Management of **CHLORINE** Hazards

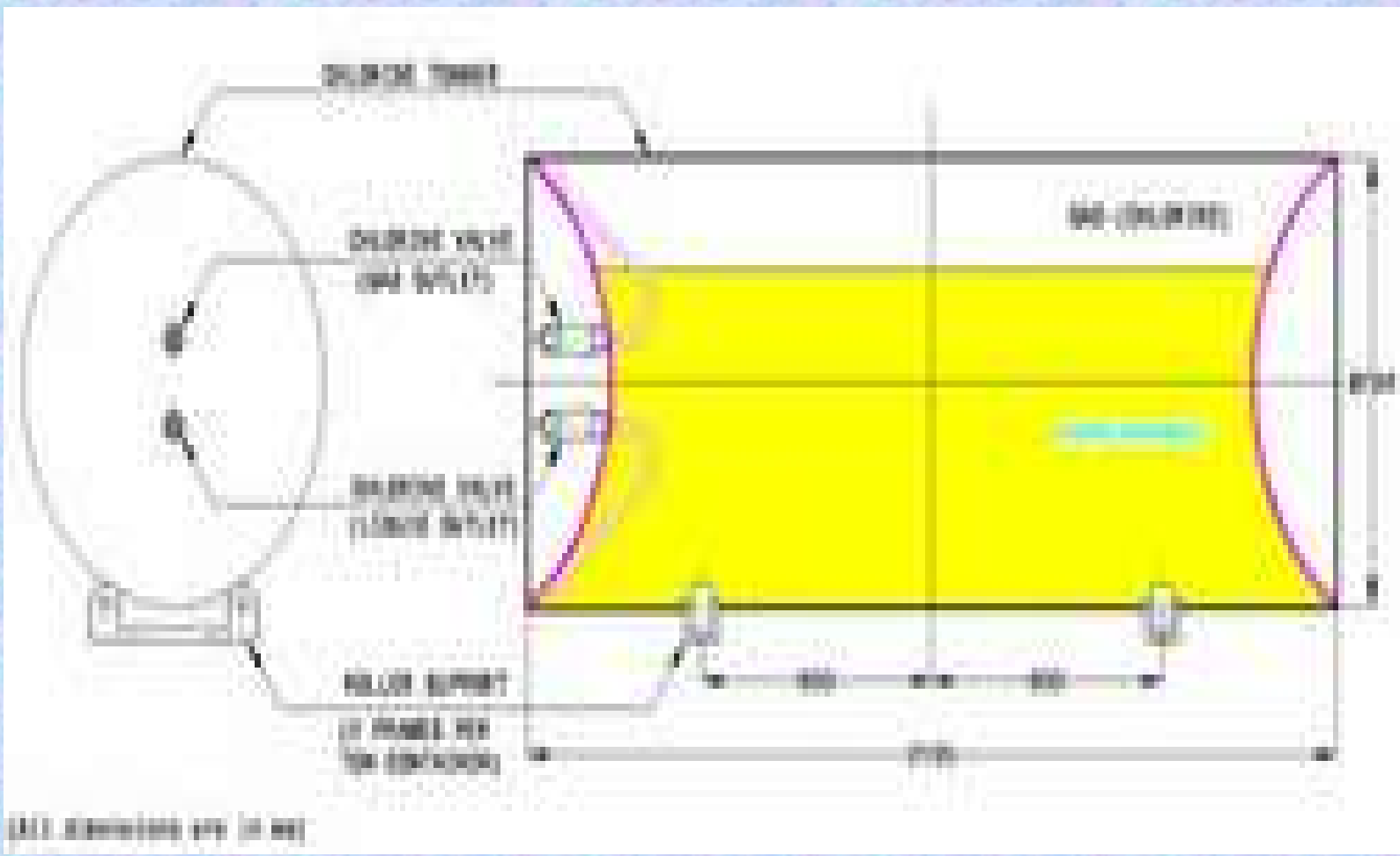
Properties of Chlorine

- Appearance : Greenish Yellow
- Physical State : Liquefied compressed Gas
- Vapor pressure @ 35^0C:27.48 mm Hg
- Boiling Point : -34^0 C(at 1 atm pressure)
- Melting Point/Freezing Point : - 101^0C
- Vapor Density(air density=1) : 2.49
- Liquid Density(water density=1) :1.47 at 20^0C
- Odour:Irritating,Bleach like choking odor
- Others: Soluble in alkali

Chlorine Tonner Specification

- Water capacity (approx.) : 780 kg
- Chlorine capacity(approx):930 kg
- Design Pressure : 19.9 kg/cm2
- Inside Diameter : 760 mm
- Shell Thickness : 10 mm
- Dished End Thickness : 9.6 mm (Min.)
- Overall length : 2085 mm
- Tare weight :620 kg

Chlorine Tonner



Permissible Limit of Exposure

Substance	Permissible limits of Exposure			
	Time-weighted average concentration (8hrs)		Short-term Exposure Limit(15 min)	
	ppm	mg/m3	ppm	mg/m3
Chlorine	1	3	3	9
Ammonia	0.25	18	35	27
Hydrogen Chloride	5	7		
Hydrazine - Skin	0.1	0.1		
Sodium Hydroxide		2		
Sulphuric Acid		1		

Chlorine Effect

Concentration of Chlorine	Observed Effect
0.06 ppm	Odor Threshold
3 ppm	Irritation of eyes and mucous membrane
15 ppm	Immediate irritation of throat
50 ppm	A dangerous health hazard, even for short period of time. Prolonged exposure may result in death.
1000 ppm	Potentially fatal after a short exposure

Hazard Identification

- Heavier than air (2.5:1) lies in low areas
- 1 volume liquid = 460 volume gas
- Slightly soluble in water (0.7% at 20^0C)
- Accelerate burning(like oxygen) – avoid sparks, high temperature, open flames
- Chemically reactive – combine with water to form acid that react with steel(avoid high humidity)

Hazard Identification

- Reacts with organics, combustibles and nitrogen based products(sometimes violently)
- Avoid hydrocarbons, cleaning solvents,paints&thinners,oil,grease, etc.
- Dry chlorine is not Corrosive
- Wet Chlorine(reacted with moisture in Air) is corrosive

Hazard Identification

- Chlorine reacts with moisture to form hydrochloric or hydrochlorous acid which can corrode most steels
- Chlorine gas combines with moisture on skin and in eyes to cause burning and irritation.

Leakage

- Exact leakage point of chlorine can be detected by ammonia torch.
- Liquid chlorine leakage should be converted to gaseous leakage by turning the cylinder.
- One volume of liquid chlorine gives 460 volume of gaseous chlorine.
- Leakage should always be attended by using PPE

Leakage

- Leakage can be detected by electronic leakage censor device.
- Censor should be fixed near the chlorine tonners or chlorine distributing station.
- Censor should be connected through hooter .

Leakage

- Always approach the leak point against the air direction.
- In no case water to be sprayed on the chlorine leak.
- In case of large leak absorb the chlorine in caustic solution or soda solution or lime solution scrubber.

First Aid Procedure

- **Inhalation**
- **Skin Contact**
- **Eye Contact**

Inhalation

- 30 ppm shortness of breath, chest pain, possible vomiting
- 40 – 60 ppm severe irritation of lungs, fluid collecting
- Prolonged exposure above 50 ppm: Unconsciousness and death
- 100 ppm may cause lethal dose
- Average lethal dose : 300-400 ppm for 30 minutes

Inhalation

- Move victim to fresh air
- Give Artificial Respiration if breathing has stopped
- Give CPR if there is no pulse
- Administering of Oxygen should only be done by trained professionals
- Seek medical attention immediately

Skin Contact

- Gaseous Contact
- Itching will develop as acid is formed on the skin
- Flush area with with a continuous stream of water for 20 minutes and seek medical attention
- Do not use oinments without medical direction

Skin Contact

- Liquid Contact
- Liquid will boil to gas drawing heat from skin and generating a gaseous exposure

- Treat area for frostbite and chemical exposure with a continuous stream of water for 20 minutes and seek medical attention.

Eye Contact

- Acid produced in eyes can cause blindness
- Flush eyes with running water for 20 minutes holding eyes open
- Do not transport victim until flushing has completed

Health Hazard

- Chlorine is very corrosive and reacts with body moisture to form corrosive acid.
- Cause respiratory injury ranging from irritation to death.
- Up to 0.5ppm no long term affect.
- 1-3ppm can be recognized by nose and preventive can be taken immediately
- 100ppm can cause lethal damage
- 1000ppm danger to life.

Reactivity

- Chlorine has great affinity for Hydrogen
- Reacts with water to produce toxic and corrosive solution of HCl and HOCl
- Reacts with NH_3 in the cold to produce extremely explosive Nitrogen Tri Chloride
- Reacts with many metals and nonmetals to form the salt.
- Reacts with Organic Compound to form Chlorinated derivative

Personnel Protective Equipment

- Self contained breathing apparatus.
- Positive pressure(blower) hose mask.
- Industrial canister type mask.
- Protective clothing.

First Aid

- Shift the affected person to open place.
- Apply oxygen immediately.
- Remove the contaminated clothing.
- Plenty of water to be used for eye and skin washing.
- Call a doctor if the victim is uncomfortable.

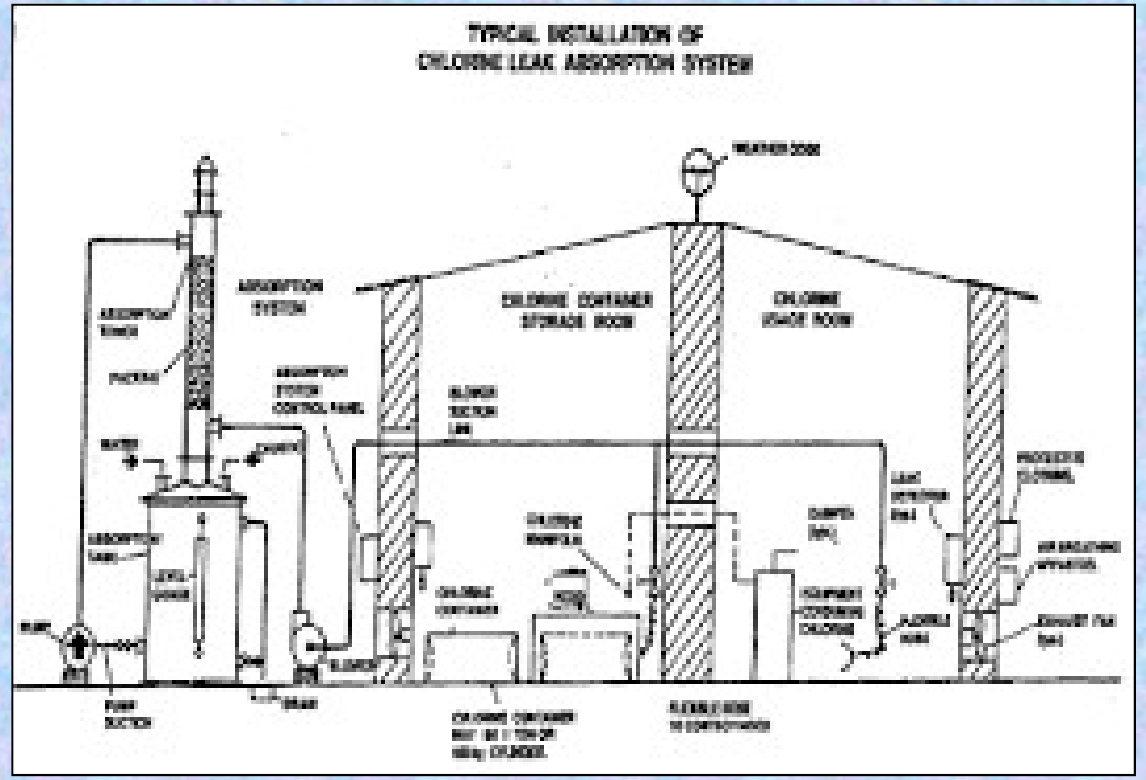
Practice should be Adopted

- Chlorine gas piping network installed with safety valve.
- Safety valves blows off if pressure goes above set pressure.
- Vent of safety valve connected with the caustic scrubber solution.
- Chlorine leakage detectors fitted in all the required places and directions.

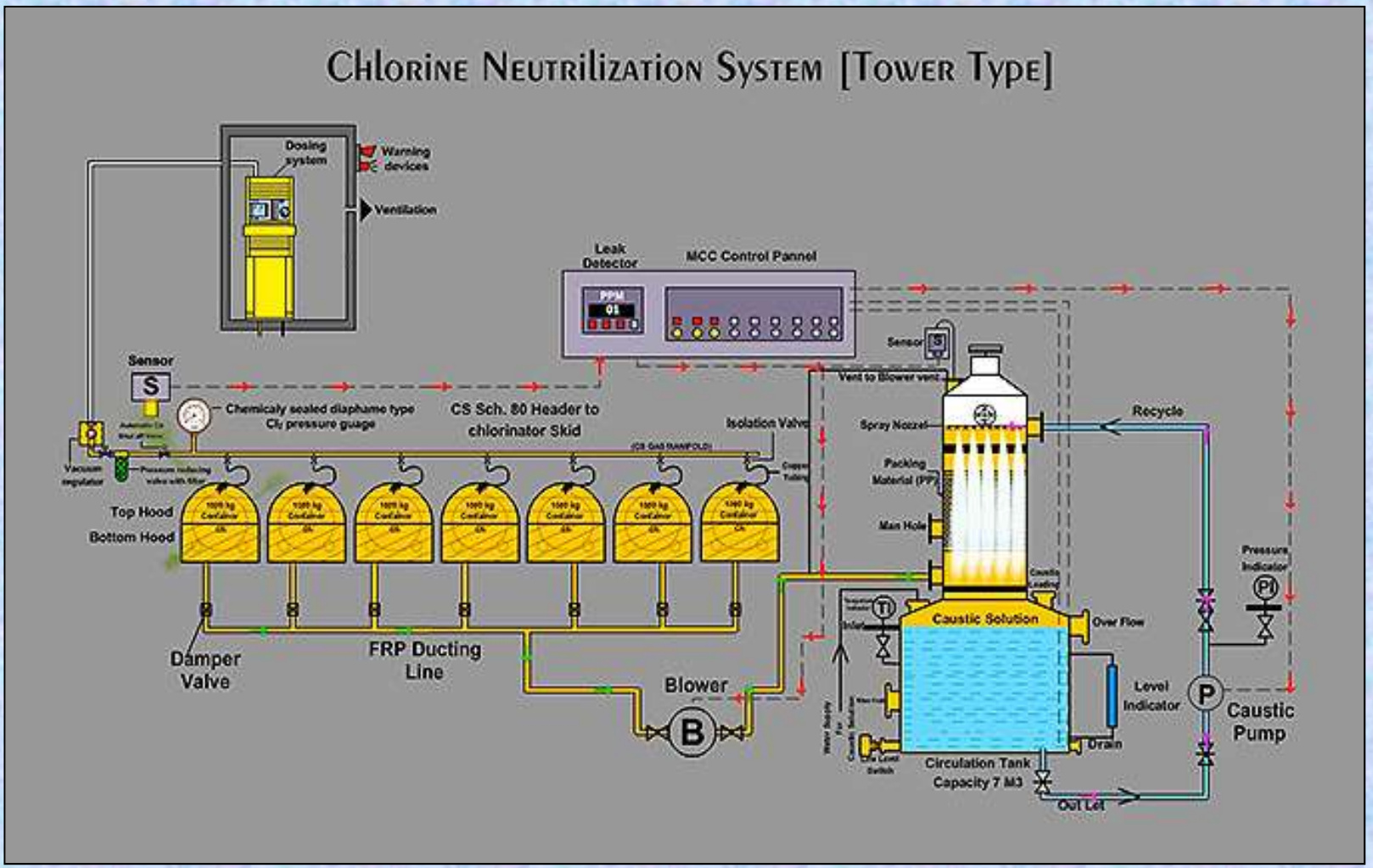
Practice should be Adopted

- Installation of Chlorine detector hooters .
- Recording of all the detectors .
- Preserving the Chlorine monitoring records .
- Caustic solution scrubber through suction blower be always ready to handle any leakage of chlorine.

Caustic Solution Scrubber



Caustic Solution Scrubber



Practice should be Adopted

- Pipe lines are regularly checked for wall thickness and proper records are maintained.
- Full cylinder (8kg/cm2) should not be dropped to the ground below from the truck, but should be carefully rolled down or mechanically lifted, shifted and placed to the consumer point.

Practice should be Adopted

- Training in regular practice .
- In house Mock drills are done quarterly.
- Off sight mock drill once in a year.
- Emergency kit should be always kept ready.
- Loaded cylinder should always be kept away from source of heat and in no case should its temp. be allowed to exceed 50^0C for the sake of safety.

Practice should be adopted

- The cylinder is fitted with two std. needle type valves. Only proper size, standard key should be used to open the valves.
- Only the valve on the upper portion of a cylinder (horizontal cylinder) should be opened for taking chlorine into line and in no case the lower valve should be opened.
- It is hazardous to return cylinder containing residual chlorine with damaged valves.

Practice should be Adopted

- Chlorine should be consumed within 15 days(max.) from the date of delivery.
- As per provision of Gas Cylinder Rule,1981,every organisation possessing/storing/consuming liquid chlorine will have to obtain specific licence from the Deptt. Of Explosives,GOI as per Schedule of the Rule.