Dr. Motasem Saidan

Hazardous Waste Management

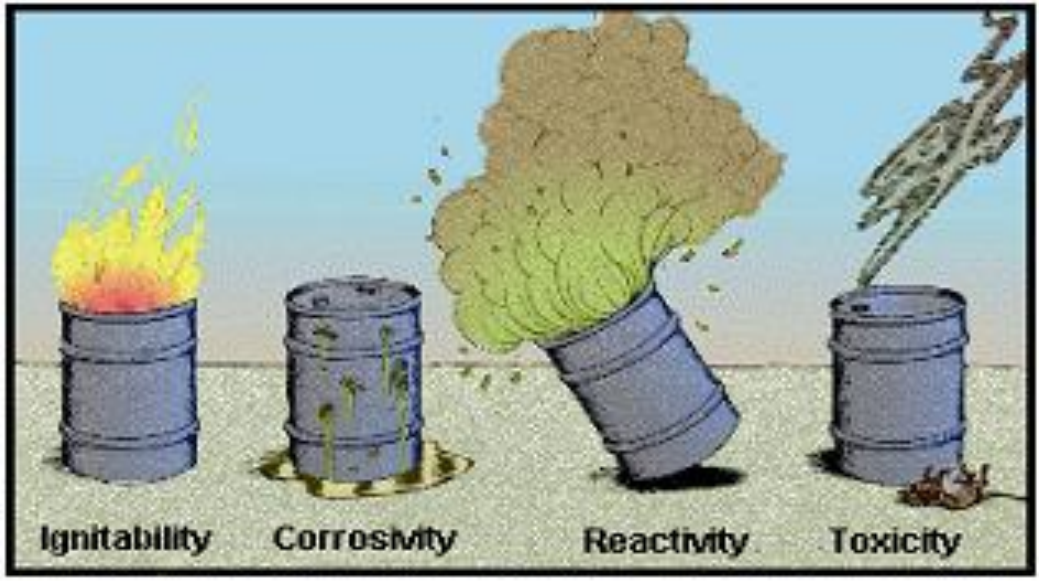
What is Hazardous Waste ?

- is a "solid waste" which because of its quantity, concentration, or physical, chemical, or infectious characteristics may pose a substantial present or potential hazard to human health or the environment when improperly treated, stored or disposed of, or otherwise mismanaged

- **Definitions**

- Hazard Vs. Risk
- Hazardous Vs. Toxic
- Hazardous waste Vs. Hazardous material
- Hazardous substance Vs. Extremely Hazardous substance

Hazardous Waste Characteristics



Ignitability (EPA Code D001)

- Liquid that have flash point less than 60^{o}C
- Solids capable of causing fire by friction, absorption of moisture, or spontaneous chemical change, and when ignited burn vigorously and persistently to create a hazard.
- Flammable compressed gases.
- Oxidizers: substances that yield

oxygen readily to stimulate combustion.

Corrosivity (EPA Code D002)

- Aqueous solutions with pH less than or equal to 2 and more than or equal to 12.5
- Liquids capable of corroding steel at a specified rate and temperature

Reactivity (EPA Code D003)

- Substances that react with water violently, or produce toxic gases or explosive mixtures with water.
- Substances that are normally unstable or explosive
- Chemicals containing cyanide or sulfide that generate toxic gases when exposed to pH 2-12.5

Toxicity (EPA Code D004 – D043)

- Materials that have certain heavy metals above regulated levels.
- Materials that have certain organic constituents, mainly solvents and pesticides above regulated levels.

Listed Wastes

- **The F-list (non-specific source wastes):**

  This **list** identifies wastes from many common manufacturing and industrial processes, such as solvents that have been used for cleaning or degreasing. Since the processes producing these wastes occur in many different industry sectors, the **F**-listed wastes are known as wastes from non-specific sources. (Non-specific meaning they don't come from one specific industry or one specific industrial or manufacturing process.)

Listed Hazardous Wastes: (F list)

- Solvent wastes
- Electroplating wastes
- Metal heat treating wastes
- Dioxin containing wastes
- Chlorinated aliphatic production wastes

- Wood preserving wastes
- Petroleum Refinery wastewater treatment wastes
- Hazardous waste landfill wastes

- The K-list (source-specific wastes):

This list includes certain wastes from specific industries, such as petroleum refining or pesticide manufacturing. Also, certain sludge and wastewaters from treatment and production processes in these specific industries are examples of source-specific wastes.

Listed Hazardous Wastes: (K list)

- Wood preservation
- Inorganic pigment manufacturing
- Organic chemical manufacturing
- Inorganic chemical manufacturing
- Pesticide manufacturing
- Explosives manufacturing
- Petroleum refining
- Iron and steel production
- Primary copper production
- Primary lead production
- Secondary lead production
- Primary zinc production
- Primary aluminum production
- Ferroalloy production
- Veterinary pharmaceutical manufacturing
- Ink formulation
- Coking

- # The P-list and the U-list (discarded commercial chemical products):

These lists include specific commercial chemical products that have not been used, but that will be (or have been) discarded. Industrial chemicals, pesticides, and pharmaceuticals are example of commercial chemical products that appear on these lists and become **hazardous waste** when discarded.

- **Products must be unused**
- **Includes pure form, technical grade, off-specification products or sole-active ingredient products (the active ingredient is the only chemically active component for the function of the product)**
- **Not a hazardous waste unless intended to be discarded or it is spilled**

* **P-List:** **comprised of chemicals that are acutely toxic. A chemical is acutely toxic if it is fatal to humans in low doses.**

* **U-list:** **comprised of chemicals that are toxic, but also includes chemicals that display other characteristics, such as ignitability or reactivity.**

Acute Hazardous Waste

Acute hazardous waste are comprised of listed hazardous wastes with certain waste codes. These codes are:

- From "F list" hazardous waste from non-specific sources F020, F021, F022, F023, F026 and F027.
- From "P list" acute hazardous commercial chemical products and manufacturing chemical intermediates
- All "P list" waste codes are acute hazardous wastes, which are:
  - unused materials that are pure,
  - technical grade, or
  - formulations in which the listed chemical is the sole active ingredient. (i.e. Heptachlore in pesticide)

- M-listed Wastes (discarded mercury-containing product) :

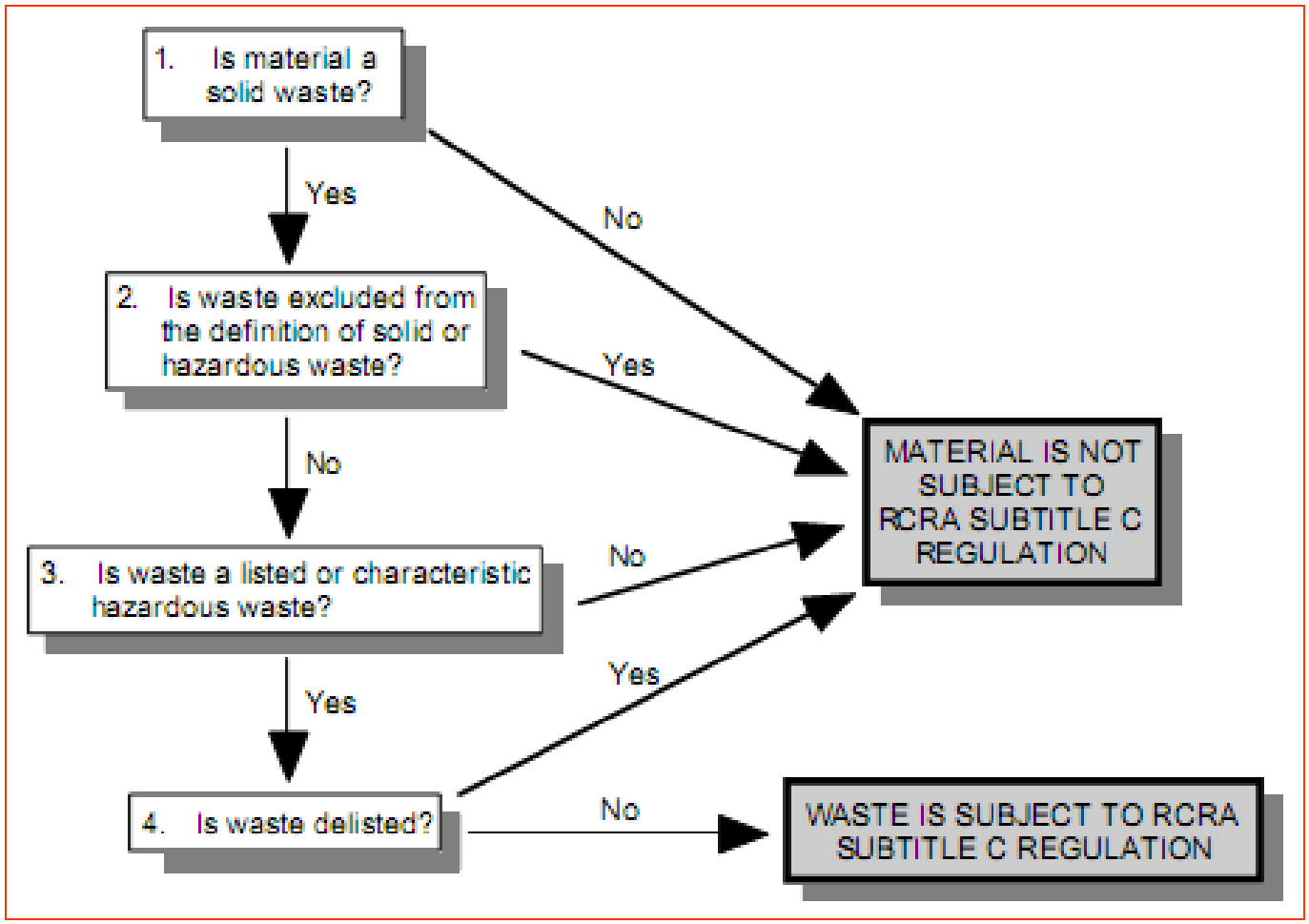
This **list** includes certain wastes known to contain mercury, such as fluorescent lamps, mercury switches and the products that house these switches, and mercury-containing novelties.

http://www.epa.gov/epawaste/hazard/wastetypes/index.htm

http://safety.nmsu.edu/programs/haz_wst/2management.htm

http://www.epa.gov/epaoswer/hazwaste/index.htm#hazwaste

HW Identification Process: RCRA Subtitle C



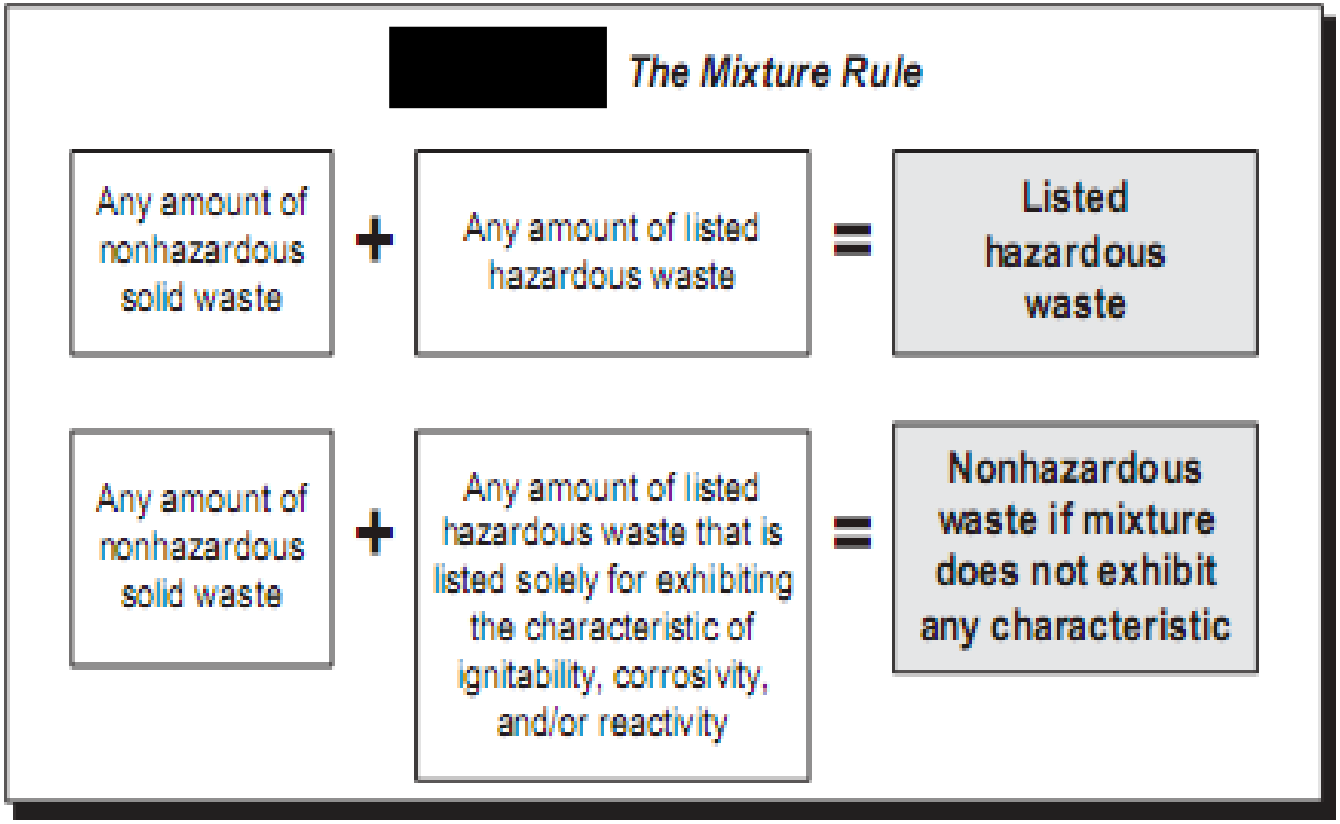
HW Exclusion:

- Any waste that is regulated under Clean Water Act
- Mixtures of sanitary wastes and other wastes (including hazardous industrial wastes) that pass through a sewer system to a Publicly Owned Treatment Works
- Irrigation Return Flows
- Radioactive Waste
- Spent Sulfuric Acid can be recycled to become virgin again
- Closed-loop recycling
- Household hazardous waste
- Agricultural waste
- Trivalent Chromium Wastes
- Spent CFCs refrigerant (to promote recycling)
- Landfill Leachate or Gas Condensate Derived from listed waste: regulated by CWA
- Household wastes
- Mining overburden returned to the mine site

…. Continued… HW Exclusion:

- Utility wastes from coal combustion
- Oil and gas exploration drilling waste
- Wastes from the extraction and processing of ores and minerals
- Cement Kiln wastes
- Certain chromium-bearing waste

Waste Mixture! Is it a HW?



Waste Derived-from! Is it a HW?

[redacted] ***The Derived-From Rule***

Listed Hazardous Waste

↓

Any residue from the treatment, storage, or disposal or a listed waste…

↓

…is still a hazardous waste…

↓

…unless the residue is derived-from a hazardous waste that is listed solely for exhibiting the characteristic of ignitability, corrosivity, and/or reactivity and does not exhibit a characteristic of hazardous waste

or

…unless the waste is recycled to make new products or processed to recover usable materials with economic value (provided that product is not used in a manner constituting disposal or burned for energy recovery)

Examples

- A five-pound sealed jar of sodium cyanide
- Used cyanide based gold electroplating solution from the art department
- A 5% solution of warfarin in water that was prepared for a lab experiment but not used
- Discarded osmium tetroxide from the electron microscope lab—OsO_4 is the sole active ingredient and it is discarded.
- A mixture of dieldrin and heptachlor prepared for use as a broad spectrum pesticide
- A mixture of chlordane and heptachlor that has occurred because heptachlor is a manufacturing impurity and decomposition product of chlordane
- A new container of carbon disulfide (CS_2)
- Spill absorbent if the CS_2 container were spilled out-of-doors and cleaned up—The contaminated absorbent material
- A container of ethyleneimine after the contents have been poured into another container
- A triple-rinsed container of ethyleneimine after the contents have been poured into another container

Examples

- A triple-rinsed container of ethyleneimine after the contents have been poured into another container
- What about the rinsate in the previous example?
- What if you rinse the above container beyond a triple rinse?
- A sealed jar of potassium cyanide
- Used cyanide-based silver electroplating solution from the art department
- Unused cyanide-based silver electroplating solution from the art department
- An unused package of gopher poison containing 2 percent zinc phosphide
- An unused package of gopher poison containing 10 percent zinc phosphide
- An unused mixture of methyl parathion and toxaphene prepared for use as a broad spectrum pesticide
- An unused mixture of aldrin and dieldrin that has occurred because dieldrin is a decomposition product of aldrin
- A discarded P list pesticide that contains formaldehyde as a preservative and propane as a propellant
- A new container of methyl hydrazine
- Spill absorbent if the previous container of methyl hydrazine spilled in the laboratory

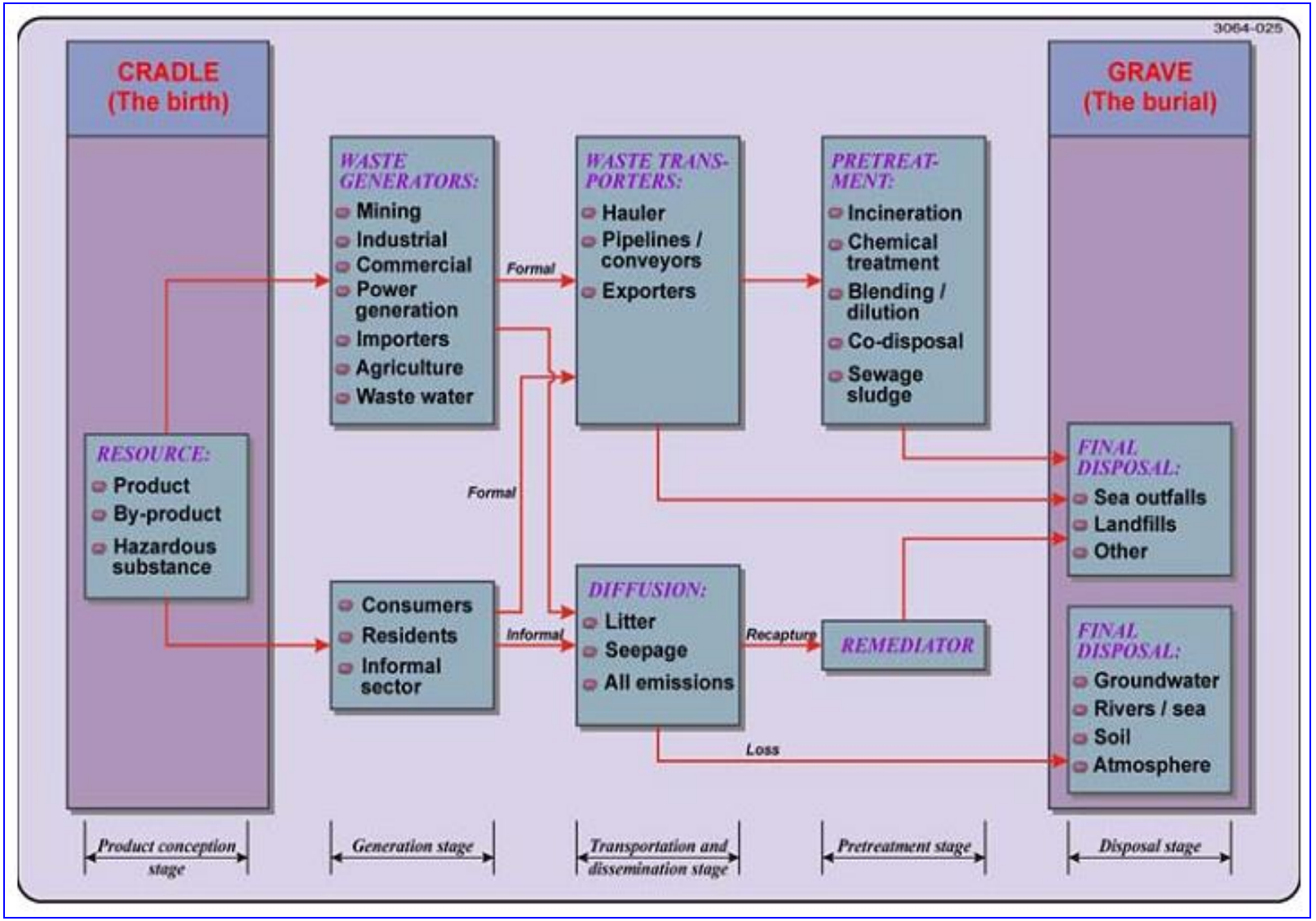
Examples

- Unused pentachlorophenol formulation for treating wood discarded by the paint shop
- A container of thiophenol after all of the contents have been poured into another container
- What about the rinsate from the triple rinse mentioned in the previous example?
- What about the rinsate from a fourth rinse of the above container?

http://www2.fpm.wisc.edu/chemwasteinfo/AcuteQuizVisible.html


OIL
EMERGENCY
SHOWER
OX

RCRA Subtitle C: Cradle-to-Grave & HWM



Hazardous Waste Generation

The RCRA regulations define a generator as:

Any person, by site, whose act or process produces hazardous waste, or whose act first causes a hazardous waste to become subject to regulation (40 CF 260.10).

- Once a waste has been identified as a RCRA hazardous waste, it becomes subject to the Subtitle C regulations, and the generator assumes very significant responsibilities for the correct management thereof.

Classifications of HW Generation

The RCRA Subtitle C regulations recognize three categories of generators

- Conditionally Exempt Small-Quantity Generators

  - Generates no more than 100 kg (220 lbs.) of RCRA hazardous waste in any calendar month; and
  - Accumulates, at any time, no more than 1,000 kg (2,200 lbs.) of RCRA hazardous waste; and
  - Generates, in any calendar month, or accumulates at any time, no more than 1 kg (2.2 lbs.) of acute hazardous waste, and no more than 100 kg (220 lbs.) of material from the cleanup of a spill of acute hazardous waste

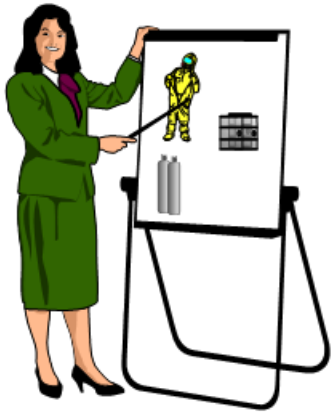
- Small-Quantity Generators
  - Generates, in any calendar month, more than 100 kg (220 lbs.) but less than 1,000 kg (2,200 lbs.) of RCRA hazardous waste; and
  - Generates, in any calendar month, or accumulates at any time, no more than 1 kg (2.2 lbs.) of acute hazardous waste and no more than 100 kg (220 lbs.) of material from the cleanup of a spill of acute hazardous waste.

  OR, the site is a Small Quantity Generator if the site:

  - Meets all other criteria for a Conditionally Exempt Small Quantity Generator (see below), but
  - Accumulates, at any time, more than 1,000 kg (2,200 lbs.) of RCRA hazardous waste, but less than 6,000 Kg at any time.

- Large-Quantity Generators
  - Generates, in any calendar month, 1,000 kg (2,200 lbs.) or more of RCRA hazardous waste; or
  - Generates, in any calendar month, or accumulates at any time, more than 1 kg (2.2 lbs.) of RCRA acute hazardous waste; or
  - Generates, in any calendar month, or accumulates at any time, more than 100 kg (220 lbs.) of spill cleanup material contaminated with RCRA acute hazardous waste.

(Self Reading: How *not* to be a LQG of HW paper)



SQG & LQG must comply with:

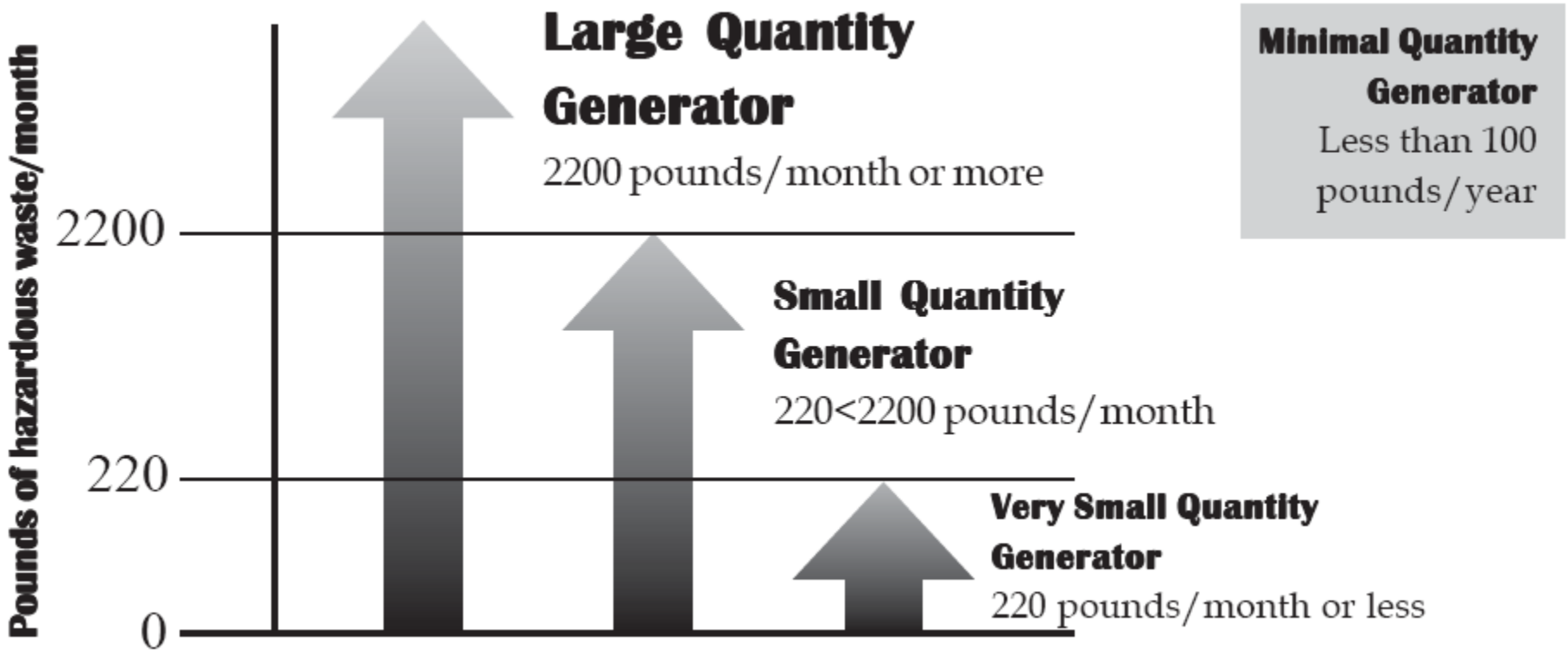
LQG must comply with the following requirements

- Proper Management
- Preparedness and Prevention
- Emergency Plan (written contingency plan & emergency coordinator)
- Personnel Training (training plan)

SQG must comply with the following requirements

- Proper Management
- Emergency Plan (emergency coordinator contingency plan but no written one!)
- Personnel Training (no training plan)

Generator Size Chart



Exercises

You are the Manager of a company that:

- Produces 110 Kg/month K-listed waste?
- Produces 75kg/month clean up spill from acute HW?
- Produces 0.5 kg/month F027 listed waste?
- Produces 0.99 kg/month P-listed waste & 105 Kg/month K-listed waste?