Case Study Presentation on

“Styrene Gas Leak Incident post COVID -19 Lockdown in Vizag”

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INCIDENT SUMMARY

- On 7th May 2020, an incident of uncontrolled Styrene vapor release has occurred at M/s LG Polymers plant (Vizag) from one of the Styrene Storage Tanks (M6).
- This Styrene vapor release, widely referred to as "Vizag Gas Leak", is a unique major Styrene vapor release incident from a bulk storage tank any where in the world.
- The accident took the lives of *12 persons* in the immediate subsequent period and *585 people* had to undergo treatment in hospitals, besides causing loss of livestock and vegetation.

INCIDENT PHOTO - 1

M6 Tank (Normal Condition)

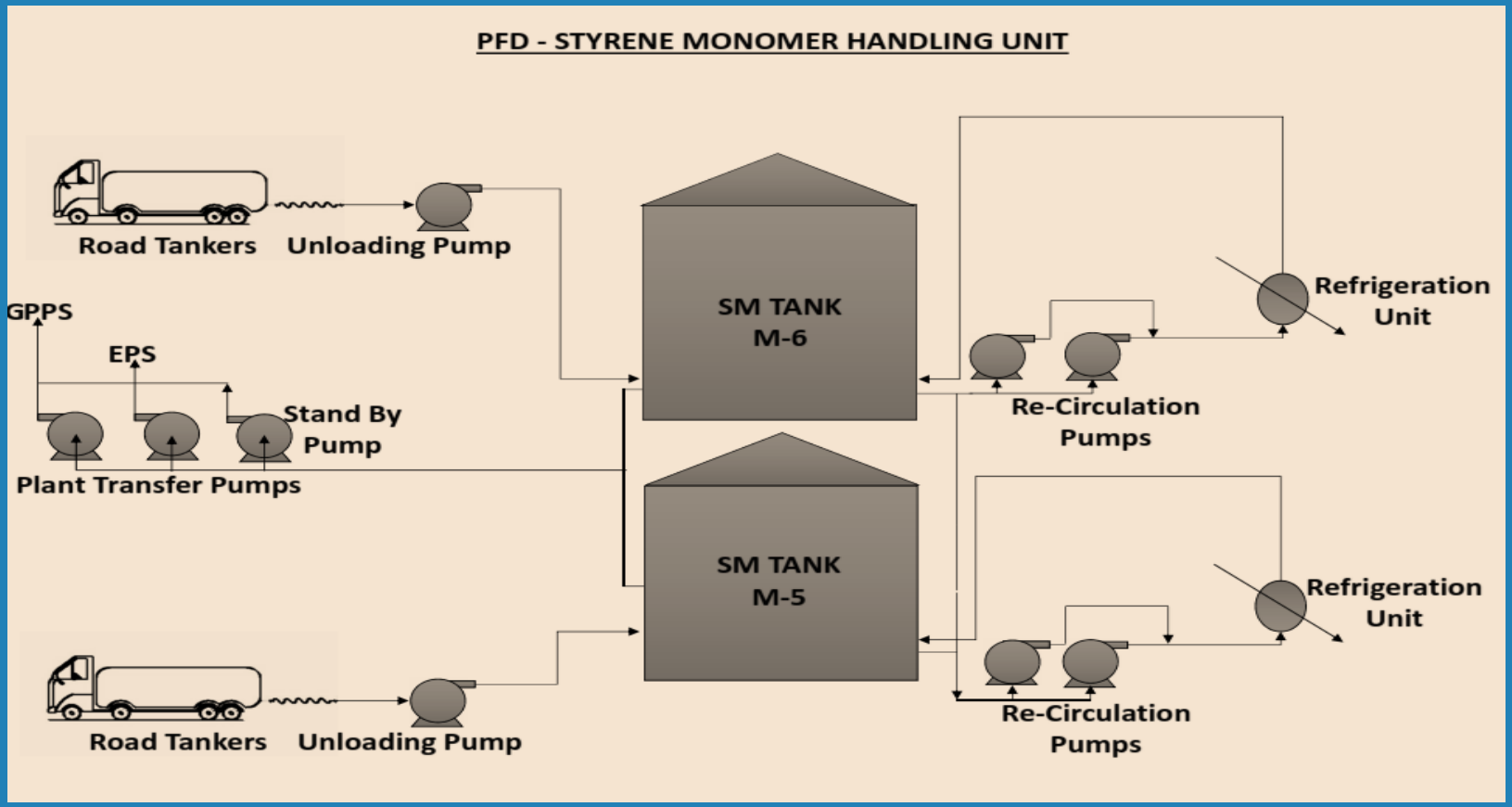
INCIDENT PHOTO - 2

Styrene Vapor Release from M6 Tank

INCIDENT PHOTO - 3

Styrene Vapor Cloud Formation

PROCESS DESCRIPTION



Schematic Diagram of Styrene Handling Plant

PROPERTIES OF STYRENE

- Colorless liquid at normal temperature
- Flash point: 31°C
- Boiling point: 145°C
- Highly Flammable with Explosive range: 1.1 to 7%
- Highly Toxic by inhalation
- TLV for 8 hours a day: 50 ppm; STEL of maximum 15 minutes: 100 ppm; IDLH: 700 ppm
- Causes severe eye, skin and respiratory irritation, CNS depression, nausea, vomiting etc. on short term exposure

ROOT CAUSE ANALYSIS (RCA)

The major parameters that influenced the increase of temperature of styrene in the tank (M6) are mainly

1. Tank Design
2. Tank Temperature Measurement and Control
3. TBC Monitoring
4. Operating Procedures
5. Availability of Updated Documents
6. Knowledge / Talent Deficit
7. Styrene Quality Testing

RCA Continues…

1. Tank Design
   - 53 year old, Atmospheric Mild steel without any inside lining, Insulated outside and with 17 nozzles
   - Conical Roof on an Inside Structure
   - Change of Design in the Suction and Discharge lines of recirculation circuit
   - Last Cleaning and Maintenance of the Tank in 2015.

RCA Continues…

2. Tank Temperature Measurement and Control
   - Single Temperature Measuring Probe at the Bottom of the Tank M6
   - Temperature measurement is restricted to the bottom zone; top and middle zones might have different temperatures

3. TBC Monitoring
   - No addition of TBC in the on-site storage tanks since last 10 years
   - Unavailability of TBC Stock

RCA Continues…

4. Operating Procedures
   - Standard Operating Procedures (SOP) are not updated to suit lockdown period
   - No daily sampling

5. Availability of Updated Documents
   - A paucity of basic Process Safety Information was observed

RCA Continues…

6. Knowledge / Talent Deficit
   - Personnel were unaware of detailed knowledge on Styrene handling and storage best practices
   - Safety officer, Shift in-charges, engineers are not qualified in engineering and not competent also
   - Personnel on-duty / in-charge: lack basics of emergency operations

7. Styrene Quality Testing
   - Collection of representative sample was not ensured
   - Only one sample from the bottom of the tank was tested

LESSONS LEARNT

- Technology and techniques should be continuously updated.
- Continual learning and keeping the equipment in good condition should be ensured.
- Senior professionals responsible for guiding should be adequately experienced & should ensure strict compliance of standard operating procedures.
- The operating personnel should be trained in on-site & off-site emergency response plans and procedures to handle emergencies for toxic chemical release along with fires & explosions.

LESSONS LEARNT

- The awareness programs should be conducted for the neighborhoods on hazard nature of chemicals and their effects.
- Procedures are to be reviewed and updated if necessary after a Management of Change
- The material of construction of the tank can be carbon steel with coating inside.
- The roof of the tank should be supported with outside structures
- The number of nozzles in the tank should be kept to a minimum required

LESSONS LEARNT

- Tank life should be clearly defined; tank cleaning and coating should be carried out once in two years
- The tank must have suction swing pipe and eductor system for efficient mixing.
- The tank should have effective cooling systems with backup cooling
- Sampling frequency to be increased when process is dormant (pandemic, turnaround, business cycles)
- Carryout PHA (Process Hazard Analysis) Studies like HAZID, HAZOP & QRA.
- Conduct PSSR after long shutdown of plant.
- Maintain PSM across all levels.

THANKS