Hazardous Waste Minimization Program

NAU NORTHERN ARIZONA UNIVERSITY

Environmental Health and Safety

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Introduction

Under state and federal law, Northern Arizona University is classified as a Large Quantity Generator (LQG) of hazardous waste. As an LQG, a waste minimization program must be in place. The NAU Waste Minimization Program presents guidelines for University personnel to reduce the amount and toxicity of wastes generated at Northern Arizona University.

Waste Minimization

NAU personnel should recognize the environmental and financial impacts related to hazardous waste disposal. Hazardous waste minimization begins with the initial buyer. Hazardous waste generators on campus include laboratories, maintenance shops, garages, machine shops, art studios, and many more. Proper hazardous waste management is an integral part of all campus waste generating operations.

This document is designed to assist waste generators in managing their operations with waste minimization in mind. The three general methods of waste minimization are source reduction, recycling, and treatment.

Source Reduction

Changing practices and processes to reduce or eliminate hazardous waste generation is referred to as source reduction. Source reduction methods may include process modification, chemical substitution, and/or improved operating procedures. Specific examples that may be employed include:

- Not mixing hazardous and non-hazardous waste
- Maintaining sound Chemical Hygiene practices to reduce waste
    - Carefully weigh/transfer reagents to minimize spills
    - Maintain sanitary secondary containment so spilt chemicals can be used
- Using micro-scale laboratory experiments
- Minimizing inventory (buy less, store less, use less)
    - Buy chemicals that will be used now, not weeks or months later
    - Practice sound purchasing (a large amount of campus waste is a result of buying too much reagent)
- Labeling all chemical products to prevent unknowns
- Centralizing purchasing of chemicals and products within departments/labs to prevent duplicate orders
- Substituting computer simulations/modeling, videos, or demonstrations for wet laboratory experiments

- Having students work in pairs/groups on experiments rather than individually
- Evaluating procedures to see if a less hazardous or a non-hazardous reagent can be used

Recycling

Another method of waste minimization is recycling. Recycled materials are used for another purpose; treated and reused for the same purpose; or reclaimed for another use rather than being discarded as waste. Examples include:

- Re-distilling used solvents (stringent standard operation procedures must be developed for recovering solvents)
- Purchasing/renting gas cylinders and lecture bottles from manufacturers who will receive/recycle them after use
- Preventing the contamination of used oil with heavy metals, halogens, etc.
- Collecting, purifying, and reusing reagents prior to disposal

Treatment

The last technique for waste minimization is treatment. Wastes that are neutralized or detoxified and managed at the source can reduce environmental risks that might occur during transportation and handling. EHS encourages in-lab chemical treatment **as the final step** of an experiment. ***If a treatment is not part of the end step in an experiment (i.e. is done separately), it is considered a "hazardous waste treatment." NAU does not have a permit to treat hazardous wastes in such a matter.*** Before initiating treatment procedures, please contact EHS. Examples of final step experiment treatment include:

- Neutralizing acids and bases
- Precipitating metals out of solution to reduce volume
- Polymerizing acrylamide solutions
- Using purchased EPA acutely toxic "P Listed" reagents such as potassium cyanide, osmium tetroxide, methyl hydrazine, 2,4-dinitrophenol, strychnine, vanadium pentoxide, etc. Disposing chemicals on this list are more expensive than others (a full list is provided here: EPA P Listed Wastes)

Efficient Waste Management

Although waste is a product of research, teaching, maintenance, construction, and other university operations it can be minimized. Chemical waste management is most efficient when waste types are properly segregated. Proper chemical waste segregation is better for the environment, reduces disposal costs, and is essential to maintaining a safe workplace.

The importance of proper chemical waste separation into various groups cannot be over emphasized. In most circumstances, the volumes and types of waste rather than the

concentration determine disposal cost. As a result, EHS requests waste generators to make an effort not to dilute their waste any more than necessary. **Never mix hazardous chemical waste with non-hazardous waste, and do not mix hazardous waste with radioactive waste (unless a procedure *requires* doing so).** This includes naturally occurring Uranium compounds.

The following section provides a brief paragraph on common laboratory reagents and bulleted ideas on how to minimize waste production specific to each category. Use safe practices when considering these situations and consult EHS with any questions or concerns.

Flammable liquids

Flammable liquids are usually recycled as fuel in other manufacturing processes. If the water content of a flammable liquid waste renders it no longer flammable, the disposal cost will increase.

- Minimize water content
- Separate flammable wastes from heavy metals, corrosives, pesticides, cyanides, and/or P listed materials (link on page 3)
- Recycle or distill solvents
- Utilize environmentally friendly solvents

Flammable & Corrosive Compounds

Flammable acid and flammable base disposal costs up to four times the amount compared to other flammable liquids. Waste minimization suggestions include:

- Minimize unnecessary dilution and water content
- Prevent the mixture of flammable solvents and acids/bases
- Investigate the use of non-flammable acids/bases
- Separate such wastes from heavy metals, pesticides, cyanides, and/or P listed materials (link on page 3).

Acids and Bases

If not contaminated with other hazardous wastes, most mineral acids and bases can be drain disposed after neutralization. Once again, this can only be done if neutralization is **included in the experiment as a final step.** Diluting acids/bases with water is not considered neutralization and is illegal. Some acids and bases (such as chromic acid or barium hydroxide) cannot be rendered non-hazardous due to their heavy metal content. Do not attempt to neutralize hydrofluoric acid, perchloric acid, concentrated nitric acid, or any other complex, multi-hazard, corrosive compounds.

- Minimize unnecessary dilutions and water content

- Neutralize waste if possible (do not attempt neutralization without proper training and a written standard operating procedure)
- Do not mix acids/bases with other wastes
- Keep acids/bases separate from wastes that contain flammable liquids, heavy metals, pesticides, cyanides, or P listed materials (link on page 3)

Halogenated Solvents

Many halogenated solvents are carcinogenic, require difficult treatment, and cost up to five times more for disposal than non-halogenated solvents. Keeping halogenated and non-halogenated wastes separate reduces disposal cost.

- Minimize unnecessary dilutions
- Separate from acids/bases
- Substitute non-halogenated reagents where possible
- Separate halogenated wastes from wastes that contain corrosives, non-halogenated flammable liquids, heavy metals, pesticides, cyanides, or P listed materials (link on page 3)
- Recycle or redistill solvents

Aqueous Metals

Certain heavy metal solutions/compounds are more expensive to dispose of than others. These include any mixture with Arsenic, Barium, Cadmium, Chromium, Lead, Mercury, Selenium, and/or Silver. It's important to note that minimizing volume in this waste category is far more important than concentration. 20 gallons of a 5 ppm Silver contaminated waste is more expensive to dispose of than 1 gallon of waste with 10,000 ppm of Silver. EHS highly recommends the substitution/use of other metals for procedures that include these metals.

- Keep heavy metal solutions separate from other wastes
- Collect mercury separate from all other waste streams including other metal waste
- Minimize unnecessary dilutions
- Use micro-scale techniques
- Substitute/eliminate heavy metal catalysts

Miscellaneous

Miscellaneous items comprise all other types of hazardous waste generated on campus. This is a broad spectrum that includes used oil, paint, fluorescent light bulbs, batteries, ballasts, cleaning products, electronic devices, and many others. The best minimization practices for these items lie with the members of campus who purchase and work with them daily. If help with minimizing these wastes is needed, please contact EHS.

Redistribution Program

EHS has a redistribution program that acquires unused and/or unwanted chemicals and gives them to other laboratories/departments in need. EHS keeps a record of these items and provides it to laboratorians upon request. Please contact EHS by emailing nauehs@nau.edu for more information.

Green Labs Program

The Green Labs Program is a joint effort between EHS and the NAU Office of Sustainability to reduce the environmental impact of research and academic laboratories. The program uses a ranking system to grade laboratories on their conservation efforts and uses the system to educate laboratories on what they can do to achieve a higher ranking. One of the main goals of the program is to reduce laboratory generated hazardous waste.

Conclusion

By taking responsibility for the byproducts of operations, Northern Arizona University community members can reduce the environmental and financial impact of hazardous waste generated on campus. Since individual generators of specific waste streams are the most familiar with their work and materials in their field, they are the best resource for waste minimization. Success of the NAU Waste Minimization Program is dependent on those who choose to participate.

Please direct questions, comments, or concerns about hazardous waste minimization to EHS by emailing nauehs@nau.edu