POL Tank Farm – Layers of Protection

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Plan of Presentation

1. Tank Appurtenances & Overfill Protection System
2. Rim Seal Protection System
3. HC Monitoring System
• Tank farms/storage area need effective safety solutions to protect Personnel, Asset and Environment

• Tank farms present difficult challenges for Safety technology

• Being a hazardous area, requires continuous monitoring

• Tank farm should have accurate, reliable monitoring system
POL locations: Safety Systems

Tank Farm Mgmt. System

HVLR Monitors

ROSOV

Hydro Carbon Detectors

Rim Seal Fire Protection

Rated equipment along with Dedicated Safety PLC
Plan of Presentation

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Safety Integrity

“Average probability of a safety instrumented system satisfactorily performing the required safety instrumented functions under all the stated conditions within a stated period of time”

Safety Integrity Level (SIL)

“Discrete level for specifying the Safety Integrity requirements of the safety instrumented functions to be allocated to the safety instrumented systems”
# Different levels of SIL

<table>
<thead>
<tr>
<th>Safety Integrity Level (SIL)</th>
<th>Frequency of Dangerous Failures Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>$&gt;10^{-9}$ to $&lt;10^{-8}$</td>
</tr>
<tr>
<td>3</td>
<td>$&gt;10^{-8}$ to $&lt;10^{-7}$</td>
</tr>
<tr>
<td>2</td>
<td>$&gt;10^{-7}$ to $&lt;10^{-6}$</td>
</tr>
<tr>
<td>1</td>
<td>$&gt;10^{-6}$ to $&lt;10^{-5}$</td>
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</table>
SIL-2 Compliant Equipment

Level Switch (Vibrating Fork)

Safety PLC

Radar Gauge and Relay Output
Major Appurtenances

ROSOV is the body valve of the tank which is Fail Safe and can be operated Remote or local

Radar Gauges of SIL 2 certified
Safety Interlock loop for Over fill Protection

ESD PLC features
Radar Gauge + Level Switch

- Safety PLC – SIL 2 or better certified
- Radar Gauge, Level Switch, Relay Output – min SIL 2 Certified
- All Radar Gauges shall be with +/- 1 mm accuracy
- HHH alarm activation basis feed back either from SIL Radar Gauge or Level Switch which ever is earlier.
Standardized Levels

- Three Standardized Levels defining overfill protection systems.

- **Critical Height (HHH):** PESO approved maximum permissible height of storage allowed in tank.

- **High High (HH):** Response time of minimum 15 minutes with maximum flow rate of 900 KI/hour.
  - HH level shall be 0.65 m below HHH level for tanks > 18m.

- **High Level:** This level shall serve as alert level to operators to take action in time.
  - H level shall be 0.25 m below HH level for tanks > 18m.
Standardized Levels for ≤ 18 m "

- Three Standardized Levels defining overfill protection systems.
  - **Critical Height (HHH)**: PESO approved maximum permissible height of storage allowed in tank.
  - **High High (HH)**: Response time of minimum 15 minutes with maximum flow rate of 900 Kl/hour.
    - HH level shall be 1.3 m below HHH level for tanks ≤ 18m.
  - **High Level**: This level shall serve as alert level to operators to take action in time.
    - H level shall be at 0.5 m below HH level for tanks ≤ 18m.
Communication Structure

- Signal from field equipment
- Safety PLC
- TAS PLC
- DR Centre
Integration of Pipe Line PLC and TAS PLC for Product receipt, despatch and alarms.

Automation of Under ground tanks should be part of Tank Farm Management System by providing Radar Gauge etc.

Tank Body Valve (ROSOV) should be designated as Safety Valve & the second valve (MOV) is designated as Process (Operating) Valve.

ROSOV shall be closed on ESD activation, Hi-Hi-Hi level activation or Local push button located outside Dyke wall or from the Control Room.

ROSOV should be opened only through push button available outside the dyke or Control Room. ROSOV for idle tanks should be kept closed.

All data related to Valves operations in Auto-Remote/Auto-Manual Mode/Local Mode shall be logged with time & date Stamp.

Dyke Valve position indicator should be provided in the System. In case of open Dyke Valve status alert shall come to the control room.
ESD - Product Transfer

Pipeline Transfer Intra OMC
- Philosophy for exchange of critical alarm & status between TAS PLC & Pipeline PLC for stopping product pumps in case of activation of ESD

Pipeline Transfer from Ship
- Using the ESD system of the ships, the pumps in the Ship to be automatically tripped in case of activation of ESD at the receiving location.

Tank Wagon
- System should shut down the Tank wagon pumps in case of activation of ESD
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- Automatic actuated Rim Seal Fire detection & Extinguishing system: to detect fire at incipient stage in Rim seal area of Floating Roof tank storing Class ‘A’ product

- Detection of fire within 10 sec of occurrence

- Extinguishing the fire within 40 Sec. from detection

- Simultaneously alert the personnel at the location so that they can respond to the incident
## Components of Rim Seal System

<table>
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<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear Heat Hollow metallic tube type detection system</td>
<td>UL listed/FM/VdS/LPC approved</td>
</tr>
<tr>
<td>Automatic Foam based Fire Extinguishing system</td>
<td></td>
</tr>
<tr>
<td>Associated Cabling &amp; Piping</td>
<td></td>
</tr>
<tr>
<td>Control and monitoring of heat detection and Fire extinguishing system</td>
<td>(Graphic console and rim seal main fire alarm panel)</td>
</tr>
</tbody>
</table>
Operating Conditions

Suitable for operating in humid and corrosive atmospheres found in oil terminals, refineries & petrochemical plants in India.

Suitable for working in relative humidity upto 95% (non condensing) & temperature range of +1 deg C to +65 deg C.

Tolerant to influences such as electromagnetic interference, Radio Frequency Interference (RFI), aggressive or corrosive vapour, UV radiation, and heavy rainfall & electrical surge.

All enclosures for electrical equipment shall be suitable for use in Zone 1, Gas group IIA/IIB as per hazardous area classification & approved by PESO India.
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Hydrocarbon Detectors

For potential leak sources of Class ‘A’ product Infra Red HC detectors (combination of beam & spot type) to be installed in Dyke area & Product pump house.
Gas Detection System

1. Smell Detection
2. Think Control
3. Act Alarm
# Philosophy of HCD System

<table>
<thead>
<tr>
<th>Area</th>
<th>Type of Detector</th>
<th>Nos.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tank dyke storing Class ‘A’ products:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Across the manifold on drain</td>
<td>Open path Gas Detector</td>
<td>One no.(min)</td>
</tr>
<tr>
<td>2. On the collection sump/drain pit</td>
<td>Point type Gas Detector or Liquid type HC detector</td>
<td>One no.(min)</td>
</tr>
<tr>
<td>PumpHouse handling Class ‘A’ products</td>
<td>Open PathGas Detector</td>
<td>One no.(min)</td>
</tr>
</tbody>
</table>
Conclusion

- Process design shall be based on Risk Assessment Study

- All Critical Equipments like Radar Gauges, Level switches shall be SIL certified

- Safe Tank farm operation, which integrates advanced technology and the people who interact with that technology to help achieve the Safe objectives

- Tank farm being the critical part of an Installation, by avoiding any possible risk to tank farm we create a Safe Work Environment
Thank You

The End
Over-fill Protection in Tank