

ATTACHMENT 3

**Comments On The Thermal-Hydraulic Analysis In
NUREG-1570**

**ACRS Materials and Metallurgy Subcommittee
& Severe Accidents Subcommittee**

March 5, 1997

**Joe Hopenfeld
GSIB/DET/RES**

My reason for commenting on NUREG-1570

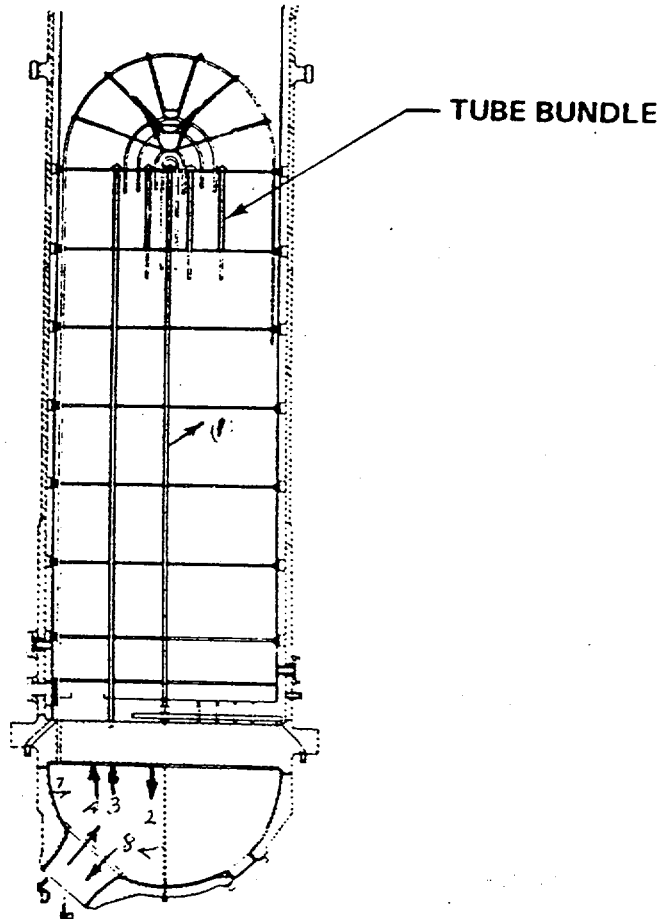
- **The results of the document are not valid because leaks through degraded tubes are ignored**
- Comparison of DPO & NUREG-1570 Results

Reference	Failure Mode	CONTAINMENT BY PASS FREQUENCY
HOPENFELD DPO- Memo To Beckjord (Effect of degraded tubes on risk from severe accidents, Sept. 11, 1992)	SG tubes fail before surge line	1.6 E-5/year
DRAFT NUREG-1570 (Feb. 1997)	Surge line fails before SG tubes for most sequences	3.3 E-6/year

- Comparison of DPO & NUREG-1570 Assumptions Regarding Mixing In SG Inlet Plenum

	DEGREE OF MIXING
DPO	None
NUREG-1570	0.87

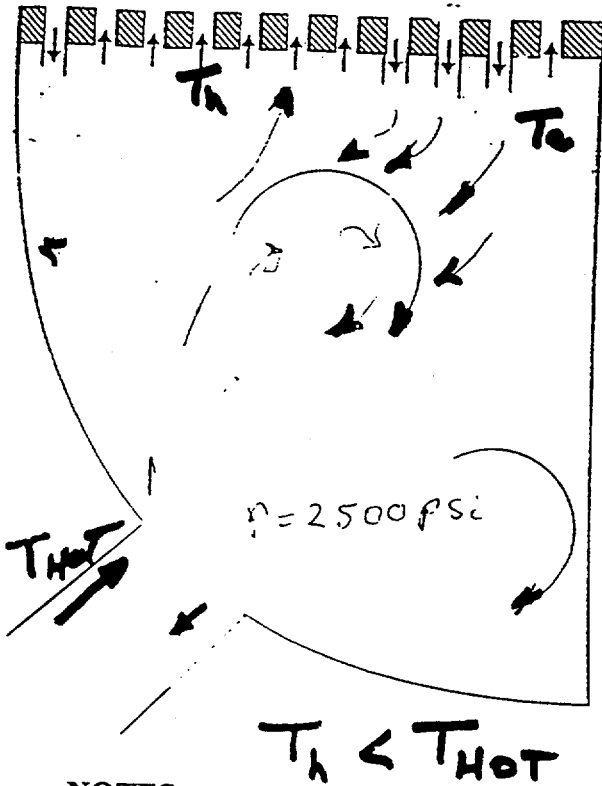
MIXING OF STEAM STREAMS IN THE INLET SG PLENUM



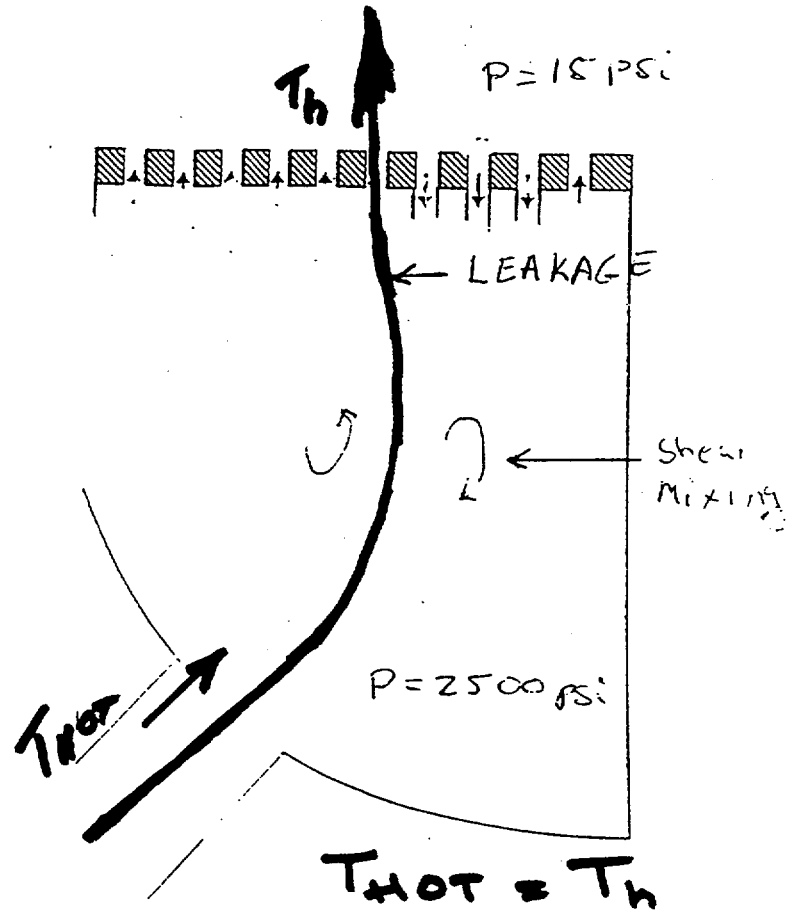
- (1) Flow from leaking tubes into the secondary side
- (2) Return flow from outlet plenum
- (3) Forced convection flow (leakage)
- (4) Free convection flow (buoyancy)
- (5) Counter flow (hot)
- (6) Counter flow (cold)
- (7),(8) Wall flow due to local temperature differences

Leaking Tubes Flow, (1) = 10 - 250 Lbs/sec
Counter Flow, (5) = 4 Lbs/sec

- Comparison between mixing (left) and non mixing models (right).
- No mixing results from high leakage (right)

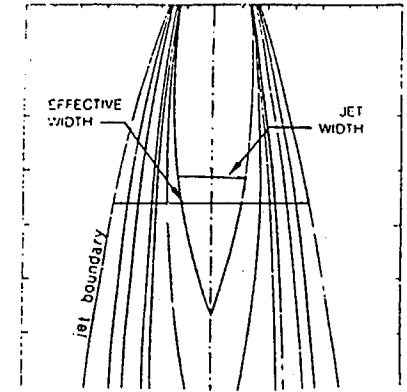
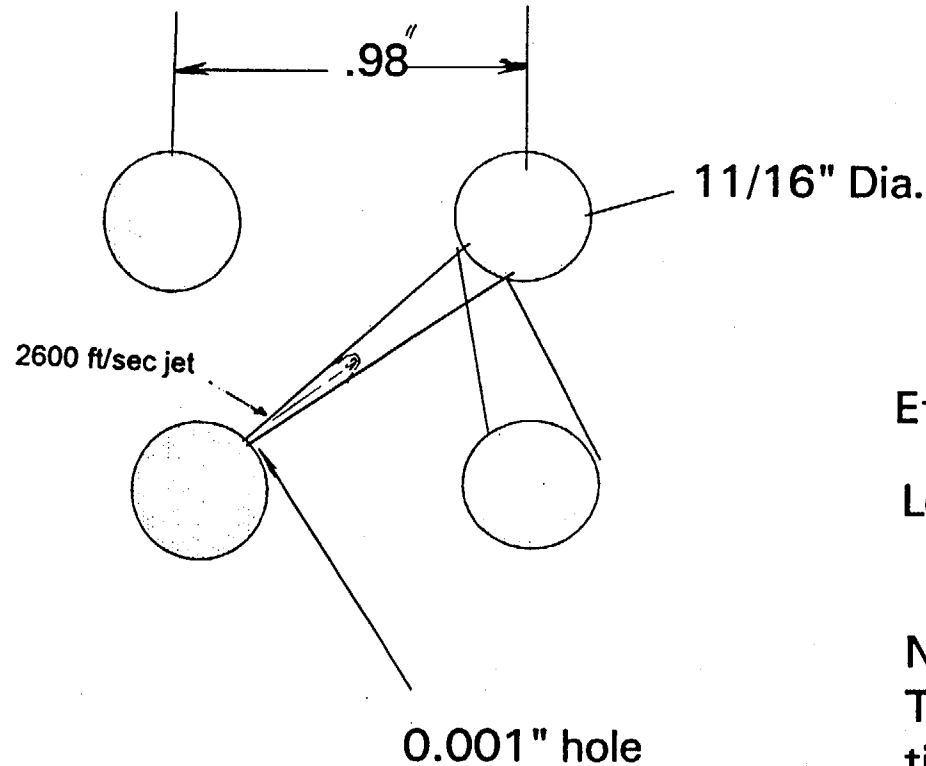


NOTES



- Mixing decreases tube temperature rise rate in comparison to the non mixing case
- NUREG analysis is based on 1/7th scale tests where there was no leakage
- Sensitivity studies which are based on 1/7th scale test data have no physical meaning. If the tests were conducted with leakage the flow pattern would have been different
- Varying the number of hot tubes and circulation ratios may be applicable when the counter flow is larger than tube leakage.

Schematic of Tube to Tube Propagation Due to 0.001" Thru Wall Defect



$$\text{Effective jet width/crack size} = 2$$

$$\text{Leakage} = 1.6E-5 (2)^N \text{ lbs/sec}$$

$$= 1.6E85$$

$$N = \text{Time for propagation} =$$

$$\text{Time to surge failure/Drilling}$$

$$\text{time} = 9000/30$$

CONCLUSIONS

- (1) Tube to Tube Damage May Propagate Very Fast
- (2) Damage to Four Tubes is a Reasonable Assumption
- (3) 4 Tube Equivalent Leakage = 260 lbs/sec

CONCLUSIONS

Risk Assessment of Severe Accident Induced Steam Generator Tube Rupture depends on the validity of the thermal-hydraulic analysis.

- **KEY ASSUMPTIONS IN THE NUREG REPORT ARE INCORRECT**
- **THE TREATMENT OF UNCERTAINTIES *DOES NOT COVER THE PROPER PARAMETERS***

**PROPOSED STEAM GENERATOR INTEGRITY RULE -
DIFFERING PROFESSIONAL OPINION**

Dr. Joe Hopenfeld, Engineer

MISSION slide 1

To inform the Commission that public health & safety will be at risk if the proposed steam generator integrity rule is approved

TO DAYS OBJECTIVE

To state my concerns

BACKGROUND slide 2

1. Identification of the leakage issue

Memo j. Hopenfeld to Beckjord, "Differing Professional Opinion" December 23, 1991

2. Supporting Information

Memo, J. Hopenfeld to Beckjord , A new Generic Issue: Multiple Steam Generator Tubes," Sept 11, 1992

3. Severe Accident - Tube vs Vent line failure

Memo, J. Hopenfeld to Beckjord, Addendum To March 27, 1992, Regarding Degraded Steam Generator Tubes, Sept. 11, 1992

4. High priority ranking of Leakage Issue by Research

Memo, C. Heltemes to F. Gillespie, GI-163 Multiple Steam Generator Tube Leakage, Sept. 28, 1992

5. Generic Letter

Memo, J. Hopenfeld to J. Taylor, Differing Professional Opinion Regarding Voltage Based Interim Repair Criteria For Steam Generator Tubes," July 1994.

6. EDO : The DPO will be addressed as part of steam generator rule making

Memo, J. Milhoan to J. Hopenfeld " Resolution of DPO regarding Voltage-Based Repair Criteria, For Steam Generator Tubes, July 13, 1994

ATTACHMENT 4

DIFFERING PROFESSIONAL OPINION

VIEW

Recent experience at the Trojan plant indicates that present inspection techniques are not sufficiently sensitive to detect steam generator tube degradation. The problem is inherent in the eddy current probe design and its use. It is essentially impossible to detect tight through the wall cracks, especially at the tube support plate regions.

The plants were not designed to operate continuously with a large number of tubes containing through the wall cracks.

My concern is that a Main Steam Line Break (MSLB) outside containment could trigger a multiple steam generator tube failure which would then result in a core melt because of depletion in coolant inventory.

NRC is currently addressing the uncertainties in the in-service inspection procedures by considering the possibility of allowing affected utilities to operate with tube imperfections beyond the 40% tech specs through the wall plugging limit.

While the above action is useful for the long term, I believe it is not focused on the main issue. The main issue is whether the core can be maintained intact and radioactivity release prevented with a MSLB outside containment and multiple steam generator tube rupture. While considerable research will be required to define a new plugging limit and change the SRP, the result will not increase plant safety. The basic problem is with the NDE procedures and their inability to predict tube degradation and leakage.

Rather than concentrating efforts on alternate plugging limits, the NRC should request all affected licensees to provide warranties that they have the capability to keep the core intact and prevent allowable dose releases with a MSLB and a multiple tube rupture of no less than 80% of all tubes.

J. Hopenfeld

J. Hopenfeld
12/23/91