnesota	http://www.pca.state.mn.us/waste/waste_rulesregs.html	Chapter 7045
Mississippi	http://www.deq.state.ms.us/MDEQ.nsf/page/Cleanup_HazardousWaste?OpenDocument	Federal
Missouri	http://www.dnr.mo.gov/env/hwp/lawsregs.htm	Title 10, 25
Montana	http://www.dnr.mo.gov/assistance/laws-regulations.htm	Title 17
Nebraska	http://www.deq.state.ne.us/	Title 128
Nevada	http://ndep.nv.gov/admin/nrs.htm	Chapter 444
New Hampshire	http://des.nh.gov/organization/commissioner/legal/index.htm	Env-Wm Chapters 100–1000
New Jersey	http://www.state.nj.us/dep/dshw/resource/rules.html#rules	Title 7
New Mexico	http://www.nmenv.state.nm.us/hwb/stareg.html	Title 20
New York	http://www.dec.ny.gov/25.html	6 NYCRR
North Carolina	http://www.enr.state.nc.us/html/rules.html	Title 15A
North Dakota	http://www.ndhealth.gov/WM/	NDAC 33–24
Ohio	http://www.epa.ohio.gov/Default.aspx?alias=www.epa.ohio.gov/dhwm	Chapter 3745
Oklahoma	www.deq.state.ok.us/	Title 252
Oregon	http://www.deq.state.or.us/regulations/rulesandlaws.htm	Chapter 340
Pennsylvania	http://www.depweb.state.pa.us/landrecwaste/cwp/view.asp?a=1216&Q=442095&landrecwasteNav=| http://www.pacode.com/secure/data/025/chapter284/chap284toc.html	Title 25
Rhode Island	http://www.dem.ri.gov/programs/benviron/waste/index.htm	-
South Carolina	http://www.scdhec.gov/environment/lwm/regulatory.htm	R.61–79
South Dakota	http://denr.sd.gov/des/wm/hw/hwmainpage.aspx	74:28
Tennessee	http://www.state.tn.us/environment/swm/	Chapter 1200

State	State Web Address - Chemistry	State Admin. Code Location
Texas	http://www.tceq.state.tx.us/nav/permits/hiw.html	335
Utah	http://www.hazardouswaste.utah.gov/	R315
Vermont	www.anr.state.vt.us/dec/wmd.htm	Chapter 7
Virginia	http://www.deq.state.va.us/waste/hazardous.html	9 VAC 20
Washington	http://www.ecy.wa.gov/waste.html	Chapters 173–303
West Virginia	http://www.wvdep.org/item.cfm?ssid=11	33 CSR 20
Wisconsin	http://www.dnr.state.wi.us/org/aw/wm/hazard/	NR 600
Wyoming	http://deq.state.wy.us/shwd/	Chapter 12

Appendix B

State Regulatory Information Sources for Disposal of Waste Containing Radioactive Contamination

State	State Addresses & Web Site URLs (if available)	
Alabama	Department of Environmental Management 1400 Coliseum Blvd. P.O. Box 301463 Montgomery, AL 36130 http://www.adem.state.al.us/	Office of Radiation Control Alabama Department of Public Health The RSA Tower, Suite 700 P.O. Box 303017 Montgomery, AL 36130-3017
Alaska	Department of Environmental Conservation Division of Air Quality Radiation Monitoring Project 610 University Avenue Fairbanks, AK 99709-3643 http://www.state.ak.us/	Radiological Health Program Section of State Laboratories Department of Health and Social Services State of Alaska 4500 Boniface Parkway Anchorage, AK 99507-1270
American Samoa	Environmental Quality Commission Government of American Samoa Pago Pago, American Samoa 96799 http://asepa.gov/hazardous-materials.asp	
Arizona	Department of Environmental Quality Waste Programs Division 3033 North Central Avenue Phoenix, AZ 85012 http://www.azdeq.gov/environ/waste/hazwaste/index.html	Radiation Regulatory Agency 4814 South 40th Street Phoenix, AZ 85040
Arkansas	Department of Environmental Quality Hazardous Waste Division 8001 National Drive, P.O. Box 9583 (use Zip code 72219-8913 for P.O. Box only) Little Rock, AR 72209 http://www.adeq.state.ar.us/regs/default.htm	Department of Health Division of Radiation Control and Emergency Management 4815 West Markham Street, Slot 30 Little Rock, AR 72205-38
California	Radiologic Health Branch Division of Food, Drugs, and Radiation Safety California Department of Health Services P.O. Box 942732 Sacramento, CA 94234-7320 Department of Health Services 714 P Street, #1492 Sacramento, CA 95814	State Water Resources Control Board and Integrated Waste Management Board 1001 I Street Sacramento, CA 95814 http://www.swrcb.ca.gov/ or http://www.ciwmb.ca.gov/

State	State Addresses & Web Site URLs (if available)	
Colorado	Department of Health, Radiation Control Division (RCD-DO-B1) 4300 Cherry Creek Drive South Denver, CO 80220-1530 http://www.cdphe.state.co.us/hm/rad/radregs.htm	
Commonwealth of Northern Mariana Islands	Commonwealth of the Northern Mariana Islands Division of Environmental Quality P.O. Box 1304, 3rd Floor, Morgens Building San Jose, Saipan, Mariana Islands 96950 http://www.deq.gov.mp/article.aspx?secID=11&artID=30	
Connecticut	Division of Radiation Department of Environmental Protection 79 Elm Street Hartford, CT 06106-5127 http://www.ct.gov/dep/cwp/view.asp?a=2713&q=324812&depNav_GID=1639	
Delaware	Department of Natural Resources and Environmental Control Solid Waste Management Branch 89 Kings Highway Dover, DE 19901	Division of Public Health Office of Radiation Control P.O. Box 637 Dover, DE 19903 http://www.dnrec.state.de.us/DNREC2000/Divisions/AWM/hw/index.htm
District of Columbia	Association of State and Territorial Solid Waste Management Officials Suite 345, Hall of the States 444 North Capitol Street, NW Washington, DC 20001 Bureau of Food, Drugs and Radiation Protection, Department of Health 614 H Streets, N.W., Room 1016 Washington, DC 20001	Department of Consumer and Regulatory Affairs Pesticides and Hazardous Waste Materials Division 614 H Street, NW, Room 505 Washington, DC 20001 http://dcra.dc.gov/dcra/site/default.asp
Florida	Department of Environmental Protection Division of Waste Management Twin Towers Office Building 2600 Blair Stone Road Tallahassee, FL 32399 http://www.dep.state.fl.us/waste/default.htm	Department of Health Bureau of Radiation Control, State Health Office 4052 Bald Cypress Way Tallahassee, FL 32399 http://www.doh.state.fl.us/environment/radiation/index.html
Georgia	Environmental Protection Land Protection Branch Industrial and Hazardous Waste Management Program Floyd Towers East 205 Butler Street, SE Atlanta, GA 30334	Radioactive Materials Program Department of Natural Resources 4244 International Parkway, Suite 114 Atlanta, GA 30354 http://www.gainsurance.org/Other/Rules.aspx?URL=http://rules.sos.state.ga.us/cgi-bin/page.cgi?g=GEORGIA_DEPARTMENT_OF_NATURAL_RESOURCES/ENVIRONMENTAL_PROTECTION/index.html

State	State Addresses & Web Site URLs (if available)	
Hawaii	Department of Health Environmental Health Division Solid and Hazardous Waste Branch P.O. Box 3378 Honolulu, HI 96801	Radiation Section Noise, Radiation and Indoor Air Quality Branch Department of Health 591 Ala Moana Boulevard Honolulu, HI 96813-4921 http://www.hawaii.gov/health/environmental/
Idaho	DEQ, Waste Management & Remediation DEQ State Office 1410 N. Hilton Boise, ID 83706 http://www.deq.state.id.us/	INEEL Oversight Program 900 N. Skyline, Suite C Idaho Falls, ID 83402
Illinois	Environmental Protection Agency, Bureau of Land 1021 North Grand Avenue East Springfield, IL 62702 http://www.epa.state.il.us/land/index.html	Department of Nuclear Safety 1035 Outer Park Drive Springfield, IL 62704 http://www.state.il.us/idns/
Indiana	Department of Environmental Management Indian Government Center North 100 N. Senate / P.O. Box 6015 Indianapolis, IN 46206-6015 http://www.in.gov/idem/	Indoor & Radiologic Health Division State Department of Health 2 N. Meridian Street Indianapolis, IN 46204-3003
Iowa	Department of Natural Resources Environmental Protection Division 900 East Grand Avenue, Henry A. Wallace Building Des Moines, IA 50319	Bureau of Radiological Health Iowa Department of Public Health Lucas State Office Building Des Moines, IA 50319-6075 http://www.idph.state.ia.us/eh/radiological_health.asp
Kansas	Department of Health and Environment Bureau of Waste Management Forbes Field, Building 740 Topeka, KS 66620 http://www.kdheks.gov/waste/	Radiation Control Program Kansas Department of Health & Environment Bureau of Air & Radiation Forbes Field, Building 283 Topeka, KS 66620-0001 http://www.kdheks.gov/bar/
Kentucky	Department of Environmental Protection Division of Waste Management Cabinet for Natural Resources and Environmental Protection 14 Reilly Road Frankfort, KY 40601 www.nr.state.ky.us/nrepc/dep/waste/dwmhome.htm	Radiation & Toxic Agents Control Branch, Cabinet for Health Services 275 East Main Street Frankfort, KY 40621-0001

State	State Addresses & Web Site URLs (if available)	
Louisiana	Office of Solid and Hazardous Waste Hazardous Waste Division Department Of Environmental Quality P.O. Box 82178 525 North 4th Street Baton Rouge, LA 70884-0259	Radiation Protection Division Office of Air Quality & Radiation Protection Department of Environmental Quality 7290 Bluebonnet Road, P.O. Box 82135 Baton Rouge, LA 70884-2135
Maine	Department of Environmental Protection Bureau of Oil and Hazardous Materials Control State House Station #17 Augusta, ME 04333 http://www.maine.gov/dep/index.shtml	Radiation Control Program Division of Health Engineering 10 State House Station Augusta, ME 04333
Maryland	Radiological Health Program Air and Radiation Management Administration Maryland Department of the Environment 2500 Broening Highway Baltimore, MD 21224 http://www.mde.state.md.us/Programs/AirPrograms/Radiological_Health/index.asp	
Massachusetts	Department of Environmental Quality Engineering Division of Solid and Hazardous Waste One Winter Street Boston, MA 02108 www.state.ma.us/dep	Radiation Control Program Department of Public Health 174 Portland Street, 5th Floor Boston, MA 02114
Michigan	Department of Environmental Quality Waste Management Division P.O. Box 30241 Lansing, Michigan 48909 http://www.michigan.gov/deq	Radiological Protection Section Drinking Water & Radiological Protection Division Michigan Department of Environmental Quality 3423 N. Martin Luther King, Jr. Boulevard P.O. Box 30630 Lansing, MI 48909-8130
Minnesota	Pollution Control Agency Solid and Hazardous Waste Division 520 Lafayette Road St. Paul, MN 55155 http://www.pca.state.mn.us/waste/index.html	Indoor Air Lead and Radiation Division of Environmental Health Department of Health 121 E. Seventh Place, Suite 220 P.O. Box 64975 St. Paul, MN 55164-0975
Mississippi	Department of Environmental Quality Office of Pollution Control Hazardous Waste P.O. Box 10385 Jackson, MS 39289 http://www.deq.state.ms.us/MDEQ.nsf/page/Main_Home?OpenDocument	Division of Radiological Health State Department of Health 3150 Lawson Street, P.O. Box 1700 Jackson, MS 39215-1700 http://www.msdh.state.ms.us/index.htm

State	State Addresses & Web Site URLs (if available)	
Missouri	Department of Natural Resources, Division of Environmental Quality, Solid Waste Management Program 205 Jefferson Street, P.O. Box 176 Jefferson City, MO 65102 http://www.dnr.mo.gov/env/index.html	Section for Environmental Public Health Division of Environmental Health & Communicable Disease Prevention P.O. Box 570 Jefferson City, MO 65102-0570
Montana	Department of Health and Environmental Sciences Solid and Hazardous Waste Bureau Cogswell Building Helena, MT 59620 http://www.deq.state.mt.us	Radiological Health Program Department of Public Health & Human Services P.O. Box 202951 Helena, MT 59620-2951
Nebraska	Department of Environmental Quality Air & Waste Management Division 1200 N Street, Suite 400, P.O. Box 98922 Lincoln, NE 68509 http://www.deq.state.ne.us/	Department of Regulation and Licensure, Nebraska Health and Human Services System P.O. Box 95007 Lincoln, NE 68590-5007
Nevada	Department of Conservation and Natural Resources, Division of Environmental Protection Bureau of Waste Management 123 West Nye Lane, Room 120 Carson City, NV 89706-0851 http://water.nv.gov/	Nevada State Health Division Radiological Health Section 4150 Technology Drive, Room 300 Carson City, Nevada 89706
New Hampshire	Department of Environmental Services Office of Waste Management 6 Hazen Drive Concord, NH 03301 http://www.des.state.nh.us/waste_intro.htm	Radiological Health Bureau Division of Public Health Services Health & Welfare Building 6 Hazen Drive Concord, NH 03301-6527
New Jersey	Department of Environmental Protection Division of Solid & Hazardous Waste 401 E. State Street Trenton, NJ 08625 http://www.state.nj.us/dep/dshw/	Department of Environmental Protection Radiation Protection Programs 25 Arctic Parkway, PO 415 Trenton, New Jersey 08625-0415 http://www.state.nj.us/dep/rpp/index.htm
New Mexico	Environment Department Ground Water Quality Bureau Harold Runnels Building 1190 St. Francis Drive Santa Fe, NM 87502-0110 http://www.nmenv.state.nm.us/nmrcb/home.html	Bureau of Hazardous & Radioactive Materials, Water and Waste Management Division Department of Environment 2044 Galisteo Road Santa Fe, NM 87502 http://www.nmenv.state.nm.us/hwb/

State	State Addresses & Web Site URLs (if available)	
New York	Division of Solid and Hazardous Materials 625 Broadway, Fl.9 Albany, New York 12233-7250 http://www.dec.ny.gov/ Radiological Health Unit Division of Safety and Health, New York State Department of Labor New York State Office Campus Building 12, Room 134A Albany, NY 12240	Bureau of Environmental Radiation Protection New York State Department of Health Two University Place Albany, NY 12203 Bureau of Radiological Health New York City Department of Health Two Lafayette Street, 11th Floor New York, NY 10007 http://www.nyc.gov/html/doh/html/radioh/radioh.shtml
North Carolina	Department of Environment and Natural Resources Division of Waste Management 1601 Mail Service Center Raleigh, NC 27669-1601	Division of Radiation Protection Department of Environment & Natural Resources 3825 Barrett Drive Raleigh, NC 27609-7221 http://www.ncradiation.net/
North Dakota	Department of Health Division of Waste Management 1200 Missouri Avenue, Room 302 P.O. Box 5520 Bismarck, ND 58506-5520 http://www.health.state.nd.us/wm/	Division of Environmental Engineering North Dakota Department of Health 1200 Missouri Avenue, Room 304 P.O. Box 5520 Bismarck, ND 58506-5520 http://www.health.state.nd.us/aq/
Ohio	Ohio EPA Division of Hazardous Waste Management 122 South Front Street P.O. Box 1049 (use zip code 43216-1049 for P.O. Box only) Columbus, OH 43215 http://www.epa.state.oh.us/dhwm/index.html	Bureau of Radiation Protection Ohio Department of Health 35 East Chestnut Street Columbus, OH 43266
Oklahoma	Oklahoma State Department of Health, Waste Management Service 1000 NE 10th Street Oklahoma City, OK 73117 http://www.health.state.ok.us/	Radiation Management Section Department of Environmental Quality P.O. Box 1677 Oklahoma City, OK 73101-1677
Oregon	Department of Environmental Quality Waste Prevention & Management 811 SW Sixth Avenue Portland, OR 97204 http://www.deq.state.or.us/lq/hw/index.htm	Radiation Protection Services Oregon State Health Division 800 N.E. Oregon Street, Suite 260 Portland, OR 97232 http://oregon.gov/DHS/ph/rps/index.shtml
Pennsylvania	Department of Environmental Protection Bureau of Land Recycling and Waste Management P.O. Box 8471 Harrisburg, PA 17105-8471 http://www.depweb.state.pa.us/landrecwaste/site/default.asp	Bureau of Radiation Protection Department of Environmental Protection Rachel Carson State Office Building P.O. Box 8469 Harrisburg, PA 17105-8469

State	State Addresses & Web Site URLs (if available)	
Puerto Rico	Environmental Quality Board P.O. Box 11488 Santurce, Puerto Rico 0010	Radiological Health Division G.P.O. Call Box 70184 Rio Piedras, PR 00936
Rhode Island	Department of Environmental Management Office of Waste Management 235 Promenade Street Providence, RI 02908-5767 http://www.health.state.ri.us/	Division of Occupational & Radiological Health Department of Health 3 Capitol Hill, Room 206 Providence, RI 02908-5097
South Carolina	Division of Waste Management Department of Health and Environmental Control J. Marion Sims Building 2600 Bull Street Columbia, SC 29201 http://www.scdhec.net/eqc/lwm/html/radio.html	Division of Radioactive Waste Management Bureau of Land and Waste Management Department of Health & Environmental Control 2600 Bull Street Columbia, SC 29201 http://www.scdhec.net/health/
South Dakota	Department of Environmental & Natural Resources Waste Management Program Foss Building 523 East Capitol Pierre, SD 57501 http://www.state.sd.us/denr/DES/WasteMgn/WMPpage1.htm	
Tennessee	Department of Environment and Conservation Division of Solid/Hazardous Waste Management 5th Floor, L &C Tower 401 Church Street Nashville, TN 37243-1535 http://www.state.tn.us/environment/#	Division of Radiological Health Tennessee Department of Environment and Conservation L&C Annex, Third Floor 401 Church Street Nashville, TN 37243-1532
Texas	Bureau of Radiation Control Bureau of Environmental Health Texas Department of Health 1100 West 49th Street Austin, TX 78756-3189 http://www.tceq.state.tx.us/	Natural Resources Conservation Commission Industrial & Hazardous Waste Division P.O. Box 13087 Austin, TX 78711
Utah	Division of Solid and Hazardous Waste Department of Environmental Quality 288 North 1460 West, P.O. Box 144880 Salt Lake City, UT 84114-4880 http://www.hazardouswaste.utah.gov/	Division of Radiation Control Department of Environmental Quality 168 North 1950 West P.O. Box 144850 Salt Lake City, UT 84114-4850 http://www.radiationcontrol.utah.gov/
Vermont	Department of Environmental Conservation Waste Management Division 103 South Main Street, West Building Waterbury, VT 05671-0401	Division of Occupational & Radiological Health Department of Health 108 Cherry Street, P.O. Box 70 Burlington, VT 05402 http://www.anr.state.vt.us/dec/wmd.htm

State	State Addresses & Web Site URLs (if available)	
Virgin Islands	Department of Planning and Natural Resources Division of Environmental Protection Government of the Virgin Islands 396-1 Annas Retreat-Foster Building Charlotte Amalie, U.S. Virgin Island 00802	
Virginia	Department of Environmental Quality Waste Management 629 East Main Street Richmond, VA 23219 http://www.deq.state.va.us/waste/	Radiological Health Programs Division of Health Hazards Control Department of Health Main Street Station 1500 East Main, Room 240 Richmond, VA 23219
Washington	Department of Ecology Solid and Hazardous Waste Management Division P.O. Box 47600 Olympia, WA 98504 http://www.ecy.wa.gov/	Division of Radiation Protection Department of Health Building #5, P.O. Box 47827 7171 Clean Water Lane Olympia, WA 98504-7827 http://www.doh.wa.gov/ehp/rp/Default.htm
West Virginia	West Virginia Division of Natural Resources State Capitol Complex, Bldg. 3 1900 Kanawha Blvd. Charleston, WV 25305-0060 http://www.wv.gov/offsite.aspx?u=http://www.wvdhhr.org/rtia/	Radiological Health Program 815 Quarrier Street Charleston, WV 25301
Wisconsin	Department of Natural Resources Waste Management Program 101 South Webster Street Madison, WI 53703 http://www.dnr.state.wi.us/org/aw/wm/index.htm	Radiation Protection Unit Bureau of Public Health Department of Health and Family Services P.O. Box 309 Madison, WI 53701-0309
Wyoming	Solid & Hazardous Waste Division Department of Environmental Quality 122 West 25th Street Herschler Building, 4W Cheyenne, WY 82002 http://deq.state.wy.us/shwd/index.asp?pageid=4	

Appendix C

State Regulatory Information Sources Disposal of Waste Containing Biological Contamination

State	Web Address	Administrative Code / Document
Alabama	http://www.adem.state.al.us/Regulations/Div13/Div13Effective5-26-09.pdf	1975, §§ 22-27-1 to 7 and Chapter 335-13-7
Alaska	https://www.dec.state.ak.us/water/npdes/Final_Application_2008/03_08_18AAC60.pdf	Title 18 AAC 60.030
Arizona	http://www.azsos.gov/public_services/Title_18/18-13.htm	Title 18, Chapter 13, Supp. 03-2, Article 14, Sections R18-13-1401–R18-13-1420
Arkansas	http://www.healthyarkansas.com/rules_regs/0601medwastereg.pdf http://www.healthyarkansas.com/rules_regs/medical_waste.pdf	Act 96 or 1913, Act 41 of 1992, Act 491 of 1993, Act 861 of 1993, Act 150 of 1999
California	http://www.cdph.ca.gov/certlic/medicalwaste/Pages/default.aspx	Division 104 Part 14 Sections 117600–118360 of California Health and Safety Code
Colorado	http://www.cdphe.state.co.us/hm/infects.pdf	Title 25 Article 15 Part 4, 6 CCR 1007-2 Section 13
Connecticut	http://www.ct.gov/dep/cwp/view.asp?a=2718&q=325338&depNav_GID=1646	Biomedical Waste Frequently Asked Questions Sections 22a-208a-1, 22a-209-15, Sections 22a-208a-1, 22a-209-15, and 22a-449(c)-11 22a-449(c)-11
Delaware	http://regulations.delaware.gov/AdminCode/title7/1000/1300/1302/index.shtml	Section 11 Part 1 Special Waste Management
Florida	http://www.doh.state.fl.us/environment/community/biomedical/pdfs/64E16.pdf http://www.doh.state.fl.us/environment/community/biomedical/index.html	Chapter 64E-16
Georgia	http://rules.sos.state.ga.us/docs/391/3/4/15.pdf	391-3-4, Rule 15
Hawaii	http://www.hawaii.gov/health/environmental/waste/sw/pdf/11-581.pdf	11-58.1-52
Idaho	http://www.deq.idaho.gov/ieg/waste/medical_pharm.cfm http://www.deq.idaho.gov/water/prog_issues/surface_water/pharmaceuticals/index.cfm	None
Illinois	http://www.epa.state.il.us/land/waste-mgmt/potentially-infectious-medical-waste.html	35 Illinois Admin. Code: Subtitle M, and 1420.102
Indiana	http://www.in.gov/legislative/ic/code/title16/ar41/ch16.html	IC-16-41-16

State	Web Address	Administrative Code / Document
Iowa	http://www.iowadnr.com/waste/policy/files/nd1.pdf	33-20-01.1
Kansas	http://www.kdheks.gov/environment/servguid.html	K.A.R.28-29
Kentucky	http://www.waste.ky.gov/branches/rla/Medical+Waste.htm	None
Louisiana	http://www.deq.louisiana.gov/portal/Default.aspx?tabid=264	L.A.C. Title 33 Part VII Chapter 13 Paragraphs 1350.D.1(a) and 13305.1.1(a)
Maine	http://www.epa.gov/osw/laws-regs/state/stats/safrn/me.htm	38 M.R.S.A. Sec. 1319-O 06-096 C.M.R. 900
Maryland	http://cha.maryland.gov/oeh/html/medical_waste.cfm	COMAR 26.04.07
Massachusetts	http://www.mass.gov/dep/recycle/hazardous/infwaste.htm	State Sanitary Code Title VIII, 105 CMR 4800.00 and 310 CMR 19.000
Michigan	http://www.michigan.gov/deq/0,1607,7-135-3312_4119---,00.html http://www.deq.state.mi.us/documents/deq-whm-hwrp-mwRegAct-Rules.pdf	MWRA Part 138 Sec. 333.13801 –333.13831
Minnesota	https://www.revisor.mn.gov/statutes/?topic=520256	Minnesota Statutes Sec. 116.76 –116.82
Mississippi	http://www.deq.state.ms.us/MDEQ.nsf/pdf/SW_MedicalWasteFactSheet/$File/MedWasteFactSheet.pdf?OpenElement	Medical Waste Fact Sheet; no applicable state regulations
Missouri	http://cms.h2e-online.org/ee/rmw/rmw-regulations/state-rmw-regulations/missouri/	10 CSR 807.010
Montana	http://cms.h2e-online.org/ee/rmw/rmw-regulations/state-rmw-regulations/montana/	Title 75, Chapter 10, Part 1002
Nebraska	http://www.deq.state.ne.us/ (type “medical waste” in webpage search engine) http://cms.h2e-online.org/ee/rmw/rmw-regulations/state-rmw-regulations/nebraska/	Title 132, Chapter 1 and Chapter 13
Nevada	http://ndep.nv.gov/bwm/special.htm	N.A.C. 444.646 and 444.662
New Hampshire	http://des.nh.gov/organization/commissioner/legal/rules/index.htm	NHCAR Part Env-Sw 904
New Jersey	http://www.nj.gov/dep/dshw/rrtp/rmw.htm http://www.nj.gov/dep/dshw/resource/rules.html	N.J.A.C. 7:26
New Mexico	http://www.nmenv.state.nm.us/NMED_regs/swb/20nmac9_1.html	20 NMAC 9.1.706 Paragraph F
New York	http://www.health.state.ny.us/facilities/waste/	Title 10 NYCRR Part 70
North Carolina	http://www.wastenotnc.org/SWHOME/Rules/SWStatutes_RulesAug2008/Section.1200.pdf	15A NCAC 13B Section 1200
North Dakota	http://www.legis.nd.gov/information/acdata/pdf/33-20-12.pdf	Title 33, Article 20, Chapter 12 (33-20-12) and 23-29-03.5 NDCC
Ohio	http://www.epa.ohio.gov/dsiwm/pages/3745_27.aspx	OAC Chapter 3745.27

State	Web Address	Administrative Code / Document
Oklahoma	http://cms.h2e-online.org/ee/rmw/rmw-regulations/state-rmw-regulations/oklahoma	Title 252.515
Oregon	http://www.deq.state.or.us/lq/sw/infectiouswaste/index.htm http://oregon.gov/DHS/ph/acd/infectwaste/infectw.shtml	Oregon Law 1989, Chapter 763 and ORS 459
Pennsylvania	http://www.depweb.state.pa.us/landrecwaste/cwp/view.asp?a=1238&Q=463634&landrecwasteNav=| http://www.pacode.com/secure/data/025/chapter284/chap284toc.html	Title 25 PAC 284
Rhode Island	http://www.dem.ri.gov/pubs/regs/regs/waste/medwaste.pdf	DEM-DAH-MW-01-92
South Carolina	http://www.scdhec.net/eqc/lwm/regs/R61-105.pdf	R 61-1-5 S.C. Code Ann. 44-93-10
South Dakota	http://legis.state.sd.us/rules/rules/74/35/7435.doc	Article 74:35
Tennessee	http://www.state.tn.us/sos/rules/1200/1200-01/1200-01-07.pdf http://www.tennessee.gov/environment/swm/pdf/SWPolicyManual.pdf	Chapter 1200-1-7-, 04, Paragraph (1) (k) 4
Texas	http://www.tceq.state.tx.us/nav/permits/mw.html http://www.tceq.state.tx.us/assets/public/legal/rules/rules/pdflib/330y.pdf	Title 30, Chapter 330, Subchapter Y, Parts 330.1201-330.1221
Utah	http://www.hazardouswaste.utah.gov/SWBranch/SWSection/Adobe/SolidWaste/2006_Infectious_Waste_Management_Guidance.pdf http://www.rules.utah.gov/publicat/code/r315/r315-316.htm	Title R315-316
Vermont	http://www.anr.state.vt.us/dec/wastediv/solid/pubs/MedWaste.pdf	10 VSA 6602
Virginia	http://www.deq.virginia.gov/waste/wastereg120.html http://www.deq.state.va.us/waste/pdf/wstregs/medwaste.pdf	Title 9 VAC 20-120
Washington	http://www.ecy.wa.gov/programs/hwtr/pharmaceuticals/pages/faqs.html http://apps.leg.wa.gov/RCW/default.aspx?cite=70.95K	RCW Chapter 70.95K
West Virginia	http://www.wvdhhr.org/wvimw/index.asp	Code of State Rules, Title 64-56
Wisconsin	http://www.legis.state.wi.us/rsb/code/nr/nr526.pdf http://www.dnr.state.wi.us/org/aw/wm/medinf/	WAC 526
Wyoming	http://deq.state.wy.us/out/downloads/medwast.htm	WS 35-11-101, 102, 109, and 501

Appendix D

Storage and Disposal Information (for Chemical Analytes Listed in SAM, Revision 5)

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Acephate *[Organophosphorus pesticides, liquid/solid, toxic]*	30560-19-1	UN 3018 (liq) UN 2783 (solid)	Alkaline materials	Store in original container in a cool, dry area	Not Listed [2]	6.1 / I, II, III	
Acrylamide *[Acrylamide]*	79-06-1	UN 3426 (liq) UN 2074 (solid)	Acids, oxidizing agents, and bases. Spontaneously reacts with hydroxyl-, amino-, and sulfhydryl-containing compounds.	Dust is combustable; store away from sunlight, heat, sparks	5000	6.1 / III	Recycle standards to vendor; Incineration
Acrylonitrile *[Acrylonitrile, stabilized]*	107-13-1	UN 1093	Acids, bases, oxidizing agents, amines, bromine	Requires stabilization by the addition of 4-methoxyphenol	100	3 / I	Treatment; Incineration [4]
Aldicarb (Temik) *[Carbamate pesticides, liquid/solid, toxic]*	116-06-3	UN 2992 (liq) UN 2757 (solid)	Alkaline materials / strong bases	Store in a cool, dry place. Dust may present explosion hazard.	1	6.1 / I,II,III	Incineration; Landfill
Aldicarb sulfone *[Carbamate pesticides, liquid/solid, toxic]*	1646-88-4	UN 2992 (liq) UN 2757 (solid)	Alkaline materials / strong bases	Store in a cool, dry place. Dust may present explosion hazard.	100	6.1 / I,II,III	
Aldicarb sulfoxide *[Carbamate pesticides, liquid/solid, toxic]*	1646-87-3	UN 2992 (liq) UN 2757 (solid)	Alkaline materials / strong bases	Store in a cool, dry place. Dust may present explosion hazard.	Not Listed [2]	6.1 / I,II,III	

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Allyl alcohol	107-18-6	UN 1098	Strong oxidizing agents, strong acids, oleum, diallyl phosphite, metal halides, sodium hydroxide, tetrachloromethane, tri-N-bromoaniline, sodium, potassium, magnesium, aluminum. Polymerizes during prolonged storage.	Good laboratory practices [6]	100	3, 6.1 / I	Incineration
4-Aminopyridine	504-24-5	UN 2671	Strong oxidizers, acids, chlorides, anhydrides	Avoid dust generation, ignition hazard	Not Listed [2]	6.1 / II	Incineration
Ammonia *[Shipping name is concentration dependent]*	7664-41-7	UN 2672 (if greater than 10% ammonia by volume)	Mercury, chlorine, calcium hypochlorite, hydrofluoric acid (anhydrous), bromine pentafluoride, chlorine trifluoride, chloroformates, strong acids, strong oxidizing agents, brass, zinc, aluminum, copper, bronze, most common metals and dimethyl sulfate	Store in high density polyethylene (HDPE) containers when possible	100	2.2, 2.3 or 8 / I	Recycle standards to vendor; Landfill standards and samples
Ammonium metavanadate (analyze as total vanadium)	7803-55-6	UN 2859	Strong oxidizers, acids	Avoid dust generation, ignition hazard	Not Listed [2]	6.1 / II	Incineration
Arsenic, Total	7440-38-2	UN 1558	Oxidizing agents, acids, moisture	Good laboratory practices [6]	1	6.1 / II	Landfill
Arsenic trioxide (analyze for total arsenic)	1327-53-3	UN 1561	Acids, Al, Cl, trifluoride, fluoride, oxygen disulfide, Hg, Zn	Reacts with metals in the presents of moisture	1	6.1 / II	Landfill

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Arsine	7784-42-1	UN 2188	Heat, acid, oxidizers	Store in stainless steel or Teflon® (PTFE) cylinders. Treatment of small amounts (<100 mL) of laboratory standards by absorption with $KMNO_4$ solution is possible.	1	2.3	Treatment of standards with $KMNO_4$ and landfill; Incineration of standards and samples
Asbestos	1332-21-4	NA 2212	None	Good laboratory practices [6]	1	9 / III	Landfill
Boron trifluoride *[Boron trifluoride]*	7637-07-2	UN 1008	Water, bases, alkaline metals, brass, aluminum	Avoid moisture as it will form hydrofluoric acid; store in stainless steel or Teflon® (PTFE) cylinders	Not Listed [2]	2.3	Recycle standards to vendor; Store samples
Brodifacoum *[Coumarin derivative pesticides, liquid/solid, toxic]*	56073-10-0	UN 3023 (liq) UN 3026 (solid)	None known. Apply good laboratory practices. [6]	Good laboratory practices [6]	Not Listed [2]	9 / III	Incineration
Bromadiolone *[Coumarin derivative pesticides, liquid/solid, toxic]*	28772-56-7	UN 3023 (liq) UN 3026 (solid)	Alkaline materials	Store in original container in a cool, dry area	1	6.1 / II	Landfill
BZ [Quinuclidinyl benzilate]	6581-06-2	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Calcium arsenate (analyze as total arsenic)	7778-44-1	UN 1573	Acids	Store in original container in a cool, dry area	1	6.1 / II	
Carbofuran (Furadan) *[Carbamate pesticides, liquid/solid, toxic]*	1563-66-2	UN 2992 (liq) UN 2757 (solid)	Heat, fire	Store in original container in a cool, dry area	10	6.1 / I	Landfill
Carfentanil	59708-52-0	Information limited [5]	Information limited [5]	Information Limited [5]	Not Listed [2]	Information Limited [5]	

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Carbon disulfide	75-15-0	UN 1131	Strong oxidizers, chemically-active materials (such as sodium, potassium, and zinc), azides, halogens, and organic amines	Iron, steel, porcelain, or glass containers should be used for storage	100	3 / I	Recycle standards to vendor; Store samples
Chlorfenvinphos *[Organophosphorus pesticides, liquid/solid, toxic]*	470-90-6	UN 3018 (liq) UN 2783 (solid)	Metal and high density polyethylene (HDPE) containers	Store in glass containers	Not Listed [2]	6.1 / I, II, III	
Chlorine	7782-50-5	UN 1017	Water, bases, alkaline metals, brass, aluminum, combustibles, reducing agents	Good laboratory practices [6]	10	2.3	Landfill
2-Chloroethanol	107-07-3	UN 1135	Fire or ignition sources	Good laboratory practices [6]	Not Listed [2]	6.1 / III	Incineration
3-Chloro-1,2-propanediol	96-24-2	UN 2689	Strong oxidizing agents	Do not store in direct sunlight; keep container closed when not in use; store in a cool, dry, well-ventilated area away from incompatible substances; keep containers tightly closed	Not Listed [2]	6.1 / III	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	**Handling / Storage / Treatment Options**	**Reportable Quantity (lbs)[2]**	**Hazard Class / Packing Group[3]**	**Disposal Method**
Chloropicrin	76-06-2	UN 1580	Bulk containers are shock sensitive and can detonate, especially when heat is available for initiation; photodegradation producing phosgene is possible; strong oxidizers, organic acids, reducing agents, sulfuric acid, aluminum, magnesium or magnesium alloys, aniline, sodium methoxide	Store in a cool, dry, well-ventilated area away from incompatible materials, direct sunlight and heat and/or sparks	Not Listed [2]	6.1 / I	Landfill
Chlorosarin	1445-76-7	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Chlorosoman	7040-57-5	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
2-Chlorovinylarsonous acid (2-CVAA) (degradation product of Lewisite)	85090-33-1	Information limited [5]	Strong oxidizers, heat	Store in a cool, dry, well-ventilated area away from incompatible materials, direct sunlight and heat and/or sparks	Not Listed [2]	Information Limited [5]	Military [5]
Chlorpyrifos *[Organophosphorus pesticides, liquid/solid, toxic]*	2921-88-2	UN 3018 (liq) UN 2783 (solid)	Information limited [5]	Store in original container in a cool, dry area	Not Listed [2]	6.1 / I, II, III	
Chlorpyrifos oxon *[Organophosphorus pesticides, liquid/solid, toxic]*	5598-15-2	UN 3018 (liq) UN 2783 (solid)	Information limited [5]	Store in original container in a cool, dry area	Not Listed [2]	6.1 / I, II, III	
Crimidine	535-89-7	UN 2588	Strong acids	Good laboratory practices [6]	Not Listed [2]	Information Limited [5]	Recycle; Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Cyanide, Amenable to chlorination *[Cyanide solutions, n.o.s* or *Cyanide inorganic solid, n.o.s]*	NA	UN 1935 (liq) UN 1588 (solid)	Ignition sources, acids	Good laboratory practices [6]	10	6.1 / I,II,III	
Cyanide, Total *[Cyanide solutions, n.o.s. or Cyanides, inorganic, solid, n.o.s.]*	57-12-5	UN 1935 (liq) UN 1588 (solid)	Ignition sources, acids	Good laboratory practices [6]	10	6.1 / I,II,III	Incineration
Cyanogen chloride	506-77-4	UN 1589	Water, acids, alkalis, ammonia, alcohols	Good laboratory practices [6]	10	2.3	Incineration
Cyclohexyl sarin (GF)	329-99-7	Information limited [5]	Water, bleach products	Moderately stable in stainless steel containers	Not Listed [2]	Information Limited [5]	Military [5]
1,2-Dichloroethane*[Ethylene dichloride]*	107-06-2	UN 1184	Liquid ammonia, dimethylamino-propylamine, nitrogen tetroxide, metal powders, organic peroxides reducing agents, and alkali and alkali earth metals; mixtures with nitric acid are easily detonated by heat, impact, or friction; mixtures with mercaptans form thioethers and generate heat; mixtures with nitrides generate heat and ammonia forming toxic fumes	Small quantities can be stored in brown bottles or opaque containers due to solvent's light sensitivity; electrically ground metal containers for liquid transfers to prevent static sparks	100	3 / II	Recycle standards to vendor; Incineration standards and samples
Dichlorvos *[Organophosphorus pesticides, liquid/solid, toxic]*	62-73-7	UN 3018 (liq) UN 2783 (solid)	Strong acids, strong alkalis	Material should be stored in glass containers	10	6.1 / I, II, III	Recycle standards to vendor; Incineration standards and samples

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Dicrotophos *[Organophosphorus pesticides, liquid/solid, toxic]*	141-66-2	UN 3018 (liq) UN 2783 (solid)	Corrosive to cast iron, mild steel, brass, and stainless steel	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	Incineration
Diesel Range Organics	NA	UN 1202	Ignition sources, acids	Good laboratory practices [6]	Not Listed [2]	3 / III	Incineration
Diisopropyl methylphosphonate (DIMP)	1445-75-6	Information limited [5]	Information limited [5]	Information Limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Dimethylphosphite *[Organophosphorus compound liquid/solid, toxic]*	868-85-9	UN 3278 (liq) UN 3464 (solid)	Heat sources	Good laboratory practices [6]	Not Listed [2]	Information Limited [5]	Recycle standards to vendor; Military [5]
Dimethylphosphoramidic acid *[Organophosphorus compound liquid/solid, toxic]*	33876-51-6	UN 3278 (liq) UN 3464 (solid)	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Diphacinone *[Coumarin derivative pesticides, liquid/solid, toxic]*	82-66-6	UN 3023 (liq) UN 3026 (solid)	Alkalis	Good laboratory practices [6]	10	6.1 / II	Incineration
Disulfoton *[Organophosphorus pesticides, liquid/solid, toxic]*	298-04-4	UN 3018 (liq) UN 2783 (solid)	Strong acids, bases, and alkaline conditions	Good laboratory practices [6]	1	6.1 / I, II, III	
Disulfoton sulfoxide *[Organophosphorus pesticides, liquid/solid, toxic]*	2497-07-6	UN 3018 (liq) UN 2783 (solid)	Strong acids, bases, and alkaline conditions	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	
1,4-Dithiane	505-29-3	Information limited [5]	Strong oxidizers	Information limited [5]	Not Listed [2]	Information Limited [5]	Recycle standards to vendor; Military [5]

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
EA2192 [Diisopropylaminoethyl methylthiolophosphonate] (hydrolysis product of VX)	73207-98-4	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Ethyl methylphosphonic acid (EMPA) (degradation product of VX)*[Organophosphorus compound liquid/solid, toxic]*	1832-53-7	UN 3278 (liq) UN 3464 (solid)	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Ethyldichloroarsine (ED)	598-14-1	UN 1892	Strong oxidizing agents, strong acids, water, brass	Should be stored in glass or steel containers	Not Listed [2]	6.1 / I	Incineration; Landfill at low concentrations
N-Ethyldiethanolamine (EDEA) (degradation product of HN-1)	139-87-7	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Ethylene oxide	75-21-8	VARIOUS depending on concentration	Water, bases, oxidizing metals, acids, alcohols, alkali metals, ammonia, chemically active metals and their salts. Highly flammable. Forms explosive mixtures with air which may be ignited by rapid compression	Store in distant outdoor tank or container protected from direct sunlight, lined with insulating material, equipped with an adequate refrigeration and water system. Indoor storage should be restricted to small quantities. Place in a fireproof, combustible liquid cabinet that conforms to regulations.	10	2.2, 2.3, 6.1	Incineration; Landfill at low concentrations

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Fenamiphos *[Organophosphorus pesticides, liquid/solid, toxic]*	22224-92-6	UN 3018 (liq) UN 2783 (solid)	Hydrolyzed by strong acids and alkalis	Effluent from fire suppression should be contained	10	6.1 / I, II, III	Recycle standards to vendor; Incineration
Fentanyl	437-38-7	Information limited [5]	None known. Apply good laboratory practices. [6]	Good laboratory practices [6]	Not Listed [2]	6.1 / II	Incineration
Fluoride	16984-48-8	UN 1690	Mineral acids, glass	Good laboratory practices [6]	Not Listed [2]	9 / III	Recycle standards to vendor; Landfill standards and samples
Fluoroacetamide	640-19-7	Information limited [5]	Acids	Store in original container in a cool, dry area	Not Listed [2]	Information Limited [5]	
Fluoroacetic acid and fluoroacetate salts (analyze for fluoroacetate ion) *[Fluoroacetic acid]*	NA	UN 2642	Mineral acids	May require refrigeration	10	6.1 / I	Incineration; Landfill
2-Fluoroethanol	371-62-0	Information limited [5]	Strong oxidizing and reducing agents, acids, acid chlorides, acid anhydrides, phosphorus halides	Room temperature			Incineration; Landfill
Formaldehyde *[Shipping name is concentration dependent]*	50-00-0	VARIOUS depending on concentration	Amines, caustics, alkali and alkaline earth metals, nitrides, organic peroxides, oxidizing agents, reducing agents	Good laboratory practices [6]	100	3, 8 / III	Incineration; Landfill at low concentrations
Gasoline Range Organics	NA	Information limited [5]	None known. Apply good laboratory practices. [6]	Good laboratory practices [6]	Not Listed [2]	2.3	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	121-82-4	UN 0483	Shock & detonators, oxidizing materials, & combustibles	Explosion-proof containers	Not Listed [2]	1.1	Enzyme biodegradation and/or Landfill
Hexamethylenetri-peroxidediamine (HMTD)	283-66-9	Shipping Forbidden	None known. Apply good laboratory practices. [6]	Store in designated segregated laboratory unit	Not Listed [2]	Information Limited [5]	Storage
Hydrogen bromide	10035-10-6	UN 1048	Moisture, bases, metals, ammonia, oxidizers, fluoride	Good laboratory practices [6]	Not Listed [2]	2.3	Incineration
Hydrogen chloride	7647-01-0	UN 1050	Alkalis, most metals. Avoid contact with water.	Well-ventilated area	5000	2.3	Incineration
Hydrogen cyanide	74-90-8	UN 1956	Bases such as caustics, amines	Can become instable over time. Treatment of small amounts (standards and samples <100 mL) with NaOH and hypochlorite solution is possible.	10	6.1 / I	Treatment; Incineration [4]
Hydrogen fluoride	7664-39-3	UN 1052	Hygroscopic. Incompatible with glass, alkali metals, light metals, alkaline earth metals	Good laboratory practices. [6] Small amounts may be treated with water and $CaCO_3$.	100	8 / I	Treatment; Incineration [4]
Hydrogen sulfide	7783-06-4	UN 1053	Strong oxidizers, strong nitric acid, metals	Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of hydrogen sulfide could occur without significant warning symptoms	100	2.3	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Isopropyl methylphosphonic acid (IMPA) (degradation product of GB) *[Organophosphorus compound liquid/solid, toxic]*	1832-54-8	UN 3278 (liq) UN 3464 (solid)	Decomposes in water	Store in stainless steel	Not Listed [2]	Information Limited [5]	Military [5]
Kerosene	64742-81-0	UN 1223	Oxidizers	Good laboratory practices [6]	Not Listed [2]	3 / III	Recycle standards to vendor; Incineration at low concentration
Lead arsenate (analyze as total arsenic)	7645-25-2	UN 1617	Strong bases, strong acids, and alkaline conditions	Store in original container in a cool, dry area	1	6.1 / II	
Lewisite 1 (L-1) (2-chlorovinyldichloroarsine)	541-25-3	Information Limited [5]	Decomposed by water and alkalis	Inactivated by bleaching powder, sodium hypochlorite	Not Listed [2]	Information Limited [5]	Inactivation treatment prior to shipping; Military [5]
Lewisite 2 (L-2) [bis(2-chlorovinyl)chloroarsine]	40334-69-8	Information Limited [5]	Decomposed by water and alkalis	Inactivated by bleaching powder, sodium hypochlorite	Not Listed [2]	Information Limited [5]	Inactivation treatment prior to shipping; Military [5]
Lewisite 3 (L-3) [tris(2-chlorovinyl)arsine]	40334-70-1	Information limited [5]	Decomposed by water and alkalis	Inactivated by bleaching powder, sodium hypochlorite	Not Listed [2]	Information Limited [5]	Inactivation treatment prior to shipping; Military [5]
Lewisite oxide	1306-02-1	UN 1556 (liq) UN 1557(solid)	Decomposed by water and alkalis	Inactivated by bleaching powder, sodium hypochlorite	Not Listed [2]	6.1 / I	Inactivation treatment prior to shipping; Military [5]

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Mercuric chloride (analyze for total mercury)	7487-94-7	UN 1624	Nitromethane	Store in non-metal container	Not Listed [2]	6.1 / II	
Mercury, Total	7439-97-6	UN 2809	Acetylene and acetylene derivatives, amines, ammonia, 3-bromopropyne, boron diiodophosphide, methyl azide, sodium carbide, heated sulfuric acid, methylsilane/oxygen mixtures; nitric acid/alcohol mixtures, tetracarbonylnickel/oxygen mixtures, alkyne/silver perchlorate mixtures, halogens (i.e., chlorine, bromine) and strong oxidizers (i.e., chlorine dioxide, perchlorates); copper, aluminum, rubidium	Good laboratory practices [6]	1	8 / III	Recycle standards to vendor; Landfill
Methamidophos *[Organophosphorus pesticides, liquid/solid, toxic]*	10265-92-6	UN 3018 (liq) UN 2783 (solid)	Alkaline materials	Optional treatment by hydrolysis and good laboratory practices [6]	100	6.2 / II	Optional hydrolysis treatment and Incineration
Methomyl *[Carbamate pesticides, liquid/solid, toxic]*	16752-77-5	UN 2992 (liq) UN 2757 (solid)	Strong bases	Good laboratory practices [6]	100	6.1 / II	Incineration; Landfill
Methoxyethylmercuric acetate (analyze for total mercury) *[Mercury compounds, liquid/solid, n.o.s.]*	151-38-2	UN 2024 (liq) UN 2025 (solid)	Strong acids	Good laboratory practices [6]	Not Listed [2]	8 / III	Recycle if high concentration; Landfill
Methyl acrylonitrile	126-98-7	UN 3079	Strong oxidizers, acids	Good laboratory practices [6]	1000	3	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Methyl fluoroacetate (analyze for fluoroacetate ion)	453-18-9	Information limited [5]	Oxidizing materials, oxygen, and peroxides	Good laboratory practices [6]	Not Listed [2]	Information Limited [5]	Information Limited [5]
Methyl hydrazine	60-34-4	UN 1244	Oxidizing materials, oxygen, peroxides, metals	Store in a cool, dry, well-ventilated area	10	6.1 / I	Treatment; Recycle standards to vendor; Incineration for all concentrations
Methyl isocyanate	624-83-9	UN 2480	Oxidizers, water	Fireproof containers preferred	10	6.1 / I	Recycle standards to vendor; incineration samples
Methyl paraoxon *[Organophosphorus pesticides, liquid/solid, toxic]*	950-35-6	UN 3018 (liq) UN 2783 (solid)	Information limited [5]	Store in original container in a cool, dry area	Not Listed [2]	6.1 / I, II, III	
Methyl parathion *[Organophosphorus pesticides, liquid/solid, toxic, n.o.s.]*	298-00-0	UN 3018 (liq) UN 2783 (solid)	Oxidizers, water	Good laboratory practices [6]	100	6.1 / I	Recycle standards to vendor; incineration samples
Methylamine *[Methylamine, aqueous solution]*	74-89-5	UN 1235	Acids, oxidizing materials, chlorine, hypochlorite, halogenated compounds, reactive organic compounds and some metals, and mercury and nitrosating compounds	Good laboratory practices [6]	100	2.1	Incineration
N-Methyldiethanolamine (MDEA)	105-59-9	Information limited [5]	Strong oxidizers, acids	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
1-Methylethyl ester ethylphosphonofluoridic acid (GE) *[Organophosphorus compound, toxic, liquid/solid, n.o.s]*	1189-87-3	UN 3278 (liq) UN 3464 (solid)	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Methylphosphonic acid (MPA) *[Organophosphorus compound, toxic, liquid/solid, n.o.s]*	993-13-5	UN 3278 (liq) UN 3464 (solid)	Strong oxidizers, bases	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Mevinphos *[Organophosphorus pesticides, liquid/solid, toxic]*	7786-34-7	UN 3018 (liq) UN 2783 (solid)	Strong oxidizers	Good laboratory practices [6]	10	6.1 / I, II, III	*In situ* disposal procedure (air stripping); Incineration
Mustard, nitrogen (HN-1) [bis(2-chloroethyl)ethylamine]	538-07-8	Information limited [5]	Ferrous alloys	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Mustard, nitrogen (HN-2) [2,2'-dichloro-N-methyldiethylamine N,N-bis(2-chloroethyl)methylamine]	51-75-2	Information limited [5]	Ferrous alloys	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Mustard, nitrogen (HN-3) [tris(2-chloroethyl)amine]	555-77-1	Information limited [5]	Combustible materials	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Mustard, sulfur / Mustard gas (HD)	505-60-2	Information limited [5]	Oxidizers, acids	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Nicotine compounds (analyze as nicotine) *[Nicotine compounds, liquid/solid, NOS]*	54-11-5	UN 3144 (liq) UN 1655 (solid)	Oxidizers, combustibles	Good laboratory practices [6]	100 (as nicotine sulfate / nicotine salts)	6.1 / II,III	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	2691-41-0	Information limited [5]	Oxidizable materials	Explosive, store in fireproof container	Not Listed [2]	Information Limited [5]	Military [5]
Organophosphate pesticides, NOS *[Organophosphorus pesticides, liquid/solid, toxic]*	NA	UN 3018 (liq) UN 2783 (solid)	Strong oxidizers	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	Incineration
Osmium tetroxide (analyze for total osmium)	20816-12-0	UN 2471	Oxidizers, 1-methylimidazole	Secondary containment required	1000	6.1 / I	Recycle standards; Landfill standards or samples
Oxamyl *[Carbamate pesticides, liquid/solid, toxic]*	23135-22-0	UN 2992 (liq) UN 2757 (solid)	Alkaline materials	Refrigeration recommended	Not Listed [2]	6.1 / I	Landfill
Paraquat *[Bipyridilium pesticides, liquid/solid, toxic]*	4685-14-7	UN 3016 (liq) UN 2781 (solid)	Strong oxidizers, alkylaryl-sulfonate wetting agents	Chemical degradation possible	Not Listed [2]	6.1 / I, II, III	Incineration; Landfill
Paraoxon *[Organophosphorus pesticides, liquid/solid, toxic]*	311-45-5	UN 3018 (liq) UN 2783 (solid)	Strong oxidizers, alkalines	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	
Parathion *[Organophosphorus pesticides, liquid/solid, toxic]*	56-38-2	UN 3018 (liq) UN 2783 (solid)	Strong oxidizers, alkalines	Good laboratory practices [6]	10	6.1 / I, II, III	Incineration
Pentaerythritol tetranitrate (PETN)	78-11-5	Shipping forbidden	Heat	Store below 40°C	Not Listed [2]	Information Limited [5]	Military [5]
Phencyclidine	77-10-1	Information limited [5]	Oxidizers	Increased documentation for tracking contaminated materials	Not Listed [2]	Information Limited [5]	Incineration (Tracking requirements)

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Phenol	108-95-2	UN 2821 (liq) UN 1671 (solid)	Strong oxidizers, calcium hypochlorite, aluminum chloride, acids	Store in closed containers with room ventilation to prevent airborne phenol concentrations >20 mg/m^3; control conditions to prevent overheating and the buildup of pressure in phenol containers	1000	6.1 / II	Recycle standards; Landfill standards or samples
Phorate *[Organophosphorus pesticides, liquid/solid, toxic]*	298-02-2	UN 3018 (liq) UN 2783 (solid)	Water, alkalis	Good laboratory practices [6]	10	6.1 / I, II, III	Incineration
Phorate sulfone*[Organophosphorus pesticides, liquid/solid, toxic]*	2588-04-7	UN 3018 (liq) UN 2783 (solid)	Water, alkalis	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	
Phorate sulfoxide *[Organophosphorus pesticides, liquid/solid, toxic]*	2588-03-6	UN 3018 (liq) UN 2783 (solid)	Water, alkalis	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	
Phosgene	75-44-5	UN 1076	Moisture, alkalis, ammonia, alcohols, copper	Possible treatment to reduce hazard component by immersion in oil	10	2.3	Treatment by disposal company; Incineration [4]
Phosphamidon *[Organophosphorus pesticides, liquid/solid, toxic]*	13171-21-6	UN 3018 (liq) UN 2783 (solid)	Reacts with bases	Hydrolysis and good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	Hydrolysis prior to Incineration [4]

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Phosphine	7803-51-2	UN 2199	Air, oxidizers, chlorine, acids, moisture, halogenated hydrocarbons, copper	The building should be adequately ventilated and equipped with a continuous phosphine monitoring and alarm system that is activated at the TLV of 0.3 ppm. In some jurisdictions, the indoor storage of toxic gases is prohibited.	100	2.3	Incineration
Phosphorus trichloride	7719-12-2	UN 1809	Water, chemically active metals, strong nitric acid, acetic acid, organic matter	Good laboratory practices [6]	1000	6.1 / I	Recycle standards; Landfill standards or samples
Pinacolyl methyl phosphonic acid (PMPA) (degradation product of GD) *[Organophosphorus compound, toxic, liquid/solid, n.o.s]*	616-52-4	UN 3278 (liq) UN 3464 (solid)	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Incineration
Propylene oxide	75-56-9	UN 1280	Oxidizers, anhydrous metal chlorides, iron, strong acids, caustics, and peroxides	Use glass or metal containers sealed with nitrogen	100	3 / I	Incineration
R-33 (VR) [methylphosphonothioic acid, S-[2-(diethylamino)ethyl] O-2-methylpropyl ester]	159939-87-4	Information limited [5]	Information limited [5]	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
Sarin (GB)	107-44-8	Information limited [5]	Decomposes in water. Reacts with bleach.	Store in stainless steel.	Not Listed [2]	Information Limited [5]	Military [5]
Semivolatile organic compounds, NOS *[Shipping name is contaminant dependent]*	NA	Additional analysis required	Apply good laboratory practices [6]	Good laboratory practices [6]	Not Listed [2]	Additional Analysis required	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Sodium arsenite (analyze for total arsenic)	7784-46-5	UN 1686 (liq) UN 2027 (solid)	Strong oxidizers, bromide azide	Good laboratory practices [6]	1	6.1 / II,III	Recycle standards; Landfill standards or samples
Sodium azide (analyze as azide ion)	26628-22-8	UN 1687	Metals, acid, water	Good laboratory practices [6]	1000	6.1 / II	Incineration
Soman (GD)	96-64-0	Information limited [5]	Decomposes in water	Information limited [5]			Military [5]
Strychnine	57-24-9	UN 1692	Oxidizers, alkali hydroxides and carbonates, aromatic ammonia spirit, bromides and iodides	Good laboratory practices [6]	10	6.1 / I	Incineration
Sulfur dioxide	7446-09-5	UN 1079	Powdered alkali metal (such as sodium & potassium), water, ammonia, zinc, aluminum, brass, copper	Good laboratory practices [6]	Not Listed [2]	2.3	Landfill
Sulfur trioxide	744-11-9	UN 1829	Moisture, organics, metals	Good laboratory practices [6]	Not Listed [2]	6.1, 8 / I	Incineration
Tabun (GA)	77-81-6	Information limited [5]	Decomposes in water	Destroyed by bleach	Not Listed [2]	Information Limited [5]	Military [5]
Tetraethyl pyrophosphate *[Organophosphorus pesticides, liquid/solid, toxic]*	107-49-3	UN 3018 (liq) UN 2783 (solid)	Strong oxidizers, alkalis, water	Good laboratory practices [6]	10	6.1 / I, II, III	Incineration
Tetramethylenedisulfotetramine *[Pesticides, liquid/solid, toxic, n.o.s]*	80-12-6	UN 2902 (liq) UN 2588 (solid)	Apply good laboratory practices [6]	Good laboratory practices [6]	Not Listed [2]	6.1 / I, II, III	Incineration

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Thallium sulfate *[Thallium compounds, n.o.s.]*	7446-18-6	UN 1707	Apply good laboratory practices [6]	Good laboratory practices [6]	100	6.1 / II	Landfill
Thiodiglycol (TDG) (degradation product of HD) *[Aviation regulated, n.o.s.]*	111-48-8	UN 3334	Strong acids and strong oxidants	Good laboratory practices [6]	Not Listed [2]	9 / I	Incineration
Thiofanox *[Carbamate pesticides, liquid/solid, toxic]*	39196-18-4	UN 2992 (liq) UN 2757 (solid)	Alkaline materials	Good laboratory practices [6]	100	6.1 / I, II, III	
1,4-Thioxane *[Flammable liquids, n.o.s.]*	15980-15-1	UN 1993	Oxidizers	Store in a cool, dry, well-ventilated area away from sunlight. Seal tightly, vapor may form explosive peroxides under certain conditions.	Not Listed [2]	3	Incineration
Titanium tetrachloride (analyze as total titanium)	7550-45-0	UN 1838	Oxidizers	Lab standards can be neutralized using a variety of procedures	1000	8 / II	Landfill
Triethanolamine (TEA) (degradation product of HN-3) *[Ethanolamine solutions]*	102-71-6	UN 2491	Oxidizers	Good laboratory practices [6]	Not Listed [2]	6.1 / I	Incineration
Trimethyl phosphite	121-45-9	UN 2329	Magnesium perchlorate, water	Good laboratory practices [6]	Not Listed [2]	3 / III	Incineration or landfill
1,3,5-Trinitrobenzene (1,3,5-TNB)	99-35-4	UN 0388	Reducing agents	Good laboratory practices [6]	10	6.1 / II	Incineration
2,4,6-Trinitrotoluene (2,4,6-TNT)	118-96-7	UN 0388	Strong oxidizers, ammonia, strong alkalis, combustible materials, heat	Explosive; fireproof containers required	Not Listed [2]	1.1D / II	Incineration or Landfill

Analyte(s) *[shipping name]*	CAS RN	UN ID[1]	STORAGE / HANDLING		DISPOSAL / TREATMENT		
			Incompatibility (Do not store with)	Handling / Storage / Treatment Options	Reportable Quantity (lbs)[2]	Hazard Class / Packing Group[3]	Disposal Method
Vanadium pentoxide (analyze for total vanadium)	1314-62-1	UN 2862	Calcium, sodium, water	Good laboratory practices [6]	1000	6.1 / III	Landfill
VE [phosphonothioic acid, ethyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21738-25-0	Information limited [5]	Oxidizers	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
VG [phosphonothioic acid, S-(2-(diethylamino)ethyl) O,O-diethyl ester]	78-53-5	Information limited [5]	Oxidizers	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
VM [phosphonothioic acid, methyl-, S-(2-(diethylamino)ethyl) O-ethyl ester]	21770-86-5	Information limited [5]	Oxidizers	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
VX [O-ethyl-S-(2-diisopropylaminoethyl) methyl-phosphonothiolate]	50782-69-9	Information limited [5]	Oxidizers	Information limited [5]	Not Listed [2]	Information Limited [5]	Military [5]
White phosphorus *[Phosphorus, white (dry or wetted)]*	12185-10-3	UN 1381	Air, oxidizers	Material should be stored under water or inert gas	1	Dependent on concentration	Incineration

[1] Refer to the tables included in 49 CFR Part 172 for additional Information (http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=d683a122678fef011339e6de2a067132&tpl=/ecfrbrowse/Title49/49cfr172_main_02.tpl).

[2] The Reportable Quantity (RQ) for liquid material will vary. Not all compounds have a specified RQ. The analyte may not be listed in the regulations (49 CFR 172.101, Appendix A), or, if listed, the analyte may not have an RQ.

[3] Packing Group requirements modified by increasing contamination concentrations.

[4] Treatment is required (e.g., stabilization) prior to storage, transportation, and disposal procedures (e.g., incineration). Treatment methods are listed in the Disposal/Treatment column.

[5] Information on specific compound is limited or restricted. Contact the EPA Coordinator and/or the local military coordinator for additional information. (For military information and contacts, see: http://www.cma.army.mil/contactus.aspx)

[6] The good laboratory practices designation indicates no specific storage or special treatment is required; the laboratory should use best professional judgment.

Appendix E

Example Hazardous Waste Manifest Form

Please print or type. *(Form designed for use on elite (12-pitch) typewriter.)* *Form ... proved. OMB No. 2050-0039. Expires 9-30-91*

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator's US EPA ID No. | Manifest Document No.

2. Page 1 of | Information in the shaded areas is not required by Federal law.

GENERATOR

3. Generator's Name and Mailing Address

4. Generator's Phone ( )

A. State Manifest Document Number

B. State Generator's ID

5. Transporter 1 Company Name | 6. US EPA ID Number

C. State Transporter's ID

D. Transporter's Phone

7. Transporter 2 Company Name | 8. US EPA ID Number

E. State Transporter's ID

F. Transporter's Phone

9. Designated Facility Name and Site Address | 10. US EPA ID Number

G. State Facility's ID

H. Facility's Phone

11. US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	12. Containers No.	Type	13. Total Quantity	14. Unit Wt/Vol	I. Waste No.
a.					
b.					
c.					
d.					

J. Additional Descriptions for Materials Listed Above

K. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. **GENERATOR'S CERTIFICATION:** I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in proper condition for transport by highway according to applicable international and national government regulations.

If I am a large quantity generator, I certify that I have a program in place to reduce the volume and toxicity of waste generated to the degree I have determined to be economically practicable and that I have selected the practicable method of treatment, storage, or disposal currently available to me which minimizes the present and future threat to human health and the environment; **OR**, if I am a small quantity generator, I have made a good faith effort to minimize my waste generation and select the best waste management method that is available to me and that I can afford.

Printed/Typed Name | Signature | Month Day Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

18. Transporter 2 Acknowledgement of Receipt of Materials

Printed/Typed Name | Signature | Month Day Year

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator: Certification of receipt of hazardous materials covered by this manifest except as noted in Item 19.

Printed/Typed Name | Signature | Month Day Year

EPA Form 8700-22 (Rev. 9-88) Previous editions are obsolete.

SCIENCE

United States
Environmental Protection
Agency

PRESORTED STANDARD
POSTAGE & FEES PAID
EPA
PERMIT NO. G-35

Office of Research and Development
National Homeland Security Research Center
Cincinnati, OH 45268