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RECIP.NAME RECIPIENT AFFILIATION

SUBJECT: LER 91-003-00:on 910416,both trains of HPI sys, (ECCS) declared inoperable due to excessive LDST pressure.Cause unknown.Excessive hydrogen vented into GWD sys to reduce LDST pressure.W/910516 ltr.

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DUKE POWER

May 16, 1991

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
LER 270/91-03

Gentlemen:

Pursuant to 10 CFR 50.73 Sections (a)(1) and (d), attached is Licensee Event Report (LER) 270/91-03 concerning excessive Letdown Storage Tank pressure.

This report is being submitted in accordance with 10 CFR 50.73 (a)(2)(i)(A). This event is considered to be of no significance with respect to the health and safety of the public.

Very truly yours,

Joe M Davis for

H. B. Barron
Station Manager

RSM/ftr

Attachment

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED OMB NO. 3150-0104
EXPIRES: 4/30/92

ESTIMATED BURDEN PER RESPONSE TO COMPLY WTH 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.

LICENSEE EVENT REPORT (LER)

FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 2	0 5 0 0 0 2 7 0	1 OF 1 0

TITLE (4)
Excessive Letdown Storage Tank Pressure for Unknown Reason Makes High Pressure Injection System Inoperable

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)
0 4	1 6	9 1	9 1	— 0 0 3	— 0 0	0 5	1 6	9 1		0 5 0 0 0
										0 5 0 0 0

OPERATING MODE (9)	POWER LEVEL (10)	THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check one or more of the following) (11)			
N	1 0 0	20.402(b)	20.405(c)	50.73(a)(2)(iv)	73.71(b)
		20.405(a)(1)(i)	50.36(c)(1)	50.73(a)(2)(v)	73.71(c)
		20.405(a)(1)(ii)	50.36(c)(2)	50.73(a)(2)(vii)	X OTHER (Specify in Abstract below and in Text, NRC Form 366A)
		20.405(a)(1)(iii)	50.73(a)(2)(i)	50.73(a)(2)(viii)(A)	50.72(b)(1)(ii)(a)
		20.405(a)(1)(iv)	X 50.73(a)(2)(ii) (a)	50.73(a)(2)(viii)(B)	
		20.405(a)(1)(v)	50.73(a)(2)(iii)	50.73(a)(2)(x)	

LICENSEE CONTACT FOR THIS LER (12)

NAME	TELEPHONE NUMBER
	AREA CODE
Henry R. Lowery, Chairman Oconee Safety Review Group	8 0 3 — 8 8 5 - 3 0 3 4

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 fifteen single-space typewritten lines) (16)

On April 16, 1991, at 1607 hours, while Unit 2 was operating at 100 % Full Power, a Control Room Operator completed addition of Hydrogen (H2) gas to the Letdown Storage Tank (LDST) by closing a solenoid valve. During subsequent isolation of the H2 fill piping, a Non-Licensed Operator heard additional flow through the pipe. She finished manual isolation and observed that the LDST pressure exceeded the procedural maximum limit. At 1610 hours this was reported to the Control Room Operators, and the excess H2 was vented to the Gaseous Waste Disposal System. At 1628 hours pressure was within the allowed operating range. Both trains of the High Pressure Injection System (HPI), an Emergency Core Cooling System, were declared inoperable for the duration of the overpressurization due to the potential for H2 to enter the HPI pump suction following a LOCA event. This could damage the HPI pumps and make the system inoperable. The root cause is Unknown. Possible Equipment Malfunction. A solenoid valve is believed to have stuck open temporarily during the H2 fill, but this could not be confirmed. A contributing cause is Inappropriate Action, Lack of Attention to detail. Planned corrective actions include procedure enhancement, inspection of the valve, and counseling of the operator.

BACKGROUND

The High Pressure Injection (HPI) System [EIIS:BQ] controls the Reactor Coolant System (RCS) [EIIS:AB] inventory, provides the seal water for the Reactor Coolant Pumps [EIIS:P], and recirculates RCS letdown for water quality maintenance and reactor coolant boric acid concentration control. The HPI system uses the Letdown Storage Tank (LDST) as a surge tank and normal suction source for the HPI pumps. During operation, Hydrogen gas is maintained in the LDST to promote oxygen scavenging. Guidance for establishing and maintaining this Hydrogen pressure is given in OP/0/A/1106/17, "Hydrogen System", which includes a graph of permissible Hydrogen pressure vs LDST level (Attachment A). During normal operation, additional Hydrogen is required every day or two.

The HPI System is also a part of the Emergency Core Cooling System (ECCS) which mitigates the consequences of loss of coolant accidents (LOCA). The HPI System prevents uncovering of the core for smaller break sizes, where high RCS pressure is maintained, and delays the uncovering of the core for intermediate break sizes. The HPI System, during emergency operation, supplies borated water to the RCS from the Borated Water Storage Tank (BWST). The HPI System has three parallel HPI pumps that have the capability to take suction from the BWST and to discharge through two redundant flow paths into the RCS, utilizing four injection nozzles (two per flow path). The injection nozzles are located on each of the reactor inlet pipes downstream of the Reactor Coolant Pumps. (See Attachment B)

The suction lines from the LDST to the HPI pumps are normally isolated from the BWST supply lines by check valves [EIIS:V] and motor operated valves. In the event of an Engineered Safeguards [EIIS:JE] actuation, the motor operated valve will open, and the pressure due to elevation head in the BWST will overcome the pressure due to LDST level and Hydrogen pressure, opening the check valves and providing flow from the BWST to the HPI pumps. Procedural limits on the LDST Hydrogen pressure and volume are intended to assure that LDST pressure does not exceed available BWST head pressure, even as BWST level is drawn down during a LOCA. LDST level and pressure are monitored in the control room and Hydrogen is periodically added, every day or two, to maintain the desired pressure.

Valve 2H-1, (Unit 2 LDST Supply), is a 3/4 inch, solenoid operated valve. It requires power to open and fails closed when the coil is de-energized. The valve position indicating lights and Operator Aid Computer inputs are actuated by contacts on the switch [EIIS:XIS] rather than actual valve stem position.

Technical Specification 3.3.1 requires three HPI pumps and two HPI flow paths to be operable when RCS temperature is greater than 350 degrees with fuel in the core. This is based on considerations of potential small breaks at the Reactor Coolant Pump discharge piping for which two HPI trains (two pumps and two flow paths) are required to assure adequate core cooling.

EVENT DESCRIPTION

On April 16, 1991, while Unit 2 was operating at 100 % Full Power, Control Room Operators (CROs) on duty observed that the Unit 2 Letdown Storage Tank (LDST) pressure had decreased to approximately 35 psig. At the current LDST level, 81 inches, this represented the low pressure boundary of the normal operating range as shown on the Maximum Pressure vs Indicated Level curve in Enclosure 3.13, "Hydrogen Addition to Unit 1, 2, or 3 LDST" of OP/0/A/1106/17, "Hydrogen System" (see Attachment A). Unit 2's main generator [EIIS:GEN] and Unit 1's LDST also required filling. Therefore, the CROs began planning the routine evolution to add Hydrogen. This primarily entailed coordination between the CROs assigned to the two units and assigning Non-Licensed Operators (NLOs) to operate manual block valves at various points in the Hydrogen System.

NLO A was assigned to operate two manual valves in the Unit 2 section of the Auxiliary Building and one in the Unit 1 section. She opened H-93 (LDST LP Control Bypass), 2H-26 (Unit 2 LDST Block), and 1H-26 (Unit 1 LDST Block) while NLO B opened valves at the Hydrogen Storage Tank building to charge the supply header and to supply Unit 2's generator.

Upon receiving confirmation that the portion of the system in the auxiliary building was lined up, CRO A operated the control switch in the Control Room to open 2H-1, (Unit 2 LDST Supply), at 1559:43 hours. At approximately the same time, CRO B operated the switch for 1H-1, (Unit 1 LDST Supply). The Unit 2 Operator Aid Computer (OAC) alarm typer documented that the 2H-1 valve control switch was in the open position three times between 15:59:43 and 16:06:01, for a total duration of five minutes and six seconds. The Unit 1 OAC alarm typer shows that 1H-1 was also operated three times during this period, and was open a total of three minutes, twenty eight seconds. CRO A stated that he kept his hand on the switch while he observed LDST pressure on an adjacent indicator gauge [EIIS:XI]. He watched pressure rise to approximately 39 psig, at which point he operated the switch to close 2H-1. He states that next he observed the position indicating lights change to show the valve closed, and heard the OAC alarm typer print out. He did not walk over to the typer but assumed that the typer entry was documenting the 2H-1 position change. He then observed the pressure indicator again and noted that it was still showing 39 psig.

Since Unit 1 was also finished filling, CRO A contacted NLO A via the page and instructed her to close the block valves. At approximately 1607 hours, he began making an entry in the Reactor Operator's Log to document the Hydrogen fill.

NLO A states that she closed 1H-26 and 2H-26. Next, while closing H-93, she heard the sound of flow through the pipe. The sound stopped when H-93 was fully closed. At this point she checked 2PG-0179, a local pressure gauge located close to, but downstream of, 2H-1. 2PG-0179 indicates the pressure in the LDST. This step is not required by the operating

procedure, but NLO A states that she and several other NLOs perform this check routinely following Hydrogen addition to the LDST. She observed that this gauge indicated approximately 60 psig, which she recognized as being higher than she had ever observed it previously.

NLO A went promptly to the Control Room, and reported her observation to CRO A at approximately 1610. CRO A immediately looked at the Control Room indication, which now showed 55 psig. At the existing level of 80 inches, this pressure violated the maximum pressure limit on the curve in Enclosure 3.13. CRO A immediately notified the Control Room Senior Reactor Operator, the Unit Supervisor and the Shift Supervisor.

The immediate corrective action was to lower the LDST pressure by venting the excess Hydrogen into the Gaseous Waste Disposal (GWD) header in accordance with OP/1+2/1104/18, "Gaseous Waste Disposal System." At 1628 hours the LDST pressure was reduced to 50 psig, the highest permissible pressure for the existing LDST level. It was lowered further to 45 psig at 1633.

At 1730 the NRC Resident Inspector was notified. At 1735 station Compliance personnel were notified. It was determined that the High Pressure Injection (HPI) system, an Engineered Safeguards Emergency Core Cooling System, had been unable to perform its intended safety function for 18 minutes due to the high LDST pressure. The significance of exceeding the limit was that, in the event of a Loss Of Cooling Accident (LOCA), the Hydrogen gas could enter the HPI pump suction, cause gas binding and severe pump damage. Due to the system lineup, all three HPI pumps could have been damaged during this potential scenario, with the possible result of core damage.

Operations personnel had NLO A repressurize the header to 2H-1 to see if any continued leakage could be observed. No noticeable change in pressure was seen, indicating that 2H-1 had fully closed at some point during the event. CRO A issued Work Request (WR) 28619C at 1745 to "Please investigate and repair 2H-1. The valve leaks past seat when indicating closed."

A caution that 2H-1 may stick open or leak past the seat was added to the Unit 2 CRO's Shift Turnover sheet. This entry requires that an NLO be stationed at 2H-26 when filling the LDST with Hydrogen in order to isolate 2H-1 if it should leak or malfunction.

During the review of the incident, the Shift Technical Advisor referenced OEE 251-23, the electrical schematic drawing of the control circuit for 2H-1, and noted that the position indications for 2H-1 (computer points and lights adjacent to the switch in the control room) are all operated by contacts on the control switch rather than actual valve position.

On April 18, 1991, Instrument and Electrical (I&E) technicians performed a troubleshooting investigation per WR 28619C. At that time 2H-1 operated

properly, but the valve could not be disassembled for inspection of the seat and plunger due to the fact that the only isolation from the LDST is a single check valve. Due to the potential for leakage past the check valve, the disassembly of 2H-1 has been deferred until a unit shutdown of sufficient duration.

A check of the maintenance history data base of 1H-1, 2H-1, and 3H-1 revealed that the solenoid had been replaced on 2H-1 in 1989 because the valve was believed to be sticking open. On Jan. 25, 1991, WR 28006C was written because the closed indicating light did not illuminate when the control switch was placed in the closed position even though the computer indicated that the switch had operated. Troubleshooting confirmed that the portion of the switch mechanism which includes the contact block for the indicating lights was not changing state. The contact block was replaced. On Feb. 27, 1991, WR 28330C was written because, again, the light did not indicate closed when the switch was moved to the closed position, but the computer did indicate closed. The discrepancy did not recur during troubleshooting. The corrective action was to tighten the same contact block, which was apparently loose. Valves 1H-1 and 3H-1 had no work requests indicated in the data base.

During the investigation of this event, it was observed that Enclosure 3.13, "Hydrogen Addition to Unit 1, 2, or 3 LDST," of OP/0/A/1106/07, "Hydrogen System," does not include a "Limit and Precaution" or "Caution" to warn of the consequences of operation above the maximum pressure, or to provide specific instructions for corrective actions. However, the potential for over pressurization of the LDST to result in damage to the HPI pumps is discussed in Operator training.

It was also observed that a control room alarm exists for both high and low LDST pressure. The high pressure setpoint is 59 psig, which is higher than the highest normal operating range pressure. The alarm setpoint is calibrated at a fixed value, and, with existing hardware, cannot vary with the tank level to follow the maximum allowable pressure curve.

There have been no reports of problems during Hydrogen additions to the LDST subsequent to this event.

CONCLUSIONS

Control Room Operator (CRO) A reports that Letdown Storage Tank (LDST) pressure was 39 psig when he turned the switch to close 2H-1. Non-Licensed Operator (NLO) A reports hearing flow through H-93 at a time when no flow should have been present. Therefore, it is concluded that 2H-1 and 2H-26 were not fully seated following closure and allowed flow of Hydrogen to continue into the LDST until H-93 was closed by NLO A.

It is presumed, for lack of evidence to the contrary, that 2H-1 failed to properly close due to Equipment Malfunction. The mode of malfunction may

have been an intermittent malfunction of the control switch, similar to two previous malfunctions of the position indication light circuit, or it may have been binding of the valve stem, possibly due to interference of a foreign particle. Because this presumption cannot be proven at this time, this event is assigned a root cause of Unknown, Possible Equipment Malfunction.

It is observed that CRO A did not adequately monitor LDST pressure following closure of 2H-1. He should have monitored to assure that system parameters were responding as expected for the existing condition. Had he properly observed the instrument, he should have identified the continued increase in pressure and instituted corrective action prior to the pressure increasing above the Maximum Pressure curve. For this reason, a contributing cause of Inappropriate Action, Lack of Attention to Detail is assigned.

It is presumed that 2H-26 was not fully seated during closure by NLO A, therefore allowing the leak to continue until H-93 was shut a few moments later. This would also be Inappropriate Action, Lack of Attention to Detail. However, NLO A properly noted the unexpected sound of flow in the line while closing H-93, followed up by investigating to determine if an unexpected condition did exist, and promptly reported the results.

It is also concluded that OP/0/A/1106/17, "Hydrogen System," could be enhanced, although it was not a causal factor in this event.

It is also noted that the control room alarm for LDST high pressure is set such that, at any LDST level less than the maximum allowed tank level, the maximum allowable pressure will be exceeded before an alarm is received. This provides little assistance to the operator, especially considering that the normal operating range has an upper limit of 40 psig compared to an alarm value of 59 psig.

A review of Problem Investigation Reports covering the previous two years indicates that this event is not recurring. No NPRDS reportable equipment failures have been confirmed, pending further inspection during a future outage. There were no injuries, releases of radioactive materials, or personnel over-exposures as a result of this event.

CORRECTIVE ACTIONS

Immediate

1. The excess Hydrogen was vented into the Gaseous Waste Disposal system in order to reduce the Letdown Storage Tank pressure to a point within the allowed operating range.

Subsequent

1. A Work Request was written for investigation and repair of a presumed seat leak on valve 2H-1.

2. An entry was made on the shift turnover sheet to remind subsequent shifts of the potential that valve 2H-1 may malfunction.

3. Both 2H-1 and 2H-26 were functionally leak tested and no pressure change due to seat leakage could be observed.

Planned

1. Valve 2H-1 will be disassembled for inspection of the plunger and seat per Work Request 28619C during the next unit shutdown of sufficient duration.

2. OP/0/A/1106/17, "Hydrogen System", will be enhanced. Operators will receive appropriate training on these changes.

3. The LDST high pressure alarm setpoint will be revised.

4. Appropriate procedure(s) will be revised to document periodic verification that LDST pressure is in the acceptable range. Other operating parameters affecting operability of safety systems will also be considered.

5. CRO A will be counseled about his inappropriate action in this event. The need to anticipate leaking valves and to monitor process parameters following an evolution will be stressed.

SAFETY ANALYSIS

The Letdown Storage Tank (LDST) has a design pressure rating of 100 psig. Overpressure protection is provided by 2HP-79, LDST Relief Valve, which relieves into a Reactor Coolant Bleed Holdup Tank. Therefore, tank integrity was not a concern for this event.

The suction lines from the LDST to the High Pressure Injection (HPI) pumps are normally isolated from the Borated Water Storage Tank (BWST) supply lines by check valves and motor operated valves. In the event of an Engineered Safeguards actuation, the motor operated valves will open, and the pressure due to elevation head in the BWST will overcome the pressure due to LDST level and Hydrogen pressure, opening the check valves and providing flow from the BWST to the HPI pumps. As BWST level is drawn down, some of the inventory in the LDST will also be used, but normal letdown flow will be isolated. Therefore, the LDST water level will drop and the Hydrogen gas will expand. Procedural limits on the LDST Hydrogen

pressure and volume are intended to assure that the Hydrogen cannot expand enough to enter the HPI pump suction.

Because the procedural limits were exceeded in this event, Design Engineering performed an Operability Evaluation which determined that the HPI system had been inoperable for 18 minutes due to the high LDST pressure. If NLO A had not followed up on the sound of flow in the line, an extended period of time could have passed prior to the discovery of the excessive pressure. The significance of exceeding the limit was that, had an accident occurred prior to the discovery of the excessive pressure, the Hydrogen gas in the LDST would expand as level dropped and could enter the HPI pump suction, cause gas binding and severe pump damage. Due to the system lineup, this potential scenario could lead to damage to all three HPI pumps which would correspond to loss of system function.

However, Design Engineering calculations show that the Hydrogen gas would not expand into the pump suction header until the BWST level had been reduced to near the minimum post-LOCA level. This would take several hours, even for the largest break sizes for which HPI is required. During this time, LDST level and pressure would be dropping slowly. Although no credit is taken in the Operability Evaluation for operator action, it is probable that the operators would take some preventative action. Possible actions would be 1) to isolate the LDST by closing 2HP-23, the LDST outlet block valve, 2) to make-up to the LDST to maintain minimum level, or 3) to vent the LDST gas volume to the Gaseous Waste Disposal System.

If a loss of the HPI System were to occur, the Emergency Operating Procedure would instruct the operators to depressurize the RCS using steam generator cooling. This depressurization would allow injection from the core flood tanks (at about 600 psig) and eventually the Low Pressure Injection System. If inadequate core cooling conditions are indicated by superheated core exit thermocouple temperatures, the operators would also open the pressurizer power operated relief valve (PORV) and the reactor vessel and hot leg high point vents to further depressurize the RCS. Although this approach may result in enough ECCS injection to prevent core damage, the effectiveness of these processes for all small break LOCA scenarios has not been demonstrated, therefore core damage is assumed.

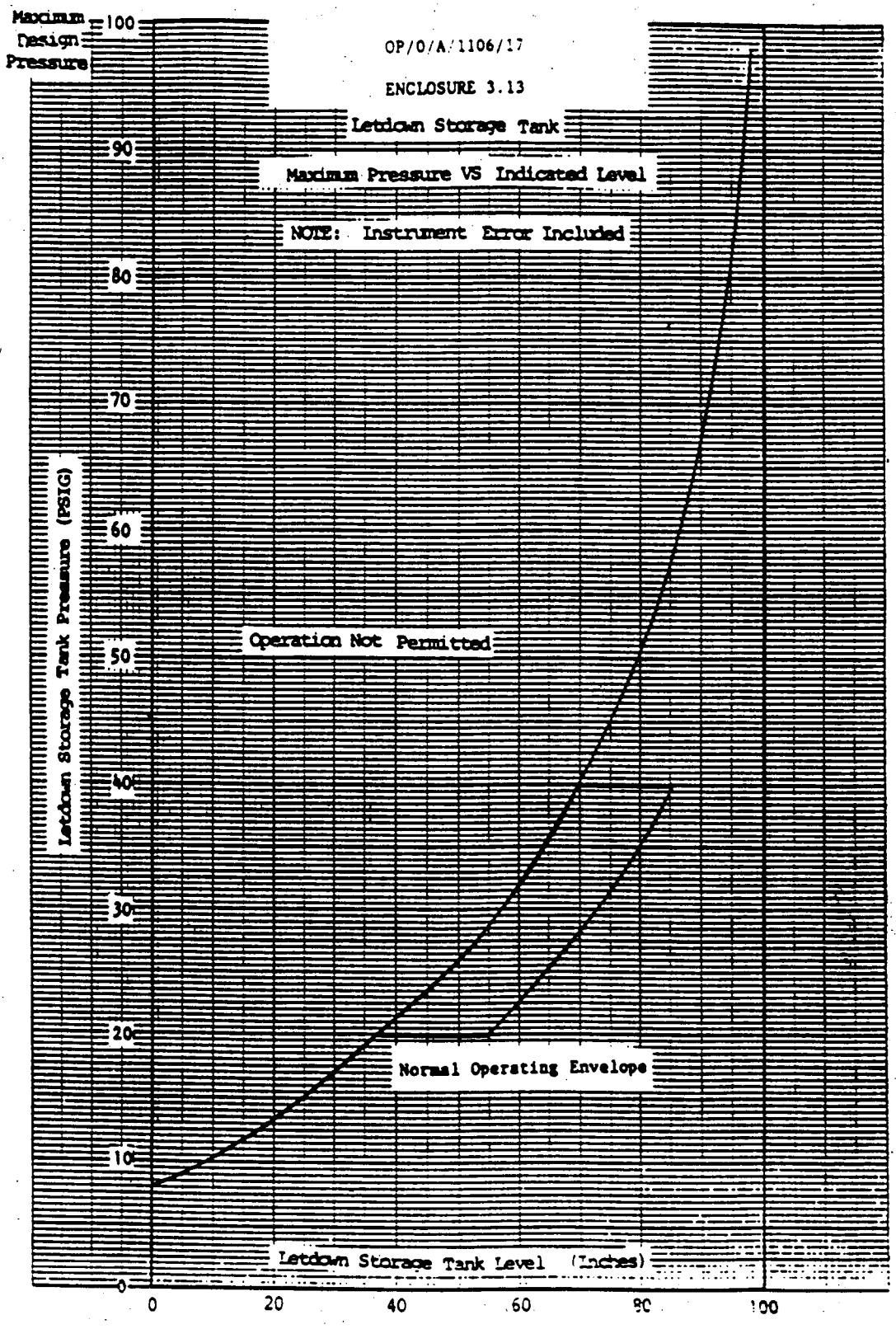
The analysis for a Maximum Hypothetical Accident (MHA) as described in the Final Safety Analysis Report assumes that some core damage occurs. That analysis shows that 10CFR100 limits would still be met.

Therefore, while it is not expected that the situation would actually result in pump damage, damage is assumed in the low probability event that a LOCA occurred simultaneously with high pressure in the LDST. The assumed loss of system function, and resulting core damage, is still bounded by FSAR analysis. Therefore, the health and safety of the public was not affected by this event.

ATTACHMENT A

OP/0/A/1106/17

ENCLOSURE 3.13



ATTACHMENT B