



Entergy Operations, Inc.
P.O. Box B
Kilona, LA 70066-0751
Tel 504 464 3120

T.R. "Ted" Leonard
General Manager
Plant Operations
Waterford 3

W3F1-97-0112
A4.05
PR

May 16, 1997

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

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

Gentlemen:

Attached is Licensee Event Report (LER) Number 97-007-01 for Waterford Steam Electric Station Unit 3. The LER, which documents the failure to consider additional inputs in the calculation of Total Loop Uncertainty for a Technical Specification instrument, was initially submitted voluntarily. However, additional information was identified that indicates the Technical Specifications were violated. Therefore, pursuant to 10 CFR 50.73(a)(2)(i)(B), this condition is being reported as a condition prohibited by Technical Specifications.

Very truly yours,

T.R. Leonard
General Manager
Plant Operations

TRL/CJT/tjs
Attachment

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Reporting of Licensee Event Report (LER 97-007-01)

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cc: E.W. Merschoff, NRC Region IV
C.P. Patel, NRC-NRR
A.L. Garibaldi
J.T. Wheelock - INPO Records Center
J. Smith
N.S. Reynolds
NRC Resident Inspectors Office
Administrator - LRPD

LICENSEE EVENT REPORT (LER)

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

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS MANDATORY INFORMATION COLLECTION REQUEST: 56.0 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 (7-8 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.

FACILITY NAME (1)

Waterford Steam Electric Station Unit 3

DOCKET NUMBER (2)

05000 382

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TITLE (4)

Discovery of Additional Refueling Water Storage Pool Instrument Uncertainty

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
03	09	97	97	007	01	05	16	97	N/A	05000
									N/A	05000

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

OPERATING MODE (9)	POWER LEVEL (10)	20.2201(b)	20.2203(a)(2)(v)	50.73(a)(2)(i)	50.73(a)(2)(viii)
				X	
		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

T.J. Gaudet, Licensing Manager

TELEPHONE NUMBER (include Area Code)

(504) 739-6666

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)

YES (If yes, complete EXPECTED SUBMISSION DATE) NO

EXPECTED SUBMISSION DATE (15)

MONTH	DAY	YEAR

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

On 2/23/97, Waterford personnel observed the indicated level of the Refueling Water Storage Pool (RWSP) change during startup of the Controlled Ventilation Area System (CVAS). The root cause of this condition is an inadequate design for the reference leg of the level transmitters. The low side of each RWSP level transmitter is vented to an area filtered by CVAS whereas the high side is connected to the RWSP. Thus, CVAS operation affects the differential pressure between the two legs of the transmitters. These transmitters are intended to measure RWSP level and initiate a Recirculation Actuation Signal (RAS) at the required setpoint. CVAS operation causes indicated RWSP level to differ from actual RWSP level in the non-conservative direction. Near-term actions included recalibrating the RWSP transmitters and conducting tests to determine additional ventilation effects. On 3/17/97, another impact associated with operation of the non-safety Condenser Off-Gas system. The system was placed in a condition that negated the impact. On 4/8/97, voluntary LER 97-007-00 was issued to document this event. Subsequently, engineering determined the CVAS effect impacts the RWSP instrument setpoint analysis and does not preserve the previously calculated analytical limit. This event is reportable as a condition prohibited by Technical Specifications. This event did not compromise the health and safety of the public.

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REPORTABLE OCCURRENCE

Waterford 3 identified two previously unknown sources of uncertainty affecting a Technical Specification (TS) instrument. When the uncertainty is factored into setpoint basis documentation, a previously calculated Analytical Limit is exceeded. Exceeding the Analytical Limit for this TS instrument is reportable pursuant to 10CFR50.73(a)(2)(i) as a condition prohibited by Technical Specifications.

INITIAL CONDITIONS

At the time of discovery, Waterford 3 was operating in Mode 1 at approximately 100% power. No structures, systems or components were out of service that contributed to this event.

EVENT DESCRIPTION

During development of Waterford 3 TS, Combustion Engineering (CE) determined that 10% of the Refueling Water Storage Pool (RWSP) volume should be available at the time a Recirculation Actuation Signal (RAS) is initiated. In consequence, a 10% Trip Setpoint value was established for the Refueling Water Storage Pool (RWSP) level instruments to initiate a RAS. Correspondence from CE indicates the 10% Trip Setpoint value was based on a traditional and generally accepted allowance. Although instrument uncertainty was considered in establishing the 10% Trip Setpoint value, it was not derived by adding instrument channel uncertainties to an analytical limit.

On December 9, 1994, Waterford 3 requested permission to modify TS Table 3.3-4, "Engineered Safety Features Actuation System Instrumentation Trip Values," to change the Allowable Value for initiation of "RWSP--Low" from $\geq 9.3\%$ to $\geq 9.08\%$. No request was made to change the traditionally accepted 10% Trip Setpoint value. The proposed Allowable Value was derived by means of an explicit setpoint calculation analysis. First, a Total Loop Uncertainty (TLU) was calculated and subtracted from the 10% Trip Setpoint value. The resultant value, 7.43%, was established as the Analytical Limit.

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Next, the Allowable Value was determined by adding an allowance between the Trip Setpoint and the Analytical Limit to account for Periodic Test Error (PTE). The proposed TS change was approved on September 5, 1995. The Safety Evaluation Report (SER) granting approval states the Allowable Value of 9.08% is adequate to "... ensure the Analytical Limit of 7.43% is met with excess margin."

On February 23, 1997, Maintenance observed an approximate 2% increase in RWSP level indication during startup of the Controlled Ventilation Area System (CVAS). The observation was pursued by Operations and Maintenance personnel.

On March 8, 1997, Maintenance collected RWSP level instrumentation data. At 2232 hours, the "RWSP--Low" bistable for Plant Protection System (PPS) channel 'A' was bypassed and the channel declared inoperable per TS 3.3.2, "Engineered Safety Features Actuation System [ESFAS] Instrumentation." Next, RWSP level data were recorded with: (1) the Reactor Auxiliary Building (RAB) Normal Ventilation System operating, (2) the RAB Normal Ventilation System secured, (3) one train of CVAS operating, and (4) two trains of CVAS operating. At 2324 hours, PPS channel 'A' was declared operable and the action statement for TS 3.3.2 exited. Data collection was repeated with PPS channels B, C, and D inoperable. At no time was more than one PPS channel inoperable.

At 2349 hours, Operations declared CVAS Train 'B' inoperable and entered the action statement for TS 3.7.7, "Controlled Ventilation Area System," due to RWSP level concerns with two trains of CVAS operating. Precautionary measures included opening the supply breaker for CVAS Train B and adding a Caution Tag to alert Operators that CVAS Train B can be restarted if CVAS Train A does not start automatically on a Safety Injection Actuation Signal (SIAS).

On March 9, 1997, at 0045 hours, additional reviews of RWSP data revealed operation of two CVAS trains during a postulated accident could potentially cause a RAS to be initiated below the TS Allowable Value of 9.08%. In consequence, at 0436 hours, Operations telephoned the NRC to report that condition. (Subsequent reviews revealed

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the RAS function was not jeopardized. The telephone notification, which was made pursuant to 10CFR50.72(a)(2)(iii), was conservative.)

Subsequent investigations revealed the high pressure side of each RWSP level transmitter is connected to the RWSP which is vented to the suction of the RAB Normal Ventilation units. Operation of the CVAS has no effect on the high pressure side. The low pressure side of each transmitter, however, is vented to an area of the RAB that is filtered by CVAS. In consequence, operation of the CVAS can affect the differential pressure between the high and low sides of the transmitters. Changes in differential pressure affect the RWSP level transmitters, which in turn affect the measurement of RWSP level. To offset the CVAS effect, the transmitters were recalibrated considering the data collected on March 8, 1997. CVAS Train B was returned to service on March 15, 1997, at 0510 hours.

On March 17, 1997, at approximately 1100 hours, another impact was discovered when the non-safety related Condenser Off-Gas exhaust was shifted to the "Filtered Exhaust" position. Level indications on all four PPS channels were noted to increase by approximately 1.5%. When the Condenser off-gas exhaust was shifted back to the "Atmosphere" position, RWSP level returned to the original level.

The RWSP vent ties into the same header as the diverted Condenser Off-Gas exhaust (through a non-safety related check valve). This provides the potential, while in the "Divert" mode, for Condenser Air Evacuation pump discharge header pressure to affect the high pressure side of the level transmitter. To compensate for that effect, the Condenser Off-Gas exhaust valves were failed in the "Atmosphere" position to prevent discharge to the RAB normal ventilation system. Furthermore, to minimize the effects of an unfiltered atmospheric release, the off-normal procedure for Steam Generator tube leakage was temporarily changed to provide instructions to commence a plant shutdown if primary to secondary leakage reaches 0.1 gpm in either Steam Generator.

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On April 9, 1997, with investigations ongoing, LER 97-007-00 was submitted voluntarily to provide industry notification of this condition. At that time, personnel had not determined the NRC relied upon the Analytical Limit of 7.43% as the basis for granting a license amendment. Since the Analytical Limit is derived by subtracting the TLU from the Trip Setpoint, any increase in TLU will affect the Analytical Limit. Therefore, when the CVAS effect is added to TLU the Analytical Limit of 7.43% is exceeded.

On April 16, 1997, Licensing determined exceeding the Analytical Limit of 7.43% for the "RWSP--Low" level instruments is a condition prohibited by TS.

CAUSAL FACTORS

The root cause of this event is an inadequate design. The design of the RWSP level transmitters, with the high pressure side connected to the RWSP and the low pressure side vented to atmosphere controlled by the CVAS, makes it possible for changes in RAB ventilation to affect level indication.

CORRECTIVE MEASURES

The following interim actions were implemented until final resolution can be completed during the Refuel 8 Outage which began on April 11, 1997:

- The RWSP level transmitters were calibrated using data obtained with ventilation systems in the accident configuration and with the worst case single failure. The impact of less severe failures would result in conservative indication.
- The Condenser Off-Gas was failed in the "Atmosphere" position to prevent diverting exhaust to the RAB normal ventilation.
- OP-901-202, "Steam Generator Tube Leakage or High Activity," has been changed giving the Control Room staff instructions to commence a plant shutdown when Steam Generator tube leakage exceeds 0.1 gpm.

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Additional corrective measures taken or planned include:

- Other tanks considered susceptible to this type of error were evaluated. The evaluation revealed:
 - (1) The Boric Acid Makeup (BAM) Tank level was observed to increase by approximately 3.8% when RAB normal ventilation was secured. With RAB normal ventilation running, the difference between indicated and actual level is in the conservative direction.
 - (2) The Plant Monitoring Computer indication for the Condensate Storage Pool (CSP) was observed to increase by approximately 0.5% when RAB normal ventilation was started. This effect was not discernible on the level instrument used to satisfy compliance with TS 4.7.1.3.1.
- The setpoint calculation analyses associated with "RWSP--Low" will be revised. The Condenser Off-Gas and CVAS effects will not be added to TLU because the low pressure legs of the RWSP level transmitters will be re-routed from the RAB (CVAS) atmosphere to the top of the RWSP during the Refuel 8 Outage.

SAFETY SIGNIFICANCE

The RWSP ensures adequate liquid capacity to support Emergency Core Cooling System (ECCS) functions. The post-accident function of the RWSP low level actuation is to perform a transfer of the suction for the ECCS pumps from the RWSP to the Safety Injection sump. This is accomplished at a level high enough to prevent vortexing and subsequent loss of pump suction.

The CVAS system provides fission product control by maintaining a portion of the RAB at a negative pressure following a design basis accident and by providing filtration. Air is exhausted from a controlled ventilation area following a LOCA at a rate required to create and maintain a negative pressure below 0.25 inches water gauge relative to the

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surrounding areas. The CVAS is designed to provide filtration of exhaust air from this controlled ventilation area of the RAB.

The non-safety related Condenser Air Evacuation system is designed to remove non-condensable gasses and in-leaking air from the steam spaces of the Main Condenser. In the event of excessive steam generator tube leakage, exhaust is automatically redirected upon detection of high radiation. A 10CFR50.59 safety evaluation determined that failing the Condenser Off-Gas exhaust to the atmosphere does not increase the potential of an uncontrolled, unplanned, or unmonitored release. That conclusion was based on two primary factors: (1) the ability to continually monitor Condenser Off-Gas releases is not affected, and (2) any unfiltered release would still be within 10CFR Appendix I dose limits.

A current calculation indicates vortexing will occur in the RWSP at a level of 5.70%. The calculation assumes runout flow of the ECCS pumps. A test case was run using expected ECCS pump flow rates. This resulted in a RWSP vortexing limit of 5.40%, a gain of 0.3%.

The RWSP level instrumentation TLU is affected by the Accident Temperature Effect (ATE) of the level transmitters. ATE is based on the difference between the temperature at the time of calibration and the temperature during accident conditions. The original calculation used a conservatively low calibration temperature input of 60°F and a conservatively high accident temperature input of 150°F. Extensive reviews of survey data revealed the minimum actual area temperature experienced was 67°F and the maximum temperature was 77°F. The Environmental Zone Maps show that the actual accident temperature is 115°F. A test case was run where TLU was calculated using a conservative calibration temperature of 65°F and the actual accident temperature of 115°F. This resulted in a TLU of 2.13%.

The total gain from the revised vortexing level (0.3%) and the revised TLU is sufficient to ensure that RAS would have been initiated prior to the onset of vortexing in the RWSP.

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The suction of the ECCS pumps decreases the level of water in the RWSP creating a vacuum condition. The RWSP vacuum breakers have a cracking pressure of 0.18 psi, or approximately 5 inches of water. Although it is impossible to determine the exact amount of vacuum that would be drawn as RWSP level decreases and the vacuum breakers cycle, it is expected these valves will maintain from 0 to 5 inches of water vacuum. This vacuum will cause indicated level to move closer to the actual level. Although no credit is taken in the vortexing calculations, this vacuum provides further confidence that RWSP vortexing would not have occurred prior to RAS initiation.

The ESFAS Instrumentation Trip Setpoints listed in TS Table 3.3-4 prescribe those settings for critical parameters that will avoid exceeding any analytical limit stated in the Final Safety Analysis Report (FSAR) for postulated Design Bases Accidents or Anticipated Operational Occurrences. The selection of these trip setpoints is such that adequate protection is provided when all sensor and signal processing component uncertainties are taken into account. To allow for calibration tolerances, instrumentation uncertainties, instrumentation drift, and severe environments, trip setpoints specified in Table 3.3-4 are conservatively adjusted with respect to the analytical limits.

Although the initially calculated Analytical Limit of 7.43% was exceeded, there is sufficient margin between the Trip Setpoint and initiation of a RAS to ensure that RWSP vortexing does not occur. Assuming the worst case CVAS and Condenser Off-Gas effects, RWSP vortexing would not have occurred. Although the available margin is small, it was derived from calculations that use conservative input criteria.

With the change to the instrument calibration for the RWSP level transmitters, the TS 3.3.2 RAS setpoint is protected and the minimum required RWSP level is maintained. The change compensates for the most limiting condition of two CVAS trains operating and a failed makeup damper creating a negative pressure on the reference leg of the transmitter. By incorporating the effects of normal RAB ventilation operation, CVAS operation, and a single failure of a make-up damper in the CVAS, the RAS setpoint is

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protected and the minimum assumed volume of borated water from the RWSP is available for ECCS. This event did not compromise the health and safety of the public.

SIMILAR EVENTS

No previous similar reportable events involving the failure to consider additional inputs in the calculation of TLU were identified.

ENERGY INDUSTRY IDENTIFIERS

Energy Industry identification System (EIS) component function identifiers and system names are identified below, in parenthesis, for those systems or components referred to in the LER text:

- RWSP Level Instruments (BP-TK-LIT)
- CVAS (VF)
- RAB Normal Ventilation (VF)
- Plant Protection System (JC)
- Condenser Off-Gas (SH)
- Condenser Air Evacuation Pump (SH-P)
- Reactor Auxiliary Building (NF)
- Emergency Core Cooling System (BE, BP, BQ)
- Steam Generator Tube (AB-SG-TBG)
- Boric Acid Makeup Tank (CA-TK)
- Plant Monitoring Computer (ID)
- Condensate Storage Pool (KA-TK)