OPTIMUM INSPECTION REQUIREMENTS FOR ETHYLENE CRYOGENIC TANKS

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OUTLINES

- Background
- Tank Layout
- Acoustic Emissions
- A Few Things to Consider
- When to Consider Decommissioning?
- Common sign of degradation
- Inspection Methodology
- Summary and Discussion
BACKGROUND

- API 650 and 653 do not recognize cryogenic tanks as separate category
  - Consequently, based on API 580 and API 581, RBI calls for internal inspection after a max period of 20 years
- Integrity management is more than just inspection
  - Do not introduce extra risks (e.g. Personal Safety, Business Interruption).
  - Eliminate introducing damages associated with the tank cycling on temperature.
CRYOGENIC TANKS LAYOUT

TANK BOTTOM PLATE INSULATION DETAILS

- Foam glass Thk. = 406 mm
- Dry Sand Thk. = 75 + 49 = 124 mm
- Fiber Glass blanket Thk. = 100 (outer shell) + 25 (inner shell) = 125 mm
- Bottom plate Thk. (inner tank) = 5.0 mm
- Bottom plate Thk. (outer tank) = 5.0 mm

Bottom plate Thk. (inner tank) = 5.0 mm
Bottom plate Thk. (outer tank) = 5.0 mm
ACOUSTIC EMISSIONS

• Acoustic Emission was considered for the inspection but ruled out
  ✓ Holes have to be drilled in the outer tank.
  ✓ Ice formation between probes and the inner tank.
  ✓ If solvent is used it could introduce new corrosion issue.
  ✓ Trade off between frequency and number of probes.
  ✓ Background measurements at the time of construction is not available.
A FEW THINGS TO CONSIDER

• Low fracture toughness (Leak before rupture)
• Internal tank failure would be visible on the outer tank
• It is actually more detrimental to decommission the tank
  ✓ The change in temperature during warming up could cause sleeping cracks to grow due to thermal stresses.
  ✓ Corrosion is a high possibility due to the existence of oxygen.
• Internal tank inspection in Italy did not exhibit any mechanical integrity issues and the material inside the tank was just like brand new.
• Staff safety and plant integrity.
• No incident recorded due to corrosion or erosion to motivate the internal inspection.
• It is obvious to say that there will be severe business impact.
WHEN TO CONSIDER DECOMMISSIONING?

• Internal inspection should be considered in case of the following:
  ✓ Severe earthquake
  ✓ Vaporization speed (sudden drop in tank pressure and high vaporization)
  ✓ Over pressure
  ✓ Low cycle fatigue
  ✓ Excessive liquid leak on the secondary containment
  ✓ Exceeding the LEL

• In case of the existence of cold spots,
  ✓ Fitness for service study shall be conducted to determine the right course of action (risk assessment, continue monitoring, emission test, plastic hammering, refilling of the perlite)
COMMON SIGN OF DEGRADATION ON THE OUTER TANK

• Ice formation on the external tank.
• Cold spot.
• Excessive underside corrosion of bottom plate.
• General Corrosion.
• Paint damage.
• Cracks.
• Leaks.
• Sealant damage at annular plate.
• Anchors degradation.
## ROUTINE INSPECTION

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# LONG TERM INSPECTION

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SUMMARY AND DISCUSSION

- RBI allows for a max period of 20 years without internal inspection.
- There is no credible damage mechanism that prompts for internal inspections.
- Due to selection of material, the tanks will leak before rupture.
- Tank integrity should be monitored from the outer tank.
- A set of inspections techniques for double wall cryogenic tanks are discussed.
- Cryogenic tanks should not to be considered for decommissioning for inspection, unless clear signs of internal tank leak are observed.
Thank you