



UNITED STATES
 NUCLEAR REGULATORY COMMISSION
 REGION II
 101 MARIETTA STREET, N.W.
 ATLANTA, GEORGIA 30323

Report Nos.: 50-369/84-39 and 50-370/84-37

Licensee: Duke Power Company
 422 South Church Street
 Charlotte, NC 28242

Docket Nos.: 50-369 and 50-370

License Nos.: NPF-9 and NPF-17

Facility Name: McGuire Nuclear Station 1 and 2

Enforcement Conference at the Region II Office - Upper Head Injection (UHI) System Inoperable

Inspector: C. W. Burger 12/12/84
 C. W. Burger Date Signed

Approved by: H. C. Dance 12/13/84
 H. C. Dance, Section Chief Date Signed
 Division of Reactor Projects

SUMMARY

An Enforcement Conference was held on November 14, 1984, to brief NRC on the sequence of events and safety analysis regarding the UHI System being inoperable. Details of the event are described in NRC Inspection Report Nos. 50-369/84-34 and 50-370/84-31.

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Report Details

1. Personnel Attending Enforcement Conference

Duke Power Company

H. B. Tucker, Vice President, Nuclear Production
K. Canady, Manager, Nuclear Engineering
M. D. McIntosh, Station Manager, McGuire
G. B. Swindlehurst, Nuclear Engineering
E. E. Estes, McGuire, Project Services
T. L. McConnell, Supt. of Technical Services
E. O'Neal McCraw, Compliance Engineer, McGuire
R. B. White, Jr., IAE Engineer, McGuire
R. Gill, Nuclear Engineering, Licensing
B. Haller, Duke Technical Services, G.O.

Nuclear Regulatory Commission Region II

J. P. O'Reilly, Regional Administrator
J. A. Olshinski, Director, Division of Reactor Projects (DRP)
J. M. Puckett, Director, Enforcement & Investigation Coordination Staff
(EICS)
P. R. Bemis, Acting Director, Division of Reactor Safety (DRS)

V. L. Brownlee, Chief, DRP, Branch 2
H. C. Dance, Section Chief 2A, DRP
A. Gibson, Chief, DRS
C. Julian, Section Chief, DRS
S. P. Weise, Section Chief 1A, DRP
C. Burger, Project Engineer 2A, DRP
F. Jape, Chief, DRS
G. Schnebli, Reactor Inspector, DRS
F. R. McCoy, Reactor Engineer, DRS
K. VanDyne, Reactor Inspector, DRS
R. Pierson, Resident Inspector, McGuire
L. Trocine, Enforcement Specialist, EICS

2. Event Discussion

The NRC staff opened the discussions concerning the UHI System being inoperable and the associated safety implications. Duke Power Company (DPC) provided the description of the sequence of events and a safety analysis. The meeting summary notes are described below. The event details are discussed in NRC Inspection Report Nos. 50-369/84-34 and 50-370/84-31.

a. Sequence of Events

DPC described the sequence of events from October 27, 1984, to November 4, 1984. A chemistry technician while taking a Unit 1 UHI water accumulator sample for determining boron concentration noticed the sample was milky in appearance which could indicate gas entrainment. Further investigation revealed that Unit 1 and Unit 2 UHI accumulators were inoperable due to gas entrainment. Upon draining the Unit 1 UHI water accumulator tank the level transmitters were declared inoperable when they did not actuate to close the applicable isolation valves as required. The UHI Unit 1 transmitters were found to be tubed incorrectly which would not allow valve closure actuation on low tank level. In addition, the Unit 1 and Unit 2 transmitters were found to have incorrect level actuation setpoints.

b. Safety Analysis

DPC discussed the safety implications of the degraded UHI system. UHI reduces the peak clad temperature during blowdown following a large break LOCA. If the isolation valves were unable to close, nitrogen injection would occur which is considered to be undesirable, however, the consequences have not been analyzed. DPC further indicated that any negative impact regarding peak clad temperature would result in exceeding the 2200°F limit using conservative Appendix K assumptions.

c. Summary and Comments

In summary, DPC made the following closing statements:

- Technician identified that a problem existed (sample was milky in appearance).
- Power was immediately reduced (when gas entrainment determined).
- Review and appropriate action taken by DPC.
- Personnel errors (Installation and post modification testing can remain hidden for long periods of time).
- Technical Specification 4.5.1.2.C.1) and post maintenance testing will be further reviewed by DPC. DPC will report their finding following their review.

- DPC identified the problems and corrective action was taken.

The NRC expressed concern that adequate tests were not performed to identify these problems following maintenance and that adequate installation instructions were not available. Technical Specification 4.5.1.2.C.1) indicates that at least once per 18 months the accumulator water level will be varied to ensure that each isolation valve closes automatically when the specified water level is reached. DPC's planned surveillance of this specification would not have detected a piping

error. The NRC questioned the post maintenance, periodic and calibration testing performed and whether similar testing or calibrations affect other equipment. The techniques and deficiencies uncovered by this event were discussed at length.

DUKE/NRC
ENFORCEMENT CONFERENCE

NOVEMBER 14, 1984

- INTRODUCTION H. B. TUCKER
- SEQUENCE OF EVENTS M. D. McINTOSH
- DISCUSSION OF SIGNIFICANT ITEMS
 - UHI WATER LEVEL TRANSMITTER (IMPULSE LINE REVERSAL) T. L. McCONNELL
 - POST-MODIFICATION TESTING T. L. McCONNELL
 - UHI WATER LEVEL TRANSMITTER SETPOINT/CALIBRATION METHODS R. B. WHITE
 - NITROGEN GAS CONCENTRATION IN UHI WATER ACCUMULATOR T. L. McCONNELL
- SAFETY ANALYSIS G. B. SWINDLEHURST
- CLOSING REMARKS H. B. TUCKER

MCGUIRE NUCLEAR STATION
UPPER HEAD INJECTION INOPERABLE
SEQUENCE OF EVENTS
UNIT 1

SATURDAY 10/27/84	2130	UNIT 1 @ MODE 3, WITH PRESSURIZER ABOVE 1900 PSIG, TO ROD OUT THE LOWER CONTAINMENT AIR HANDLING UNITS. WHILE TAKING UHI WATER ACCUMULATOR SAMPLE FOR DETERMINING BORON CONCENTRATION, A CHEMISTRY TECHNICIAN NOTICED THE SAMPLE WAS "MILKY" IN APPEARANCE WHICH COULD INDICATE GAS ENTRAINMENT. THE CHEMISTRY TECHNICIAN DISCUSSED THE OBSERVATION WITH HER SUPERVISOR.
MONDAY 10/29/84	AM	MANAGEMENT DISCUSSION OF THE TECHNICIAN OBSERVATION LED TO A DECISION TO FURTHER INVESTIGATE THE POSSIBILITY OF EXCESSIVE DISSOLVED GASES IN THE UNIT 1 UHI ACCUMULATOR TANK.
	2015	AFTER SAMPLING EQUIPMENT SETUP WAS COMPLETE A PROGRAM WAS BEGUN TO TAKE THREE SAMPLES FOR TOTAL DISSOLVED GASES AT TWO SAMPLE POINTS ON THE UNIT 1 UHI ACCUMULATOR TANK.

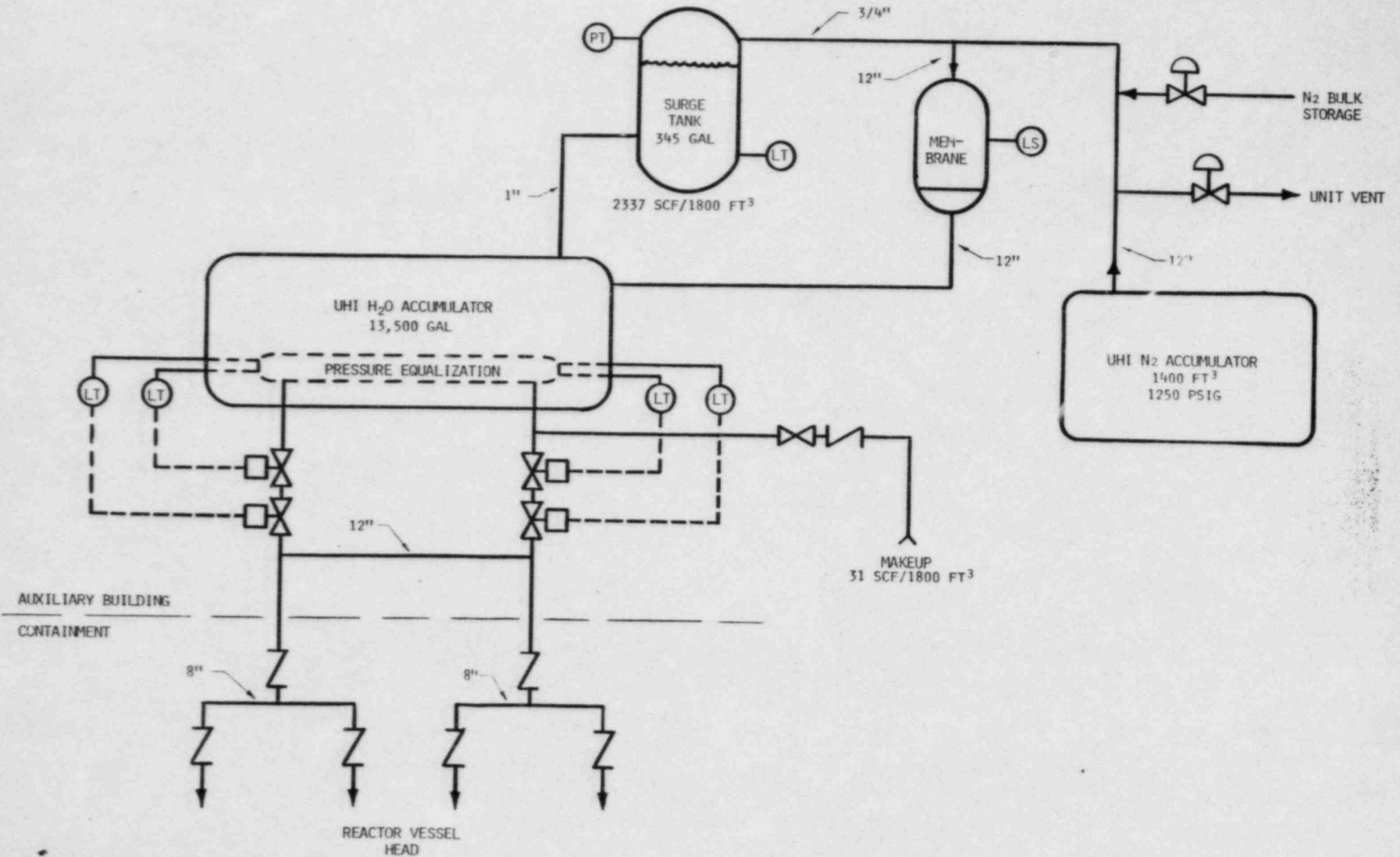
TUESDAY 10/30/84

- 1130 ANALYSIS COMPLETED ON UNIT 1 TANK.
- 1215 UNIT 1 UHI WATER ACCUMULATOR
DECLARED INOPERABLE BASED ON SAMPLE
RESULTS.
- 1225 COMMENCED UNIT 1 SHUTDOWN AT 20%
PER HOUR.
- 1223 NOTIFIED NRC VIA ENS OF INITIATING
SHUTDOWN OF UNIT 1 AS REQUIRED BY
TECH SPECS.
- 1815 UNIT 1 AT MODE 3 BELOW 1900 PSIG.
- 2200 STARTED DRAINING UNIT 1 UHI
ACCUMULATOR.

WEDNESDAY 10/31/84

- 1304 UNIT 1 UHI LEVEL TRANSMITTERS WERE
DECLARED INOPERABLE WHEN THEY DID
NOT ACTUATE TO CLOSE APPLICABLE
ISOLATION VALVES AS REQUIRED WHILE
THE ACCUMULATOR TANK WAS BEING DRAINED.
INSTRUMENT AND ELECTRICAL TECHNICIANS
BEGAN TROUBLE SHOOTING THE PROBLEM.

McGUIRE NUCLEAR STATION UPPER HEAD INJECTION SYSTEM



THURSDAY 11/1/84

- 0200 STARTED REFILLING UNIT 1 UHI WATER ACCUMULATOR.
- 0915 UNIT 1 UHI LEVEL TRANSMITTERS WERE FOUND TO BE TUBED INCORRECTLY.
- 1030 CHEMISTRY SAMPLE OF UNIT 1 UHI ACCUMULATOR INDICATED DISSOLVED GASES WERE WITHIN TECHNICAL SPECIFICATIONS.
- 1154 NRC NOTIFIED VIA ENS OF UNIT 1 LEVEL TRANSMITTER PROBLEM.
- 1500 CORRECTED TUBING INSTALLATION ON UNIT 1 UHI LEVEL TRANSMITTERS.
- 1930 FUNCTIONAL VERIFICATION FOLLOWING CALIBRATION OF UNIT 1 UHI LEVEL TRANSMITTERS INDICATED SETPOINTS WERE POTENTIALLY SET TOO HIGH. AN INVESTIGATION WAS INITIATED ON BOTH UNITS.

FRIDAY 11/2/84

- 0900 DECISION WAS MADE TO RECALIBRATE UNIT 1 & 2 TRANSMITTERS USING A WET METHOD. AS FOUND DATA CONFIRMED INCORRECT ACTUATION SETPOINTS.

SATURDAY 11/3/84

- 0300 UNIT 1 TRANSMITTER RECALIBRATION COMPLETE AND UNIT 1 UHI DECLARED OPERABLE.
- 1047 UNIT 1 IN MODE 1 WITH POWER ESCALATION IN PROGRESS.

MCGUIRE NUCLEAR STATION
UPPER HEAD INJECTION INOPERABLE
SEQUENCE OF EVENTS
UNIT 2

WEDNESDAY 10/31/84	1100	THE DECISION WAS MADE TO SAMPLE THE UNIT 2 UHI WATER ACCUMULATOR TO VERIFY NO DISSOLVED GASES PROBLEM EXISTED.
	2115	UNIT 2 UHI WATER ACCUMULATOR DECLARED INOPERABLE DUE TO HIGH DISSOLVED GASES DETERMINED BY CHEMISTRY SAMPLES. BEGAN LOAD REDUCTION TO COMPLY WITH TECH SPEC.
THURSDAY 11/1/84	0330	UNIT 2 AT 45% POWER, UHI ISOLATION VALVES CLOSED AND ACCUMULATOR TANK DRAINING IN PROGRESS.
	1100	UNIT 2 UHI LEVEL TRANSMITTERS WERE FOUND CORRECTLY TUBED. (UNIT 1 TRANSMITTERS FOUND INCORRECT AT 0915).
FRIDAY 11/2/84	0900	DECISION WAS MADE TO RECALIBRATE UNIT 1 & 2 TRANSMITTERS USING A WET METHOD. AS FOUND DATA CONFIRMED INCORRECT ACTUATION SETPOINTS.

SUNDAY 11/4/84

- 1335 CHEMISTRY SAMPLES ON UNIT 2 UHI
WATER ACCUMULATOR INDICATE DISSOLVED
GASES WERE WITHIN TECHNICAL
SPECIFICATIONS.
- 1530 UNIT 2 TRANSMITTER RECALIBRATION
COMPLETE AND UNIT 2 UHI DECLARED
OPERABLE.
- 2135 STARTED POWER INCREASE ON UNIT 2.

McGUIRE NUCLEAR STATION
UPPER HEAD INJECTION WATER ACCUMULATOR

LEVEL TRANSMITTER IMPULSE LINE REVERSAL

ROOT CAUSE

- PERSONNEL ERROR
- INSTALLATION PROCEDURE DID NOT REQUIRE VERIFICATION OF PROPER TUBING CONNECTIONS

CORRECTIVE ACTIONS

- THIS INCIDENT WILL BE REVIEWED WITH ALL AFFECTED WORKING GROUPS ON SITE
- REVIEW OF ALL CURRENT SAFETY RELATED ΔP APPLICATIONS
- A NEW INSTALLATION PROCEDURE WAS IMPLEMENTED ON 10/22/84 PRIOR TO DISCOVERY OF THIS INCIDENT WHICH REQUIRES VERIFICATION OF PROPER TUBING CONNECTIONS
- WILL PERFORM A COMPREHENSIVE REVIEW OF THE REMOVAL, REPAIR, AND REPLACEMENT INSTRUMENT PROCEDURES TO IDENTIFY POTENTIAL IMPULSE LINE REVERSAL ERRORS

McGUIRE NUCLEAR STATION
UPPER HEAD INJECTION WATER ACCUMULATOR

LEVEL SWITCH MODIFICATION
POST MODIFICATION TEST DEFICIENCY

ROOT CAUSE

- IMPULSE LINES WERE NOT INSTALLED CORRECTLY DUE TO PERSONNEL ERROR.
- THE POST MODIFICATION TESTING DID NOT ADEQUATELY IDENTIFY THE TUBING ERROR.

CORRECTIVE ACTIONS

- VERIFIED THAT IMPULSE LINES ARE PROPERLY INSTALLED
- ΔP APPLICATIONS AND MODIFICATION REVIEW
- STRENGTHEN THE POST MODIFICATION TESTING PROGRAM

I. DISCUSSION OF INCORRECT UHI SETPOINTS

- CHRONOLOGY
- ROOT CAUSE/CORRECTIVE ACTION

II. UHI INSTRUMENT DETAIL

- UNIQUE CHARACTERISTICS
- THEORY OF OPERATION (INSTRUMENTATION)
- DRY CALIBRATION
- WET CALIBRATION
- CALIBRATION METHODOLOGY

III. IAE PROCEDURAL AND OTHER CHANGES

INCORRECT UHI LEVEL ACTUATION SETPOINTS

CHRONOLOGY

<u>DATE</u>	<u>EVENT</u>
PRIOR TO 2/23/83	UHI LVL SWITCHES CALIBRATED USING "WET" METHOD (SETPOINTS CORRECT)
PRIOR TO 2/23/83	"DRIFT" PROBLEMS IDENTIFIED WITH BARTON 288A LS
PRIOR TO 2/23/83	W RECOMMENDS GOING TO "DRY" CALIBRATION METHOD TO ELIMINATE REFERENCE LEG AS CONTRIBUTOR TO SETPOINT DRIFT
PRIOR TO 2/23/83	<ul style="list-style-type: none">• PROCEDURE APPROVED INCORPORATING "DRY" CALIBRATION METHOD (2/14/83)• THIS PROCEDURE INTRODUCES 24" ERROR WHEN RESPONSIBLE INSTRUMENT ENGINEER MISINTERPRETS TANK MEASUREMENTS MADE BY INSTRUMENT TECHNICIANS• SECOND ENGINEER REVIEWS PROCEDURE AND DOES NOT IDENTIFY 24" SETPOINT MISTAKE
2/23/83	1N1LS5720, 1N1LS5740 CALIBRATED USING INCORRECT SETPOINTS
3/9/83 - 3/23/83	REMAINING UNIT 1 AND UNIT 2 (3/17 - 3/23) SWITCHES CALIBRATED USING INCORRECT SETPOINTS

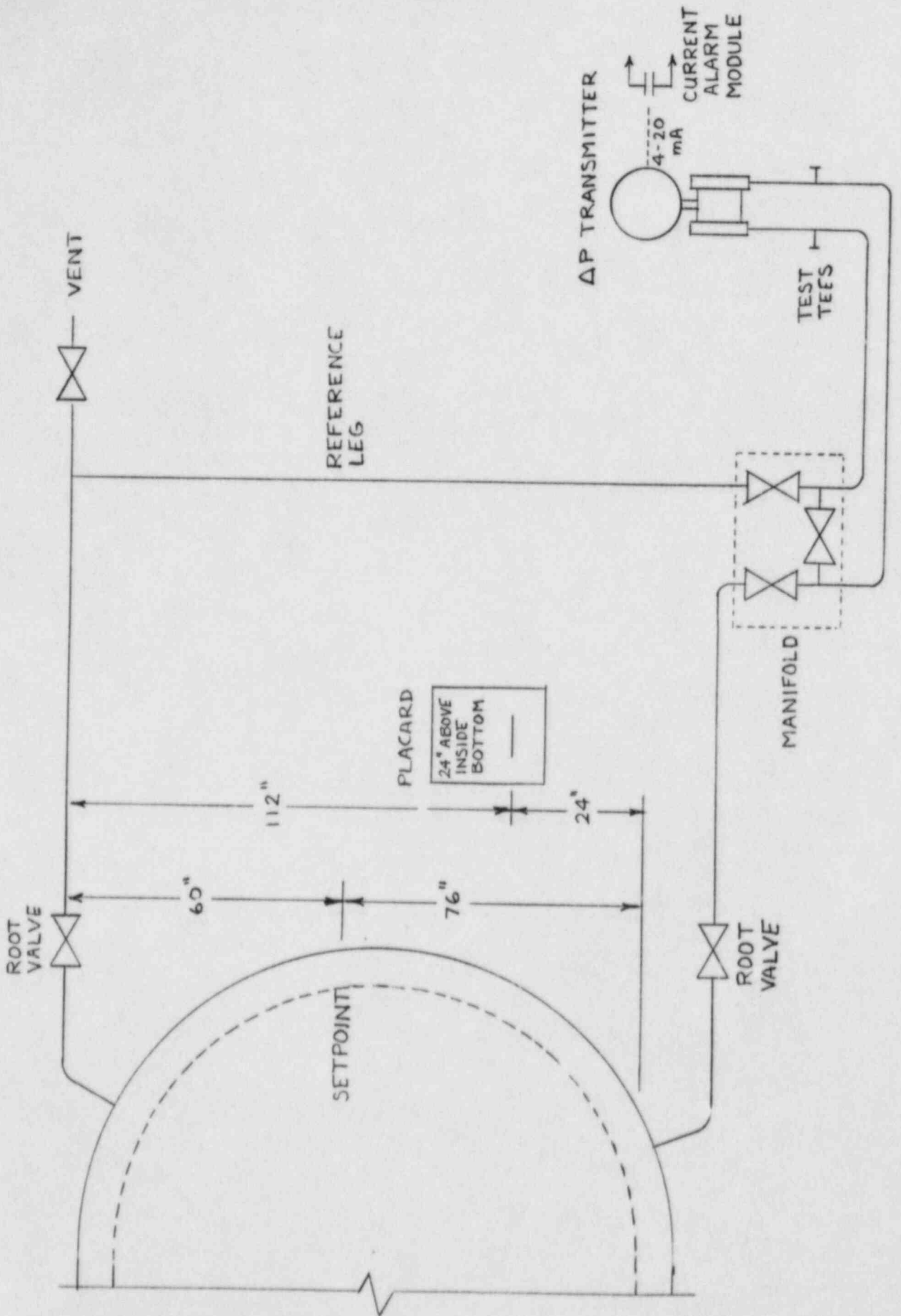
<u>DATE</u>	<u>EVENT</u>
1/84 (UNIT 2) 4/84 (UNIT 1)	STATION MODIFICATION IMPLEMENTED TO CHANGE BARTON SWITCHES TO ROSEMOUNT TRANSMITTERS IN ORDER TO ELIMINATE "DRIFT" PROBLEM
2/84	DRY CALIBRATION METHOD AND 24" SETPOINT ERROR IS CARRIED OVER TO ROSEMOUNT TRANSMITTERS
11/1/84	DISCOVERED UNIT 1 UHI LEVEL TRANSMITTER IMPULSE LINES REVERSED
11/2/84	RETURNED TO "WET" CALIBRATION METHOD IN ORDER TO INCLUDE REFERENCE LEG IN CALIBRATION TECHNIQUE
11/2/84	DISCOVERED 24" SETPOINT ERROR WHILE TAKING "AS FOUND" DATA
11/2/84 - 11/4/84	CALIBRATED ALL UHI LVL SWITCHES TO CORRECT SETPOINTS USING "WET METHOD"

PROBLEM: INCORRECT UHI LEVEL ACTUATION SETPOINTS

ROOT CAUSE: PERSONNEL ERROR

CORRECTIVE ACTION:

- IMMEDIATE - PROCEDURE CHANGED TO INCORPORATE CORRECT SETPOINT ACTUATION AND ALL UHI LEVEL TRANSMITTERS RECALIBRATED
- PLANNED - PRESENT "LESSONS LEARNED" TO ALL IAE PERSONNEL ON THIS INCIDENT
- ESTABLISH INTERNAL GUIDELINES WHICH REQUIRE PROCEDURE PREPARER TO PROVIDE DOCUMENTED BASIS FOR SETPOINT AND OTHER INHOUSE CALCULATIONS TO PROCEDURE REVIEWER
- REQUIRE PROCEDURE REVIEWER TO REVIEW PROCEDURE AND ALL SUPPORTING CALCULATIONS TO INSURE AGREEMENT ON PROCEDURE AS WELL AS BASIS FOR INHOUSE CALCULATIONS



UNIQUE CHARACTERISTICS OF UHI LEVEL SYSTEM

- STATIC TANK (FULL DURING NORMAL OPERATION)
- NO LEVEL INDICATORS
- DIRECT ACTING VS REVERSE ACTING TRANSMITTER

DIFFERENTIAL PRESSURE OUTPUT
EQUATION

$$\Delta P = P_{HP} - P_{LP}$$

DIRECT ACTING: AS $\Delta P \uparrow$ TRANS. OUTPUT (MA) \uparrow

WHEN CONNECTED AS DESIGNED:

$$P_{HP} = P_{RL} \text{ (REF. LEG)}$$

$$P_{LP} = P_P \text{ (PROCESS)}$$

$$\Delta P = P_{HP} - P_{LP}$$

$$= P_{RL} - P_P$$

$$\Delta P = 120'' - P_P$$

TANK FULL: $\Delta P = 120'' - 120'' = 0'' \Delta P$ (4MA)

TANK EMPTY: $\Delta P = 120'' - 0'' = 120'' \Delta P$ (20MA)

$$\Delta P = P_{HP} - P_{LP}$$

WITH IMPULSE LINES REVERSED:

$$P_{HP} = P_P \text{ (PROCESS)}$$

$$P_{LP} = P_{RL} \text{ (REF. LEG)}$$

$$\Delta P = P_P - P_{RL}$$

$$\Delta P = P_P - 120''$$

$$\text{TANK FULL: } \Delta P = 120'' - 120'' = 0\Delta P \text{ (4MA)}$$

$$\text{TANK EMPTY: } \Delta P = 0'' - 120'' = -120''\Delta P \text{ (<4MA)}$$

NOTE: VALVE CLOSURE ACTUATION WILL NOT OCCUR ON LOW TANK LEVEL

UHI DRY CALIBRATION METHOD

1. ISOLATE TRANSMITTER AT ROOT AND MANIFOLD VALVES.
2. DRAIN WATER FROM LP AND HP SIDE OF TRANSMITTER.
3. VENT LP SIDE OF TRANSMITTER AT TEST TEE.
4. CONNECT PRESSURE SOURCE TO HP SIDE OF TRANSMITTER AT TEST TEE.
5. SET TRANSMITTER ZERO, SPAN AND ACTUATION POINT BY VARYING INPUT PRESSURE TO HP SIDE OF TRANSMITTER WHILE LP SIDE REMAINS VENTED TO ATMOSPHERE.

NOTE: THIS METHOD DID NOT REVEAL IMPULSE LINES REVERSAL BECAUSE THE ACTUAL REFERENCE LEG IS NOT USED DURING DRY CALIBRATION.

UHI WET CALIBRATION METHOD

1. INSURE REFERENCE LEG IS FULL, THEN ISOLATE TRANSMITTER AT ROOT VALVES.
2. ATTACH TYGON HOSE TO LP SIDE OF TRANSMITTER AND VENT REFERENCE LEG TO ATMOSPHERE.
3. SET TRANSMITTER ZERO, SPAN AND ACTUATION POINT BY VARYING LEVEL IN THE TYGON HOSE (SIMULATES TANK LEVEL CHANGES) ON THE LP SIDE WHILE FULL REFERENCE LEG ACTS ON HP SIDE OF TRANSMITTER.

NOTE: THIS METHOD WOULD REVEAL IMPULSE LINE REVERSAL BECAUSE THE ACTUAL REFERENCE LEG IS USED DURING WET CALIBRATION.

CALIBRATION METHODOLOGY

- BOTH WET AND DRY CALIBRATION METHODS ARE ACCEPTABLE
- RETURN TO WET CALIBRATION IN THIS INSTANCE WAS DONE IN ORDER TO FACILITATE CALIBRATION AND FUNCTIONAL VERIFICATION/RETEST
- DRY CALIBRATION, IN CONJUNCTION WITH SEPARATE FUNCTIONAL TESTING, WOULD ALSO BE ACCEPTABLE

IAE PROCEDURAL AND OTHER CHANGES

- INCORPORATED WET CALIBRATION TECHNIQUE
- CORRECTED SETPOINT ERRORS
- DETAILED VENTING STEPS IN CAL. PROCEDURE
- FLAGGED UHI OPERATING PROCEDURE TO REQUIRE REFERENCE LEG VENTING
- REVIEW OF REMOVAL/REPAIR/REPLACEMENT PROCEDURES

McGUIRE NUCLEAR STATION
UPPER HEAD INJECTION WATER ACCUMULATOR

DISSOLVED GAS CONCENTRATION
EXCEEDING TECHNICAL SPECIFICATIONS

ROOT CAUSE

- VALVE LEAKAGE, CAUSING WATER LOSS FROM ACCUMULATOR
- DISPLACED VOLUME IN ACCUMULATOR FROM LEAKAGE WAS REPLACED WITH N₂ SATURATED WATER FROM SURGE TANK
- DISPLACEMENT/REPLACEMENT PROCESS WILL GRADUALLY DRIVE ACCUMULATOR "OUT-OF-SPEC"

CORRECTIVE ACTIONS

- UNITS 1 AND 2 ACCUMULATORS WERE DRAINED AND REFILLED
- 18 MONTH DISSOLVED GAS SAMPLING FREQUENCY CHANGED TO DAILY SAMPLING (INTERIM MEASURES)
- IDENTIFYING ALL WATER LEAKAGE PATHS AND SCHEDULING REPAIRS
- WATER INJECTION INTO ACCUMULATOR EQUAL TO LEAKAGE RATE
- EVALUATING FEASIBILITY OF INSTALLING MORE LEAK TIGHT VALVES
- WILL DEVELOP PROGRAM THAT TIES SAMPLING FREQUENCY REQUIREMENTS TO MAKEUP RATE

SAFETY ANALYSIS

- FAILURE OF UHI ISOLATION VALVES TO CLOSE AUTOMATICALLY
 - UHI nitrogen can be injected for scenarios characterized by significant RCS depressurization (LBLOCAs and larger SBLOCAs)
 - An increase in the volume of UHI water delivered will result
- EARLY ISOLATION OF THE UHI ACCUMULATOR DUE TO THE LOW LEVEL SETPOINT CALIBRATION ERROR
 - A decrease in the volume of UHI water delivered will result
- EXCESSIVE DISSOLVED NITROGEN IN THE UHI WATER ACCUMULATOR
 - Potential reduction in UHI delivery rate
 - An increase in the volume of noncondensable gas delivered to the RCS

UHI SYSTEM DESIGN FUNCTION

- AN ADDITIONAL ECCS SUB-SYSTEM FOR INJECTING BORATED WATER AT HIGH RCS PRESSURE. UHI INJECTION REDUCES THE PEAK CLAD TEMPERATURE DURING BLOWDOWN FOLLOWING A LARGE BREAK LOCA.
- ECCS PERFORMANCE FOR A LBLOCA WITHOUT UHI IS ACCEPTABLE PER APPENDIX K BELOW 46% POWER (FOR MNS UNIT 2).
- SMALL BREAK LOCA ANALYSES TAKE CREDIT FOR UHI DELIVERY UHI IS NOT REQUIRED FOR NON-APPENDIX K CALCULATIONS.
- UHI MAY ACTUATE FOR NON-LOCA TRANSIENTS SUCH AS A LARGE STEAM LINE BREAK, HOWEVER THE RCS DEPRESSURIZATION DOES NOT HAVE THE POTENTIAL FOR NITROGEN INJECTION.

UHI ISOLATION VALVE DESIGN BASIS

- ISOLATION VALVES WERE ADDED TO THE DESIGN TO SIMPLIFY THE ECCS PERFORMANCE EVALUATION
 - Simulation development for nitrogen injection during LOCAs not required
 - Licensing effort to gain approval of nitrogen injection modeling not required
- ALTHOUGH UHI NITROGEN INJECTION WAS CONSIDERED TO BE UNDESIRABLE, THE CONSEQUENCES HAVE NOT BEEN ANALYZED.
- NITROGEN INJECTION FROM COLD LEG ACCUMULATORS HAS BEEN CONSIDERED DURING LOCA EVALUATIONS FOR BOTH W AND NON-W DESIGNS.

EFFECTS OF UHI NITROGEN INJECTION

- REFLOODING OF THE CORE FOLLOWING LOCAS THAT RESULT IN CORE UNCOVERY WILL BE SLOWED
 - HIGHER RCS BACKPRESSURE REDUCES ECCS FLOWRATE
 - SLIGHTLY HIGHER CONTAINMENT BACKPRESSURE
- NITROGEN ACCUMULATION IN STEAM GENERATOR TUBES
 - CAN DEGRADE HEAT TRANSFER
 - CAN BLOCK NATURAL CIRCULATION
- INCREASE IN CONTAINMENT PEAK PRESSURE RESPONSE

EFFECTS OF INCREASE/DECREASE IN UHI WATER DELIVERY

- A DECREASE HAS A NEGATIVE IMPACT
 - AN INCREASE SHOULD HAVE A POSITIVE IMPACT
- THE CURRENT APPENDIX K LOCA EVALUATION MODEL INDICATES A PENALTY WITH CERTAIN ASSUMPTIONS, HOWEVER THIS EFFECT IS CONSIDERED TO BE ARTIFICIAL.

EVALUATION OF OPERATOR ACTION

- LBLOCA
 - NO TIME TO RESPOND
- LARGER SBLOCAS
 - CONTINUOUS RCS DEPRESSURIZATION THROUGH UHI INJECTION PHASE
 - DON'T EXPECT POSITIVE OPERATOR ACTION TO IDENTIFY AND MITIGATE AN ISOLATION VALVE FAILURE
- SMALLER SBLOCAS
 - RCS PRESSURE WILL STABILIZE PRIOR TO UHI NITROGEN INJECTION
 - TIME AND THE OPPORTUNITY EXISTS TO ISOLATE UHI SIMILAR TO A NORMAL COOLDOWN
 - THE OPPORTUNITY EXISTS TO IDENTIFY AND MITIGATE AUTOMATIC UHI ISOLATION FAILURE
 - UHI NITROGEN INJECTION CAN BE PREVENTED

IMPACT ON LBLOCA

- THE CURRENT PEAK CLAD TEMPERATURE (PCT) IS 2175°F
- ANY NEGATIVE IMPACT WOULD RESULT IN EXCEEDING THE 2200°F LIMIT USING CONSERVATIVE APPENDIX K ASSUMPTIONS
- THE INDUSTRY AND NRC ACKNOWLEDGE THE CONSERVATISM OF APPENDIX K ASSUMPTIONS
 - A NEW METHODOLOGY EXPECTED TO BE APPROVED BY NRC ALLOWS AN INCREASE IN F-Q FROM 2.15 TO 2.26 INCLUDING APPENDIX K ASSUMPTIONS
- THE RESULTS OF A BEST ESTIMATE UHI LBLOCA ANALYSIS PERFORMED BY BATTELLE PACIFIC NORTHWEST LAB UNDER CONTRACT TO NRC (NUREG/CR-3642, MARCH 1984)
 - PCT = 1155°F AT 8 SECONDS
 - PCT REMAINED BELOW 600°F SUBSEQUENTLY
 - NO ADIABATIC HEATUP DURING THE REFLOOD PHASE

IMPACT ON SBLOCA

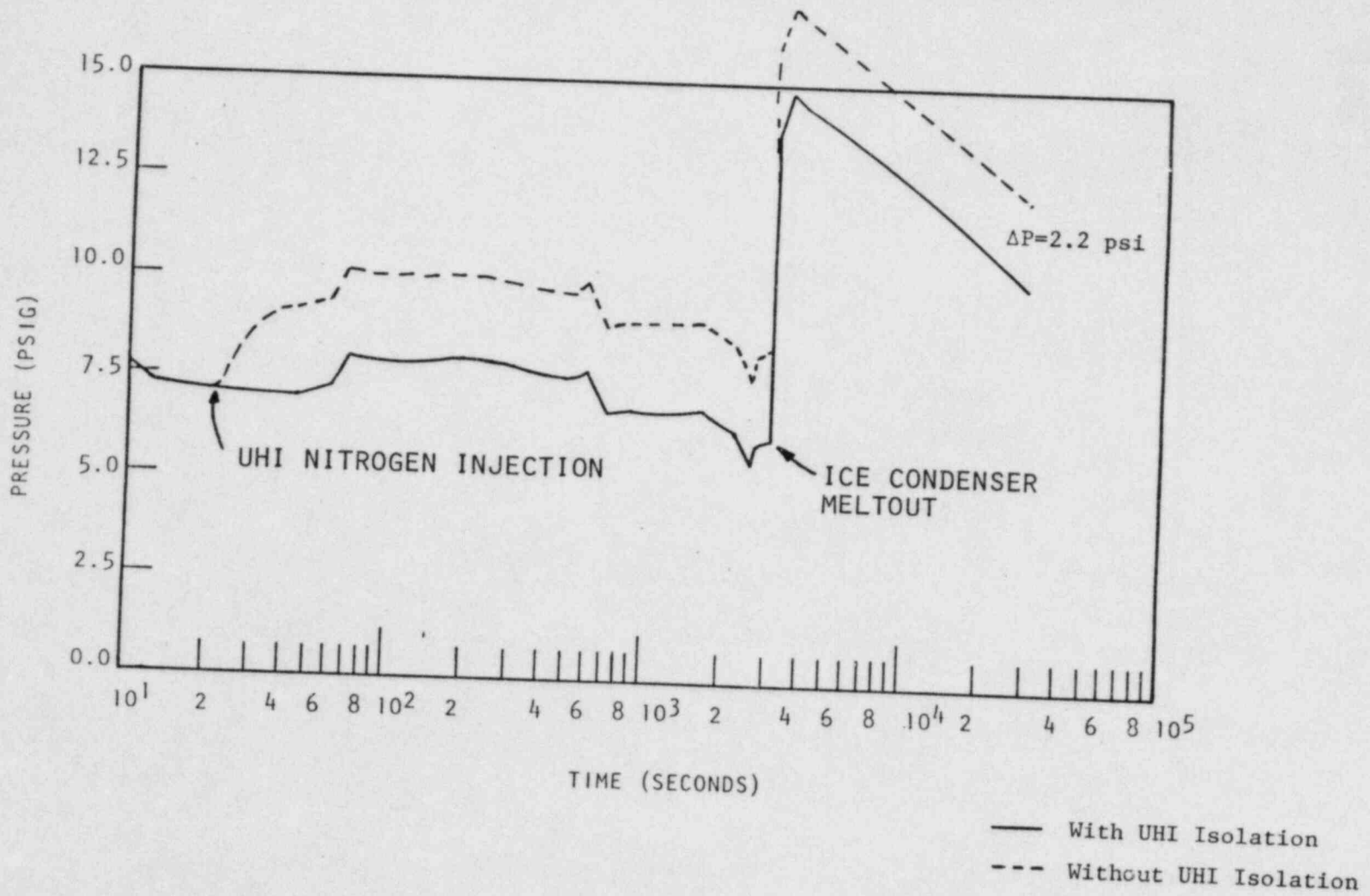
- LARGER SBLOCAS: THOSE SBLOCAS THAT DEPRESSURIZE TO BELOW STEAM GENERATOR PRESSURE
 - BREAK FLOW REMOVES RCS STORED ENERGY AND DECAY HEAT
 - STEAM GENERATORS ARE NOT REQUIRED AS A HEAT SINK
 - THE CURRENT FSAR PCT IS 1499 F
 - SIGNIFICANT MARGIN EXISTS TO OFFSET NEGATIVE IMPACT DUE TO A REDUCED REFLOOD RATE INCLUDING APPENDIX K ASSUMPTIONS
 - NO IMPACT ON BEST ESTIMATE SBLOCA DUE TO PLENTY OF MARGIN

- SMALLER SBLOCAS: THOSE SBLOCAS THAT STABILIZE AT OR ABOVE STEAM GENERATOR PRESSURE
 - PROBABLE SBLOCAS FALL INTO THIS CATEGORY
 - NO CORE UNCOVERY IS PREDICTED EVEN WITH APPENDIX K ASSUMPTIONS SO THAT PLENTY OF MARGIN EXISTS
 - UHI NITROGEN INJECTION WITH ACCUMULATION IN THE STEAM GENERATOR TUBES IS UNDESIRABLE
 - FEED AND BLEED IS AVAILABLE AS AN ALTERNATE COOLDOWN METHOD
 - COOLDOWN AND DEPRESSURIZATION OF THE RCS IS UNDER MANUAL CONTROL
 - RECOVERY ACTIONS WILL ATTEMPT TO RESTORE NORMAL PLANT CONDITIONS
 - THE OPPORTUNITY EXISTS FOR THE OPERATOR TO ISOLATE UHI SIMILAR TO A NORMAL COOLDOWN
 - EXTENSIVE CLASSROOM AND SIMULATOR TRAINING SHOULD RESULT IN VERIFYING AUTOMATIC UHI ISOLATION.
 - UHI NITROGEN INJECTION CAN BE PREVENTED



CONTAINMENT PRESSURE TRANSIENT
McGUIRE NUCLEAR STATION
Figure 6.2.1-23
Revision 36

IMPACT ON PEAK CONTAINMENT PRESSURE RESPONSE



SUMMARY

- LBLOCA
 - USING APPENDIX K ASSUMPTIONS THE PCT OF 2200°F WOULD MOST LIKELY BE EXCEEDED
 - BEST ESTIMATE ANALYSES INCLUDES SUFFICIENT MARGIN TO OFFSET ANY NEGATIVE IMPACT

- SBLOCA
 - FOR BOTH APPENDIX K AND BEST ESTIMATE ASSUMPTIONS SUFFICIENT MARGIN EXISTS TO OFFSET ANY NEGATIVE IMPACT
 - FOR THE PROBABLE SBLOCA THE OPPORTUNITY EXISTS FOR THE OPERATOR TO ISOLATE UHI PRIOR TO NITROGEN INJECTION

- CONTAINMENT INTEGRITY
 - THE WORST CASE INCREASE IN CONTAINMENT PRESSURE DUE TO UHI NITROGEN INJECTION IS 2.2 PSI. THE DESIGN PRESSURE OF 15 PSIG WOULD BE EXCEEDED BY 2.0 PSIG IN THE WORST CASE.
 - SUPPLEMENT 7 TO THE MCGUIRE SER STATES THAT THE LOWER BOUND ULTIMATE CAPACITY OF THE CONTAINMENT IS 48 PSIG.

- ENVIRONMENTAL CONSEQUENCES
 - FSAR LOCA DOSE CALCULATIONS ARE PERFORMED USING REGULATORY GUIDELINES AND ASSUMPTIONS. THE DOSES ARE INDEPENDENT OF THE SPECIFIC RESULTS OF THE LOCA ANALYSIS