SAND2019-10034PE

Life Extension of Tanks for High Pressure Storage Vessels

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Livermore, CA, USA

August 8, 2019

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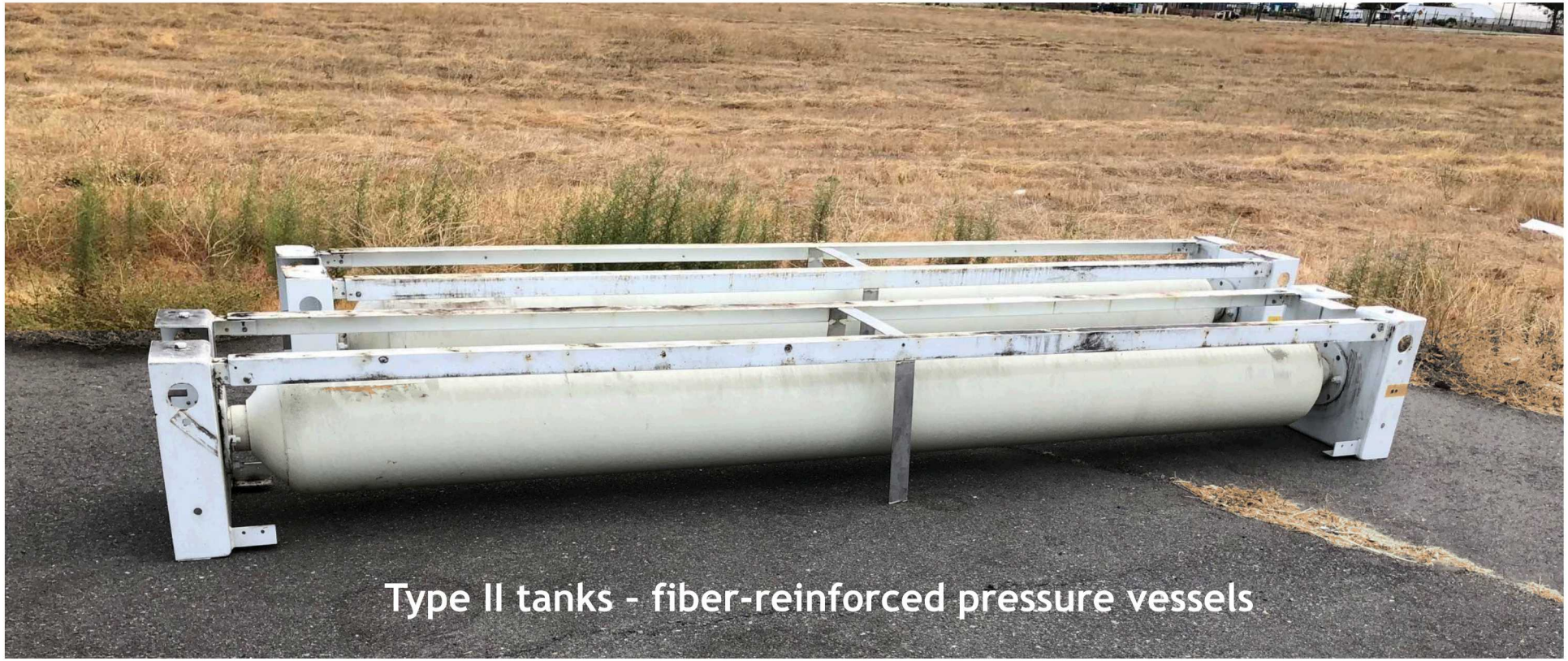
Numerous instances in reaching end of life criteria far sooner than anticipated

Design life: 37,500 cycles or 20 year (whichever comes first)

Pressure range: 13,500 psi (93 MPa) to 8,900 psi (61.3 MPa)

Reached cycle life in ~ 7 years



Type II tanks - fiber-reinforced pressure vessels

How can life of vessels be extended?

Improved definition of Cycle Counting

- Should every pressure fluctuation count as a cycle?

Defining inspection criteria

- Challenging as conventional NDE is not feasible on fiber reinforced tanks
- NDE must ultimately be a field measurement technique to make cost effective

How do we capture influence of autofrettage in these vessels?

- Residual stress

Need acceptance in Codes for life extension

- What will it take to get acceptance of life extension in codes?
- Likely some component testing.

Project Objective(s)

1) Develop understanding of opportunity space for life extension
   - Which cycles can be ignored? Collect operational data and analyze
   - Perform ΔK_{th} testing
2) Assess defect population in end of life vessels
   - Develop techniques for NDE for Type II tanks
3) Develop guidelines and protocols for life extension
   - Could range from predictive tool that operators could employ to generic guidance on what cycles can be dismissed
4) Experimental validation of life extension practice
   - Pressure cycling of miniature vessels with engineered defects?

→ The result of this effort will be science-based justification for tank life-extension which can be adopted by industry and standards.

Risks in Project

1) NDE technique to inspect steel liner of Type 2 tank not currently available
   - Response Plan: Possibly perform destructive evaluation if NDE is not identified

2) ΔK_{th} measurements in 100 MPa H_2 is challenging and time consuming
   - Response Plan: Modify pressures / frequencies to measure high fidelity ΔK_{th}

Are you interested in Participating?

- NDE technique development – (Digital Wave, Luna)
  - Can we get support in inspection?
- Data from industry – (Fiba, Becht, Air Products)
  - Can you reach out and obtain this information so we can start analyzing?
  - Are you interested in analyzing?
- Are we overlooking something? We rely on your input

Next Steps?

- How can your team contribute