

A Risk-Informed Technical Basis to Support Revision of the PTS Rule



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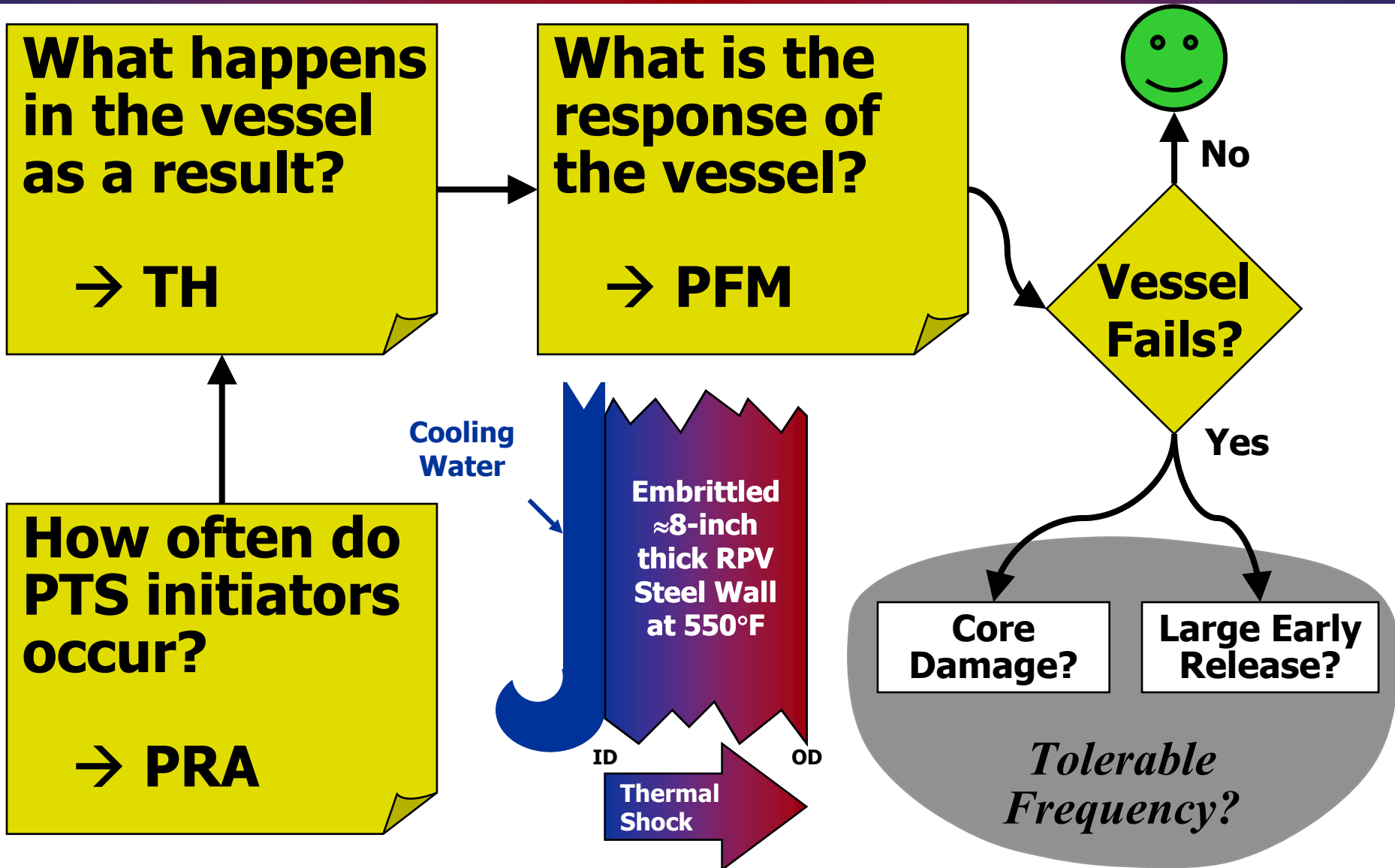
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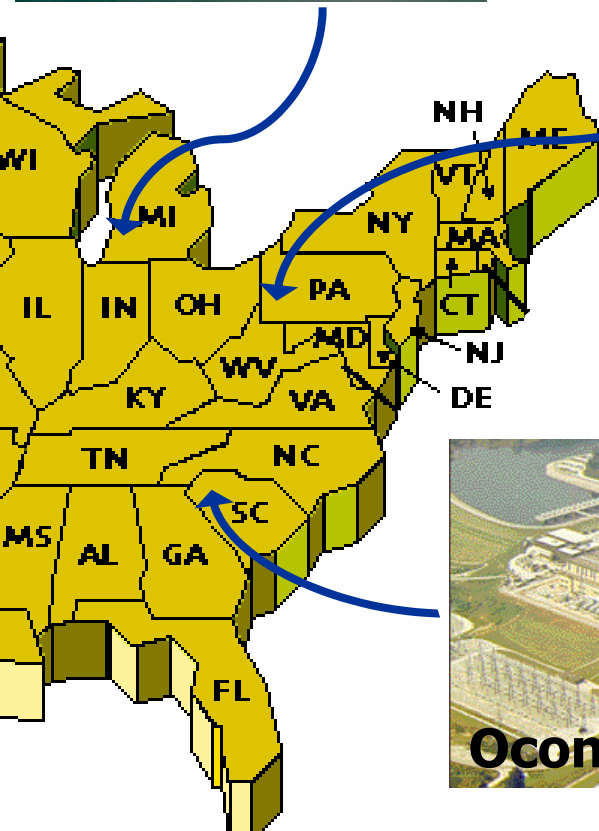
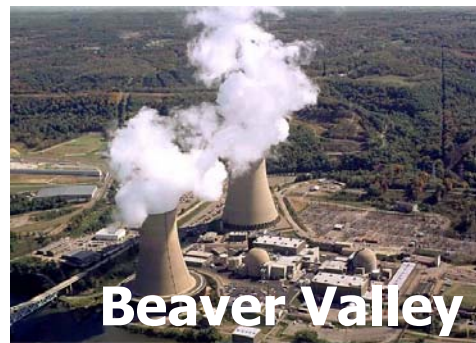
Objective

- **Perform a probabilistic assessment (calculation) of the risk of reactor pressure vessel failure arising due to pressurized thermal shock. Assessment should consider**
 - **Probability of PTS initiators occurring**
 - **Consequences of human actions**
 - **Loading of the vessel (thermal hydraulics)**
 - **Response of the vessel (embrittlement & fracture mechanics)**
 - ✓ **Crack initiation (or not)**
 - ✓ **Through-wall cracking (or not)**
 - **Effects of uncertainties on all models**
 - ✓ **Quantitative**
 - ✓ **Qualitative**

Analysis Methodology



Scope of Analysis

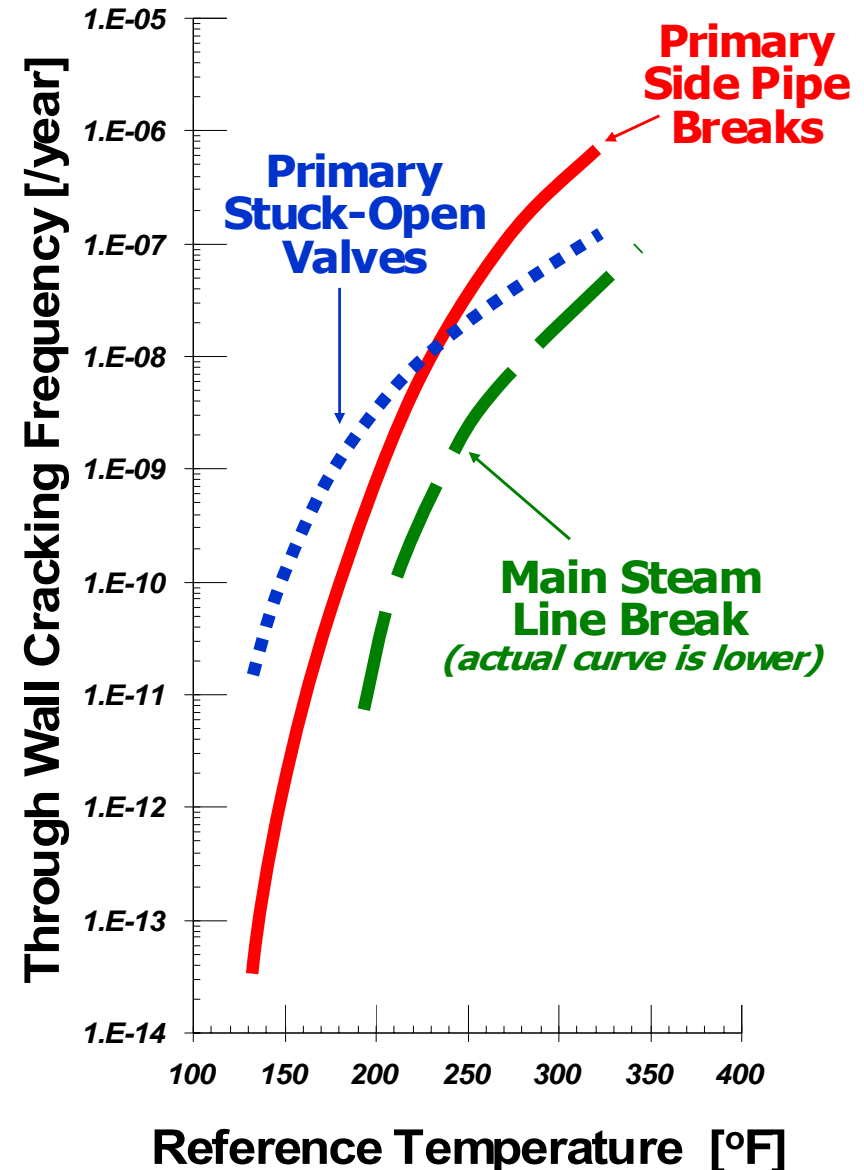


- **Detailed analysis of 3 PWRs**
 - **All PWR manufacturers**
 - ✓ 1 Westinghouse
 - ✓ 1 CE
 - ✓ 1 B&W
 - **1 plant from original (1980s) PTS study**
 - **2 plants very close to the current PTS screening criteria**
- **Generalization to all PWRs**
 - **Characteristics of materials and transients that dominate failure frequencies**
 - **Examination of 5 more**

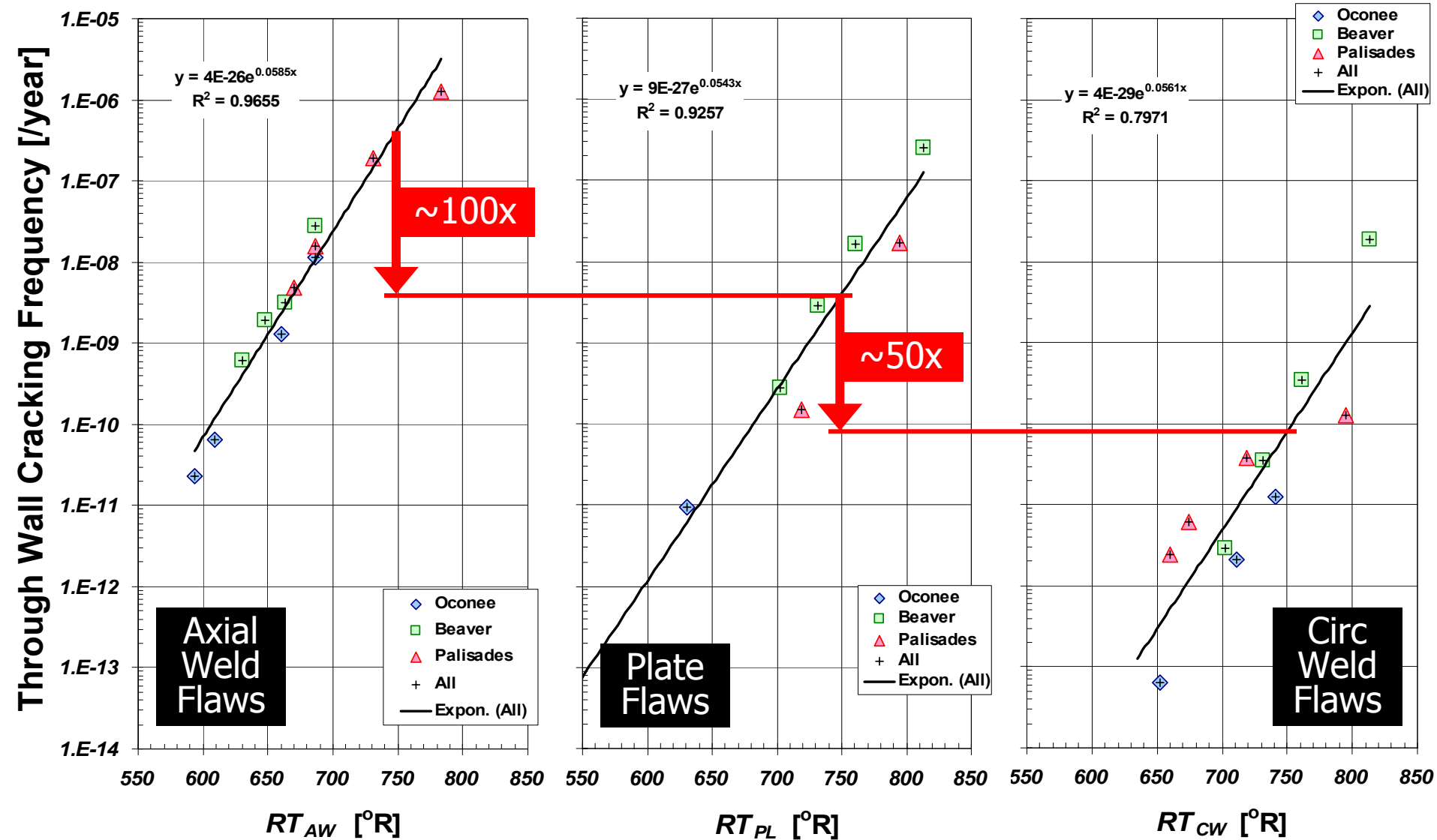
Primary Side Failures Dominate PTS Risk

- **Primary side failures dominate risk (75% or more)**
 - **Low embrittlement:** stuck open valves that later re-close
 - **Higher embrittlement:** medium & large diameter pipe breaks
- **Secondary side failures**
 - main steam line breaks
 - stuck open valves

of much smaller consequence, & only at extremely high embrittlement levels



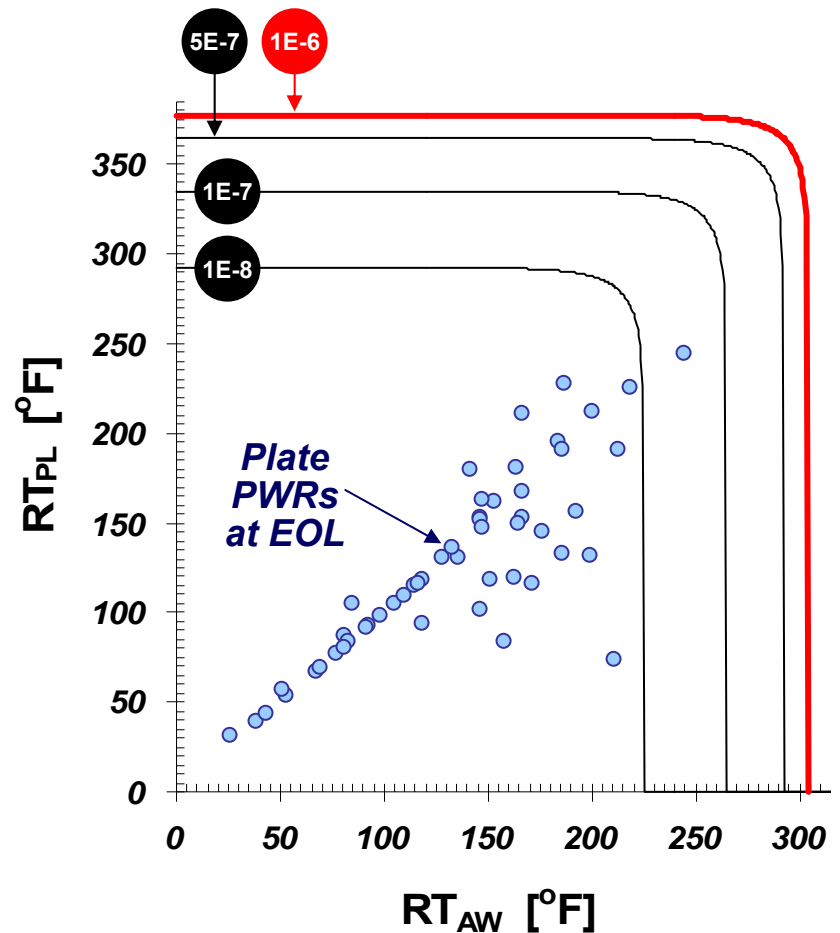
Material Properties of Axial Welds and Plates Dominate PTS Risk



Assessment of U.S. PWRs at EOL Relative to Proposed PTS Screening Limits

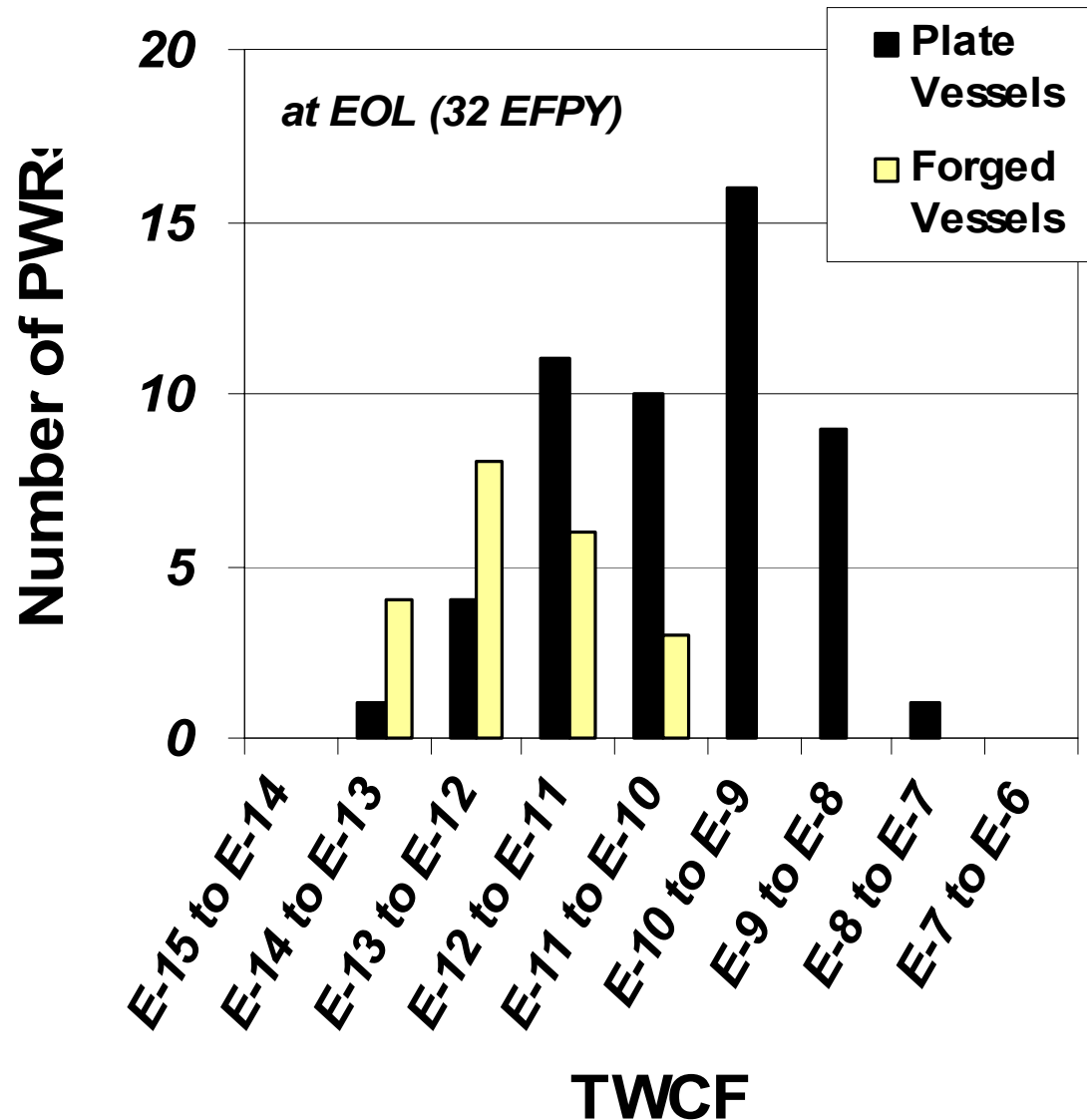
**REALISTICALLY
CONSERVATIVE
ANALYSIS REVEALS
NO PLANTS TO BE
NEAR PROPOSED
PTS SCREENING
LIMITS AT EITHER
40 OR 60 YEARS.**

Plate Welded Plants



Proposed PTS Screening Limits & Current Plant Status

THE RISK OF VESSEL FAILURE IS LOW FOR CURRENT OPERATING CONDITIONS, EVEN OUT TO 60 YEARS OF OPERATION.



Proposed PTS Screening Limits & Current Plant Status

FOR CURRENT OPERATING CONDITIONS, ALL PLANTS STAY WELL AWAY FROM NEWLY PROPOSED SCREENING LIMITS ON RT.

