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ABSTRACT

Artists, art teachers, and students need to understand the problems associated with disposing of waste materials, some of which may be hazardous. The waste products of art projects, even if non-hazardous, also use up space in overloaded landfills. The Environmental Protection Agency (EPA) sets forth guidelines for disposing of hazardous wastes. Hazardous waste disposal comes under the Resource Conservation and Recovery Act (RCRA), while industrial wastewater discharges fall under the Clean Water Act (CWA). The EPA divides hazardous waste producers into large quantity, small quantity, and conditionally exempt small quantity generators of hazardous waste, each category of which must follow a particular set of regulations. Most artists and art educators produce too little liquid waste to require compliance with the CWA. However, certain art related industries, such as porcelain enameling and photographic processing, must comply with certain EPA standards. There are many types of solid waste. Among these are toxic waste, acutely hazardous waste, flammable waste, corrosive waste, reactive waste, and leachable toxic waste. Waste management methods, in order of preference, include: (1) elimination or reduction at the source; (2) separation or concentration; (3) exchange; (4) energy or material recovery; (5) incineration or treatment; and (6) secure land disposal. (SG)

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Waste Management and Disposal

for

Artists and Schools

By Angela Babin, M.S. and Michael McCann, Ph.D., C.I.H.

Introduction

Artists, art teachers and students often produce solid waste and sometimes liquid waste as a result of their art processes. Much of this waste can be hazardous, leaving the problem of how to dispose of it safely and legally. Some waste, while non-hazardous, can be bulky and use up space in our overloaded landfills. Certain non-hazardous wastes can be storage or fire hazards. For further information on these considerations, please see CSA's data sheets: *Safe Storage and Handling of Chemicals*, and *Fire Prevention*.

The most important concept in safe waste management is to really know the materials, and the hazards involved. The primary step is defining if the material in question is actually a hazardous waste or not. Understanding materials, including the ingredients, chemical reactivities, physical properties, and hazards involved in using, handling, storing, treating, or transporting is crucial.

Regulations

Legally, everyone - companies, schools, colleges, and even individual artists - has to properly dispose of hazardous waste. In the United States, the Environmental Protection Agency (EPA) regulates the disposal of hazardous waste under the Resource Conservation and Recovery Act (RCRA). Industrial wastewater discharges are not considered solid waste, and are regulated under the EPA Clean Water Act (CWA). There are special considerations for regulation of household wastes. The laws will be discussed in more detail below.

RCRA

The Resource Conservation and Recovery Act (RCRA) was enacted in 1976 as an amendment to the Solid Waste Disposal Act (SWDA). In most cases, RCRA can be administered by the individual states. The basic goals of RCRA are: to protect human health and the environment, to reduce waste and conserve energy and natural resources, and to reduce or eliminate the generation of hazardous waste as expeditiously as possible. *Title 40*, of the Code of Federal Regulations *(CFR) Part 240-281*, has 10 subtitles of the Act, A through J. Of particular concern is Subtitle C, which refers directly to the management of hazardous waste, (a subset of all solid waste as regulated in Subtitle D). Subtitle C (RCRA sections 3001 - 3019 of the Act) was designed to prevent the mismanagement of hazardous waste. Specifically, the "cradle-to-grave" system establishes statutory and regulatory requirements for the identification of hazardous waste and generators, amongst other requirements.

There is also the transfer of the responsibilities of Subtitle C from the federal government to the individual states. Most of the states' hazardous waste programs resemble RCRA. One can contact individual state environmental offices to elucidate particular differences between states.

Recordkeeping is a critical part of waste management. Records must be compiled and maintained. EPA requires that all hazardous waste records be kept for three years. Copies of all manifests and other documentation available should be retained for an indefinite time, because there is no statute of limitations under RCRA. In fact, generators of hazardous wastes can be held responsible for damage caused by their waste to both the environment and to personal property. The EPA also requires an emergency contingency plan, as per 40 CFR 262.34, that covers preparation for spills including the appointment of an emergency coordinator present or on call.

Hazardous Waste Generators

Generators are the first link in the cradle-to-grave chain of hazardous waste management under RCRA. In this booklet, only this aspect of RCRA will be discussed. (See references for more complete information.) There are different categories of producers of waste art materials. The basic distinctions center around the amounts of hazardous waste produced. State definitions may vary.

According to RCRA (*40 CFR Part 261)*, there are three categories of hazardous waste generators:

1. *Large Quantity Generators (LQG)*: LQGs produce more than 1000 kilograms (2200 pounds) per month of hazardous waste, or more than 1 kg (2.2 lbs)/month of acutely hazardous waste. LQGs must obtain a US EPA identification number from their state hazardous waste management agency or EPA regional office, and must comply with all EPA requirements, including storage time, quantity, handling, record-keeping (manifest) specifications, and emergency contingency plans.

2. *Small Quantity Generators (SQG)*: SQGs produce more than 100 kg (220 lbs.)/month and less than 1000 kg (2200 lbs.)/month, and accumulate less than 6,000 kg (13200 lbs.). SQGs also must obtain a US EPA identification number from their state hazardous waste management agency or EPA regional office, and must comply with storage time, quantity, handling, record-keeping (manifest) requirements, and emergency contingency plans.

3. *Conditionally Exempt Small Quantity Generators (CESQG)*: Those facilities producing less than 100 kg (220 lbs.)/month of hazardous waste, and less than 1 kg (2.2 pounds)/month of acutely hazardous waste, are "conditionally exempt" from Subtitle C, and the manifest system. Notwithstanding, CESQGs must identify all hazardous waste, never accumulate more than 1000 kg, must treat or dispose of their waste on-site or make sure that the waste is sent to proper waste disposal facilities. These include permitted or interim status treatment storage or disposal facilities (TSDFs), permitted municipal or industrial solid waste facilities, or recycling facilities. Not all states recognize a difference in requirements for CESQGs as compared with those for SQGs. Check states for more stringent requirements.

Thus, if one produces more than 220 pounds per month of hazardous waste (or more than 2.2 pounds of acutely hazardous waste), then one also has to prove that hazardous waste was disposed of properly through EPA's waste manifest system.

These above categories of generators represent industrial or "commercial" generators. An arts community group, a printmaking studio, a high school or college art program, or a photographic studio may indeed produce wastes in quantity that they meet the definitions of a CESQG, a SQG, or even a LQG.

Household Hazardous Waste

Household wastes are exempted from federal hazardous waste regulations (*40 CFR Part 261.4(b)(1)*). This exemption allows individual citizens, and home (non-professional) artists and hobbyists, to discard materials into municipal waste streams without restriction from federal hazardous waste regulations. EPA states that the reason for this exemption doesn't mean these wastes aren't hazardous, but rather that enforcement and management of wastes generated by consumers in their households isn't feasible. Thus, handlers of household hazardous wastes don't need to comply with the federal regulations when managing household wastes.

Household hazardous waste collection programs (HHWCPs), are an ideal option for residential artists, home hobbyists, and CESQGs.

There are two criteria that regulate the exempt materials. Firstly, materials must be generated by individuals on the premises of a temporary or permanent residence, and secondly, they must be predominately composed of materials found in the wastes generated by consumers in their homes in their daily living. EPA has written the regulations so that wastes generated at single and multiple residences, hotels and motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas are exempt (provided they also meet the second criterion). Wastes from establishments such as retail stores, office buildings, restaurants, and shopping centers are clearly not generated on the premises of a residence for individuals, and thus are not covered by the household waste exemption.

There is a grey area surrounding the boundaries that define artists and their working scenarios. For example, an artist who has a separate studio may not be eligible for disposal of unwanted materials to a HHWCP. If a small studio owner brings in unused paint, previously used to paint his studio that is attached, but not on, the premises of his residence, he probably would not be eligible for the federal household waste exemption. EPA would recommend a comprehensive questioning of this type of small business owner. Likewise, homeowners, gardeners and artists who bring in suspiciously large amounts of materials to a HHWCP may be turned away from services because their quantities resemble those of businesses, small farmers, and commercial art businesses. CSA has produced a list of U.S. and Canadian collection programs that accept waste from both individual artists, and also from small "commercial" art businesses. For this list, along with recycling and exchange program information, see our data sheet *Health and Safety Resources for Artists.*

CWA

The EPA has developed categorical and pretreatment regulations that establish the basis for wastewater management under the Clean Water Act of 1977. Each municipality develops and enforces programs regulating sewer and wastewater treatment. For specific information on local regulations, one must consult the local Public Works and own Department of Environmental Protection.

Most artists won't produce liquid wastes in amounts that are relevant to these regulations. In fact, to qualify for status as a "significant industrial user," one must discharge at least 25,000 gallons per day of wastewater (excluding sanitary wastewater), or contribute a waste stream that accounts for 5 or more percent of the hydraulic or organic capacity of a publicly owned treatment works (POTWs), or as especially designated by the municipality. Large photographic processing studios and large electroplating studios are examples of businesses that may need comply with this law.

University arts programs or community arts facilities may produce amounts of aqueous waste that are covered in the pretreatment regulations discussed below.

Categorical Standards

The EPA has special 21 categorical standards for certain industries, including:

Part 413 - electroplating

Part 433 - metal finishing

Part 449 - paint manufacturing

Part 447 - ink manufacturing

Part 459 - photographics

Part 463 - plastics molding and forming

Part 464 - metal molding and casting

Part 466 - porcelain enameling

which are only relevant if there is direct discharge to a water body.

Pretreatment Standards

The federal Water Pollution Act of 1972, and the Clean Water Act were enacted with the goal to "restore and maintain the chemical, physical and biological integrity of the nation's waters". *Title 40 CFR Section 402* requires that POTWs (sewage treatment plants), establish local pretreatment programs to ensure compliance. The actual pretreatment requirements are given in Section 403. These include: general and specific discharge limitations and prohibitions to all sewage treatment plants, categorical pretreatment standard programs, requirements for POTW pretreatment programs, and the reporting requirements for industrial users.

It is forbidden to discharge pollutants with certain characteristics into a sewage treatment plant, including:

1. Pollutants that will cause fire or explosion hazard.

2. Pollutants that will cause corrosive damage to the POTW.

3. Solid or viscous pollutants that can obstruct flow.

4. Pollutants released at flow rates that interfere with flow.

5. High temperature discharges that may inhibit biological activity.

6. Petroleum oil, cutting oil, or mineral oil products.

7. Pollutants that can generate toxic gases, at levels that may cause health and safety problems.

8. Trucked or hauled pollutants, not at specific discharge points identified by the sewage treatment plant.

Industrial users must notify their local POTW of all discharges, that may cause problems with operation and flow. All "significant industrial users" have to also notify the sewage treatment plant, and their regional EPA office of any discharge of hazardous substances. All POTWs are required to develop local sewer use codes. These limits are designed to reflect the particular local environmental conditions of the area. Sewer codes will vary according to where POTW discharges are made. For instance, the local limits for discharge right at the San Francisco Bay area for zinc, (which may be present in wastewater from acid etching on zinc plates), is 4 parts per million, and if the same wastewater is discharged at the nearby airport, the corresponding limit would be 0.54 ppm. This is because discharge in the San Francisco Bay area occurs miles off-shore, while at the airport, discharge is direct, yielding much less dilution. Many states are allowed to administer their own approved programs, and may have more stringent requirements.

Sewer Codes

It is impossible to present all the municipal sewage regulations here. Those concerned must contact their municipal Public Works Offices for details on the regulations. Given below is a sample toxic substances list supplied by the New York City Department of Environmental Protection, Bureau of Clean Water, Industrial Wastes Control Section. Sewer codes do restrict certain constituents, and some of the requirements include pH, temperature, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), suspended solids, and temperature.

Examples of materials that cannot be discharged down the sewer system include:

1. Construction materials, ashes, cinders, straw, shavings, tar, plastic, wood, manure, coffee grounds, fur, wax, or obstructive solids.

2. Flammable or explosive liquids, solids or gases.

3. Petroleum hydrocarbons, in concentrations > 50 mg/L.

4. Paints and waste from paint manufacturing.

5. Wastewater with pH less than 5.0 or greater than 9.5.

6. Toxic Substances exceeding the following permissible concentration for any given time: (in milligrams per liter)

Cadmium	2
Chromium (hexavalent)	5
Copper	5
Cyanide (amenable)	0.2
Lead	2
Mercury	0.05
Nickel	3
Zinc	5

DOT and Transportation

Shipments of hazardous wastes off-site are regulated by both the EPA and Department of Transportation (DOT). DOT requires that wastes be segregated by hazard class.

EPA requires that off-site shipments of hazardous waste must be accompanied by a "Uniform Hazardous Waste Manifest", which is a shipping paper used to track the waste. The manifest documents the "cradle-to-grave" requirements, and contains the name and address of the generator, the receiving facility site, and all transporters, along with a listing of all hazardous wastes in the shipments. All personnel handling the wastes must sign the manifest. Large quantity generators must have certification regarding waste minimization including programs to reduce the volume, quantity and the toxicity of the wastes. Similarly, small quantity generators must sign such a statement.

Containers used for transporting wastes over public streets and highways must meet DOT requirements for construction, compatibility with contained material, and tightness.

Waste Treatment Procedures

Many artists who generate hazardous waste work in a community that uses the municipal sewer for both processing hazardous wastes and sanitary wastes. Usually, the municipality specifies the composition, flow rate, and total quantity of the discharges.

There are two types of waste treatment, primary and secondary. Primary treatment consists of sedimentation processes, that only separates out solids. In secondary treatment, bacterial activity and aeration are utilized to mimic, in hours rather than days, the aerobic biological activity that would occur if the waste was dumped in a stream of water. In this type of aerobic system, the bacterial action destroys many oxygen-demanding chemicals, found both in sanitary waste and in waste products in the studio. If the sewage plant does not have a secondary treatment stage, then many waste chemicals will pass untreated into the waterways and will slowly be treated by bacteria in the waterways. This process, however, uses up the oxygen in the waterways and thus can kill off aquatic life due to lack of oxygen.

If there is only primary treatment, or if no municipal waste treatment plant is available, then hazardous wastes may have to be treated before they can be discharged into the waterways. For this type of point source discharge, then the stream standards apply. Under the National Pollution Discharge Elimination System (NPDES) of the Federal Water Pollution Control Act of 1972, permits are needed for point source discharges that go directly to water. Individual states have their own adaptations of these particular regulations with the State Pollution Discharge Elimination System (SPDES).

Artists and schools located in rural areas sometimes rely on other forms of waste treatment, and this can pose particular problems. Septic tanks, although biological systems, process waste in an anaerobic manner, meaning without aeration. They do not degrade waste very efficiently, and can easily be overloaded with a moderate volume of waste, such as the amounts produced in photographic processing. Aerated lagoons require large amounts of land to take care of studio waste. Deep-well injection is possible only if extensive and expensive tests are run.

Types of Hazardous Waste

What is hazardous waste? There are several categories of chemicals used by artists and schools that come under the heading of hazardous waste. While RCRA designates specific categories of hazardous waste, one can also define hazardous waste colloquially as a material that is of no further use, and cannot be safely returned to the environment, in original form. Types of hazardous waste are listed below.

Toxic Wastes

This category includes toxic chemicals, such as solvents, formaldehyde, lead compounds, mercury, chromates, etc., and is listed in 40 CFR 261.33. Table 1 contains selected chemicals used by artists and schools that are listed as toxic wastes. See the EPA regulations for the complete list.

Table 1. Selected Toxic Wastes Regulated by 40 CFR 261.33

Acetaldehyde
Acetone
Benzene
para-Benzoquinone
n-Butyl alcohol
Carbon tetrachloride
Chloroform
Creosote
Cyclohexane
Cyclohexanone
Dibutyl phthalate
ortho-dichlorobenzene
para-dichlorobenzene
Dichloroethylene
Diethylhexyl phthalate
Diethyl phthalate
Dimethyl phthalate
Di-n-octyl phthalate
para-Dioxane
2-Ethoxyethanol
Ethyl acetate
Ethylene dichloride
Ethylene glycol monoethyl ether
Ethylene glycol monomethyl ether
Ethylene oxide
Ethyl ether
Formaldehyde
Formic acid
Freons
Hydrofluoric acid
Hydrogen sulfide
Isobutyl alcohol
Mercury
Methyl alcohol
Methyl bromide
Methylene dichloride
Methyl chloroform
Methyl ethyl ketone
Methyl ethyl ketone peroxide

Methyl isobutyl ketone
Methyl methacrylate
Naphthalene
Pentachlorophenol
Perchloroethylene
Phenol
Resorcinol
Selenious acid
Selenium dioxide
Selenium sulfide
Tetrahydrofuran
Thiourea
Toluene
Toluene diisocyanate
1,1,1-Trichloroethane
Trichloroethylene
Xylene

Acutely Hazardous Waste

This is hazardous waste that is very dangerous even in small amounts. One has to follow EPA regulations if one generates more than 1 kilogram (2.2 pounds) of these materials in a month. Table 2 contains selected acutely hazardous wastes listed in 40 CFR 161.33 which may be generated by artists and schools. See the EPA regulations for the complete list.

Table 2. Selected Acutely Hazardous Wastes Regulated by 40 CFR 261.33

Arsenic oxides
Beryllium
Carbon disulfide
Cyanides
Hydrogen cyanide
Nitrogen oxides
Phenylmercury acetate
Phosphine
Strontium sulfide
Vanadium pentoxide

Flammable Waste

This category includes:

1) flammable and combustible liquids (flash point less than 142° F or 61° C);

2) solids capable of causing fire through friction, moisture absorption, or spontaneous combustion (e.g. oil-soaked rags);

3) ignitable compressed gases (e.g. propane, acetylene); and

4) oxidizing substances (e.g. potassium chlorate, concentrated nitric acid, dichromates, etc.).

Corrosive Waste

Wastes with a pH less than 2 or greater than 12 are considered corrosive. Examples include nitric acid etching baths, photographic developing baths, anodizing and electroplating baths, ammonia, and acid dyebaths.

Reactive Waste

Reactive waste includes:

1) normally unstable compounds that can undergo violent change without detonating (e.g. methyl ethyl ketone peroxide);

2) cyanide or sulfide wastes which can generate dangerous amounts of toxic gases at pHs between 2 and 12.5 (e.g. cyanide electroplating solutions);

3) compounds that react violently with water (e.g. phosphorus); and

4) compounds that form potentially explosive mixtures with water.

Leachable Toxic Waste

EPA has defined a Toxicity Characteristic Leaching Procedure (TCLP) to determine if a hazardous waste could leach toxic amounts of certain metals, pesticides and organic chemicals into the ground water. This test is specified in Appendix 2, of Part 40 CFR 261. Table 3 lists selected chemicals restricted under this regulation. See the EPA regulations for the complete list.

Table 3. Selected Chemicals Regulated Under the TCLP Rule (40 CFR 261.24)

Arsenic
Benzene
Barium
Cadmium
Carbon tetrachloride
Chloroform
Chromium
ortho-dichlorobenzene
para-dichlorobenzene
1,2-dichloroethylene
Lead
Mercury
Methyl ethyl ketone
Pentachlorophenol
Perchloroethylene
Selenium
Silver
Trichloroethylene

Other classes of hazardous waste, not normally encountered by artists, include radioactive materials and pathological waste.

Waste Management Methods

There are many waste management methods available. Obviously some are better than others. The following list the common ones in order of priority:

1. Waste elimination or reduction at the source
2. Waste separation and concentration
3. Waste exchange
4. Energy and material recovery
5. Incineration or treatment
6. Secure land disposal

Sometimes, a combination of these methods will be needed. While the two most commonly used options of hazardous chemical waste management are secure chemical landfill storage and incineration, they may not be the most preferable.

Waste Elimination or Reduction

The best way of managing hazardous waste is to actually eliminate or minimize its production. The first step is to understand the hazards of the materials used. Then, artists, or even schools and teachers, can investigate the substitution of lesser toxic materials. In a certain sense, waste minimization pays particular attention to reducing the environmental toxicity - which is often reflected in the health hazards of the materials. Using lead-free glazes instead of leaded glazes results in the reduction in the amount of lead that enters the environment, via kiln fumes (health and air hazard), and also in discarding unwanted or waste material (as hazardous waste). Also, lead-glazed pottery is often not foodsafe, and lead glazes cannot be donated to many art programs because of the hazards involved. Another example of waste minimization is the use of water-based screen printing inks instead of solvent-based ones.

Waste Separation and Concentration

If one cannot reduce the actual amount of hazardous waste being produced, the next step is to keep hazardous waste from "contaminating" regular garbage. In this way, these different waste streams remain separated. An example of this is separating used and unwanted solvent-based paint from water-based paint. Sometimes wastes can in fact be combined in an advantageous manner. For example, mixing dilute solutions of spent photographic developer (basic pH) with dilute solutions of spent photographic stop baths (acidic pH) can result in neutralization of both to nonhazardous waste solutions. If treatments are part of routine processing then extra permits are not needed.

Small amounts of solvents or solvent-containing materials (less than a pint) can be evaporated if no other better alternative is available. Of course, this evaporation should take place outside, or inside a local exhaust hood where no one will be exposed to the solvent vapors.

Waste Exchange and Recycling

One of the most exciting methods of waste management is exchange and recycling of products. There are two types of recycling methods, which can be described as internal or external approaches.

Internal Recycling

This method involves individual re-use of material. Oil-painting solvents used during painting can be allowed to settle, and then strained through cheesecloth (to remove the solids), and finally, re-used either in actual painting or during cleanup. Internal recycling is usually going to be beneficial in terms of cost. We encourage artists to look at their extra materials and unwanted materials for possible re-use and recycling at another time.

External Recycling

This method involves actually passing unwanted materials on to someone else who can use them. What is refuse to one may be sustenance to another. For example, leftover art materials can be donated to an art center or secondary school. Note that hazardous materials should never be donated to elementary schools, and highly toxic materials like lead glazes should not be recycled.

CSA has received reports of Household Hazardous Waste Collection Programs (HHWCPs) setting up collection of paints and giving away the usable materials. There are increasing numbers of actual waste exchange programs. For example, the Northeast Industrial Waste Exchange, Inc. (NIWE) is one non-profit information clearinghouse for the resale of waste. They put out a quarterly catalog on both wanted and available resources.

Energy and Material Recovery

Sometimes a waste cannot be put to good use in the form that it is generated, and must be treated to access beneficial qualities. Reclamation involves pick-up and handling of hazardous wastes by licensed companies. Large printmaking facilities, which generate many solvent- or oil-soaked rags can contract pick-up, laundry and return of their rags for re-use.

Incineration or Treatment

It is sometimes impossible to re-use a material, and in this case it must be either destroyed by a process such as incineration, or treated in some manner to convert it into a less toxic material can be re-used in the environment. There are three types of treatment options that are available.

1. *Volume reduction* refers to water removal, or concentration of chemicals that really doesn't result in a more acceptable waste, but a form of waste that is easier and safer to handle. While concentration of wastes conserves space, it rarely results in a more environmentally acceptable waste. Instead, concentration normally is practiced to conserve space in a chemical landfill.

2. *Detoxification* can involve several processes. Spraying materials removes volatile toxins from aqueous waste. Sometimes, toxic metals can be converted to highly insoluble and thus less biologically accessible compounds; for instance,

highly toxic and soluble barium salts can be converted to the less toxic sulfates. Certain biodegradable wastes can be treated in surface impoundments. Neutralization of acids and bases is another example.

3. *Solidification* involves converting waste into a solid form, usually by incorporation into a matrix. The purpose of solidification is to trap the waste in order to control the rate at which ground or surface water that contacts the waste can dissolve the hazardous components.

Secure Land Disposal

The least favorable option, placed at the bottom of the waste management hierarchy is secure land disposal. There are two techniques of secure land disposal. The first is similar to the operation of a sanitary landfill facility, where waste is placed in contact with soil or buried under soil, to encourage biological degradation. A very high degree of ground and surface water isolation is required. Another approach to secure land disposal is perpetual storage.

Secure land disposal and perpetual storage is placed last in the hierarchy of management options because of the many uncertainties regarding longterm success and safety, and maintenance complexities. Landfill design, transportation safeguards, labeling, surveillance, leachate management, disease control, barrier development and land use are just some of the safety concerns.

Waste Management Services

These six options can be relevant to individual artists and hobbyists, in that certain treatments and recycling processes can be done individually. The first three options are the best. Larger studios or facilities, and also individuals with extremely toxic or large amounts of materials may opt for licensed collection services. Hazardous materials that can't be properly disposed of in other ways should be taken (if generated by a household or a CESQG), in compliance with EPA and DOT requirements, to a licensed hazardous waste disposal company, or picked up by a licensed hazardous waste transporter. Often this can be expensive. If one is considering transporting hazardous waste yourself, one should be aware that many fire departments restrict the transportation of flammable liquids by car, and RCRA also regulates the transport of hazardous waste.

Once a contract is open with a waste management firm, the contractor will often help the client meet transportation and recordkeeping requirements (i.e., prepare the shipping manifests). Specific contractors may have additional container labeling or marking requirements, or require specific waste analyses, or special packaging beyond that which is specified by the regulations. When wastes are shipped off-site, they are usually consolidated or lab packed.

Lab Packs

Many companies, because of the high costs of insuring the transportation vehicles, have set up special services, such as lab packs, that are very helpful in areas such as museum conservation laboratories, where there may be a great variety of chemicals, but the quantities that actually accumulate may be small. Smaller containers of similar and compatible materials can be placed in larger DOT-approved containers (e.g. a steel or fiber drum), provided that there are enough cushioning and absorbent material (e.g. vermiculite) surrounding each container. A chemical inventory is made as the containers are added to the drum. When the drum is full, it is sealed and shipped to the disposal facility, for processing, along with a copy of the inventory sheet. This system is called a lab pack, and is particularly useful when actual quantities of hazardous wastes generated are small. Lab packs are often put together at the time of shipment of hazardous waste. A lab pack must contain compatible wastes, even though the individual identity may vary.

Disadvantages of lab packing include the fact that actual disposal is expensive since absorbants make up the majority of the material disposed. When the inner containers are not full, actual space in the drum is wasted. Advantages include the fact that lab packs are generally safe, and simple, in that there is little chance of personnel exposure from transferring wastes or of hazardous mixing of incompatibles.

Consolidation

The alternative to lab packing is consolidation of compatible waste materials into bulk form. Consolidation of wastes, however, presents different advantages and disadvantages. Utilization of space in consolidation is very efficient since chemicals are removed from their original containers and combined. About 3 or 4 times the amount of chemicals can be placed in a consolidated drum as compared to a lab pack. The total costs for disposal are lower, but there is a much greater risk of a chemical reaction or spill.

Sometimes a facility may not accept a lab pack or consolidated waste drum if certain wastes included are not allowed under their permits. For example, the inclusion of wastes containing mercury in a container of other wastes could prevent incineration of the entire waste stream in the container, thus making it impossible to dispose of the waste. Also, the improper mixing of solvents, might prevent certain reclamation, reuse, or land disposal of the material.

Drawing by D. Reilly; © 1990 The New Yorker Magazine, Inc.

Recommendations for Treatment or Disposal

These recommendations are for actual treatment or disposal of art materials. If possible, leftover or waste art materials should be recycled or handled by other methods as listed above, especially since recycling of hazardous waste materials exempts waste generators from EPA regulations.

Whenever pouring or neutralizing chemicals, wear proper, approved personal protective equipment. This includes:

- chemical splash goggles approved by the American National Standards Institute (ANSI);
- protective clothing (impermeable gloves, aprons, etc.);
- exhaust ventilation for volatile gases or solvents or;
- appropriate respirators approved by the National Institute for Occupational Safety and Health (NIOSH).

In addition, all routine chemical handling should be done in areas that are equipped with:

- emergency spill control kits for large amounts of liquids;
- fire extinguishers for flammable and combustible materials;
- eyewash fountains in case of splashes in the eyes;
- emergency showers for concentrated acids and alkalis.

Acids

Examples: acetic acid, boric acid, hydrochloric acid, hydrofluoric acid, oxalic acid, nitric acid, phosphoric acid, sulfuric acid, p-toluenesulfonic acid.

Dilute Acids

1. Neutralize dilute acid solutions by slowly adding baking soda (sodium bicarbonate) until bubbling stops. Check the pH with pH paper (neutral being pH 7).
2. Pour neutralized acid down the sink with lots of water.
3. Wear appropriate personal protective equipment.
4. Hydrofluoric and chromic acid solutions should never be poured down the sink. Dispose of as hazardous waste.

Concentrated Acid Solutions

1. Less than a cup of concentrated acids can be diluted by slowly pouring into 10 parts of water to one of acid, and then neutralized as above. Always add the acid to the water to avoid production of large amounts of heat and boiling.
2. Wear appropriate personal protective equipment.
3. Larger amounts of concentrated acids should be disposed of as hazardous waste.

Solid Acids

Solids such as boric acid and oxalic acid should be disposed of as hazardous waste.

Aerosol Spray Cans

Examples: spray adhesives, spray fixatives, spray paints

1. Empty aerosol spray cans completely by spraying (outside or in a spray booth), and then placed in the garbage. Spray cans with residues are fire and explosive hazards.

Alkalis

Examples: ammonia, calcium hydroxide (slaked lime), calcium oxide (lime), lithium oxide, potassium hydroxide (caustic potash), potassium carbonate (potash), sodium carbonate (soda ash, washing soda), sodium hydroxide (caustic soda), sodium silicate, trisodium phosphate.

Dilute Alkaline Solutions

1. Neutralize by slowly adding citric acid or white vinegar using pH paper to indicate when neutral (pH 7).
2. Pour neutralized alkali down the drain with lots of water.
3. Wear appropriate personal protective equipment.

Concentrated Alkaline Solutions

1. Small amounts (less than a cup) can be diluted by slowly pouring into 10 parts of water to one of alkali, and then neutralizing as above. Always add the alkali to the water.
2. Wear appropriate personal protective equipment.
3. Larger amounts of concentrated alkaline solutions should be disposed of as hazardous waste.

Solid Alkalis

1. Dispose of as hazardous waste.

Chlorine Bleach

1. Chlorine bleaches (sodium hypochlorite) are alkaline, and can produce chlorine gas when mixed with acid, or other poison gases if mixed with ammonia.
2. Less than a cup of household strength chlorine bleach can be poured down the drain with lots of water.
3. More than a pint of household bleach and stronger bleach solutions should be disposed of as hazardous waste.

Clay

1. Place in garbage in sealed plastic bags. Clay is not listed as a hazardous waste by RCRA.

Dyes

Powders

1. Place in garbage in sealed plastic bags. Most dyes are biodegradable and are not listed as hazardous waste.

Dye Solutions

1. Pour dye solutions down the drain with lots of water.
2. If the dyebath is acidic or alkaline, neutralize as discussed under Acids and Alkalis.
3. Mordant baths containing dichromates must not be poured down the drain since they are oxidizing agents and probable carcinogens. They should be disposed of as hazardous waste. Evaporation can reduce the volume of hazardous waste.

Enamels - See Glazes and Glaze Chemicals

Etches and Pickling Solutions

1. These are acidic and should be neutralized. See Acids.

2. Acid etching on zinc and copper dissolve zinc and copper, which are regulated under local sewer codes. These codes do not normally apply to small waste generators. If desired, zinc and copper can be precipitated by adjusting to pH 8, by the addition of sodium carbonate (washing soda) and filtering the solution. The precipitate can be placed in the garbage and the solution poured down the drain with lots of water.

3. Wear appropriate personal protective equipment.

Glazes and Glaze Chemicals

1. Glaze chemicals, glazes, and glazed pottery are considered hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.

2. Other glaze chemicals, glazes and glazed pottery can be placed in the garbage. Dry glazes before disposal.

3. Recycle glazes when possible. Residual glazes and glaze scrapings from spray booths can be combined, homogenized, tested, and used as a glaze. If needed, they can be adjusted with fluxes, colorants, etc.

4. Do not pour any glazes down the sink.

Glues and Cements

1. Dry water-based glues and cements, and place in garbage.

2. Dry small amounts of solvent-based glues and cements (e.g. less than a cup) in a laboratory hood, spray booth, or outside (if allowed by local regulations) in a location which will not expose anyone to solvent vapors. Keep away from sparks, flames, or other ignition sources since most solvent-based glues are flammable.

3. See Plastics Resins for epoxy glues and methyl methacrylate glues.

Metals

1. Scrap metals are not considered hazardous waste if they are recycled or reclaimed.

2. If they are not recycled, then scrap metals would be considered hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.

3. Beryllium is an acutely hazardous waste.

4. Mercury is a hazardous waste. Never mix mercury containing waste with other hazardous waste.

5. Scrap solders containing lead, cadmium or silver are considered hazardous waste unless recycled or reclaimed.

6. Other scrap metals can be placed in the garbage (unless they are coated with hazardous paints).

Metal Compounds

1. Arsenic oxides, arsenic acid, phenyl mercuric acetate, strontium sulfide, and vanadium pentoxide are acutely hazardous wastes.

2. Calcium chromate, lead acetate, lead phosphate, selenious acid, selenium dioxide, and selenium sulfide are toxic hazardous wastes.

3. Metallic compounds are hazardous waste if they can not pass the acid leaching tests specified by EPA for arsenic, barium, cadmium, chromium, lead, nickel, or selenium.

Minerals

1. Minerals such as stones, feldspars, flint, silica, and talc are not hazardous waste, and can be placed in the garbage.

Oils, Organic

Examples: linseed oil, safflower oil, tung oil

1. These are ignitable due to the risk of spontaneous combustion (especially oil-soaked rags).

2. If oil-soaked (or solvent-soaked) rags are sent for laundering to laundries equipped to handle them, they are not considered hazardous waste.

3. Oil-soaked rags can also be hung up to dry individually so that heat can't accumulate, and then reused.

Organic Peroxides

Examples: methyl ethyl ketone peroxide, benzoyl peroxide

1. Organic peroxides are oxidizers, and can burn or explode if heated.

2. Organic peroxides should be dated and kept in original containers, since many contaminants can react with them. If they dry out, call the fire department for help since they can explode if heated (even from friction).

3. Small amounts of organic peroxides can be reacted with the plastic resin they were bought with to give a nonhazardous solid waste.

4. Large amounts of residual organic peroxides should be disposed of as hazardous waste. Keep separate from other hazardous wastes.

5. Wear appropriate personal protective equipment.

Oxidizing Agents

Examples: dichromates, chlorates, chromates, hypochlorites, nitric acid (concentrated), periodates, permanganates, persulfates

1. Oxidizers can react with organic materials such as sawdust, solvents, organic resins, starch, etc. to cause fires and explosions.

2. Oxidizers should be disposed of as hazardous waste. Keep them separate from other hazardous waste.

Paints and Other Coatings

Examples: Paints, varnishes, stains, finishes, sealants

Water-based Coatings

1. Paints containing lead, cadmium, chromate pigments, or mercury preservatives should be disposed of as hazardous waste.

2. Other water-based paints and coatings should be allowed to dry, and then placed in the garbage.

Solvent-based Coatings

1. Small amounts of solvent-based paints and coatings (less than a cup) can be allowed to evaporate in a laboratory hood, spray booth or outside (if local regulations allow), where no one is exposed.

2. If the residue contains lead, cadmium, or chromate pigments, it should be disposed of as hazardous waste; otherwise the residue can be placed in the garbage.

3. Larger quantities of solvent-based materials should be disposed of as hazardous waste. See also Solvents.

4. Stains containing wood preservatives are considered hazardous waste. See also Pesticides and Preservatives.

Patinas - See Metallic Compounds

Pesticides

1. Pesticides should be disposed of as hazardous waste.

2. Completely use up pesticides; pesticide containers should be triple rinsed. Rinse water should be used as a pesticide.

3. Pesticide spray cans - See Aerosol Spray Cans

4. Wear appropriate personal protective equipment.

Photochemicals

1. Old or unused concentrated photochemical solutions or powders, toning solutions, chromium solutions, color processing solutions containing high concentrations of solvents, and platinum/palladium printing solutions should be recycled or disposed of as hazardous waste.

2. Neutralize the alkaline developer by mixing with the stop bath and pouring down the sink with lots of water. Wear appropriate personal protective equipment.

3. Do not treat the fixing bath with acid (e.g mixing with stop bath), since fixing baths usually contain sulfites and bisulfites which will produce sulfur dioxide gas. Mix small amounts of fixer with wash water, and pour down the drain.

4. Many municipalities regulate the amount of silver that can be dumped into the sewer system. Silver can be recovered from the fixer by several types of silver recovery systems. The simplest uses steel wool or another source of iron. The iron dissolves and silver is precipitated out. The precipitated silver must be sent to a company that can recover the silver. Kodak has a test kit for silver in the effluent.

5. Replenishment systems, where fresh solutions are added regularly to replace solutions carried out by film or paper, reduce daily volume of solution needing disposal. Ultimately, you will have to dispose of these replenished systems.

6. In most areas professional photographers need a permit to dump photographic wastes into septic systems. Because of variations in local laws, Kodak no longer recommends dumping photographic wastes into septic systems without checking with local authorities. Previously, they recommended that photographic solutions (including wash water) constitute a maximum of 1/4 of the amount of household sanitary waste going into the septic system, and not to release more than a few pints at any one time.

Pigments

1. Lead, chromate, and cadmium pigments should be disposed of as hazardous waste.

2. Other pigments can be placed in the garbage. Dry pigments should be placed in sealed plastic bags.

Plaster

1. Plaster is not considered a hazardous waste. Place in the garbage in sealed plastic bags.

Plastics

1. Solid plastics are not considered hazardous waste.

Plastics Resins

Examples: epoxy, methyl methacrylate, phenol- or urea-formaldehyde, polyester, polyurethane.

1. Leftover resins should be reacted to form a solid plastic, which can be placed in the garbage.

2. Old or large amounts of plastics resins should be disposed of as hazardous waste.

3. Wear appropriate personal protective equipment.

Solvents

Examples: turpentine, acetone, mineral spirits, methyl ethyl ketone, xylene, toluene, glycol ethers.

1. Small amounts of solvents or solvent-containing materials (e.g. less than a cup) can be evaporated inside a laboratory hood, spray booth, or outside (if local regulations allow), so no one would be exposed.

2. Large amounts of solvents can be mixed together and disposed of as hazardous waste.

3. Chlorinated solvents (e.g. methylene chloride, 1,1,1-trichloroethane), or mixtures containing them, should be separated from other solvents since hazardous waste containing chlorinated solvents can be considered chlorinated waste and is thus more expensive to dispose of.

4. Waste cleaning solvents containing solids can often be reused by allowing the solids to settle, and filtering. If the solids are toxic, then they should be disposed of as hazardous waste. Otherwise, place them in the garbage.

Wood

1. Ordinary wood or wood waste can be recycled, burned as a fuel, or placed in the garbage.

2. Wood that has been treated with wood preservatives such as chromated copper arsenate or other toxic chemicals should be disposed of as hazardous waste.

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For Further Information

Written and telephoned inquiries about hazards in the arts will be answered by the Art Hazards Information Center of the Center for Safety in the Arts. Send a stamped, self-addressed envelope for a list of our many publications. Permission to reprint this data sheet may be requested in writing from CSA. Write: Center for Safety in the Arts, 5 Beekman Street, Suite 1030, New York, NY 10038. Telephone (212) 227-6220.

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