UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 28, 1983

5/20/83
rlm

Docket No. 50-289

FACILITY: Three Mile Island Nuclear Station, Unit 1 (TMI-1)

LICENSEE: GPU Nuclear Corporation (GPUN)

SUBJECT: SUMMARY OF MEETING WITH GPUN ON MARCH 10, 1983 CONCERNING THE TMI-1 STEAM GENERATOR RECOVERY PROGRAM

Background

The purpose of the March 10, 1983 meeting was to brief the staff and staff consultants on the GPUN Reactor Coolant System Cleanup Program. The brief addressed the results and present status of various supporting tests, as well as the reactor coolant system (RCS) conditions for cleaning, chemistry parameters, cleaning effects, etc., The recovery program schedule and licensing considerations were also discussed. The meeting attendees are listed in Enclosure 1. The GPUN presentation material is included as Enclosure 2.

Reactor Coolant System Cleanup Program

GPUN described the purpose of the program as reducing the levels of sulfur in the RCS. This would be done by adding H_2O_2 to the coolant to convert the sulfur to sulfate. The sulfate would then be removed from the system by ion exchange. The process would be performed under protective (alkaline) conditions. GPUN characterized the potential risk of resumed or continuing steam generator corrosion as a result of the H_2O_2 cleaning process as being small. As evidence, GPUN observed that no H_2O_2 related corrosion problems have been identified at PWRs which routinely add H_2O_2 to and/or routinely form H_2O_2 in the coolant. GPUN also cited specific test results and on-going confirmatory tests as additional evidence. GPUN presented a synaposis of its February 10, 1983 meeting of industry experts on this issue; an NRC observer did attend that meeting. GPUN also presented the results of sulfur measurements on a TMI-1 steam generator tube sample, a graph of polypropylene-like film* thickness on a tube sample versus H_2O_2 cleaning time, and other test results and measurements. GPUN concluded that it needs a better understanding of polypropylene film behavior during cleaning, better comprehension of total sulfur data, and a better understanding of atmospheric sulfur contributions. GPUN further concluded that the only remaining major question is how much cleaning time is required to effectively clean polypropylene-coated tubes.

*The kinetic expansion process has deposited a thin polypropylene coating on the inner surface of the tubes.

by J. Van Vliet.

53-213
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PRIORITY ATTENTION REQUIRED

MORNING REPORT - REGION I
5-13-83

PRIORITY ATTENTION REQUIRED

TO: James Blaha, Chief, Program Support Branch, IE
FROM: James M. Allan, Region I

Licensee/Facility	Notification/Subject	Description of Items or Events
DPRP		
Three Mile Island Unit 1 DN 50-289	Fax from RI 5/12 OTSG Tube Repair Process	Once Through Steam Generator (OTSG) Tube Repair Process Update. The licensee is in the process of evaluating drip and bubble test data conducted on both OTSG's. These tests were performed to verify the leak tightness of the Kinetic Expansion process, new tube plugging and stabilization repair. The drip and bubble test are being performed to supplement Eddy Current Testing (ECT) data. Preliminary data indicated approximately 30 tubes (by the drip test) and 40 tubes (by bubble test) are leaking. The video tapes of the bubble tests are being reevaluated for correlation with the drip tests and ECT data. The licensee is identifying small pin hole leaks that are below the threshold for ECT detection. After final evaluation, it is expected that tubes with indications of leaks will be removed from service. A final bubble and drip test will be performed to verify these repairs.

REG. TORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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AUTH.NAME AUTHOR AFFILIATION
HUKILL,H.D. General Public Utilities - GPU Service Corp.
RECIP.NAME RECIPIENT AFFILIATION
STOLZ,J.F. Operating Reactors Branch 4

SUBJECT: Forwards "Rept of Third Party Review of TMI-1 Steam Generator Repair." Rept includes discussions from 821209 meeting.

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NOTES:			3	3				

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83-236

APPENDIX D

TPR Bibilography

1. Date: April 12, 1982
   Subject: Third Party Review
   To: TPR Members

   Material Transmitted:

   .1 OTSG CHARTER
   .2 Membership List and Resumes of TPR
   .3 Map to GPUN
   .4 OTSG Repair Task Organization
   .5 Preliminary Report Failure Analysis
   .6 Preliminary Report - Eddy Current Exam Program
   .7 Agenda - April 23 - TMI-1 OTSG Review Outline
   .8 Handout from April 7 Status meeting with NRC
   .9 Handout from January 25, TMI-1 OTSG Status Review (NRC)

2. Date: April 16, 1982
   Subject: TPR
   To: TPR Members

   Material Transmitted:

   .1 Attachment 8, Part I, Haudouts from April 7th Status Meeting with NRC
   .2 Two Additional Resumes of Members of TPR Team

3. Date: April 23, 1982 (No Cover Letter)
   Subject: TPR
   To: TPR Members

   Material Transmitted:

   .1 TMI-1 Steam Generator Recovery Program Task 7
   .2 Reactor Coolant System Inspection and Requalification (April 16, 1982) B&W
   .3 Handout from NRC April 23, 1982 from N. Kazanas
   .4 Reactor Coolant System Review Task 7 4/23/82
   .5 TMI-1 OTSG Tube Failure Probability from D. Slear 4/23
   .6 OTSG-B E/C Absolute (4 x 1) Results Summary from D. Slear 4/23
   .7 TMI-1 OTSG Tube Making Process 4/23

• 4. Date: May 13, 1982
Subject: Draft Minutes of First Meeting
To: TPR Members

Material Transmitted:

.1 OTSG Charter (Revised)
.2 Preliminary Specification for the Repair
.3 TMI-1 Tube Preliminary Stress Report (4/21/82)
.4 MPR Associates - draft Residual Stress Report (April 27, 1982)
.5 EPRI Reference Material

a. EPRI Activities in Support of TMI-1 OTSG Recovery Memorandum Report April 1982
b. APPENDIX 1 Status Report 2/24/82
c. APPENDIX VI Laboratory Experience of Cracking of Materials (Other than IN600) in Solutions Containing Sulfur Species

• 5. Date: June 1, 1982
Subject: Draft Minutes of May 20, 21 TPR Meeting
To: TPR Members

Material Transmitted:

.1 Telecon M. Graham w/R. Jacobs (NRC) 5/24 re: NRC Participation
.2 Memo: OTSG Testing Program 4/1/82 TMI-E3914 from D. Slear

• 6. Date: June 21, 1982
Subject: TPR
To: Prof. Arturs Kalnins

Material Transmitted:

.1 EPRI Letter: Status of Tasks Assigned to EPRI by GPUN Failure Analysis Task Group on 2/11/82

• 7. Date: July 2, 1982
Subject: TPR
To: Prof. Arturs Kalnins

Material Transmitted:

.1 Stress report Work by Jim Moore (Updated Copy)

• 8. Date: July 26, 1982
Subject: TPR
To: Prof. Arturs Kalnins

Material Transmitted:

.1 BAW - 10146 (October, 1980), "Determination of Minimum Required Tube Wall Thickness for 177 FA Once Through Steam Generators"

• 9. Date: August 10, 1982
Subject: TPR
To: TPR Members

Material Transmitted:

.1 TMI-1 OTSG Failure Analysis Report, 7/82
.2 TMI-1 OTSG As-Built Tube Stress Analysis
.3 TMI-1 OTSG Recovery
.4 B&W Evaluation of Tube Samples from TMI-1
.5 Battelle final report on Failure Analysis of Inconel 600 Tubes from OTSG A and B of TMI-1

• 10. Date: August 20, 1982
Subject: TMI-1 OTSG Repair Safety Evaluation
To: TPR Members

Material Transmitted

.1 TMI-1 OTSG Repair Safety Evaluation

• 11. Date: September, 1982
Subject: Minutes of Meeting
To: TPR Members

Material Transmitted

.1 Sulfur Cleanup Handout
.2 OTSG Logic Diagram
.3 B&W Memo of July 30, 1982 from J. F. Pearson: Report on Prequalification Charge Sizing for TMI-1 Steam Generator Tube Expansion
.4 Kazanas Handout: August 9, 1982 TMI-1 OTSG Task 4 Eddy Current Presentation to the NRC.

• 12. Date: September 17, 1982
Subject: TMI-1 OTSG Repair Process Description and Qualification
To: TPR/GORB Members

Material Transmitted:

.1 Handout from September 15, meeting in conjunction with Foster Wheeler and Babcock & Wilcox) with NRC.

• 13. Date: September 24, 1982
Subject: TPR
To: TPR Members

17. ——— OK Following Pages

MC-1750

Inter-Office Memorandum

Date March 29, 1983

GPU Nuclear

Subject INSPECTION OF LEAKING PLUGS AND CORRECTIVE MEASURES

To M. J. Graham

Location CHB

The following is a summary of inspections and corrective actions for the leaking Westinghouse plugs which will answer the NRC inspectors question regarding the subject matters:

1. The leaking plugs will be diatested prior to their removal to obtain the actual wall-thinning in order to determine if any under-roll conditions existed. Immediately after plug removal, the tube end and the I.D. surface of the tubes will be visually inspected to verify if there are any cracks, flaws, deposits or surface imperfections. Engineering will evaluate the inspection results to determine if they can be repaired by replugging with Westinghouse rolled plugs. If there is no evidence of surface imperfection or cracks in the rolled area of the tube end, the tube will be honed, cleaned and replugged with a new Westinghouse plug. It has been justified by the intentionally "Defective Tube Test" that a circumferential crack at 3/8" from the tube end will not affect the leak sealing capability of the rolled plug designed for TMI-I. These results were documented in W WCAP Report - 10084.

2. It has been proven by the qualification test that when the tube was replugged after honing, a leak tight joint resulted. Therefore, it is concluded that the leaking plug will be repaired by replugging as described above.

3. Should cracks or longitudinal indications be found in the rolled area of the tube end, an explosive plug will be utilized as the alternative repair method to isolate the defects instead of the mechanical rolled plug.

4. Bubble and Drift Tests will be performed to verify whether the repair is satisfactory. The backup repair method of utilizing B&W's explosive plug MK-3 type will assure that a leaktight joint is attained based on B&W's experience and test results.

C. K. Lee

Heat Transfer & Auxiliary Equipment Manager

CKL/atk

cc: J. J. Colitz
B. D. Elam
D. G. Slear
H. A. Schmidt

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GPUN's acceptance standard for OTSC plug welds for welder qualification is more stringent than ASME Section XI Code since it is realized that the weld size measurement/check on production welds is not feasible. GPUN's acceptance criteria for welder qualifications of OTSC stabilizer plugs are as follows:

a. The welder qualifies (i.e. weld 5 plugs consecutively) on a mockup to simulate the actual tube/tubesheet configuration with simulated physical restraint (e.g. access condition, face mask).

b. The test set passes the liquid penetrant test as per ASME Section XI and III Code requirements.

c. Twenty (20) weld faces upon sectioning be macro examined at 10X and then micro examined at 100X for cracks, lack of fusion, etc. It should be noted that the Code requires only macro examination at 10X for crack only. GPUN does not accept lack of fusion, gross porosity or inclusions or any sharp notches in addition to the presence of any cracks.

d. The minimum weld throat (or leak path) measurement for welder qualification is based upon stress analysis data (and not on Code required 2/3X T) for the actual weld. In the case of the modified design stabilizer plugs the minimum acceptable leak path/weld throat is .027" (instead of .022" required for Section III & XI qualification). In addition, horizontal and vertical leg of the welds are measured to assure the consistancy of the welds.

The above acceptance standard reflects very clearly how it is more stringent than the Code. Although not specifically stated in GPUN procedure(s), in practice, a welder is given only one chance for requalification whereas the Code is open on the number of requalification tests. GPUN's position is that the conservatism applied to the qualification acceptance criteria has a more significant impact on the quality of production welds than relying on final inspection to assure acceptable welds.

A question was raised by Mr. Lee on how GPUN assures that the production welds have the minimum throat size (.027" in this case). The weld size measurement of the production welds by nondestructive means is not feasible. The Code realizes this and therefore requires either visual or liquid penetrant test for final acceptance. A liquid penetrant test will reveal linear indications open to the surface. In the past twelve (12) months, GPUN Laboratory has examined over 300 such welds and did not observe any crack or linear indication open to the surface. Therefore, the usefulness of performing LP testing on the plug welds in the OTSC's is of questionable value. It should be noted that during or before LP examination, grinding may actually reduce the weld size. The writer believes that a thorough and careful visual examination of the production welds will yield more meaningful result than a LP test.

S. K. SAHA

SKS/PSC:lbq

CC: R. Schmidt
C. E. Lee
ED & CC BA 120012

Inter-Office Memorandum

GPU Nuclear

Date March 28, 1983
MTI-1296

Subject OTSG Stabilizer Plug Welds - TMI-1

To D. C. SLEAR Location Reading

1. Introduction:

On March 25, 1983 Mr. C. K. Lee of Mechanical Components contacted this writer to discuss and review the weld acceptance criteria for modified B&W stabilizer plug to tube/seal welds on the TMI-1 OTSG's. This subject was raised by Mr. Lee in context of the recent NRC audit issue to provide engineering justifications of postweld inspection being performed on OTSG stabilizer plug (modified design) welds at TMI-1.

2. Evaluation and Conclusion:

The writer upon evaluation concluded the following:

a. The present GPUN requirements for welder qualification and postweld inspection meet the requirements of ASME Section XI Code.

b. The GPUN welder qualification requirements, as discussed below, are more conservative than ASME Section XI Code requirements. This conservatism provides a greater degree of assurance that Code requirements will be met on the production welds.

c. Historically plug weld qualification samples have not revealed rejectable liquid penetrant indications. Therefore, assuring quality welds and minimum throat size on production welds is best addressed by adequate welder qualification and not by the final inspection performed.

3. Discussion:

The above plug welds fall within the jurisdiction of ASME Section XI. TMI-1 is committed to meeting the requirements of ASME Section XI 1974 edition up to Winter 1975 Addenda. Since this Code edition does not address tube plugging situation, the requirements of ASME Section XI 1980 edition up to Summer '81 Addenda is being utilized by GPUN. The requirements of Section XI (1980) Code show that to qualify a WPS or a welder, five consecutively welded plugs on a similar mockup with simulated physical restrictions must pass a liquid penetrant test, followed by macro examination (10X) of twenty (20) resultant weld faces (after cutting). These examinations shall show no cracks and the welds shall have a minimum throat (or the minimum leakage path) of 2/3X tube wall thickness. For the production welds the same Code specifies a visual or liquid penetrant examination as the final NDE acceptance criteria before leak test.

A0000648

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 3/29/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side		
	A. Temp. Chem. System		
2.	Ops OTSG Status		
	. OTSG Level "A" - 576"		
	. OTSG Level "B" - 571" will be filled in an hour		
	. Ship Backing Plates for "A" Upper Manway		4/1
3.	Post Expansion		
	. Felt Plug Blowing Device-Store at Reactor Bldg		
	. Final Freepath - Blow Plugs from Top		TBD
	. B&W Equipment		3/27
	. Revised B&W Proposal		TBD
4.	Immunol Flush System		
	. Revised Spec for Flushing	T. Functions	TBD
5.	Tube Plug Stabilization		
6.	Miscellaneous Items to Resolve		
	. Hydrogen Peroxide Tube Soak		

B W is done 1 in upper below the spec. no plug found

B Dia 30 tubes fail / 21 / 8 plugs did not meet spec

A upper head qualified taper plug

Fri Sat call-in workday

A bad lot of explosives 9 tubes 36" up into the tube

51 done 67 good plugs not enough on site to finish the job

2 Westinghouse plug that will not come out will be plugged

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OTSG REPAIRS DATE 3/29/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	B&W
345-82	2 Tubes Plugged Incorrectly	
354-82	Documentation for Immunol-1st Batch	Eng
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs → hydro lasing	
067-83	Endmilling to 40 mils	
064-83	Holders for Stabilizers	
	Removal W Rolled Plugs	
	Two Explosive Plugs in One Tube	

manner
~~lasing~~ mingle

8. Tube Endmilling
   . Photos

9. Rad Con Exposure Data (Based on SRDs) as of 3/28
   . W Plugging - 13.8 Man Rem
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 778.2 Man Rem
   . Total OTSG Exposure since Nov 1981 - 954.4 Man Rem

10. Bubble and Drip Test
    6 Drip Test on 10

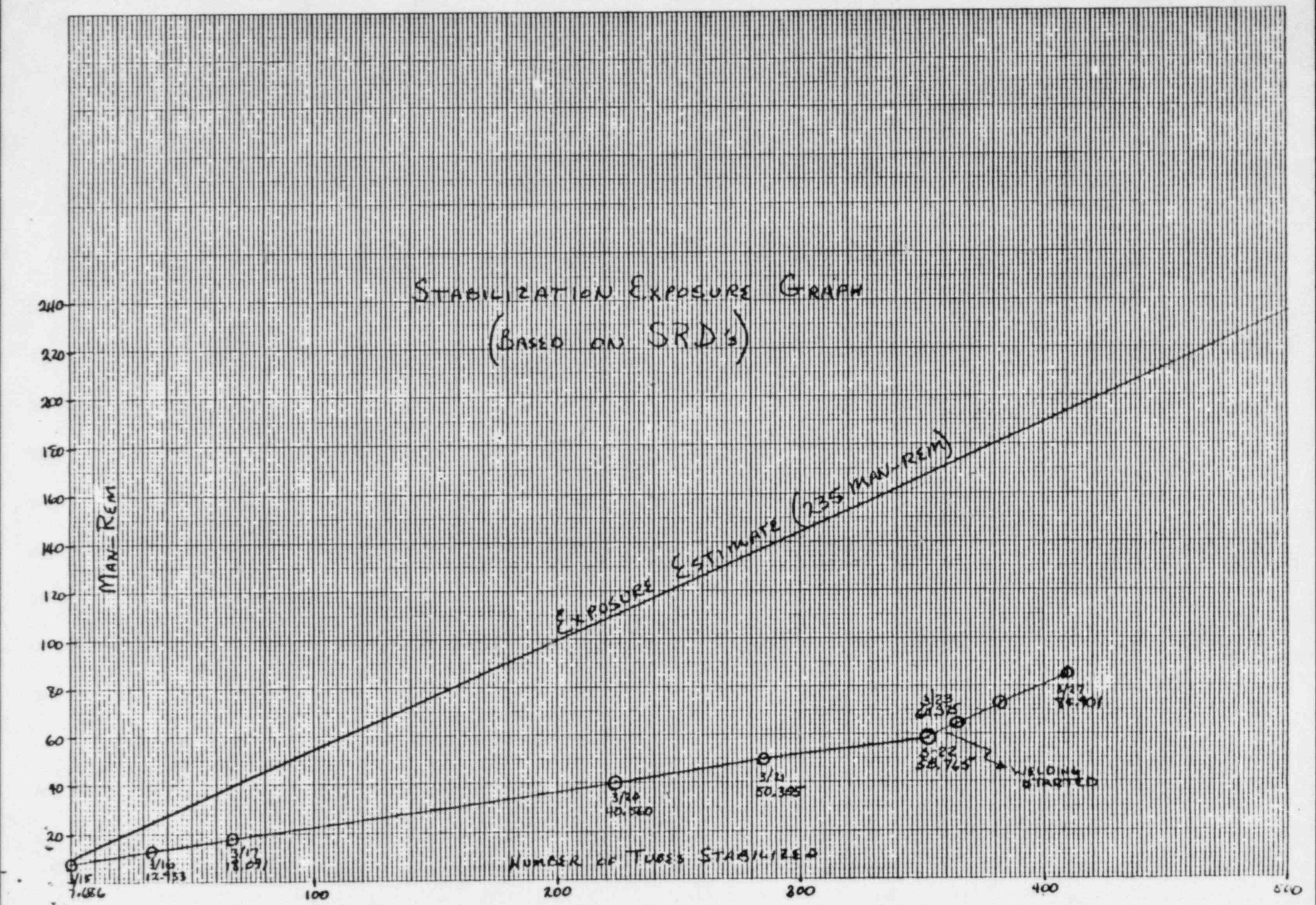
11. Cleaning of the Cold Legs
    . Issue Purchase Requistion for Vendor

12. Anticipated Jumps

Date	Description	Responsibility
3/29	A - Upper - → Water found tube	Levin/Catalytic
	A - Lower - explore	
3/29	B - Upper - drop test	
	B - Lower -	

first inspection on Monday

1500



46 1512

K&E 10 X 10 TO THE CENTIMETER 18 X 25 CM
KEUFFEL & ESSER CO. MADE IN U.S.A.

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 3/30/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side		
	A. Temp. Chem. System		
2.	Ops OTSG Status		
	. OTSG Level "A" - 576"		
	. OTSG Level "B" Full Wet Layup		
	. Ship Backing Plates for "A" Upper Manway		4/1
3.	Post Expansion/Felt Plug Blowing		
	. Felt Plug Blowing Device-Store at Reactor Bldg		
	. Final Freepath - Blow Plugs from Top		TBD
	. B&W Equipment		3/27
	. Revised B&W Proposal		TBD
	. Issue Procedure for Felt Plug Blowing	G. Kull	
4.	Immunol Flush System		
	. Revised Spec for Flushing	T. Functions	TBD
5.	Tube Plug Stabilization		
	. Solution for Removing 9 Misfired Plugs		
6.	Miscellaneous Items to Resolve mtg at 10:		
	. Hydrogen Peroxide Tube Soak		
	. Makeup Line Backflush STP		

Westinghouse

OTSG REPAIRS DATE 3/30/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	B&W
345-82	2 Tubes Plugged Incorrectly	
354-82	Documentation for Immunol-1st Batch	Eng
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
067-83	Endmilling to 40 mils	
064-83	Holders for Stabilizers	
	Removal W Rolled Plugs	

8. Tube Endmilling
   . Photos

9. Rad Con Exposure Data (Based on SRDs) as of 3/28
   . W Plugging - 13.8 Man Rem
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 778.2 Man Rem 785.4
   . Total OTSG Exposure since Nov 1981 - 954.4 Man Rem 961.6

10. Bubble and Drip Test
    . Results of Drip Test at "B" Weekend of Reserves
    upper ~~tube~~ tube sheet
    11 tubes one 28 drips/min → 7 more tubes

11. Cleaning of the Cold Legs

12. Anticipated Jumps

Date	Description	Responsibility
3/30	A - Upper - Westinghouse template	Levin/Catalytic
	A - Lower - Exposure plug	
3/30	B - Upper - drip test	
	B - Lower -	

Westinghouse will recall for fourth time

2:00PM Process Center on Hydrolaz

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 3/31/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side		
	NC A. Temp. Chem. System		
2.	Ops OTSG Status		
	. OTSG Level "A" - 576" (Depressurized)		
	. OTSG Level "B" Full Wet Layup		
	. Ship Backing Plates for "A" Upper Manway		4/1
3.	Post Expansion/Felt Plug Blowing		
	. Felt Plug Blowing Device-Store at Reactor Bldg		
	Started AP1030 . Final Freepath - Blow Plugs from Top		TBD
	. B&W Equipment		3/27
	. Revised B&W Proposal		TBD
	. Issue Procedure for Felt Plug Blowing	G. Kull	
4.	Immunol Flush System		
	. Revised Spec for Flushing Version five	T. Functions	TBD
5.	Tube Plug Stabilization		
	. Solution for Removing 9 Misfired Plugs	300	60 shots left 27 shots on site
	. Removal of W Plugs		
6.	Miscellaneous Items to Resolve	the small loop will go in	
	. Hydrogen Peroxide Tube Soak		
	. Makeup Line Backflush STP		

OTSG REPAIRS DATE 3/31/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	B&W
345-82	2 Tubes Plugged Incorrectly	
354-82	Documentation for Immunol-1st Batch	Eng
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
067-83	Endmilling to 40 mils	
064-83	Holders for Stabilizers	
	Removal W Rolled Plugs	

8. Tube Endmilling
   . Photos

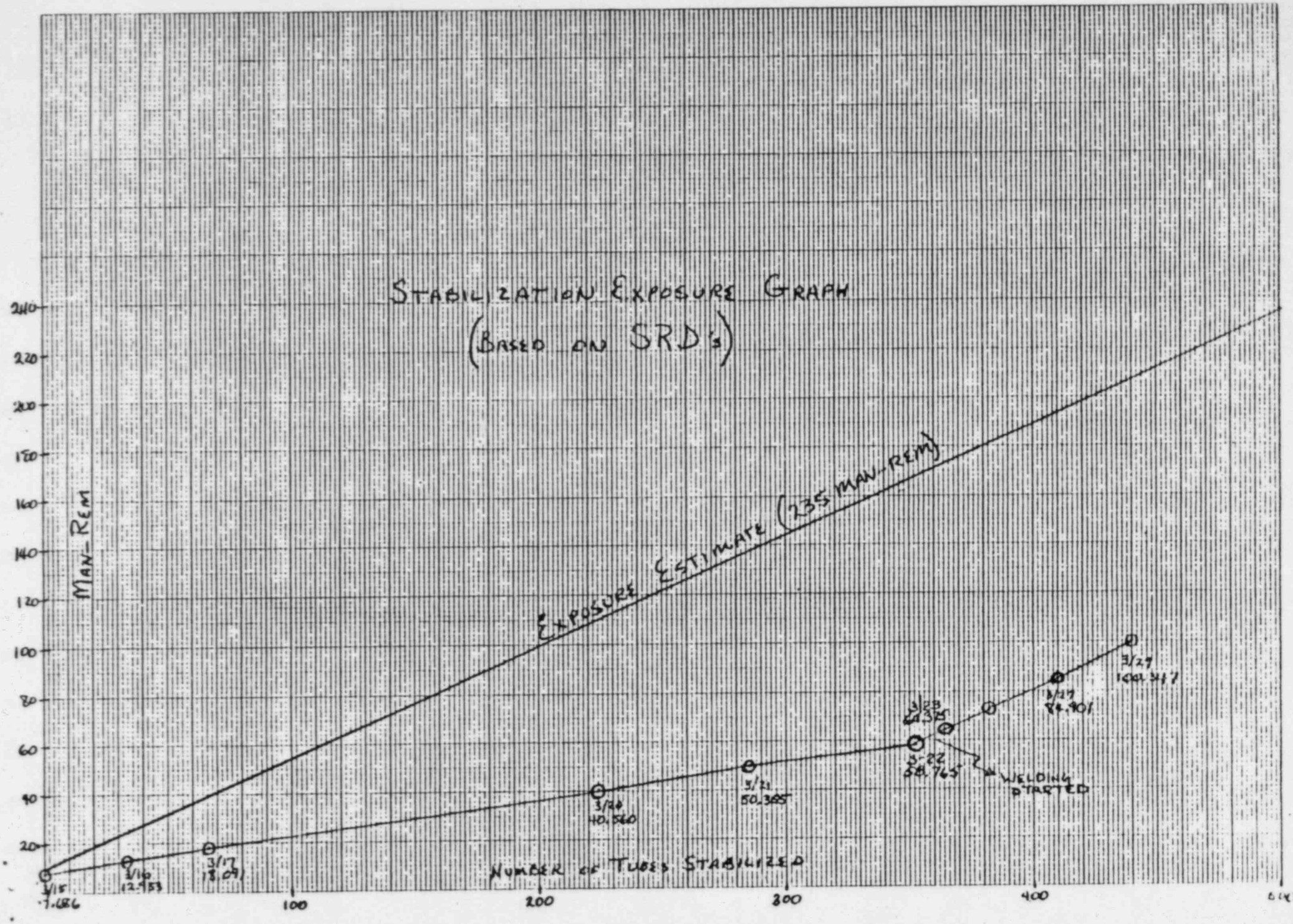
9. Rad Con Exposure Data (Based on SRDs) as of 3/30
   . W Plugging - 13.8 Man Rem
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 794.7 Man Rem
   . Total OTSG Exposure since Nov 1981 - 970.9 Man Rem

10. Bubble and Drip Test
    . Results of Drip Test at "B"
    4 Additional Preliminary numbers, B&W plugs, 22 Tubes that leak

11. Cleaning of the Cold Legs

12. Anticipated Jumps

Date	Description	Responsibility
3/31	A - Upper - Westinghouse templates	Levin/Catalytic
	A - Lower - explosive plugging	
3/31	B - Upper - 1st plug blown	
	B - Lower -	blob


STABILIZATION EXPOSURE GRAPH
(BASED ON SRD's)
EXPOSURE ESTIMATE (235 MAN-REM)
MAN-REM
NUMBER OF TUBES STABILIZED
240
220
200
180
160
140
120
100
80
60
40
20
100
200
300
400
3/15
7.686
3/16
12.553
3/17
18.09
3/20
40.560
3/21
50.385
3/22
58.765
3/23
64.345
3/27
84.901
3/29
WELDING STARTED

4/4/83 to 4/5/83

DAILY REPORT - UNIT 1

(1) PRIMARY PLANT CONDITIONS

Pressure	0 psi
Temperature	100°F (90-110°F)
Cooling Mode	DH Loop B
Water Level	Primary side - OTSG's drained; RCS at 10 to 15 inches above center line of cold leg - open to atmosphere
OTSG-A	Nitrogen supplied - Drain to 572
OTSG-B	Nitrogen supplied - Full wet layup

(2) WORK FOR NEXT PERIOD

A. RC-H-1's - Engr.

1. Radiation Exposure - Rad Con (as of 4-4-83 0001)

   22.6

   a. Total OTSG manrem since first blast - 821.318 Rem
   b. Number of company employees greater than 2000 mrem (year to date) - ~~22~~ 21
   c. High individual - company (year to date) - 2317 mrem NC
   d. Total OTSG man rem since Nov. 1981 - 997.507 Rem 1003.789
   e. High individual - contractor (year to date) - 2.617 Rem 2.766

2. OTSG-B (24 hours per day)

   a. Hot plugs/cold leg plugs installed J-leg covers installed - Taper plug to be installed
   b. Drip test (~~22~~ 23 leakers) 24 HR
      - 21 tubes (no plugs)
      - 1 B&W plug
      - determine where leak is at
   c. Felt plug blow - In progress

3. OTSG-A (20 hours per day)

   a. Hot plug/cold leg plugs installed J-leg covers installed
   b. Westinghouse roll plugs - In progress
      - 6 to remove (4 done) 42 installed
      - 231 tubes to plug
   c. 5 tubes to weld in upper
      2 tubes come out

B. Rad Waste Area - Ross

1. 4/4/83 (3-11)

   ~~a.~~ Rx Bldg. laundry
   ~~b.~~ LWST area
   c. Neut tank room Resched
   ~~d.~~ Hydrolaser setup for przr inspection

E. EX Steam Defect - (MO-T-2C)

1. Fix for pipe indication - CAT
   - ~~Job order DRF 8789 by 3-31-83~~
   - Start work 4/5/83

2. Install insulation - CAT
   A 200-856/10-0469; purchasing NC
   Bids 4-12-83

F. Decon Facility - Rad Waste Ops
   Repair weld leak - MM

G. Valve Inspection (RC-V-2/RC-RV-2)

1. RC-RV-2 (all parts on site for reassembly) Fuhrer
   Parts at Batell (Analysis in process)
   (SP 1101-28-004) for cleaning - QC problem
   - Valve body - Intermediate Bldg.
   - Parts to clean - 4-4-83
   - Need criteria for PT/X-ray
   - X-ray work (2 welds) 4-6-83
   - PT work (2 welds and seat area) 4-6-83
   - Reassemble WO - 4-11-83
   - Leak test
   - Pop test

2. RC-V-2
   - Valve body - Hot Shop
   - Wall thickness measurements - Q.C.
   - PT work
   - X-ray work

3. RC-V-1 at weld Engr
   - Weld leak off line (after przr inspection)

4. Przr inspection - Engr./Maint/Ops
   a. Manway
      1. Mag particules test studs (11 studs) 4-5-83 ← H A Machine Shop
      ~~2. Swipe manway cover~~
      3. 1 stud clean in place and test

   b. TV inspections

   c. Man Entry 4-5-83 0700
      ~~1.~~ Preparation to take scrapes/swipes
      ~~2~~ Swipes
      - Highest point above MW
      - Scope in SP-1101-22-103 paragraph 4.4
      ~~3.~~ Sludge sample from bottom of przr - Rad Con
      4. Rad survey heater area - Rad Con

HTR Area Clean Rad

<¼" ←

1.4 R/HR

500 mR/HR Contact
500 mR/HR

L. River Water Interim Lube Water System - schedule 4-~~4~~-83 (3-11)

M. Snubber Testing (10) - Shovlin

1. MS-209 - Failed - need to install — rebuild
2. MS-211 - passed - need to install
3. FW-111 - passed - need to install

N. DH-P-1A Repair - Harper Works daylight

- Replace/reassemble parts - in progress O-ring (QC accept)
- Concentricity readings
- Run pump — ? Fri 1st Thing Monday

O. Hayes Gas O_2 Analyzer - Harper/Snyder
- Install new pump 4/5/83
- Place in service

P. WDL-P-14A/B Mech Seals - Shovlin - In progress

Q. WDL-V-128 Diaphragm - Shovlin - Schedule

R. ~~Task 8 Energize New MCC 4-5-83~~ Back To Deen.
Screen Drum Pump Reading before Restart

(3) TECH SPEC CLOCK ITEM

Hayes Gas 4-3-83 (7 days) 1400

(4) RELEASES

NONE

(5) RADIOACTIVE WASTE

A. Limits on shipment - None

B. Shipment past period - None

C. Planned shipment - ~~4 Hitman liners 4-5-83~~

R. C. Troutman
Ext. 8154

Document ID 0037K

GPU Nuclear

TMI-1 OTSG Repair and Return to Service

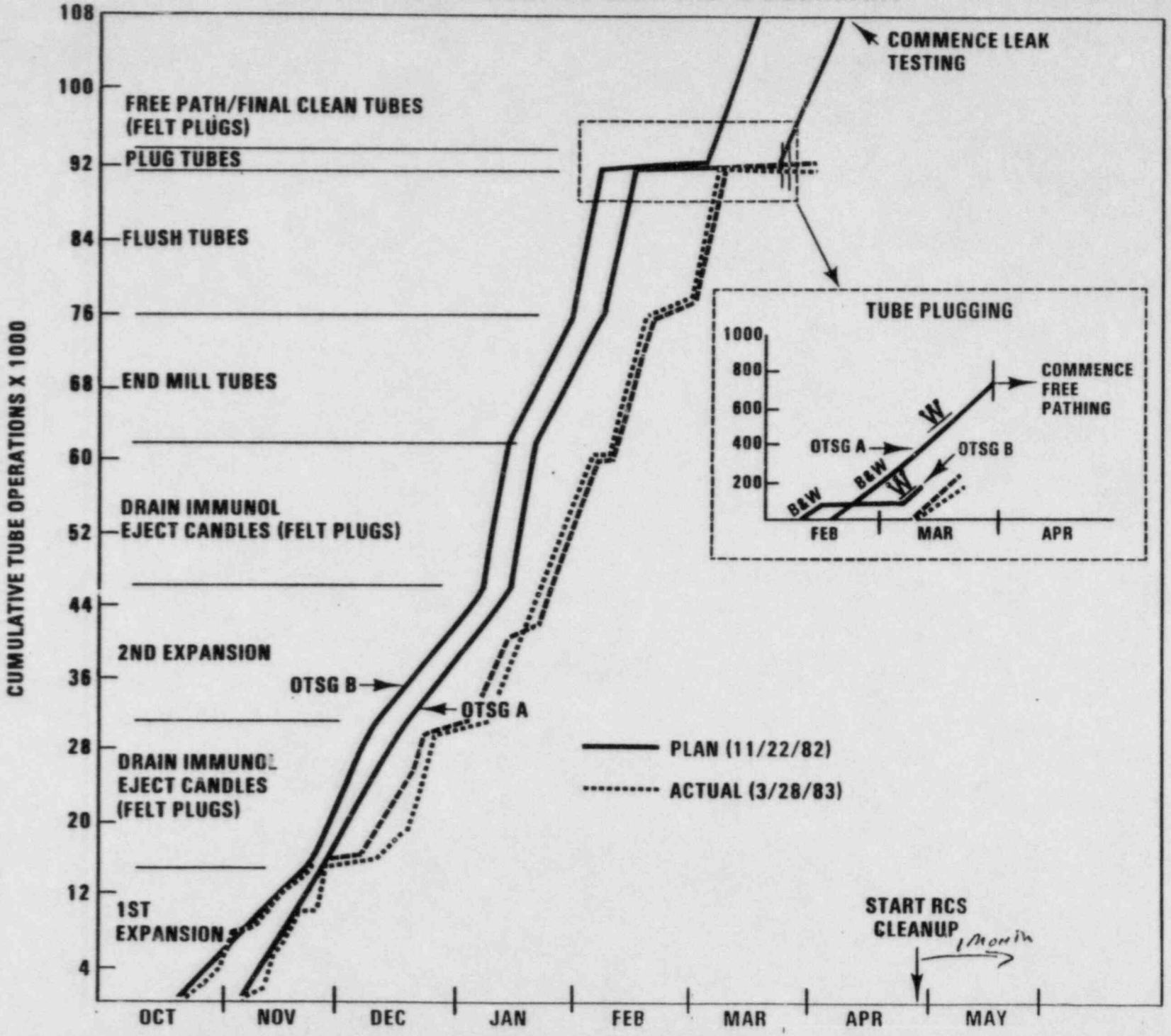
NRC Presentation
April 5, 1983

NRC Presentation 4/5/83

Agenda

I.	• Introduction/Repair Status • Overview of SER Logic • Plugging/Stabilization Plans • Qualification Zone 8x1 ECT Indications • ECT Future Plans	D. Slear
II.	• Leak Before Break	D. Croneberger
III.	• Operational Guidelines	G. Broughton
IV.	• Support Systems Sulfur Investigations • Sulfur Transport Mechanism • Corrective and Preventive Actions	M. Sanford
V.	• Startup Program	J. Carroll

OTSG REPAIR PROGRESS GRAPHICAL SUMMARY

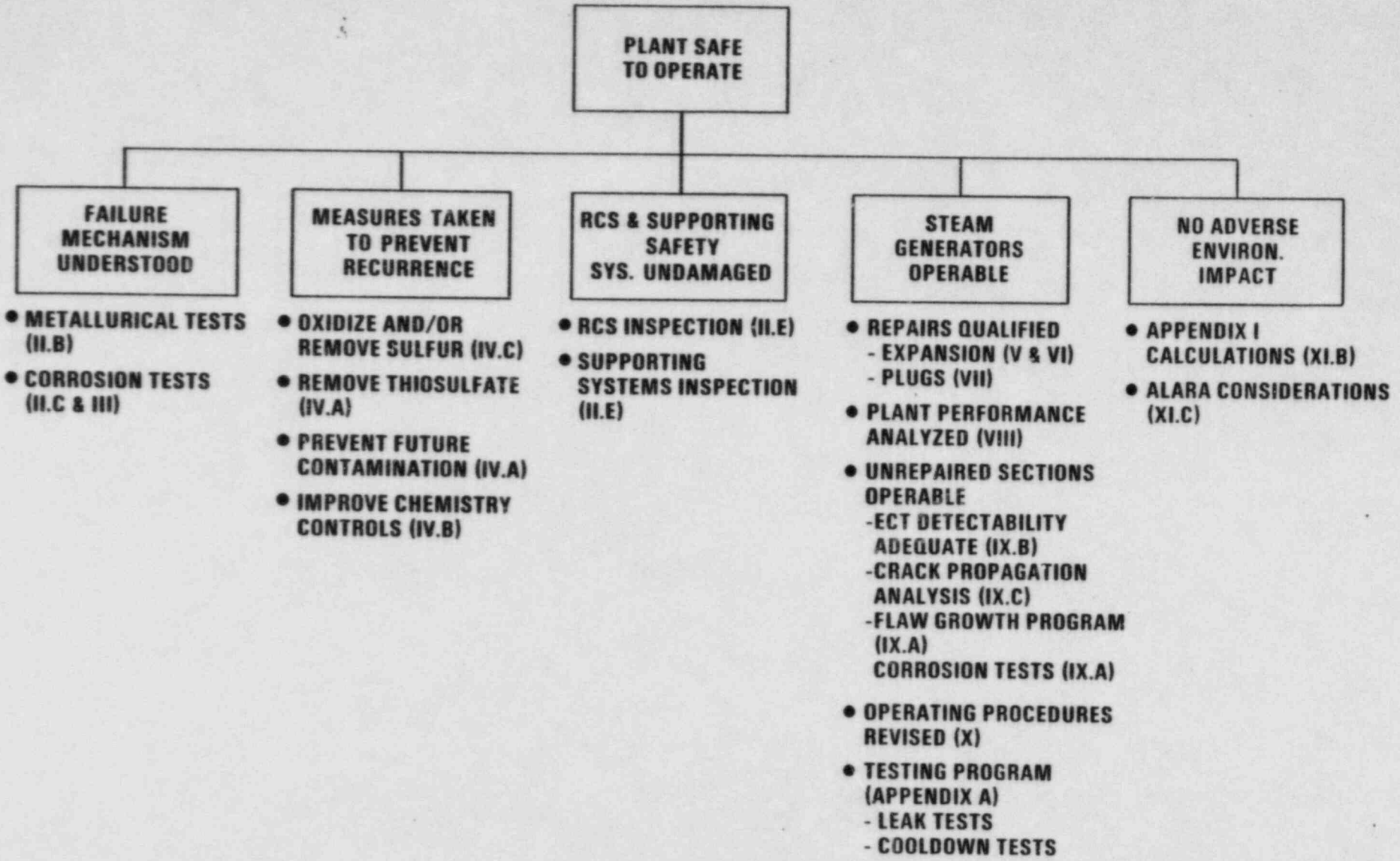


Exposures from OTSG Program

	Actual to Date	Additional Projected
RCS Inspection	12	0
Eddy Current Testing	35	10
Pre-Repair Testing	5	0
Tube Sample Pulling Plugging and Stabilization	120	0
Plugging and Stabilization		
• W plugs	-	75
• Stabilization	-	235
Kinetic Expansion		
• Pre-expansion Preparation	16	0
• First Pass Expansion	168	0
• First Pass Debris Removal	132	0
• Second Pass Expansion	167	0
• Second Pass Debris Removal	75	0
End Milling	125	0
Clean-up		
• Flush	-	30
• Soak and Clean	-	30
• Individual Tube Cleaning	-	10-40*
Testing		
• Drip Test	-	5
• Bubble Test	-	5
• Final Inspection and Turnover	-	5-10*
Totals	855	405-440

*Items for which planning is not complete.

PLANT RETURN TO SERVICE SAFETY EVALUATION OVERVIEW



OTSG B
OTSG Post-Expansion Eddy Current Absolute (8x1) Results

Background

151 tubes kinetically expanded and E/C examined. Nine (9) tubes were reported by 8x1 as having indications not seen by .540 S.D.

Results

Row/Tube	Location	ABSOLUTE Coil	Volts	Distortion	NOISE LEVEL S.D. 400 Base	Mix
4-19	US+11	1	.5	1	2V	.6V
4-30	US+12.9	2	2	2		
3-27	US+9.4	3	6	2	2V	.6V
3-25	US+10.7	1	1	1	2V	.6V
3-24	US+12.6	2	2	2	2V	.6V
3-21	US+10	1	1	1	2V	.6V
2-21	US+13.1	1	1	1	2V	.6V
2-22	US+13.2	4	1 (MULTIPLE)	2	1.8V	.5V
*2-25	US+07	1	1	1	1.5V	.5V

*New Kinetic Transition

8X1 – OK FOR EC EXAM OF EXPANDED END OF TUBE

8X1 – SHOWS OBJECT, BUT NOT effective IN DISCRIMINATING THRU WALL VS EXPANSION THRU

540 PROBE – OK for EXPANDED END OF TUBE

OTSG A
OTSG Post-Expansion Eddy Current Absolute (8x1) Results

Background

284 tubes kinetically expanded and E/C examined before and after expansion. Six (6) tubes were reported by 8x1 as having indications not seen by .540 S.D.

Results		- Absolute -			- Level of Noise S.D. -	
Row/Tube	Location	Coil	Volts	Distortion	400 Base	Mix
AFTER EXPANSION						
2-12			Not expanded		.8V	.4V
6-43	US+4	1	1	1	.8V	.2V
7-54	US+1 TO US+10.7	1	1 (MULTIPLE)	1	.6V	.3V
4-4	US+9.1	1	<1	1	2V	1V
4-32	US+11.9	1	.5	1	1.8V	1V
2-7	US+6.3	1	.5	1	1.2V	.4V
BEFORE EXPANSION						
*2-12	US-3 TO	1	<1 (MULTIPLE)	1		
	US+7	3	<.5	1		
*6-43	US+4	1	<1	1		
*7-54	US-8 TO US+13	1	<1 (MULTIPLE)	1		

*8x1 Reported 3 tubes as having indications before expansion

1 = Slow

→ LAB TEST

Result - No ductile growth during ICE.

8x1 Signal - Did not change from Before to After Kinetic Expansion

ICE - Did not change cracks.

Fiberscope ID A/B Gens - pits/scratches @ 25/40X - No CRX.

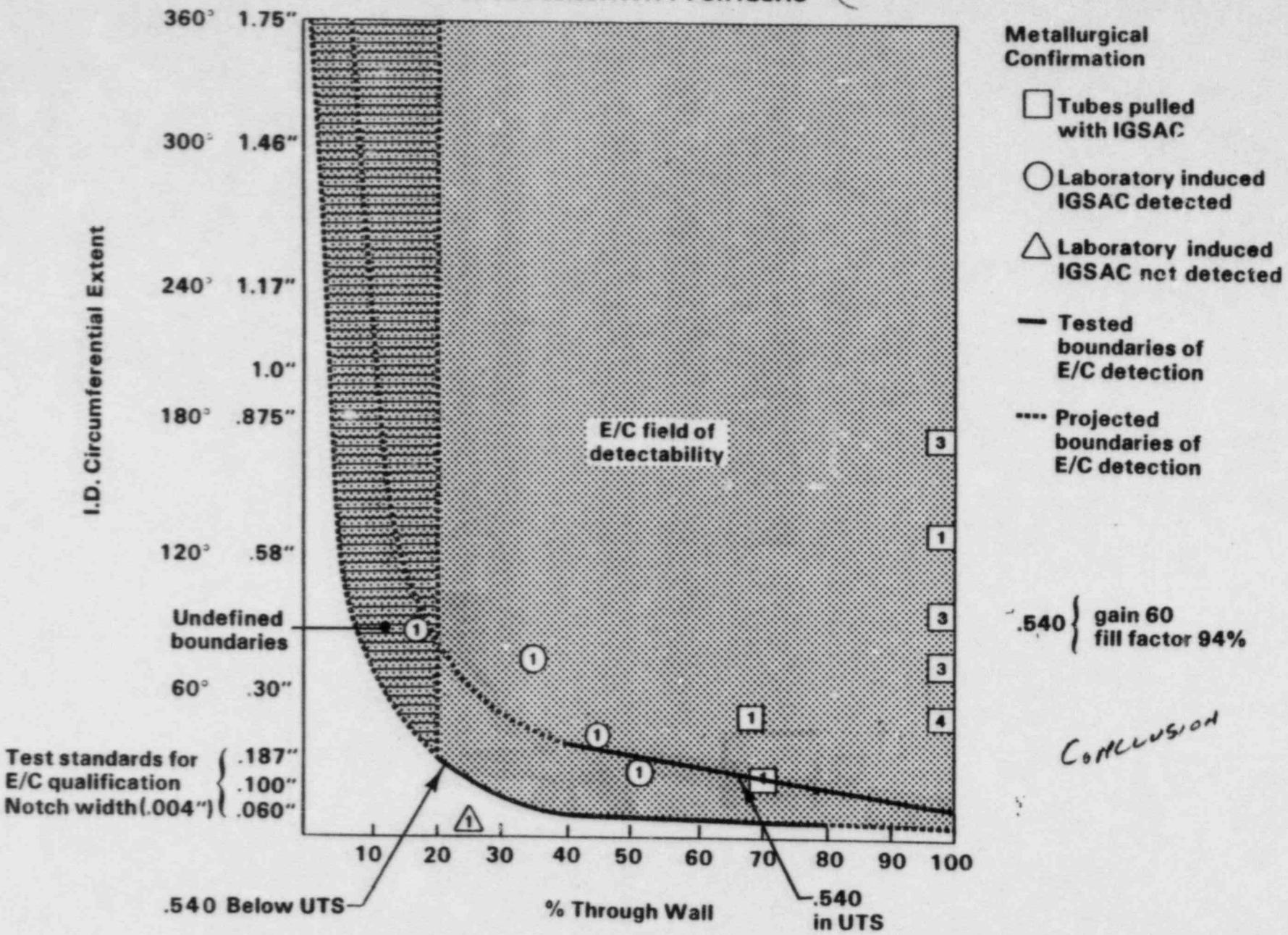
OTSG Post-Expansion Eddy Current Fiberscope Examination Summary

OTSG	ROW	TUBE	VISUAL INDICATION	LOCATION	SIZE (in.) CIRC	SIZE (in.) AXIAL	ECT COILS	ECT VOLTS
B	3	24	Line of Pits	US+13	.01	.02	2	2
B	2	22	Area of Pits	US+13	.01	.06	4	2
B	3	27	Area of Pits	US+10	.01	.03	3	6
B	2	25	Scratch	US+7	>.05	-	1	1
A	4	32	No visible indications	US+11.9	-	-	1	<1
A	2	7	No visible indications	US+6.3	-	-	1	<1

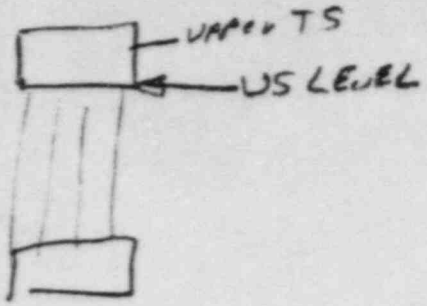
Kinetic Expansion Qualification Length ECT Examination Conclusions

- Many of the indications are from pits or scratches which are of no consequence.
- None of the indications have been identified visually as ID cracks.

METALLURGICAL CONFIRMATION OF ECT SENSITIVITY FOR IGSAC (Not KE TUBES)



Conclusion

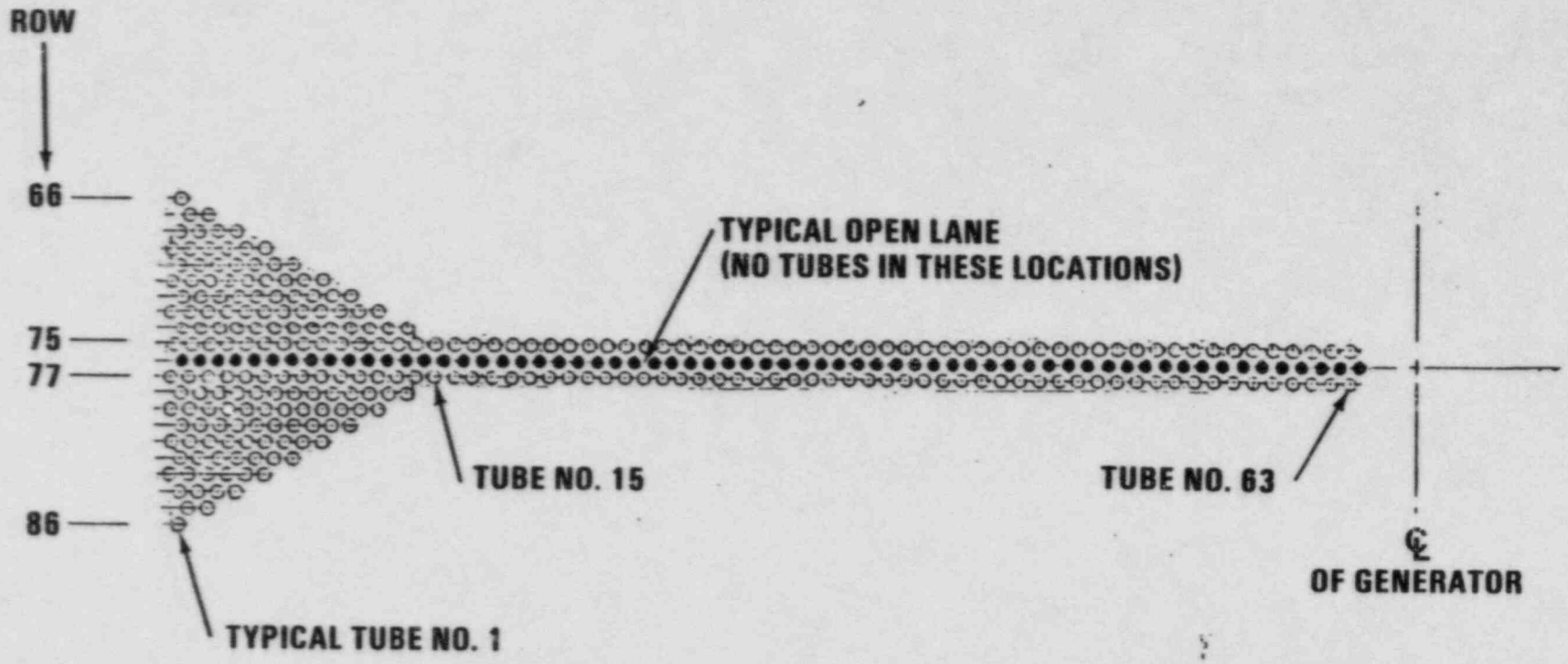


TMI-1 TUBE PLUGGING/STABILIZING PLAN

STD BTW STABALIZER

ANY DETECTABLE INDICATION	DEFECT ≥40% TW				ID INDICATION <40 PERCENT TW AND 8x1 >2 COILS	
15TH SP TO US + 4	15TH SP TO LS-4 8x1 >2 COILS	15TH SP TO LS-4 IN LANE/WEDGE HISTORICAL DEFECT AREA	15TH SP TO LS-4 8x1 ≤2 COILS	US + 4 TO +8 AND LS -4 TO -24	ANY TUBE SPAN NOT ISOLATED BY BOTTOM 6" OF KINETIC EXPANSION	15TH SP TO LS-4 IN LANE/WEDGE HISTORICAL DEFECT AREA
PLUG & STABILIZE TO BOTTOM OF 14TH SP	PLUG AND STABILIZE THROUGH SPAN OF DEFECT	PLUG AND STABILIZE TO BOTTOM OF 14TH SP	PLUG ONLY		PLUG ONLY	PLUG AND STABILIZE TO BOTTOM OF 14TH SP

Lane/Wedge Area of Tubes to be Stabilized



Tube Plugging Summary

Plugged

DESCRIPTION	NUMBER OF TUBES OTSG A	OTSG B	TOTAL
PREVIOUSLY PLUGGED OR STABILIZED	259	88	347
STABILIZED (1983)	395	80	475
PLUGGED (1983)	231	105	336
TOTAL	885	273	1158

22 dippers (2 over 1 row in)

Remain in Service

For ISE performance

DESCRIPTION (<40% TW)	NUMBER OF TUBES OTSG A	OTSG B	TOTAL
ID, 8x1 ≤2 COILS	3	14	17

Below 15th support plate.

TMI-1 POST REPAIR ECT INSPECTION SUMMARY

DESCRIPTION	SCOPE	PROBE	TOTAL NUMBER OF TUBES	
			BASELINE DATA DEVELOPMENT	90 DAYS
KINETIC EXPANSION (6" QUAL. LENGTH) Aim - ISI inspection TO SHOW DEFECTS NOT GROWING.	• 15 TUBES WITH PREVIOUS INDICATIONS	8x1	15	15
	• 3% BASELINE/OTSG	8x1	930	930
WEAR (INSERVICE TUBES ADJACENT TO UNSTABILIZED PLUGGED TUBES) .540 - 4 channel 1 channel in absolute mode	• 10 PERIPHERAL/OTSG	.540 SD*	~60	~60
	• 10 WITH DEFECT IN 15TH, 10TH OR 1ST SPAN/OTSG	.540 SD*	~120	~120
	• 5 WITH .540 SD > 3V	.540 SD*	~60	~60
INSERVICE (<40% TW) 0-40% - Degraded Tubes	• DEFECT LOCATION • FULL LENGTH	8x1 .540 SD	66	66
HIGH PLUGGING DENSITY	• 50 FULL LENGTH/OTSG	.540 SD	100	100
STANDARD INSPECTION	• 3% FULL LENGTH/OTSG	.540 SD	COMPLETED IN 1982	930
		TOTAL	~1350	~2300

*LABORATORY QUALIFICATION USING WEAR SPECIMEN COMPLETED

OTSG Tube Leak Indication Before Tube Break

Introduction

PURPOSE:

Provide the results of critical thru-wall crack sizes in OTSG tubes subject to MSLB and maximum cooldown loading, establish the leakrate for critical crack sizes and to demonstrate that OTSG leakage provides indication of tube cracks before tubes are subject to failure during cooldown transients.

OUTLINE:

- Provide critical thru-wall defect sizes for MSLB and maximum operating cooldown.
- Provide results of crack growth due to mechanical effects.
- Provide single tube leakrate versus thru-wall defect sizes based on tube tensile load.
- Provide the leakrate from critical thru-wall defects. Establish an operational leakrate limit.

CONSERVATISMS:

- MSLB tube loads based on guillotine break with double ended flow through 36" M.S. lines (TMI-1 has 24" ϕ M.S. nozzles and can't have double ended flow). Cooldown less severe.
- All leakage is assumed from only one tube.
- The single leaking tube is assumed to be in a location which will produce the smallest leakrate.

OPERATIONAL LEAKRATE

- Measured leakage following post-repair testing establishes base line.
- Post-repair testing assures leakage from any single tube is small compared to leak rate predicted from leak-before-break analysis.
- Guidelines for operational leak rate are a function of 6 GPH increase from baseline leakage.

BASIS TMI Chemistry + Temp

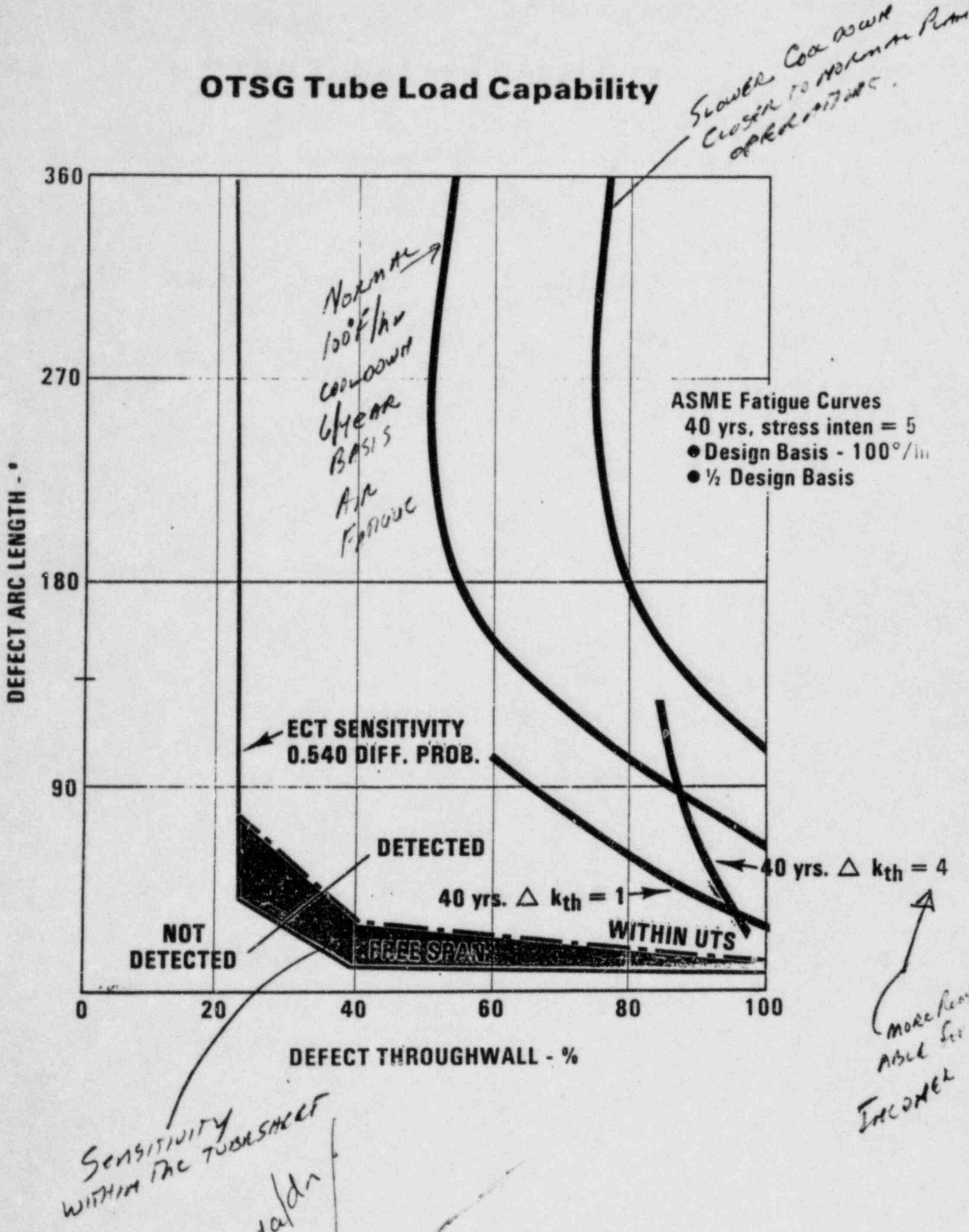
CONCLUSION:

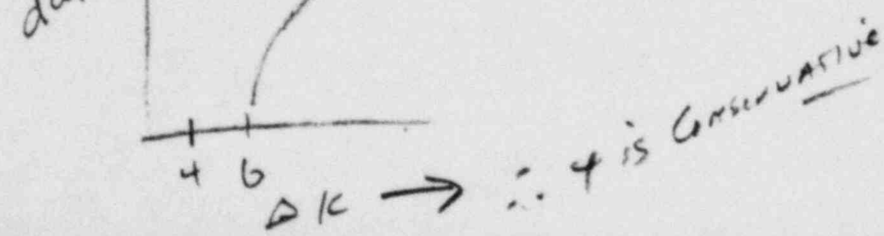
Defects will propagate radially and result in leakage due to thru wall extent prior to propagating circumferentially to a critical size.

A leak rate change of no more than 6 GPH assures that a normal plant cooldown can be accomplished and that a more rapid cooldown due to a MSLB can be accomodated without a tube rupture.

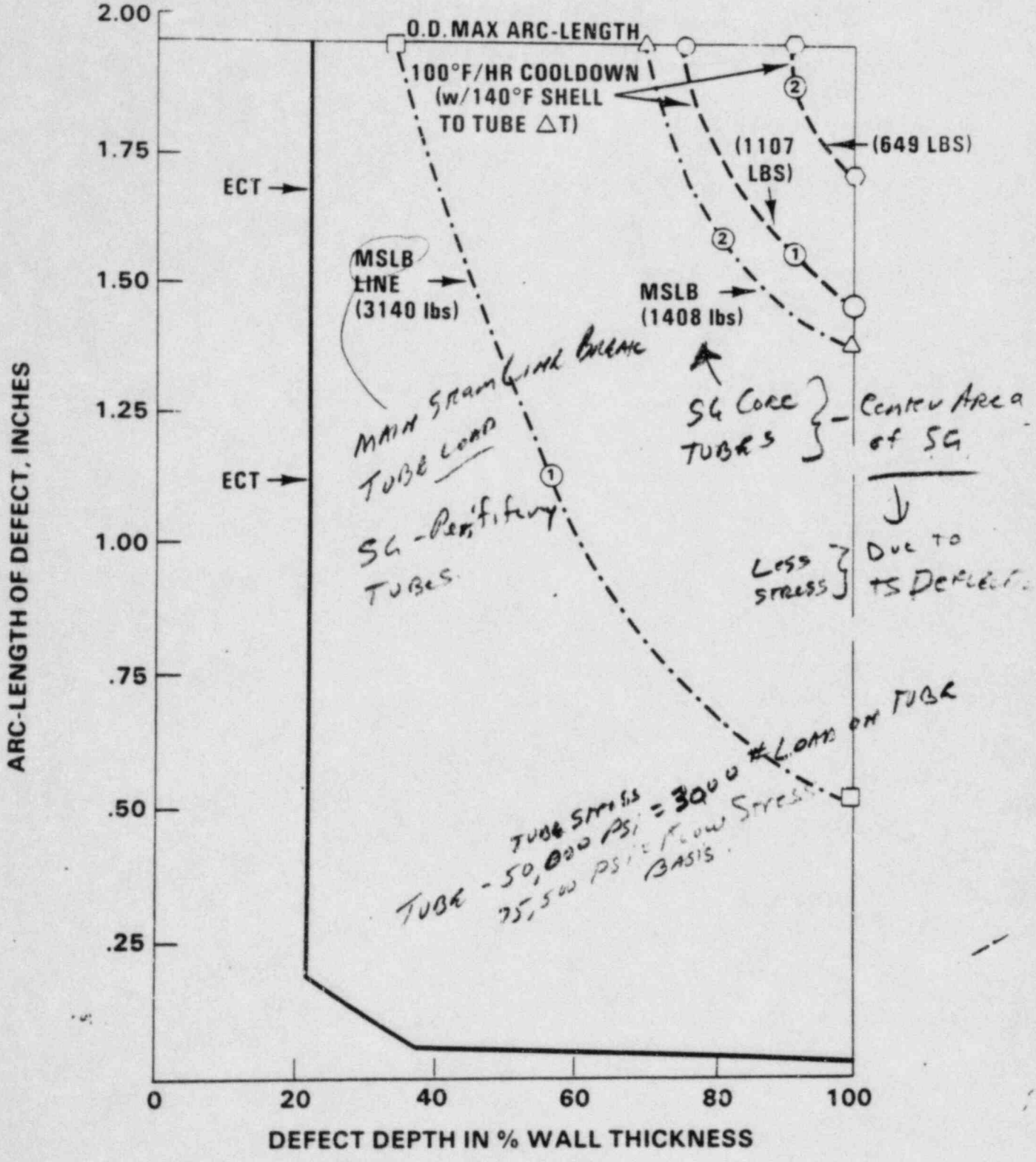
Tech Spec = 1 gpm Leak
= 60 gpm max

OTSG Tube Load Capability





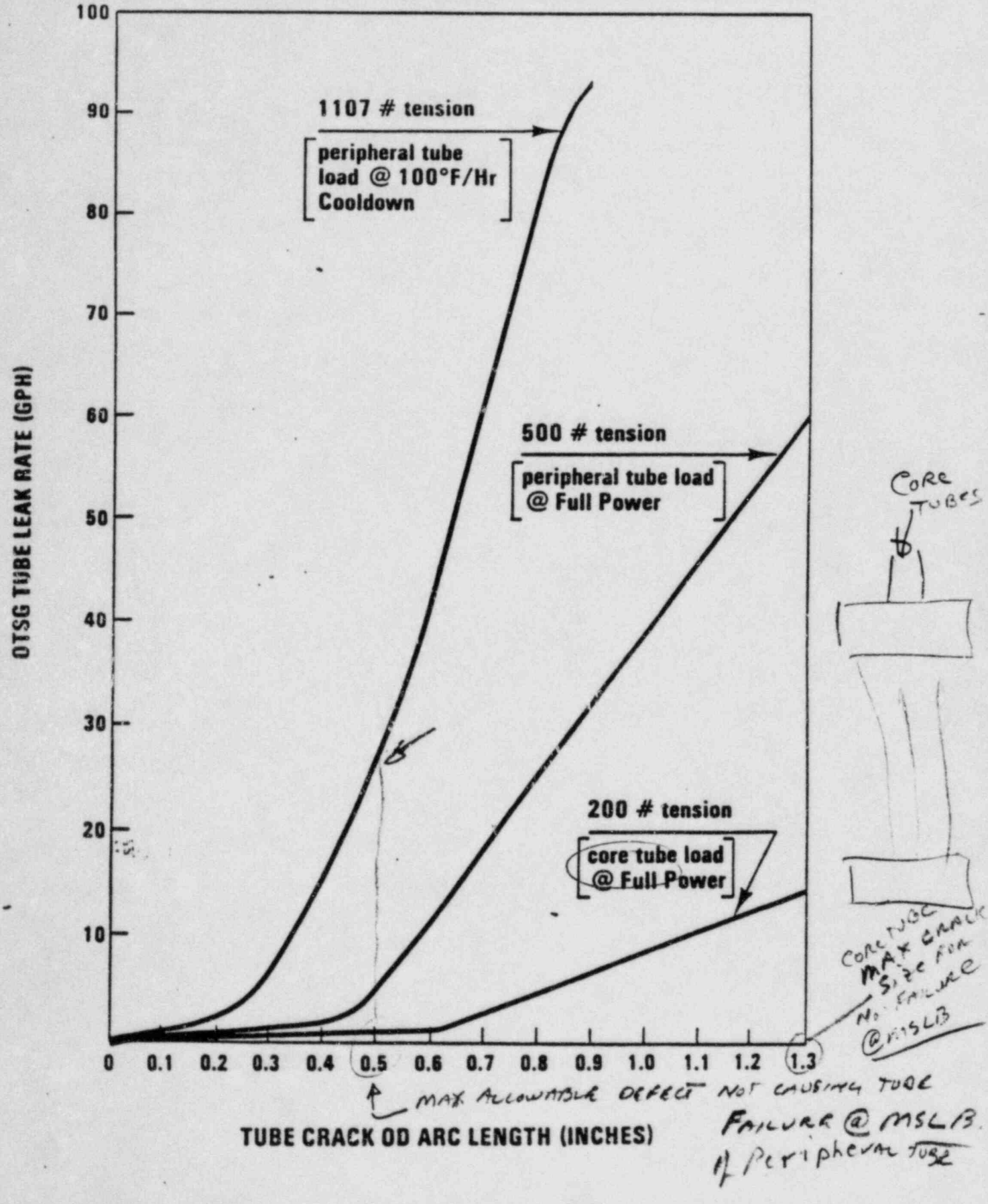
OTSG Tube Critical Crack Sizes



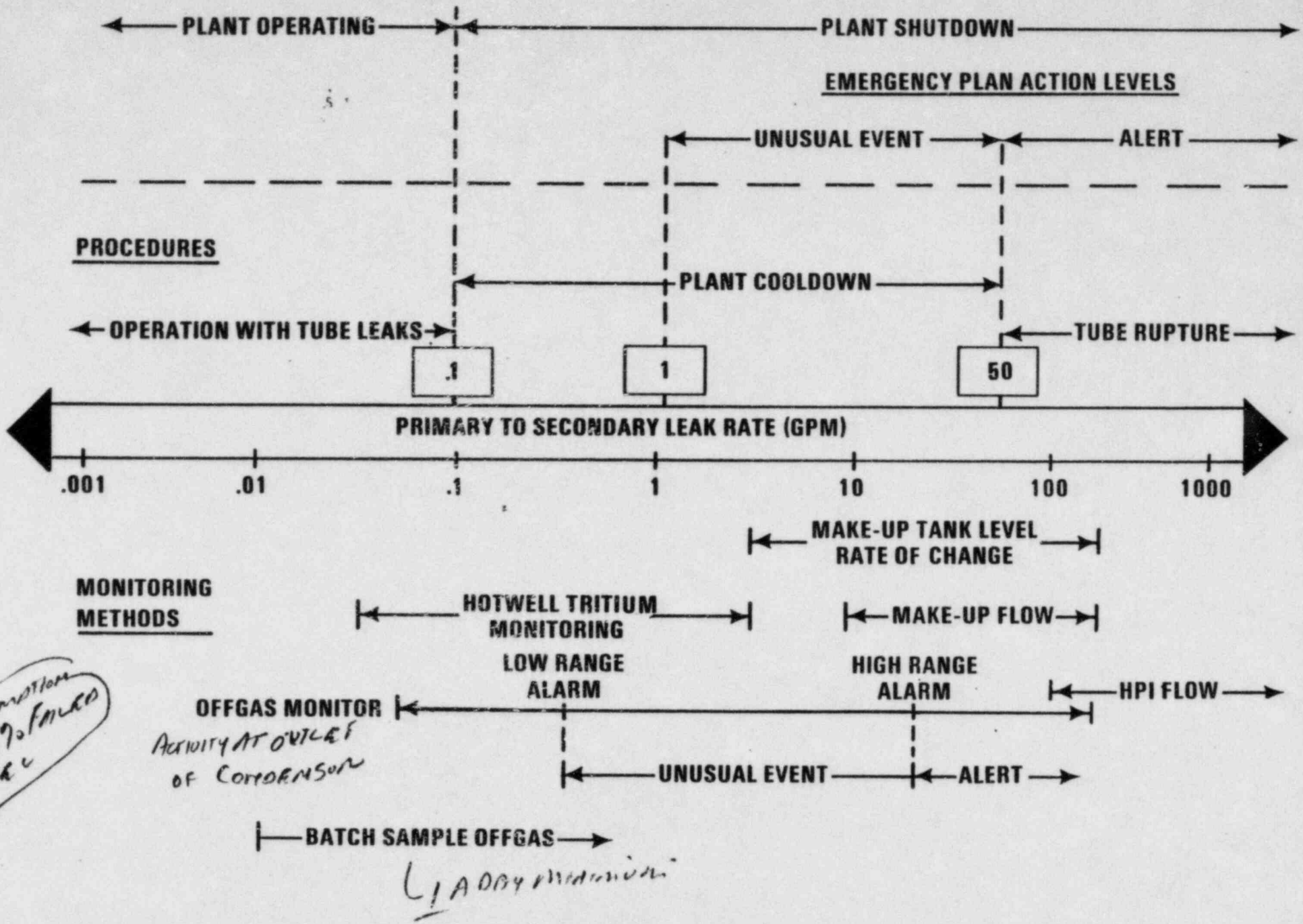
TMI-1 OTSG Tubes
Critical Crack Sizes and Operating Leakrate

TUBE LOCATION:	**CORE**	**PERIPHERY**
Tube Load @ 100% Power (Lbs.)	200 (Tension)	500 (Tension)
TRANSIENTS:		
1 - MSLB		
Transient Tube Load (Lbs.)	1408 (Tension)	3140 (Tension)
Critical Crack Size (Inches)	1.28	0.52
Leakrate (GPH) @ 100% Power Operation	14	6
2 - 100°F/Hr Cooldown (140°F Shell to Tube ΔT)		
Transient Tube Load (Lbs.)	649 (Tension)	1107 (Tension)
Critical Crack Size (Inches)	1.72	1.48
Leakrate (GPH) @ 100% Power Operation	22	72

OTSG Leak Rate as a Function of Crack Length & Tube Tensile Load

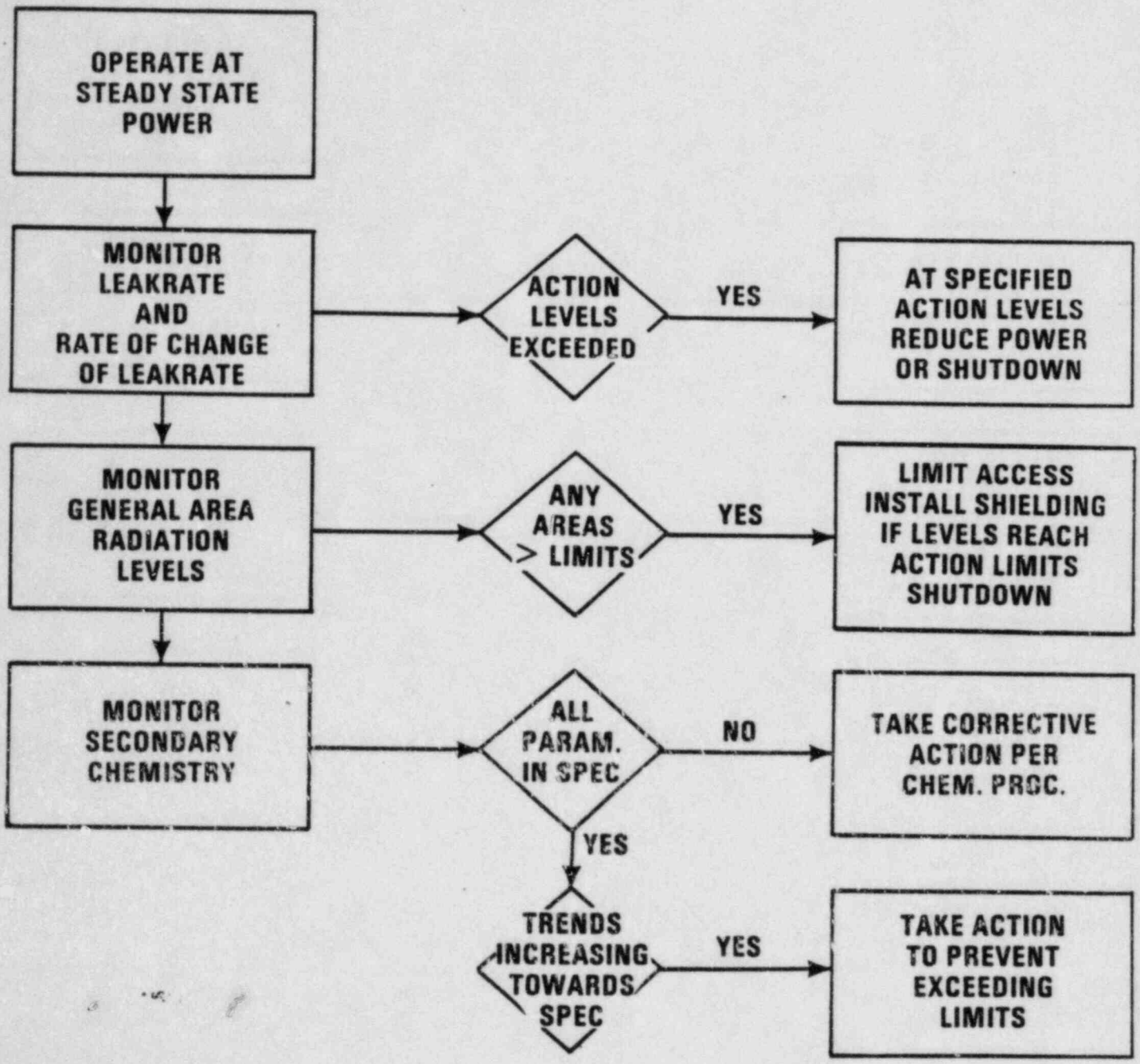


Operator Actions as a Function of Leakrate



ASSUMPTION .03% FAILED FUEL

Steady State Monitoring Guidelines



Leakage Detection

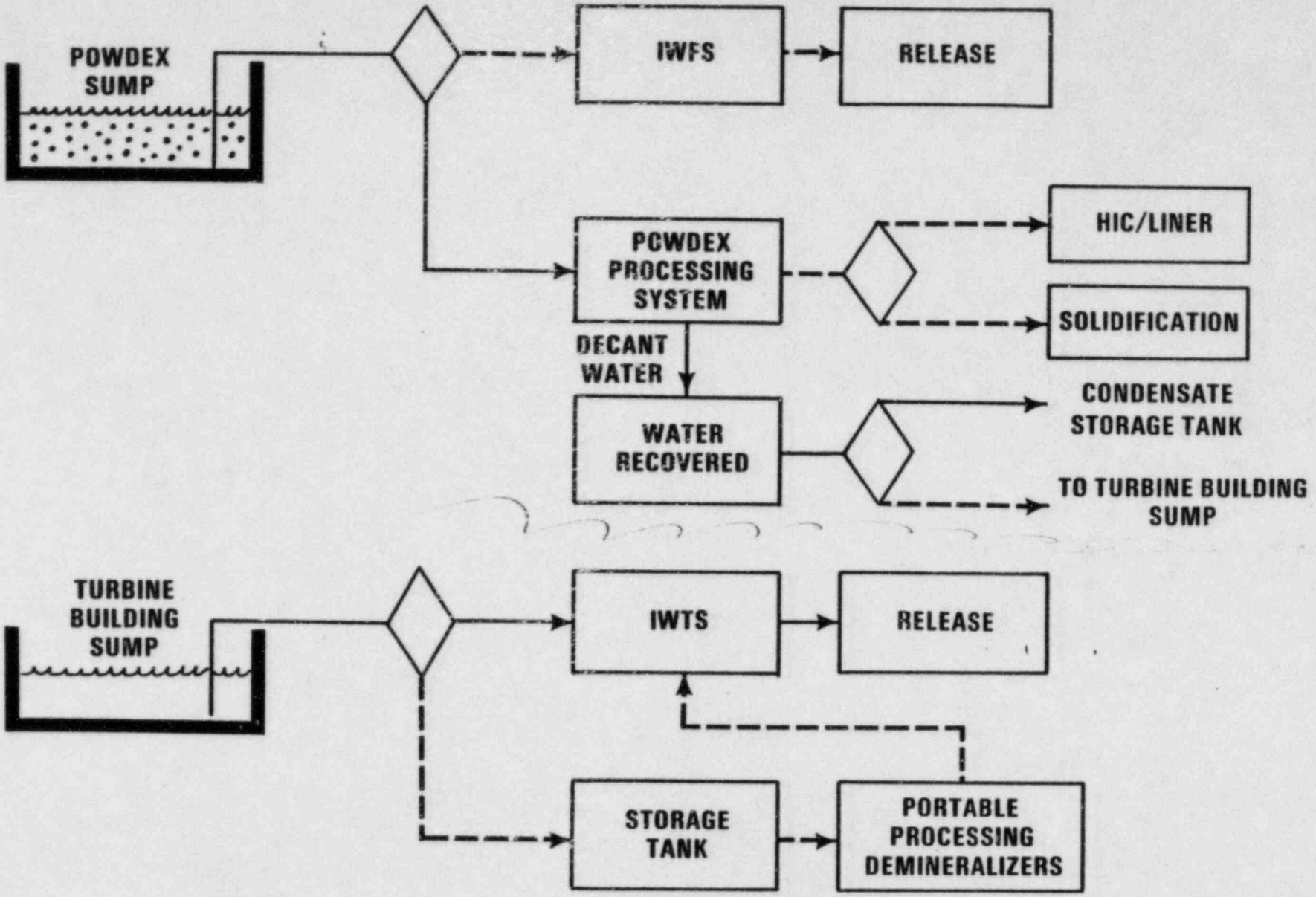
LOCATION	METHOD	FREQUENCY	LIMIT	ACTION
CONDENSER OFF GAS	ON LINE MONITOR (Xe 133)	CONTINUOUS	.5 GPH INCREASE IN 8 HOURS	TAKE BATCH SAMPLE
			1 GPM	COMMENCE SHUTDOWN
	BATCH SAMPLE (Xe 133 Xe 135 TOTAL GAS)	DAILY OR EACH SHIFT WHEN TRIGGERED	6 GPH (.1 GPM) ABOVE BASELINE	PERFORM NORMAL SHUTDOWN
REACTOR COOLANT SYSTEM	PRIMARY LEAK RATE CALCULATION	EACH SHIFT	.33 GPM INCREASE	TAKE BATCH SAMPLE
STEAM LINE	PORTABLE MONITOR (GAMMA)	WHEN TRIGGFRED	NONE	SURVEY EACH MAIN STEAM LINE

LEAK RATES ARE CALCULATED BASED ON RATIOS OF MEASURED SECONDARY ACTIVITIES TO RCS ACTIVITY

Radiation Monitoring

LOCATION	METHOD	FREQUENCY	LIMIT	ACTION
POWDEX VESSELS	PORTABLE MONITOR	TWICE PER WEEK	5 MR/HR @ 10'	DUMP AND FLUSH POWDEX VESSELS
POWDEX RECOVERY SYSTEM VESSELS	PORTABLE MONITOR	TWICE PER WEEK	100 MR/HR @ 10'	PERFORM NORMAL SHUTDOWN
TURBINE BUILDING	PORTABLE MONITOR	TWICE PER WEEK OR DAILY WHEN TRIGGERED	.5 MR/HR	INCREASE FREQUENCY TO DAILY
			5 MR/HR	PERFORM NORMAL SHUTDOWN
TURBINE BUILDING DRAINS	SWIPE	WEEKLY	1000 DPM/100 cm^2 Bγ 100 DPM/100 cm^2 α	DECONTAMINATE DRAIN
SECONDARY SYSTEM VENTS AND DRAINS	PORTABLE MONITOR	WHEN OPERATING VENTS AND DRAINS	SECONDARY ACTIVITY > MDA	OBSERVE HP PRECAUTIONS

Three Mile Island Unit 1
Turbine Building Liquid and Solid Waste Management
During Operations with OTSG Leakage



Guidelines for Operation During Power or Temperature Changes

Objective:

Reduce tube end loading to reduce leakage from existing cracks and to prevent crack propagation

Limits:

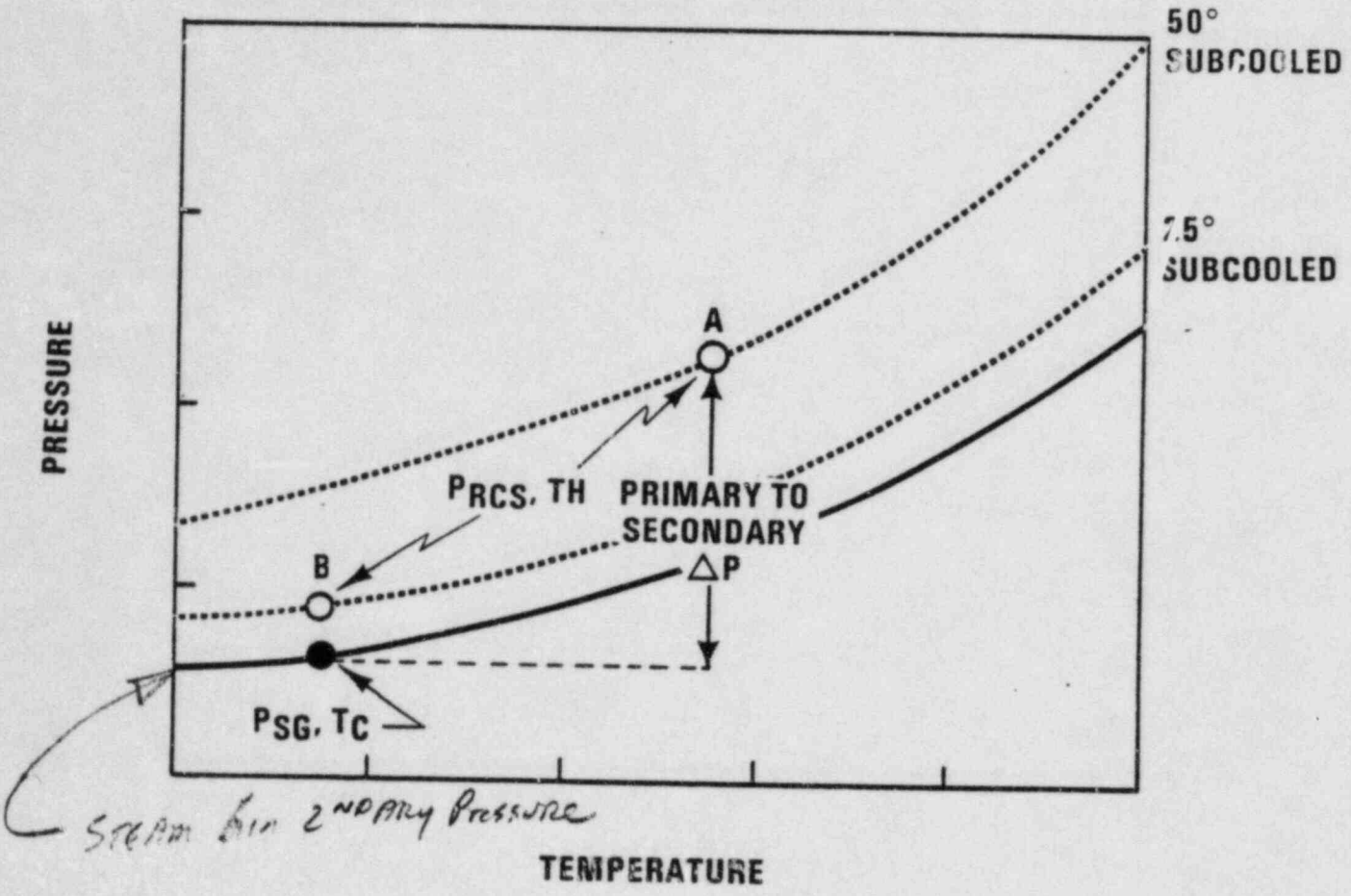
The following limits will maintain tube end loading less than 550 lb.

- cooldown limit 1.67 °F/min

- tube to shell ΔT 70°F

Shutdown if leakage exceeds .1 gpm (6 gph) above baseline.

Comparison of Existing to Proposed Pump Trip/Subcooling Guidelines



A (current requirements): - 50° subcooling
- RCP trip on HPI actuation

B (proposed requirements): - 25° subcooling (If Leak, to get Lower ΔP)
- RCP trip on loss of subcooling

Benefits: - RCP operation during larger breaks
- Lower tube ΔP
- Reduced leak rate

Break Flow for Single Ruptured Tube

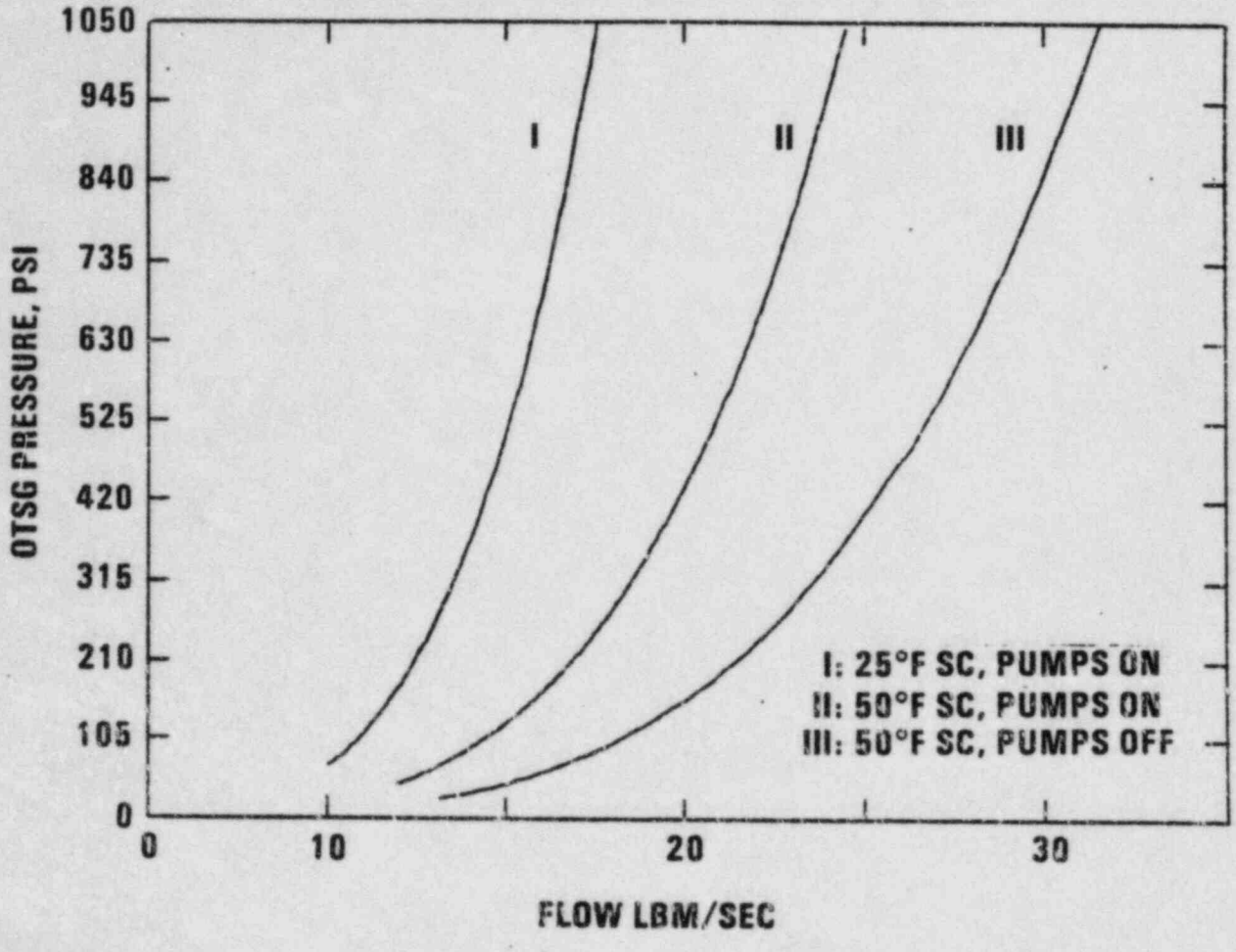
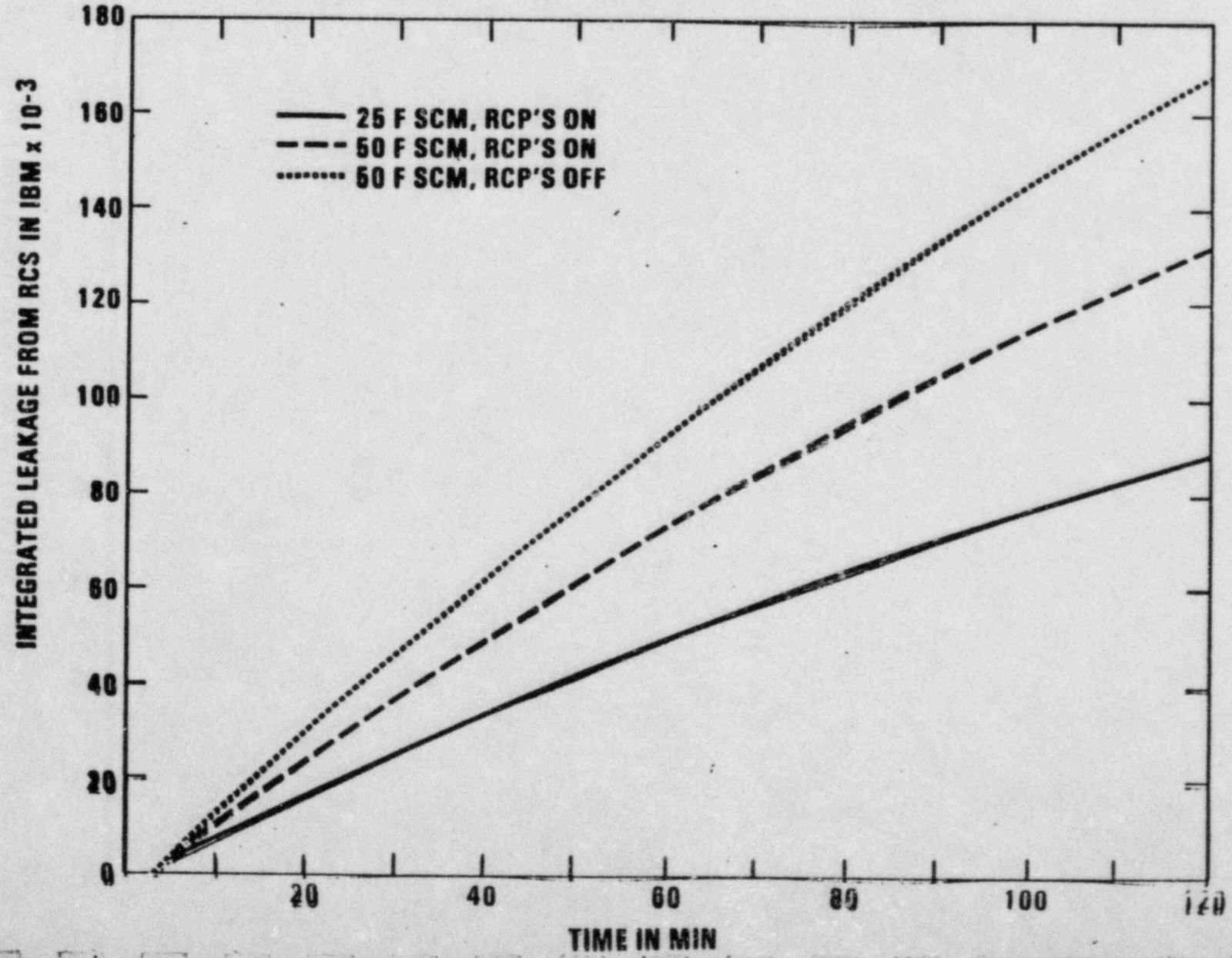
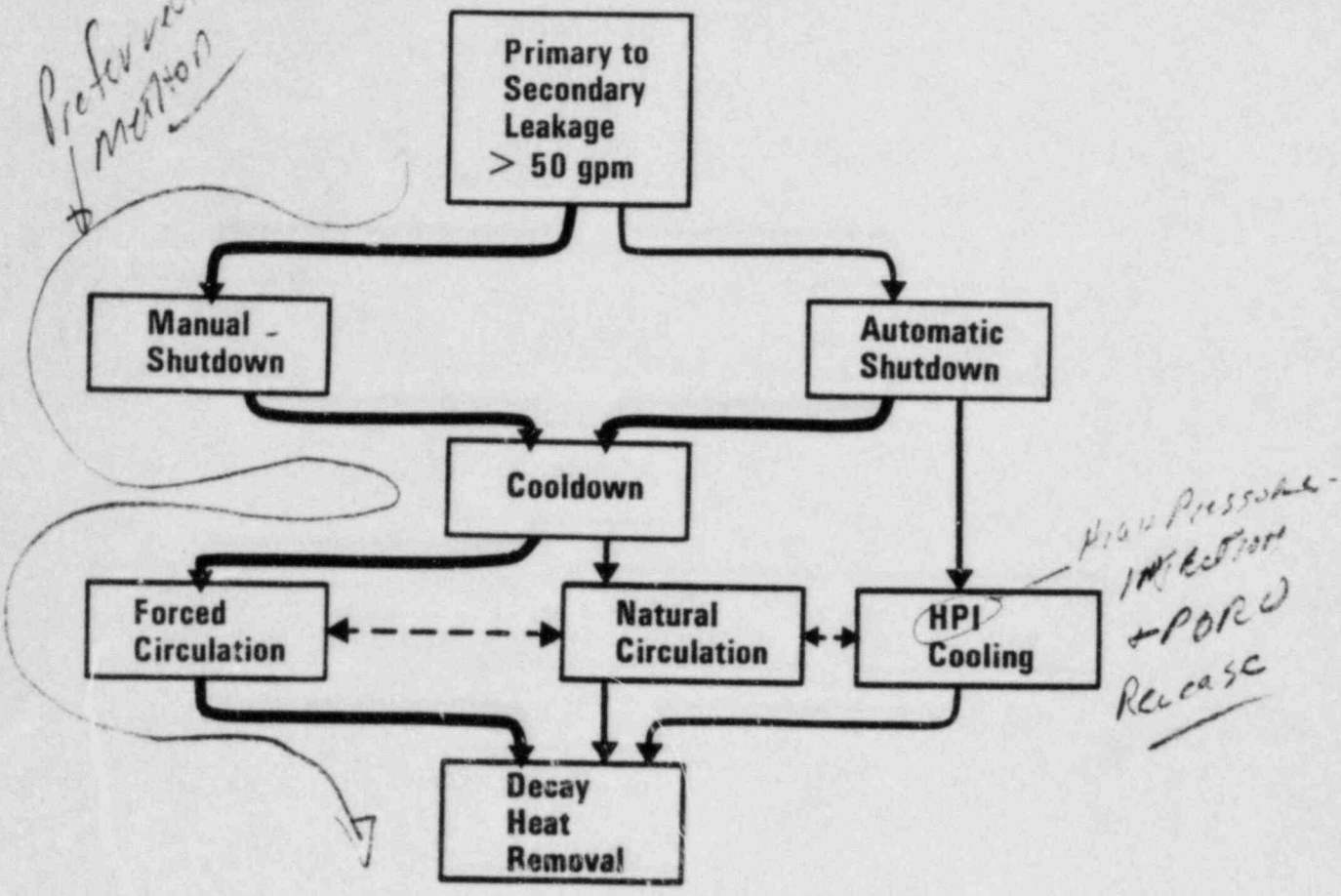


FIGURE 3

Effect of RC Pump Operation on Integrated System Leakage for Single Ruptured Tube



Tube Rupture Guidelines



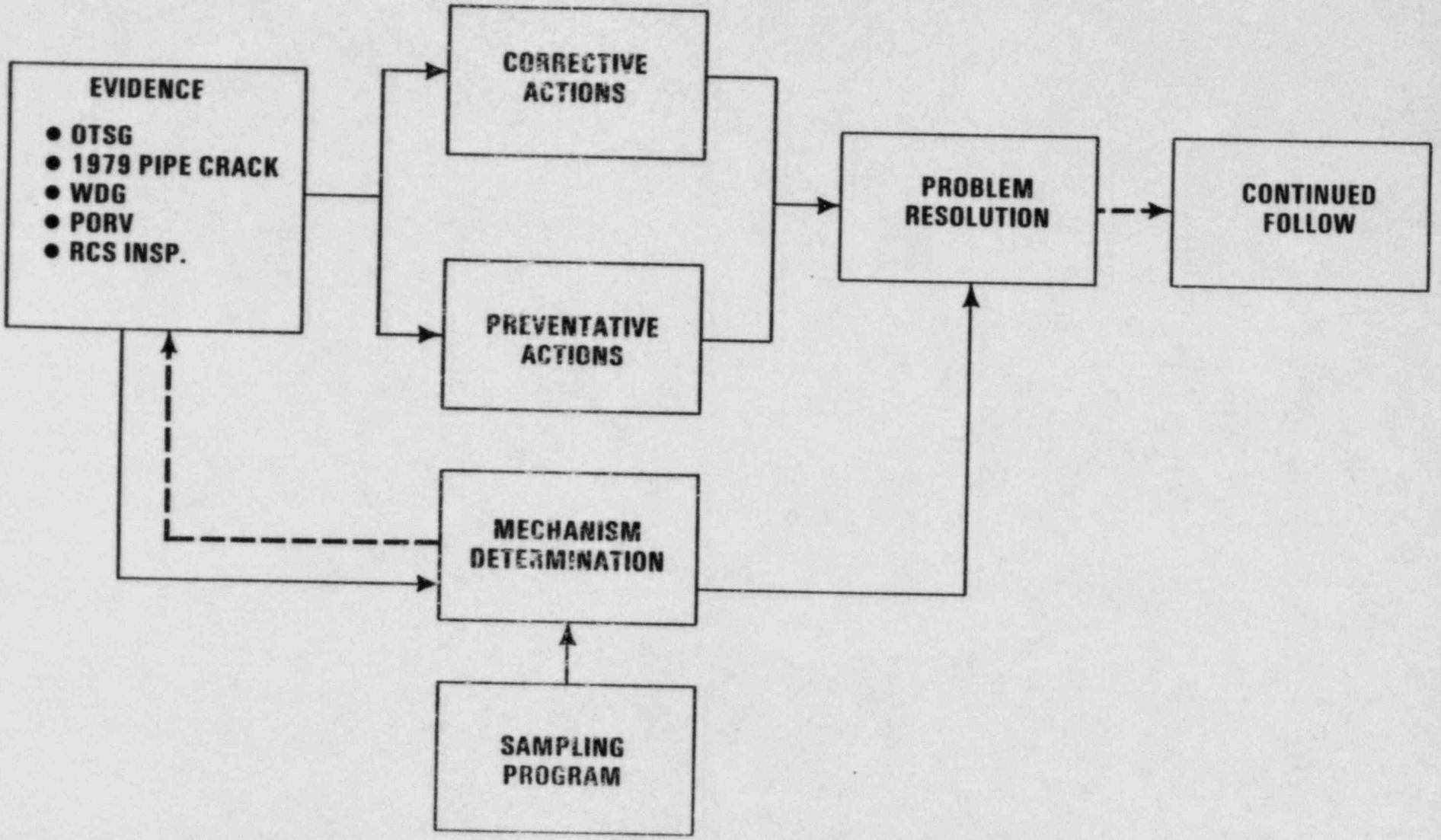
New Guidance:

- multiple tube ruptures
- ruptures in both steam generators
- HPI cooling
- Secondary water management

Improved guidance:

- Minimum subcooling reduced to 25°
- RCP trip criteria
- tube to shell ΔT
- steam generator steaming, feeding, flooding

TMI-1 Sulfur
Investigation & Resolution



Evidence Relating to Sulfur Attack

- **1979 Pipe Cracking**

  — Through wall cracks in Spent Fuel Pool Cooling Pipe at weld HAZ

  — Extensive NDE program undertaken

System	Total Welds	Welds Inspected
SPENT FUEL	566	566
DECAY HEAT	408	408
BUILDING SPRAY	241	241
MAKE-UP	1051	697
CORE FLOOD	31	31
REACTOR COOLANT SURGE	11	11
REACTOR COOLANT SPRAY	28	28

  — Disposition

  Periodic monitoring of 20 indications
  Remaining joints removed — replaced with 304L

  — Conclusion

  IGSCC of some HAZ's in stagnant, borated, oxygenated systems

Fuel Pool

Evidence Relating to Sulfur Attack

Gas (Some Condensate)

- **Waste Disposal Gas Piping — 1982**

  — Through wall crack on Aux Bldg side of WDG-V4
  — WDG piping examined between RCDT and MWST

Pipe Segment	Welds Examined	Indications
RCDT to WDG-V3	3 (U.T.)	NONE
WDG-V3 to WDG-V4	11 (2 UT, 11 RT)	4 WITH PITTING NO CRACKING
WDG-V4 to HORRIZ. PIPE	7 (7 UT, 4 RT)	4 CRACKS
HORRIZ. PIPE TO MWST	7 (7 UT)	NONE
MWST DISCHARGE	17 (17 UT)	1 POSSIBLE CRACK

  — Disposition

    WDG-V4 replaced
    50 feet WDG pipe replaced with 304L
    Periodic monitoring of one weld

  — Conclusion

    Localized sulfur assisted IGSCC in HAZ

Evidence Relating to Sulfur Attack

- **PORV** — open to pressurizer

  — PORV 1 (in service 4/76 - 4/81)

    No unusual corrosion observed during 1979 refurbishment

    General and pitting corrosion of Martensitic and Inconel X-750 parts observed during 1982 refurbishment

  — PORV 2 (in service 4/81 - 2/83)

    General and pitting corrosion of Martensitic and Inconel X-750 parts observed during 1983 examination

    Pure crystalline sulfur and sulfur compounds found on PORV body & parts

  — Block Valve (upstream of PORV)

    No unusual corrosion observed (no Martensitic or X-750 parts)

    High sulfur deposits present

  — Disposition

    Clean, inspect, and re-install block valve

    Clean & inspect PORV body; replace internal parts

  — Conclusion

    1) Damage mechanism existed after 1979 and prior to 1981 HFT as well as during 1981 HFT

    2) Martensitic and Inconel X-750 parts are susceptible to corrosion

    3) Non-sensitized austenitic parts are not susceptible to corrosion

Evidence Relating to Sulfur Attack

Pressurizer Area Valve Examinations

VALVE	SERVICE	INDICATIONS
RC-V1	PRESSURIZER SPRAY	S DEPOSITS NO CORROSION
RC-V17	PRESSURIZER VENT	MINOR PITTING
RC-RV1A RC-RV1B	SAFETY VALVE SAFETY VALVE	NONE MINOR PITTING
WDG-V1	RCDT RELIEF	MINOR PITTING

Disposition: All corrosion indications are minor and do not affect valve integrity or function.

Conclusion: 1) Safety valves were protected by loop seal.
2) Valves not in close proximity to pressurizer are not significantly attacked.

Evidence Relating to Sulfur Attack

RCS Component Examinations

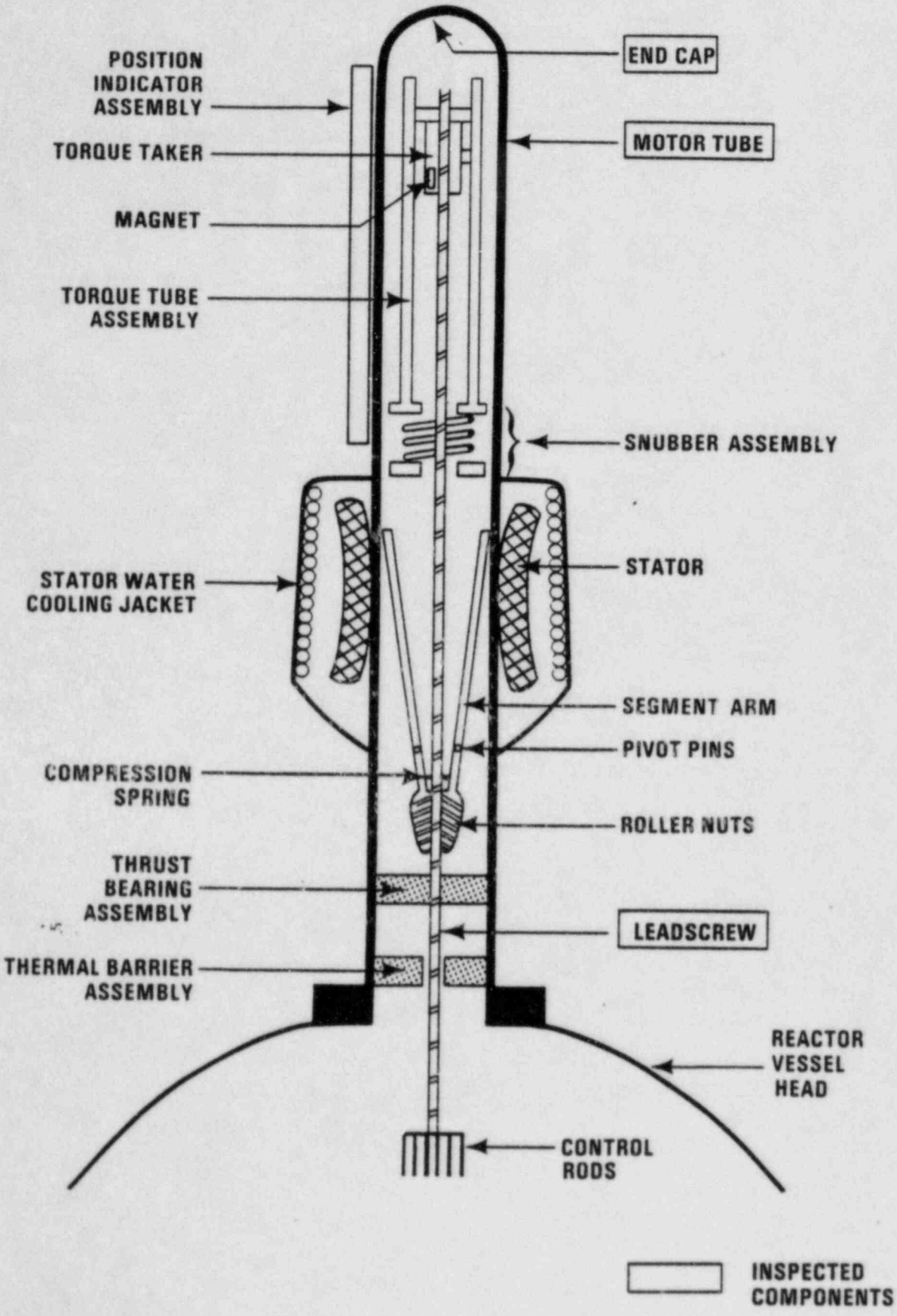
RCS COMPONENT	AREA EXAMINED	METHODS	INDICATIONS
OTSG	UPPER & LOWER HEAD	PT, W	NONE
	UPPER & LOWER TUBESHEET	PT, W	NONE
NOZZLES	MAKE-UP & HPI	RT, UT	NONE
	PRESSURIZER SPRAY & SURGE	RT, UT	NONE
CRDM	LEADSCREW	V, W	NONE
	MOTOR TUBE	UT	NONE
	END FITTING	PT, M, W	NONE
	RV NOZZLE	EC	NONE
RV & PLENUM	INNER O-RING	M, PT, W	NONE
	PLENUM LIFT LUG BOLTS	UT	NONE
	PLENUM ASSEMBLY	V	NONE
	PLENUM CYLINDER BOLTS	UT	NONE
	INCORE DETECTORS & SHEATH	F, PT, W	NONE
	VENT VALVE TC NOZZLE	EC	NONE
RV INTERNALS	TOP OF CORE & CONTROL COMP	V	NONE
	FUEL ASSEMBLY & CONTROL COMP	V	NONE
	RNS RETAINER	PT, M	NONE
	CORE SUPPORT SHIELD TO BARREL BOLT	UT	NONE
	LOWER HEAD & BOLTING RING	V	NONE
	BAFFLE PLATE REGION	V	NONE
	VENT VALVES & CORE SUPPORT SHIELD	V, F	NONE

KEY:

PT	DYE PENETRANT	UT	ULTRASONIC
W	WIPE SAMPLE	V	VISUAL OR VIDEO
RT	RADIOGRAPH	F	FUNCTIONAL
		M	METALLOGRAPHIC

Conclusion:
No general RCS component corrosion had occurred.

SIMPLIFIED
CONTROL ROD DRIVE MECHANISM



Inspections to be Performed

Pressurizer Internals

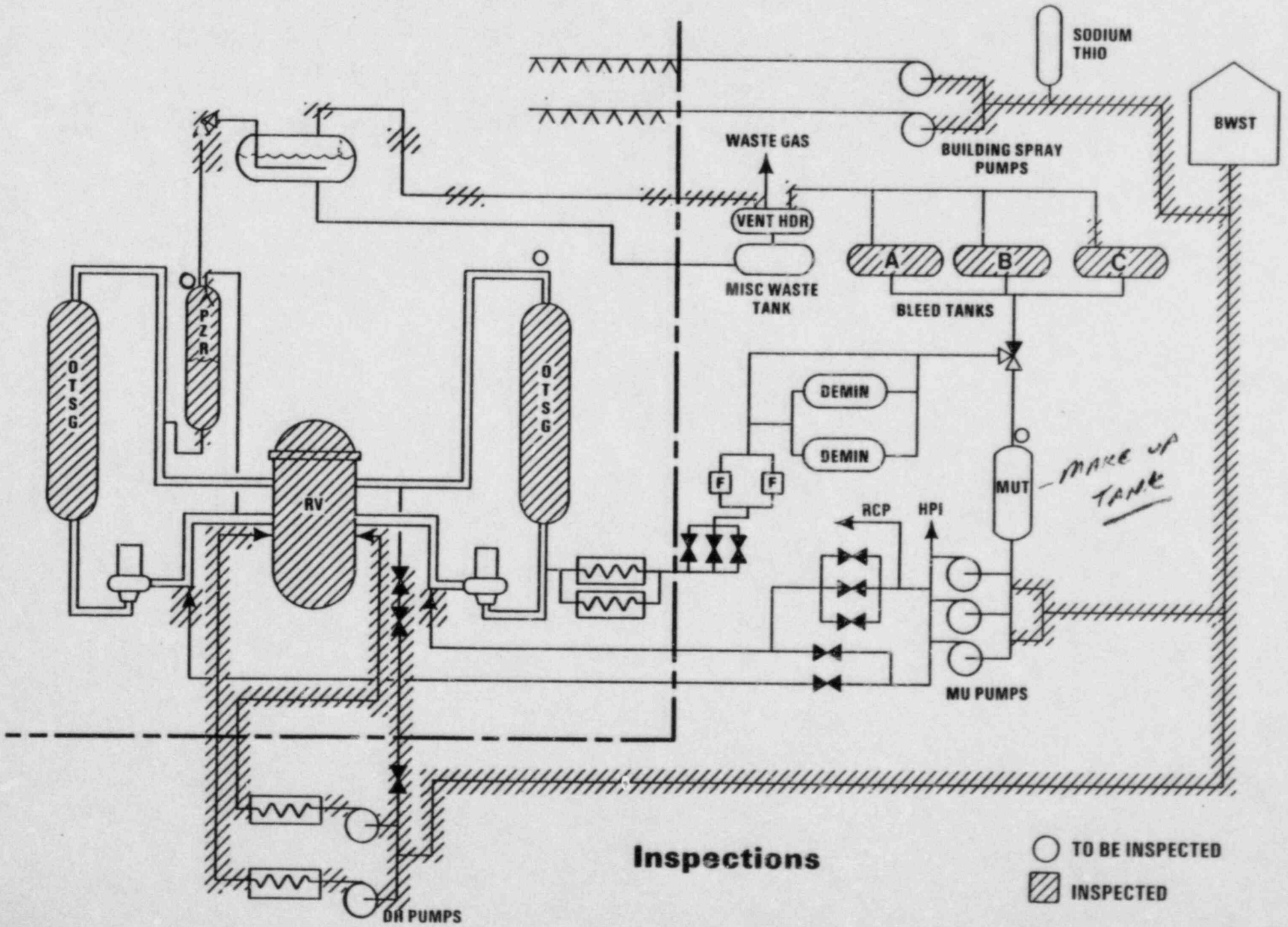
- Spray pipe & nozzle
- Shell
- Ladder welds
- Heater bundle

RCS Piping

- Hot leg vent
- Pressurizer vent

Auxiliary Systems

- Make-up tank relief valve & nozzle


SODIUM THIO
BWST
WASTE GAS
BUILDING SPRAY PUMPS
VENT HDR
MISC WASTE TANK
A
B
C
BLEED TANKS
OTSG
PZR
OTSG
DEMIN
DEMIN
F
F
RV
MUT
MAKE UP TANK
RCP
HPI
MU PUMPS
DH PUMPS
Inspections
TO BE INSPECTED
INSPECTED

Corrective Action Summary

OTSG

Kinetic Expansion
Plugging

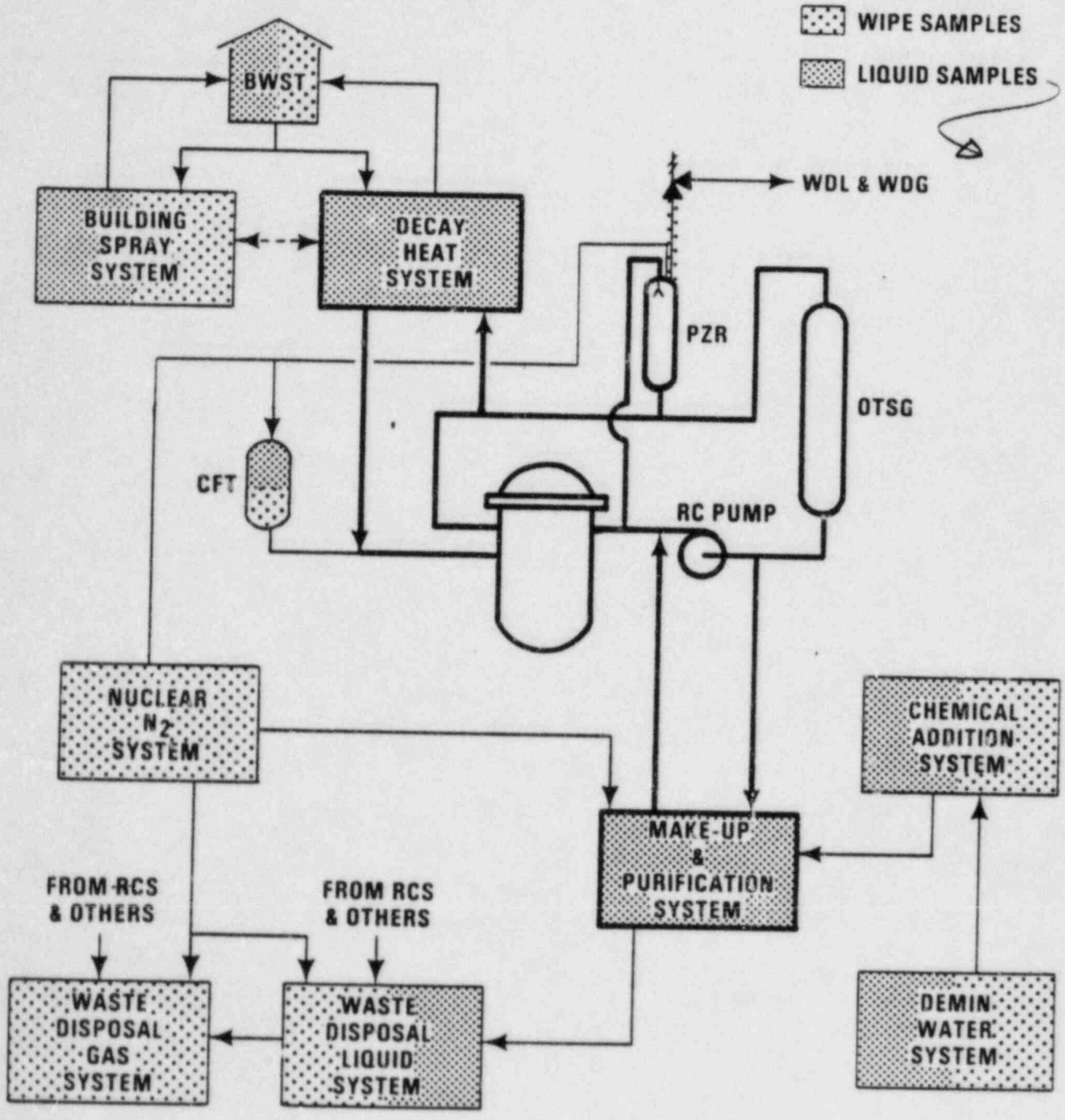
PORV

Clean & refurbish

WDG

Replace 50 feet of pipe
Replace WDG - V4

Liquid and Wipe Sampling



Sulfur
Transport & Corrosion Mechanism

OTSG Tube Cracking (review)

- ID initiated stress assisted IGA
- Temperature + oxydation potential + sulfur → potentially aggressive form
- Sulfur concentration mechanism + oxygen → cracking on draindown

PORV Pitting and General Corrosion & WDG Cracking

- Gaseous sulfur compounds are transported from liquid phase
- Condensation areas result in potentially corrosive local concentrations
- Corrosion occurred at low temperatures

Susceptible Materials & Conditions

	CRACKING	GEN CORR OR PITTING
MATERIAL	SENSITIZED AUSTENITIC STAINLESS OR HIGH NICKEL ALLOY	MARTENSITIC STAINLESS OR INCONEL X-750
CONDITIONS	1) EXPOSURE TO GASEOUS FORM WITH A CONDENSING SURFACE. 2) EXPOSURE TO A CONCENTRATION MECHANISM	1) EXPOSURE TO GASEOUS FORM WITH A CONDENSING SURFACE

Conditions NOT Associated with Attack

- Non-sensitized materials
- Flooded & flowing piping
- Piping drained well after shutdown

Preventative Actions

Eliminate Sulfur Source

- Sodium thiosulfate tank eliminated
- Monitor chemical additions

Clean Residual Sulfur

- Hydrolaze pressurizer
- Peroxide clean: Reactor Coolant System
  Decay Heat System
  Make-up and Purification System

Prevent Recontamination

- Sample storage tanks to assure quality
- Monitor building spray and fuel pool cooling

Provide Continued Monitoring

- Daily RCS sulfur samples

TMI-1
Sulfur Investigation

Conclusions

1. Sulfur phenomena is understood from full spectrum of studies.

2. Sulfur related damage has been or is being located and repaired as appropriate.

3. Recurrence potential is minimized by system modifications, system cleaning, and chemistry control.

4. Chemistry monitoring will provide rapid detection in the unlikely event of recurrence.

TMI-1 Restart Test Program

Purpose

- To provide a deliberate, methodical well planned verification of proper modification installation and performance in accordance with design

- Verification of the adequacy of the OTSG Tube Repair Program by operational leak testing and on-line monitoring throughout the test program

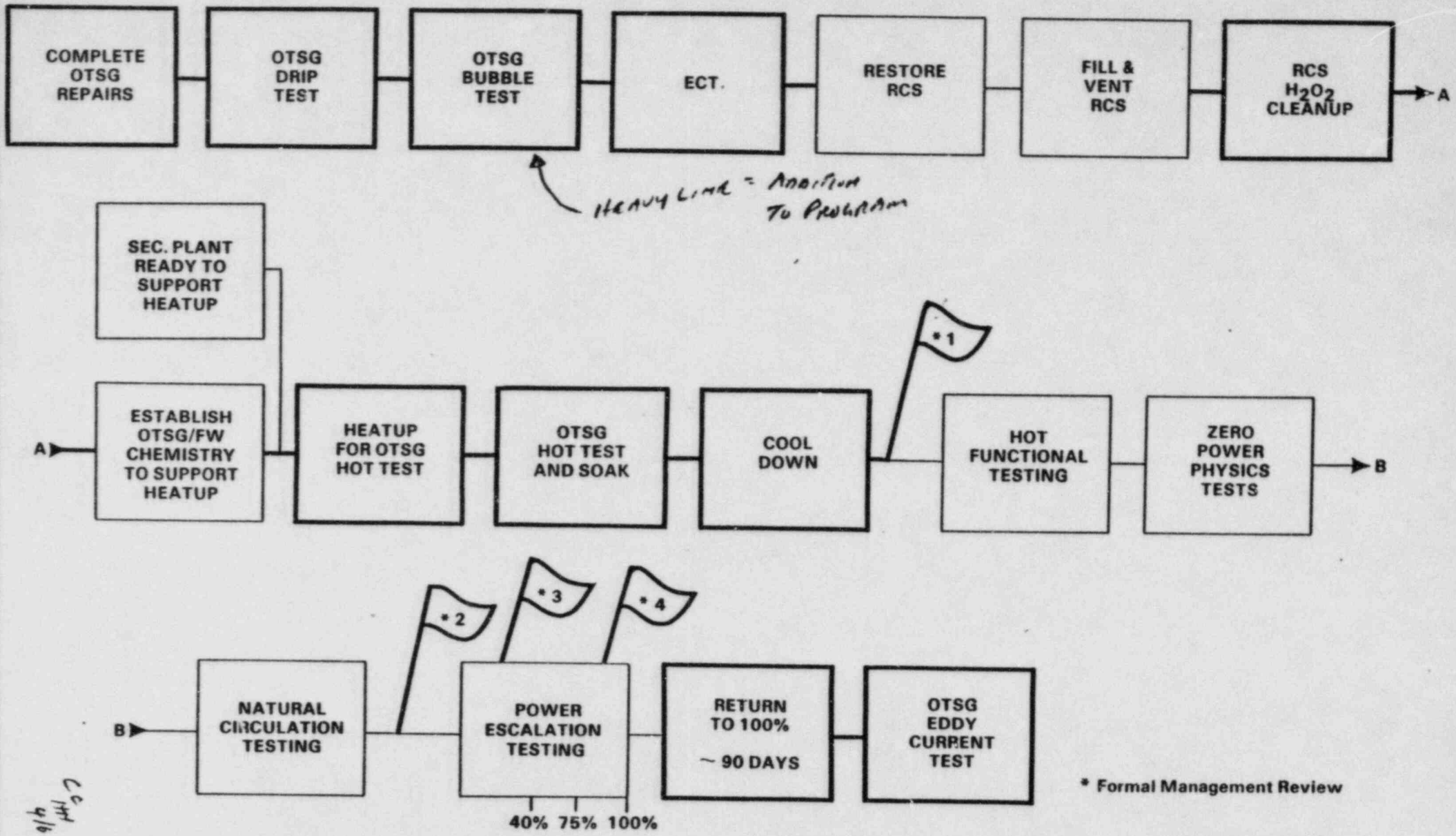
- Determination of plant transient response characteristics and verification of acceptable integrated plant operation with modified systems/components

- Verification of acceptable system readiness and plant operation with new and modified plant operating, surveillance, emergency, abnormal and maintenance procedures

- Performance of sufficient modified system/plant steady state and transient operations to provide operator training and familiarization with modified system/plant response throughout a range that he is likely to experience during the design life of the plant

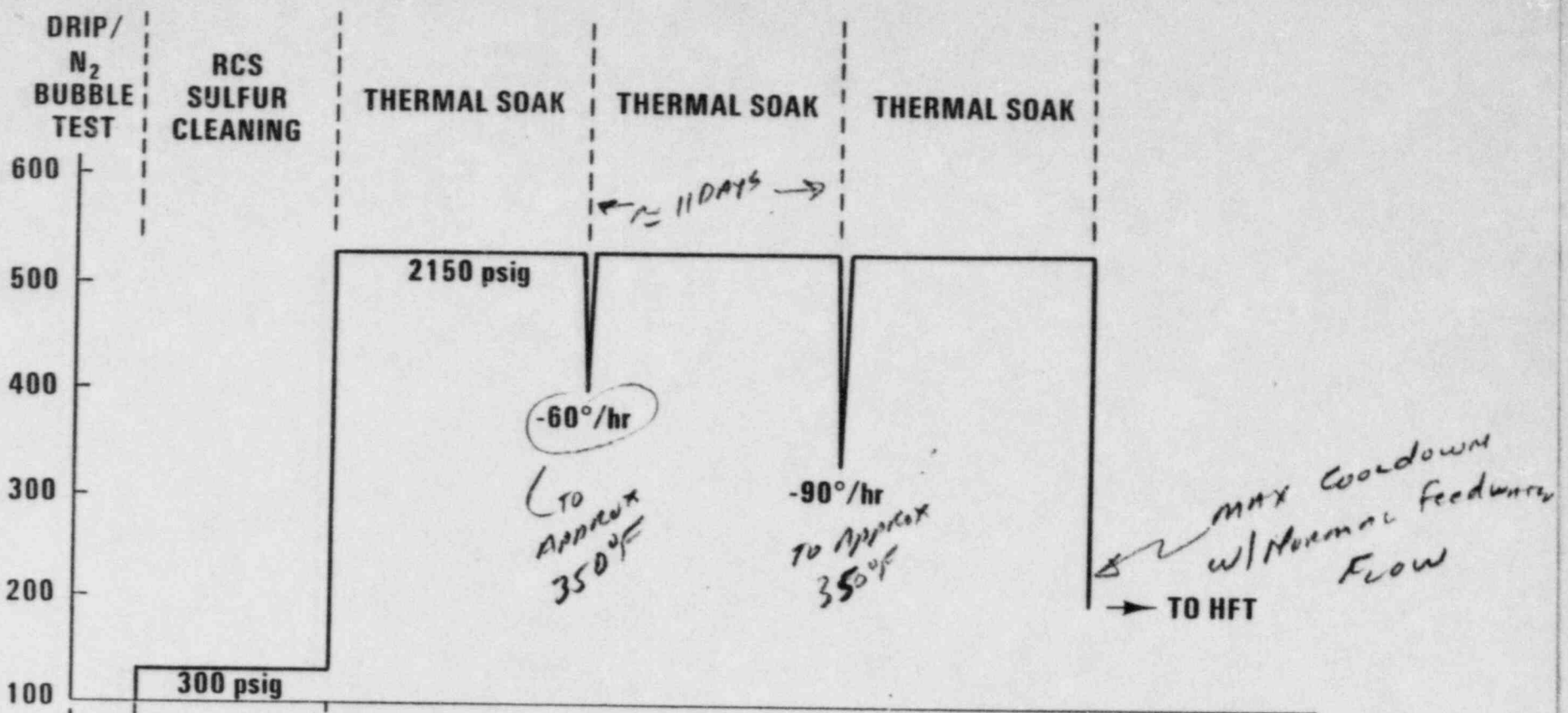
CC HH 4/6

TMI-1 Restart Test Program Including OTSG Repair



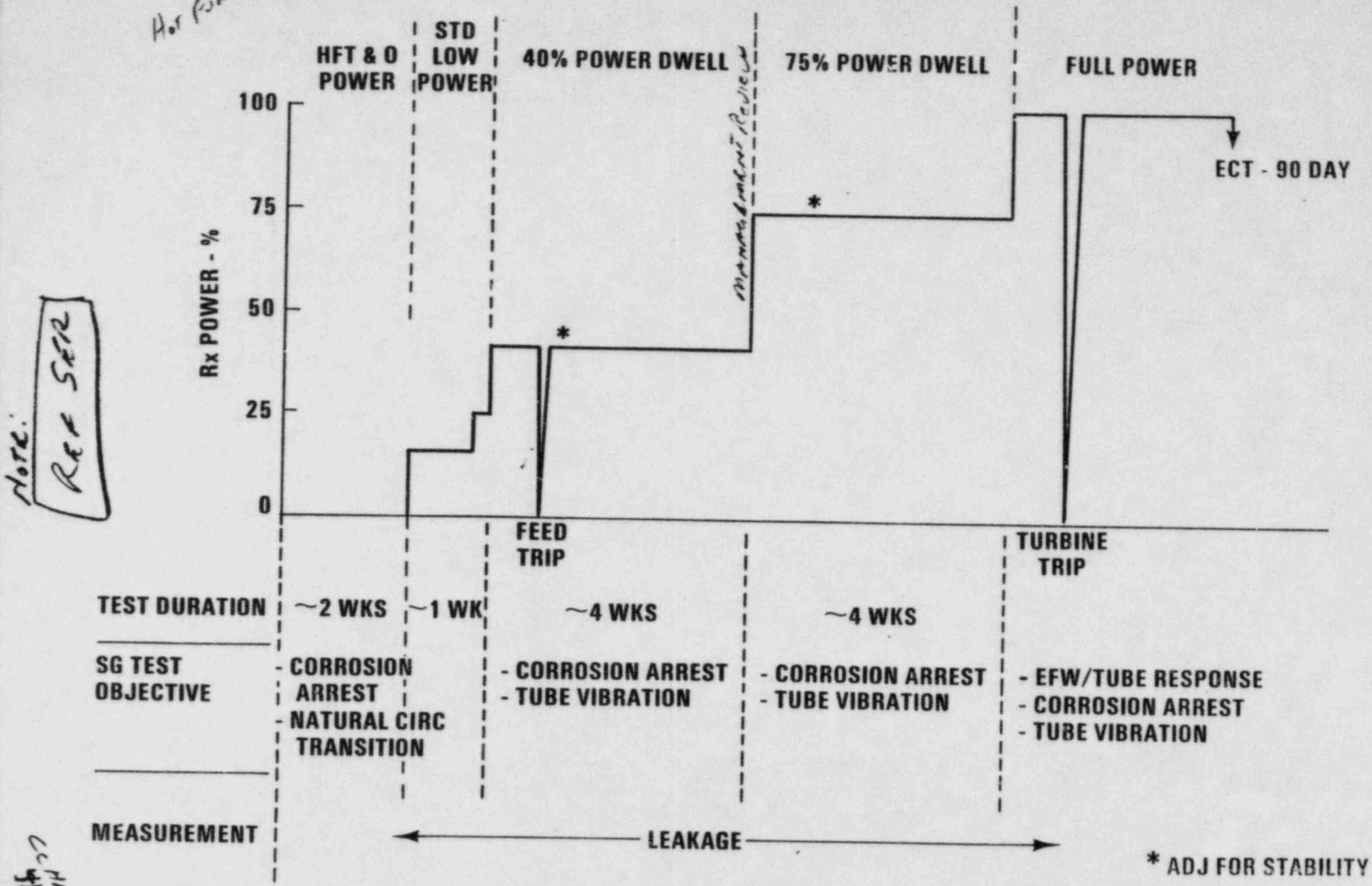
* Formal Management Review

OTSG Testing



TIME DURATION	~1 WK	~4 WKS	~4 WKS
SG TEST OBJECTIVE	TUBE LEAKAGE	—	- HOT, PRESSURIZED INTEGRAL SG LEAKAGE - CORROSION ARREST - REPAIR JOINT/TUBE STRUCTURAL - EFW SPRAY/TUBE RESPONSE
MEASUREMENT			LEAKAGE

OTSG Testing
during HFT & Power Escalation



10:00 Peroxide Meeting

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 4/6/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side A. Temp. Chem. System		
Done			
2.	Ops OTSG Status . OTSG Level "A" - 576" . OTSG Level "B" Full Wet Layup . Receive Backing Plates for "A" Upper Manway		4/4
3.	Post Expansion/Felt Plug Blowing . # of Tubes Blown @ "A" ---- . # of Tubes Blown @ "B" 2533 3685/ ✱ . # of Tubes Blocked @ "A" ---- . # of Tubes Blocked @ "B" 12/16	 B&W Catches 90% effective B&W	
4.	Immunol Flush System . Revised Spec for Flushing		
	A upper are to be pulled	1 dripper is B&W upper	
5.	Tube Plug Stabilization . Removal of W Plugs . 5 Stabilizers in "A" upper . Reroll Tube "B" upper 2 tube	 B&W Westinghouse	
	7 tubes mini + 4 wall thickness = 11 Grooves in the magazine		
6.	Miscellaneous Items to Resolve . Hydrogen Peroxide Tube Soak . Makeup Line Backflush STP	 F. Paulewicz	 4/5

OTSG REPAIRS DATE 4/6/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	QC
345-82	2 Tubes Plugged Incorrectly	
354-82	Documentation for Immunol-1st Batch	QC
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
067-83	Endmilling to 40 mils	QC
064-83	Holders for Stabilizers	QC
073-83	Explosive Plug that fell out	QC

8. Tube Endmilling
   . Photos

9 Rad Con Exposure Data (Based on SRDs) as of 4/4
   . W Plugging - 13.8 Man Rem
   . Exposure Estimate - 75 Man Rem ~~827.4~~
   . Total OTSG Exposure since 1st Blast - 821.3 Man Rem
   . Total OTSG Exposure since Nov 1981 - 997.5 Man Rem
   1003.9

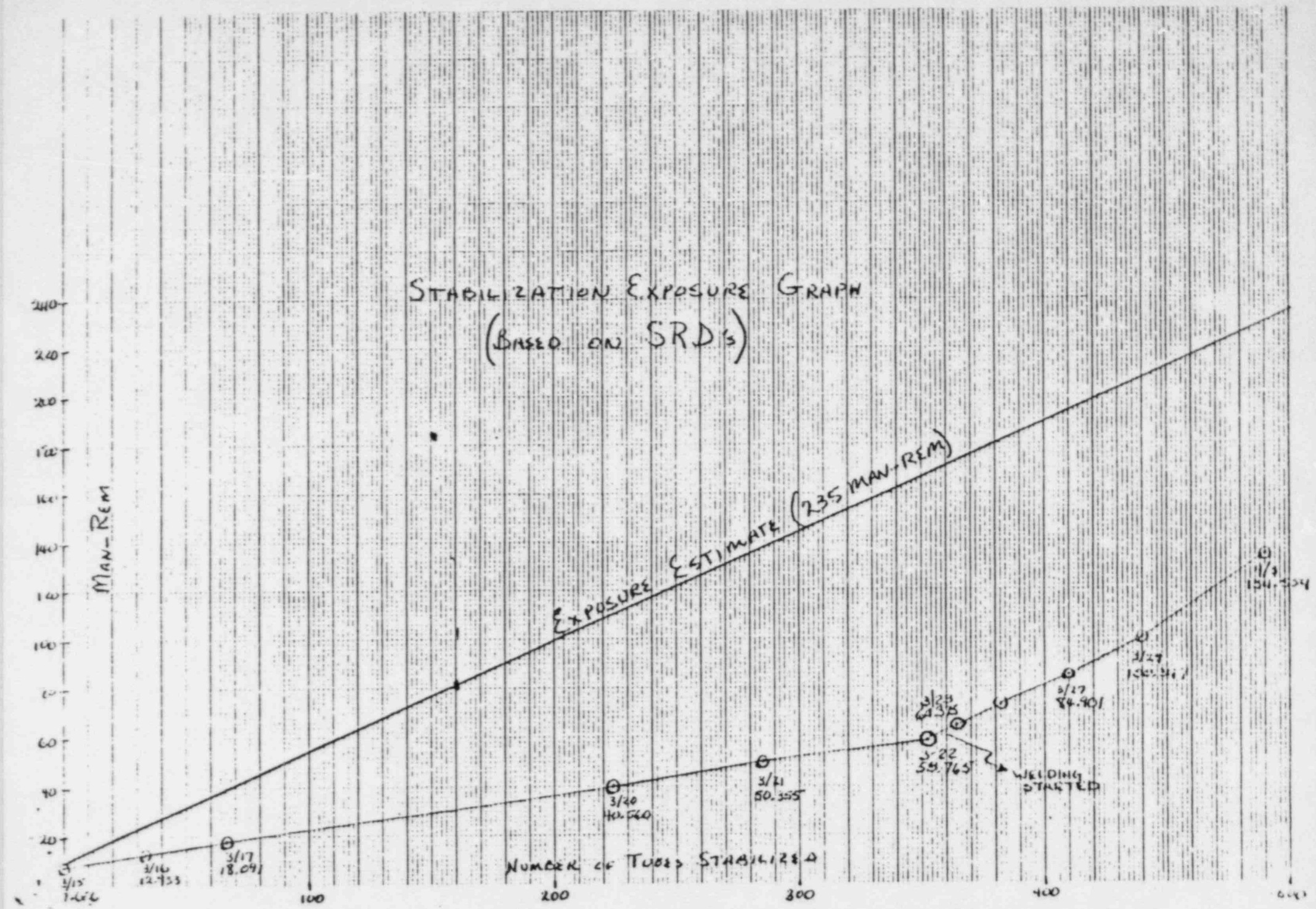
10. Bubble and Drip Test — Friday at 10:00
   . Receive Hard Rollers — J. Martin — Week of 4/18
   . Bubble Test Procedure

11. Cleaning of the Cold Legs

12. Anticipated Jumps

Date	Description	Responsibility
4/6	A - Upper - ~~W~~ roller plugs	Levin/Catalytic
	A - Lower - W/ roll plugs	
4/6	B - Upper - B&W Nozzle Repair	
	B - Lower - Catcher	

Roll today upper 5 stabilizers 1 day weld inspection
~~Plug~~ Pull/Re Pull
Dip tests
W Roll Lower


STABILIZATION EXPOSURE GRAPH
(BASED ON SRDs)
MAN-REM
EXPOSURE ESTIMATE (235 MAN-REM)
NUMBER OF TUBES STABILIZED
3/15
3/16
12.733
3/17
18.041
3/20
40.560
3/21
50.355
3/22
59.765
WELDING STARTED
3/23
3/25
3/27
84.901
1/3
154.534
100
200
300
400

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 4/7/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side A. Temp. Chem. System		
2.	Ops OTSG Status . OTSG Level "A" - 576" 572" . OTSG Level "B" Full Wet Layup . Receive Backing Plates for "A" Upper Manway		4/4
3.	Post Expansion/Felt Plug Blowing . # of Tubes Blown @ "A" ---- . # of Tubes Blown @ "B" 3685 & 5059 . # of Tubes Blocked @ "A" ---- . # of Tubes Blocked @ "B" 12 18 . # of Tubes Unreachable at "B" 15 . Receive Heapa Filters	B&W B&W	TBD
4.	Immunol Flush System . Revised Spec for Flushing Possible reflush OTSG's		
5.	Tube Plug Stabilization . Removal of W Plugs . 5 Stabilizers in "A" upper . Rerolled Tubes "B" upper	 B&W Westinghouse	4/6
6.	Miscellaneous Items to Resolve . Hydrogen Peroxide Tube Soak . Makeup Line Backflush STP . Temporary Mechanical	F. Paulewicz	4/5

W A upper-done

W B lower rolling today

OTSG REPAIRS DATE 4/7/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	QC
345-82	2 Tubes Plugged Incorrectly	QC
354-82	Documentation for Immunol-1st Batch	QC
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
067-83	Endmilling to 40 mils	QC
064-83	Holders for Stabilizers	QC
073-83	Explosive Plug that fell out	QC
063-83		

8. Tube Endmilling
   . Photos

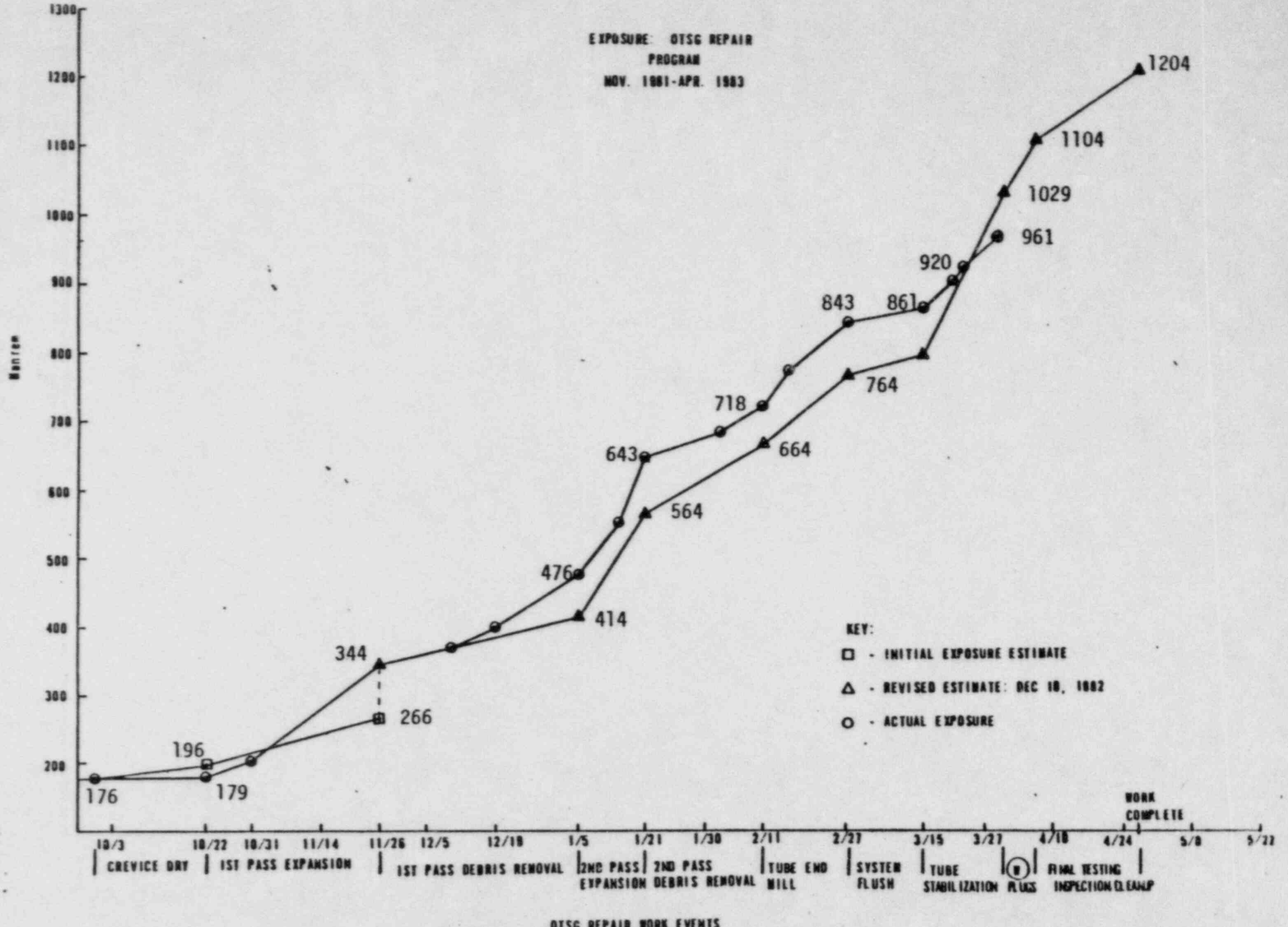
9. Rad Con Exposure Data (Based on SRDs) as of 4/6
   . W Plugging - 13.8 Man Rem 21.9
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 836.7 Man Rem
   . Total OTSG Exposure since Nov 1981 - 1012.9 Man Rem

10. Bubble and Drip Test 10:00 Meeting
    . Receive Hard Rollers — J. Martin — Week of 4/18
    . Draft Bubble Test Procedure — 4/6
    Early Next Week

11. Cleaning of the Cold Legs — Hard roller on site around 20

12. Anticipated Jumps

Date	Description	Responsibility
4/7	A - Upper - A - Lower - W Rolling	Levin/Catalytic
4/7	B - Upper - B - Lower - Felt Plugs	


EXPOSURE: OTSG REPAIR PROGRAM
NOV. 1981-APR. 1983
Rem-rem
1300
1200
1100
1000
900
800
700
600
500
400
300
200
1204
1104
1029
961
920
861
843
764
718
664
643
564
476
414
344
266
196
179
176
KEY:
□ - INITIAL EXPOSURE ESTIMATE
△ - REVISED ESTIMATE: DEC 18, 1982
○ - ACTUAL EXPOSURE
WORK COMPLETE
10/3
10/22
10/31
11/14
11/26
12/5
12/18
1/5
1/21
1/30
2/11
2/27
3/15
3/27
4/18
4/24
5/8
5/22
CREVICE DRY
1ST PASS EXPANSION
1ST PASS DEBRIS REMOVAL
2ND PASS EXPANSION
2ND PASS DEBRIS REMOVAL
TUBE END MILL
SYSTEM FLUSH
TUBE STABILIZATION
PLUGS
FINAL TESTING INSPECTION CLEANUP
OTSG REPAIR WORK EVENTS

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 4/11/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side		
	A. Temp. Chem. System		
2.	Ops OTSG Status		
	. OTSG Level "A" - 572"		
	. OTSG Level "B" Full Wet Layup		
3.	Post Expansion/Felt Plug Blowing		
	. # of Tubes Blown @ "A" ----		
	. # of Tubes Blown @ "B" 6304 76	B&W	
	. # of Tubes Blocked @ "A" ----		
	. # of Tubes Blocked @ "B"	B&W	
	. # of Tubes Temporarily Unreachable		
	. Receive Hepa Filters		4/8 - 4/12
4.	Immunol Flush System		
	. Revised Spec for Flushing		
	. Samples From Filters		TBD
5.	Tube Plug Stabilization		
	. Fab Tool for W Plug Removal tool broke	D. Harper	4/9
	. Removal of W Plugs (1 of 2 done)		4/6
	. 5 Stabilizers in "A" upper	B&W	
	All stabilizers are in except 1 W		
6.	Miscellaneous Items to Resolve		
	. Hydrogen Peroxide Tube Soak		
	. Makeup Line Backflush STP	F. Paulewicz	4/5

7) W NCR

B W 13 did not meet the roll di check

A 3 did not meet the roll di check

OTSG REPAIRS DATE 4/11/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	QC
345-82	2 Tubes Plugged Incorrectly	QC
354-82	Documentation for Immunol-1st Batch	QC
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
073-83	Explosive Plug that fell out	QC

8. Tube Endmilling
   . Photos

9. Rad Con Exposure Data (Based on SRDs) as of 4/6
   . W Plugging - 21.9 Man Rem
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 836.7 Man Rem
   . Total OTSG Exposure since Nov 1981 - 1012.9 Man Rem

10. Bubble and Drip Test

. Ship Hard Rollers	J. Martin	4/19
. Draft Bubble Test Procedure		4/6
. Receive Spec for Hard Rolling	T. Functions	TBD

Drip test on ↑ tapes at 1:00

11. Cleaning of the Cold Legs

. Issue Change Notice to Contractor Purchase Rec.	S. Levin	TBD

12. Anticipated Jumps

Date	Description	Responsibility
4/11	A - Upper - plug out / QC inspection A - Lower -	Levin/Catalytic
4/11	B - Upper - B - Lower - Fell plug blowing	

GENERAL PUBLIC UTILITIES
OTSG REPAIRS

DATE 4/12/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED
1.	Restoration Secondary Side . Temp. Chem. System	S. Levin	TBD
2.	Ops OTSG Status . OTSG Level "A" - 572" . OTSG Level "B" Full Wet Layup 'B' in 124 lbs		
3.	Post Expansion/Felt Plug Blowing . # of Tubes Blown @ "A" ---- . # of Tubes Blown @ "B" 9836 . # of Tubes Blocked @ "A" ---- . # of Tubes Blocked @ "B" 20 . # of Tubes Temporarily Unreachable at "B" 202 . Receive Hepa Filters 1000 per day	B&W B&W	4/15
4.	Immunel Flush System . Revised Spec for Flushing . Results of Samples From Filters → to Battelle		TBD
5.	Tube Plug Stabilization . Removal of W Plug in "A" Upper . Resolve 6 NCRs from W 42 tubes that require weld repairs probes are right hole	Eng.	4/6 TBD
6.	Miscellaneous Items to Resolve . Hydrogen Peroxide Tube Soak . Makeup Line Backflush STP	F. Paulewicz	4/5

221 W plug left

OTSG REPAIRS DATE 4/12/83

ITEM	DESCRIPTION	RESPONSIBILITY	DATE REQUIRED

7. Waiting Documentation

MNCR		Responsibility
215-82	Plug Exploded at Wrong Area of Tube	QC
345-82	2 Tubes Plugged Incorrectly	QC
354-82	Documentation for Immunol-1st Batch	QC
426-82	Wire Brush B6-1	
009-83	Immunol at Cold Legs	
073-83	Explosive Plug that fell out	QC

8. Tube Endmilling
   . Photos

9. Rad Con Exposure Data (Based on SRDs) as of 4/6
   . W Plugging - 21.9 Man Rem - 45 man rem
   . Exposure Estimate - 75 Man Rem
   . Total OTSG Exposure since 1st Blast - 836.7 Man Rem
   . Total OTSG Exposure since Nov 1981 - 1012.9 Man Rem
   Fdk Plug 25-30

10. Bubble and Drip Test

. Ship Hard Rollers	J. Martin	4/19
. Draft Bubble Test Procedure		4/6
. Receive Spec for Hard Rolling	T. Functions	TBD
. STP for 3 Leakers in "B"		TBD
. Install Stoppers for 3 Leakers in "B"		

200 G expansion

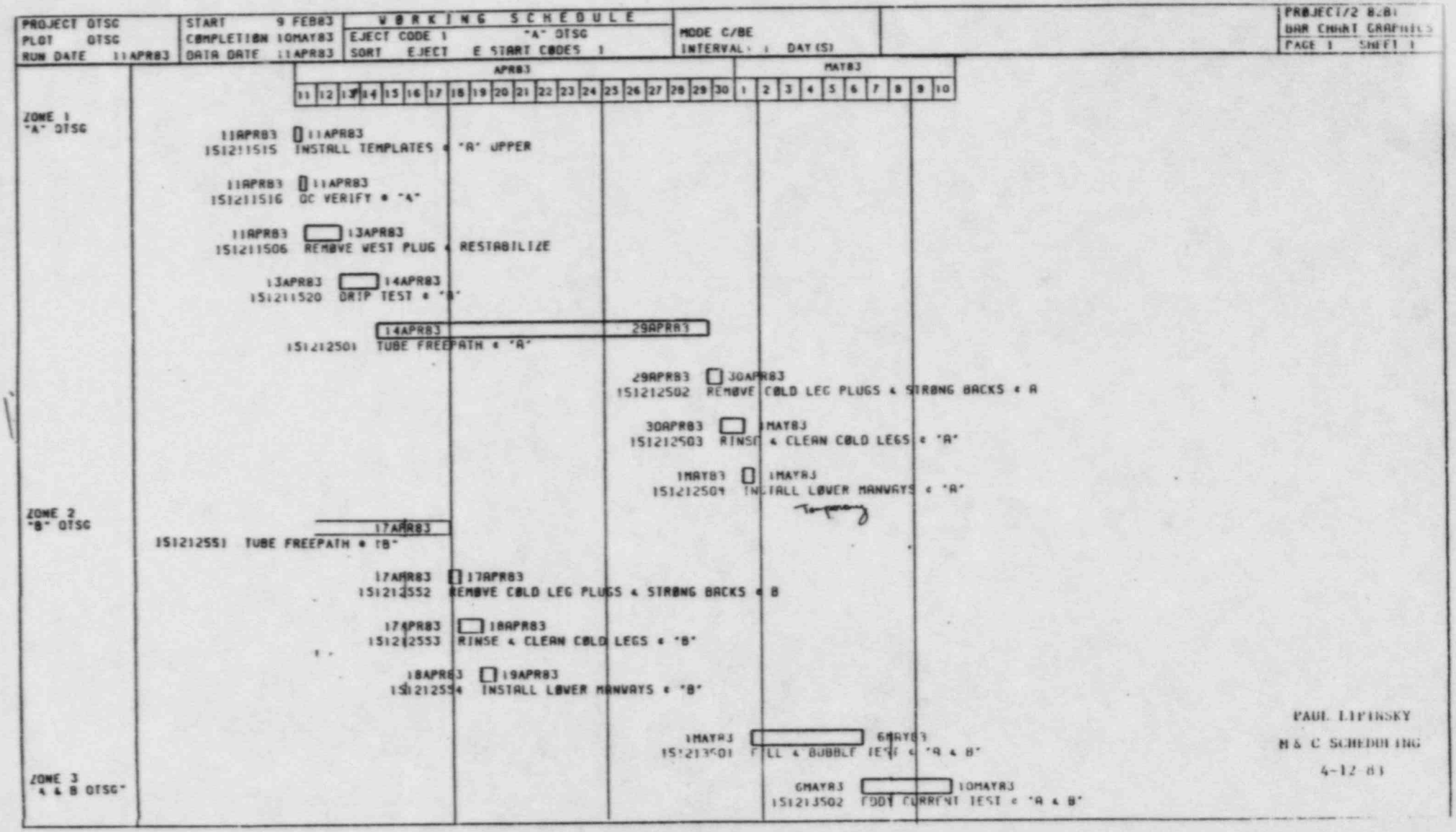
Crystal River bubble acceptable

11. Cleaning of the Cold Legs

. Issue Change Notice to Contractor	S. Levin	TBD

12. Anticipated Jumps

Date	Description	Responsibility
4/12	A - Upper - w plugs/weldouts	Levin/Catalytic
	A - Lower -	
4/12	B - Upper - Felt plug blowing	
	B - Lower -	


PROJECT OTSG
PLOT OTSG
RUN DATE 11APR83
START 9 FEB83
COMPLETION 10MAY83
DATA DATE 11APR83
WORKING SCHEDULE
EJECT CODE 1 "A" OTSG
SORT EJECT E START CODES 1
MODE C/BE
INTERVAL: 1 DAY(S)
PROJECT/2 8.81
BAR CHART GRAPHICS
PAGE 1 SHEET 1
APR83
MAY83
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 1 2 3 4 5 6 7 8 9 10
ZONE 1
"A" OTSG
11APR83 11APR83
151211515 INSTALL TEMPLATES @ "A" UPPER
11APR83 11APR83
151211516 QC VERIFY @ "A"
11APR83 13APR83
151211506 REMOVE WEST PLUG & RESTABILIZE
13APR83 14APR83
151211520 DRIP TEST @ "A"
14APR83 29APR83
151212501 TUBE FREEPATH @ "A"
29APR83 30APR83
151212502 REMOVE COLD LEG PLUGS & STRONG BACKS @ A
30APR83 1MAY83
151212503 RINSE & CLEAN COLD LEGS @ "A"
1MAY83 1MAY83
151212509 INSTALL LOWER MANWAYS @ "A"
ZONE 2
"B" OTSG
17APR83
151212551 TUBE FREEPATH @ "B"
17APR83 17APR83
151212552 REMOVE COLD LEG PLUGS & STRONG BACKS @ B
17APR83 18APR83
151212553 RINSE & CLEAN COLD LEGS @ "B"
18APR83 19APR83
151212554 INSTALL LOWER MANWAYS @ "B"
1MAY83 6MAY83
151213501 FILL & BUBBLE TEST @ "A & B"
6MAY83 10MAY83
151213502 EDDY CURRENT TEST @ "A & B"
ZONE 3
A & B OTSG"
PAUL LIPINSKY
M & C SCHEDULING
4-12-83

gray

4/21

PRIORITY ATTENTION REQUIRED

MORNING REPORT - REGION I
4-18-83

PRIORITY ATTENTION REQUIRED

TO: James Blaha, Chief, Program Support Branch, IE
FROM: James M. Allan, Acting Regional Administrator, Region I

Licensee/Facility	Notification/Subject	Description of Items or Events
DPRP		
Ginna 50-244	SRI fax	Daily Report 4/8 Update. The licensee has completed a sampling UT examination of feedwaster ring "J" tubes in the "B" Steam Generator (S/G). Results indicated wall loss similar to that identified in the "A" S/G. The licensee intends to cut out all existing carbon steel "J" tubes in both S/G's, and replace them with Inconel "J" tubes. Work is expected to start in early May.
Shoreham 50-322	SRI fax	Representative Markey will be holding hearings on Long Island on Emergency Planning Regulations and Requirements as they apply to Shoreham. Expected to testify: Governor M. Cuomo; Senator D. Moynihan; County Executive P. Cohalen; NRC staff members, W. Dircks, G. Cunningham, J. Sniezek, R. Blond.
Susquehanna Unit 1 50-387	ENS call	The licensee reported that Reactor Building ventilation isolated and the Control Room Emergency Outside Air Supply System (Creoass) initiated while the licensee was transferring the Moisture/Separator from the Reactor vessel to the storage area. The transfer caused radiation levels at the Refuel floor exhaust monitor channel "A" to peak at 6 millirem/hour with the trip setpoint presently set at 5 millirem/hour. The isolation occurred at approximately 00:15 a.m. on April 17 and was reset by 00:20 a.m. The licensee is continuing to isolate the source of the noise that was being sensed by the Loose Parts Monitoring System.
Limerick Units 1 and 2 50-352/353	--	There will be a SALP Board Meeting today at 2:00 in the regional office to evaluate licensee performance in the operation of Limerick Generating Station.
Three Mile Island Unit 1 50-289	4/18 SRI fax/ Once Through Steam Generator (OTSG) Tube Degradation Update	Late on April 15, 1983, the licensee completed a leak tightness test at 150 lb. pressure (drip test) on both "A" and "B" OTSG. The "A" OTSG appeared to have 15 tubes leaking while the "B" OTSG appeared to have 22 tubes leaking. The drip test was conducted at this time to obtain an indication of the number of tubes that are leaking after kinetic expansion. The licensee plans on conducting a nitrogen bubble leak tightness test after the completion of final free path check of all tubes and selected Eddy Current Testing. Preliminary plans indicate that tubes which were found to be leaking will be mechanically hard rolled to form a new leak tight seal. The licensee is on schedule for Hot Functional Testing in the late part of May 1983.

Licensee/Facility	Notification/Subject	Description of Items or Events
DPRP (cont'd)		
Three Mile Island Unit 1 50-289	4/18 SRI fax/ Prompt Reportable Occurrence	On April 15, 1983, the licensee reported the failure of a bearing on one Decay Heat Removal Pump (DH-P1A, Low Pressure Injection System). Preliminary information indicates improper oil level subsequent to the installation of a remote oil system. The licensee considers this reportable per Technical Specification 6.9.A.9. The redundant pump was operable.
DETP		
Salem Unit 2 50-311	4/18 RRI fax/ Airborne Radio- activity in Primary Containment	At about 4:30 p.m., 4/16, workers exiting containment were found contaminated around the nasal area. Grab sampling of containment air at 5:00 p.m. indicated Cobalt-58, 60 and Manganese 54 at about 41.7 times Appendix B limits. The activity was apparently stirred up by air currents while conducting vibration testing of a reactor coolant pump motor in the vicinity of Steam Generator 22. Other workers in the steam generator were removing a broken nozzle dam stud from the hot leg. An airborne cleanup system used during this work was found to be out-of-service. Containment access was restricted. Of 208 workers who had been in containment during the period, 150 have been given whole body counts as of 7:00 a.m., 4/18. Sixty-seven sustained low intakes of radioactive materials. (The highest was 5% of 10 CFR 20 quarterly limits.) Local media interest was high. The resident inspector and a health physics inspector were dispatched to the site. PNO-83-32 was issued 4/18 for information.

THI - DRAFT
MORNING REPORT -- REGION I
April 12, 1983

4/11

Licensee/Facility	Notification/Subject	Description of Item or Event
Three Mile Island Unit 1 DN 50-289	Fax from SRI 4/12 Pressurizer Entry	During the past week (4/4 - 11/83), the licensee completed various evolutions associated with the Pressurizer Internal Inspection. Before hydrolazing the internals, visual, video (black and white), and photographic (color) surveys of the pressurizer internals were completed along with radiological surveys and ~~the taking of~~ surface ~~scrape~~ samples for laboratory analysis. Subsequent to hydrolazing, additional visual, video, and photographic surveys were completed. On initial entry, yellowish deposits (purported to be sulphur) were noted near a vent nozzle and on a U-Bolt (spray nozzle support) at the dome of the pressurizer. Small amounts of a red deposit (purported to be iron sulfide) were noted on the pressurizer internal surface. Small amounts of a rusty deposit were noted on the heater banks. ~~It appears~~ Hydrolazing was effective in removing the yellowish and rusty deposits and most of the red deposits on the walls of the pressurizer. As expected, general area radiation levels were an increasing gradient from 5 mR/hr (gamma) at the manway at the top of the pressurizer to approximately 500 mR/hr (gamma) at the bottom of the pressurizer. ~~Preliminary dosimetry data indicates that those who entered the pressurizer received exposures within NRC limits.~~ The resident inspectors followed licensee work activities and visually inspected the pressurizer internals.

Durr

Reynolds

Gregg

Gray 1/Ga 4/12

Richards