



THERMAX

DISPOSAL OF HAZARDOUS WASTES BY THERMAL OXIDATION

**S. S. BASARGEKAR
THERMAX LIMITED**

WASTES

GENERAL

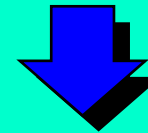
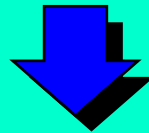
- OFFICE WASTE
- DOMESTIC WASTE

INFECTITIOUS

- HOSPITAL WASTE
- RESEARCH LAB WASTE

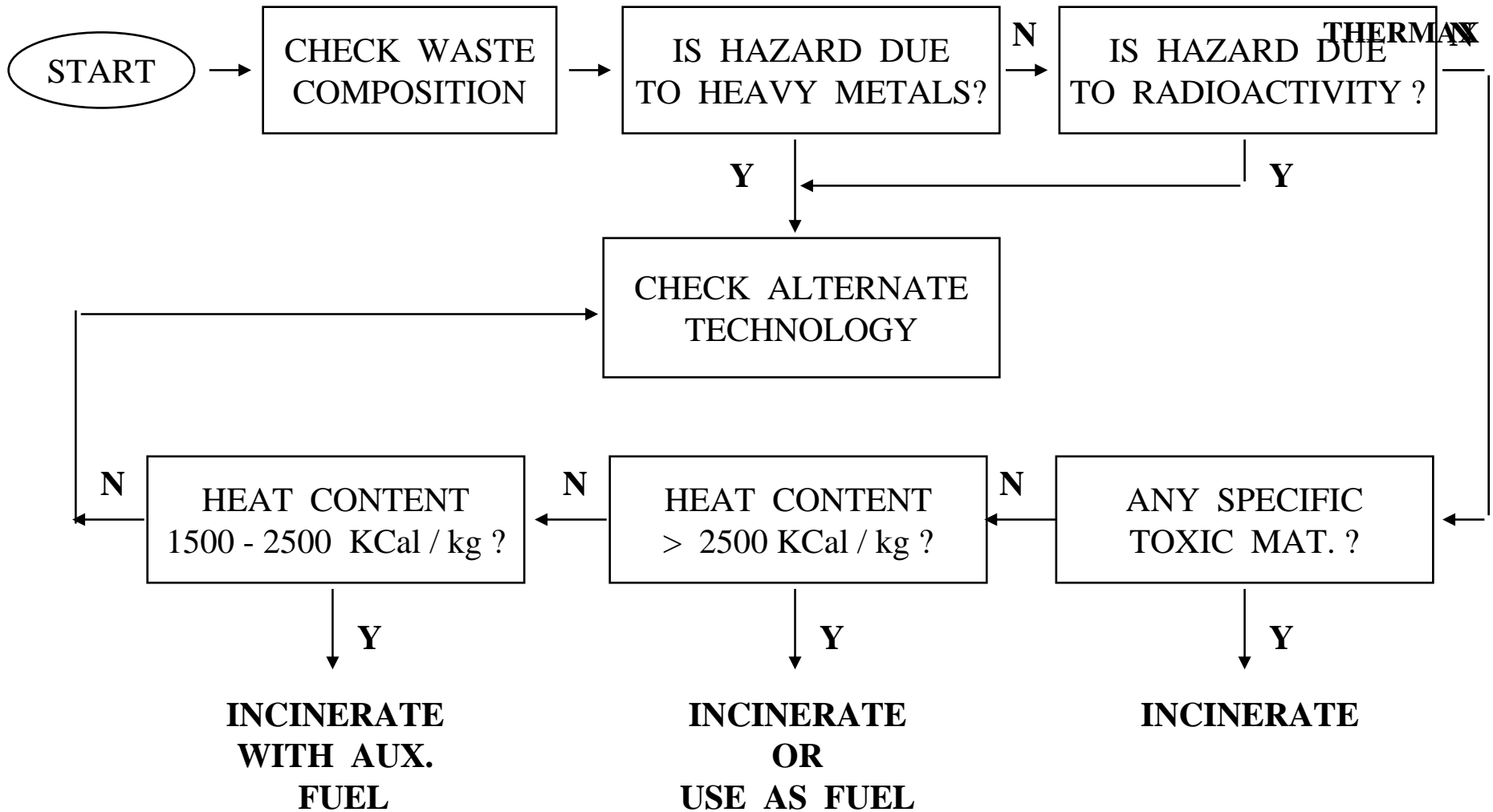
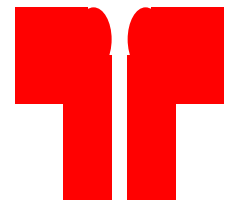
CHEMICAL

- PHARMACEUTICAL
- CHEMICAL
- PESTICIDES
- REFINERIES



HAZARDOUS

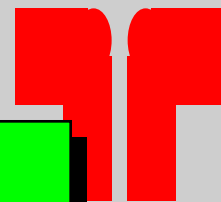
STRATEGY TO DECIDE INCINERATION





INCINERATION

- Thermal Treatment Process
- Combustion At High Temperature
- Controlled For High Combustion Efficiency
Defined As,
- $CE = \% (CO_2 / (CO + CO_2))$
- With Minimum Undesirable Products
- Treatment Of Combustion Products For Safe Disposal



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**WASTE
CONSTITUENTS**

C

H

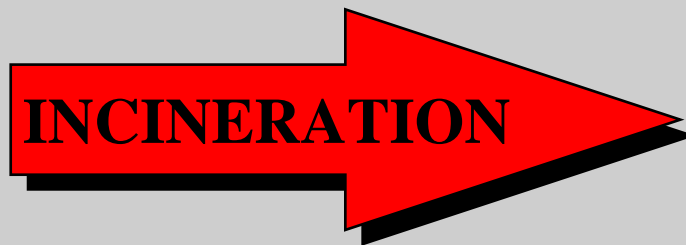
O

Cl

N

S

P



**END
PRODUCTS**

CO₂

H₂O

O₂

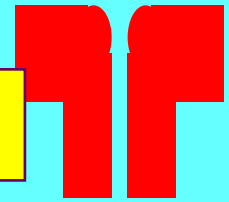
HCl

N₂

SO_x

P₂O₅

INCINERATION EFFICIENCY



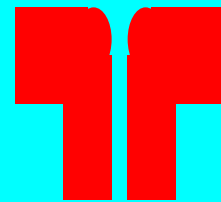
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$$\text{DESTRUCTION \& REMOVAL EFFICIENCY (DRE)} = \frac{W_{IN} - W_{OUT}}{W_{IN}} \times 100$$

W_{IN} = MASS FEED RATE OF POHC TO INCINERATOR

W_{OUT} = MASS EMISSION RATE OF POHC IN THE STACK

POHC = PRINCIPAL ORGANIC HAZARDOUS CONSTITUENT



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HAZARDOUS WASTE

CHEMICAL

TYPES OF INCINERABLE WASTE



- 1. By-product Gases And Vapors**
- 2. Organic Liquid Streams**
- 3. Aqueous Waste Containing Dissolved Organics And Salts**
- 4. Distillation Bottom Tars**
- 5. Organic Sludge And Semi-solids**
- 6. Slurries And Sludge With High Moisture**
- 7. Granular Solids, Filter Cakes**

SOURCES OF WASTE



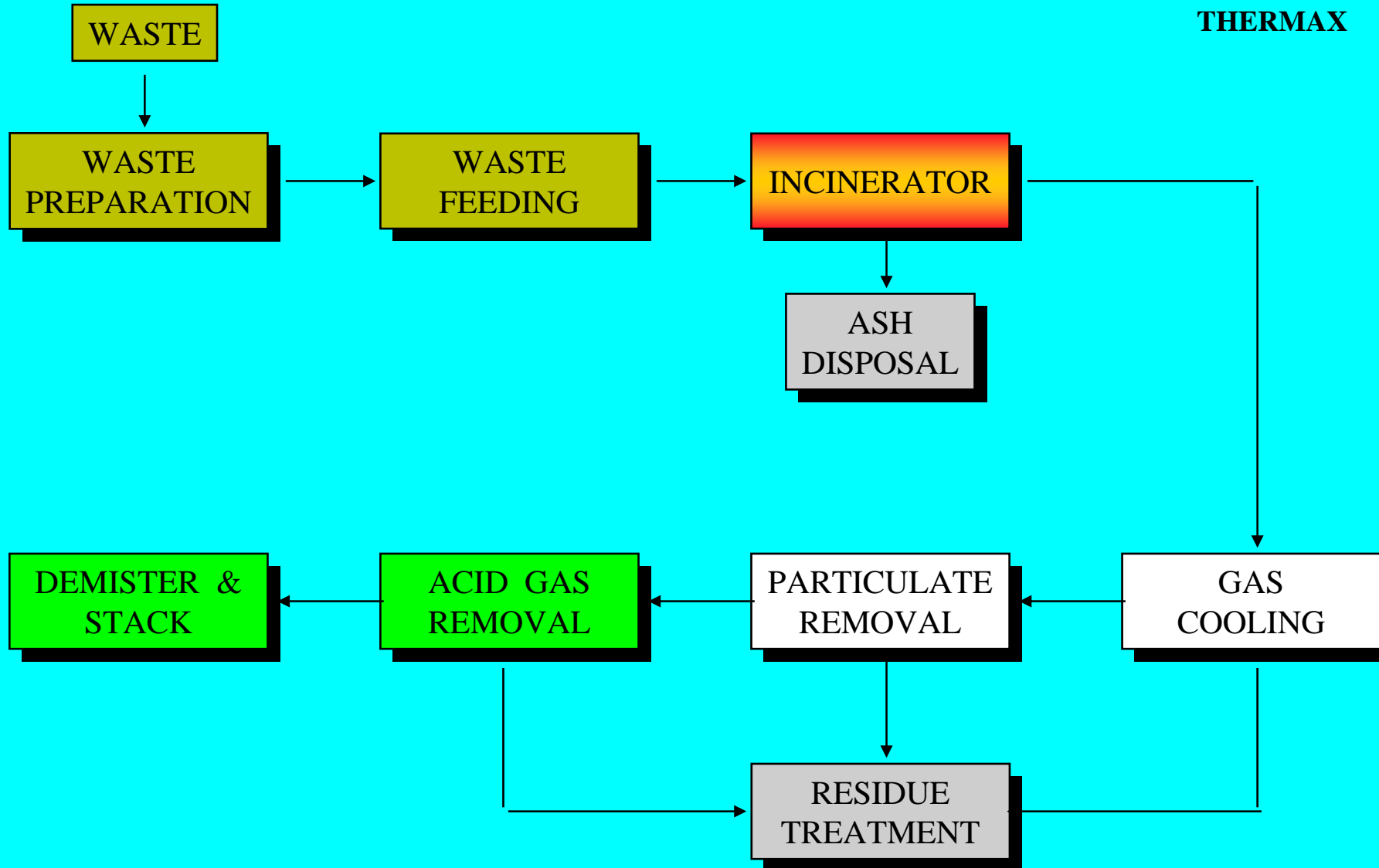
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Industries Manufacturing And Handling Variety Of Chemicals Such As:

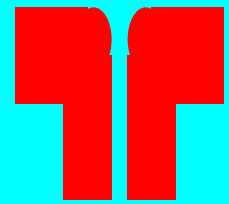
- Petrochemicals
- Pharmaceuticals
- Antibiotics, Bulk Drugs
- Oil Refineries, Srus
- Agro-chemicals, Pesticides
- Dyes, Dye-intermediates
- Organic Chemicals
- Speciality Chemicals

- Polymers, Plastics
- Pulping Mills
- Coke Ovens (By-product Recovery)
- Coating, Printing, And Laminating
- Automobiles (Paint Shop)

INCINERATION SYSTEM



WASTE HANDLING



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ACTIVITY

METHODS / EQUIPMENT

Preparation



Screening /Shredding, Crushing, Blending,
Heating, Baling, Evaporation

Conveying



Slat /Screw / Grab / Pneumatic Conveyors,
Hoists, Pumps, Blowers

Feeding



Manual / Gravity /Ram / Screw Feeders,
burners, Injectors, Sludge lances

INCINERATORS

STATIC

- LIQUID / GASEOUS INJECTION
- FLUID BED INCINERATOR
- FIXED HEARTH

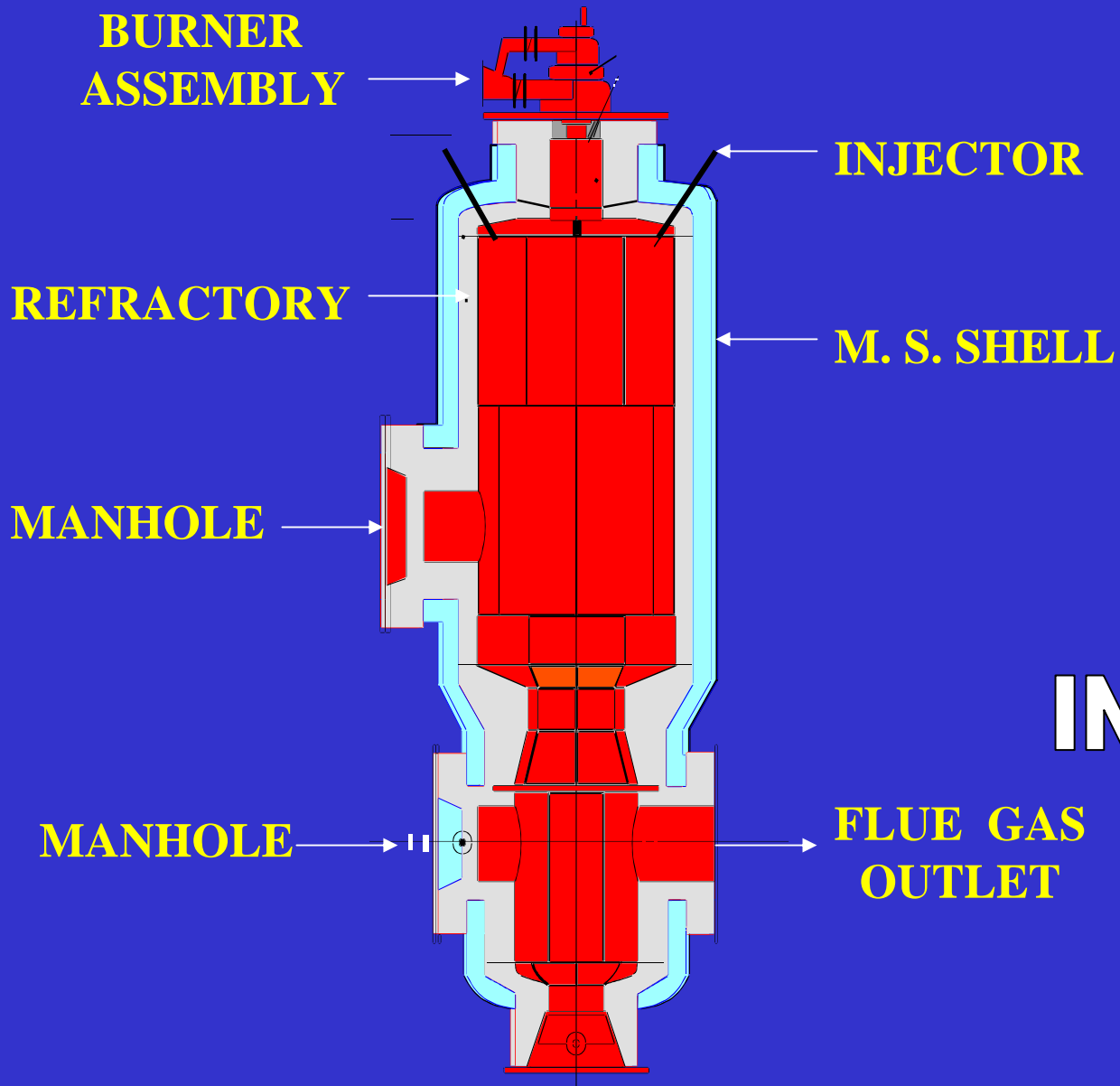
NON - STATIC

- ROTARY KILN

APPLICABILITY OF INCINERATION TO WASTE TYPES



WASTE TYPE	LIQUID INJECTION	FLUID BED	FIXED HEARTH	ROTARY KILN
SOLIDS				
Granular, Homogenous		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Irregular Bulky			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Low Melting Type	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
With Fusible Ash				<input checked="" type="checkbox"/>
Large Bulky Material				<input checked="" type="checkbox"/>
LIQUIDS				
Aqueous Wastes	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Organic Liquids	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
GASES				
Organic Vapour Laden	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
SOLIDS / LIQUIDS				
Halogenated Compound	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Sludges		<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>



LIQUID WASTE INCINERATOR

SYSTEM CONFIGURATION

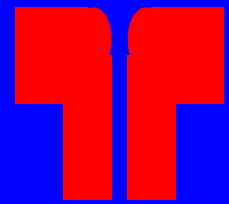
LIQUID WASTE INCINERATORS



APPLICATIONS

1. Low melting distillation bottoms
2. Organic liquid waste
3. Waste Waters
4. Gaseous Waste
5. Chlorinated waste from PVC / ECH manufacturing
6. High fluorine containing waste.

LIQUID WASTE INCINERATORS

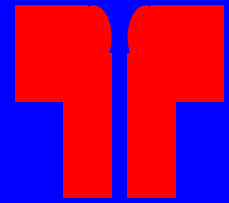


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MERITS

1. No Secondary Combustion Chamber
2. Simple Construction
3. No Moving Parts
4. Suitable For Gaseous / Liquid Waste
5. Low Maintenance Required
6. Capable Of High Turndown.
7. Accepts Wide Range Of Liquid / Gaseous Waste.

LIQUID WASTE INCINERATORS

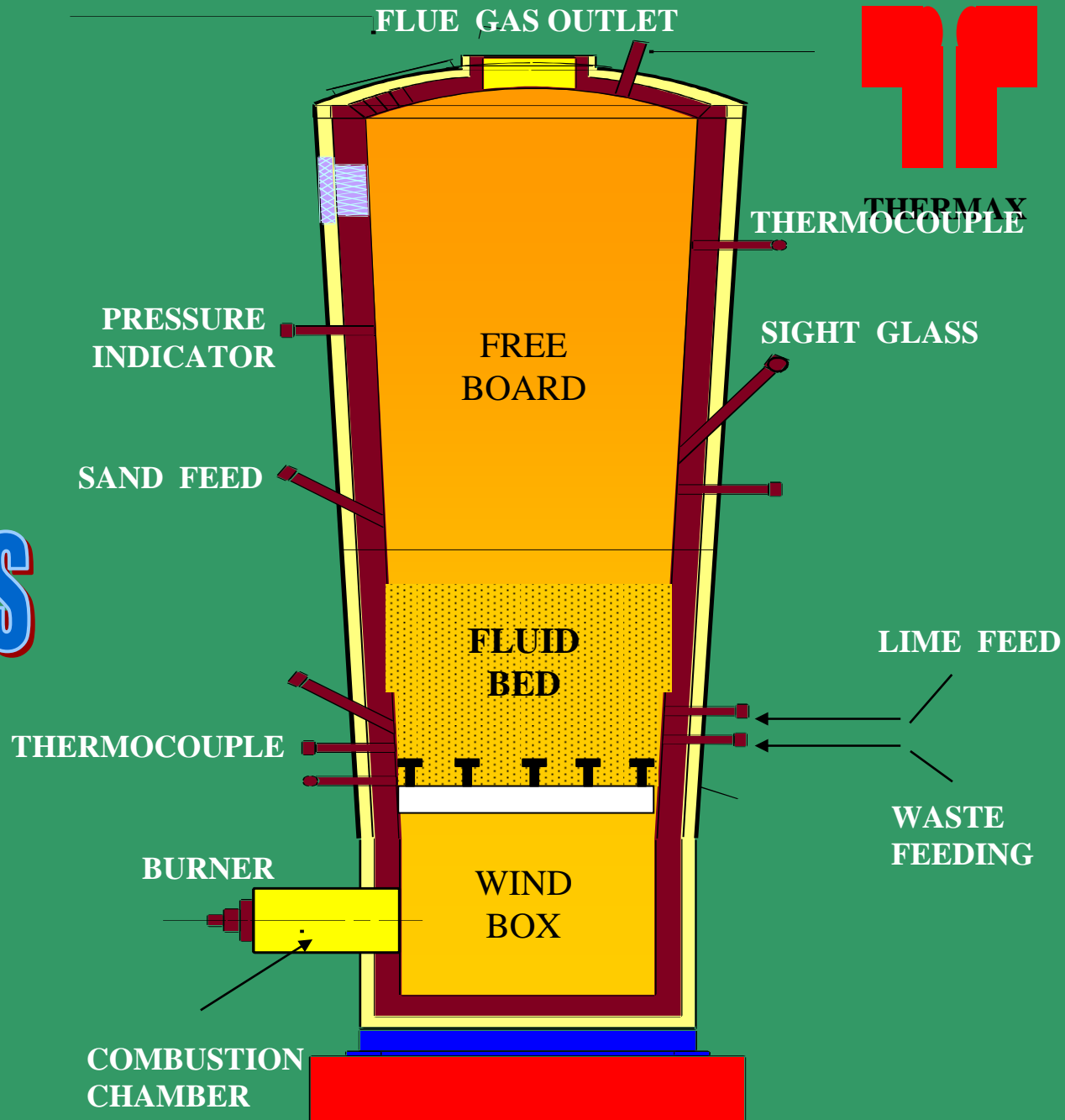


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DEMERITS

- For Only Atomizable Liquid Wastes.
- Not Suitable For Slurries With Large Size Solids.

FLUID BED INCINERATORS



APPLICATIONS



8

1. Distillation Bottom Tars
2. Organic Liquid & Semi Solid Waste.
3. Sludge With High Moisture Content.
4. Organic Sludge.
5. Pharmaceutical Sludge
6. Aqueous Waste containing Sodium Sulfate & Sodium Carbonate & Recovery
7. Granular, Powdery waste

Also applicable for general garbage (after shredding) and Gaseous waste in combination with above types.

MERITS



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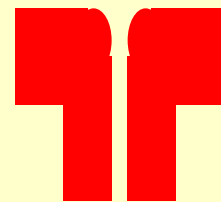
- Ability to handle heterogeneous waste.
- High efficiency due to
 - Vigorous mixing in the bed
 - High retention time
- Low NO_x formation due to
 - Lower operating temperature &
 - Low excess air.
- In bed neutralization possible for removing acid gases
- Quick re-start due to heat stored in the bed.
- Absence of moving parts hence low maintenance.
- Flexibility to handle diverse fuels.

DE-MERITS

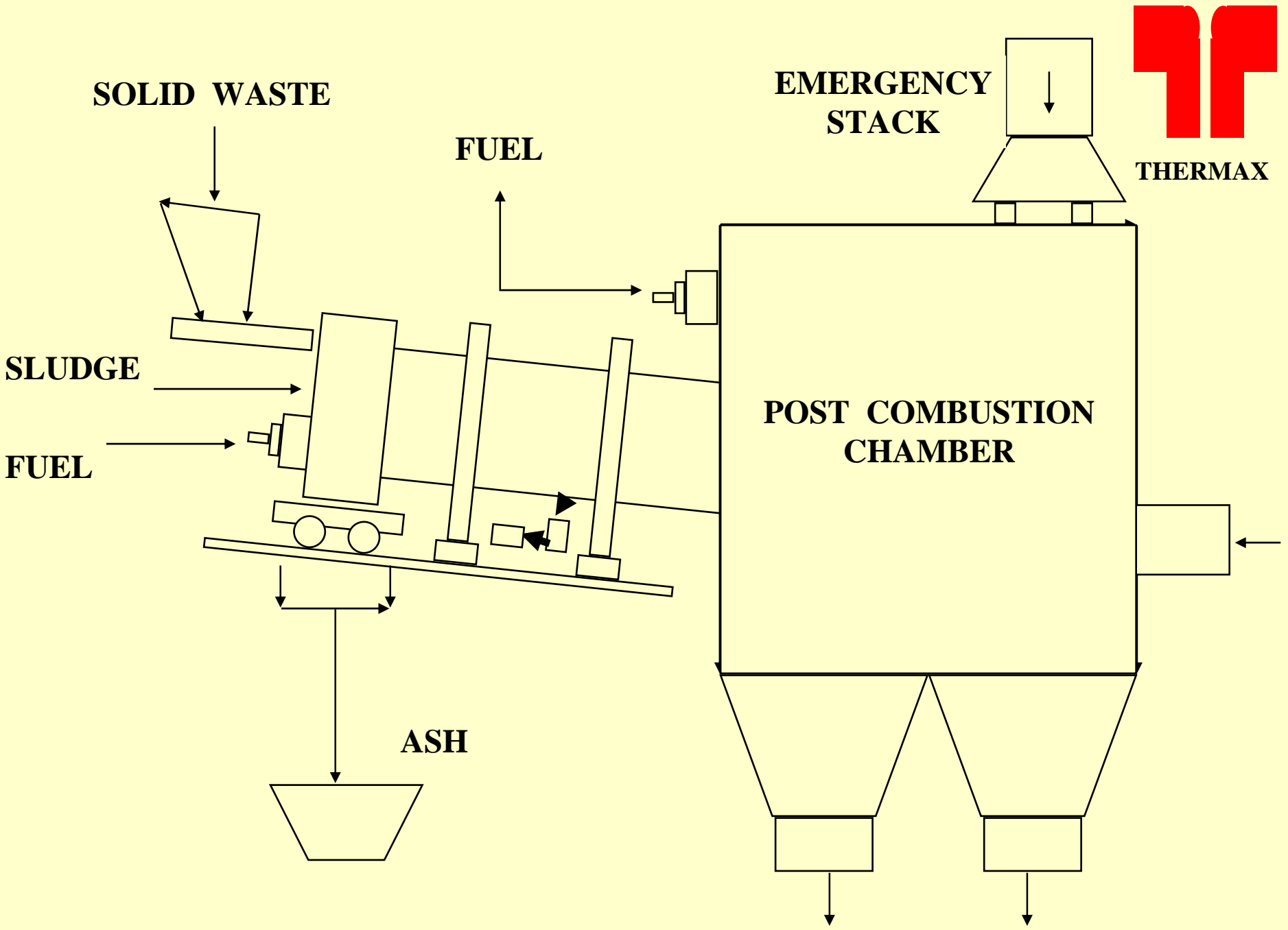


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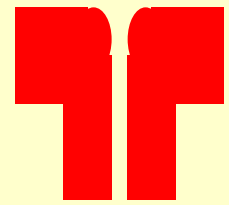
- Difficult To Remove Residual Materials From Bed.
- Requires Elaborate Waste Preparation For Bulk Solids.
- High Power Costs.
- Incineration Temperature Limited To 800 Deg C.
- Special Care For Feed Selection & Mixing Of Additives To Prevent Bed Damage.



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ROTARY KILN INCINERATORS

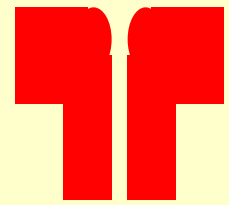


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MERITS

- **Suitable For All Kinds Of Wastes.**
- **Feed Capability For Drums & Bulk Containers.**
- **Can Be Operated At High Temperatures.**
- **Residence Time Adjusted By Varying Kiln Speed.**
- **Waste Feeding - Without Much Preparation.**

ROTARY KILN INCINERATORS

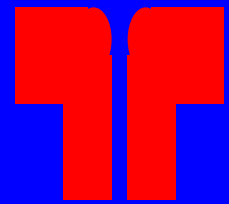


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LIMITATIONS

- **Expensive For Low Feed Rates.**
- **Subject To High Wear & Tear.**
- **Relatively Low Thermal Efficiency.**
- **Large Particulate Carry-over.**
- **Air leakage possible without good sealing**

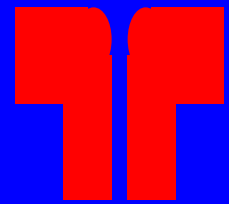
GAS COOLING DEVICES



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- **Waste Heat Recovery**
 - **Boiler (Hot water / Steam)**
 - **Thermic Fluid Heater**
 - **Air Preheater**
- **Quench / Evaporative Cooler**
- **Dilution by air**

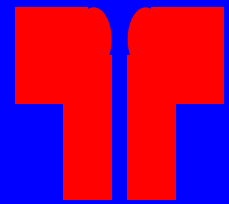
DRY SCRUBBING SYSTEM



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- Evaporative Cooler
- Dry Lime / Carbon Injection
- Bag Filter / ESP

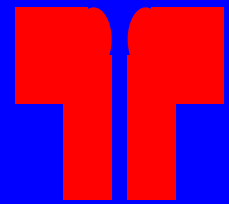
SEMI-DRY SCRUBBING SYSTEM



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- Spray Dryer Using Lime Slurry
- Carbon Injection
- Bag Filter / ESP

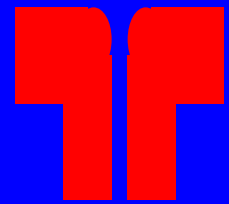
WET SCRUBBING SYSTEM



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- Quench
- Venturi Scrubber
- Absorption Tower
- Aerosol / Mist removal
- Plume Suppression

CONTROLS AND SAFETIES



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- Temp. control for constant efficiency
- Air control for adequate excess air
- Pressure control for balance draft
- pH control for scrubber performance
- Interlocks for safe operation & shutdown

THANK YOU.