Task Action Plan

(1) GI number and Title	Generic Safety Issue (GSI)-188, “Steam Generator Tube Leaks or Ruptures Concurrent With Containment Bypass from Main Steam Line or Feedwater Line Breaches.”
(2) TAP Objective	The objective of this Task Action Plan (TAP) is to address unisolable secondary system breaches with containment bypass and Steam Generator (SG) tube leakage that may result in releases in excess of that allowed in 10 CFR Part 100. The technical issues to be addressed in the TAP include the ability to correctly predict SG secondary side thermal-hydraulic behavior, physical loadings, component response, resonance vibrations within the tube bundles, operator response, and risk. The TAP will address the overlap of GSI-188 with GSI-163, “Multiple SG Tube Leakage.”
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(4) GI Classification	Generic Safety Issue
(5) GI Stage	Stage 3, “Technical Screening.”
(6) Generic Issue Abstract	During the review of GSI-163, “Multiple Steam Generator Tube Leakage,” two potentially risk-significant events were identified that are not fully addressed as design basis accidents in Final Safety Analysis Reports, industry analyses, Standard Review Plans, or staff reviews. The first event is based on operating experience and design information that suggests that the potential exists for a line breach to significantly increase SG tube leakage because of resonant vibration of SG tubes from a secondary side blowdown. Alternatively, significant SG tube leakage could lead to secondary system breaches from a variety of causes. The resulting SG secondary side blowdown could further increase tube leakage due to resonance vibration within the affected SG tube bundle.
(7) Regulatory Assessment	Main steam line break and steam generator tube rupture (SGTR) are both included as design basis accidents in Chapter 15 of most FSARs and the SRP and are addressed as accident initiators in most plant-specific PRAs. However, these accident initiators are assumed to occur independently unless there is severe core damage. Moreover, a SGTR is assumed to occur spontaneously in just one tube. This GSI addresses the possibility that a main steam line or feedwater line break in an unisolable portion of the secondary system is postulated to cause a number of SGTRs or leaks. Conversely, significant SGTRs or leaks are postulated to

cause an unisolable secondary side breach which then may exacerbate the leakage.

Consequences of such an accident scenario may be significant because primary coolant could be lost to the environment through SGTRs or leaks out of the break in the secondary system. The amount of release will depend on the duration of the blowdown.

This GSI also includes concerns about increased risk from degraded operator performance because of environmental conditions that occur during this event.

Current regulations do not require consideration of two events occurring simultaneously. Since these accident scenarios are postulated and there are no regulatory requirements to consider these accident scenarios, there is not sufficient justification to take action at this time.

(8) Proposed Actions

Develop a staff policy position at the conclusion of this program if appropriate.

(9) Schedule Milestones

Receive concurrence on TAP through RES. 2nd Quarter, 2002 (Chokshi)

Develop improved methods for assessing the risk associated with SG tubes under accident conditions. Specific tasks include

a) Development of an integrated framework for assessing the risk for the accident scenarios of interest. 2nd Quarter, 2002 (Cunningham)

b) Development of improved methods for identifying accident scenarios (including MSLB) that lead to challenges on the reactor coolant pressure boundary. 3rd Quarter, 2003 (Cunningham)

c) Development of improved PRA models of the scenarios identified above, including the impact of operator actions and appropriate treatment of uncertainty. Relatively large steam line breaks have occurred at two plants during hot functional testing. Large amplitude vibrations of components and structures were witnessed that resulted in water hammers and sonic booms which affected the operators ability to communicate and carry out required actions. 3rd Quarter, 2003 (Cunningham)

Use information from existing analyses and from new results from RES thermal-hydraulic (T-H) calculations and sensitivity studies during a MSLB to estimate upper bound loads, including cyclic loads, and displacements on support structures and tubes. Factors taken into consideration will be tube support plate and wrapper design, crevices that are packed, open, or mixed, tube

support plate motion, and locking of tubes. As a start, the staff will use the TRAC-M code, however, the staff is aware of concerns with the ability of this code to accurately predict the conditions that occur very early in the transient. The staff is reviewing other codes for potential use in this study. Also, determine the effect of other secondary system breaks on tube performance. This could include the main feedwater line, the steam line supplying steam-driven auxiliary feedwater, or other steam supply lines. If no degradation is observed when using the upper bound loads, the issue will be closed. If significant damage is observed using the upper bound loads, more realistic loads will be identified and investigated to determine if similar damage results. 1st Quarter, 2003 (Chokshi/Rosenthal)

The tubes may be degraded as a result of a number of degradation mechanisms. These include outside diameter stress corrosion cracking, primary water stress corrosion cracking, fretting and wear, pitting, and wastage which are bounded by crack type flaws. It is possible that small cracks or defects could remain in service. Estimate flaw growth, if any, for a range of flaw types and sizes using bounding loads and displacements (or more realistic loads and displacements if deemed necessary) in addition to the pressure stresses. Include also any effects from tube support plate movement and cyclic loads. 1st Quarter, 2003 (Chokshi)

Estimate the margins for crack propagation for a range of crack sizes for MSLB type loads and displacements in addition to the pressure stress. 1st Quarter, 2003 (Chokshi)

Based on the margins calculated over and above the bounding loads, decide if more refined T-H analyses are required to obtain the forces and displacements of structures under MSLB conditions. 1st Quarter, 2003 (Chokshi)

Conduct tests of the degraded tubes under pressure and with axial and bending loads, simulating the MSLB and other secondary side depressurizing loads, to validate the analytical results. 3rd Quarter, 2003 (Chokshi)

Conduct analyses similar to above with refined load estimates if necessary. 3Q 2004

ACRS review. 2nd Quarter, 2003 (Chokshi)

Based on the contention, evaluate if increased SGTRs or leaks could result in secondary side breaches which could further increase tube leakage due to resonance vibration within the affected SG tube bundle. 3rd Quarter, 2003 (Rosenthal)

Establish the impact of GSI-188 on GSI-163. 3rd Quarter, 2003 (Chokshi)

ACRS review. 4th Quarter, 2003 (Chokshi)

(10) <u>Resourse Requirements</u>

Estimated NRC Staff Hours - 1.6 FTE/FY2002, 0.9FTE/FY2003
Contractor Costs - $685k/FY2002; $850k/FY2003

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1. Note to Jim Wiggins & Ivan Catton from Bob Spence, “Resonance Vibrations in Steam Generator Tubes During Steam Line Break Depressurization,” ML003726252, May 22, 2000.

2. Memorandum for Ashok Thadani, Director, Office of Research, from James T. Wiggins, Office of the Executive Director for Operations, “Staff Member Concern Regarding the Potential for Resonance Vibrations of Steam Generator Tubes During a Main Steam Line Break Event,” June 27, 2000.

3. NUREG 0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants,” July 1981.

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5. USNRC Inquiry Memorandum from W. C. Seidle, Senior Reactor Inspector, Region II to J. P. O’Reilly, Chief, Reactor Inspection and Enforcement Branch, NRC Headquarters, April 30, 1970.

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7. Letter to W. Travers from D. Powers, “Differing Professional Opinion on Steam Generator Tube Integrity,” February 1, 2001, transmitting NUREG-1750, “Voltage-Based Alternate Repair Criteria,” February 2001.

8. Letter to D. L. Farrar, Commonwealth Edison Company from M. D. Lynch, Senior Project Manager, NRR, “Issuance of Amendments (TAC Nos. M91671, M91672, M91673, and M91674),” November 9, 1995, (Enclosed Safety Evaluation Section 4.3.5).

9. Letter to USNRC from David H. Oatley, Vice President, Pacific Gas and Electric Company, “Closure of TACs M99011/M99012 - WCAP 14707/14708, ‘Model 51 Steam Generator Limited Tube Support Plant Displacement Analysis for Dented or Packed Tube to Tube Support Plate Crevices, May 3, 2000.

10. Letter to William T. Cottle, President and Chief Executive Officer, STP Nuclear Operating Company from Mohan C. Thadani, Senior Project Manager, NRR, “South Texas Project (STP), Unit 2- Issuance of Amendment Revising the Technical Specifications to Implement 3-Volt Alternate Repair Criteria for Steam Generator Tube Repair (TAC No. MA8271),” ML010710090, March 8, 2001.

11. Letter to W. F. Conway, Executive Vice President, Nuclear, Arizona Public Service Company from J. B. Martin, Regional Administrator, Region V, “NRC Inspection Report 50-529/93-14,” April 16, 1993.

12. Letter to A. Alan Blind, Vice President - Nuclear Power, Consolidated Edison Company of New York, from H. J. Miller, Regional Administrator, Region I, “NRC Augmented Inspection Team - Steam Generator Tube Failure - Report No. 05000247/2000-002,” April 28, 2000.

13. NUREG/IA-0137, “A Study of Control Room Staffing Levels for Advanced Reactors,” USNRC/RES, October 2000.