



Entergy
Operations

Entergy Operations, Inc.

One West St.

Boston, MA 02108

Tel: 617-552-8000

Ref: 10CFR50.73(a)(2)(vii)

W3B5-91-0160

A4.05

QA

June 4, 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-91-005-00 for Waterford Steam Electric Station Unit 3. This Licensee Event Report is submitted pursuant to 10CFR50.73(a)(2)(vii).

Very truly yours,

D.F. Packer
General Manager - Plant Operations

DFP/LDC/rk
Attachment

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

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PDR ADDCK 05000382
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LICENSEE EVENT REPORT (LER)

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 (FACID), 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

PAGE (3)

1 OF 1

TITLE (4)

Shutdown Cooling Malfunction due to Ineffective Work Controls

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 (S)
0	5	0	1	9	1	0	0	5	N/A	0 5 0 0 0 0
0	5	0	1	9	1	0	0	5	N/A	0 5 0 0 0 0

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR 2. (Check one or more of the following) (11)

OPERATING MODE (9)	20.402(b)	20.405(c)	60.73(a)(2)(i)	73.71(b)
5	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
POWER LEVEL (10)	20.405(a)(1)(i)	60.36(c)(1)	60.73(a)(2)(iv)	73.71(c)
0 1 0 0	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	20.405(a)(1)(ii)	60.36(c)(2)	60.73(a)(2)(v)	OTHER (Specify in Abstract below and in Text, NRC Form 306A)
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	20.405(a)(1)(iii)	60.73(a)(2)(i)	60.73(a)(2)(vi)(A)	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	20.405(a)(1)(iv)	60.73(a)(2)(ii)	60.73(a)(2)(vi)(B)	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
	20.405(a)(1)(v)	60.73(a)(2)(iii)	60.73(a)(2)(ix)	
	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

LICENSEE CONTACT FOR THIS LER (12)

NAME

J.G. Hoffpauir, Maintenance Superintendent

TELEPHONE NUMBER

AREA CODE

5 10 14 4 1 6 4 1 - 1 3 1 1 3 8

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

CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC	CAUSE	SYSTEM	COMPONENT	MANUFACTURER	REPORTABLE TO NRC

SUPPLEMENTAL REPORT EXPECTED (14)

EXPECTED SUBMISSION DATE (15)

MONTH DAY YEAR

☐ YES (If yes, complete EXPECTED SUBMISSION DATE)☒ NO

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

At 1656 hours on May 5, 1991, Waterford Steam Electric Station Unit 3 was in Mode 5, when a Shutdown Cooling System (SDC) malfunction occurred on the operating 'B' train. Operating Procedure OP-901-046, Shutdown Cooling Malfunction, was entered. Low Pressure Safety Injection (LPSI) pump 'B', which provides flow for the SDC 'B' train, was discovered to be air bound. SDC flow was restored on the SDC 'A' train at 1715 hours. This event is reportable as a single cause or condition which caused an independent train to become inoperable for a system designed to remove residual heat.

The loss of SDC occurred when the bonnet from SI 512A (high pressure safety injection to reactor coolant loop 1 hot leg check valve) was removed as part of planned maintenance. The root cause of this event is that a collective decision was made to repair SI 512A without technical basis. The potential to disrupt the loop seal between the reactor and the LPSI pump 'B' was not realized in the decision to repair SI 512A.

Operator action quickly identified the SDC malfunction and restored SDC capability within 19 minutes of the event initiation, limiting the change in core exit thermocouple temperature to 10 degrees Fahrenheit (F) with a maximum temperature of 110 degrees F. Therefore, this event did not result in any increased risk to the health and safety of the public or plant personnel.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 60.0 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATE TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P-630), 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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TEXT (If more space is required, use additional NRC Form 365A's) (17)

At 1656 hours on May 5, 1991, Waterford Steam Electric Station Unit 3 was in Mode 5, when a Shutdown Cooling System (SDC) (EIIIS Identifier BP) malfunction occurred on the operating 'B' train. Operating Procedure OP-901-046, Shutdown Cooling Malfunction, was entered. Low Pressure Safety Injection (LPSI) pump 'B' (EIIIS Identifier BP-P), which provides flow for the SDC 'B' train, was discovered to be air bound. SDC flow was restored on the SDC 'A' train at 1715 hours. This event is reportable as a single cause or condition which caused an independent train to become inoperable for a system designed to remove residual heat.

The loss of SDC was initiated when the bonnet from Safety Injection (SI) valve 512A (EIIIS Identifier BP-V) was removed as part of planned maintenance to replace the gaskets. The root cause of this event is that a collective decision was made to repair SI 512A without technical basis. SI 512A is the hot leg injection check valve from the High Pressure Safety Injection (HPSI) (EIIIS Identifier BQ) header to reactor coolant loop 1. The potential to disrupt the loop seal (EIIIS Identifier SEAL) between the reactor (EIIIS Identifier AB) and the LPSI pump 'B' was not realized in the decision process to work SI 512A at a Reactor Coolant System (RCS) level of 19 feet mean sea level (MSL) and without a freeze seal. The sequence of the events leading up to the shutdown cooling malfunction and subsequent operator actions are described as follows.

On October 6, 1990, Condition Identification (CI) number 271453 was generated reporting boron buildup around the hinge pin cover and bonnet on Safety Injection (SI) valve 512A. Planning and Scheduling Department scheduled the repair of SI 512A in conjunction with the seat repair of SI 301 since both valves could be repaired with the same freeze seal. SI 301 is the reactor coolant loop 1 hot leg injection drain valve (Figure 1).

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 (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 9 1 —	LER NUMBER (6)			PAGE (3)		
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TEXT (If more space is required, use additional NRC Form 356A's) (17)

On April 18, 1991, a Carbon Dioxide (CO2) freeze seal was placed on the horizontal piping between the high point vent and SI 512A (Figure 1). The RCS level was approximately 44 feet MSL, with plant operation in Mode 6, when repairs were initiated. SDC was in service on the 'A' train. A 3 inch frost band was achieved and repairs to SI 301 were completed.

Repairs to SI 512A were initiated. The hinge pin cover was removed and the hinge pin gasket and bushing were replaced. While attempting to remove the bonnet retaining ring on SI 512A, excessive drainage was noted and the CO2 freeze seal began to melt. The repairs were halted and the cap screws to the bonnet were re-torqued.

On April 25, 1991, a nitrogen freeze seal was placed on the same segment of piping where the CO2 freeze seal had previously been applied, in order to complete the repairs to SI 512A. The RCS level was approximately 44 feet MSL with plant operation in Mode 6. Approximately 6 inches c. frost band was achieved. While attempting to remove the bonnet retaining ring, a steady stream of cold water issued from around the bonnet retaining ring and the nitrogen freeze seal began to slowly melt. The cap screws to the bonnet retaining ring were re-torqued and the job once again was halted. Upon failure of the nitrogen freeze seal on April 25, 1991, a plan to apply a vertical seal was discussed but never implemented.

On May 5, 1991, discussion between Maintenance, Operations, and Planning and Scheduling Departments resulted in a decision to work SI 512A without a freeze seal at an RCS level of 19 feet MSL. The plant conditions prior to initiating the repairs to SI 512A were as follows. Plant operation in Mode 5 with reduced inventory RCS level (i.e. RCS level less than 18 feet). SDC train 'B' was in service and LPSI pump 'A' was lined up to fill the RCS.

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

The internals of SI 108B, LPSI pump 'B' suction from the refueling water storage pool (RWSP) check valve, had been removed for repairs and a blank flange installed and as a result, filling of the RCS required the use of LPSI pump 'A'. The highest core exit thermocouple (CET) temperature reading noted was 100 degrees Fahrenheit (F).

At 1635 hours on May 5, 1991, LPSI pump 'A' was secured after filling the RCS to 19 feet MSL. Maintenance personnel were pre-briefed on repairing SI 512A. The pre-brief included discussion on restoring the valve to an operable status if excessive leakage occurred or air was drawn in while attempting to remove the bonnet.

At approximately 1655 hours on May 5, 1991, maintenance personnel loosened the 4 cap screws on the bonnet retaining ring. When maintenance personnel tilted the bonnet to check for leakage, the bonnet was drawn into the body of the valve due to a differential pressure across the bonnet. Maintenance personnel noted the substantial vacuum on the valve and appropriately expedited the proper completion of the job.

Operations personnel in the Control Room noted that the RCS level rapidly increased to 21.3 feet MSL and that Control Panel (CP)-8 indicated that SDC flow on the 'B' train had decreased from 2200 gpm to 500 gpm. The LPSI pump indicated amperage had decreased from 45 to 20 amperes. The flow and amperage readings were steady.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 800 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.

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

At 1656 hours off-normal procedure OP-901-046, Shutdown Cooling Malfunction, was entered. The vacuum priming pumps for the LPSI system were placed into service and LPSI pump 'B' was vented. The auxiliary operators noted that the vacuum priming pumps and LPSI pump 'B' were drawing a significant amount of air. The Control Room staff were aware of the maintenance on SI 512A and quickly diagnosed SI 512A as the most probable source of the air introduction. LPSI pump 'B' was secured and SDC train 'A' was placed into service at 1715 hours. The highest CET temperature observed was 110 degrees F. At 1727 hours, the maintenance hatch was in place with 4 bolts tightened. At 1728 hours, CET temperatures had returned to 99 degrees F. Procedure OP-901-046 was exited with plant conditions stable at 1737 hours. At 2023 hours SDC train 'B' was restored to operable status.

The shutdown cooling malfunction was initiated with the removal of the bonnet from SI 512A. SI 512A is located at an elevation level of 23 feet 10 inches MSL. Removal of the bonnet provided an opening, at atmospheric pressure, on a 3 inch piping path located at an elevation of 23 feet 10 inches MSL. The 3 inch piping connects to the top of a loop seal, located at an elevation of 23 feet MSL (Figure 1). Since the RCS vessel level was only 19 feet MSL, the loop seal was drained and subsequently, the LPSI pump 'B' became air bound and lost net positive suction head (NPSH), resulting in a loss of SDC flow.

The root cause of this event is that a collective decision was made without technical basis to repair SI 512A at an RCS level of 19 feet MSL without the use of a freeze seal, as originally required in the work package. Absent the review of the isometric drawings and specific system configurations, the potential to disrupt the loop seal between the reactor vessel and the suction of the LPSI pump 'B' was not realized.

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.

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

Several administrative barriers or management decisions could have prevented this event from occurring. A proper review of the system design and arrangement could have identified the potential for creating a SDC system flow disturbance.

The cause of the failure to establish proper freeze seal was air entrapment in the piping while forming the freeze seal. The horizontal piping where the freeze seal was applied was approximately 1 inch higher than the vent path, allowing air to be entrapped in the piping. The horizontal section of piping was vented and air remained entrapped because the vented flow path was from the RCS side of the piping and the entrapped air between the vent and SI 512A could not have been vented due to the physical arrangement of the piping.

Contributing to this event is that previously established controls to prevent a loss of SDC were properly implemented but not fully employed during conditions where RCS level is above 18 feet MSL.

A basic criteria for applying increased emphasis to a particular job is the initial RCS level planned for the job. Awareness and sensitivity for potential SDC system malfunctions was assumed to be highest during periods of operation with reduced RCS inventory conditions. The barriers established toward assuring the reliability of the SDC system include but are not limited to the following.

1. Operation and Maintenance Directive 26, Revision 1, Safe Work Program, requires the inclusion of reliability risk flags for work that could affect components in the SDC flow path or that created the potential for a loss of RCS inventory while in a reduced RCS inventory condition.

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.

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

2. Work packages that could affect SDC operation are denoted with a "SDC" stamp to increase the sensitivity of personnel to the critical nature of the work.
3. The Outage Risk Assessment (ORA) Task Force was assembled prior to Refuel IV for the purpose of identifying and assessing potential reliability risk in an outage environment. The Task Force had identified the SI 512A work package as work that could impact SDC, but the work was planned with RCS level at 44 feet MSL and a freeze seal on the affected piping. Therefore, the work on SI 512A was not considered to be a reliability risk for a potential loss of SDC.
4. Maintenance Procedure MD-001-026, Maintenance Department Work Center Planning, requires significant planner actions to enhance work packages that may affect SDC or RCS inventory at an RCS level of less than 18 feet.
5. Operations Procedure OP-001-003, Reactor Coolant System Drain Down, requires the use of an RCS perturbation log to identify and evaluate any potential RCS perturbations.
6. Administrative Procedure UNT-005-015, Work Authorization Preparation and Implementation, requires that work scope changes be approved by the Shift Supervisor and Maintenance Superintendent. The work package change which deleted the freeze seal requirement did not receive such a review.

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 9 1	LER NUMBER (6) <table border="1"><thead><tr><th data-bbox="1044 263 1120 293">YEAR</th><th data-bbox="1126 263 1285 293">SEQUENTIAL NUMBER</th><th data-bbox="1291 263 1390 293">REVISION NUMBER</th></tr></thead><tbody><tr><td data-bbox="1044 327 1120 348">—</td><td data-bbox="1126 327 1285 348">0 0 5</td><td data-bbox="1291 327 1390 348">— 0 0</td></tr></tbody></table>	YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	—	0 0 5	— 0 0	PAGE (3) 0 8 OF 1 0
YEAR	SEQUENTIAL NUMBER	REVISION NUMBER							
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TEXT (If more space is required, use additional NRC Form 366A's) (17)

To prevent recurrence of this event the following action will be implemented. This event will be discussed on a recurring basis with Operations, Maintenance, and Planning and Scheduling Department personnel prior to each refuel. The ORA task force will evaluate current controls to prevent SDC and RCS inventory problems. In addition, work controls involving a change in work scope will be evaluated and revised as necessary. This evaluation will include expanding the administrative controls for the reduced inventory requirements at RCS levels above 18 feet MSL and any maintenance that may affect critical systems (i.e. SDC) or cause a loss of RCS inventory. These actions will be completed prior to the next refueling outage.

A team building seminar will be implemented by the next refueling outage to discuss this event using a case study approach with Operations, Planning and Scheduling, Maintenance, Plant Engineering and Plant Management.

Calculations based on the initial RCS level of 19 feet MSL resulted in an estimated time for heatup to bulk boiling conditions of 80.6 minutes. The time to core uncover was estimated at 15 hours. The recorded changes in CET temperatures as a result of this event were 10 degrees F with a maximum CET temperature of 110 degrees F. Operator action identified the SDC malfunction and restored SDC capability within 19 minutes of the loss of SDC; therefore, this event did not result in any increased risk to the health and safety of the public or plant personnel.

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 (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.

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

SIMILAR EVENTS

LER 86-015 reported a loss of SDC on July 14, 1986, due to simultaneously using more than one method of draining the RCS and inaccurate level indication. The cause of this event was corrected by procedural changes and plant modification.

LER 85-003 reported a loss of SDC on January 17, 1985, due to inadvertently shorted leads while performing maintenance on the Engineered Safety Feature Actuation Signal Relay Cabinet B (EISS Identifier JE-RLY-CAB). This resulted in a loss of the operating LPSI pump. The cause of this event was corrected by administrative controls.

PLANT CONTACT

J.G. Hoffpauir, Maintenance Superintendent, 504/464-3138

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

APPROVED OMB NO. 3150-0104
EXPIRES 6/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WITH THIS INFORMATION COLLECTION REQUEST: 600 HRS. FORWARD COMMENTS REGARDING BURDEN ESTIMATES TO THE RECORDS AND REPORTS MANAGEMENT BRANCH (P&30), U.S. NUCLEAR REGULATORY COMMISSION, WASHINGTON, DC 20540, 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)

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TEXT (if more space is required, use additional NRC Form 286A's) (17)

SI VALVE ELEVATIONS

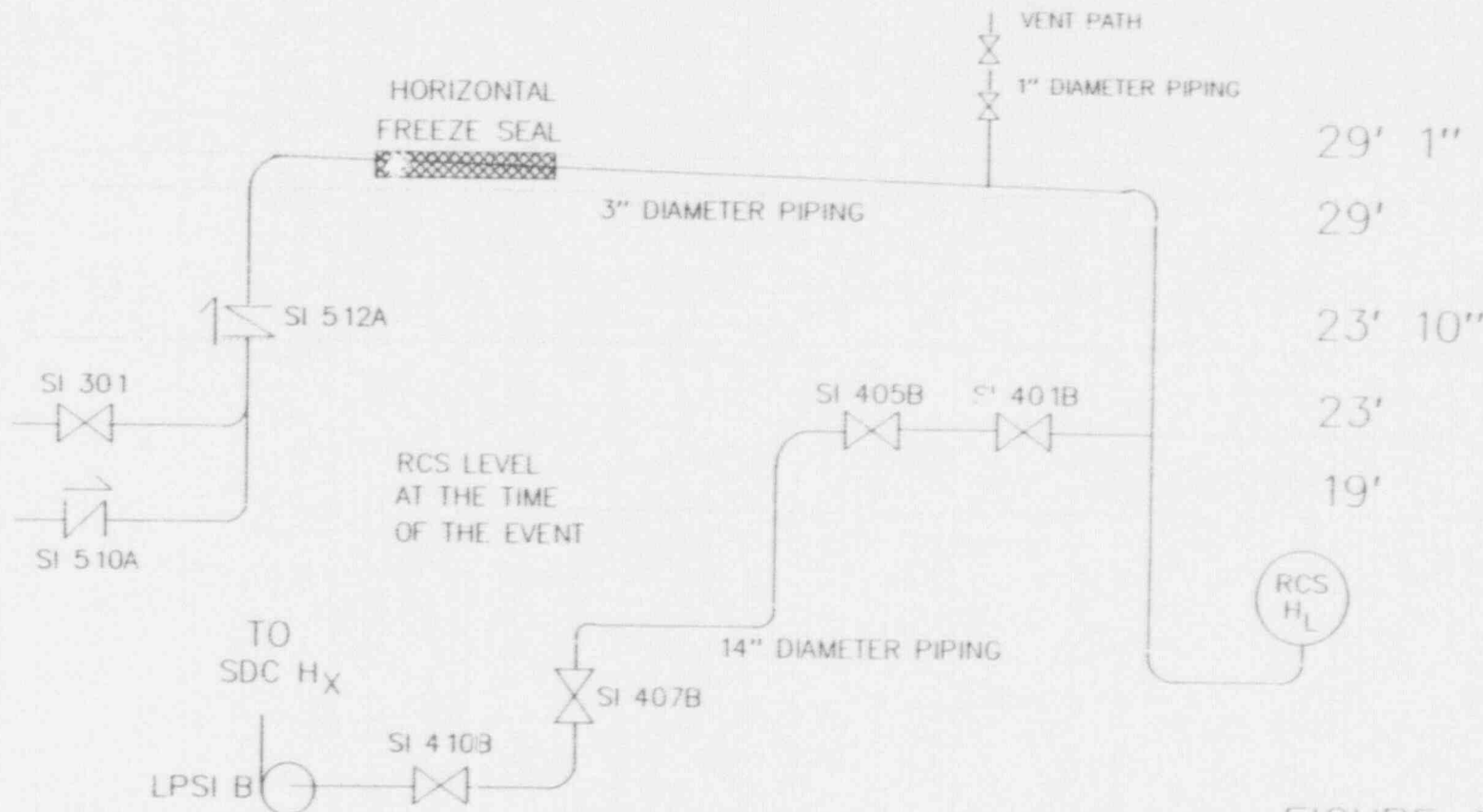


FIGURE 1