PRESENTATION TO NRC ON MONTICELLO FEEDWATER NOZZLE MODIFICATION

AUGUST 4, 1981

PRESENTED BY:

-NORTHERN STATES POWER CO. -NUTECH

-GENERAL ELECTRIC CO.

8108200274 810810 PDR ADDCK 05000263 -NEWPORT NEWS INDUSTRIAL CORP.

PURPOSE OF MEETING

- PROVIDE NRC STAFF WITH UPDATED STATUS OF MONTICELLO FEEDWATER NOZZLE PLANS FOR OCTOBER, 1981 OUTAGE
- ADDRESS NINE SPECIFIC TOPICS IN NRC REQUEST FOR ADDITIONAL INFORMATION

SEQUENCE OF EVENTS LEADING TO TODAY'S MEETING

FALL, 1977	 CLAD REMOVED/INTERIM, SINGLE SLEEVE SPARGER INSTALLED NOT POSSIBLE TO MACHINE SAFE-END TO ACCEPT TRIPLE SLEEVE SPARGER
FALL, 1978	 NUTECH LEAKAGE MONITORING SYSTEM INSTALLED LEAKAGE INDICATED IN 1 OR 2 SPARGERS
SEP., 1979 -MAR., 1980	 GE CONDUCTED STUDY OF MONTICELLO SPARGER ALTERNATIVES
APR., 1980	 NSP DECIDED ON NEW DESIGN CONCEPT INFORMALLY BRIEFED NRC PRESENTED TECHNICAL DETAILS + MOCKUP TO NRC
MAY, 1980	 NRC CONCLUDED THAT PROPOSED MODIFICATION SHOULD PREVENT CRACK INITIATION AND GROWTH
DEC., 1980	 NUREG-0619 ISSUED REQUIRED LICENSEE IMPLEMENTATION DATES
JAN., 1981	 NSP RESPONSE TO NUREG-0619 GAVE PLANS & SCHEDULE FOR NEW SPARGER INSTALLATION COMMITMENT TO STUDY LOW FLOW CONTROLLER
FEBMAR. 1981	 NRC REQUESTED ADDITIONAL INFORMATION

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DESIGN CONCEPT SELECTED IN APRIL, 1980

	AGENDA	
	PRESENTED BY	<u>NRC</u> * <u>TOPIC NO</u> .
 INTRODUCTION 	NSP	
• PRESENT STATUS	NUTECH	I
• DESIGN	GE	II, III, VII, VIII
• INSTALLATION	NNI	IV, V, VI
• ALARA	NNI	V
• ISI PROGRAM	NUTECH	IX
 CONCLUSIONS 	NSP	

* REFERS TO TOPICS IDENTIFIED IN NRC REQUEST FOR ADDITIONAL INFORMATION IN FEB/MARCH 1981 MONTICELLO FEEDWATER NOZZLE PRESENT STATUS

- LEAKAGE MONITORING SYSTEM
- LEAKAGE HISTORY
- USAGE FACTOR STATUS
- SYSTEM & OPERATING PROCEDURE MODIFICATIONS



FW NOZZLE THERMAL FATIGUE EVALUATION

LEAKAGE PREDICTION LEAKAGE RATE $q = f (\Delta T_{T/B}, Q)$ FW FLOW RATE TOP-TO-BOTTOM TEMPERATURE DIFFERENTIAL

METAL TEMPERATURE CYCLING

 $\Delta T_{p-p} = f(q, Q, LOCATION)$

FATIGUE USAGE FACTOR

$$U = \sum_{i=1}^{N} \frac{N_{APPLIED}}{N_{ALLOWABLE}} = f(\Delta T_{p-p}, FLOW MAP)$$
SYSTEM & OPERATIONAL
PROCEDURE



MONTICELLO FEEDWATER NOZZLE A FIELD DATA FROM THE LEAKAGE MONITORING SYSTEM VERSUS TIME (NON-LEAKING)

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LEAKAGE RATE VERSUS TIME CURVE FOR FEEDWATER NOZZLE D



RAPID CYCLING CUMMULATIVE USAGE FACTOR VERSUS TIME

USAGE FACTOR STATUS

SYSTEM CYCLING

SAFEEND - .015 PER YEAR

BORE - .0055 PER YEAR

BLEND RADIUS REGION - .0045 PER YEAR

RAPID CYCLING

-DEPENDING ON LEAKAGE (BORE & BLEND RADIUS ONLY)

MAX. COMBINED FATIGUE USAGE FACTOR AT TIME OF MODIFICATION

UF = .102 (BORE REGION)

SYSTEMS & OPERATIONAL PROCEDURE

MODIFICATIONS

- FEEDWATER THERMAL DUTY MAP
- LOW FLOW CONTROLLER CHARACTERISTICS
- RWCU REROUTE
- MINIMIZE STEAM FLOW DURING STARTUP
- MAXIMIZE HEAT UP RATE DURING STARTUP



NSP-27-015



GE TYPICAL FEEDWATER THERMAL DUTY MAP

MONTICELLO FEEDWATER LOW FLOW CONTROLLER CHARACTERISTICS

IMPROVEMENTS IMPLEMENTED

∼1974 -- AUTOMATIC LEVEL CONTROL CAPABILITY ADDED~1978 -- CONVENTIONAL PLUG VALVE REPLACED BY DRAG VALVE

 COMPARISON TO NUREG -0619/GE RECOMMENDED LOW FLOW CONTROLLER CHARACTERISTICS:

- GE REFERENCE CRACK GROWTH ANALYSIS (CASE J)

- ONE "TURBINE ROLL" CYCLE WITH **∆**T = 385°F
- FLOW MODULATION CYCLING WITH ▲T = 100°F
 AND FREQUENCY = 4 CYCLES/HOUR

- OBSERVED LOW FLOW CONTROLLER CYCLING AT MONTICELLO

- ONE LARGE CYCLE PER STARTUP ($\Delta T = 385^{\circ}F$)
- FLOW MODULATION CYCLING AVERAGE AT = 100°F
 AND FREQUENCY = 1.5 CYCLES/HOUR
- <u>CONCLUSION</u> -- EXISTING LOW FLOW CONTROLLER AT MONTICELLO MEETS NUREG- 0619/GENERIC LETTER 81-11 CRACK GROWTH REQUIREMENTS



IMPROVED LOW FLOW CONTROLLER PARAMETRIC CRACK GROWTH RESULTS FROM NEDE - 21821-A



TIME (W)

CTARTUP/SHUTDOWN CYCLES FOR CASE J IN NEDE-21821-A CRACK GROWTH ANALYSIS





DESIGN

o CONFIGURATION

o DESIGN FEATURES

o DESIGN CRITERIA

o MATERIALS OF CONSTRUCTION

o SUMMARY OF ANALYSIS RESULTS

o THERMAL HYDRAULICS

• VIBRATION AND CRACK GROWTH

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EXISTING MONTICELLO FEEDWATER NOZZLE



THERMAL SLEEVE DESIGN

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DESIGN FEATURES

- DOUBLE THERMAL SLEEVE PROVIDES ENHANCED THERMAL PROTECTION TO NOZZLE
- WELDED SAFE END DESIGN ELIMINATES LEAKAGE ON THE NOZZLE BORE
- REMOVEABLE SPARGER AND OUTER THERMAL SLEEVE PROVIDES ACCESS TO THE NOZZLE INNER BLEND RADIUS AND CRITICAL BORE AREAS FOR IN-SPECTION
- EXTENDED OUTER THERMAL SLEEVE DIRECTS ANY LEAKAGE FLOW AT THE IN-TERFERENCE FIT AWAY FROM THE NOZZLE INNER BLEND RADIUS
- NO SERVICING REQUIRED SINCE PERFORMANCE IS NOT AFFECTED BY CORROSION RATES OR WEAR ON COMPONENTS
- O THERMAL SLEEVE TO SAFE END WELD IS NOT ON PRESSURE BOUNDARY
- THERMAL SLEEVE TO SAFE END WELD IS A FULL PENETRATION SHOP WELD WHICH HAS BEEN INSPECTED FROM BOTH SIDES OF THE WELD
- NO BI-METALLIC WELDS ON THE PRIMARY PRESSURE BOUNDARY
- O PRESSURE BOUNDARY WELDS HAVE ACCESS FOR NON-DESTRUCTIVE EXAMINATIONS
- O SPARGER HAS TOP MOUNTED NOZZLES

DESIGN CRITERIA

- REPLACEMENT SAFE END AND THERMAL SLEEVE FURNISHED AS AN ASME SECTION III, CLASS 1 PART USING THE 1977 EDITION WITH ADDENDA TO AN INCLUDING SUMMER 1978 (CODE CASE 1804 INCORPORATED INTO THIS CODE)
- REACTION LOADS FROM FEEDWATER PIPE STRESS ANALYSIS WERE SPECIFIED FOR THE REPLACEMENT SAFE END DESIGN
- MECHANICAL LOADS FOR A WELDED THERMAL SLEEVE ATTACHMENT WERE SPECIFIED FOR THE REPLACEMENT SAFE END DESIGN
- SYSTEM THERMAL CYCLING FROM ORIGINAL FEEDWATER NOZZLE DESIGN WAS SPECIFIED
- GENERIC FORMULAS DEVELOPED BY GE FOR RAPID CYCLING WITH MODI-FICATIONS TO ACCOUNT FOR UNIQUE DESIGN FEATURES AND PLANT OPERAT-ING CONDITIONS WERE SPECIFIED
- SYSTEM AND RAPID CYCLING FATIGUE USAGE REQUIRED TO BE COMBINED WITH THE ACCUMULATED NOZZLE FATIGUE USAGE AND MEET THE ASME LIMIT OF 1.0
- REPLACEMENT SPARGER DESIGNED IN ACCORDANCE WITH GE DESIGN CRITERIA ESTABLISHED FOR GENERIC SPARGER REPLACEMENTS
- DESIGN SOFTWARE WAS PRODUCED IN ACCORDANCE WITH Q.A. PROGRAM WHICH MEETS REQUIREMENTS OF 10CFR50



	F	F	F	M	M	M
•	x	У	Z	X	У	z
Dead Weight	0	3	5	-1.2	0	0
Thermal (RFE)	• 0	0	-1.2	0	0	0
Hydraulic	0	0	-2.5	0	. 0	0
Seismic	<u>+</u> 2.5	± .3	<u>+ 1.5</u>	<u>+ 1.2</u>	<u>+</u> 2.0	0

NOZZLE THERMAL SLEEVE LOADINGS*

Design Mechanical Loads are to be taken as the sum of the hydraulic, seismic, and dead weight loads.



LUADING FRUM ALLACHED PIP	LOAD	ING	FROM	ATTACHED	PTPR
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Nozzle	Loads	F x	Fy	Fz	Mx	M y	Mz	R
Nozzle A and B	Design Mechanical	2.54	3.15	2.28	387.6	172.9	324.6	131.6
Nozzle 'A' (operating loads)	Dead Weight Seismic Thermal	11 ±.29 .02	63 ± 2.51 .16	.15 ± 2.23 21	$ \begin{array}{r} 11.6 \\ \pm 9.3 \\ -12.0 \end{array} $	-14.1 + 158.9 12.1	-11.1 ± 313.4 -45.0	131.6 131.6 131.6
Nozzle 'B' (operating loads)	Dead Weight Seismic Thermal	07 <u>+</u> 2.44 .82	.18 ± 1.97 -4.34	04 ± .26 1.37	-7.0 ± 376.0 267.2	-2.1 ± 106.3 66.7	-7.3 ± 10.6 1.4	131.6 131.6 131.6

MATERIALS

o SUMMARY OF MATERIALS USED FOR CONSTRUCTION

<u>COMPONENT</u>

MATERIAL

SAFE END ASSEMBLY

SAFE END THERMAL SLEEVE

ASME SA-350 LF2 ASME SA-182 TYPE F316 (LOW CARBON)

SPARGER ASSEMBLY

HEADER PIPE ADAPTER EXTENSION PIPE ORIFICE ELBOW TEE END PLATE LIFTING LUG

OUTER THERMAL SLEEVE

5/8" SQUARE PIN

END BRACKET

END PIN

STOP

STAINLESS STEEL FILLER METALSFA 5.9 ER308LCARBON STEEL FILLER METALSFA 5.18 E70S-3

ASME/ASTM SA-312 TYPE 316L ASME SA-479 TYPE 316L ASME SA-312 TYPE 316L ASME SA-479 TYPE 316L ASME SA-479 TYPE 316L ASME SA-240 TYPE 316L ASME SA-182 TYPE 316L ASME/ASTM SA-479 TYPE 316L ASTM A-312 TYPE 316L ASTM A-479 TYPE 316L ASME SA-351 GRADE CF3 ASTM A479 TYPE 316L SFA 5.9 ER308L

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MATERIALS (CONTINUED)

- THE CORROSION ALLOWANCES FOR DESIGN OF THE CARBON STEEL SAFE END WERE .06 FOR INTERNAL SURFACES IN CONTACT WITH REACTOR WATER, AND .03 FOR EXTERNAL SURFACES. FOR STAINLESS STEEL .003 INCHES WAS USED.
- GENERAL CORROSION RATES FOR CARBON STEEL AND STAINLESS STEEL ARE WELL ESTABLISHED FOR THE BWR ENVIRONMENT. THERE IS NO APPRECIABLE DIFFERENCE IN RATES FOR BASE METAL, WELD METAL OR WELD HEAT AFFECTED ZONES.
- ALTHOUGH NOT REQUIRED, THE SPARGER MATERIALS WERE PUR-CHASED AND FABRICATED UNDER A Q.A. PROGRAM WHICH MEETS THE RE-QUIREMENTS OF 10CFR50.
- REPLACEMENT SAFE ENDS WERE FABRICATED AS A SAFETY ESSENTIAL COMPONENT UNDER Q.A. PROGRAM WHICH MEETS THE REQUIREMENTS OF 10CFR50.

MEASURES TAKEN TO PREVENT IGSCC

- ALL WROUGHT STAINLESS STEEL IS TYPE 316 OR 316L WITH THE FOLLOWING ADDITIONAL CONTROLS:
 - CHEMISTRY CONTROL (<0.02% CARBON)
 - SOLUTION HEAT TREATMENT CONTROL
 - EXAMINATION FOR INTERGRANULAR ATTACK
 - TESTING FOR SENSITIZATION
 - HARDNESS CONTROL
- STAINLESS STEEL WELD FILLER METAL IS TYPE 308L
 WITH FERRITE CONTROLLED
- o FABRICATION CONTROLS
 - WELD HEAT INPUT CONTROLLED
 - COLD DEFORMATION LIMITED
 - PROCESSING MATERIALS CONTROLLED
 - CREVICES AT WELDS ELIMINATED IN DESIGN
- IGSCC IN CARBON STEEL BASE MATERIAL AND WELD METAL HAS NOT BEEN OBSERVED IN THE FIELD OR IN THE LAB-ORATORY

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STRESS CATEGORY	COMPONENT	MAX.STRESS (KSI)	ALLOWABLE (KSI)	LOCATION
PRIMARY MEMBRANE (PM) SERVICE LEVEL C	EXISTING NOZZLE EXISTING SAFE END SAFE END THERMAL SLEEVE	15.46 15.46 15.46 3.16	42.60 27.10 27.85 19.2	A B&C D&E I&J
PRIMARY MEMBRANE PLUS BENDING (PM+B) SERVICE LEVEL C	EXISTING NOZZLE EXISTING SAFE END SAFE END THERMAL SLEEVE	27.73 27.65 33.28 17.18	63.90 40.65 41.77 28.80	A B F I
PRIMARY PLUS SECONDARY (P+Q) SERVICE LEVEL A&B	EXISTING NOZZLE EXISTING SAFE END SAFE END THERMAL SLEEVE	32.22 39.27 45.42* 33.19*	80.1 54.3 55.8 48.0	B C H I
FATIGUE USAGE	EXISTING NOZZLE EXISTING SAFE END SAFE END THERMAL SLEEVE	.2458 * * .2810 .4100 .2007	1.0 1.0 1.0 1.0 1.0	B C H I
* VALUE CHOUN TO UTTU -				

* VALUE SHOWN IS WITH THERMAL BENDING REMOVED **FATIGUE USAGE ON MACHINED NOZZLE BORE & BLEND RADIUS LESS THAN VALUE SHOWN.

THERMAL/HYDRAULICS

- EXCEPT FOR THE SINGLE THERMAL SLEEVE REGION OF THE NEW SAFE END, THE REPLACEMENT DESIGN IS ESSENTIALLY IDENTICAL TO THE GE DOUBLE PISTON RING DESIGN FROM A THERMAL HYDRAULIC VIEWPOINT.
- SAFE END THERMAL STRESSES ARE LOWER WHEN A SINGLE THERMAL SLEEVE JOINS TO THE SAFE END.
- THE THERMAL SLEEVE TO NOZZLE ANNULUS FLUID TEMPERATURES USED IN THE THERMAL ANALYSIS WERE ADJUSTED USING EXISTING GE THERMAL DATA TO CORRECT FOR THERMAL VARIATIONS FROM THE SINGLE SLEEVE REGION.
- GE FEEDWATER THERMAL TEST DATA BASE WAS UTILIZED TO DEMONSTRATE ACCEPTABILITY OF REPLACEMENT DESIGN.
- IN-VESSEL THERMAL MONITORING AT DUANE ARNOLD (SIMILAR DESIGN) ON THE NOZZLE INNER BLEND RADIUS DEMONSTRATED THAT FATIGUE USAGE FROM RAPID CYCLING WAS LOW.

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• EROSION CAUSED BY HYDRAULIC FLOW WILL BE INSIGNIFICANT SINCE FLOW VELOCITIES AT ALL LOCATIONS ARE LESS THAN 50 FT/SEC.

VIBRATION

- EXISTING G.E. VIBRATIONAL TEST DATA IS REPRESENTATIVE OF THE MONTICELLO REPLACEMENT SPARGER DESIGN.
- VIBRATION TESTING OF DUANE ARNOLD DESIGN (SIMILAR THERMAL SLEEVE/ SPARGER INTERFACE) DEMONSTRATED THAT FLOW INDUCED VIBRATION WILL NOT OCCUR UNTIL A RADIAL GAP IN EXCESS OF .015 INCHES IS PRESENT.
- SINCE THE REPLACEMENT SPARGER HEADER IS THE SAME SIZE AS THE EXISTING SPARGER, DOWNCOMER FLOW INDUCED VIBRATION WILL NOT BE A PROBLEM.
- IN GENERAL, GE VIBRATION TESTING WHERE A TIGHT THERMAL SLEEVE GAP WAS MAINTAINED HAS FOUND EXTREMELY LOW VIBRATION LEVELS WHICH ARE WELL BELOW THE GE DESIGN CRITERIA.

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VIBRATION/CRACK GROWTH ANALYSIS SUMMARY

- LOCATION SAFE END TO THERMAL SLEEVE DISSIMILAR METAL WELD (CARBON STEEL & STAINLESS STEEL)
- LOADING PRESSURE, THERMAL, EXTERNAL LOADS, RESIDUAL AND VIBRATORY
- FATIGUE CRACK GROWTH LAW
 - CARBON STEEL ASME SECT. XI, APP. A
 - STAINLESS STEEL ASTM STP513, POOK.
- ANALYTICAL MODEL CIRCUMFERENTIAL CRACK IN A CYLINDER (INITIAL CRACK SIZE = .1t)
- LOADING CYCLES CONSISTENT W/GE USAGE FACTOR CALCS.
- VIBRATORY STRESS
 - -2.40 KSI ≤ 10 KSI (ENDURANCE LIMIT)
 - $\Delta K = 1.08 \text{ ksi} \sqrt{\text{in}} \leq 4 \text{ ksi} \sqrt{\text{in}}$ (threshhold)
 - NO CRACK GROWTH DUE TO VIBRATORY STRESS
- FINAL CALCULATED CRACK SIZE WITHIN SECTION XI ALLOWABLE $-A_{FINAL} = .16 \text{ in}$
 - $-K_{\text{APPLIED}} = 60 \text{ ksi} \sqrt{\text{IN}} < K_{\text{IR}}/3$

FEEDWATER NOZZLE SAFE-END





APPLIED STRESS INTENSITY FACTORS



PREDICTED CRACK GROWTH RATES

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PREPARATION FOR INSTALLATION

- NORMAL VESSEL DISASSEMBLY AND ABOVE CORE INTERNALS REMOVAL (AS IN REFUELING)
- DRAIN & DECONTAMINATE CAVITY
- DROP WATER LEVEL
- DECONTAMINATE VESSEL (HYDROLASER)
- INSTALL WORK PLATFORM & SHIELDING
- INSTALL VESSEL LEVEL INSTRUMENTS
- REMOVE OLD SPARGERS
- CLEAN NOZZLE & BORE

INSTALLATION

ESTABLISH EXTERNAL PIPING CUT LOCATIONS

- -ROUGH CUT OF SAFE END REFERENCED FROM CENTERLINE OF EXISTING SAFE END-TO-NOZZLE WELD, ALLOWING APPROXIMATELY 3/4" EXCESS STOCK
- -CUT BELOW ELBOW REFERENCED FROM CENTERLINE OF NOZZLE
- CUT AND REMOVE PIPING
- PREPARE NOZZLE BORE AND BLEND RADIUS AND PERFORM SURFACE INSPECTION
- TRIAL FIT ACTUAL SPARGER AND DUMMY SLEEVE

 ESTABLISH PROPER ALIGNMENT OF SPARGER TO REACTOR WALL
 ESTABLISH PROPER ALIGNMENT OF DUMMY SLEEVE TO OUTBOARD END OF NOZZLE

-ESTABLISH AND MARK FINAL WELD PREP LOCATION

- WELD PREP EXISTING SAFE END STUB
- MEASURE AND CUT OUTER THERMAL SLEEVE TO LENGTH AND DRILL HOLES FOR STAKING PINS
- FIT NEW SAFE END ASSEMBLY TO EXISTING SAFE END STUB
- INSTALL "DUMMY" SPARGER, A DEVICE WHICH MONITORS WELD SHRINKAGE AND DISTORTION BY REFERENCING OFF INNER VESSEL WALL
- WELD NEW SAFE END TO EXISTING SAFE END STUB, MONITORING WELD SHRINKAGE/DISTORTION BY USING DUMMY SPARGER.
 -IN PROCESS CORRECTION IF NEEDED
- INSTALL OUTER THERMAL SLEEVE USING STAKING PINS
- SHRINK SPARGER TEE USING LIQUID NITROGEN AND INSTALL
- PIN SPARGER ARMS
- REPLACE PIPING IN DRYWELL USING NEW MATERIALS
- RESTORE WORK AREA TO ORIGINAL CONDITION

WELDING OF SAFE ENDS

- A. WELDING PROCEDURE HIGHLIGHTS
 - AUTOMATIC, ORBITAL GAS TUNGSTEN ARC (GTAW) PIPE WELDER
 - SINGLE V-GROOVE WITH 75^o INCLUDED ANGLE AND 1/32" LAND USING CONSUMABLE "K" RING
 - 60 F MINIMUM PREHEAT TEMPERATURE
 - 60 F 500 F INTERPASS TEMPERATURE
 - NO POST WELD HEAT TREATMENT
- B. WELDING PROCEDURE QUALIFICATION
 - PER APPLICABLE REQUIREMENTS OF ASME III, IX AND XI
 - MECHANICAL TESTING TO INCLUDE:
 - o BEND TESTS
 - TENSILE TESTS
 - O CHARPY V-NOTCH IMPACT TESTS OF WELD
 - METAL, BASE METAL, AND HEAT AFFECTED ZONE (HAZ)

- MAXIMUM HEAT INPUT ESTABLISHED IN QUALIFICATION WILL NOT BE EXCEEDED IN PRODUCTION
- C. PREVENTION OF CREVICES IN WELD ROOT AREA
 - INTERNAL COUNTERBORE TRANSITION ANGLE WILL BE 14° MAXIMUM
 - VOLUMETRIC WELD INSPECTION BY RADIOGRAPHY (RT) AND ULTRASONICS (UT) WILL VERIFY THAT NO DETRIMENTAL CREVICES EXIST .

INSPECTION/NDE

A. IN-PROCESS INSPECTION

- 1. FULL PENETRATION WELDS PRESSURE BOUNDRY
 - RADIOGRAPHY (RT) PLUS MAGNETIC PARTICLE (MT) OR LIQUID PENETRANT (PT) INSPECTION
 - TECHNIQUE PER ASME V
 - ACCEPTANCE CRITERIA PER ASME III NB-5000
 - ACCEPTANCE CRITERIA PER ASME XI IWB-3000 MAY BE INVOKED ON A CASE BASIS
- 2. PARTIAL PENETRATION AND FILLET WELDS
 - MAGNETIC PARTICLE (MT) OR LIQUID PENETRANT (PT) INSPECTION
 - TECHNIQUE PER ASME V
 - ACCEPTANCE CRITERIA PER ASME III NB-5000
- B. PRESERVICE INSPECTION
 - 1. BASELINE ISI ULTRASONIC (UT) INSPECTION PER ASME XI
 - 2. SYSTEM LEAK TEST PER ASME XI

REVIEW OF THERMAL SLEEVE/SPARGER

DESIGN FEATURES

- Positive Assurance of No Bypass Leakage at Thermal Sleeve/Safe-End Attachment
 - Shop-Welded Joint
 - INSPECTABLE FROM BOTH SIDES
 - No Crevices
- Multiple Sleeve Protection of Nozzle From Effects of Feedwater
- POTENTIAL LEAKAGE AT SPARGER/THERMAL SLEEVE ATTACHMENT MINIMAL CONCERN BECAUSE:
 - STAINLESS-TO-STAINLESS INTERFERENCE FIT
 - ISO-THERMAL
 - NO DIFFERENTIAL PRESSURE EXPANSION
 - STILL SEPARATED FROM NOZZLE BY THERMAL SLEEVE
- CONSERVATIVE ANAL. SHOWS NEGLIGIBLE RAPID CYCLE FATIGUE USAGE IN NOZZLE BLEND RADIUS/BORE REGIONS

REVIEW OF OTHER FEEDWATER NOZZLE

IMPROVEMENTS AT MONTICELLO

- Clad Removed
- RWCU REROUTE IMPLEMENTED
- IMPROVED OPERATING PROCEDURES/DUTY MAP
- Low Flow Controller Satisfies NUREG-0619/Generic Letter 81-11
- LEAKAGE MONITORING

ALARA SUMMARY

- PROCEDURE PREPARATION
- WORK SEQUENCE
- PLANNING
- SHIELDING
- CORE SPRAY SPARGER TO BE FLUSHED
- DECON
- EXPOSURE CONTROL SUPERVISION NSP
- TRAINING MOCK UP
- IN PROCESS CLEANUP TO MINIMIZE SPREAD OF CONTAMINATION
- PIPING TO BE REMOVED FROM AREA AND REPLACED WITH CLEAN, NEW PIPE

PLANNED ISI PROGRAM FOLLOWING MODIFICATION

- PRESSURE BOUNDARY WELDS RECEIVE STANDARD UT/PT/VT PER Section XI
- Nozzle Blend Radius and Bore Region
 - UT ONE NOZZLE EVERY SECOND REFUELING OUTAGE
 - VT SPARGERS EVERY FOURTH REFUELING OUTAGE
 - No Internal PT as Long as Leakage Monitor Confirms
 No Leakage
 - ESTABLISH ACTION PLAN IF LEAKAGE MONITOR OR SPARGER
 VT REVEAL ANYTHING UNEXPECTED

CONCLUSIONS

- DESIGN CONCEPT PREVIOUSLY APPROVED
- DETAILED DESIGN ANALYSIS CONFIRMS WIDE MARGINS ON FATIGUE USAGE
- DESIGN NOT SUBJECT TO SERVICE DETERIORATION
- HARDWARE ON-SITE
- INSTALLATION SOFTWARE 90% DONE
- MOCKUP ORDERED AND IN FABRICATION
- INSTALLATION SCHEDULED FOR FALL '81

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