Entergy Operations

Entergy Operations, Inc.
P.O. Box B
Killona, LA 70066
Tel 504-464-3120

D. R. Keuter
General Manager
Plant Operations
Waterford 3

W3F1-95-0196
A4.05
PR

December 4, 1995

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Subject: Waterford 3 SES
Docket No. 50-382
License No. NPF-38
Reporting of Licensee Event Report

Gentlemen:

Attached is Licensee Event Report Number LER-95-005-00 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted in accordance with 10CFR50.73(a)(2)(i)(B).

Very truly yours,

D.R. Keuter
General Manager
Plant Operations

DRK/WHP/tjs
Attachment

cc: L.J. Callan, NRC Region IV
C.P. Patel, NRC-NRR
G.L. Florreich
J.T. Wheelock - INPO Records Center
R.B. McGehee
N.S. Reynolds
NRC Resident Inspectors Office
Administrator - LRPD

060003

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NRC FORM 366 (4-95) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104
EXPIRES 04/30/98

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 50.0 HRS. REPORTED LESSONS LEARNED ARE INCORPORATED INTO THE LICENSING PROCESS AND FED BACK TO INDUSTRY. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE INFORMATION AND RECORDS MANAGEMENT BRANCH (T-6 F33), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555-0001, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Waterford Steam Electric Station Unit 3	05000 382	1 OF 21

TITLE (4)
Rosemount Instrument Transmitter Errors

EVENT DATE (5)			LER NUMBER (6)			REPORT DATE (7)			OTHER FACILITIES INVOLVED (8)	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
									N/A	05000
11	02	95	95	005	00	12	04	95	N/A	05000

OPERATING MODE (9): 1
POWER LEVEL (10): 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more) (11)

	20.2201(b)		20.2203(a)(2)(v)	X	50.73(a)(2)(i)		50.73(a)(2)(viii)
	20.2203(a)(1)		20.2203(a)(3)(i)		50.73(a)(2)(ii)		50.73(a)(2)(x)
	20.2203(a)(2)(i)		20.2203(a)(3)(ii)		50.73(a)(2)(iii)		73.71
	20.2203(a)(2)(ii)		20.2203(a)(4)		50.73(a)(2)(iv)		OTHER
	20.2203(a)(2)(iii)		50.36(c)(1)		50.73(a)(2)(v)		Specify in Abstract below or in NRC Form 366A
	20.2203(a)(2)(iv)		50.36(c)(2)		50.73(a)(2)(vii)		

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER (Include Area Code)
R.G. Pittman, Supervisor, I&C Maintenance	(504) 464-3839

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NPRDS

SUPPLEMENTAL REPORT EXPECTED (14)

				EXPECTED SUBMISSION DATE (15)	MONTH	DAY	YEAR
	YES (If yes, complete EXPECTED SUBMISSION DATE).	X	NO				

ABSTRACT (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines) (16)

On November 2, 1995, while reviewing Main Steam Flow Loop calculations, it was discovered that the calibration input data for some of the safety and non-safety Rosemount, differential pressure type, flow and level transmitters was in error. The static span shift correction factor for some was misapplied. The misapplication and subsequent actions resulted in Safety Injection Tank(SIT) and Steam Generator(S/G) indicated levels being slightly higher than actual levels (non-conservative), and Main Steam flows indicating lower than actual. Records have shown that the SIT actual levels were, at times during the previous cycle and since startup this cycle, below the minimum allowed by Technical Specification for periods longer than their allowed outage time. A principal root cause for this event is attributed to an ineffective review process for these instrument calculations allowing calculational errors to go undetected. Immediate corrective actions included establishing administrative controls for SIT level control and resetting the S/G low level trip bistable to a slightly higher, more conservative, setpoint.

REQUIRED NUMBER OF DIGITS/CHARACTERS FOR EACH BLOCK

BLOCK NUMBER	NUMBER OF DIGITS/CHARACTERS	TITLE
1	UP TO 46	FACILITY NAME
2	8 TOTAL 3 IN ADDITION TO 05000	DOCKET NUMBER
3	VARIES	PAGE NUMBER
4	UP TO 76	TITLE
5	6 TOTAL 2 PER BLOCK	EVENT DATE
6	7 TOTAL 2 FOR YEAR 3 FOR SEQUENTIAL NUMBER 2 FOR REVISION NUMBER	LER NUMBER
7	6 TOTAL 2 PER BLOCK	REPORT DATE
8	UP TO 18 -- FACILITY NAME 8 TOTAL -- DOCKET NUMBER 3 IN ADDITION TO 05000	OTHER FACILITIES INVOLVED
9	1	OPERATING MODE
10	3	POWER LEVEL
11	1 CHECK BOX THAT APPLIES	REQUIREMENTS OF 10 CFR
12	UP TO 50 FOR NAME 14 FOR TELEPHONE	LICENSEE CONTACT
13	CAUSE VARIES 2 FOR SYSTEM 4 FOR COMPONENT 4 FOR MANUFACTURER NPRDS VARIES	EACH COMPONENT FAILURE
14	1 CHECK BOX THAT APPLIES	SUPPLEMENTAL REPORT EXPECTED
15	6 TOTAL 2 PER BLOCK	EXPECTED SUBMISSION DATE

REPORTABLE OCCURRENCE

On November 2, 1995, while reviewing Main Steam Flow Loop (EIIS SB-FT) calculations, it was discovered that the calibration input data for some of the safety and non-safety Rosemount, differential pressure type, flow and level transmitters was in error.

In October, 1992, Safety Injection Tank Level transmitters (EIIS BP-FT) were recalibrated using new instrument calculations. Errors were introduced into these calculations through the assumptions used for density and temperature.

The errors introduced into the Safety Injection Tank level calibration calculations since October 1992, resulted in the Safety Injection Tank levels indicating in a non-conservative direction (i.e., indicating higher than the actual tank level by approximately 3 percent).

A record search was performed and it was discovered that there were times, during previous cycles and since startup this cycle, where the actual level of a Safety Injection Tank was lower than the minimum required water volume allowed by Technical Specification (78 percent) for periods of time longer than the allowed outage time (1 hour). Using the maximum amount of indication error, the actual SIT level would not be any lower than 75.7 percent when the indicated SIT level was at the Technical Specification minimum of 78 percent.

Because there were times when an actual SIT water volume was below the Technical Specification minimum of 78 percent, this condition is reportable as a Technical Specification Prohibited Condition per 10CFR50.73(a)(2)(i)(B).

INITIAL CONDITIONS

At the time this condition was identified, Waterford 3 was operating in MODE 3, in preparation for startup operations. The plant was restoring from its Refuel 7 outage. There was no major equipment out of service specific to this event and no Technical Specification Limiting Conditions for Operation (LCO's) were in effect specific to this event at the time this condition was discovered.

EVENT BACKGROUND

(Refer to Attachment A for the following discussion)

The following is provided to aid in the understanding of the effects of high static pressure, in particular the span effect, on Rosemount differential pressure (D/P) transmitters:

To understand the span effect, it is necessary to understand the inner workings of the D/P cell.

The Rosemount D/P cell is a variable capacitance device. In the cell, differential pressure moves the sensing diaphragm between two fixed capacitor plates (See Figure 1, Attachment A). The sensing diaphragm is centered between the fixed plates and welded to the cylindrical body of the cell. The varying capacitance between the sensing diaphragm and the plates (caused by application of a differential pressure across the diaphragm) is converted electronically to a 4-20 mA dc output that is directly proportional to the differential pressure.

When high pressure (such as system operating pressure) is applied to both sides of the cell, a slight movement takes place increasing tension radially in the sensing diaphragm (See Figure 2, Attachment A). The net effect of the increased tension is that the sensing diaphragm moves toward the true center of the transmitter (this happens at all differential pressures except for zero differential pressure, where the diaphragm is already centered). As the static pressure increases, the tension increases causing a greater movement of the diaphragm. The movement of the diaphragm is always toward the zero differential, or center position. The effect of this movement (toward the center) on transmitter output depends on the application in which the transmitter is used.

Two cases are discussed below to illustrate the possible effects on transmitter output.

CASE 1 - D/P Transmitter Used as a Flow Transmitter

In flow applications, the differential pressure is applied such that the higher pressure is always on the upstream or HIGH PRESSURE side of the transmitter. This process input would distend the diaphragm toward the LOW PRESSURE side of the transmitter which always causes transmitter output to increase. With process input (D/P) held constant, an increase in static pressure would always move the diaphragm toward the center and toward the HIGH PRESSURE side, which always decreases transmitter output. In this application, the static pressure span effect would "oppose" the input (D/P); therefore, indicated flow would be lower than actual flow.

TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

CASE 2 - D/P Transmitter Used as a Level Transmitter with a FILLED REFERENCE LEG

In level applications (FILLED REFERENCE LEG ONLY), the differential pressure is applied such that the higher pressure is always on the LOW PRESSURE side of the transmitter. This process input distends the diaphragm toward the HIGH PRESSURE side of the transmitter, which always causes output to decrease. With process input (D/P) held constant, an increase in static pressure would always move the diaphragm toward the center, which always increases transmitter output. In this application, the static pressure span effect would "aid" the input (D/P); therefore, indicated level would be higher than actual level.

Note that level transmitters with DRY reference legs act exactly the same as the Flow Transmitter application discussed in Case 1 above.

The static pressure span effect is predictable in magnitude and direction, repeatable, and linear. Therefore, correction factors can be calculated and applied to calibration inputs to compensate for the effect. The static pressure span shifts are specified by Rosemount for each model and range code, as is the method for calculating correction factors.

EVENT DESCRIPTION

On November 2, 1995, CR-95-1125 was initiated to document that a review of Main Steam Flow Loop calculations discovered the calibration input data for the Main Steam Flow transmitters was in error; that is, the static pressure span shift correction factor was applied in the wrong direction. As a result of this condition, Site Directive No. W4.101, "Operability/

Qualification Confirmation Process," was invoked by the Shift Supervisor and a comprehensive review of Rosemount differential pressure transmitter calibration calculations was initiated to identify and quantify any generic issues.

The W4.101 review determined that the static pressure span shift correction factor was also misapplied in the calibration calculations for some of the safety and non-safety flow and level instruments using Rosemount transmitters. As part of the immediate corrective action for the calculation errors, the narrow range SIT level transmitters and the Core Operating Limit Supervisory System (COLSS) Main Steam Flow transmitters were recalibrated.

On November 4, 1995, it was determined that the original SIT transmitter calculation for static span shift was, in fact, correct and that recalibration had introduced errors. CR-95-1126 was initiated for the condition and W4.101 was again invoked to confirm operability.

Concurrent with the reevaluation of the SIT calculations it was confirmed that the static pressure span shift correction had been incorrectly applied to the Steam Generator (S/G) narrow range level transmitters. The S/G #2 Channel A low level trip setpoint was found to be below the Technical Specification allowable value; all other channels were determined to be OPERABLE. This condition was also evaluated as part of the operability confirmation. As corrective action, all of the S/G low level trip bistables were reset to a temporary value to compensate for the incorrect calibration until the instruments can be recalibrated. CR-95-1156 was subsequently initiated to document the condition.

On November 7, 1995, CR-95-1144 was initiated when another review of the wide and narrow range SIT level transmitter calculations noted that an incorrect density value for borated water and an inconsistent temperature assumption had been previously used (October 10, 1992). In addition, the static pressure span shift value used in the SIT wide range transmitter calculation was found to be incorrect.

The SIT wide range transmitters had been replaced under a Design Change during Refueling Outage 5 (Fall 1992), but the calculation had not been updated with the new value for static pressure span shift. The new SIT wide range transmitters have span shift of .75 percent/ 1000 psi; the old transmitters had a span shift of 1 percent/ 1000 psi. As a temporary measure charts were prepared, using the most conservative correction, to correlate actual wide and narrow range SIT levels with indicated levels. This would allow operations personnel to administratively control SIT level within the appropriate band.

The following chronology includes information that predates the condition report process but was found to be relevant to the event analysis. All times are approximate.

<u>1992</u>

October 22-23, 1992
SIT Level transmitters were recalibrated under Work Authorization #01101854 based on new instrument calculations. New calculations were performed because it was discovered that the static pressure span shift correction factor was misapplied in the previous calculations. However, while correcting the static pressure span shift problem, errors were introduced through assumptions used for density and temperature.

Also, in October 1992, the SIT wide range transmitters were replaced by DC-3307. The new transmitters have a static pressure span shift of .75 percent/1000 psi; the old transmitters had a shift of 1 percent/1000 psi. This difference in span shift was not factored into the new calculations for the wide range SIT levels. CR-95-1144 addresses this problem.

1994

July 8, 1994
CR-94-0661 was written which determined Main Steam Flow transmitters needed to be rescaled for density compensation due to the plant operating at a lower Steam Generator pressure after implementation of the T_{hot} Reduction Program. Recalibration was scheduled for action during Refuel 7 since a containment entry would be required.

1995

July 13, 1995
Design Engineering (DE) provided Steam Generator operating pressure assumptions to I&C Maintenance (PMI) to support calculations for recalibrating the Steam Generator Narrow and Wide Range Level instruments. It had also been determined that the lower operating pressure of the T_{hot} Reduction Program required updating the Steam Generator Level calibration data sheets. The assumptions were also needed by Reactor Engineering & Performance for scaling Main Steam Flow into COLSS.

October 9, 1995
DE sent Combustion Engineering (ABB-CE) an information package detailing how the COLSS Main Steam Flow was calculated for the instrument loop. ABB-CE needed this information to rescale COLSS. At this time, no one suspected the data was deficient and pursuit of ABB-CE's assistance was prioritized accordingly.

October 10, 1995
ABB-CE notified DE by facsimile (fax) that there might be a problem with the COLSS Main Steam Flow instrument calculations based on the use of high pressure static pressure span shift values. DE re-performed the calculations and found that their results concurred with ABB-CE.

October 11, 1995
DE faxed a full package plus a spread sheet depicting DE's calculations to a contract engineer. The package included the COLSS Main Steam Flow instrument calculations performed by both DE and PMI.

October 11,- November 1, 1995
DE,PMI, a contract engineer, and ABB/CE engaged in discussions concerning the COLSS Main Steam Flow calculations.

November 1, 1995
The contract engineer arrived on-site and contacted PMI. Some urgency was recognized, though it was felt that the concern was only with the Main Steam Flow calculations.

November 2, 1995
The contract engineer met with DE and PMI to discuss the Main Steam Flow concerns. PMI now fully understood the nature of the concerns. It was determined that there could be wider implications affecting Rosemount transmitters at Waterford 3. The I&C Maintenance Superintendent and DE supervision were notified of the concerns.

An additional meeting was held to discuss the problem with the contract engineer and representatives from Systems Engineering, DE, PMI, and ABB-CE. Rosemount, who was contacted during the meeting, initially did not feel that there was a problem with Waterford's calculations of Main Steam Flow; however, prior to the end of the meeting, Rosemount concurred that the static pressure span shift value was applied in the wrong direction. CR-95-1125 was written.

November 2, 1995, (1558 hours)
Invoked Site Directive W4.101, "Operability/Qualification Confirmation Process." Design Engineering prepares W4.101 evaluation.

November 3, 1995
W4.101 Conclusions: Calibrate the two COLSS Main Steam Flow transmitters and eight narrow range SIT Level transmitters and use administrative controls to operate the SITs within reduced bands.

Plant Operations Review Committee (PORC) approved the conclusions of the W4.101.

PMI calibrated the transmitters located in containment. This included the narrow range SIT Level transmitters and two Main Steam Flow transmitters which input to COLSS.

November 4, 1995
It was discovered by PMI planners that a package being prepared to recalibrate Pressurizer Level was in error. It was discovered that the value of the static pressure span shift should be negative instead of positive. Because of this discovery, it was determined that there was no need to recalibrate Pressurizer Level. In addition, it was noted that an incorrect value for the static pressure span shift had been applied to the narrow range SIT Level instruments which had been previously recalibrated using this incorrect span shift information.

Site Directive W4.101, "Operability/Qualification Confirmation Process" was invoked to confirm operability and CR-95-1126 was written.

During evaluation a new issue affecting the Steam Generator (S/G) Low Level Trip setpoints was identified by Design Engineering. An error apparently had been introduced when the calibration calculations were revised on August 17, 1995, and involved an inaccurate application of static pressure span shift, although the direction in which it was applied (negative) was correct. PMI and DE performed calculations for comparison to determine if a problem existed.

November 5, 1995
It was confirmed that S/G #2 low level channel A did not meet the Allowable Value setpoint as calibrated.

November 5, 1995, (0837 hours)
S/G #2 Low Level Trip channel A was declared inoperable. All other channels were determined to be acceptable since their values were within the Technical Specification Allowable Values.

November 5, 1995, (1008 hours)
Exited W4.101 after the revised operability evaluation was approved with the following conclusions:

S/G Low Level Trip setpoints were to be reset to a higher, more conservative, value to compensate for calculational errors until the narrow range S/G Level transmitters can be recalibrated.

SIT Levels were acceptable with administrative controls until the narrow range transmitters are corrected to compensate for the slight error introduced.

November 5, 1995
It was discovered that the SIT Level calculations performed in 1992 assumed the correct specific gravity but miscalculated the density term. (i.e., the density for borated water was calculated using an incorrect reference temperature.)

S/G #2 Low Level Trip channel A was declared OPERABLE after its setpoint was reset.

November 6, 1995
Completed resetting all S/G Low Level Trip setpoints to a higher, more conservative, value.

November 6, 1995
DE recalculated SIT Level calibration data using the correct boron density values.

Tables were drafted for use by Operations personnel to allow for adequate administrative control of SIT Levels.

November 7, 1995
CR-95-1144 which addressed the improper density compensation as well as the use of an incorrect static pressure span shift value for SIT Level instruments was issued.

CAUSAL FACTORS

An investigative team was assembled to determine the causes for the events described in this report and to recommend corrective actions. Although the team identified areas for improvement in the calibration process, it should be noted that errors have been found in only a small fraction of the total population of calibration calculations and data sheets. Additionally, the identified instrument indication deviations have been small.

Identified Causes:
A principal root cause for this event is attributed to an ineffective review process for these instrument calculations allowing calculational errors to go undetected. The investigative team conclusions about the underlying causes for the inadequate reviews, as well as specific causes related to the events described, are discussed below.

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TEXT (If more space is required, use additional copies of NRC Form 366A) (17)

Generic concerns with the calibration calculation process:

1. Even though the instrument calibration calculations are independently reviewed, the calibration calculation process is primarily organized around a single individual who prepares all of the calculations. This tends to place the bulk of the responsibility for calculation accuracy on that individual.

2. The technical review/verification process is not well defined for calibration calculations. There is no formal guidance for the review process.

3. PMI directives do not provide sufficient technical guidance for preparation and review of calculations. This includes application of static pressure span shift, appropriate use of reference temperatures, and density compensation, etc.

4. In a few instances, a lack of effective communications among PMI, Systems Engineering and Design Engineering apparently contributed to calibration calculations, instrument data sheets, or instrument uncertainty calculations not being appropriately updated when the changes were programatically initiated.

Causes Specific to the Events Described in this Report:

5. The initial W4.101 operability confirmation for this event contained errors apparently caused by the following:

a) The large scope and complexity of the issue;

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b) The limited resources available due to the specialized knowledge required; and

c) The relatively short period of time in which the evaluation was performed.

Additionally, the errors were carried through to the preparation and review of the work packages for SIT Level instrument calibrations prepared as a result of the W4.101 evaluation conclusions. The team concluded that the verification of the W4.101 and subsequent reviews of the SIT Level calibration packages were inadequate.

6. The team concluded that the corrective action program was not invoked in a timely manner, since a Condition Report was not initiated when a potential problem was first indicated.

IMMEDIATE CORRECTIVE MEASURES

1. Design Engineering initiated a CR on the Steam Generator Level transmitter calibration error.

2. Design Engineering is coordinating an independent review of the SIT Level calibration calculation by ABB-CE prior to installing a Temporary Alteration Request (TAR) to correct density and span errors.

3. Systems Engineering is coordinating installation of a TAR to compensate for SIT Level calibration errors without entering containment.

4. Systems Engineering evaluated COLSS for immediate possible problems with respect to the errors discovered.

5. PMI provided documentation that the initial Steam Flow calculations (prior to RF07) did not have static pressure span shift errors.

Intermediate Actions To Address Generic Concerns With Calibration Calculations:

Although the investigation team identified areas for improvement in the calibration process, it should be noted that errors have been found in only a small fraction of the total population of calibration calculation sheets. Nevertheless, the types of calibration calculation errors found are not limited to specific instruments or even to Rosemount differential pressure transmitters. Therefore, the entire population of calibration calculations (1555 calculations) was evaluated to determine those that are most susceptible to the same types of errors.

Calculations were first categorized in accordance with the criteria described in the following table:

	SAFETY/QUALITY RELATED?	COMPLEX CALCULATION?(*)
PRIORITY 1	YES	YES
PRIORITY 2($)	YES	NO
OTHER CALCULATIONS	NO	YES/NO

(*) This includes as a minimum Rosemount D/P transmitter calculations and other calculations that include compensation for density or chemistry (e.g., boron, oil)

($) Also includes Rosemount D/P transmitters that are not safety or quality related

As a result of the initial evaluation, three lists of calculations were developed, one for each category. Each calculation was further evaluated based on the significance to plant operations of the associated component and the lists were revised accordingly. This was to ensure that the calculations for the most significant components are reviewed first.

The final totals for each category are:

PRIORITY 1 .... 162 calculations
PRIORITY 2 .... 453 calculations
OTHER .... 940 calculations

A review of the Priority 1 calibration calculations and a sampling of Priority 2 calibration calculations will be conducted to determine if additional errors exist. Condition Reports will be generated for any adverse conditions identified.

ACTIONS TO PREVENT RECURRENCE

A team will be convened with representatives from Systems Engineering, Design Engineering, Maintenance Engineering and PMI tasked to:

a) Examine and make recommendations on the review/verification process for calibration data packages in light of the events described in this report,

b) Establish and communicate expectations for the transfer of information between Engineering and PMI regarding configuration control processes which affect instrument calibrations, and develop/refine administrative controls for sharing that information.

Some other actions to address causes specific to the events described in this report include:

1. Quality Assurance to assess the W4.101 process.

2. Site Management will review expectations and lessons learned from this event with the appropriate individuals. Specific topics will include:
   a) Timeliness of initiating CR's.
   b) Thorough and accurate identification of generic problems.
   c) Management of the W4.101 process.
   d) Thorough and accurate technical reviews.

3. CR-95-0705 was previously written to address an adverse trend related to timeliness of documentation of adverse conditions (i.e., delays in initiating a CR when an potential or actual adverse condition is identified). CR-95-0705 was classified as a significant adverse condition and a root cause analysis was performed. It is anticipated that the corrective actions identified in that CR will adequately address the related causes identified in this report.

SAFETY SIGNIFICANCE

The four Safety Injection Tanks (SITs) function to supply borated water to the reactor vessel during the blowdown phase of a Large Break Loss of

Coolant Accident (LBLOCA), and to provide inventory to help accomplish the refill phase that follows.

The blowdown phase of a large break LOCA is the initial period of the transient during which the RCS departs from equilibrium conditions, and heat from fission product decay, hot internals, and the vessel continues to be transferred to the reactor coolant. The blowdown phase of the transient ends when the RCS pressure falls to a value approaching that of the containment atmosphere.

The refill phase of a LOCA follows immediately when reactor coolant inventory has vacated the core through steam flashing and ejection out through the break. The balance of the SITs' inventory is then available to help fill the lower plenum and reactor vessel downcomer to establish a recovery level at the bottom of the core and ongoing reflood of the core with the addition of safety injection water.

The SITs are pressure vessels, partially filled with borated water and pressurized with nitrogen gas. The SITs are passive components, since no operator or control action is required for them to perform their function. Internal tank pressure is sufficient to discharge the contents to the RCS, if RCS pressure decreases below the SIT pressure following a LOCA.

Each SIT is piped into one RCS cold leg via the injection lines utilized by the High Pressure Safety Injection and Low Pressure Safety Injection (HPSI and LPSI) systems. Each SIT is isolated from the RCS by a motor operated isolation valve and two check valves in series. The motor operated isolation valves are normally open, with power removed from the valve motor to prevent inadvertent closure prior to or during an accident.

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The SIT gas and water volumes, gas pressure, and outlet pipe size are selected to allow three of the four SITs to cover the core. Thus, limiting Peak Clad Temperature (PCT) clad oxidation. The need to ensure that three SITs are adequate for this function is consistent with the LOCA assumption that the entire contents of one SIT will be lost via the break during the blowdown phase of a LOCA.

TS Limiting Condition for Operation (LCO) 3.5.1 specifies minimum and maximum SIT level and SIT nitrogen pressure requirements to preserve the following aspects derived from the safety analysis:

1) The minimum volume requirement ensures that three SITs can provide adequate inventory to reflood the core and downcomer to the elevation of the bottom of the inlet nozzles following a LOCA.

2) The maximum volume limit is based on maintaining an adequate gas volume to ensure proper injection and the ability of the SITs to fully discharge.

3) The minimum nitrogen cover pressure requirements ensures that the contained gas volume will generate discharge flow rates during injection that are consistent with those assumed in the safety analysis.

4) The maximum nitrogen cover pressure limit ensures that sufficient inventory exists at the end of the blowdown period to reflood the core (i.e. water does not inject too early and go out the break).

SIT indicated levels for this event have not been below the Technical Specification minimum values for periods longer than the allowed outage time. The SIT's actual level would be 75.7 percent with a Technical

Specification minimum indicated level of 78 percent. A Technical Specification Change Request has been docketed which includes a change to the minimum SIT level. The requested lower level limit is 40 percent. This lower level has been analyzed by ABB-CE (via ABB-CE Analysis ST-95-0468) and shown to be acceptable. Therefore, an adequate water volume has been available to allow the SIT's to perform their intended safety function.

This condition did not prevent the fulfillment of the Safety Injection Tanks safety function therefore this condition did not prevent the fulfillment of the safety function of a system needed to mitigate the consequences of an accident, remove residual heat, shutdown the reactor and maintain it in a safe shutdown condition, or control the release of radioactive material. This event did not compromise the health and safety of the public.

SIMILAR EVENTS

There have been no similar events at Waterford 3 reported as LER's.