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SUBJECT: Special rept:on 901018,review determined potential operability problems w/ECCS during piggyback mode of operation.Caused by design deficiency.EOPs changed to restrict total HPI flow during piggyback operations.

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DUKE POWER

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February 6, 1991

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

Subject: Oconee Nuclear Station
Docket Nos. 50-269, -270, -287
Special Report Concerning Emergency Core
Cooling System Potential Operability Problems
While in Piggyback Mode

Gentlemen:

This report is provided for information regarding Emergency Core Cooling System potential operability problems while in piggyback mode.

If you have any questions, please contact Rick Matheson at (803) 885-3119.

Very truly yours,

H B Barron

H. B. Barron
Station Manager

/ftr

Attachment

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NRC FORM 366 (6-89)

U.S. NUCLEAR REGULATORY COMMISSION

LICENSEE EVENT REPORT (LER)

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

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FACILITY NAME (1)	DOCKET NUMBER (2)	PAGE (3)
Oconee Nuclear Station, Unit 1	0 5 0 0 0 2 6 9	1 OF 1 3

TITLE (4) Emergency Core Cooling System Potential Operability Problems while in Piggyback Mode due to Design Deficiency

EVENT DATE (5) MONTH	DAY	YEAR	LER NUMBER (6) YEAR	SEQUENTIAL NUMBER	REVISION NUMBER	REPORT DATE (7) MONTH	DAY	YEAR	OTHER FACILITIES INVOLVED (8) FACILITY NAMES	DOCKET NUMBER(S)
1 0	1 8	9 0	9 0	-Special-	0 0	0 2	0 6	9 1	Oconee, Unit 2	0 5 0 0 0 2 7 0
									Oconee, Unit 3	0 5 0 0 0 2 8 7

OPERATING MODE (9): N

POWER LEVEL (10): 1 0 0

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

[ ] 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)* Special Report
[ ] 20.405(a)(1)(iii)	[ ] 50.73(a)(2)(i)	[ ] 50.73(a)(2)(viii)(A)	
[ ] 20.405(a)(1)(iv)	[ ] 50.73(a)(2)(ii)	[ ] 50.73(a)(2)(viii)(B)	
[ ] 20.405(a)(1)(v)	[ ] 50.73(a)(2)(iii)	[ ] 50.73(a)(2)(x)	

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

On October 18, 1990, while reviewing a follow-up item from a Self Initiated Technical Audit, Design Engineering identified five potential problems within the Low Pressure Injection and High Pressure Injection (HPI) Systems when in the piggyback mode of operation. The problems that were identified eliminated some piggyback operating alignments previously permitted by the Emergency Operating Procedures. On December 5, 1990, Design Engineering completed an Operability Evaluation which determined that the HPI system is operable per the guidelines of calculation OSC-4177. Each potential problem had mitigating factors which would have been expected to have been detected and controlled through operator action, or had already been scheduled for correction in response to Regulatory Guide 1.97. However, due to the complexity of these problems, and to ensure that other facilities are aware of the potential for such problems, this special report is being submitted. To correct these potential problems, procedures have been revised and instrumentation will be upgraded. Because these potential problems were not identified in the original evaluations of the HPI System design bases, this event is assigned the root cause Design Deficiency, Unanticipated Interaction of Systems, design oversight.

BACKGROUND

The High Pressure Injection (HPI) [EIIS:BQ], Low Pressure Injection (LPI) [EIIS:BP] and the Core Flood [EIIS:BP] Systems make up the Emergency Core Cooling System (ECCS) which mitigates Loss of Coolant Accidents (LOCA). During a LOCA, the Borated Water Storage Tank (BWST) provides the initial water suction source for the HPI, LPI, and Reactor Building Spray [EIIS:BE] Systems. The BWST contains a minimum 350,000 gallons of borated water. As the volume of water in the BWST is depleted, the level in the Reactor Building Emergency Sump (RBES) increases, thus providing the source of makeup to the Reactor [EIIS:AC] in a recirculation mode.

The LPI and RBS Systems are capable of taking suction directly from the RBES, however the HPI pumps are not directly connected to the RBES. In a small break LOCA, the Reactor Coolant System (RCS) [EIIS:AB] pressure may remain above the discharge capability of the LPI system. As the BWST approaches depletion, the LPI pump can be aligned to provide suction to the HPI pumps. This alignment is referred to as the piggyback mode of operation. It is necessary for the LPI system to provide adequate Net Positive Suction Head for the HPI pumps during the piggyback mode of operation. The normal piggyback alignment is with one LPI pump supplying two operating HPI pumps, with the cross-over from one LPI pump to two HPI trains occurring either in the LPI pump discharge header or the HPI pump suction header. (see Attachment 1.)

Per the HPI Design Bases Document, a small break LOCA located in the Reactor Coolant Pump discharge piping has been identified, which requires a flow rate of 500 gpm (at 600 psig) within ten minutes of the initiating break. In order to achieve this, an operator shall be capable of aligning the system so that two operating HPI pumps are supplying the RCS through both HPI injection headers within the allotted time without leaving the control room. With this alignment, the system shall be capable of supplying a total of 500 gpm to the RCS through the two headers.

To prevent pump runout, each of the HPI pumps are limited to a maximum flow rate of 525 gpm by the manufacturer and 500 gpm by procedure. The LPI pumps have a manufacturer's minimum continuous flow limit of 800 gpm.

During normal operation, the HPI System provides normal RCS makeup and Reactor Coolant Pump Seal injection flow. The Letdown Storage Tank (LDST) is used to collect letdown and seal return and to serve as a makeup source to the RCS via the HPI pumps. Normally, hydrogen overpressure is maintained in the LDST to scavenge any free oxygen, thereby helping to prevent corrosion. A minimum flow of 35 gpm is required for each running HPI pump. This is assured by minimum flow recirculation lines which return the flow from the discharge of each HPI pump to the LDST. (see Attachment 2.)

Upon Engineered Safeguard [EIIS:JE] actuation, valves open to connect the BWST to the HPI pump suctions. The higher pressure in the BWST holds a check valve closed, isolating suction from the LDST. However, the relative pressures are close to the same value, so that, as the LDST starts to fill due to the minimum flow recirculation from the HPI pumps, the LDST pressure equals BWST pressure and the check valve opens. This allows flow from the LDST to the suction of the pumps which prevents the LDST from overpressurizing.

EVENT DESCRIPTION

On October 8, 1990, the Quality Assurance Department completed a Self Initiated Technical Audit (number SITA-90-01-ON) to assess the operational readiness of Oconee's High Pressure Injection (HPI) System. One audit follow-up item sited the possibility of overfilling the Letdown Storage Tank (LDST) while in piggyback mode.

Design Engineering's research into this problem revealed other potential problems within the piggyback mode of operation. The five following potential problems were formally identified in Problem Investigation Report (PIR) number 4-090-0100 on October 18, 1990.

PROBLEM OVERVIEW:

1) Insufficient HPI pump Net Positive Suction Head (NPSH)

In September 1988, PIR number 4-088-0125 was completed, which addressed NPSH requirements for the HPI pumps during the piggyback mode of operation. At that time flow limits were established to ensure adequate NPSH for the HPI pumps. However, during the review for the new PIR, it was discovered that some operating modes were permitted which would not have met these flow requirements. The limits that were established for PIR number 4-088-0125 were preserved as the following newly identified problems were resolved.

2) Overflow/overpressurization of the LDST

The throttling of HPI flow in order to increase NPSH for the HPI pumps increases the potential to overfill/overpressurize the LDST. This problem could occur because flow through the orificed minimum flow recirculation lines, which provides minimum flow protection, for the HPI pumps, is normally directed to the LDST. During piggyback, however, the increased LPI pump discharge pressure head may prevent water from leaving the LDST to enter the HPI pump suction, so that the minimum flow recirculation could cause a continuous increase in the LDST level and pressure.

3) Inadequate Emergency Core Cooling System (ECCS) flow to the Reactor Coolant System (RCS)

Throttling HPI flow in order to increase NPSH for the HPI pumps could also prevent an adequate supply of ECCS flow to the RCS. The RCS must be supplied a flow rate of 500 gpm from the ECCS during a small break LOCA, therefore the HPI total flow must not be throttled lower than this value for the purpose of maintaining adequate NPSH for the pumps.

4) Inability to provide Low Pressure Injection (LPI) pump minimum continuous flow

The reduction of HPI flow would be below the LPI pump manufacturer's minimum continuous flow requirements for

alignments in which HPI flow is the only discharge path for the LPI pump, (i.e., without the Building Spray System aligned).

5) Protection against HPI pump runout

Procedures provide flow limits to prevent runout, but the potential for pump runout prior to operator action could have existed. Further throttling of HPI flow to prevent pump runout could also cause inadequate ECCS flow.

In addition to the statement of the problems above, potential inaccuracies in the HPI flow instrumentation has an impact upon the operator's ability to limit HPI flow to prevent loss of HPI pump NPSH or HPI pump runout, while simultaneously maintaining adequate flow to fulfill ECCS requirements and minimum LPI pump flow requirements. Transcending the problem of potential instrument inaccuracy, however, are the concerns for availability of this instrumentation during an accident, as already addressed by the NRC and Duke Power Company under Regulatory Guide (RG) 1.97. Oconee's current HPI instrumentation is not environmentally qualified, and is pneumatically operated by a non-safety grade, non-seismic air system. This instrumentation is scheduled to be replaced by instrumentation which will meet all requirements for accuracy and accident availability.

Design Engineering began an Operability Evaluation to assess these problems and determine resolutions. On December 5, 1990, they issued calculation number OSC-4177 "Operability Evaluation for PIR 4-090-0100: High Pressure Injection System", which provided the resolutions for these potential problems.

PROBLEM DESCRIPTION AND RESOLUTION:

1) Insufficient HPI pump NPSH

Since no credit for reactor building heat removal is taken for the Reactor Building Spray in piggyback mode, an alignment was eliminated by removing procedural instructions which could have allowed aligning LPI to both HPI and RBS while in the piggyback mode. This widened the range for operation of the HPI pumps in piggyback by increasing the available NPSH and by expanding the range of flow through the piggyback line. This provides a greater margin of flow in which to operate--the low end being the minimum flow to be delivered to the RCS and the high end being the flow available for the HPI pumps with the Reactor Building Spray system isolated from the piggyback header. The greatest flow margin is created using two HPI pumps with the Building Spray System isolated. Even considering the HPI flow instrument inaccuracies, this provides a margin in which operators can control the flow. In the event that one of the two LPI-to-HPI flowpaths is removed by single failure, the total HPI flow is procedurally limited to less than 750 gpm. This ensures adequate NPSH for two HPI pumps in piggyback mode.

2) Overflow/overpressurization of the LDST

During piggyback operation, the LPI pumps can maintain the HPI pump suction header pressure sufficiently high that the HPI suction cannot serve its normal function as the LDST relief path. With no outflow from the LDST, continued HPI minimum flow recirculation to the LDST would eventually overfill and/or overpressurize the tank. If the LDST relief valve (HP-79) setpoint pressure of 106 psig is reached in the LDST, it could overflow to a Reactor Coolant Bleed Holdup Tank which could subsequently overflow. Overflowing the LDST represents a loss of RCS inventory that would be needed to cool the core. Another concern about the overflow of the tank is that the piping downstream of valve HP-79, and the Reactor Coolant Bleed Holdup Tank itself, are not seismically qualified and not safety related. If the Maximum Hypothetical Accident source terms are assumed, as committed in Duke Power Company's response to NUREG-0737, this overflow of the LDST could also result in additional off-site dose beyond the acceptance criteria of 10 CFR 100.

Both LDST pressure and level are indicated in the control room by non-safety grade instruments with alarms for each. During an accident scenario, these instruments could not be relied upon to ensure that the operators would be alerted to LDST overfilling conditions. Having identified this potential problem, Design Engineering developed guidance for preventing the possibility of overfilling the LDST.

The resolution to assure that the LDST does not overpressurize is to prevent flow from the HPI minimum flow recirculation lines from reaching the LDST. By opening valve HP-363 (Letdown Line to LPI Pump Suction Block) prior to entering the piggyback mode, the flow can be diverted from the LDST to the LPI pump suction header. This line of piping is ASME class 'C', safety-related and seismically qualified. Emergency Operating Procedures were changed to include this direction. In the event of a single failure, (i.e., failure of HP-363 to open), another option would be available by isolating the HPI pump minimum flow recirculation lines.

The flow path, from the HPI minimum flow recirculation lines through HP-363 to the LPI pump suction header, passes near the Post Accident Liquid Sample panel in the auxiliary building. A design study will be performed to resolve any accessibility concerns for the Post Accident Liquid Sampling System.

The introduction of hydrogen gas from the LDST into the LPI pump suction line is also a concern using this new line-up through HP-363 to the LPI pump suction. The purpose of the LDST inlet check valve, HP-78, is to prevent the escape of the contents. Therefore, hydrogen gas is not expected to escape the LDST and reach the LPI pump suction. If HP-78 allowed gas to pass from the tank, it is not expected that gas would accumulate in the LPI pump suction, due to the relative piping elevation, volume of piping, and the velocity of the water stream. The LDST outlet header

check valve, HP-97, should isolate reverse flow to ensure that the higher HPI pump suction header pressure, while in piggyback mode, will not leak past this check valve and overpressurize the LDST. Both HP-78 and HP-97 have been identified, as a result of this PIR, as active valves and will be addressed in the In-Service Testing Program with respect to their isolation function.

3) Inadequate ECCS flow to the RCS

In attempting to provide the HPI pump with adequate NPSH during piggyback operation, HPI flow could have been limited to the extent that sufficient ECCS flow may not have been provided to the RCS. Previously, procedures did not provide enough margin to envelope instrument inaccuracies, which could have prevented the delivery of the required HPI flow to the RCS. However, training and procedures direct operators to monitor core conditions during an accident, and to take appropriate actions. The operators would actually be throttling HPI flow as necessary to control the RCS pressure/temperature relationship. Should inadequate core cooling develop, safety grade instrumentation (i.e., incore thermocouples) is provided for core monitoring. The scheduled instrumentation upgrade will provide flow instruments of such accuracy that adequate ECCS flow will be assured.

4) Inability to provide LPI pump minimum continuous flow

In maintaining HPI pump NPSH by throttling HPI flow, it also became a concern that the LPI pump would be required to run at or below the manufacturer's minimum continuous flow requirement of 800 gpm during the piggyback operation. An initial operability evaluation issued by Design Engineering required two LPI pumps, for 12 hours each, for the duration of the piggyback mode, thus decreasing the time that each pump would be required to run at the lower flow rate. A problem that would have been associated with this method of operation was that three operable LPI pumps would have always been required to prevent the entire piggyback system from being vulnerable to a single failure. Design Engineering, in seeking a better solution to this LPI pump minimum continuous flow requirement, considered previous Oconee testing in which an LPI pump was operated at 400 gpm for 12 hours. Information gathered during this test was evaluated by the pump manufacturer, Ingersoll-Rand. Ingersoll-Rand stated that, in their judgement, the reduced flow rate would not cause the pump to fail within the 24 hour time period assumed for piggyback operation. Also, under a previous evaluation for NRC Bulletin 88-04, "Safety Related Pump Minimum Flow," Ingersoll-Rand developed an analytical method for determining the affect of this reduced flow rate on the best estimate pump life before servicing. This considers operation below the recommended pump minimum continuous flow. This calculation showed that the piggyback operation of LPI pumps accounts for less than 3% of the pump service life and that one LPI pump may run without failure for 24 hours and still have approximately 90% of its service life remaining. Due to this new information, the operability evaluation was revised on

December 18, 1990, removing the requirement for two LPI pumps at 12 hours each during the piggyback mode and allowing operation of one pump for 24 hours.

5) Protection against HPI pump runout

The final problem identified by this PIR was that the RCS may depressurize, during a LOCA, such that the HPI pumps would require throttling to prevent pump runout. The potential for HPI pump runout was already addressed by operating procedures, which specified an HPI pump throttling limit of 500 gpm to prevent pump runout. However, this limit was not adjusted for instrument error. This HPI pump runout problem is not particularly associated with piggyback operation--it applies to other ECCS operating modes as well. If depressurization were to occur so quickly that the operator did not have sufficient time to respond (typically assumed to be within ten minutes), the HPI pumps could exceed the manufacturer's runout flow rate limit of 525 gpm per pump. Ingersoll-Rand has provided an extended runout flow rate limit of 585 gpm per pump during the early stages of HPI pump operation in which there is adequate NPSH provided by a full BWST. Design Engineering analysis shows that the 585 gpm per pump limit would not be exceeded during this first ten minutes of operation. After ten minutes, which is the time assumed for operator response, action can be taken to throttle the HPI pumps to the original runout limit.

HPI flow instrumentation inaccuracy is also a problem in regard to simultaneously verifying HPI flow to be above that required for ECCS and below that which could cause HPI pump runout. If only one HPI pump were in service, the current instrument uncertainty bands around these lower and upper HPI flows would overlap. Under previous operating requirements, only two HPI pumps were required when operating below 60% full power. Assuming one pump failed at the beginning of an accident, the operator would have been required to maintain flow from the pump below the 500 gpm runout limit in the procedure. Given the existing instrument inaccuracy, this could have caused actual flow to be less than had been analyzed. However, three HPI pumps are currently required to be operable, as described in a recently submitted LER (number 269/90-15), so that even if a failure prevented one pump from operating, at least two pumps would be available. With two pumps operating, the combined flow from the pumps can satisfy the ECCS flow requirement, while limiting the flow from each pump to below the point of potential runout, even while considering current instrumentation inaccuracies.

HPI flow instrumentation, as well as LPI and RBS flow instrumentation, is scheduled to be replaced during the next refueling outage on each Oconee unit. This HPI flow instrumentation will meet all the requirements of RG 1.97. The replacement HPI flow instrumentation will be of much greater accuracy, such that the instrument inaccuracy problems discussed in this report will be removed. This will include, if necessary, any flow limit changes in the Emergency Operating Procedures. In the case of Unit 3, which will enter its next refueling outage in February 1991, the high-accuracy HPI flow instrumentation may not be delivered in time for

installation. If this occurs, HPI flow instrumentation meeting all other RG 1.97 requirements will be installed, and the high-accuracy instruments will be installed at the next available opportunity.

CONCLUSIONS

In September 1988, Design Engineering had analyzed the High Pressure Injection System (HPI) in piggyback operation with respect to providing adequate Net Positive Suction Head (NPSH) to the HPI pumps and resolutions had been implemented. In October 1990, when the Self Initiated Technical Audit by the Quality Assurance Department raised another issue of the possibly of overfilling the Letdown Storage Tank (LDST), Design Engineering evaluated both the NPSH problem and the LDST overflow problem concurrently. As a result of the resolution of these problems, additional problems were also identified and included in this Problem Investigation Report. These included Low Pressure Injection minimum continuous flow, inadequate Emergency Core Cooling System flow, and HPI pumps runout concerns. These problems originated in the initial design of the plant and the interaction between the HPI, LPI, and RBS Systems were not properly analyzed. New programs have been initiated and existing programs have been enhanced, resulting in an increased level of detail and accuracy of the evaluation/analyses for Oconee. It is expected that improved programs have increased the level of detail and accuracy, such that these types of problems would be identified if this mode of operation were being designed under current programs. Discovery of the problems identified in this report are indicative of the effectiveness of the current programs, which should also ensure that any other problems of a similar nature would also have been detected. However, because these potential problems existed and were not identified and resolved at the time the design bases for the piggyback mode was established, this event is assigned the root cause Design Deficiency, Unanticipated Interaction of Systems, design oversight.

This potential problem is identified as recurring based on two previous LERs dealing with the HPI system in piggyback mode.

1. LER 269/88-06 Rev.1 Inadequate Design Analysis of the High Pressure Injection System in the Emergency Core Cooling System Sump Recirculation Mode (due to design deficiency).

2. LER 269/90-15 Unit Operation in an Unanalyzed Condition Due to Design Deficiency, design oversight.

Both these reports documented instances where the design deficiencies had existed since the initial design. Since this report documents discovery of design deficiencies which occurred during original plant design, none of the corrective actions from these two events could have been expected to prevent the design oversight that caused the potential problems identified in this report.

This potential event did not involve a component failure or malfunction, therefore it is not NPRDS reportable. In addition, this event did not result in the release of radioactivity, any radiation exposure, or personnel injuries.

CORRECTIVE ACTIONS

Immediate

1. Duke Power Design Engineering performed an Operability Evaluation which determined operability per OSC-4177.

Subsequent

1. Shift Technical Advisors were issued the Operability Evaluation performed by Design Engineering that listed additional actions necessary to mitigate an accident scenario in which the piggyback mode would be used. This corrective action was performed for the interim until the Emergency Operating Procedures (EOPs) could be revised.

2. A step was added to the EOPs for each unit to open valve HP-363 (Letdown Line to LPI pump Suction Block), prior to entering the piggyback mode of operation, to prevent potential LDST overflow/overpressurization.

3. The EOPs were changed to remove the option of aligning the Reactor Building Spray System to take suction from the piggyback piping during the piggyback mode of operation.

4. The EOPs were changed to restrict the total HPI flow during piggyback operation, from less than 900 gpm to less than 750 gpm, when only one LPI-to-HPI flowpath is available.

Planned

1. In response to Regulatory Guide 1.97, HPI flow instrumentation will be replaced to improve accuracy such that adequate ECCS injection flow rate and HPI pump runout protection can be verified.

2. A design study will be performed to resolve any accessibility concerns for the Post Accident Liquid Sampling System.

3. LDST inlet check valve, HP-78, and LDST outlet header check valve, HP-97, will be addressed in the In-Service Testing Program, with respect to their isolation function.

SAFETY ANALYSIS

The Emergency Core Cooling System (ECCS), is designed to meet criteria established in 10 CFR 50.46, Acceptance for Emergency Core Cooling Systems for Light Water Reactors. One criteria in this section requires the establishment of long term cooling. This criterion states, "After any calculated successful initial operation of the ECCS, the calculated core temperature shall be maintained at an acceptably low value and decay heat shall be removed for the extended period of time required by the long-lived radioactivity remaining in the core." Although the FSAR

Chapter 15 Loss of Coolant Accident (LOCA) analyses demonstrate ECCS acceptability during the initial phase of the LOCA, it is implied that long term cooling can be established by virtue of the ECCS system design.

Following a small break LOCA, the High Pressure Injection (HPI) piggyback mode is required to sustain injection flow when the Borated Water Storage Tank (BWST) has been depleted and Reactor Coolant System (RCS) pressure remains above the shutoff head of the Low Pressure Injection (LPI) pumps. Since the HPI system is not directly connected to the emergency sump, fluid recirculation through the LPI system is necessary to maintain the HPI suction supply.

The occurrence of a small break LOCA alone does not necessarily imply reliance on the HPI piggyback mode of operation. Depending upon the combination of break size, location, and equipment availability, the operator may be able to successfully cool and depressurize the RCS to LPI system operating conditions prior to depletion of the BWST. The operator may also be able to provide makeup to the BWST and minimize flow to the RBS system to conserve inventory. However, a certain small break "window" exists for which the piggyback mode of operation is necessary.

Although instrument inaccuracies exist within the HPI system and certain alignments would have made it difficult to operate in the piggyback mode, failure of the HPI system would not have been expected. Inadequate HPI pump Net Positive Suction Head (NPSH) requirements would have resulted only if the appropriate combination of instrument inaccuracies, HPI flow, and LPI flow existed. However, assuming problems occurred and were not effectively mitigated, the HPI piggyback mode may not have operated as designed. Even though some of the HPI system instruments, which would have been used to detect and control these potential problems, are not Regulatory Guide 1.97 qualified, they would normally be expected to be available, and appropriate operator actions would be expected for any of these potential problems.

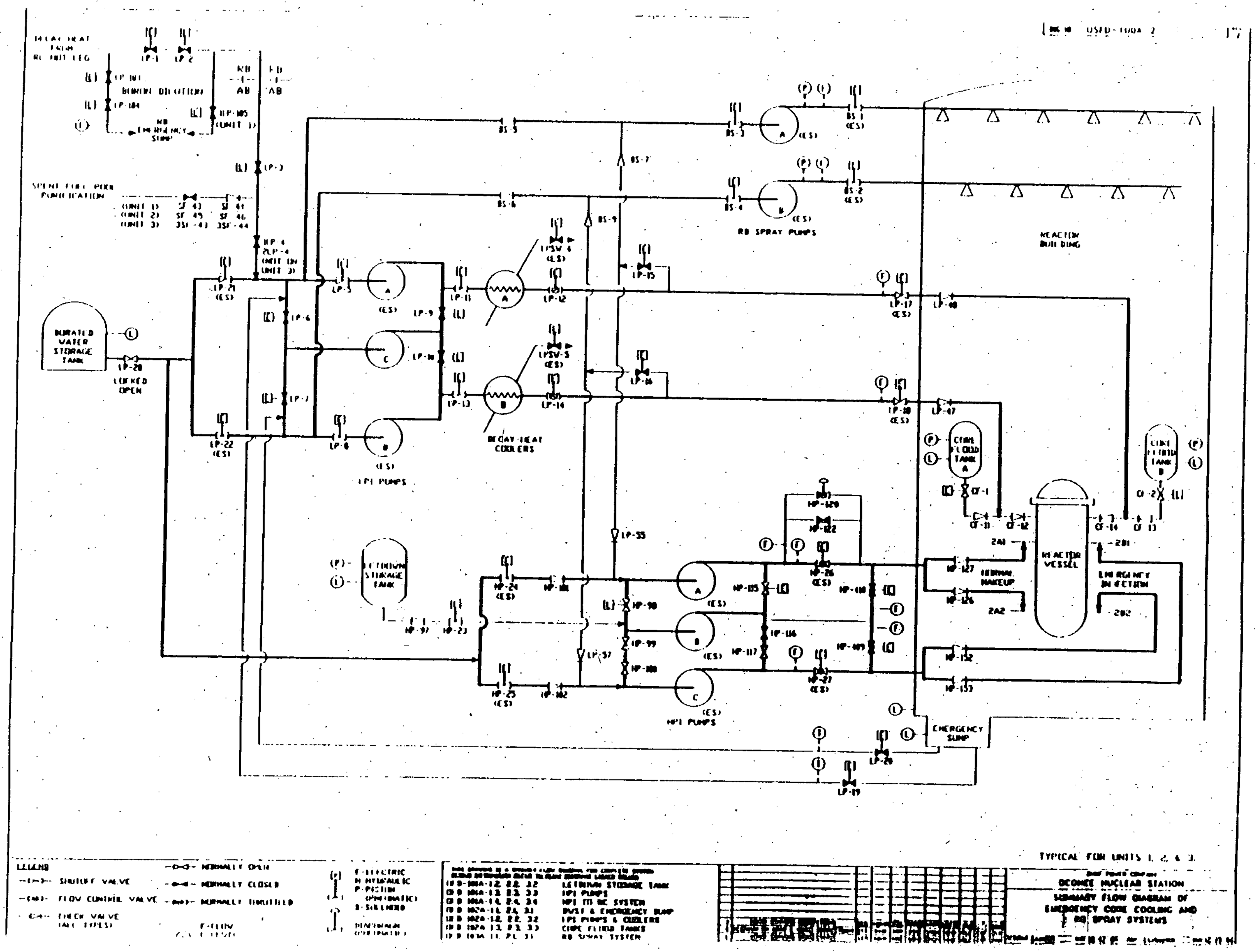
There are no redundant systems which would have performed the same function as the HPI system in the piggyback mode. However, the loop and reactor vessel high point vents and the Power Operated Relief Valve could have been opened in an attempt to depressurize the RCS to LPI operating pressures. Although this option exists in the Emergency Operating Procedure (EOP) and may have resulted in RCS depressurization, the effectiveness of venting is not assured.

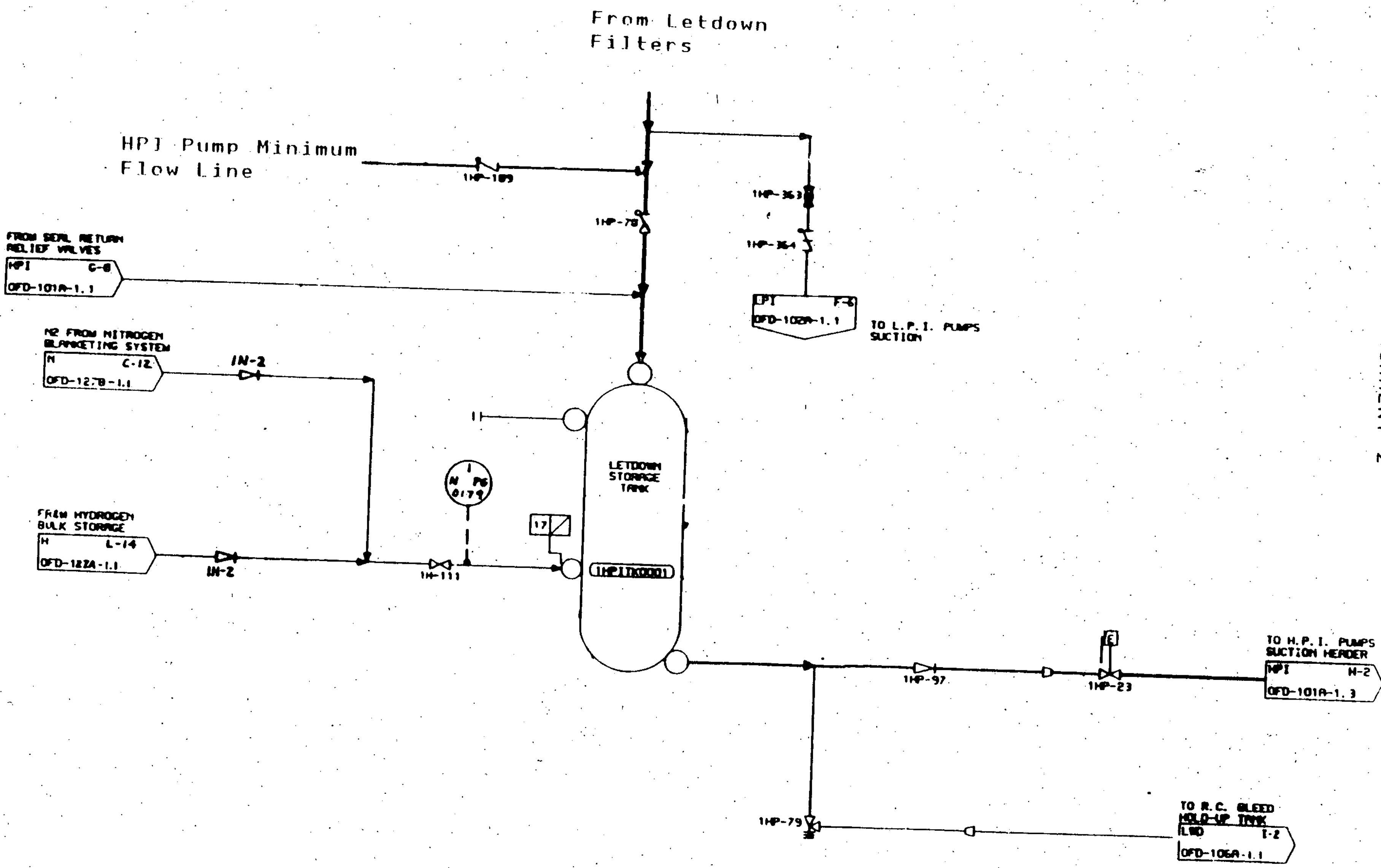
Another option for cooling and depressurizing the RCS is cooling by use of the steam generators (SG), as is also directed by the EOP. The licensing bases small break LOCA analysis takes credit for some SG heat removal. However, currently this analysis does not model the impact of operator actions to improve SG heat transfer. In reality operator actions would enhance the ability to cool the core. Once the Reactor Coolant pumps are tripped, the licensing bases small break LOCA analysis takes credit for the SG level being automatically raised to the natural circulation setpoint. However, this analysis does not take credit for operator action to further increase SG level to the loss-of-subcooled margin natural circulation setpoint. In addition, the licensing bases analysis only takes credit for relieving steam through the main steam safety valves. No credit is taken for operator action to depressurize the SG by way of the atmospheric dump valves or the turbine by-pass valves.

Considering the leak rate which could be expected from the Letdown Storage Tank overflow piping, if ruptured by a seismic event during piggyback operation, the additional radioactivity released assuming Maximum Hypothetical Accident source terms would exceed the current 2-hour exclusion area thyroid dose acceptance criteria for this accident. In a maximum realistic case (FSAR section 15.14), the type of event which would require the piggyback mode of operation is not expected to result in core damage, and only those nuclides residing in the fuel pin gap would be released to the RCS. The 2-hour exclusion area dose resulting from the additional leakage and gap release source terms would be well within 10 CFR 100 limits.

It is concluded that, although the HPI piggyback mode of operation is not required for all small break LOCAs and the HPI system would not have necessarily failed during piggyback operation, a potential for problems within the HPI system existed. There have been no incidents which called for use of the HPI system in the piggyback mode. This incident did not cause any releases of radioactive materials, radiation exposures, or personal injuries. It is concluded that the health and safety of the public were not affected by the potential problems discussed in this report.

Attachment 1




From Letdown
Filters
HPI Pump Minimum
Flow Line
1HP-189
1HP-78
1HP-363
1HP-364
FROM SEAL RETURN
RELIEF VALVES
HPI C-8
OFD-101A-1.1
LPI F-6
OFD-102A-1.1
TO L.P.I. PUMPS
SUCTION
N2 FROM NITROGEN
BLANKETING SYSTEM
N C-12
OFD-127B-1.1
IN-2
LETDOWN
STORAGE
TANK
N PG
0179
17
1HP1TK0001
FROM HYDROGEN
BULK STORAGE
H L-14
OFD-122A-1.1
IN-2
1N-111
TO H.P.I. PUMPS
SUCTION HEADER
HPI H-2
OFD-101A-1.3
1HP-97
1HP-23
1HP-79
TO R.C. BLEED
HOLD-UP TANK
LWD I-2
OFD-106A-1.1