

**MEDICAL UNIVERSITY SOUTH CAROLINA
MIXED WASTE MANAGEMENT PROGRAM**

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**Medical University South Carolina
Mixed Waste Management Program**

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I. Introduction

The Medical University of South Carolina, (MUSC) conducts biomedical research and patient care activities that generate different types of waste streams (i. e. sanitary, hazardous, infectious, and radioactive). These waste streams are managed in accordance with all applicable state and federal regulation. In recent years another waste stream termed “mixed waste” has been identified and added to the MUSC list of regulated waste streams.

Mixed waste is defined by the Environmental Protection Agency, (EPA) as any solid waste (a solid waste being material that is solid, liquid, or gas) which has both a hazardous waste component, as regulated under Subtitle C of Resource Conservation and Recovery Act, (RCRA) and a radioactive component, that is regulated under the Atomic Energy Act, (AEA and the Nuclear Regulatory Commission, (NRC). An example of mixed waste is spent liquid scintillation cocktails. This waste has both radioactive properties (i. e. Tritium H3) and also hazardous properties (i.e. a solvent such as Toluene). New regulations regarding the management of this waste stream are currently being developed and promulgated. The fact that no final federal or state regulation strategy regarding mixed waste exists presents complex management problems for generators and disposer.

Both the NRC and EPA govern the storage, treatment and disposal of mixed waste. This dual regulatory framework creates problems in that regulations for radioactive and hazardous chemical waste frequently overlap and in some cases pose conflicts. Further complications are engendered by the fact that there are few waste disposal facilities permitted by EPA and licensed by NRC to accept, store, treat and/or dispose of mixed waste. In addition, the facilities that do exist are not free of problems associated with operating a waste disposal facility. Regulatory problems can arise anywhere and limit the

disposal options generators have. That means they may be required to store their mixed waste (or stop generating mixed waste) until a disposal method or facility is available.

MUSC has developed a mixed waste management program that complies with all current regulations regarding the generation, storage, treatment and disposal of mixed waste. The program is designed to be flexible so that any problem that may arise regarding the disposal of mixed waste will not create regulatory compliance problems for MUSC. The program is also a “working” program in that when final mixed waste regulations are promulgated by EPA or South Carolina Department of Health and Environmental Control (SCDHEC) can be easily added to the program.

II. Mixed Waste Generation

A survey of MUSC laboratories that currently generates mixed waste revealed that 30 satellite accumulation points currently produce approximately 175 gallons of mixed waste annually (excluding liquid scintillation waste). Currently policy promulgated by EPA (see Federal Register / Vol. 59, No. 76/ Extension of the Policy on Enforcement of RCRA Section 3004 (j) Storage Prohibition at Facilities Generating Mixed Radioactive/Hazardous Waste), states that mixed waste generators who generate less than 1,000 ft³/year (27,000 gal/year) are considered small quantity generators of mixed waste.

MUSC meets this requirement since only six- (6) ft³ of mixed waste were generated in 1994. Six- (6) ft³/year is less than 1 percent of the aforementioned 1,000 ft³/year. EPA’s immediate concern is with large quantity generators unlike MUSC.

The mixed waste streams generated by MUSC include the following:

- LSC Vials – Liquid scintillation counting (LSC) is the largest producer of mixed waste at MUSC. Spent LSC vials contents are radioactive and may contain a variety of different chemicals including acids, surfactants and/or organic solvents. These potentially

hazardous chemicals may make the contents of the LSC vials flammable and/or corrosive and/or toxic depending on the specific cocktail formulation. MUSC generated approximately 84,000 (112 gallons) vials in 1998. Of the 84,000 vials, 60,000 vials (60 gallons) were considered deregulated by NRC and were disposed of as hazardous waste according to S.C. RHA 3.31. The remaining 24,000 vials (32 gallons) were considered regulated mixed waste and were accumulated in the satellite accumulation points until the end of a prespecified 90 day storage period (e.g. every three months). All accumulated LSC vials are currently shipped to Perma-Fix (Gainesville, FL) for disposal.

- Miscible/Aqueous Liquids – These mixed waste liquids average about 85 percent water and may contain trace amounts of organic solvents, carcinogens, mutagens and/or other toxic chemicals. Chloroform from decarboxylation of spent trichloroacetic acid solutions is one of the major toxic components. Approximately 60 liters (15 gallons) of miscible/aqueous mixed waste are generated annually. Currently, the above described waste is not characteristically hazardous, and is therefore considered exempt by EPA, is disposed via the sanitary sewer following the guidelines set forth by S.C. RHA 3.53.
- Non-aqueous Liquids – Most of the non-aqueous liquid wastes are mixtures of organic solvents such as acetonitrile and methanol from HPLC units: phenol chloroform mixtures from nucleic acid extractions and acetic acid/methanol mixtures from gel fixing. Approximately 610 liters (160 gallons) of non-aqueous mixed waste are generated annually. Storage and disposal of non-aqueous mixed waste are discussed in Section III of this plan.

III. Management of Mixed Waste

The Occupational Safety and Health Office in conjunction with the Radiation Safety Office under Risk Management has developed the following procedures regarding the

management of mixed waste. These procedures include both hazardous waste management protocols as well as radioactive waste management protocols. [Note: Mixed waste cannot be accepted for storage at MUSC's RCRA permitted storage facility due to permit restrictions.]

A. Labeling and Classification

Generators of mixed waste must use both a MUSC hazardous waste label and a radioactive waste label on any container used for collection. Also, the contents in each container must be accurately identified using generator knowledge of the chemicals (and their respective percentages) present in the mixture as well as the pH of the mixture.

On the radioactive waste label a list of the radionuclides present as well as their representative activity in the mixed waste must be recorded.

B. General Storage

While the mixed waste is being accumulated it must be stored in a designated hazardous waste storage area (i.e. a flammable storage cabinet or suitable area) which has adequate radiation shielding to ensure that only "As Low As Reasonable Achievable" (ALARA) radiation exposures occur. Satellite accumulation points may accumulate up to fifty-five gallons of mixed waste during the prespecified accumulation period. Those laboratories needing to accumulate more than fifty-five gallons in that time period will be addressed on a case by case basis by both OSHP and RSO offices. [Note: The Radiation Safety Manual states that all mixed waste must be stored such that radiation dose rates at the surface of the storage area is less than 2.0 mRem/hr. Surface areas of storage containers, which exceed dose rates above 2.0mRem/hr, must have additional shielding. RSO personal will determine the shielding needed.]

The location of all storage areas must be approved by both RSO and OSHP personnel prior to actual storage of mixed waste. Once approved, the storage areas must be kept secure from unauthorized access or removal of the mixed waste. To ensure compliance with these requirements, surveys of each storage area will be conducted at the discretion of OSHP and RSO.

Between days 80 and 90 of the prespecified accumulation period, a chemical inventory of all mixed waste to be disposed will be generated by RSO personnel. The purpose of this inventory is so the proper number and size of containers necessary for the shipment can be determined. On the day of shipment OSHP and RSO personnel will come to each mixed waste generation area and bulk the mixed waste into appropriate containers. Each drum will be labeled and packed by OSHP and RSO personnel following strict EPA, NRC, and DOT guidelines. The mixed waste shipment will then be moved to a predetermined area where it will be picked up by the transporter and conveyed to the disposal facility.

C. Special Case Storage

Currently, the only permitted treatment, storage, and disposal facilities for mixed waste are restricted as to the type of mixed waste that they may accept. These restrictions are based on the radionuclides present within the waste and their respective activities. For example, Perma-Fix cannot accept mixed waste containing Tritium (H3) and Carbon (c14) with activity levels greater than 0.05 uCi/g, or waste containing all other radionuclides with activity levels greater than 0.002 uCi/g. The majority of mixed waste generated by MUSC will fall within these acceptable disposal limits; however, there will be instances when mixed waste will be generated that

exceeds these restriction limits. The three solutions available to alleviate this problem are (1) “decay-in-storage”, (2) “extended-Storage” and (3) “ship for disposal

1. “Decay-in-storage” regulations are discussed in 10 CFR 35.92. These regulations allow for the storage of mixed waste containing radionuclides with physical half-lives of less than 65 days so that storage for a period of at least 10 half-lives will allow the radioactivity to decay to below background levels. When background levels are reached, the waste no longer exists mixed waste characteristics and can be managed solely as a hazardous waste. Only Phosphorus (P32, P33) and Iodine (I125, I 131) radionuclides are eligible decay-in-storage since their half-lives are less than 65 days. All other radionuclides currently used at MUSC have half-lives greater than 65 days and must be addressed under “extended-storage”.

2. “Extended-storage” will apply to mixed waste which have activity levels greater than those that can be accepted by a permitted treatment, storage and disposal facility but which are not covered under the decay-in-storage umbrella. In these cases it may be necessary to store mixed waste for a period of time greater than the prespecified 90 days to either allow the radionuclide to decay to acceptable levels for disposal or to allow for bulking of aliquots of the waste with another less active yet chemically compatible mixed waste to create a mixture that is within the acceptable activity levels of the disposal facility.

Neither “decay-in-storage” nor “extended-storage” create regulatory compliance problems according to South Carolina Hazardous Waste Management Regulations 262.34(c) (1) and 40 CFR 262.34 (c) (1) which

allow for hazardous/mixed waste storage in satellite accumulation points for an indefinite period of time as long as 55 gallons of hazardous waste or one quart of acutely hazardous waste is not exceeded. Additional discussion regarding the accumulation of mixed waste is included in this plan.

Labeling, classification and storage protocols for “decay-in-storage” and “extended-storage” waste will be the same as those procedures previously discussed for mixed waste with the following additional requirements.

- All decay-in-storage and extended-storage waste must bear radioactive labels with the investigator's name, radionuclide (s) present, activity levels, date of storage generation, and a survey reading at the time of storage.
- All decay-in-storage and extended-storage waste must bear hazardous waste labels with chemical names, quantity, and percentages of solution.
- Each investigator decaying waste must keep a notebook or ledger containing the date of storage, radionuclide(s) present, survey reading (s) of the waste from weekly inspections, serial number of the instrument used for surveying, survey reading at time of disposal and the signature of individuals doing surveys. All decay-in-storage waste will be held for 10 half-lives prior to disposal as non-radioactive material.
- Copies of these records shall be sent to the RSO on a monthly basis.
- All signs and labels on waste containers shall be of the conventional radiation colors (magenta or purple on a yellow background) and shall be in compliance with 10 CFR 20.203.

D. Bulking

Bulking of liquid mixed waste in satellite accumulation points will be permitted providing the wastes being bulked are chemically compatible. OSHP and RSO personnel will address bulking in each laboratory on a case by case basis to ensure

chemical compatibility and that the bulk mixed waste can be accepted by disposal facility for storage or blending.

E. Mixed Waste Treatment

Disposal facilities will generally not accept corrosive mixed waste for disposal. According to 40 CFR 270.1, MUSC is authorized to treat (without a permit) wastes that are hazardous solely due to corrosivity by elementary neutralization. With regard to these treatment allowances, MUSC may elect to conduct certain mixed waste treatment activities at satellite accumulation points. If so, these activities will be conducted within a fume hood to prevent vapors from entering the satellite accumulation point.

F. Compliance and Inspection

In order to insure compliance with the above procedures, OSHP and RSO will inspect each satellite accumulation point on at least a quarterly basis. Mixed waste containers without the above-required information and labeling will be labeled properly.

G. Mixed Waste Off-Site Disposal

To be eligible for disposal services, MUSC will be required to submit a profile representative of the mixed waste being generated for review and approval by the selected disposal facility. Upon approval of the profile information (and any other information requested), the facility will accept those mixed waste streams which are defined by the profile. [Note: Some facilities will not accept corrosive wastes (pH <2 or >12.5), or waste which exceed permitted radioactivity levels. MUSC will contract with a licensed hazardous waste hauler for transportation to the disposal facility.

IV. **Mixed Waste Minimization**

MUSC is committed to the minimization of all waste streams, especially mixed waste. Occupational Safety and Health Programs (OSHP) encourages the following strategies for reducing the generation of mixed waste:

- Before starting research involving the mixing of hazardous chemicals and radioactive materials, develop a plan that will avoid mixing these two materials. If avoidance is not possible, is there a method for separating the materials before dispensing into a waste container?
- Space is very limited at MUSC and there may be a tendency to place all waste together in the same container. Non-radioactive waste must never be mixed with radioactive waste, unless this process is vital to research.
- Use short-lived radionuclides when possible. This may allow mixed waste to be disposed of as a hazardous waste after a shorter storage for decay period.
- Use less hazardous chemicals if the research process requires mixing with radionuclides. There are non-hazardous, biodegradable chemicals on the market that may be substituted for many solvents.
- Reduce the amount of chemicals used in research to reduce amount of waste generated. Investigate similar research at other facilities to see if small-scale techniques are available.

V. **Accumulation of Mixed Waste**

RCRA regulations specify two different types of hazardous waste accumulation locations that are available for selection. During the permitting process conducted for the hazardous waste storage building, MUSC was required to choose one of the two types available. MUSC chose the Satellite accumulation point type. A discussion of each type is presented in the following sections.

the accumulation point, the 90-day limit for that container begins as soon as the waste first added to the container.

A. Satellite Accumulation Point

A satellite accumulation point is an area at or near the point of generation, which is under the control of the operator of the process generating the waste. No more than 55 gallons of hazardous waste or one quart of acutely hazardous waste may be accumulated at a satellite accumulation point.

B. Discussion

The differences between a satellite accumulation point and accumulation point are the volume and the length of time waste may be accumulated. At a satellite accumulation point, up to 55 gallons of hazardous waste may be accumulated for an unlimited amount of time. At an accumulation point, an unlimited volume of waste may be accumulated in containers for up to 90-days.

Satellite accumulation points are typically used to increase the efficiency of waste collection and to reduce the cost of waste disposal. Waste collection at satellite accumulation points are collected right at the point where the waste are generated so it is not necessary to immediately transfer waste to a central collection area or accumulation point. In addition, waste may be collected at the point indefinitely until 55 gallons of hazardous waste are accumulated. There is no need to ship partially full drums of waste off-site at full cost due to accumulation time restrictions. All waste at satellite accumulation points must be under the control of the operator of the process generating the waste. For example, the container at a satellite accumulation point must be placed right next to or near the process which generates

the hazardous waste and the person who generates that process or area must control the hazardous waste placed in that container.