Example of planning to reduce risk and ensure integrity of the petroleum products storage depot

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Ministry of Environment and Energy
CROATIA
1. Petroleum Storage Depot
2. Ageing Plant
3. Planning to Reduce Risk
   • Monitoring and Control
   • Integrity of Installations and Equipment
   • Maintenance Program and Inspection
4. New Design
5. Conclusion
PETROLEUM STORAGE DEPOT
AGEING PLANT
AGEING PLANT

Plant & Assets condition
Operational integrity
Maintenance and Inspection
Assets availability & reliability
Hazard potential & PSM
Environmental efficiency

► How to operate a Seveso plant safely in a sustainable way through many years?
► How to avoid “surprises”?
PLANNING TO REDUCE RISK

Ageing is not about how old is your equipment, it is about its condition and how that is changing over time.

How to make a good plan to reduce risks from ageing plant?
## PLANNING TO REDUCE RISK - Process Hazard Analysis

<table>
<thead>
<tr>
<th>PLANT</th>
<th>PROJECT PROCESS PARAMETERS AND EQUIPMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTRUCTION, CONNECTIVITY</td>
<td>Projected pressure</td>
</tr>
<tr>
<td>STARTING</td>
<td>Design temperature</td>
</tr>
<tr>
<td>PREPARATION FOR MAINTENANCE WORK</td>
<td>Projected load (vessels, pipes, compensators, structures)</td>
</tr>
<tr>
<td>STOPPING</td>
<td>Schedule of the plant</td>
</tr>
<tr>
<td>PROCEDURES (for work, maintenance, emergency situations)</td>
<td>Heating</td>
</tr>
<tr>
<td>DECOMPOSITION, REMOVAL</td>
<td>Isolation</td>
</tr>
<tr>
<td>INDEPENDENT WORK</td>
<td>Supports (pipes, compensators, vessels)</td>
</tr>
<tr>
<td></td>
<td>Infrastructure (road, traffic)</td>
</tr>
<tr>
<td><strong>Process Regulation</strong></td>
<td>Access (working, maintenance, emergency situations, handrails, ladders, cranes, platforms, vehicles, fire extinguishers)</td>
</tr>
<tr>
<td>HARDWARE (DCS, ESD, cables, network, printers)</td>
<td>Flame retardants and detonators</td>
</tr>
<tr>
<td>SOFTWARE</td>
<td>Marking</td>
</tr>
<tr>
<td>Security (viruses, access)</td>
<td>Overheating and overpressure protection</td>
</tr>
<tr>
<td>Alarm and block settings</td>
<td>Restraint system and torch system</td>
</tr>
<tr>
<td>Security-critical loops (SIL)</td>
<td>Deviation from specifications / norms</td>
</tr>
<tr>
<td>Logic control, the sequence</td>
<td>Area classification / ATEX compliance (electric and non-electric)</td>
</tr>
</tbody>
</table>
PROCESS MANAGEMENT SYSTEM

- Operation monitoring, maintenance
- Control and monitoring
- Work orders
- Procedure instructions
- Processor computer
- Emergency management
- Emergency equipment
- Technical process

Control - to reduce
Prevent - to reduce
Limit - to reduce
Reduce
Limit - to reduce
Reduce
MONITORING AND CONTROL

SCADA

Supervisory Control And Data Acquisition System for monitoring, measuring and managing industrial systems
INTEGRITY - STORAGE TANKS

- corrosion allowance
- ATEX control,
- control of fixed fire fighting systems;
- detection on presence of hydrocarbons,
INTEGRITY - STORAGE TANKS

- Floor plate thickness control
- Overfill control - top level switches / radar level measurement system
- Automatic fire detection

- Automatic start-up and shutdown
- Automatic valves on all pipelines
INTEGRITY - BUNDS

✓ Concrete bunds / steel bunds
✓ Double bottomed container / leak detection system integrated into the SCADA system.
✓ Rainwater removal system
INTEGRITY - BUNDS

✓ capacity,
✓ liquid tightness,
✓ water removal
INTEGRITY - VALVES

✓ automatic closing valves
INTEGRITY – TRUCK LOADING AREA

permanent presence, overfill control, emergency buttons, fire protection, vapour recover unit
INTEGRITY - PIPELINES

- corrosion allowance
- overpressure resistance
- pig inspection
<table>
<thead>
<tr>
<th>Ordinal number</th>
<th>WHAT IF...</th>
<th>RISK</th>
<th>CAUSES</th>
<th>CONSEQUENCE</th>
<th>“Owner” of risk / service</th>
<th>RISK assessment</th>
<th>Risk level before reduction</th>
<th>Control / Protective Measures</th>
<th>Responsible person</th>
<th>Deadline</th>
<th>Risk level after reduction</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>... pipeline leaks?</td>
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<td>2</td>
<td>... Flammable, corrosive or toxic gas under high pressure passes through a pipeline with a liquid?</td>
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<td>3</td>
<td>... pipeline breaks?</td>
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<td>4</td>
<td>... pipeline clogging occurs?</td>
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<td>5</td>
<td>... came to a precipitate in the pipeline?</td>
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<td>6</td>
<td>... In the pipeline lag moisture behind?</td>
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<td>7</td>
<td>... comes to corrosion of pipelines (internal or external)?</td>
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<td>... pipeline erosion occurs?</td>
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<td>9</td>
<td>...dođe do stvaranja pukotina na cjevovodu?</td>
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<td>10</td>
<td>...cjevovod izgubi popratno grijanje?</td>
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<td>11</td>
<td>...dođe do popuštanja oslonca cjevovoda?</td>
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<td>12</td>
<td>...dođe do povratnog toka u cjevovodu?</td>
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<td>13</td>
<td>... je cjevovod izložen naglom porastu protoka ili tlaka?</td>
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<td>14</td>
<td>... je cjevovod izložen hidrauličnom udaru?</td>
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<td>15</td>
<td>... je cjevovod izložen vibracijama?</td>
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<td>16</td>
<td>...zavari na cjevovodu nisu dovoljni?</td>
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<td>17</td>
<td>...propušta brtva ili prirubnica cjevovoda?</td>
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<td>18</td>
<td>...nema izvedenog sustava rasterećenja tlaka?</td>
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<td>19</td>
<td>...zakaže rasterećenje tlaka?</td>
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MAINTENANCE PROGRAM
MAINTENANCE
MAINTENANCE-INSPECTION
MAINTENANCE-INSPECTION

Presented inspection object - GasFindIR
Example:
✓ Control of aging
Thermographic recording of the main pumps cooler
NEW DESIGN

- process safety management (PSM)
- all collected experience is used in new projects
CONCLUSION

✓ Good planning is crucial for risk reduction in petroleum storage depots

✓ Ageing increases the production cost

✓ Ageing increases the MAP (Major Accident Potential)

✓ It is necessary to define measures to continue operations in a safe and sustainable manner

✓ The balance between safety, cost and time pressure in any commercial hazardous installation is always difficult
THANK YOU FOR YOUR ATTENTION