Tube Rupture Credibility Assessments

Evaluate Risk and Eliminate Unnecessary Pressure Relief System Modifications

At Equity Engineering, we have developed a proprietary tube rupture credibility assessment (TRCA) methodology that determines the credibility of a tube rupture scenario by accounting for the exchanger design and the process conditions. The goal of the TRCA is to evaluate the risk of the tube rupture scenario and eliminate the need for unnecessary pressure relief system (PRS) modifications. Our work process meets all the requirements of API 521.

Conducting a TRCA will save money, increase the safety of the PRS and heat exchangers, and improve the PRS design. The rigorous analysis of the heat exchanger design will outline any potential process changes, potential damage mechanisms, and material upgrades or modifications to address a full-bore tube rupture.

The TRCA Workflow

In alignment with API 521, Equity Engineering's proprietary TRCA workflow determines whether the exchangers need overpressure protection for the tube rupture case and what type of overpressure protection is required. The TRCA will identify several decision-making points throughout a tube rupture scenario that must be considered to identify the best course of action.

1 Tube Vibration Analysis & Erosion Check

- Determine extent of tube vibration
- Consider potential of tube-to-baffle chafing
- Identify whether tubes are subject o erosion

2 Tube-to-Tubesheet Joint Design

- Determine likelihood of tube pullout
- Considers potential for fatigue

3 Metallurgical and Corrosion Analysis

- Analyze tube material, thickness, and process conditions
- Identify susceptible damage mechanisms and likelihood of instantaneous failure

4 Bundle Inspection Program Review

- Determine if appropriate tube inspection program exists
- Provide guidance and directive for further mitigating tube rupture through inspection

Case Study

Determine the Path Forward for Tube Rupture Mitigation

Industry:
Dowstream Oil & Gas

Type of Asset:
Refinery

Location:
USA

Issue:
The client identified a need to redesign the existing pressure relief system for a heat exchanger so it could adequately handle the full-bore tube rupture scenario.

Solution:
We performed a rigorous analysis of the heat exchanger design and process conditions to determine whether the exchanger was susceptible to a full-bore tube rupture via tube vibration, erosion, applicable damage mechanisms, fatigue, tube pullout, or tube buckling.

Result:
The full-bore tube rupture scenario was determined to be non-credible for the exchanger, thereby eliminating the need to redesign the existing pressure relief system. We recommended incorporating a leak detection system and regular tube inspection to mitigate the client's concern of any long-term damage that could lead to a full-bore tube rupture.

Benefits

- **Increase safety of PRS**
- **Reduce tube leak or full-bore ruptures**
- **Improve the PRS design**

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