Designation: D 4447 – 84 (Reapproved 2003)

Standard Guide for Disposal of Laboratory Chemicals and Samples[1]

This standard is issued under the fixed designation D 4447; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is intended to provide the chemical laboratory manager with guidelines for the disposal of small quantities of laboratory wastes safely and in an environmentally sound manner. This guide is applicable to laboratories that generate small quantities of chemical or toxic wastes. Generally, such tasks include, but are not limited to, analytical chemistry, process control, and research or life science laboratories. It would be impossible to address the disposal of all waste from all types of laboratories. This guide is intended to address the more common laboratory waste streams.

1.2 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *Department of Transportation Regulations:*

40 CFR 173 Shippers—General Requirements for Shipments and Packagings[2]

40 CFR 178 Shipping Container Specifications[2]

40 CFR 179 Specifications for Tank Cars[2]

40 CFR 261.3 Definition of Hazardous Waste[2]

40 CFR 261.33 Discarded Commercial Chemical Products, Off-Specifications Species, Container Residues, and Residues Thereof[2]

40 CFR 261.5 Special Requirements for Hazardous Waste Generated by Small Quantity Generators[2]

40 CFR 761 Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions[2]

49 CFR 172 Hazardous Materials Tables and Hazardous Materials Communications Regulations[2]

3. Summary of Guide

3.1 The necessary classification of the waste for shipping and manifesting is addressed both by their common or generic chemical name and by Department of Transportation (DOT) guidelines.

3.2 Various types of wastes are listed and defined in a manner necessary to segregate them for recovery, pretreatment, or disposal, or both.

3.3 Procedures are not for recovery of the materials, or to render them nonhazardous and amenable to municipal landfill or in-house disposal, or to prepare them for disposal in an authorized chemical waste disposal site.

3.4 Various methods of disposal are discussed.

3.5 Each type of waste is designated a specific recovery or pretreatment and disposal method. In most cases, disposal alternatives are offered.

4. Significance and Use

4.1 Laboratories rarely generate or handle large volumes of hazardous substances. However, the safe handling and disposal of these substances are impaired by diversity, toxicity, high hazard risks, and contemptuous familiarity. With the promulgation of the Resource Conservation and Recovery Act (RCRA) of 1976, more attention is being given to the proper handling and disposal of such materials. Laboratory management should designate an individual who will be responsible for waste disposal and must review the RCRA guidelines, in particular, the definition of a hazardous waste, the specific substances listed as hazardous, generator requirements and exclusions, and proper shipping and manifesting procedures. Because many laboratory employees could be involved in the proper (and improper) treatment and disposal of laboratory chemicals and samples, it is suggested that a safety and training program be designed and presented to all regarding procedures to follow in the treatment and disposal of designated laboratory wastes.

4.2 If practical and economically feasible, it is, of course, recommended that all laboratory waste be either recovered, re-used, or disposed of in-house. The disposal of laboratory samples, especially those received in large numbers or quantities from a specific source, can often be accommodated by returning the material to the originator, so he can combine them

[1] This guide is under the jurisdiction of ASTM Committee D34 on Waste Management and is the direct responsibility of Subcommittee D34.01.01 on Planning for Sampling.

Current edition approved March 10, 2003. Published June 2003. Originally approved in 1984. Last previous edition approved in 1997 as D 4447 – 84 (1997).

[2] *Draft Manual for Infectious Waste Management*, SW-957, USEPA, Washington, DC., September 1982.

with larger quantities for recycling or disposal. However, should this not be the case, other alternatives are presented. This guide is intended only as a suggested organized method for classification, segregation, and disposal of chemical laboratory waste.

4.3 Even though the small quantity generator exclusion (40 CRF 261.5) may apply to laboratories, the professional laboratory supervisor and his or her employers must balance the importance of protecting human health and the environment from the adverse impact of potential mismanagement of small quantities of hazardous waste, with the need to hold the administrative and economic burden of management of these wastes under RCRA within reasonable and practical limits. Additionally, all lab supervisors should be aware of all current local, state, and federal regulations, and specific hazardous waste management facility criteria.

5. Classification of Waste Types

5.1 The individual responsible for classification and segregation must be familiar with the waste's chemical, physical, and hazardous properties. If the waste is ultimately to be disposed of off-site, it must be segregated, packaged, and classified according to defined DOT hazard classification, as specified in the DOT hazardous materials regulations 49 CFR 172.

5.2 The chemical waste may be segregated into the following waste types,

5.2.1 Trash, inert chemicals, non-toxic, non-reactive, non-ignitable, non-corrosive solids as per RCRA or DOT guidelines,

5.2.2 Weak aqueous acid solutions (<10 % weight) and related compounds,

5.2.3 Weak aqueous alkaline solutions (<10 % weight) and related compounds,

5.2.4 Concentrated aqueous acid solutions and related compounds,

5.2.5 Concentrated aqueous alkaline solutions and related compounds,

5.2.6 Flammable (flash point, closed cup, °F < 140°), non-halogenated organic solvents and related compounds,

5.2.7 Flammable halogenated organic solvents and related compounds,

5.2.8 Non-flammable non-halogenated organic solvents and related compounds,

5.2.9 Non-flammable halogenated organic solvents and related compounds,

5.2.10 Organic acids,

5.2.11 Organic bases,

5.2.12 Inorganic oxidizers, peroxides,

5.2.13 Organic oxidizers, peroxides,

5.2.14 Toxic heavy metals,

5.2.15 Toxic poisons, herbicides, pesticides, and carcinogens,

5.2.16 Aqueous solutions of reducing agents and related compounds,

5.2.17 Pyrophoric substances,

5.2.18 Water reactive substances,

5.2.19 Cyanide, sulfide, and ammonia bearing waste,

5.2.20 Explosive materials,

5.2.21 Radioactive materials,

5.2.22 Infectious waste in life science laboratories,

5.2.23 Infectious waste in hospitals,

5.2.24 Water soluble waste of unknown origin or properties,

5.2.25 Water insoluble waste of unknown origin or properties,

5.2.26 Empty containers,

5.2.27 Asbestos or asbestos containing waste,

5.2.28 Contaminated labware and trash,

5.2.29 Polychlorinated biphenyls (PCBs).

6. Pretreatment and Recovery Methods

6.1 The following methods may be employed for the recovery or pretreatment of waste in the laboratory. All persons using chemicals in the laboratory must be aware of the toxic or hazardous properties of the substance(s) used, including consideration of the toxic properties of possible reaction products. In incorporating the following procedures, examine the possible hazards associated with each.

6.1.1 *Recovery, re-use*— Consideration should be given to distillation for the recovery of larger volumes of solvents. Many laboratories have systems for the recovery and re-use of mercury. Other recovery methods such as precipitation or crystallization may be practical.

6.1.2 *Dilution*—Many laboratory chemical wastes can be diluted to an extent to allow disposal to the sewer system. However, this procedure is not recommended for toxic substances exhibiting characteristics of eroaccumulation, persistence, or degradation to more toxic substances. Strong acid and bases should be diluted to pH 3-11 for this purpose. Some solutions of water soluble flammable solvents can be diluted enough to render them non-flammable. Small amounts of various heavy metal compounds may be diluted to an extent that does not pose a hazard to a sewer system. Consult the local waste-water treatment facility for acceptable guidelines.

6.1.3 *Neutralization*— Strong acids and bases can carefully be neutralized to pH 3-11 to render them less hazardous for disposal.

6.1.4 *Oxidation*—Compounds such as sulfides, cyanides, aldehydes, mercaptans, and phenolics can be oxidized to less toxic and less odoriferous compounds.

6.1.5 *Reduction*—In addition to oxidizers and peroxides, various organic chemicals and heavy metal solutions can be reduced to less toxic substances. Aqueous waste containing hexavalent chromium may be reduced to tri-valent using reducing agents such as bisulfite and ferrous sulfate. Mercury, lead, and silver may be removed from aqueous streams by the process of reduction/precipitation. Organo-lead compounds can be removed by the same type processes. The resulting concentrated heavy metal waste can be containerized and disposed of at an authorized hazardous waste management facility, or subjected to recovery at a treatment facility.

6.1.6 *Controlled Reactions/Processes*—Other methods for reducing the hazardous properties of waste will involve processes specific to particular waste generated by the laboratory. To be practical, the waste would have to be of sufficient volume and, for safety purposes, the process would need to be carefully studied and the resulting products identified. Examples may