Safety in handling hazardous waste

#Impacts of human exposure to chemicals and other hazardous materials can range from simple skin irritation to long-term illnesses such as cancer. Aware of the dangers that exist, it's important to create a culture of safety for handling, transporting, and storing these kinds of materials. All employees responsible for handling hazardous materials are required by federal regulations to undergo proper hazmat training, but that doesn't remove your company's responsibility to provide an environment that is conducive to the safe handling of hazmat materials.

Encourage your employees to take ownership of creating and maintaining a safe work environment. Start by following these 10 rules which represent the best ways to avoid a hazmat incident.

1. **Assess the risks that exist in the workplace. Know which materials in the workplace represent hazards.**
2. Provide employees adequate training and information about the hazardous materials in your workplace. As mentioned, federal training is a prerequisite, but often stipulates only a minimum obligation. Don't be afraid to expand safety consultation and procedures beyond those required by law and encourage established procedures on employees.
3. Consider potential hazards and plan ahead. Have arrangements and procedures in place to handle emergency circumstances that may arise from hazmat spills or exposure. This means making sure employees understand emergency procedures, including evacuation, cleanup or what to do in case of fire. Make sure emergency equipment such as eye wash and shower stations are accessible, kept clean and are tested routinely. Train employees on first-aid skills and how to respond to co-workers who may be injured or experience chemical exposure.
4. Always use the proper personal protection equipment (PPE). Old or damaged PPE should be replaced, and the PPE should be inspected prior to each use. Proper control measures like ventilation hoods should always be used and routinely inspected.
5. Ensure all hazardous materials are properly marked. Make sure all hazmat containers are adequately labeled and that all chemicals are stored in the appropriate containers.
6. Keep all hazardous materials stored properly. Keep chemicals in dry, cool and ventilated areas, and separate incompatible materials. Always keep lids closed – meaning leak-proof and vapor-tight – on all hazmat containers. Make sure these storage areas are free from items that might cause trips, falls or spills, and free from

materials that might encourage pests or rodents. Always keep work areas clean. Not just of clutter, but clean work surfaces frequently to minimize risk of contamination or exposure.

7. Only use hazardous materials for their intended purposes.
8. Never eat or drink while handling hazardous materials, and always wash hands after using, handling or transporting hazardous chemicals.
9. Employees handling hazardous materials should always read the labels to understand what they're working with and have the safety data sheet (SDS) accessible prior to using any materials in order to understand how to handle a spill or exposure to that chemical.
10. Report any concerns about damaged containers or potential leaks or spills. Even if a suspicion turns out to be incorrect, as the saying goes, it's always better to be safe than sorry..

Physical , chemical , Thermal treatment process for H. W .

#Physical treatment processes include gravity separation, phase change Systems, such as air and steam stripping of volatiles from liquid wastes, and Various filtering operations, including carbon adsorption.

#Chemical treatment transforms waste into less hazardous substances Using such techniques as pH neutralisation, oxidation or reduction, and Precipitation. Biological treatment uses microorganisms to degrade organic Compounds in the waste stream.

#Thermal destruction processes include incineration, which is increasingly Becoming a preferred option for the treatment of hazardous wastes, and Pyrolysis, which is the chemical decomposition of waste is brought about by Heating the material in the absence of oxygen.

Stabilisation techniques:
involve removal of excess of water from a waste And solidifying the remainder either by mixing it with a stabilising agent such as Portland cement, or vitrifying it to a glassy substance.
Most treatment measures have both physical and chemical aspects.

Physical treatment methods

Adsorption: Adsorption on activated carbon occurs when a molecule is brought up to its Surface and held there by physical and /or chemical forces. This process is

Reversible, thus allowing activated carbon to be regenerated and reused by Proper application of heat and steam, or solvent.

The factors that relate to adsorption capacity are:

- Greater surface area produces greater adsorption capacity [e.g: Activated Carbon has large surface area (500-1500 m2/g)]
- Adsorptivity increases as the solubility of the solute (in solvent) decreases. Thus, for hydrocarbons, adsorption increases with molecular weight
- For solutes with ionisable groups, maximum adsorption will be achieved at A pH corresponding to minimum ionisation.
- Adsorption capacity decreases with increasing temperature.

Resin adsorption:

Waste treatment by resin involves two basic steps: (1) contacting the

Liquid waste stream with resin and allowing the resin to adsorb the solutes from

The solution; and (2) subsequently regenerating the resins by removing the

Adsorbed chemicals, by simply washing with proper solvent.

Sedimentation : Sedimentation is a physical process where by particles suspended in a liquid Settle by means of gravity. The fundamental elements of most sedimentationProcesses are:

- a basin or container of sufficient size to maintain the liquid to be Treated in a relatively quiescent state for a specified period of time
- a means of directing the liquid to be treated into the above basin in A manner conducive to settling.
- a means of physically removing the settled particles from the liquid.

Reverse osmosis:

This technique which is most widely used consists of a membrane Permeable to solvent but impermeable to most dissolved species, both organic And inorganic. These devices use pressure to force the contaminated water Against the semipermeable membrane. The membrane acts as a filter, allowing The water to be pushed through the pores, but restricting the passage of larger Molecules that are to be removed.

Solvent extraction:

Solvent extraction is the separation of the constituents of a liquid solution By contact with another immiscible liquid. If the substances comprising the Original solution distribute themselves differently between the two liquid phases, A certain degree of separation will result and this may be enhanced by the use of Multiple contacts. The major application of solvent extraction to waste treatment has been in The removal of phenol from by-product water produced in coal coking, petroleum Refining, and chemical synthesis that involve phenol.

Distillation:

Distillation is expensive and energy intensive and can probably be justified Only in cases where valuable product recovery is feasible (e.g., solvent recovery). This technique has only limited application in the treatment of dilute aqueousHazardous wastes.

Evaporation:
Evaporation process is used for the treatment of hazardous waste such as Radioactive liquids and sludges and concentrating of plating and paint solvent Waste among many other applications. It is capable of handling liquids, slurries And sometimes sludges, both organic and inorganic, containing suspended or Dissolved solids or dissolved liquids, where one of the components is essentially Non volatile. It can be used to reduce waste volume prior to land fill disposal or Incineration.

Filtration:

Filtration is well-developed economical process used in the full scale Treatment of many industrial waste waters and waste sludges. Energy Requirements are relatively low, and operational parameters are well defined. However it is not a primary treatment process and is often used in conjunction With precipitation, flocculation, and sedimentation to remove these solids.

Flocculation:

The various phenomena that occur during flocculation can be grouped in to two Sequential mechanisms.

- Chemically induced destabilisation of repulsive surface related forces, Thus allowing particles to stick together when they touch and
- Chemical bridging and physical enmeshment between the non repelling Particles, allowing for the formation of large particles.

Chemicals used for flocculation include alum, lime, ferric chloride, ferrous Sulphate and poly electrolytes. Poly electrolytes consist of long chain, water Soluble

polymers such as polyacrylamides. They are used either in conjunction With inorganic flocculants, or as primary flocculating agent. The inorganic Flocculants such as alum, upon mixing with water, the slightly higher pH of water Causes them to hydrolyse to form gelatinous precipitates of aluminium hydroxide. It is partially because of their large surface area, they are able to enmesh smal Particles, and thereby create larger particles.

Hazardous waste sources

Hazardous waste sources include

1. Industry,
2. Institutional establishments,
3. Research laboratories,
4. Mining sites,
5. Mineral processing sites,
6. Agricultural facilities and
7. The natural environment.

The term hazardous waste often includes by-products of industrial, domestic, commercial, and health care activities.

Rapid development and improvement of various industrial technologies, products and practices may increase hazardous waste generation.

Most hazardous wastes are produced in the manufacturing of products for consumption or further industrial application.

Hazardous waste sources include industry, institutional establishments, research laboratories, mining sites, mineral processing sites, agricultural facilities and the natural environment.

All sources that discharge liquid, gaseous or solid wastes that fit the above definition can be regarded as sources of hazardous wastes.

Major hazardous waste sources and their pollution routes in the environment are listed below:

1.Agricultural land and agro-industry:

Hazardous wastes from agricultural land and agro-industry can expose people to pesticides, fertilizers and hazardous veterinary

product wastes. Farms are a major source of these wastes, and agrochemicals can leach into the environment while in storage or can cause damage after their application.

2.Domestic:

Households stock various hazardous substances such as batteries and dry cells, furniture polishes, wood preservatives, stain removers, paint thinners, rat poisons, herbicides and pesticides, mosquito repellents, paints, disinfectants, and fuels (i.e. kerosene) and other automotive products. These can present a variety of dangers during storage, use and disposal.

3. Mines and mineral processing sites

Mining and mineral processing sites handle hazardous products that are present in the additives, the products and the wastes.

4. Health care facilities

Health care facilities are sources of pathological waste, human blood and contaminated needles. Specific sources of these wastes include dentists, veterinary clinics, home health care, blood banks, hospitals, clinics and medical laboratorie**s.**

5. Commercial wastes

Commercial waste sources include gasoline stations, dry cleaners and automobile repair shops (workshops). The types of hazardous wastes generated by these sources depend on the services provided.

6.Industrial hazardous waste sources

Hazardous wastes are created by many industrial activities. For example, the hazardous wastes from the petroleum fuel industry include the refinery products (fuels and tar), impurities like phenol and cyanides in the waste stream, and sludge flushed from the storage tanks.

Sources:-

The Inclusive listing adopted by EPA includes separate lists of nonspecific source wastes, specific source wastes, and commercial chemical Hazardous Waste Lists

F-list:

The F-list contains hazardous wastes from non-specific sources, that is, various industrial processes that may have generated the waste. The list consists of solvents commonly used in degreasing, metal treatment baths and sludges, wastewaters from metal plating operations and dioxin containing chemicals or their precursors. Examples of solvents that are F-listed hazardous wastes, along with their code numbers, include benzene (F005), carbon tetrachloride (F001), cresylic acid (F004), methyl ethyl ketone (F005), methylene chloride (F001), 1,1,1, trichloroethane (F001), toluene (F005) and trichloroethylene (F001). Solvent mixtures or blends, which contain greater than 10% of one or more of the solvents listed in F001, F002, F003, F004 and F005 are also considered F-listed wastes.

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K-list: The K-list contains hazardous wastes generated by specific industrial processes. Examples of industries, which generate K-listed wastes include wood preservation, pigment production, chemical production, petroleum refining, iron and steel production, explosive manufacturing and pesticide production.

P and U lists: The P and U lists contain discarded commercial chemical products, off-specification chemicals, container residues and residues from the spillage of materials. These two lists include commercial pure grades of the chemical, any technical grades of the chemical that are produced or marketed, and all formulations in which the chemical is the sole active ingredient.

M-List (Discarded Mercury-Containing Products)

The M-list includes discarded products or wastes containing mercury. Some of the examples of wastes listed on the M-list are mercury switches, fluorescent lamps, and mercury-containing novelties.

Characteristics Of Hazardous Wastes

The regulations define characteristic hazardous wastes as wastes that exhibit measurable properties posing sufficient threats to warrant regulation.

For a waste to be deemed a characteristic hazardous waste, it must cause, or significantly contribute to, an increased mortality or an increase in serious irreversible or incapacitating reversible illness, or pose a substantial hazard or threat of a hazard to human health or the environment, when it is improperly treated, stored, transported, disposed of, or otherwise mismanaged.

- Ignitability (EPA Waste Identification Number D001):

A waste is an ignitable hazardous waste, if it has a flash point of less than 60 C;

Readily catches fire and burns so vigorously as to create a hazard;

Or is an ignitable compressed gas or an oxidiser.

A simple method of determining the flash point of a waste is to review the material safety data sheet, which can be obtained from the manufacturer or distributor of the material.

Naphtha, lacquer thinner, epoxy resins, adhesives and oil based paints are all examples of ignitable hazardous wastes.

- Corrosivity (EPA Waste Identification Number D002):

A liquid waste which has a pH of less than or equal to 2 or greater than or equal to 12.5 is considered to be a corrosive hazardous waste.

Sodium hydroxide, a caustic solution with a high pH, is often used by many industries to clean or degrease metal parts.

Hydrochloric acid, a solution with a low pH, is used by many industries to clean metal parts prior to painting.

When these caustic or acid solutions are disposed of, the waste is a corrosive hazardous waste.