



Entergy
Operations

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

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Waterford 3

W385-92-0135
A4.05
QA

June 25, 1992

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-91-009-01 for Waterford Steam Electric Station Unit 3. This Licensee Event Report supplement is submitted to provide additional information and clarification acquired during the investigation of the events described. This Licensee Event Report is submitted pursuant to 10CFR50.73(a)(2)(i).

Very truly yours,

D.F. Packer
General Manager - Plant Operations

JFP/JDC/rk
Attachment

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

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PAGE 13

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| 0 | 5 | 0 | 0 | 0 | 3 | 8 | 2 | 1 | OF | 0 | 9 |
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Safety Injection Tank 1A and 1B Inoperable due to Relief Valve Malfunction

LICENSEE CONTACT FOR THIS LER (12)

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT 113

SUPPLEMENTAL REPORT EXPECTED 114

ABSTRACT (Limit to 1400 spaces, i.e. approximately fifteen single space typewritten lines) (16)

On May 21, 1991, the plant was shutdown in Mode 3 at a Reactor Coolant System (RCS) pressure and temperature of 2250 psia and 540 degrees Fahrenheit, respectively. Safety Injection Tank (SIT) 1A was out of service due to an inoperable nitrogen relief valve. At 1411 hours the relief valve for SIT 1B lifted, lowering SIT 1B pressure below 600 psig. The resulting condition of two SITs inoperable under the existing plant conditions is reportable under 10CFR50.73(a)(2)(i) as a condition prohibited by technical specifications (TSs) (entry into TS 3.0.3).

RCS pressure was lowered to less than 1750 psia, SIT 1A and 1B were declared operable, and Technical Specification 3.0.3 was exited. The relief valves for SIT 1A and 1B were later removed, tested, and returned to service.

The most likely root causes of this event were equipment malfunction due to abnormal vibration of the relief valve or valve tailpiece when agitated by scaffolding movement, and Equipment Design due to the installed SIT relief valves did not meet the specified blowdown criteria. This agitation resulted in the spurious opening of the SIT 1A and 1B relief valves at a pressure lower than the required setpoint. Due to the prompt actions of operations personnel to place the plant in a stable condition in which the SITs were all operable, there was no danger to the health and safety of the general public or site personnel.

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-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.

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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 (3) | | | PAGE (3) | |
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | | |
| | | 9 1 | 0 0 9 | 0 1 | 0 2 | OF 0 9 |

TEXT (If more space is required, use additional NRC Form 386A's) (17)

Reportable Condition:

On May 21, 1991, Waterford 3 was in Mode 3 lowering Reactor Coolant System (EIIIS Identifier AB) pressure in accordance with Technical Specification (TS) Limiting Condition for Operation (LCO) 3.5.1 due to an inoperable Safety Injection Tank (SIT) (EIIIS Identifier BP-TK) 1A. At 1405 while a scaffolding crew was removing scaffolding from the vicinity of SIT 1B, when the on-shift control room operator noted a dropping pressure in SIT 1B with the receipt of annunciators "SI TANK 1B PRESSURE HI/LO" AND "SI TANK 1B PRESSURE LO-LO". SIT 1B pressure dropped below the TS LCO 3.5.1 minimum pressure of 600 psig and SIT 1B was declared inoperable. TS LCO 3.0.3 was entered due to the condition of two SITs being inoperable. The resulting condition of two SITs being inoperable under the existing plant conditions is reportable under 10CFR50.73(a)(2)(i) as a condition prohibited by technical specifications (entry into TS 3.0.3).

Initial Conditions:

Power - zero (0)%

Mode - 3

RCS Temperature - 540 °F

RCS Pressure - 1990 psia

TS LCO in effect - 3.5.1

Maintenance in Progress - Construction removing scaffolding from vicinity of SIT 1B

SIT 1A pressure - 329 psig (610 psig before first lift)

SIT 1B pressure - 615 psig

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 (F430) U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20546, AND TO THE PAPERWORK REDUCTION PROJECT (3150-0194), OFFICE OF MANAGEMENT AND BUDGET, WASHINGTON, DC 20503.

FACILITY NAME (1)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

Waterford Steam
Electric Station Unit 3

0 5 0 0 0 3 8 2 9 1 - 0 0 9 - 0 1 0 3 OF 0 9

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

Event Sequence:System Description:

There are four SITs at Waterford 3 which constitute the passive injection portion of the Safety Injection (SI) (EIIIS Identifier BP) system. Each tank contains borated water pressurized by a nitrogen cover pressure and is connected to an associated RCS cold leg by a line containing two check valves that isolate the SIT from the RCS during normal operation. The SITs are specifically designed to rapidly reflood and cool the core during the time period between the occurrence of a large break Loss of Coolant Accident (LOCA) and the time when safety injection flow can actually reach the core. A nitrogen gas cover pressure is maintained between 600 and 625 psig as required by TS 3.5.1. Nitrogen cover pressure is raised by adding nitrogen from the Waterford 3 Nitrogen system (EIIIS Identifier - LK) or lowered by venting the SIT cover gas to containment atmosphere with one or both of the two solenoid operated vent valves. Overpressure protection is provided by a relief valve (EIIIS Identifier - RV) (Crosby Valve & Gauge Co., model # JMBUB) with a setpoint of 700 psig.

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-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.

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

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

On May 21, 1991, at 1045 hours at a RCS pressure and temperature of 2250 psia and 540 °F, respectively, Construction personnel entered containment to remove scaffolding from Safety Injection Tank 1A. The removal of scaffolding was nearly complete, when, at 1110 hours, a loud air noise was heard by personnel in containment in the vicinity of SIT 1A. Concurrently, the Control Room received the "SI TANK 1A PRESSURE HI/LO" and "SI TANK PRESSURE LO-LO" annunciators with a dropping indicated pressure on SIT 1A. SIT 1A was declared inoperable due to indicated pressure dropping below the TS minimum of 600 psig with RCS pressure greater than 1750 psia in Mode 3, and TS LCO 3.5.1 was entered. An attempt was made to restore pressure by opening the SIT 1A nitrogen fill valve (E11S identifier LK-ISV), but pressure continued to drop.

The nitrogen fill valve was closed at 1120 hours to prevent a reduction in nitrogen system pressure. At 1155 hours SIT 1A pressure had stopped dropping and the nitrogen system was fully pressurized. Nitrogen was aligned to increase SIT 1A pressure. However, at about 1223 hours, SIT 1A relief valve again lifted and pressure could not be restored above approximately 545 psig. SIT 1A pressure stopped dropping at 329 psig.

Reactor Coolant System depressurization was commenced at 1235 hours to reduce RCS pressure below 1750 psia in accordance with TS LCO 3.5.1. At approximately 1405 hours, a scaffolding crew went to SIT 1B to remove scaffolding. When one of the scaffolders stepped on top of SIT 1B, he heard a loud noise. Air was heard rushing out of a floor drain and was noted to last approximately 5 minutes. The air noise was reported to the Control Room staff, which had received the "SI TANK 1B PRESSURE HI/LO" and "SI TANK 1B PRESSURE LO-LO" annunciators and noted a dropping SIT 1B indicated pressure. Pressure drop in SIT 1B stopped at 335 psig. There was no pressure or level increase noted for SIT 1B before the pressure drop occurred. These indications were checked to see if SIT 1B pressure may have actually increased. At 1411 hours, SIT 1B was declared inoperable and Technical

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.3 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-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 9 1

LER NUMBER (5)

PAGE (3)

YEAR SEQUENTIAL REVISION
NUMBER NUMBER

0 0 9 0 1

0 5 OF 0 6

TEXT (If more space is required, use additional NRC Form 386A's) (17)

Specification 3.0.3 was entered due to the condition of two inoperable SITs. At 1428 hours, RCS pressure was lowered to less than 1750 psia. With SIT 1A and 1B pressure above 235 psig and RCS pressure below 1750 psia, all SITs were now operable in accordance with TS 3.5.1. Technical Specification LCO 3.5.1 and 3.0.3 were exited at 1428 hours.

Both SIT 1A and 1B were vented and the relief valves were bench tested. The relief valve for SIT 1A (SI-327A) was found to have a loose lock out on the setpoint adjustment which allowed the setpoint to drift low. SI-327A was adjusted to a setpoint of 700 psig and placed back in service. SIT 1B relief valve (SI-327B) was found to lift at the normal setpoint of 700 psig and was placed back in service.

Under Work Authorization (WA) 01078469, a test was performed to determine if mechanical agitation of the valves could have caused a premature lift. A spare Crosby Relief valve (Model JMBUB) was installed on a test stand and the setpoint pressure was verified at 702 psig. When subjected to a pressure of 650 psig and struck from the top or side with a 5 pound rubber mallet, the valve lifted. The test conclusion was "... a blow to the valve will cause it to lift below its set pressure."

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-330), 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)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

Waterford Steam
Electric Station Unit 3

YEAR

SEQUENTIAL
NUMBERREVISION
NUMBER

0 5 0 0 0 3 8 2 9 1 - 0 0 9 - 0 1 0 6 OF 0 4

TEXT (If more space is required, use additional NRC Form 385A's) (17)

Under WA #01081235 further testing was performed to determine the effects of impacts on valve operation. One test sequence involved checking the relief valve setpoint at temperatures from 73 °F to 414 °F. As temperature was raised above 70 °F (bench test temperature) a drop in setpoint is noted. Average setpoints noted were 705 psig (73 °F), 693 psig (100 °F), 683 psig (175 °F), 668 psig (250 °F), and 647 psig (325 °F).

Another test involved impacting the valve and associated piping with a hammer with various impacts while the valve was at approximately 70 °F. At normal pressure and 70 °F temperature the valve did not lift even when subjected to a 20 pound impact force. However, this testing demonstrated that when the SIT pressure is within 89% of the setpoint, an impact to the valve or associated piping can cause the valve to lift.

The synergistic effect of the loose locknut in the SIT 1A relief valve with the high ambient temperature in the vicinity of the SIT reliefs, could lower the SIT 1A relief setting sufficiently that the SIT 1A pressure (610 psig) was within 89% of the lower valve setpoint. Then a blow to the valve or attached piping would cause it to lift. During blowdown, the relief valve would experience further vibration which could cause the compression screw to back out more and cause a further reduction in setpoint. This would account for the valve lifting below 600 psig during repressurization of SIT 1A.

SIT 1B was at 615 psig when its lift occurred as a scaffolder stepped on top of the tank. If setpoint for the SIT 1B relief were 691 psig or less, the operating pressure would then be within 89% of the setpoint. In the testing under WA #01081235 it is shown that at 100 °F the setpoint was 693 psig (average of three lifts) and at 175 °F the setpoint dropped to 683 psig. At the time of the incident, average Containment Fan Cooler (CFC) (EIS Identifier - BK/FAN) inlet temperature on the technical specification logs was recorded as 103.6 °F for the

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-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 9 1 | LER NUMBER (8) | | | PAGE (3) | |
| | | YEAR | SEQUENTIAL NUMBER | REVISION NUMBER | | OF |
| | | | | | | |

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

0700 reading and 104.2 °F for the 1500 reading. Since the CFCs are on the -4 and +21 mean sea level (MSL) elevation and the SIT reliefs are at an approximate level of +90 MSL, the ambient temperature at the SIT reliefs is even higher. A review of containment temperatures recorded since Refuel 4 by the Environmental Qualification department shows that there is an increase of approximately 12 °F from the -4 MSL elevation to the +96 MSL elevation in containment. This would imply an ambient temperature of 117 °F on May 21, 1991 in the area of the SIT reliefs. A lower valve setpoint below the 89% value (691 psig) could result. If the scaffolder accidentally struck the SIT 1B relief valve or stepped on the valve or piping (causing a deflection which could cause valve distortion and leakage past the seat) the valve could lift.

It was noted during both incidents that the valves blew down approximately 50% instead of the expected 10%. Ebasco Specification 1564.124 specifies a blowdown of 10%, but in a discussion between Waterford 3 Purchasing, Waterford 3 Maintenance Engineering, and Crosby Valve & Gauge Co., it was indicated by Crosby that these valves normally achieve 40% to 50% blowdown and could not be worked to achieve a 10% blowdown capability.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 50.0 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)

LER NUMBER (6)

PAGE (3)

Waterford Steam
Electric Station Unit 3

YEAR

SEQUENTIAL
NUMBERREVISION
NUMBER

0 5 0 0 0 3 2 2 9 1 -- 0 0 9 -- 0 1 0 8 OF 0 9

TEXT (If more space is required, use additional NRC Form 306A's) (17)

Causal Factors:

- A. Equipment Malfunction - Valves lifted due to abnormal vibration or displacement when scaffolding personnel were removing scaffolding.
- B. Equipment Design - The design of the reliefs allowed a 40% to 50% blowdown, while the specification for the relief limited the blowdown to 10%. The valves blew down below the Technical Specification minimum pressure for the SITs.

Corrective Actions:

- A. A precaution will be added to NOCP-207 "Erecting Scaffolding", before Refuel 5, cautioning scaffolders to exercise caution when erecting or removing scaffolding in the vicinity of the Safety Injection Tanks.
- B. The presently installed Crosby relief valves will be replaced during Refuel 5 with a relief valve that more closely meets the criteria of Ebasco Specification 1564.124. Non-conformance Condition Identifications (NCIs) 277839, 278548, 278549, and 278550 were written to replace the four non-conforming SIT relief valves.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 600 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-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)

DOCKET NUMBER (2)

LER NUMBER (6)

PAGE (3)

Waterford Steam
Electric Station Unit 3YEAR SEQUENTIAL REVISION
NUMBER NUMBER

0 5 0 0 0 3 8 2 9 1 - 0 0 9 - 0 1 0 9 OF 0 9

TEXT (If more space is required, use additional NRC Form 386A's) (17)

Safety Significance:

Due to the prompt actions of operations personnel to place the plant in a stable condition in which the SITs were operable, there was no danger to the health and safety of the general public or site personnel.

Previous Events:

Waterford 3: None

Industry: None for the Grosby Model JMBUB