



Entergy
Operations

Ref. 10CFR50.73(a)(2)(ii)

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A4.05

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July 29, 1991

U.S. Nuclear Regulatory Commission
ATTENTION: 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-89-007-02 for Waterford Steam Electric Station Unit 3. This Licensee Event Report supplement is submitted to provide additional information resulting from investigation of the events described. This Licensee Event Report is submitted pursuant to 10CFR50.73(a)(2)(ii).

Very truly yours,

D.F. Packer
General Manager - Plant Operations

JRM/LDC/jrr
Attachment

cc: Messrs. R.D. Martin
G.L. Florreich
J.T. Wheelock - INPO Records Center
E.L. Blake
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NRC Resident Inspectors Office

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LICENSEE EVENT REPORT (LER)

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0104), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)										DOCKET NUMBER (2)										PAGE (3)																													
Waterford Steam Electric Station Unit 3										0 5 0 0 0 3 8 2										1 OF 0 8																													
TITLE (4) Inadequate Design of Air Accumulators Due to Incomplete Review of Post-TMI Action Plan																																																	
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 NAMES										DOCKET NUMBER(S)												
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POWER LEVEL (10)										20.402(b)										20.406(a)										50.73(a)(2)(iv)										73.71(b)									
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LICENSEE CONTACT FOR THIS LER (12)																																																	
NAME																				PHONE NUMBER																													
G.M. Davis, Event Analysis, Reporting, and Response Manager																				AREA CODE																													
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ABSTRACT (Limit to 1400 spaces, i.e., approximately fifteen single space typewritten lines) (16)

At 1100 hours on March 31, 1989, Waterford Steam Electric Station Unit 3 was operating at 100% power when the issue of reportability was raised on the sizing of the Instrument Air (IA) accumulators which supply the Safety Injection (SI) Recirculation Sump Outlet Valves, SI-602A&B. Design requirements did not consider certain accident scenarios, with a postulated loss of IA where operation of the valves may be required. Manual operation of the valves was not considered an adequate backup due to potential radiation levels at the valve location. Therefore, the plant was operated in an unanalyzed condition since initial startup.

On February 6, 1991, a review of Surveillance Procedures revealed that the plant was operated with a nitrogen accumulator IV leakage rate of 57.6 psi/hr vice the 55 psi/hr maximum required by Design Basis Documentation (DBD). An evaluation was performed to determine the significance of operation with excessive leakage on nitrogen accumulator IV. Some of the affected valves may have required manual operation in approximately 9.5 hours vice 10 hours in a post accident scenario with loss of IA.

The root cause of this event was an inadequate review of design requirements implemented as part of the post-TMI action plan. DC 3195 installed a motor operated valve for SI-602A&B. The source of leakage was found and corrected on nitrogen accumulator IV.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (F-530), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20555, 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) 0 5 0 0 0 3 8 2	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	— 0 0 7	— 0 2	0 2	OF	0 8

TEXT (If more space is required, use additional NRC Form 388A's) (17)

At 1100 hours on March 31, 1989, Waterford Steam Electric Station Unit 3 was operating at 100% power when the issue of reportability was raised on the installed design of the instrument air (IA) accumulators (EIIS Identifier LD-ACC) which supply the Safety Injection Sump Recirculation Outlet Isolation Valves (SI 602A&B) (EIIS Identifier BP-V). The accumulators were designed to allow each valve to cycle once within one hour during a design large break loss of coolant accident (LOCA) coincident with a loss of IA. During a small break LOCA scenario the valves may be required to operate longer than one hour after the IA supply is compromised. The radiation levels in the vicinity of SI 602A&B would peak at 910 rem/hour during a design large break LOCA according to section 12.3A of the Final Safety Analysis Report (FSAR). This would not allow personnel to enter the SI 602A&B area after a LOCA. However, the radiation levels coincident with a design small break LOCA would be much lower and would likely not differ appreciably from normal levels, thus permitting access to the valves. Because an analysis is not available for radiation levels coincident with a design small break LOCA, local manual operation of SI 602A&B cannot be considered an adequate backup method for remote valve operation. Thus, the plant is considered to have operated in an unanalyzed condition since issuance of the operating license.

SI 602A&B are closed during normal operation and open upon receipt of a Recirculation Actuation Signal (RAS). A RAS is generated when two out of four Refueling Water Storage Pool (RWSP) (EIIS Identifier BP-TK) low level signals received with a Safety Injection Actuation Signal present. The RAS then opens SI 602A&B at a RWSP level of 10%. The suction of the Containment Spray Pumps (CSPs) (EIIS Identifier BE-P) and the High Pressure Safety Injection Pumps (EIIS Identifier BQ-P) can then transfer from the RWSP to the SI Sump during a LOCA. This transfer maintains an adequate supply of water for reactor coolant system (EIIS Identifier AB) cooling throughout an accident scenario.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 500 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-330), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20545, 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) 0 5 0 0 0 3 8 2 8 9 — 0 0 7 — 0 2 0 3 OF 0 8	LER NUMBER (8) YEAR SEQUENTIAL NUMBER REVISION NUMBER	PAGE (9)
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

General Design Criterion 2 as stated in the Final Safety Analysis Report (FSAR) Section 3.1.2 requires components that are vital to the mitigation and control of accident conditions be designed to withstand the effects of a LOCA coincident with the effects of a Safe Shutdown Earthquake (SSE). SI 602A&B must therefore operate during a LOCA concurrent with a SSE. Because the IA system upstream of the accumulators is not designed to survive a SSE, the stored air in the accumulators is required to operate SI 602A&B during the above conditions. The installation specifications required the accumulators to store adequate air pressure to cycle the valves once following a loss of IA lasting one hour post LOCA. This was the design criteria at the time of installation and was not reevaluated when NUREG 0737 was implemented.

In January 1988, Waterford Steam Electric Station Unit 3 received NRC Information Notice No. (IEN) 87-28, Supplement 1, "Air Systems Problems at U.S. Light Water Reactors." Following a review of the IEN, recommendations were made to improve the air systems at Waterford 3. A concern in the review was testing air accumulators for leakage with their IA supply isolated. Subsequently, operations personnel issued Problem Evaluation Information Request (PEIR) 60951 for information to develop acceptable test criteria for the SI 602 accumulators. One question asked in the PEIR was, "What is the length of time the accumulators are required to maintain sufficient pressure to perform their function?" The response to the PEIR stated that "the Architect Engineer's specifications state that the accumulators were designed to maintain sufficient pressure to perform their function for one hour." This response was not satisfactory to Operations personnel. At this time, NRC Generic Letter 88-14, "Instrument Air Supply System Problems Affecting Safety Related Equipment," was received. A task force was formed to ensure the issues in this letter were evaluated and to draft a response. One issue the task force considered was the SI 602 accumulator design. In January 1989, PEIR 10673 was generated to resolve the issue that SI 602A&B may need to operate beyond the current one hour as designed. This potential accumulator size discrepancy was reported to the NRC in the response to Generic Letter 88-14, letter W3P89-0028 dated February 21, 1989. The letter stated the issue was being reviewed under PEIR 10673.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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FACILITY NAME (1) Waterford Steam Electric Station Unit 3	DOCKET NUMBER (2) 0 5 0 0 0 3 8 2	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	-- 0 0 7 --	0 2	0 4	OF	0 8

TEXT (If more space is required, use additional NRC Form 305A's.)

On March 30, 1989, an on-site NRC inspection team reviewed the response to Generic Letter 88-14 with management. Nonconformance Condition Identification (NCI) 262265 was then issued to obtain a preliminary engineering evaluation. On March 31, 1989, the situation was determined to be reportable as an unanalyzed condition. The NCI was evaluated, and a graph of required IA header pressure versus maximum allowable accumulator pressure decay rate was developed. By maintaining IA pressure above the graph's curve, the accumulators would be able to maintain sufficient air pressure to operate SI 602A&B once within four hours following a loss of IA. The four hour time limit is a concern for a 0.01 ft^2 small break LOCA. For this size LOCA, a RAS would occur at slightly less than four hours. However, one CSP must be operated continuously to assure that a RAS would occur within four hours. The area in the vicinity of SI 602A&B is considered to be a high radiation area in the event of a LOCA. For a break smaller than 0.01 ft^2 , the time to a RAS will be greater than four hours. FSAR Figure 13.6-173 indicates the core is not uncovered for breaks of 0.01 ft^2 and smaller. Therefore, for breaks of 0.01 ft^2 and smaller there should not be a significant radiation field in the area and SI 602A&B could most probably be manually operated.

Considering the available options, operating a CSP continuously until a RAS is not desirable. The actual leak rate of air from the accumulators combined with the normal operating pressure of IA ensures that the accumulators will have sufficient air pressure to operate SI 602A&B longer than four hours after a loss of IA. In a conference call on April 4, 1989, NRC Region IV personnel were informed that the CSPs would not be run continuously during an accident condition. The SI 602 accumulators are expected to maintain adequate air pressure much longer than four hours. During the next quarter the pressure decay rate of the accumulators was checked monthly rather than quarterly to demonstrate that sufficient air pressure could be maintained.

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FACILITY NAME (1) Waterford Steam Electric Station Unit 3	DOCKET NUMBER (2) 05000382	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
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TEXT (If more space is required, use additional NRC Form 360A's.) (17)

On April 20, 1989, an addendum to NCI 262265 was approved. For the limiting 0.01 ft² small break LOCA, a RAS is predicted to occur within 16 hours without CSP operation. Because this scenario is the most limiting condition, another graph of IA header pressure versus accumulator pressure decay rate was produced. Operations issued Standing Instruction 89-04 to establish IA operation with the revised IA header pressure graph. If IA pressure drops below the normal 16 hour operating curve established in the addendum to NCI 262265, IA pressure will be restored above the curve within one hour or the plant will be placed in hot standby within the next six hours. Standing Instruction 89-04 also established operability of the SI 602 accumulators based on the 16 hour curve and instructed that IA pressure be maintained on the shift supervisor and control room supervisor turn of events.

Long term corrective action Design Change (DC) 3195. DC 3195 was installed in two phases. Phase I provided safety-related tubing connections to allow an alternate means to supply nitrogen backup for operation of SI-602A&B. The nitrogen backup was located in an accessible area such that SI-602A&B can be operated in the limiting scenario, without radiological exposure concerns to the operators. Phase I of DC 3195 was completed on March 12, 1990, and as a result, Standing Instruction 89-04 was cancelled. Phase II of DC 3195 was completed during Refueling Outage IV, providing long term corrective action by installing motor operated valves for SI 602A&B.

The root cause of this event was an inadequate review of design requirements implemented as part of the post-TMI action plan. The SI 602A&B accumulator specifications were based on a large break LOCA with IA not available and a RAS generated within one hour. The accumulators were not reevaluated during construction to ensure they were adequately designed for the small break LOCA. PEIR 71128 was initiated to review the design basis of the air and nitrogen accumulators with respect to small break LOCAs.

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FACILITY NAME (1) Waterford Steam Electric Station Unit 3	DOCKET NUMBER (2) 0 5 0 0 0 3 8 2 8 9 —	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
			0 0 7	— 0 2	0 6	OF	0 8

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

As a result of the problems identified with accumulator sizing and questions concerning the design basis of the air and nitrogen accumulators, formulation of a Design Basis Document (DBD) was initiated. W3-DBD-014 for Safety Related, Air Operated valves, was issued on March 21, 1990. PEIR 71128 and W3-DBD-014 specifically documented the design basis of the air and nitrogen accumulators and the associated leak rate requirements.

On February 6, 1991, a review of Surveillance Tests revealed that an inconsistency existed between W3-DBD-014 and the Operations Department leak rate testing procedures. Specifically, W3-DBD-014 requires nitrogen accumulator IV leak rate to be less than 55 psi/hr while Surveillance Operating Procedure (OP)-903-032, Quarterly Inservice Test (IST) Valve Test, allows Nitrogen Accumulator IV leak rate to be less than or equal to 5 psi, over a 5 minute interval, which equates to a leakage rate of 60 psi per hour or less.

OP-903-032 tests the operability of check valves associated with Nitrogen Accumulators on a quarterly basis. Testing of check valve NG-704 for operability in accordance with OP-903-032, also provides some indication of the nitrogen accumulator IV leak rate over a 5 minute interval. On November 23, 1990, OP-903-032 was performed and resulted in a leak rate of 4.8 psi in 5 minutes equating to a 57.6 psi/hr leak rate for Accumulator IV.

Upon discovery of the leak rate in excess of W3-DBD-014 on February 6, 1991, Nitrogen Accumulator IV was declared inoperable. Several small leaks were identified and corrected. OP-903-032 was performed at 2259 hours on February 6, 1991, with satisfactory test results of 3.2 psi over a 5 minute time interval (38.4 psi/hr). Review of Surveillance Procedure OP-903-033, Cold Shutdown IST Valve Tests, which performs a one hour leakage test on the nitrogen accumulators, revealed that the last leakage test performed on nitrogen accumulator IV was completed on October 9, 1990, with a satisfactory leakage rate of 50 psi/hr.

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FACILITY NAME (1) Waterford Steam Electric Station Unit 3	DOCKET NUMBER (2) 0 5 0 0 0 3 8 2	LER NUMBER (6)			PAGE (3)		
		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	— 0 0 7	— 0 2	0 7	OF	0 8

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

An evaluation was performed to assess the safety significance of operating with nitrogen accumulator IV leakage in excess of the requirements established by W3-DBD-014. The limiting event analyzed for long term valve operation is the LOCA with a loss of IA. All valves operated by nitrogen accumulator IV in a post accident scenario, for supporting operation based on a standard 10 hours past event initiation required by W3-DBD-014, would have had no safety significance based on either operator action to manual operate valves in approximately 9.5 hours or valves having no requirement for operation.

The limiting valve, from which nitrogen accumulator IV provides backup motive gas for operation, was initially evaluated to be SI-106B (EIIIS Identifier BP-V), the RWSP outlet isolation valve to the SI pump suction. SI-106B is normally open, fails as is on loss of power or loss of air pressure, and is shut after a RAS to prevent back flow from containment to the RWSP (as a result of a high containment pressure condition) and a potential loss of net positive suction to CSP B if SI-106B is not shut. Further evaluation based on calculation EC-M91-011, SI-106B Closing Requirement Calculation, revealed that no safety significance is associated with shutting SI-106A after a RAS.

The evaluation revealed that component cooling water (CCW) (EIIIS Identifier CC) valves CC-127A&B (CCW pump discharge cross connect) and CC-115A&B (CCW pump suction cross connect) are the limiting valves required for operation which receive backup motive gas from nitrogen accumulator IV. These valves close upon a Safety Injection Actuation Signal (SIAS) (EIIIS Identifier JE) or low-low CCW surge tank level (EIIIS Identifier CC-TK) to isolate the CCW trains into two independent trains. All four valves fail open on loss of IA or nitrogen pressure. Another set of CCW valves, CC-126A&B (CCW pump discharge cross connect) and CC-115A&B (CCW pump suction cross connect), also isolate the CCW trains into two independent trains on a SIAS or low-low CCW surge tank level.

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		YEAR	SEQUENTIAL NUMBER	REVISION NUMBER			
		8 9	— 0 0 7	— 0 2	0 8	OF	0 8

TICK (If more space is required, use additional NRC Form 366A's) (17)

The observed leak rate of 57.6 psi/hr on nitrogen accumulator IV could have resulted in the requirement for operator action to manually override these valves closed to prevent the valves from failing open in approximately 9.5 hours post accident, vice the standard 10 hours assumed in W3-DBD-014. The valves are accessible post-accident and have handwheels for manual operation. Operator action to shut these valves in approximately 9.5 hours vice 10 hours would have mitigated any consequences of the excessive leakage rate on nitrogen accumulator IV.

Maintaining nitrogen accumulator IV leakage rate less than or equal to 55 psig/hr is currently not considered overly restrictive. The limit on leakage rate for air and nitrogen accumulators will be maintained in accordance with W3-DBD-014. Excessive leakage rates will be trended for long term evaluation on maintaining the nitrogen accumulators within the established leak rates. An Air Operated Valve Task Force Meeting was held to specifically address air operated valves and W3-DBD-014. No significant problems were found. OP-903-032 and OP-903-033 were revised to incorporate DBD data.

In summary, design requirements established by evaluating certain accident scenarios required the installation of motor operated valves for SI-602A&B. Leak rate was found to be 57.6 psi/hr on nitrogen accumulator IV. This leak rate was in excess of the less than or equal to 55 psi/hr required by W3-DBD-014 which was based on a 10 hour standard requirement for valve operation post accident. Operator action would have been required in 9.5 hours vice 10 hours post accident in the event of an SIAS or CCW level problems. Therefore, this event did not threaten the health and safety of the general public or plant personnel.

SIMILAR EVENTS

NONE

PLANT CONTACT

G.M. Davis, Event Analysis, Reporting & Response Manager, 504/464-3153