Books

1. Hazardous & Industrial Waste Treatment — Haas, Charles
2. Hazardous Waste: Identification and Classification Manual. — Wagner T.P.
3. Hazardous Waste Treatment - Lagrega M.D.
4. Industrial and Hazardous waste treatment By Nemerow N.L.
5. Standard Hand book of Hazardous waste treatment & Disposal by Freeman Harry
6. Hazardous waste incineration — Brunner Calvin
7. Toxic & Hazardous waste Disposal — Pojasek Robert B.
8. Regulation on Hazardous management → CPCB in India

What are Hazardous Waste?

Which exhibits hazardous properties one of many.

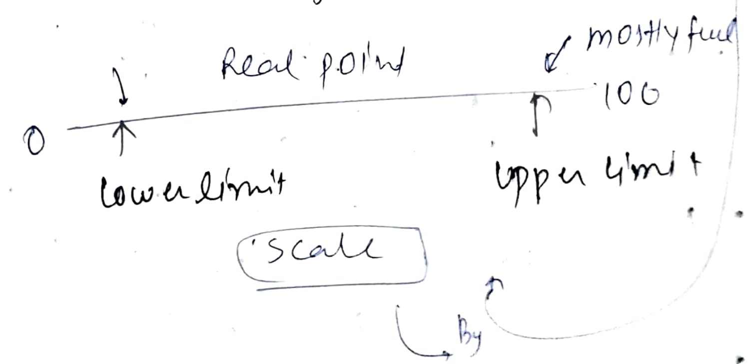
Property
(a) Ignitability
(b) Corrosivity
(c) Reactivity
(d) Toxicity

→ many other flammable property
Fire and Explosion

EPA [Environmental Pollution Agency]
any waste material which is exhibity one or such property, it is of Hazardous causes threat to Human Health

Ignitability → oil, grease, sluge (oily), Petrochemical residue
solvent (MEK, DMA), HCs, gases

Flammability (Fire & Explosion) index can be calcula By DOW method.



C, H
$C + O_2 \rightarrow CO_2$
$H + O_2 \rightarrow H_2O$
} Exothermic Rxn

vap pressure ↑ Vap than solid
↳ chance of explosion.
sound, vibration

Fire lead to create explosion.

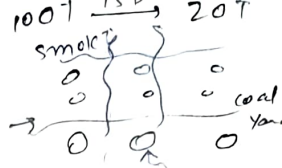
$C + O_2 \xrightarrow{-\Delta H} CO_2$

either from Methane or coal

$T = 250°C$ $T_0 = 25°C$
$T = 150°C$ $t = t$
$T = 45°C \leftarrow T = 35°C$

Here smoke will generate from coal

spontaneous combustion coal



Smoke
↳ reac

A waste is a hazardous waste if it exhibits any of the characteristics identified below:

→ Toxic Waste (T)
→ Acute Hazardous Waste (H)
→ Ignitable Waste (I)
→ Corrosive Waste (C)
→ Reactive Waste (R)
→ Toxicity characteristic Waste (E)

Haz. Was. Prop.

• Ignitable → Ign. chemical (solvents, Lightu
can create fire under certain cond

• Corrosive → (Fertilizer, Acid plant, chloro-Alk
Inorganic base chemical Industries)

Corrosive waste (eg. Battery wastes) cau
a chemical action that eats away materials o
living tissue. They are capable of corrodi
metal, such as tanks, containers, drums and ban

• Reactive – Material that can react violen
or create toxic fumes:

→ Reactive

• toxic in nature
Inhale long term effect
C, H, S Burnable ch's, Wood is not BCS of large temp. if very fine wood then it is

→ Acidic or Alkaline in nature, Battery waste
(lead Acidic Battery, corrosion
phosphoric acid

→ High Reactivity property, Sodium Powder
$Na + H_2O \rightarrow [H_2]$ catch fire
Highly exothermic rxn

Toxic-

1.

2.

3.

4, Lethal Dose: LD50 (50 % of species die)

5

6 Hazardous waste Related Disease and consequence : effect of chemical Hazardous materials on the human body and safety precautions to be followed are closely related. either are only

7 Ingestion

8

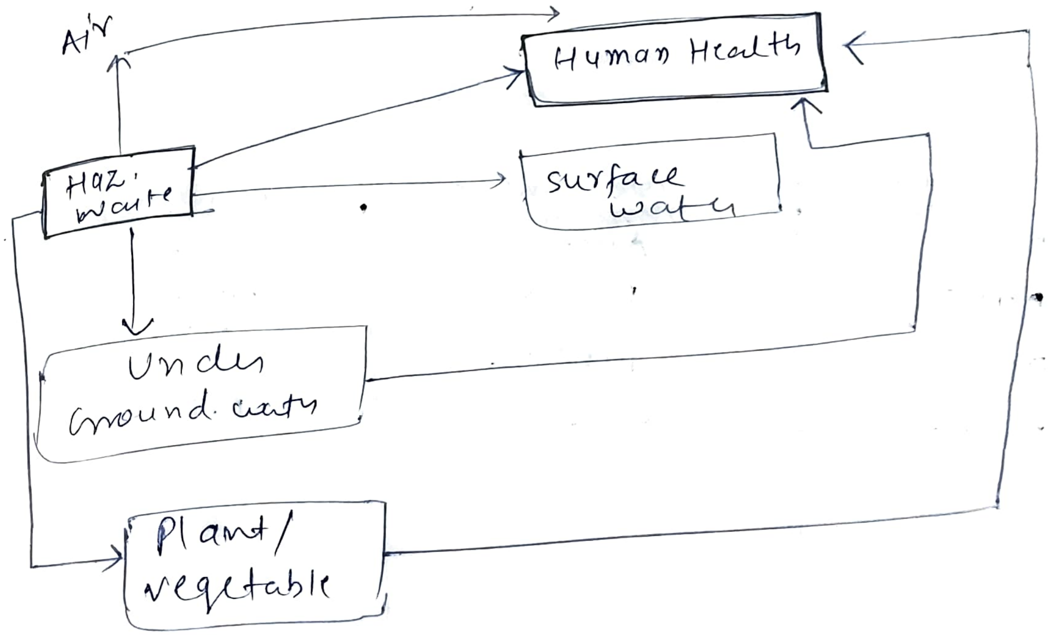
Inhalation

Skin contact

NH3 { Keep in freeze for 1 hr then open by
Skin Burn Redish

Routes of Migration

- Groundwater
- surface water
- Air
- Direct contact / soil ingestion



for controlling, we have to prevent it.

EPA's criteria for listing waste chart

acute or toxic

1.

. Acute listings

2. → fatal to humans in low doses

3. → certain dermal and inhalation toxic

. Toxic listings

4.

5.

6.

Toxicity Characteristic constituents and Regulatory levels

Waste code	Contaminant	Regulatory level concentration
D004	Arsenic	5.0
D005	Barium	100.0
D018	Benzene	0.5
D006	Cadmium	1.0

Question on
one industry
one technique on Hazardous waste Mang.

30 mid
50 End
15 Case study presentation By specific Student
5 Punctuality, Behavior

Hazardous Waste Minimization Techniques

Q1 Why minimize Hazardous Waste?

→ Reduce Risk & safe for Human Health, property.

→ Reduce cost

→ Increase process efficiency and productivity

→ Maintain or increase competitiveness

→ Decrease exposure to long-term liability.

→ Reduce present and future regulatory burdens

→ Improve workplace safety

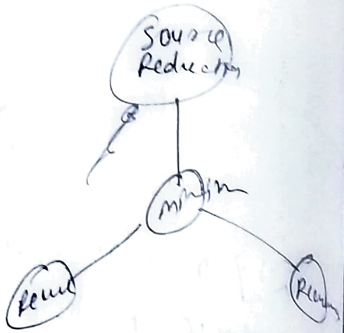
→ Improve environmental quality

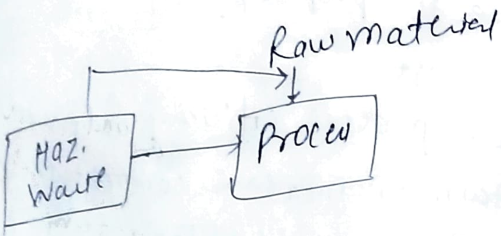
→ Accidental casualty reduce & maintain or improve institutional image.

Minimization

min— of Haz-waste is done by following methods:

- → source reduction
- → reuse
- → Recycling





Aluminium manufacturing

F^- — By sodium flouride or calcium flouride

$NaF + Al_2O_2 \longrightarrow A$

CaF_2

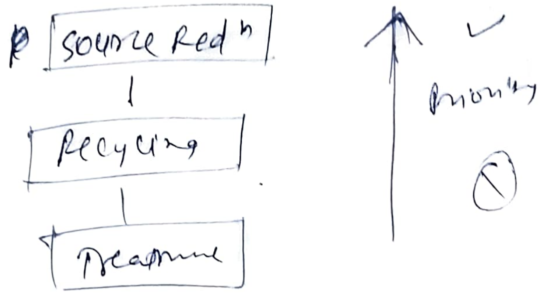
F^- 14 mgL, 37 mgL — RO — Treating of water

1.5 mgL permissible limit

$F^- + Al_2O_3 \longrightarrow$ (Al_2O_3)

$Al_2O_3 + F^- \longrightarrow$ Pol ↑ CaF_2, NaF

Hazardous waste management Hierarchy.



Types of Hazardous Waste

Asbestos

TSF

Generator (H.W. container) / Industrial / Plants → Transporter → TSFB (Treatment & Final storage)

⇒ Storing is different & Dumping is different.

⇒ Ultraviolet light for testing leaking of container.

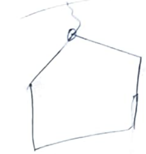
Primary containment, secondary containment

Volume > Volume (Primary) (Secondary)

10% of Primary.

For solid waste → 25 kg (Primary containment)
entire floor covered with polythin Bag. (Secondary containment)

Tags [excat content of container]



methylene chloride & chloroform → Halogenated solvents
↳ more costly to dispose.

Ignitable Mat...

H/c | C + O_2 → CO_2
H + O_2 → H_2O
S + O_2 → SO_3

Haz. Effluent

RO-1 14-20 mg/L
RO-2 35-40 mg/L

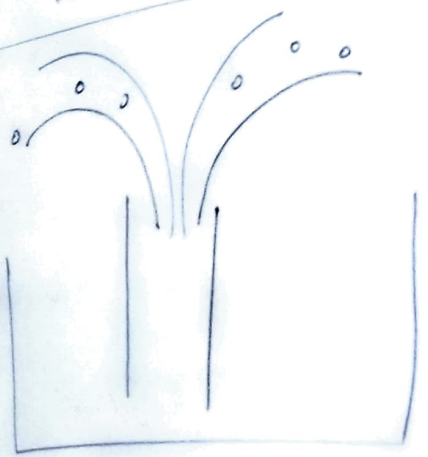
F^- Bearing Waste Water → Pond

Permissible limit 1.5 mg/L

7-10 mg/L

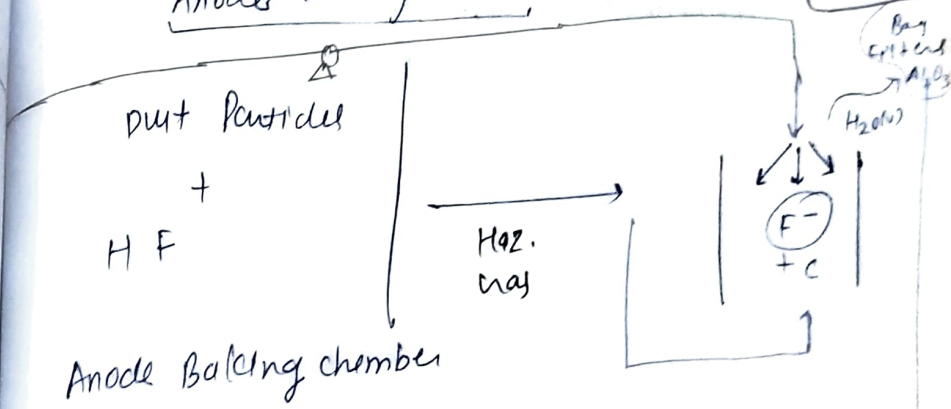
Q = 20,000 Lt/hr

Flouride accumulated on solid mud which needs to be treated



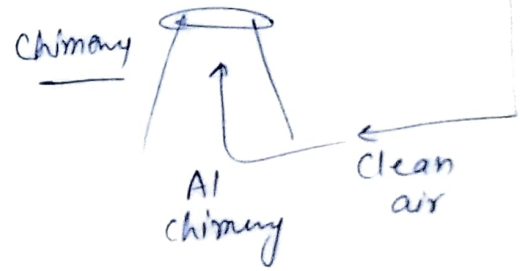
Evaporate maxm quantity of water.

Anode Baking Process

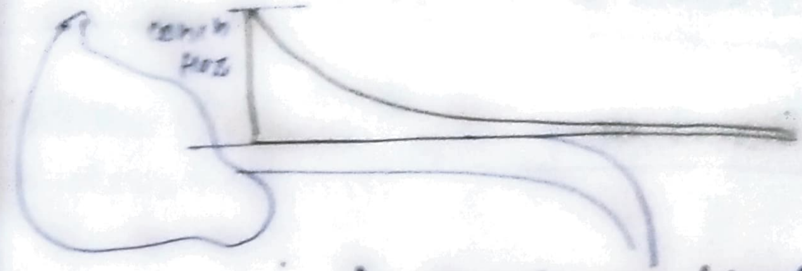


C + silica + F^-

Haz. solid → sluge → Dry materials



physical | chemical | Biological Treatment.



L Drain/channel/Canal/River

Processing & Treatment Technologies

Physical Processes (Sedimentation, [illegible])
Chemical Processes (acid by alkalinen)
Biological Processes (microorganism, [illegible])
Integrated Process (more than one process combine)

Treatment Methods and Disposal

Hazardous waste treatment Inchn…

Incinerator for medical waste, complete distr…

1

2.

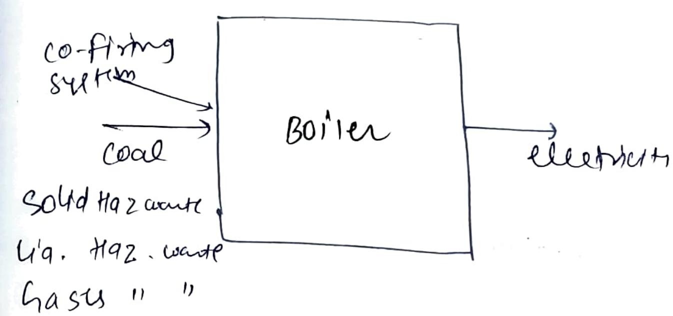
3. Rl

4 R

5.

captive power plant to generate their own electricity.

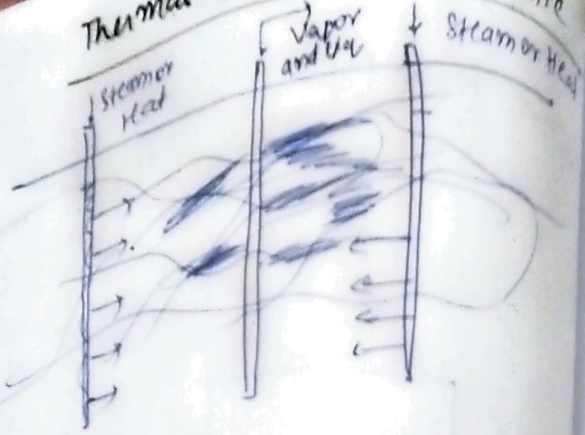
Captive Power plant



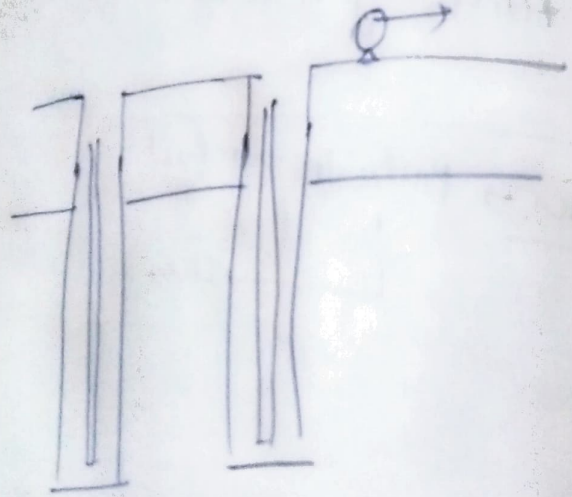
Retrofitting of the Boiler

Pyrolyzer → Products → Fuel.
→ Char

Thermal In-Situ Schematic



Recirculation well



Cyanide

$$CN^- + 2OH^- + Cl_2 = CNO^- + H_2O$$

$$2CNO^- + 3Cl_2 + 4OH^- = 2CO_2 + N_2 + 2H_2O$$

complete distruction of cyanide waste