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U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Extension of Risk-Informed Inservice Inspection (RI-ISI) Methodology

Dear Dr. Sheron:

The USNRC approved the EPRI Risk-Informed Inservice Inspection (RI-ISI) methodology for generic application in 1999 (Reference 1). Since that time, its application has received widespread acceptance in the industry as a means to focus resources on risk significant components and eliminate unnecessary occupational exposures (Reference 2).

Attachment 2 to Reference 3 was provided to the USNRC as a means of providing additional insights gained from more recent applications of the EPRI RI-ISI methodology. This attachment provided additional criteria for assessing the susceptibility of piping to thermal fatigue (i.e. TASCS). The criteria is being applied by some licensees that have RI-ISI submittals underway and was provided to the USNRC to support generic approval thereby avoiding the need for future plant specific approvals.

Attached is an updated description of the TASCS susceptibility criteria incorporating comments received from USNRC staff. These criteria for assessing the susceptibility to TASCS are consistent with EPRI TR-1000701, "Interim Thermal Fatigue Management Guidelines (MRP-24)".

The existing RI-ISI process includes a living program component. As such, once the final MRP guidance has been developed, it is our intent to update the RI-ISI methodology for the evaluation of susceptibility to thermal fatigue, as appropriate.

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We look forward to your review of the attached, as well as the other information provided in Reference 3.

Sincerely,

F. Ammirato for P. O'Regan

Pat O'Regan
EPRI Risk Informed Inspection Program Manager

cc: S. Ali (USNRC)
G. Holahan (USNRC)
L. Ohlshan (USNRC)
F. Ammirato (EPRI)
R. Bradley (NEI)

References:

1. SAFETY EVALUATION REPORT related to "Revised Risk-Informed Inservice Inspection Procedure" (EPRI TR-112657, Rev. B July 1999), dated October 28, 1999.

2. NEI letter from Anthony Pietrangelo to Dr. Brian Sheron (USNRC), dated October 20, 2000.

3. EPRI letter from P.J. O'Regan to Dr. B Sheron (USNRC), dated February 28, 2001

Attachments:

1. Updated TASCS Severity Assessment

TASCS Methodology

- Additional Screen -

Table 3-16 of EPRI TR-112657 contains criteria for assessing the potential for thermal stratification, cycling and striping (TASCS). Key attributes for horizontal or slightly sloped piping greater than 1" nominal pipe size (NPS) include:

1. Potential exists for low flow in a pipe section connected to a component allowing mixing of hot and cold fluids, or
2. Potential exists for leakage flow past a valve, including in-leakage, out-leakage and cross-leakage allowing mixing of hot and cold fluids, or
3. Potential exists for convective heating in dead-ended pipe sections connected to a source of hot fluid, or
4. Potential exists for two phase (steam/water) flow, or
5. Potential exists for turbulent penetration into a relatively colder branch pipe connected to header piping containing hot fluid with turbulent flow,

AND

$\Delta T > 50°F$,

AND

Richardson Number > 4 *(this value predicts the potential buoyancy of a stratified flow)*

These criteria, based on meeting a high cycle fatigue endurance limit with the actual ΔT assumed equal to the greatest potential ΔT for the transient, will identify all locations where stratification is likely to occur, but allows for no assessment of severity. As such, many locations will be identified as subject to TASCS where no significant potential for thermal fatigue exists. The critical attribute missing from the existing methodology that would allow consideration of fatigue severity is a criterion that addresses the potential for fluid cycling. The impact of this additional consideration on the existing TASCS susceptibility criteria is presented below.

- **Turbulent penetration TASCS**

  Turbulent penetration typically occurs in lines connected to piping containing hot flowing fluid. In the case of downward sloping lines that then turn horizontal, as shown in Figure 1, significant top-to-bottom cyclic ΔTs can develop in the horizontal sections if the horizontal section is less than about 25 pipe diameters from the reactor coolant piping. Therefore, TASCS is considered for this configuration.

  For upward sloping branch lines connected to the hot fluid source that turn horizontal or in horizontal branch lines as shown if Figures 2 and 3, natural convective effects combined with effects of turbulence penetration will keep the line filled with hot water. If there is no potential for in-leakage towards the hot fluid source from the outboard end of the line, this will result in a well-mixed fluid condition where significant top-to-bottom ΔTs will not occur. Therefore TASCS is not considered for these configurations. Even in fairly long lines, where some heat loss from the outside of the piping will tend to occur and some fluid stratification may be present, there is no significant potential for cycling as has been observed for the in-leakage case. The effect of TASCS will not be significant under these conditions and can be neglected.

- **Low flow TASCS**

  In some situations, the transient startup of a system (e.g., RHR suction piping) creates the potential for fluid stratification as flow is established. In cases where no cold fluid source exists, the hot flowing fluid will fairly rapidly displace the cold fluid in stagnant lines, while fluid mixing will occur in the piping further removed from the hot source and stratified conditions will exist only briefly as the line fills with hot fluid. As such, since the situation is transient in nature, it can be assumed that the criteria for thermal transients (TT) will govern.

- **Valve leakage TASCS**

  Sometimes a very small leakage flow of hot water can occur outward past a valve into a line that is relatively colder, creating a significant temperature difference. However, since this is a generally a "steady-state" phenomenon with no potential for cyclic temperature changes, the effect of TASCS is not significant and can be neglected.

- **Convection heating TASCS**

  Similarly, there sometimes exists the potential for heat transfer across a valve to an isolated section beyond the valve, resulting in fluid stratification due to natural convection. However, since there is no potential for cyclic temperature changes in this case, the effect of TASCS is not significant and can be neglected.

In summary, these additional considerations for determining the potential for thermal fatigue as a result of the effects of TASCS provide an allowance for the consideration of cycle severity in assessing the potential for TASCS effects.

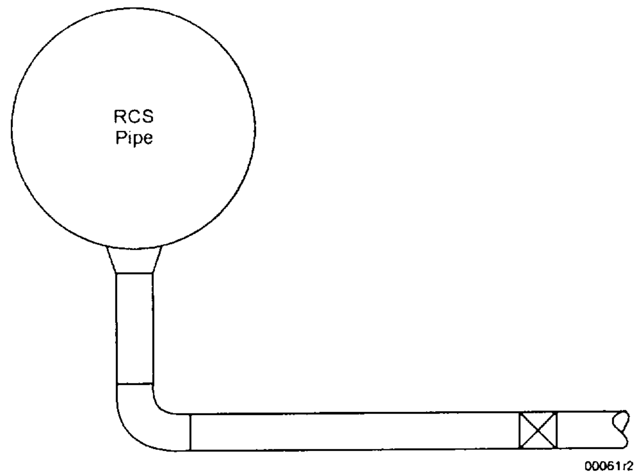

Figure 1
Downward Sloping/Horizontal Line Configuration

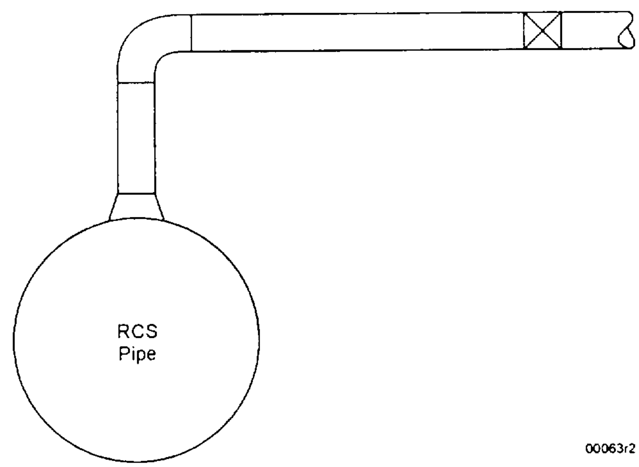

Figure 2
Upward Sloping/Horizontal Line Configuration

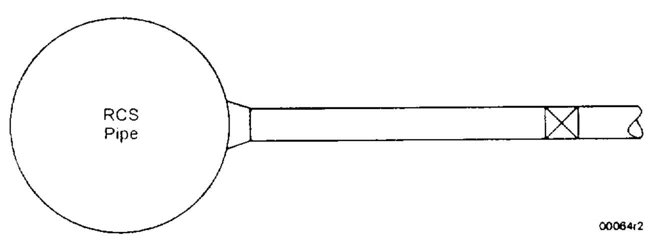

Figure 3
Horizontal Line Configuration