Hazardous Waste Management

PDH: 3.0 Hours

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Hazardous Waste Management

1. Introduction

The collection, treatment, and disposal of waste material that, when improperly handled, can cause substantial harm to human health and safety or to the environment. Hazardous wastes can take the form of solids, liquids, sludges, or contained gases, and they are generated primarily by chemical production, manufacturing, and other industrial activities. They may cause damage during inadequate storage, transportation, treatment, or disposal operations. Improper hazardous-waste storage or disposal frequently contaminates surface and groundwater supplies. People living in homes built near old and abandoned waste disposal sites may be in a particularly vulnerable position. In an effort to remedy existing problems and to prevent future harm from hazardous wastes, governments closely regulate the practice of hazardous-waste management.

2. Learning Outcomes

After completing this course, the participants will be able to:

- Define hazardous waste (HW) from working, technical, and regulatory points of view
- Explain the historical roots of HW management and landmark episodes
- Identify HW and know the HW exclusions and exemptions
- Classify the types of HW
- Describe the HW recycling and universal waste (UW)
- Discuss the types of HW generators and transporters
- Explain the processes of permitting TSDFs and types of special permits.

3. Definitions

Technical definition of hazardous waste (HW): Wastes that pose a substantial danger immediately or over a period of time to human, plant, and animal life are classified as hazardous waste.

Regulatory definition of hazardous waste: "Hazardous waste" means a solid waste or combination of solid wastes which, because of its quantity, concentration or physical, chemical or infectious characteristics, may:

1. Cause or significantly contribute to an increase in mortality or an increase in serious irreversible or incapacitating illness; or
2. Pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

"Household hazardous waste" means any waste material derived from households (including single and multiple residences, hotels, motels, bunkhouses, ranger stations, crew quarters, campgrounds, picnic grounds and day-use recreation areas) which, except for the fact that it is derived from a household, would be classified as a hazardous waste, including but not limited to,

nickel, cadmium, mercuric oxide, manganese, zinc-carbon or lead batteries; solvent-based paint, paint thinner, paint strippers, or other paint solvents; toxic art supplies, used motor oil and unusable gasoline or kerosene, fluorescent or high intensity light bulbs, ammunition, fireworks, banned pesticides, or restricted-use pesticides as defined in §3.1-249.27. All empty household product containers and any household products in legal distribution, storage or use shall not be considered household hazardous waste.

4. Introduction to RCRA

RCRA stands for Resource Conservation and Recovery Act. The broad goals set by RCRA are:

- To protect human health and the environment from the hazard posed by waste disposal
- To conserve energy and natural resources through waste recycling and recovery
- To reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste
- To ensure that wastes are managed in a manner that is protective of human health and the environment.

To achieve the above goals, RCRA developed three interrelated programs. The three interrelated programs are presented in Figure 1.

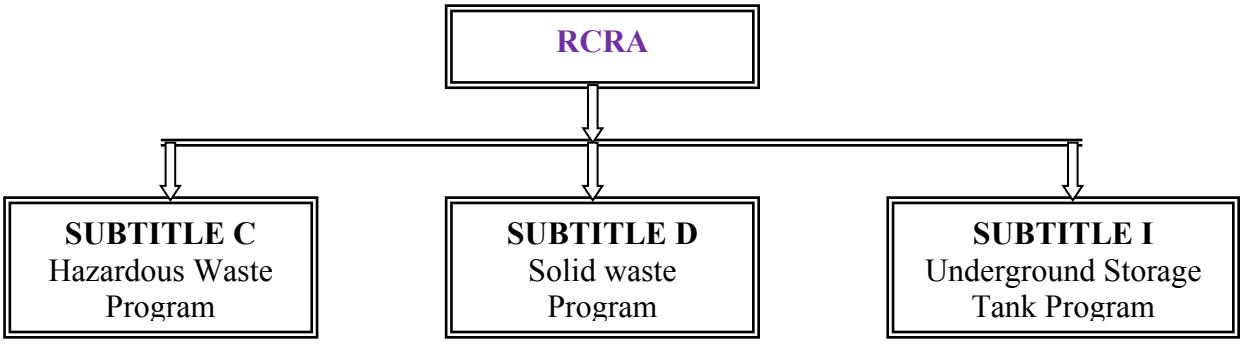

Figure 1: RCRA's three interrelated programs

4.1 Waste Management Act and Provisions

THE ACT is defined as the law that describes the kind of waste management program that Congress wants to establish. The Act also provides the administrator of EPA (or his or her designee) with the authority to implement the Act. Today the Act consists of 10 provisions/subtitles.

Subtitle	Provision/Subtitle
A	General Provisions
B	Office of Solid Waste; Authorities of the Administrator and Interagency Coordinating Committee
C	Hazardous Waste Management
D	State or Regional Solid Waste Plans

E	Duties of the Secretary of Commerce in Resource and Recovery
F	Federal Responsibilities
G	Miscellaneous Provisions
H	Research, Development, Demonstration, and Information
I	Regulations of Underground Storage Tanks
J	Standards for the Tracking and Management of Medical Waste

4.2 Evolution of RCRA Legislation

The act that is actually a combination of the first federal solid waste status and all subsequent amendments. The evolution of significant RCRA legislation is illustrated as follows (Figure 2):

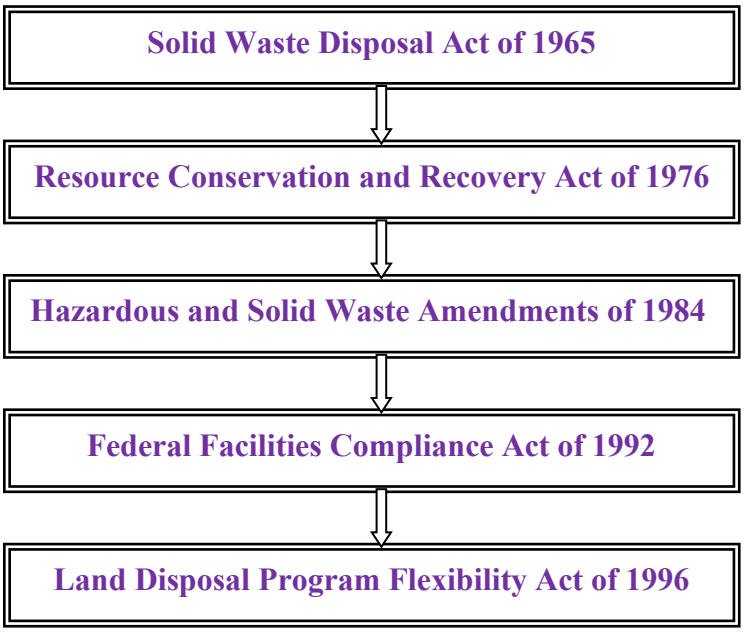

Figure 2: Evolution of RCRA legislation

The components of RCRA are Act, Regulations, Guidance, and Policy.

Act - As defined earlier

Regulations - Legal mechanisms that establish standards or impose requirements as mandated by the ACT. It also translates the general mandate of a statute into a set of requirements for the Agency and the regulated community.

Guidance (Guidance = How To) - It provides direction for implementing and complying with regulations.

Policy (Policy = Should Do) - Statements that outline a position on a topic or give instructions of how a procedure should be conducted.

4.3 RCRA and Its Interrelationship to Other Environmental Statutes

RCRA is one of several regulatory programs in place to protect the environment. The RCRA regulations work closely with other environmental statutes such as the Clean Air Act (CAA); Clean Water Act (CWA); the Emergency Planning and Community Right-to-Know Act (EPCRA); the Federal Insecticides, Fungicides, and Rodenticide Act (FIFRA); the Marine Protection, Research, and Sanctuaries Act (MPRSA); the Occupational Safety and Health Act (OSHA); the Safe Drinking Water Act (SDWA); and the Toxic Substance Control Act (TSCA).

One statute in particular, CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act), or Superfund, is closely tied to RCRA: both are designed to protect human health and the environment from the dangers of hazardous waste. While these programs are similar, they do have different regulatory focuses:

- RCRA regulates how wastes should be managed to avoid potential treats to human health and the environment;

- CERCLA focuses on actual releases, or substantial threats of a release in the environment of a hazardous substance, pollutant, or contaminant, that present an imminent and substantial threat to human health.

5. CERCLA and SARA

- **CERCLA:** Comprehensive Environmental Response, Compensation, and Liability Act. CERCLA is also known as Superfund**.**

- **SARA:** Superfund Amendments and Reauthorization Act.

5.1 Relationship of RCRA and CERCLA

CERCLA is closely tied to RCRA: both are designed to protect human health and the environment from the dangers of hazardous waste. While these programs are similar, they do have different regulatory focuses:

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5.2 CERCLA Response and Enforcement Mechanisms

CERCLA provides for both response and enforcement mechanisms. The 4 major provisions of the law establish:

1. A fund ("superfund") to pay for investigations and remedies at sites where the responsible people cannot be found or will not voluntarily pay;
2. A priority list of abandoned or inactive hazardous waste sites for cleanup (the National Priority List);
3. The mechanism for action at abandoned or inactive sites (the National Contingency Plan);

4. Liability for those responsible for cleaning up.

The National Priority List

- The National Priority List (NPL) serves as a tool for the EPA to use in identifying sites that appear to present a significant risk to public health or the environment and may merit use of Superfund money.
- It was first published in 1982. A matrix system called the Hazard Ranking System (HRS) was developed and used to HRS score the contaminated sites to go to the NPL with highest score.
- Sites on the NPL are eligible for Superfund money for cleanup.

The Hazard Ranking System

- The Hazard Ranking System (HRS) is a metric system that is used for ranking the uncontrolled hazardous waste sites in terms of the potential threat based on containment of the hazardous substances, route of release, characteristics and amount of substances, and likely targets.
- HRS score is based on the probability of contamination from 4 pathways:
  - ✓ groundwater;
  - ✓ surface water;
  - ✓ soil; and
  - ✓ air
- The groundwater and air migration pathways are evaluated for ingestion and inhalation respectively.
- The surface water migration and soil exposure pathways are evaluated for multiple intake routes. Surface water is evaluated for:
  - ✓ 1. drinking water
  - ✓ 2. human food chain, and
  - ✓ 3. environmental contact/ exposure
- Soil is evaluated for potential exposure to the
  - ✓ 1. resident population; and
  - ✓ 2. nearby population

The National Contingency Plan

- The National Contingency Plan (NCP) is the EPA's blueprint for implementing Superfund.
- The 1982 NCP, issued in response to the 1980 CERCLA, provided a framework for the Remedial Investigation/Feasibility Study (RI/FS) process; specified criteria determining priorities among sites through HRS.
- The 1990 NCP, issued in response to the 1986 SARA, established risk levels for the evaluation of whether sites required remediation (*carcinogenic risk in the range of 10^{-6} to 10^{-4} and non-carcinogenic hazard index of 1*);
- modified the FS process to provide for a preference in the selection of permanent remedies involving treatment to reduce the volume, toxicity or mobility of hazardous substances, and established the Superfund Innovative Technology Evaluation (SITE) program.

Liability

- The Superfund process includes liability provisions that are intended to replenish the fund and place the burden of cleaning up sites onto those entities responsible for the contamination. Congress mandated that the EPA should recover costs for site cleanup from Potential Responsible Parties (PRPs). The PRPs include:
  - ✓ Present and past owners of the property in question
  - ✓ Operators of the facility at the time of disposal
  - ✓ Generators (i.e., persons whose wastes were disposed of at the site)
  - ✓ Transporters who conveyed any hazardous substances to the site.

5.3 Superfund Amendments and Reauthorization Act (SARA)

- Following nearly 2 years of debate, SARA was passed in the final days of the 99th Congress in 1986.
- SARA created an $8.5 billion fund for cleanup abandoned waste disposal sites and an additional $500 million for cleaning up leaking underground petroleum tanks.
- SARA increased EPA's flexibility to perform removal actions, required attainment of Applicable or Relevant and Appropriate Requirements (ARARs) at the federal level or more stringent state standards, and established a preference for permanent remedies that reduce the volume, toxicity, or mobility of hazardous substances in selecting remedies for Superfund sites.
- After Bhopal Tragedy (In India), the Community Right-to-Know (Title III – EPCRA – Emergency Planning and Community Right-to-Know Act) provisions of SARA require industries to plan emergencies and inform the public of hazardous substance being used.
- Bhopal tragedy was caused by <u>hazardous materials not by hazardous waste</u>.
- Bhopal Tragedy (In India – Union Carbide India, Ltd. A pesticide plant)
  - ✓ Happened at 1:00 am Sunday, December 3, 1984
  - ✓ About 45 tons of methyl isocyanate (CH_3NCO) leaked from a storage tank. 3,000 people died and 200,000 injured.

Union Carbide's long-closed pesticide plant in Bhopal

- SARA required that the Hazardous Ranking System (HRS) that determines which site are eligible for cleanup funding be totally revised.
- Pursuant to SARA, the EPA initiated Remedial Investigation/Feasibility Studies at 650 sites and remedial action at 375 sites within 5 years.

6. Identification of Hazardous Waste

Proper identification of hazardous waste is essential to the success of the Resource Conservation and Recover Act (RCRA) program. This identification process can be a very complex task. If facility owners and operators answer the following questions, they can determine if they are producing a hazardous waste:

(1) Is the material in question is solid waste?
(2) Is the material excluded from the definition of solid waste or hazardous waste?
(3) Is the waste a listed or characteristic hazardous waste?
(4) Is the waste delisted?

Figure 3 can also be used to identify a hazardous waste.

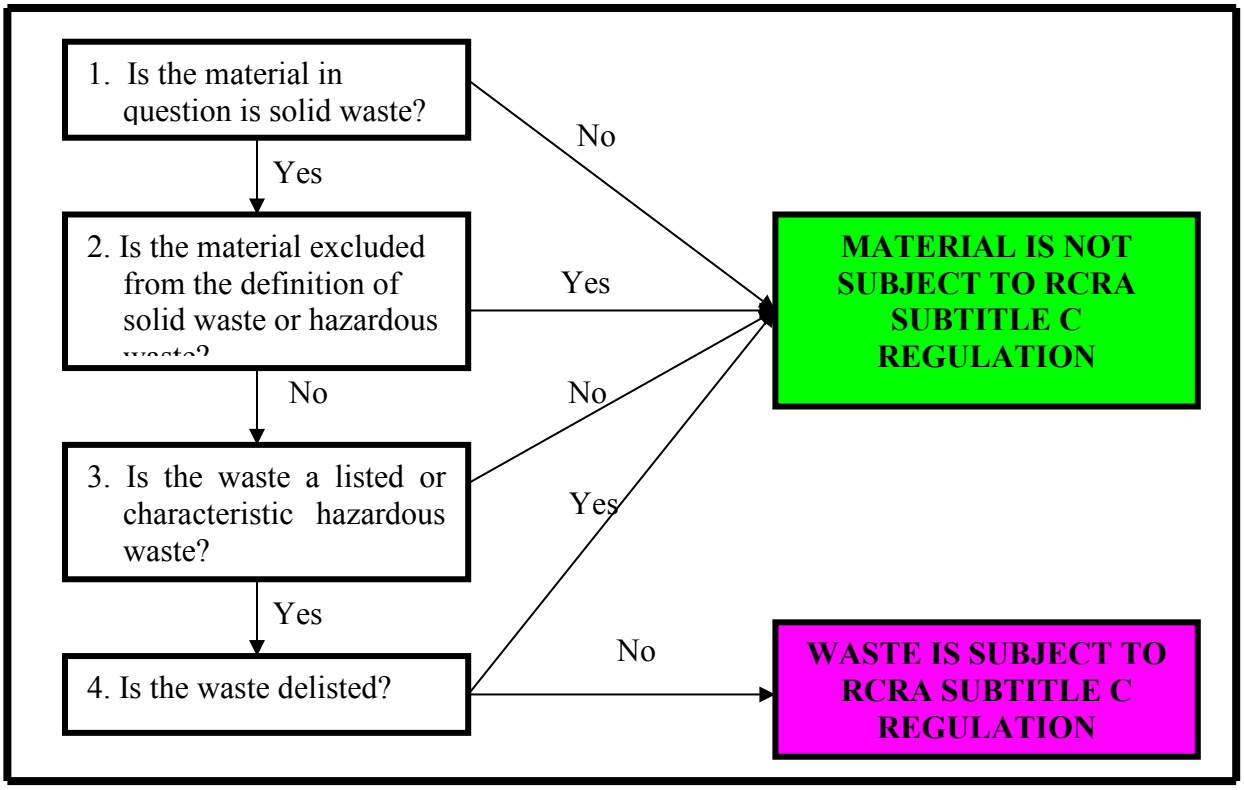


Figure 3: Hazardous waste identification process

6.1 Hazardous Waste Exclusions

A material cannot be a hazardous waste it if does not meet the definition of a solid waste. Thus, wastes that are excluded from the definition of solid waste are not subject to RCRA Subtitle C hazardous waste regulation. There are 19 exclusions from the definition of solid waste such as:

(1) Domestic sewage and mixed of domestic sewage;
(2) Industrial wastewater discharges (Point source discharges);
(3) Irrigation return flows;
(4) Radioactive waste;
(5) In-situ mining waste;
(6) Pulping liquor;
(7) Spent sulfuric acid;
(8) Closed-loop recycling;
(9) Spent wood preservatives;
(10) Coke by-product wastes;
(11) Splash condenser dross residue;
(12) Hazardous oil bearing secondary materials and reserved oil from petroleum refining operations;
(13) Condensate from kraft mill steam strippers;
(14) Comparable fuel;
(15) Processed scrap metal;
(16) Shredded circuit boards;
(17) Mineral processing spent materials;
(18) Petrochemical recovered oil; and
(19) Spent caustic solutions from petroleum refining.

6.2 Hazardous Waste Exemptions

EPA also exempts certain solid/hazardous wastes from the definition of hazardous waste. If a material meets an exemption from the definition of hazardous waste, it cannot be hazardous waste, even if the material technically meets a listing or exhibits a characteristic. There are 17 exemptions from the definition of hazardous waste:

(1) Household hazardous waste;
(2) Agricultural waste;
(3) Mining overburden;
(4) Bentsen (i.e., oil, gas, and geothermal exploration development and production wastes) and Bevill (i.e., fossil fuel combustion wastes, mining and mineral processing wastes, and cement kiln dust waste) wastes;
(5) Trivalent chromium wastes;
(6) Arsenically treated wood;
(7) Petroleum-contaminated media and debris from underground storage tanks;
(8) Spent chlorofluorocarbon refrigerants;
(9) Used oil filters;
(10) Used oil distillation bottoms;
(11) Landfill leachate or gas condensate;
(12) Project XL pilot project exclusions;
(13) Raw material, product storage, and process unit waste exclusions;
(14) Sample and treatability study exclusions;
(15) Waste characterization samples;
(16) Treatability study samples; and
(17) Dredge materials exclusions.

7. Types of Hazardous Waste

Hazardous wastes are classified on the basis of their biological, chemical, and physical properties. These properties generate materials that are either toxic, reactive, ignitable, corrosive, infectious, or radioactive.

Toxic wastes are poisons, even in very small or trace amounts. They may have acute effects, causing death or violent illness, or they may have chronic effects, slowly causing irreparable harm. Some are carcinogenic, causing cancer after many years of exposure. Others are mutagenic, causing major biological changes in the offspring of exposed humans and wildlife. There are two types of hazardous waste such as **listed hazardous waste** and **characteristic hazardous** waste.

71. Listed Hazardous Waste

The hazardous waste listings consist of four lists:

- The F list
- The P list
- The K list
- The U list

Listed wastes are wastes from generic industrial processes, wastes from certain sectors of industry, and unused pure chemical products and formulations.

Listing Criteria: There are three different criteria EPA uses to decide whether or not a waste is a hazardous waste. The three criteria are:

- The waste typically contains toxic chemicals at levels that could pose a threat to human health and the environment if improperly managed. Such wastes are known as **toxic** listed wastes.

- The waste such contains such dangerous chemicals that it could pose a threat to human health and the environment even when properly managed. These wastes are fatal to humans and animals even in low doses. Such wastes are known as **acute** hazardous wastes.

- The waste typically exhibits one of four characteristics of hazardous waste: ignitability, corrosivity, reactivity, and toxicity.

Constituents of Listed HW: The entire list that the EPA considers when listing wastes is contained in Section 261, Appendix VIII. For each waste listed as acutely hazardous or toxic, the hazardous constituents causing that waste to be listed are given in Appendix VII. Each listed waste is assigned one or more of these hazardous waste categories/indicators:

(I) Ignitable	(E) Toxicity Characteristic
(C) Corrosive	(H) Acutely Hazardous
(R) Reactive	(T) Toxic

Acutely Hazardous: The waste has been shown to be fatal to humans in low doses. EPA uses toxicity information from the literature to decide which wastes are acutely hazardous.

Toxic: EPA lists a waste as "toxic" if it contains certain "hazardous constituents" and EPA judges that the waste could pose health or environmental problems according to certain criteria including chronic toxicity, migration potential, bioaccumulation, quantities of waste generated, and past environmental problems caused by mismanagement of the waste.

The F List HW: The F list includes wastes from certain common industrial and manufacturing processes and is assigned EPA Waste Codes "**F001** to **F039**"[1]. The F list wastes are also known as **waste from nonspecific sources (40 CFR §261.31)**. The F list wastes can be divided into seven groups depending on the type of manufacturing or industrial operations that creates them:

1. Spent solvent wastes (EPA waste code F001 through F005);
2. Electroplating and other metal finishing wastes (F006 through F012, and F019);
3. Dioxin-bearing wastes (F020 through F023 and F026 through F028);
4. Chlorinated aliphatic hydrocarbons production wastes (F024 and F025);
5. Wood preservative wastes (F032, F034, and F035);
6. Petroleum refinery wastewater treatment sludges (F037 and F038); and
7. Multisource leachate (F039).

The K List HW: The K list designates waste from specific sectors of industry and manufacturing and is assigned EPA Waste Codes "**K001** to **K181**"[1]. Like F list wastes, K list wastes are manufacturing process wastes **(40 CFR § 261.32).** The following are the 13 industries that create K list wastes:

1. Wood preservation;
2. Organic chemical manufacturing;
3. Pesticides manufacturing;
4. Petroleum refining;
5. Veterinary pharmaceutical manufacturing;
6. Inorganic pigment manufacturing;
7. Inorganic chemicals manufacturing;
8. Explosives manufacturing;
9. Iron and steel production;
10. Primary aluminum production;
11. Secondary lead processing;
12. Ink formulation; and
13. Coking (processing of coal to produce coke, a material used in iron and steel production).

The P and U List HW: Discarded Commercial Chemical Products

The P and U lists designate as hazardous waste pure and commercial grade formulations of certain unused chemicals that are being disposed. The P and U are assigned EPA Waste Code "**P001** to **P205**" and "**U001** to **U411**"[1], respectively. Unused chemicals may become waste for a

[1] Hazardous Waste Determination: D001 Ignitable - Daniels Training Services

number of reasons. For example, some unused chemicals are spilled by accident. Others are intentionally discarded because they are off-specification and cannot serve the purpose for which they were originally produced. For a waste to qualify as P- **(Acutely Toxic Hazardous; 40 CFR §261.33(e))** or U-listed **(Toxic Hazardous, but not highly toxic; 40 CFR §261.33 (f))**, the waste must meet the following three criteria:

- The waste must contain one of the chemicals listed on the P or U list;
- The chemical in the waste must be unused; and
- The chemical in the waste must be in the form of commercial chemical product (CCP).

For purposes of the P and U lists, a CCP is defined as a chemical that is one of the following:

- 100% pure (means that the chemical is the only chemical constituent in the product);
- Technical (e.g., commercial, means that the formulation is not 100% pure, but is of grade of purity that is either marketed or recognized in general usage by the chemical industry) grade;
- The sole active ingredient (means the chemical is the only ingredient serving the function of the formulation) in a chemical formulation.

Notes on P and U Codes: *This listing includes only those products and intermediates, which are being, discarded either in their pure form or contained in a mixture as the sole active ingredient. Process wastes, which merely contain any of the P/U chemicals, even in high concentrations, are not hazardous wastes by this listing mechanism. In addition, products that contain more than one active ingredient listed in P/U codes are not hazardous waste by this listing.*

7.2 Characteristic Hazardous Waste

Hazardous wastes that exhibit the following four characteristics:

- Ignitability,
- Corrosivity,
- Reactivity, or
- Toxicity.

In the past, hazardous wastes were often grouped into the following categories: (a) radioactive substances, (b) chemicals that include wastes that are corrosive, reactive, or toxic, (c) biological wastes that usually are generated from hospitals and biological research facilities, (d) flammable wastes, and (e) explosives.

Ignitability: Ignitable materials are capable of causing a fire through friction, absorption of moisture, or spontaneous chemicals changes, and continue to burn aggressively. Ignitable wastes carry an EPA Waste Code "**D001"**[1] and are among the most common hazardous waste. Examples of ignitable waste are fuels, oils, used solvents, ignitable compressed gas, and oxidizers.

- The characteristic of ignitability can apply to any physical state.

- The most common test of ignitability is if the waste :
  (1) is a liquid at 68°F, and
  (2) has a flashpoint of less than 140°F.
- **Note:** The flash point test measures the temperature at which the vapors volatilizing from a liquid will ignite, causing the liquid itself to ignite. A solid which contains a low flash point liquid will yield the same flash point measurement as the liquid itself. However, whereas the liquid alone will ignite at that flash point temperature, the solid/liquid mixture will not. Therefore, flash point tests apply only to liquids.

Other wastes regulated as ignitable are:

- Oxidizers by Department of Transportation (**DOT**) definition. DOT defines an oxidizer as "a substance such as chlorate or a nitrate that yields oxygen readily to stimulate combustion of organic matter.
- Wastes, not a liquid at 20ºC and 1 atm pressure, that are spontaneously combustible.
- Flammable compressed gases as defined by DOT in 49 CFR 173.300.

Corrosivity: The characteristic of corrosivity applies only to liquid and aqueous wastes. Corrosive wastes carry an EPA Waste Code "**D002"**[1]. The ISO Corrosivity Classification table defines six corrosivity categories (C1 - very low, C2 - low, C3 - medium, C4 - high, C5 - very high, CX - extreme) based on one-year corrosion mass loss or penetration of steel, zinc, copper, and aluminum coupons. It is important to note that CX generally covers the most extreme environments - usually offshore environments. Corrosivity Category determination based on corrosion rate measurement of standard specimens table can be found in ISO 9223[2]. A waste is corrosive if it is:

- Aqueous and its pH is 2 or less (acids), or 12.5 or greater (bases).
- Liquid and it corrodes steel at a rate greater than 6.35 millimeters per year.
- Can react dangerously with other waste materials and are harmful to humans because they irritate the skin, respiratory tract or mucous membranes. Acids, batteries, and caustics are the examples of corrosive materials.

Reactivity: Reactive wastes are normally unstable, and may react violently at standard temperature and pressure. These wastes cause a reaction when mixed with other chemicals, or even water. Some generate toxic fumes when mixed with water or when exposed to acidic conditions. Examples of reactive wastes are pool chemicals, hydrogen peroxide, disinfectants, water from TNT (Tri-nitro Toluene) operations and used cyanide solvents. Waste exhibiting the characteristic of reactivity is assigned an EPA Waste Code "**D003"**[1]. The characteristic of reactivity evaluates two different types of hazards:

- Physical hazards
  - ✓ *Explosions, violent reactions, fire hazards*
- Health hazards from release of toxic gases from the waste

Description of physical hazards:

- Normally unstable and readily undergoes violent change without detonating

[2] CPC Source - Environmental Severity Classification (ESC) | WBDG - Whole Building Design Guide

- Reacts violently with water
- Forms potentially explosive mixtures with water
- Capable of detonation or explosive reaction if it is subjected to a strong initiating source or heated under confinement
- Readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure
- Meets DOT definition of "forbidden explosive, class A explosive, class B explosive

Descriptions of health hazards:

- When exposed to water (or when exposed to pH conditions between 2 and 12.5, if the waste contains sulfide or cyanide) it "generates toxic gases, vapors, or fumes in quantity sufficient to present a danger to human health or the environment."

Complaint Levels of Reactivity: The waste is considered to be reactive if the waste contains:

- ≥ 250 mg/kg total cyanide,
- ≥ 500 mg/kg total sulfide.

Toxicity: Toxic wastes cause injury upon exposure or ingestion. Examples of toxic wastes are pesticides, cleaners, and mothballs. Toxicity is assigned EPA Waste Codes "**D004 to D043"**[1]**.** Toxicity of hazardous wastes is determined by an analytical test method called Toxicity Characteristic Leaching Procedure (TCLP). Toxicity level is determined for the presence (and concentration) of hazardous constituents including:

- Metals, such as *arsenic, lead, cadmium, chromium, mercury, silver, barium, selenium.*
- Pesticides/Herbicides.
- Polychlorinated Biphenyl (PCBs).
- Volatile Organics (VOC's), such as *benzene, carbon tetrachloride, etc.*
- Semi-Volatile Organics (SVOC's) such as *pyridene, hexachloroethane.*

The TCLP requires a facility to create a liquid leachate from its hazardous waste samples. This leachate would be similar to the leachate generated by a landfill containing a mixture of household and industrial wastes. The waste is determined to be toxic and must be managed as hazardous waste if it contains any of the 40 different toxic chemicals in amounts above the specified regulatory levels as listed in Table 1.

Table 1: TCLP regulatory levels

Waste Code	Contaminant	Concentration (mg/L)		Waste Code	Contaminant	Concentration (mg/L)
D004	Arsenic	5.0		D032	Hexachlorobenzene	0.1
D005	Barium	100.0		D033	Hexachlorobutadiene	0.5
D018	Benzene	0.5		D034	Hexachloroethane	3.0
D006	Cadmium	1.0		D008	Lead	5.0
D019	Carbon tetrachloride	0.5		D013	Lindane	0.4
D020	Chlordane	0.03		D009	Mercury	0.2

Waste Code	Contaminant	Concentration (mg/L)		Waste Code	Contaminant	Concentration (mg/L)
D021	Chlorobenzene	100.0		D014	Methoxychlor	10.0
D022	Chloroform	6.0		D035	Methyl ethyl ketone	200.0
D007	Chromium	5.0		D036	Nitrobenzene	2.0
D023	o-Cresol	200.0		D037	Pentachlorophenol	100.0
D024	m-Cresol	200.0		D038	Pyridine	5.0
D025	p-Cresol	200.0		D010	Selenium	1.0
D026	Total Cresols	200.0		D011	Silver	5.0
D016	2,4-D	10.0		D039	Tetrachloroethylene	0.7
D027	1,4-Dichlorobenzene	7.5		D015	Toxaphene	0.5
D028	1,2-Dichloroethane	0.5		D040	Trichloroethylene	0.5
D029	1,1-Dichloroethylene	0.7		D041	2,4,5-Trichlorophenol	400.0
D030	2,4-Dinitrotoluene	0.13		D042	2,4,6-Trichlorophenol	2.0
D012	Endrin	0.02		D017	2,4,5-TP (Silvex)	1.0
D031	Heptachlor (and its epoxide)	0.008		D043	Vinyl Chloride	0.2

8. Mixture Rule

The mixture rule is intended to ensure that mixtures of listed wastes with nonhazardous solid wastes are regulated in a manner that minimizes threats to human health and the environment. Figure 4 illustrates the process of determining the type of mixed wastes.

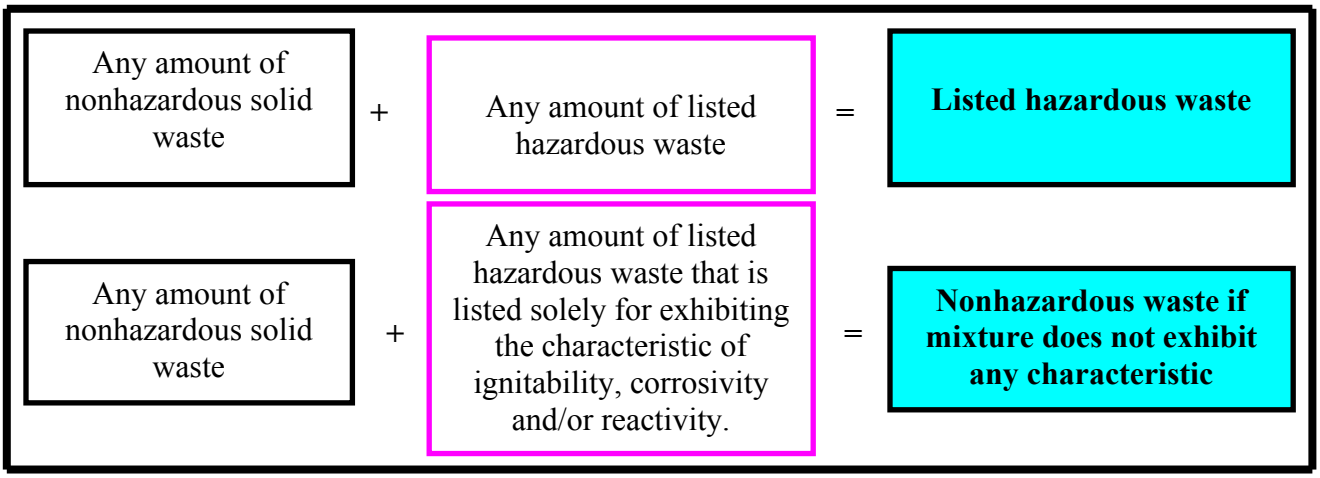


Figure 4: The mixture rule

9. Hazardous Waste Recycling and Universal Waste

9.1 HW Recycling

RCRA hazardous wastes do not cease to be dangerous simply because they are being reused, recycled, or reclaimed. Many hazardous waste recycling operations may pose serious health and

environmental hazards and should be subject to Subtitle C regulations. Reuse, recycling, and reclamation should be viewed instead as ways of managing hazardous wastes which, if properly conducted, can avoid environmental hazards, protect scarce natural resources, and reduce the nation's reliance on raw materials and energy. Promoting reuse and recover is certainly one of the goals of RCRA; however, this goal does not take precedence over assuring the proper management of hazardous waste.

How a material is regulated under RCRA (i.e., whether or not it is a solid and potentially a hazardous waste) when it is recycled depends on what type of material it is, and what type of recycling is occurring. If the recycled material is not a solid waste, then it is not a hazardous waste and is not subject to RCRA Subtitle C regulation requirements. However, if the material qualifies as a solid and hazardous waste, it is subject to RCRA Subtitle C jurisdiction.

Exemptions: Not all hazardous wastes pose the same degree of hazard when recycled. EPA believes wastes that may be recycled in a protective manner, or that are addressed under other environmental regulations, warrant exemptions from RCRA Subtitle C. Consequently, handlers of these materials are not subject to any hazardous waste regulations. These exempt recyclable hazardous wastes are:

- Industrial ethyl alcohol;
- Scrap metal
- Waste-derived fuels from refining processes; and
- Unrefined waste-derived fuels and oils from petroleum refineries.

Special Standards: While RCRA specifically exempts some wastes when recycled, some recycling processes may still pose enough of a hazard to warrant some degree of regulation. However, due to the nature of the recycling process itself or the nature of the materials being recycled, these processes may require a specialized set of standards. These processes are:

- Use constituting disposal (practice of recycling HWs by placing them on the land or using as ingredients in a product that will be placed on the land);
- Precious metals reclamation (such as gold, silver, platinum, palladium, iridium, osmium, rhodium, and ruthenium);
- Spent lead-acid battery reclamation; and
- Burning for energy recover (Boilers or Industrial Furnaces, BIFs).

Used Oil:
Used oil is regulated under its own recycling program. Used oil is defined as any oil that has been refined from crude oil or any synthetic oil that has been used and as a result of such use is contaminated by physical or chemical impurities. The used oil recycling provisions include management standards for used oil:

- Generators;
- Collection centers and aggregation points;
- Transporters;
- Transfer facilities;

- Processors and refiners;
- Burners; and
- Marketers.

9.2 Universal Wastes

EPA discovered that subjecting other commonly recycled materials to hazardous waste regulation was burdensome on many handlers of these wastes. This burden has the potential of discouraging waste recycling by facilities who are otherwise willing to engage in such activity. In response to these concerns, EPA promulgated the universal waste program, in May 1995. These requirements are codified in 40 CFR Part 273.

The universal waste program promotes the collection and recycling of certain widely generated hazardous wastes, known as **universal wastes**. *Universal wastes are subject to special management provisions intended to ease the management/regulatory burden on the facilities that manage universal wastes, particularly by allowing more time accumulation of these wastes in order to facilitate appropriate recycling or disposal*. Three types of wastes were originally covered under the universal waste regulations:

1. Hazardous waste batteries,
2. Hazardous waste pesticides that are either recalled or collected in waste pesticide collection program, and
3. Hazardous waste thermostats.

In July 1999, EPA added hazardous waste **lamps** to the universal waste regulations. In June 2002, EPA proposed to add mercury-containing equipment. Other similar waste may be added to the universal waste regulations in future. The regulated community may also petition the Agency to include additional wastes in the universal waste program.

There are four types of regulated participants in the universal waste system:

1. Small quantity handlers of universal waste (SQHUW);
2. Large quantity handlers of universal waste (LQHUW);
3. Universal waste transporters; and
4. Universal waste destination facilities.

9.3 Universal Waste Handlers

There are two types of handlers of universal waste:

1. A person who generates, or creates universal waste. For example, this may include a person who uses batteries, pesticides, thermostats, or lamps and who eventually decides that they are no longer usable; and
2. A person who receives universal waste from other handlers, accumulates the waste and then sends it on to other handlers, recyclers, or treatment or disposal facilities without performing the actual treatment, recycling or disposal. This may include a person who collects batteries, pesticides, or thermostats from small businesses and sends the wastes to a recycling facility. The handler requirements depend on how much universal waste a handler accumulates at any one time.

SQHUW: Accumulate less than 5,000 kg (approximately 11,000 pounds) of universal wastes categories at their location at any time. The accumulation time for universal waste at any location is limited to one year. SQHUW are required to manage universal waste in a way that prevents releases to the environment. SQHUW must also immediately respond to releases of universal waste. SQHUW must distribute basic waste handling and emergency information to their employees to ensure that their staff are aware of proper handling and emergency procedures.

LQHUW: Accumulate 5,000 kg (approximately 11,000 pounds) or more of universal wastes at any time. The designation as a LQHUW is retained for the remainder of the calendar year in which the 5,000 kg threshold was exceeded, and may be reevaluated in the following calendar year. LQHUW must comply with the same requirements as SQHUW, as well as a few additional ones. LQHUW must also maintain basic records documenting shipments received at the facility and shipments sent from the facility, must obtain an EPA ID number, and must comply with stricter employee training requirements.

9.4 Universal Waste Transporters

Universal waste transporters are persons who transport universal waste from handlers of universal waste to other handlers, destination facilities, or foreign destinations. These wastes do not need to be accompanied by a RCRA hazardous waste manifest during transport, but transporters must comply with applicable DOT requirements. Transporters may store universal waste for up to *10 days* at a transfer facility during the course of transportation. If transporter keeps universal waste for more than *10 days* at one location, the transporter is subject to all applicable SQHUW or LQHUW regulations.

9.5 Universal Waste Destination Facilities

Universal waste destination facilities are facilities that treat, dispose of, or recycle a particular category of universal waste. These facilities are subject to the same requirements as fully regulated hazardous waste treatment, storage, and disposal facilities (TSDFs). Full requirements include permit requirements, general facility standards, and unit-specific standards. The universal waste program includes only two additional specific universal waste requirements for destination facilities. These requirements are:

- Procedures for rejecting shipments of universal waste, and
- Documentation of the receipt of universal waste.

10. Hazardous Waste Generators:

10.1 Definition

The Subtitle C regulations broadly define the term generator to include any person, by site, who:

- First creates or produces a hazardous waste (e.g., from an industrial process)

OR

- First brings a hazardous waste into the RCRA Subtitle C system (e,g., imports a hazardous waste into the Unites States)

Because the generators are the first step in the RCRA Subtitle C system, it is important that they properly classify and identify their waste to ensure proper handling later in the hazardous waste management process. As a result, generators of hazardous waste must make the following determinations:

- Is the waste a solid waste?
- Is the waste excluded?
- Is the waste a listed hazardous waste?
- Is the waste a characteristic waste?

RCRA regulates generators based on the amount of waste that they generate in a calendar month. There are three categories of hazardous waste generators:

1. Large quantity generators (LQGs);
2. Small quantity generators (SQGs); and
3. Conditionally exempt small quantity generators (CESQGs).

10.2 Large Quantity Generators (LQGs)

LQGs are defined as those facilities that generate:

- 1,000 kg or more (approximately 2,200 pounds) of hazardous waste per calendar month.

OR

- 1 kg or more (approximately 2.2 pounds) of acutely hazardous waste per calendar month.
- A LQG may accumulate hazardous waste on site for 90 days or less.

*In 1999, there were approximately **20,000** LQGs in the USA.*
*In 2003, there were approximately **16,000** LQGs in the USA.*

10.3 Small Quantity Generators (SQGs)

SQGs are defined as those facilities that:

- Generate between 100 kg (approximately 220 pounds) and 1,000 kg (approximately 2,200 pounds) of hazardous waste per calendar month.

AND

- Accumulate less than 6,000 kg (approximately 13,200 pounds) of hazardous waste at any time.
- A SQG may accumulate hazardous waste on site for 180 days or less.

*In 1999, there were approximately **125,000** SQGs in the USA.*
*In 2001, there were approximately **200,000** SQGs in the USA.*

10.4 Conditionally Exempted Small Quantity Generators (CESQGs)

CESQGs are defined as those facilities that generate:

- 100 kg or less (approximately 220 pounds) of hazardous waste per calendar month.

OR

- 1 kg or less (approximately 2.2 pounds) of acutely hazardous waste per calendar month.

Beyond this monthly generation limits

- CESQGs are limited to total accumulation of **1,000** kg of hazardous waste or **1** kg of acute hazardous waste or **100** kg of any residue from cleanup of a spill of acute hazardous waste at any time.

10.5 Episodic Generation

Because generator status is determined on a monthly basis, it is possible that a generator's status can change from one month to the next, depending on the amount of waste generated in a particular month. This is referred to ***episodic generation***. If a generator's status does in fact change, the generator is required to comply with the respective regulatory requirements for that class of generators for the waste generated in that particular month.

10.6 Regulatory Requirements for LQGs and SQGs

LQGs and SQGs are subject to regulations contained in 40 CFR Part 262 that require each generator to:

- Identify and count waste;
- Obtain an EPA ID number;
- Comply with accumulation and storage requirements (including requirements for training, contingency planning, and emergency arrangement);
- Prepare the waste for transportation;
- Track the shipment and receipt of such waste; and
- Meet record keeping and reporting requirements.

LQGs and SQGs may also be subject to land disposal restrictions (LDR) requirements.

10.7 Regulatory Requirements for CESQGs

CESQGs are not subject to most of the generator requirements applicable to LQGs and SQGs, but they must identify their hazardous waste, comply with storage limit requirements, and ensure waste treatment or disposal in an on-site or off-site:

- Permitted or interim status hazardous waste TSDF;
- State hazardous waste facility;
- State permitted, licensed, or registered solid waste disposal facility;
- State municipal solid waste landfill (MSWLF);
- Recycling facility; and
- Universal waste facility.

11. Record Keeping and Reporting Requirements

The recordkeeping and reporting requirements for LQGs and SQGs provide EPA and the states with a method of tracking the quantities of hazardous waste generated and the movement of hazardous wastes. The generator regulations in 40 CFR Part 262 contain three primary recordkeeping and reporting requirements:

- Biennial reporting
- Exception reporting

- Three-year record retention.

11.1 Biennial Reporting

LQGs must submit biennial report *(EPA Form 8700-13A and B)* to EPA or state by March 1, of each even-numbered year. The report details the generator's activities during the previous calendar year and includes the:

- EPA ID number, name, and address of the generator;
- EPA ID number and name of each transporter used throughout the year;
- EPA ID number, name, and address of each off-site TSDF and recycler to which waste was sent during the year; and
- Description and quantities of each hazardous waste generated.

The federal RCRA regulations do not require SQGs to file biennial reports.

11.2 Exception Reporting

RCRA regulations ensure that the transport of hazardous waste from its point of generation to its point of treatment, storage, or disposal is documented through a manifest system. This system requires the designated facility to return a signed and dated copy of the manifest to the generator in order to acknowledge receipt of the waste. If the generator does not receive this paperwork, additional steps need to be taken to locate the waste. As a result, LQGs who transport waste off site, but don not receive a signed and dated copy of the manifest from the designated facility within *45 days* from the date on which the initial transporter accepted the waste, must submit an ***exception report*** to the EPA Regional Administrator. The exception report must describe efforts made to locate the waste and the results of these efforts.

SQGs who do not receive a signed and dated copy of the manifest from the designated facility within *60 days* must send a copy of the original manifest to the EPA Regional Administrator with a note indicating that they have not received a return copy.

11.3 Record Retention

Generators must keep a copy each biennial and any exception reports for at least three years from the due date of the report. Generators are also required to keep copies of all manifests for three years or until a signed and dated copy of the manifest is received from the designated facility. Records of waste analyses and determinations performed by the generator must be kept for at least three years from the date the waste was last sent to an on-site or off-site TSDF. These retention periods may be extended automatically during the course of any unresolved enforcement action regarding the regulated activity, or as requested by the EPA Administrator.

12. Quantity and Time Limits of HW Generators

SQGs may not store more than ***6,000*** kg and CESQGs not more than ***1,000*** kg of hazardous waste on site any time. LQGs must move all hazardous waste that they generate within ***90*** days. May store F006 listed (wastewater treatment sludges from electroplating operations) waste for ***180 or 270*** days if the waste is to be recycled. SQGs have ***180*** days to move all hazardous waste off-site. SQGs transporting hazardous waste for off-site treatment, storage, or disposal over distances greater than **200** miles may accumulate waste up to **270** days. If **SQGs or CESQGs**

exceed their respective storage quantity limits, or **LQGs or SQGs** exceed their respective accumulation time limits, the facility becomes a storage facility subject to all applicable requirements for **TSDF**s (including permitting) unless they have received an accumulation time limit extension from EPA or their state.

13. HW Imports and Exports

Any person importing hazardous waste into the United States from a foreign country is subject to hazardous waste generator standards. RCRA also contains specific requirements for hazardous waste exports. Importers and exporters must also comply with the provisions of international trade treaties, such as the Basel Convention and the Organization for Economic Cooperation and Development (OECD) Council Decision.

14. HW Exclusion for Farmers

Because farmers disposing of certain pesticide wastes on their own land are subject to regulation under RCRA and Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), RCRA specifically excludes such farmers from generator requirements.

15. Hazardous Waste Transporters

Hazardous waste transporter is subject to several regulations under RCRA and must:

- Obtain EPA ID number;
- Comply with the manifest system; and
- Properly handle hazardous waste discharges.

EPA ID Number: One way of keeping track of hazardous waste transporter is by requiring transporter company to obtain EPA ID number. Without this ID number, the transporter is forbidden from transporting hazardous waste.

The Manifest: With exception of water and rail shipments and the transport of certain SQG recycling wastes, a transporter may not accept hazardous waste from a generator unless the waste is accompanied by a properly prepared manifest (Figure 5).

Figure 5: Hazardous Waste Management Manifest[1]

Handling Hazardous Waste Discharges: In order to address the probability of happening accidents during transportation of hazardous waste, the regulations require transporters to take immediate action to protect human health and the environment if a release occurs (e.g., notifying local authorities and diking the discharge area). When a serious accident or spill occurs, the transporter must notify and the National Response Council (NRC) by phone. The Centers for Disease Control (CDC) must also be informed if the spill involves disease-causing agents.

16. HW Transfer Facilities

A transfer facility is defined as any transportation-related facility, such as loading docks, parking areas, storage areas, and other similar areas where shipments are held during the normal course of transportation. A transporter may hold waste at a transfer facility for up to 10 days. If a transfer facility hold the waste at a transfer facility for more than 10 days, the transfer facility

becomes a storage facility which is subject to all applicable requirements for TSDFs, including permitting.

17. Treatment, Storage, and Disposal Facilities (TSDFs)

TSDFs are the last link in the cradle-to-grave hazardous waste management system. The requirements for TSDFs, located in 40 CFR Parts 264 and 265, are more extensive than standards for generators and transporters. With some exception, a TSDF is a facility engaged in one or more of the following activities:

- **Treatment** - Any method, technique, or process designed to physically, chemically, or biologically change the nature of a hazardous waste.

- **Storage -** Holding hazardous waste for a temporary period, after which hazardous waste is treated, disposed of, or stored elsewhere.

- **Disposal -** The discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid or hazardous waste on or in the land or water. A disposal facility is nay site where hazardous waste is intentionally placed and where the waste will remain after a TSDF stops operation.

The TSDF standards require facilities to comply with:

- General facility standards;
- Preparedness and prevention requirements;
- Contingency plans and emergency procedure provisions; and
- Manifest, recordkeeping, and reporting requirements.

Owners and operators can manage their waste in any of the following units:

- Containers;
- Containment buildings;
- Drip pads;
- Land treatment units;
- Landfills;
- Surface impoundments;
- Tanks;
- Waste piles; and
- Miscellaneous unit.

18. Land Disposal Restrictions (LDR)

When EPA promulgates a final treatment standard for a waste, handlers of the waste must manage it in accordance with all the LDR requirements and cannot dispose of it on the land until it meets all applicable treatment standards. Figure 6 describes applicability of LDR on wastes.

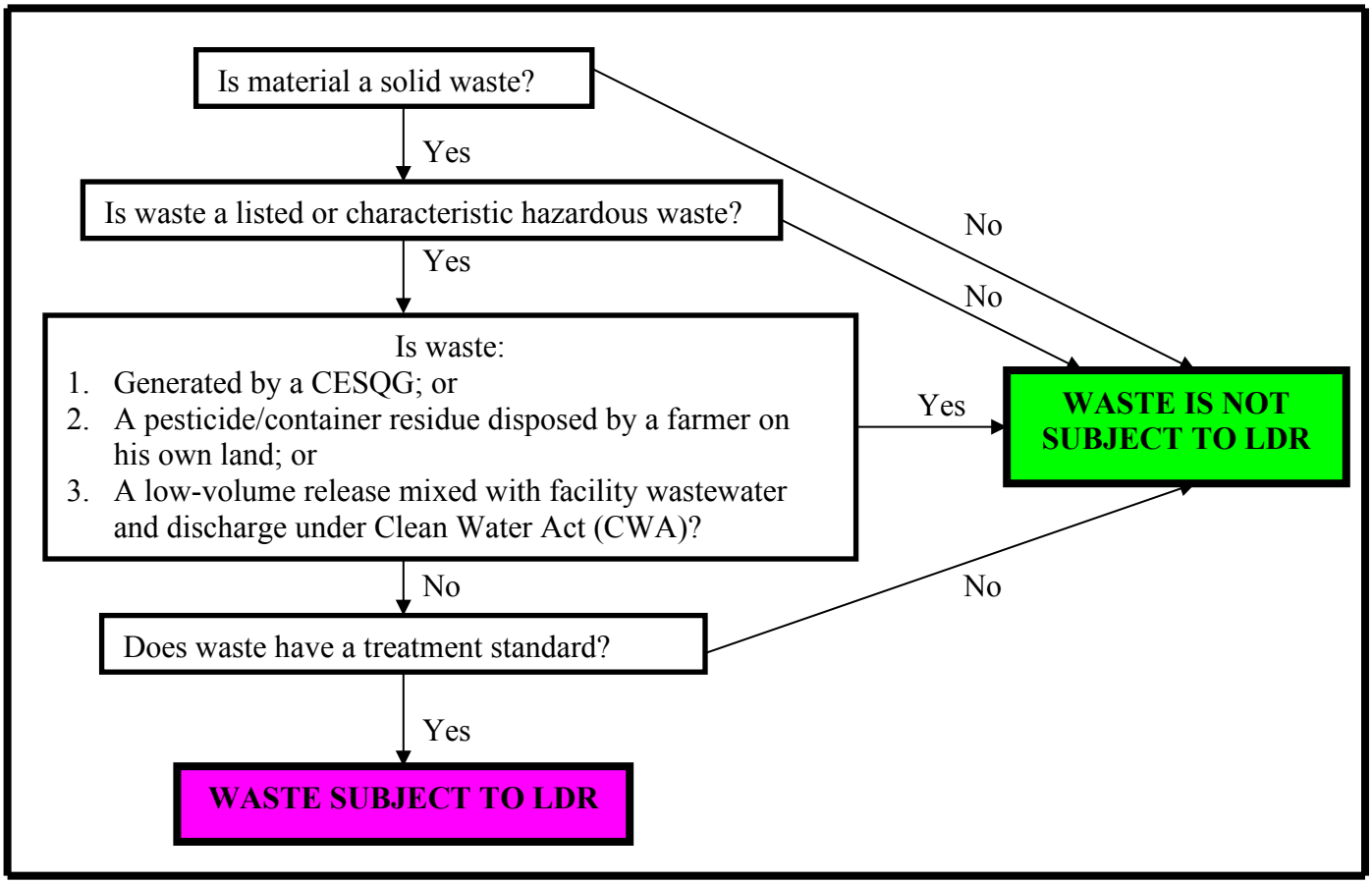


Figure 6: Applicability of land disposal restrictions

While the LDR program generally applies to all persons who generate, transport, treat, store, or dispose of restricted hazardous wastes, there are exclusions from the LDR requirements. The following wastes are not subject to the LDR program:

- Waste generated by CESQGs;
- Waste pesticides and container residues disposed of by farmers on their own land;
- Newly identified or newly listed hazardous wastes for which EPA has yet to promulgate treatment standards; and
- Certain waste releases that are mixed with a facility's wastewater and discharged pursuant to CWA.

Combustion:
The controlled burning of hazardous wastes/substances in an enclosed area. The regulated units for combustions are:

- Incinerators;
- Boilers; and
- Industrial Furnaces.

Incinerator: An enclosed device that uses controlled flame combustion and does not meet the more specific criteria for classification as boiler, industrial furnaces, sludge dryer (a unit that dehydrates hazardous sludge), or carbon regeneration unit. Incinerators include:

- Infrared incinerators (a unit that uses heat followed by a controlled flame afterburner).
- Plasma arc incinerators (a unit that uses electrical discharge followed by a controlled flame afterburner).

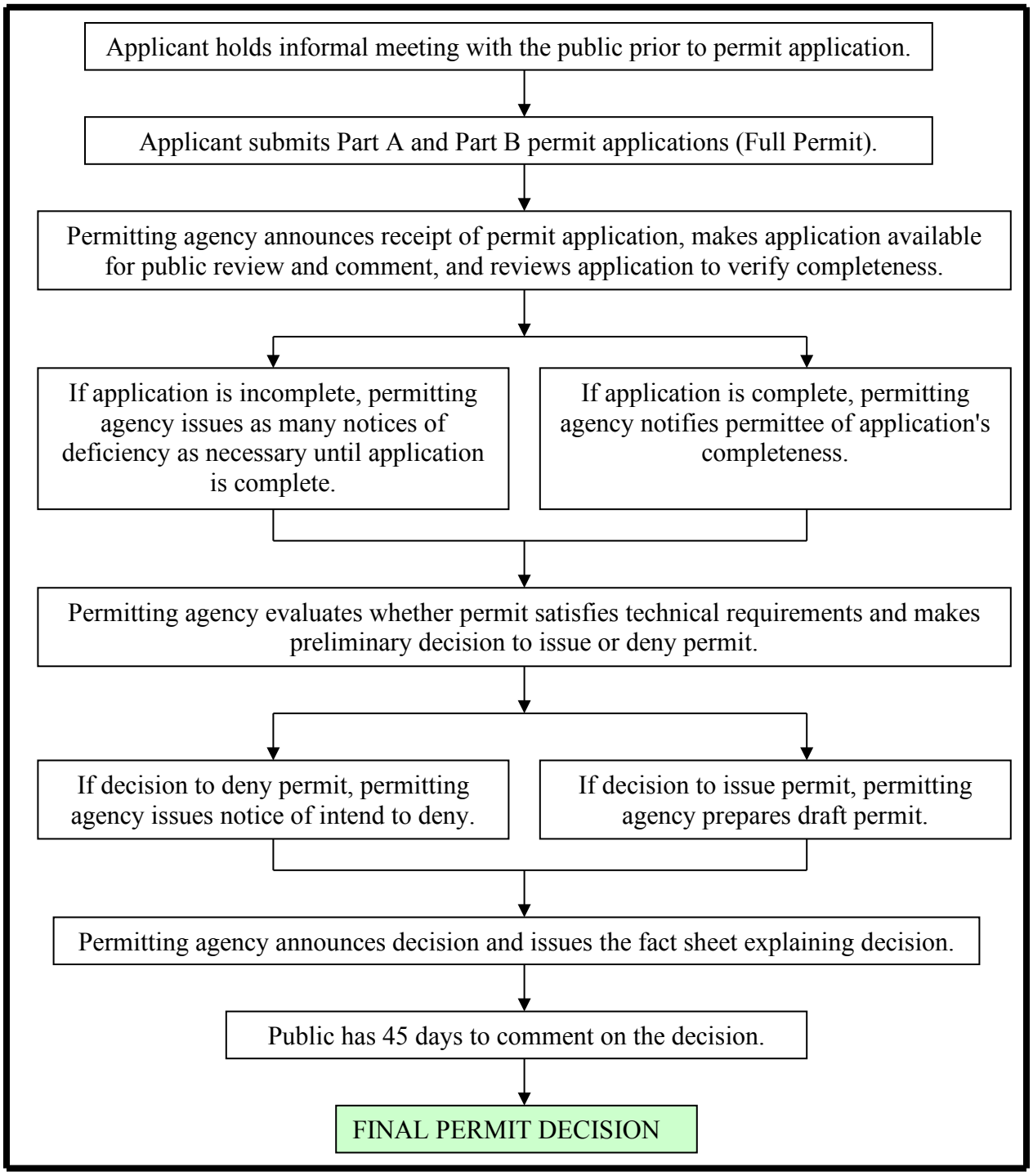
Boiler: An enclosed device that uses controlled combustion flame combustion to recover and export energy in the form of steam, heated fluid, or heated gases.

Industrial Furnace: An enclosed device that is integral parts of a manufacturing process and use thermal treatment to recover materials or energy from hazardous waste. The following 12 devices meet the definition of an industrial furnace:

- Cement kiln;
- Aggregate kiln;
- Coke oven;
- Smelting, melting, and refining furnace;
- Methane reforming furnace;
- Pulping liquor recovery furnace;
- Lime kiln;
- Phosphate kiln;
- Blast furnace;
- Titanium dioxide chloride process oxidation reactor;
- Halogen acid furnace; and
- Combustion device used in the recovery of sulfur valves from spent sulfuric acid.

19. Permitting for TSDFs

Permits provide TSDF owners and operators with the legal authority to treat, store, or dispose of hazardous waste and deal with how the facility must comply with the regulations. Compliance with this permit ensures that hazardous waste is handled in a controlled manner that is protective of human health and the environment. Permits also serve as an implementation mechanism, and as a means by which EPA can track waste management at facilities that choose to handle hazardous waste. Owners and operators who are subject to the permitting requirements must submit a permit application (for full permit) in accordance with specific permit application procedures as outlined in Figure 7.



Note: *RCRA permits are effective for a fixed term of a maximum of 10 years.*

Figure 7: Outline of the permitting process

Examples of Part A and Part B Permit Application Information Requirements:

Part A
- Activities conducted that require a permit;
- Facility Name, mailing address, and location;
- Facility standard industrial classification (SIC) codes;
- Treatment, storage, and disposal processes;
- Design capacity of waste management and/or disposal units;
- List of wastes to be managed and/or disposed of a facility;
- Permits received or applied for under other regulatory programs; and
- Topographic map(s).

Part B
- General facility description;
- Analysis of wastes to be managed and/or disposed of;
- Facility security procedures;
- Inspection schedule;
- Contingency plan;
- Procedures and precautions to prevent release of waste into environment;
- Procedures and precautions to prevent accidental ignition or reaction of waste; and
- Facility location information.

19.1 Interim Status Facilities

Facilities that were existing and operating on the effective date of a regulation that required them to obtain an operating permit are considered interim status facilities. They are allowed to continue operating as long as they comply with certain general facility and unit-specific TSDF standards until the implementing agency makes a final permit determination.

19.2 Special Forms of Permits

Some waste management operations and practices require special permit provisions. The special forms of permits are:

1. Permit-by-Rule (PBR);
2. Emergency Permits;
3. Research, Development, and Demonstration (RD&D) Permits;
4. Land Treatment Demonstration Permits;
5. Combustion Permits;
6. Post-Closure Permits; and
7. Remedial Action Plans.

Additionally, EPA proposed another special type of permit called a "**standardized permit**." This type of permit is for facilities that generate hazardous waste and store or non-thermally treat the waste in tanks, containers, and containment buildings on site.

1. **Permit-by-Rule (PBR):** The regulatory and technical requirements for PBR is less stringent that that of a full permit. PBRs are available for:
   - Ocean disposal vessels and barges regulated under Marine Protection, Research, and Sanctuaries Act (MPRSA);
   - Underground Injection Control (UIC) wells regulated under (Safe Drinking Water Act (SDWA); and
   - Publicly Owned Treatment Works (POTWs) regulated under Clean Water Act (CWA).

2. **Emergency Permits:** A temporary permit that is issued when EPA or an authorized state finds there is an imminent and substantial endangerment to human health and the environment in order to allow treatment, storage, or disposal of hazardous waste by a nonpermitted facility or by a permitted facility that has not been permitted to engage in such an activity. The duration of an emergency permit cannot exceed **90** days.

3. **RD&D Permits:** Owners and operators who propose too use innovative hazardous waste treatment technologies can receive a RD&D permit, provided that permit standards for such an activity have not already been established by EPA.

4. **Land Treatment Demonstration Permits**: This kind of permits allow an owner and operator to perform the required treatment with a demonstration that hazardous constituents in a waste can be completely degraded, transformed, or immobilized in the treatment zone.

5. **Combustion Permits:** Combustion permits specify the conditions under which a combustion facility must operate. They also specify the operating conditions such as waste feed rate, unit temperature, gas velocity, and carbon monoxide emissions, which guarantee that a combust unit will meets its respective performance standards. The permit also specifies combustion unit waste analysis, inspection, monitoring, residue management requirements and sets conditions for all other hazardous waste storage, treatment, and disposal.

6. **Post-Closure Permits:** Owners and operators of hazardous waste disposal and management units that cannot clean close must close the units as landfills and must conduct post-closure care, including groundwater monitoring and maintenance of an impermeable cap.

7. **Remedial Action Plans:** This is special form of RCRA permit that a facility may obtain to treat, store, or dispose of hazardous remediation waste at a remediation waste site.

20. Summary

In this course we have defined hazardous waste and several terms and abbreviations related to hazardous waste management, waste management act and provisions/subtitles. We took a look at the evolution of RCRA legislation, components of RCRA, RCRA and its interrelationship to other environmental statutes such as Subtitles C, D, and I. We learned as to how we can identify hazardous waste, what are the hazardous waste exclusions and exemptions. We also discussed two types of hazardous waste: listed and characteristic hazardous wastes, mixture rule, hazardous

waste recycling and universal wastes, hazardous waste generators and transporters, hazardous waste treatment, storage, and disposal facilities (TSDFs), land disposal restrictions, combustion, and permitting for TSDFs. Finally we learned about Part **A** (siting) and Part **B** (detailed design) permitting application submission requirements and **Special Forms of Permits** such as Permit-by-Rule (PBR); Emergency Permits; Research, Development, and Demonstration (RD&D) Permits; Land Treatment Demonstration Permits; Combustion Permits; Post-Closure Permits; and Remedial Action Plans.

21. References

1. Open source from internet (USEPA website)
2. Personal work experiences

QUIZ for Introduction to Hazardous Waste Management (*Answer Key)

1. RCRA was passed in 1976 by the 94th Congress and was assigned a number PL94-580.
a. True
b. False

2. RCRA stands for?
a. Research Conservation and Recycling Act
b. Resources Conservation and Recovery Administration
c. Resources Conservations and Recovery Act
d. All of the above
e. None of the above

3. To achieve the required goals, RCRA developed three interrelated programs and the programs are: _____, _____, and _____.
a. Subtitle C
b. Subtitle D
c. Subtitle I
d. All of the above
e. None of the above

4. RCRA regulates how wastes should be managed to avoid potential treats to human health and the environment.
a. True
b. False

5. CERCLA focuses on actual releases, or substantial threats of a release in the environment of a hazardous substance, pollutant, or contaminant, that present an imminent and substantial threat to human health.
a. True
b. False

6. CERCLA provides for both response and enforcement mechanisms. The major provisions of CERCLA established and these provisions are:
a. A fund ("superfund") to pay for investigations and remedies at sites where the responsible people cannot be found or will voluntarily pay
b. A priority list of abandoned or inactive hazardous waste sites for clean-up (the National Priority List)
c. The mechanism for action at abandoned or inactive sites (the National Contingency Plan)
d. Liability for those responsible for cleaning up
e. All of the above
f. None of the above

7. The Hazard Ranking System (HRS) HRS score is based on the probability of contamination from 4 pathways and these are:
a. groundwater
b. surface water
c. soil
d. air
e. all of the above
f. none of the above

8. The 1990 NCP, issued in response to the 1986 SARA, established risk levels for the evaluation of whether sites required remediation, for *carcinogenic risk in the range of* _____ *to* _____ .
a. 10^{-5} to 10^{-3}
b. 10^{-6} to 10^{-4}
c. 10^{-7} to 10^{-5}
d. 10^{-8} to 10^{-6}

9. The 1990 NCP, issued in response to the 1986 SARA, established risk levels for the evaluation of whether sites required remediation, for *non-carcinogenic hazard index of* ____.
a. 1
b. 1.5
c. 2
d. 2.5

10. The most common test of ignitability is if the waste:
a. is a liquid at 68°F and has a flashpoint of less than 140°F
b. is a liquid at 58°F and has a flashpoint of less than 150°F
c. is a liquid at 78°F and has a flashpoint of less than 150°F
d. all of the above

11. If a material does meet an exemption from the definition of hazardous waste, it cannot be hazardous waste, even if the material technically meets a listing or exhibits a characteristic.
a. True
b. False

12. There are two types of hazardous waste and they are:
a. listed and characteristics hazardous wastes
b. nuclear and radioactive hazardous wastes
c. all of the above
d. none of the above

13. EPA Waste Code and Waste Category/Indicator for Ignitable wastes are:
a. D003 and R
b. D002 and C
c. D001 and I
d. all of the above
e. none of the above

14. EPA Waste Code and Waste Category/Indicator for Corrosive wastes are:
a. D003 and R
b. D002 and C
c. D001 and I
d. all of the above
e. none of the above

15. EPA Waste Code and Waste Category/Indicator for Reactive wastes are:
a. D003 and R
b. D002 and C
c. D001 and I
d. all of the above
e. none of the above

16. The **K** list designates wastes from **specific sectors of industry** and manufacturing. Like F list wastes, **K** list wastes are manufacturing process wastes **(40 CFR § 261.32).**
a. True
b. False

17. How many characteristics do the characteristics hazardous wastes exhibit?
a. 1
b. 2
c. 3
d. 4
e. 5

18. A waste is corrosive if it is:
a. Non-aqueous and its pH > 2
b. Aqueous and its pH ≤ 2 (acids), or ≥ 12.5 (bases)
c. Aqueous and its pH > 2 and < 12
d. None of the above
e. All of the above

19. A hazardous waste is considered to be reactive if the waste contains:
a. total cyanide ≥ 250 mg/kg total cyanide and total sulfide ≥ 500 mg/kg total sulfide
b. total cyanide ≥ 500 mg/kg total cyanide and total sulfide ≥ 250 mg/kg total sulfide
c. total cyanide ≥ 250 mg/kg total cyanide and total sulfide ≥ 1500 mg/kg total sulfide
d. total cyanide ≥ 1250 mg/kg total cyanide and total sulfide ≥ 500 mg/kg total sulfide

20. Toxicity of hazardous wastes is determined by an analytical test method called _____.
a. Extraction Procedure Toxicity Test (EPTox)
b. Liquid Release Test
c. Paint filter test
d. Toxicity Characteristic Leaching Procedure (TCLP)

21. The waste is determined to be toxic and must be managed as hazardous waste if it contains any of the _____ different toxic chemicals in amounts above the specified regulatory levels as listed in Table.
a. 20
b. 35
c. 40
d. 60

22. EPA discovered that subjecting other commonly recycled materials to hazardous waste regulation was burdensome on many handlers of these wastes. This burden has the potential of discouraging waste recycling by facilities that are otherwise willing to engage in such activity. In response to these concerns, EPA promulgated the universal waste program, in _____.
a. May 1995
b. May 1990
c. May 2000
d. May 2010.

23. Three types of wastes were originally covered under the universal waste regulations and these are:
a. batteries, pesticides, and lamps
b. batteries, pesticides, and thermostats
c. batteries, thermostats, and lamps
d. pesticides, thermostats, and lamps

24. In July _____, EPA added hazardous waste ***lamps*** to the universal waste regulations which is the 4th universal waste in the regulations.
a. 1995
b. 1997
c. 1999
d. 2001

25. A generator who generates 1,000 kg or more of hazardous waste per calendar month or 1 kg or more of acutely hazardous waste per calendar month is designated as:
a. A small quantity generator
b. A large quantity generator
c. A conditionally exempt small quantity generator
d. All of the above
e. None of the above

26. A generator who generates between 100 kg and 1,000 kg of hazardous waste per calendar month and accumulates less than 6,000 kg of hazardous waste at any time is designated as.
a. A small quantity generator
b. A large quantity generator
c. A conditionally exempt small quantity generator
d. None of the above
e. All of the above

27. A generator who generates **100** kg or less of hazardous waste per calendar month or **1 kg or less** of acutely hazardous waste per calendar month is designated as:
a. A small quantity generator
b. A large quantity generator
c. A conditionally exempt small quantity generator
d. All of the above
e. None of the above

28. The hazardous waste generator regulations in **40 CFR Part 262** contain three primary recordkeeping and reporting requirements:
a. Biennial reporting, exception reporting, and three-year record retention
b. Semiannual reporting, exception reporting, and three-year record retention
c. Annual reporting, exception reporting, and five-year record retention
d. Biennial reporting, exception reporting, and ten-year record retention

29. Large quantity generators who transport hazardous waste off site, but do not receive a signed and dated copy of the manifest from the designated facility within _____ ***days*** from the date on which the initial transporter accepted the waste, must submit an ***exception report*** to the EPA Regional Administrator.
a. 25
b. 45
c. 60
d. 75

30. Small quantity generators who do not receive a signed and dated copy of the manifest from the designated facility within _____ ***days*** must send a copy of the original manifest to the EPA Regional Administrator with a note indicating that they have not received a return copy.
a. 25
b. 45
c. 60
d. 75

31. Hazardous waste generators must keep a copy each biennial and any exception reports for at least _____ ***years*** from the due date of the report.
a. 2
b. 3
c. 4
d. 5

32. SQGs may not store more than ***6,000*** kg and CESQGs not more than ***1,000*** kg of hazardous waste on site any time.
a. True
b. False

33. LQGs must move all hazardous waste that they generate within ***90*** days. May store F006 listed (wastewater treatment sludges from electroplating operations) waste for ***180 or 270*** days if the waste is to be recycled.
a. True
b. False

34. A hazardous waste transporter may hold waste at a transfer facility for up to _____ days. If a transfer facility holds the waste at a transfer facility for more than _____ days, the transfer facility becomes a storage facility which is subject to all applicable requirements for TSDFs, including permitting.
a. 7
b. 10
c. 12
d. 15

35. Owners and operators of hazardous waste disposal and management units that cannot clean close must close the units as landfills and must conduct post-closure care, including groundwater monitoring and maintenance of an impermeable cap. This is definition of _____.
a. emergency permit
b. post-closure permit
c. permit-by-rule (PBR)
d. combustion permit