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# **Safety Critical System**

**in**

# **Engro Chemical Pakistan Ltd**

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**Syed Muhammad Zeshan Bukhari**

**Engro Chemical Pakistan LTD.**

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# Background ... Bhopal Incident

## What happened ?

- Contamination of Methyl isocyanate (MIC) storage tank with water & chloroform.
- Reaction runaway
- MIC vapours discharged to atmosphere.
  
- **2000 Fatalities \***
- **200,000 Injuries \***

## Why happened ?

- Refrigeration system was shut down.
- Scrubbing system was not available.
- Flare system was out of order.

**Safety Protective  
equipments were out of  
order**

\* Ref : "What went wrong" by Trevor Kletz

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# Engro's Safety critical system

## Safety Critical equipment

Device, equipment or system, whose failure can result in, allow or contribute to release of or exposure to sufficient quantities of hazardous substances or their energies which can result in serious injuries, significant property damage or environmental impacts.

## Purpose

- The purpose is to avoid:
  - Fires
  - Explosions
  - Release of Hazardous Materials or Energy
  - Unhealthy Exposures

**To Protect People ,  
Environment and Assets.**

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# Identification of Safety critical equipment

All highly hazardous chemicals listed in 29 CFR 1910.119 (OSHA regulation) &/ or 40 CFR part 68 (EPA regulations).

Activity which has significant potential for irreversible or significant environmental damage, toxicity, reactivity/corrosivity or thermal instability

Equipments containing hazardous substance, Containment controls, Shut down controls, mitigation systems

Identify Hazardous chemicals

Identify High Hazard Process

Identify control loops/ circuit

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# Criteria for HHP

## Criteria

- Quantities of pressurized fuel gases
- Toxic material
- Flammable/ explosives
- Steam

## Remarks

- Any quantity of fuel gas having pressure > 5 psig.
  - As listed by OSHA/ EPA.
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  - All pressures due to latent heat
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# Identification of Safety critical

## ■ Equipment

- Containing hazardous substance in threshold amounts.
- Vessels, exchangers, piping system, pumps, compressors.

## ■ Controls

- Relief devices
- Check valves
- Remote block valves
- Controlled release systems like Flare system, vents.

## ■ Shut down Controls

- Emergency shut down systems
- Sensors, final control elements
- Interlocks.

## ■ Mitigation systems

- Fire protection systems
- Fire water systems
- Dykes
- Fire walls



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# Examples at ECPL

- All equipments containing threshold quantity of ammonia (10000 lb or more – OSHA).
  - Low fuel pressure shut down of furnace and boilers
  - Low water level shut down of boilers.
  - All pressure safety valves (PSV)
  - Fire detection & suppression systems e.g. Smoke detectors, fire water.
  - Flare system.
  - Emergency communication system e.g. emergency siren, hot line
  - High vibration shut down of turbo compressors.
  - Surge control system of compressors.
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# Reliability program

- Full year Preventive Maintenance (PM) plan.
    - Inspection of vessels, exchangers, piping, relief valves.
    - PM of SC valves, interlocks, motors.
  - Dummy check up procedures / inspection guidelines for PM.
  - Observations during PM are recorded and shared with area incharges.
  - On spot corrective actions.
  - Monthly stewardship of PM compliance by senior managers.
  - Incident is declared and investigated, if Safety critical device or equipment malfunctions.
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# Control of Defeat of SC system

- Utmost importance is given to keep SC system in service.
  - Need is established to defeat the system
    - PM
    - Malfunction
  - Not bypassed without written approval of Shift coordinator.
  - Approving person notifies higher level of authority about bypassing.
  - Precautions, contingency planning along with responsibilities are written, understood by all and displayed at conspicuous location in control room.
  - Highest priority is given to return the SC system back in service,
  - Incident is declared and investigated if bypassed without approval.
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Safety does not put money in the bank. But it can keep from having an extreme amount flowing out for a very expensive mistake.

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