

Thermal Fatigue

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NRC Concerns with Thermal Fatigue Flaws

The number of high-cycle thermal fatigue flaws in piping has increased in the past several years

While thermal fatigue is not a new issue, it is appearing in new areas

The thermal fatigue cracks have led to leakage in some cases

Some welds examined under impracticality relief requests have leaked in the next 10-year inspection interval

Industry Guidance on Thermal Fatigue Cracking

Enhanced program described in letter dated July 6, 2015 “EPRI-MRP Interim Guidance for Management of Thermal Fatigue”

Industry uses MRP-146, MRP-192

Largely covers inspections outside of normal RI-ISI programs

The guidance documents cover T-junctions and other difficult to inspect areas

Industry Guidance on Thermal Fatigue Issues

Needed Requirements:

One Time and Periodic Inspections of Select Areas

Examination Coverage:

- Examination Volume Specification – MRP-146
- Documentation of Limitations and Coverage Calculations
- Examination Volume Coverage
 - (If less than 90%) “The Responsible Engineer shall assess the potential risk from cracking in the unexamined volumes and determine if compensatory measures such as alternate examination techniques or weld crown removal are warranted.”

Base Material

Pipe base material (far from a weld) does not require Section XI inspection but are covered under MRP-146

Should these areas be addressed in ASME Code?

NRC Concerns

In one case a licensee used phased array UT to examine a weld with reduced coverage

The advanced PAUT was able to detect cracking in the weld that was missed in the same weld in a sister plant

The calculated code-qualified coverage in each case was the same, but the “best effort” in one case was sufficient while not in the other

The EPRI guidance does not provide technical advice on how to achieve higher-quality best effort examinations