

JoVE: Science Education
Proper waste disposal, including sharps and glass
--Manuscript Draft--

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Science Education Title: Proper Waste Disposal, Including Sharps and Glass

Overview:

Users are responsible for the proper disposal of the waste generated during the course of their work. Improper waste disposal may severely endanger public health and/or the environment. The handling of hazardous waste must be regulated from the moment of generation until its disposal at its offsite final destination facility. A waste management system must be devised before work begins on any laboratory activity. Users must comply with the rules and regulations of their institute's Environmental Health and Safety (EHS) office, which develops and implements proper waste management systems satisfying diverse regulations and standards such as those imposed by the Occupational Safety and Health Administration (OSHA).

Principles:

Proper waste disposal begins with good waste management by the researcher, including minimum waste generation, reusing surplus materials, and recycling of appropriate (*i.e.*, uncontaminated) waste. The generated waste must be properly collected and stored, paying close attention to labeling, segregating according to chemical compatibility, and accumulating in a well-ventilated location. This location should be well labeled. Other laboratory waste items such as sharps and glass must also be disposed with care in appropriate labeled and compatible containers.

Procedure:

1. Waste Management

- 1.1. Users should make an effort in keeping waste to a minimum. The best way to do so is by reducing the scale of operation, which minimizes the quantity of waste generated. Whenever possible, chemicals used should be substituted with less hazardous chemicals.
- 1.2. Chemical quantities should be kept to minimum. -Store only what will be used in the near term.
- 1.3. Besides preventing or minimizing waste generation, chemicals should be recycled or recovered for reuse.
- 1.4. When waste is generated, it must be disposed of properly. Sink disposal may not always be appropriate and may end up as a source of contaminants in drinking water. Alternative methods of disposal should be considered including incineration, treatment, and land disposal. The institute's EHS office should be consulted to determine the proper disposal method for the different waste types.

2. Waste Collection and Storage

Commented [ASW1]: This Procedure is very conceptual. Some of the points are specific actions that we can film, but others are a lot more about keeping things in mind. Steps like "chemicals should be recycled or recovered for reuse." should be re-written as discrete actions.

Commented [RR2]: I think this is a very important point. It is certainly conceptual rather than demonstrable.

Commented [RR3]: Here we could show the proper disposal of waste. Not mixing incompatible chemicals. We can show how to recycle chemicals (especially solvents). I am not sure that is practiced too much.

We could also show what a proper satellite accumulation area should look like (*i.e.*, proper labeling, secondary containment, incompatible chemical separation).

Commented [RR4]: Here is an area that we can demonstrate and film. I would imagine we could show a situation where you have generated various types of waste (*i.e.* reaction work-up). We'd show how we separate waste type and dispose of properly.

- 2.1. When generating or managing any chemical waste, proper personal protective equipment (PPE) must be worn and engineering controls should be implemented as necessary.
- 2.2. Users should collect and store chemical waste at or near the point of generation in a designated satellite accumulation area. This accumulation area should be well marked for easy identification.
- 2.3. Chemical wastes must be stored in compatible containers with closed and properly fitted caps.
- 2.4. Waste containers must be labeled mentioning chemical compositions, the accumulation start date, and hazard warnings as appropriate. The institute's EHS office typically provides these required labels.
- 2.5. Incompatible waste types should not be mixed and be kept separate in order to avoid any reaction, heat generation, and/or gas evolution.
- 2.6. Waste containers should be stored in secondary containers and in a ventilated, cool, and dry area.
- 2.7. In the central accumulation area, waste containers should be grounded to avoid fire and explosion hazards.
- 2.8. Trained laboratory researchers who are most familiar with the waste generated should work with EHS to ensure proper waste management.

Sharps Disposal - Syringes and Needles

- 2.9. Chemically contaminated needles, syringes, and razor blades should be disposed inside of a proper sharps container (See **Figure 1**).
- 2.10. Syringes or needles must never be disposed in a laboratory waste bin or a general waste container.

4. Glass Recycling

- 4.1. Recycling glass is friendly to the environment as it reduces pollution caused by the waste ending up in landfill sites. Every laboratory should have a separate recycling bin dedicated to glass.



Figure 1: Plastic sharps container

- 4.2. Clean empty glass bottles and broken glassware may be recycled. To clean an empty glass bottle, it must be “triple rinsed” with water or other suitable solvent and air-dried before disposal.
- 4.3. Chemically contaminated laboratory glassware such as sample tubes, droppers, and glass wool must be disposed as controlled waste.

Summary:

A basic guideline for laboratory waste disposal is provided and users must work and comply with their institute's EHS office, to determine the proper method for waste disposal satisfying diverse regulations and standards. The laboratory user should be cognizant of what waste material is being generated and hazards present should be carefully assessed to determine proper waste disposal, which may otherwise put public health or the environment in danger. No matter how small or large a waste quantity is handled, proper PPE must be worn.

References:

1. Occupational Health and Safety [OSHA] (Standard - 1910.1450 App A). at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10107
2. Princeton University Environmental Health Safety Empty Chemical Container Management at <https://ehs.princeton.edu/environmental-programs/waste-management/empty-chemical-container-management>
3. US Environmental Protection Agency Table of Regulated Drinking Water Contaminants at <https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants>

Contaminant	Maximum Contaminant Level, mg/L
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
1,2-Dibromo-3-chloropropane (DBCP)	0.0002
1,2-Dichloroethane	0.005
1,2-Dichloropropane	0.005
1,2,4-Trichlorobenzene	0.07
2,4-D	0.07
2,4,5-TP (Silvex)	0.05
Alachlor	0.002
Antimony	0.006

Arsenic	0.010 as of 01/23/06
Asbestos (fiber > 10 micrometers)	7
Atrazine	0.003
Barium	2
Benzene	0.005
Benzo(a)pyrene (PAHs)	0.0002
Beryllium	0.004
Bromate	0.01
Cadmium	0.005
Carbofuran	0.04
Carbon tetrachloride	0.005
Chloramines (as Cl ₂)	4
Chlordane	0.002
Chlorine (as Cl ₂)	4
Chlorine dioxide (as ClO ₂)	0.8
Chlorite	1
Chlorobenzene	0.1
Chromium (total)	0.1
cis-1,2-Dichloroethylene	0.07
Cyanide (as free cyanide)	0.2
Dalapon	0.2
Di(2-ethylhexyl) adipate	0.4
Di(2-ethylhexyl) phthalate	0.006
Dichloromethane	0.005
Dinoseb	0.007
Dioxin (2,3,7,8-TCDD)	0.00000003
Diquat	0.02
Endothall	0.1
Endrin	0.002
Ethylbenzene	0.7
Ethylene dibromide	0.00005
Fluoride	4
Glyphosate	0.7

Haloacetic acids (HAA5)	0.06
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Hexachlorobenzene	0.001
Hexachlorocyclopentadiene	0.05
Lindane	0.0002
Mercury (inorganic)	0.002
Methoxychlor	0.04
Nitrate (measured as Nitrogen)	10
Nitrite (measured as Nitrogen)	1
o-Dichlorobenzene	0.6
Oxamyl (Vydate)	0.2
p-Dichlorobenzene	0.075
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated biphenyls (PCBs)	0.0005
Selenium	0.05
Simazine	0.004
Styrene	0.1
Tetrachloroethylene	0.005
Thallium	0.002
Toluene	1
Total Trihalomethanes (TTHMs)	0.08
Toxaphene	0.003
trans-1,2-Dichloroethylene	0.1
Trichloroethylene	0.005
Vinyl chloride	0.002
Xylenes (total)	10

Table 1. Table of Regulated Drinking Water Contaminants. Obtained from US Environmental Protection Agency website at <https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants>