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**DUKE POWER**

50-269, 270, 287

April 2, 1992

To: Mr. L. A. Wiens  
Office of Nuclear Reactor Regulation  
U. S. Nuclear Regulatory Commission  
Washington, DC 20553

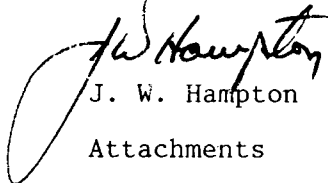
Subject: Oconee Nuclear Station Low Pressure Injection System Upgrade

As requested, we are providing an information package on the subject plant modification. Included is a copy of the Design Engineering Department Scope Document giving a description of the modification and functional description on the operation of the modified system. Also included is a copy of the 10CFR 50.59 evaluation, a history showing the evolution from origination to the present, and schematics showing system configuration before and after this modification is implemented. The attached information is excerpted from the Unit 2 package. Unit 1 and Unit 2 are basically identical.

As you will see from the attached information, although different from the original concept, the present design will provide a reliable Decay Heat Removal System with redundancy during switchover operation and enhanced operator flexibility.

If further information or discussion is needed, please contact Mark E. Patrick at (803) 885-3292.

Very truly yours,

  
J. W. Hampton

Attachments

/cmb

Add: L. A. Wiens <sup>Hr</sup>  
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# DESIGN ENGINEERING DEPARTMENT SCOPE DOCUMENT

Station Oconee Nuclear Station

Work Item No. PSM ON-22861 Rev. 0 Part —

Work Item Description Unit 2 LPI cooler Upgrade

Initial \_\_\_\_\_ Rev. No. \_\_\_\_\_

\_\_\_\_\_ Project Description  
\_\_\_\_\_ Design Scope Summary

FSAR Changes Required Yes  No   
Tech. Spec. Changes Required Yes  No

**FOR INFORMATION ONLY**

Final  Rev. No. 0

Rev. Supersedes Entire Document Rev. \_\_\_\_\_

- Project Description
- Functional Description
- Civil Description of Changes to Equipment or Components
- Civil Description of Changes to Pipe Supports
- NA Electrical Description of Changes to Equipment or Components
- Mechanical Description of Changes to Equipment or Components
- PMT Objectives/Acceptance Criteria Summary
- Design Summary Dose Assessment
- Civil - List of Calculations
- NA Electrical - List of Calculations
- Mechanical - List of Calculations
- Other \_\_\_\_\_

QA Condition 1, 2, 3 or 4 Documents Affected  
 Yes  No

Design Expiration Date: 11/15/94

If implementation is not completed by the above date, the design implementation package shall be put "on hold" until it is reviewed by Design Engineering and a new expiration date is established.

Prepared By C. G. Abellana (Lead Engineer) Date 11/15/91

NSM ON-22861  
LPI COOLER UPGRADE  
FINAL SCOPE DOCUMENT REV.0

FOR INFORMATION ONLY

PROJECT DESCRIPTION OVERVIEW:

The intent of the modification is to provide an alternate path that is operationally more feasible during cooldown. The modification will also eliminate the single failure potential that presently exists with switchover cooldown alignment. In effect, the modification will make available the "A" & "B" LPI coolers during the initial stages of decay heat removal.

PURPOSE:

The present LPI system may cause a shutdown delay if the "B" cooler or portions of the "A" & "B" trains that are used during "switchover" were to develop a failure. The most drastic failure is a tube leak on the "B" cooler, which will require other means of cooling until the RCS pressure is low enough to allow "A" train to be placed in service. The purpose of this NSM is not to eliminate "switchover", rather to use it as an alternate method of cooling by upgrading certain sections of the "A" train that will be capable of operating at higher pressures.

NSM ON-22861  
LPI COOLER UPGRADE  
FINAL SCOPE DOCUMENT REV.0

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DETAILED PROJECT DESCRIPTION:

This modification will consist of work required to upgrade "A" LPI cooler, add inlet/outlet flanges, add a monorail to assist in removal/installation of "A" and "B" cooler channel end covers, and upgrade the piping (downstream of "A" pump to the cooler). This modification also consists of valve and pipe additions at the suction of the "A" train and replacement of an existing relief valve due to an increase in LPI system design conditions.

Normal lineup of "A" LPI train of the Decay Heat Removal System (LPI) will be allowed after this modification is implemented, thus eliminating the single failure potential which currently exists because of the switchover mode of operation. The design package contains the following items.

1. Replace piping from "A" pump discharge valve 2LP-11 to the cooler inlet (sizes 6", 8", 10", 14" & 16" sch.10s) with sch.20 pipe.
2. Relocate 2LPITX-0236 thermowell (to allow feasibility of installation of testing equipment) from present location of underneath the channel head to the vertical run on the suction of the cooler.
3. Replace tube side channel on LPI cooler "A". This tube side channel head will be identical in design pressure/temp. to Unit-3 (505 psig/ 250 deg.F).
  - A. Prior to unbolting the existing the channel head, the tube sheet and shell side flange shall be reinforce with metal strips and supported underneath in order not to relax the gasket presently in placed.
  - B. The channel head will be delivered pretested (i.e. PT, RT and Hydro). The cooler will be exempt from any additional testing other than in service leak check once in operation.
  - C. The channel head will be delivered with flange end connection to facilitate installation.
  - D. Shellside split rings will be installed when the new channel head is in place.
3. Add flanges to the "A" cooler inlet and outlet piping to facilitate future maintenance activities.

NSM ON-22861  
LPI COOLER UPGRADE  
FINAL SCOPE DOCUMENT REV.0

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4. Add monorail to aid in removing/replacing channel end cover for "B" coolers ("A" cooler monorail added per OE-3438).
5. Replace relief valve 2LP-36 with a higher set pressure.
6. Install new 10" sch.20 suction piping from just upstream of 2LP-4 to upstream of 2LP-74 and 2LP-75.
  - A. Portions of an existing drain line will be relocated in order not to interfere with the valve operator.
  - B. The existing tee connections down stream of 2LP-74 and 2LP-75 will be reinforced with a saddle if the connection is other than a standard tee. If the existing connection is a fabricated tee with reinforcing, the installation will require Design Engineering review.
7. Install a 10" gate valve (2LP-139) on the new suction line.
8. Install new spring can in the vicinity of 2LP-139.

NOTE: Items 6 through 8 are the new suction portion of the "A" LPI train. This portion is dependent on the timely delivery of the new valve (2LP-139). If the new valve is not on site within the scheduling window and the LPI system is required to be placed back in operation this portion shall not be installed this outage.

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LPI COOLER UPGRADE  
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FUNCTIONAL DESCRIPTION:

SHUTDOWN OPERATION:

During the initial stages of cooldown operation (315 psig/ 246 F) the LPI system will be lined up through the "A" cooler using either "A" or "C" pump. The suction line up will be, 2LP-4 closed and 2LP-139, 2LP-74, 2LP-75 open. Depending on operators discretion "A" or "C" pump is energized. When the system pressure is low enough (at approximately 125 psig), the "B" cooler and/or "B" pump/train can be placed in service using the existing suction line. These alignments eliminate the use of the "switchover" mode as the normal mode of cooling from 320 psig to 125 psig. Aligning "A" or "C" pump to "A" cooler will also be used during heat-up (by-passing the switchover line up).

The cooler inlet (2LP-11/open), outlet (2LP-12/throttled) and outlet block (2LP-17/open) should be positioned accordingly prior to opening the RCS isolation valves (2LP-1 & 2LP-2) since the system pressure can restrict these valves from opening. These valves are set to operate for a maximum Dp of 200 psig per G.L. 89-10 calculation.

NORMAL OPERATION / ES LINE UP:

The LPI system is not used during power operations however, it is normally aligned for (ES) Engineering Safeguard operation. The new suction bypass (with 2LP-139, 2LP-74, 2LP-75 open and 2LP-4 closed), will be added to the ES line up to allow the operator added flexibility of having (2) two LPI pumps that can supply the "A" cooler and not affect the "B" cooler/train.

Having the new suction line open will not render the system inoperable since passive and active failure mechanisms will not inhibit train separation (see definition below).

ACCIDENT SCENARIO OPERATION:

DEFINITIONS:

Active Failure is a malfunction (excluding passive failure) of a component which relies on mechanical movement to complete its intended function upon demand (ANSI N271-1976).

Passive Failure is a breach in the fluid pressure boundary or a mechanical failure which adversely affects a flow path.

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APPLICABILITY:

The ES line up is how the LPI system is configured in response to an accident condition. During the short term, (LPI from BWST) ECCS coolant injection mode following a LOCA, the most limiting failure is an active failure. The new suction line and its alignment are not active and will be required to respond during this portion of the accident.

During the long term, ECCS recirc cooling mode, the most limiting active or single passive failure would occur from a valve or pump seal failure. Other passive failures, based on engineering judgement, such as pipe or valve breaks are considered to have an acceptably low likelihood of occurring during long term phase of a LOCA (NRC Information Report SECY-77-439). However, if a pipe break were to occur downstream of 2LP-139 the LPI system will not be rendered inoperable since the break is isolatable by 2LP-19 and valves 2LP-6, 2LP-7, & 2LP-4 are closed.

Appendix R Applicability:

The new cooldown alignment will replace the existing Appendix R shutdown line up (presently shown at "switchover"). The damage control procedure shall be revised and direct replacement spare parts shall be verified for compatability to accomodate the new set up. Instruments 2-LPIPG 0007, 2LPIPG-0023, 2LPITE-0209 shall be interchange for 2LPIPG-0006, 2LPIPG-0021, 2LPITE-0210 respectively.

Appendix R (OSS-0072-00-00-0006) will be revised when the system is as built.



Duke Power Company  
**10 CFR 50.59 EVALUATION**

See attached  
 calculation  
 OSC-4543,  
 Rev. 0

(1) Station: Oconee Unit(s): 2

(2) Evaluation for: NSM ON-22861/0 - Low Pressure Injection System Upgrade

(3) FSAR sections consulted: 3.1.44, 5.4.7.1, 6.3, 9.3.3, 15.0

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(4) Technical specifications consulted: 3.3, 4.5

Will technical specification changes be required?  Yes  No

\* Technical specifications affected: \_\_\_\_\_

\* NPD Regulatory Compliance personnel contacted: \_\_\_\_\_

**(5) USQ EVALUATION APPLICABILITY**

Does the modification affect structures, systems, or components that are addressed in the FSAR in a significant manner?  Yes  No

Does the modification appear significant enough to require inclusion in the FSAR?  Yes  No

**(6) USQ EVALUATION**

USQ EVALUATION NOT APPLICABLE

**May the modification:**

Increase the probability of an accident evaluated in the SAR?  Yes  No

Increase the consequences of an accident evaluated in the SAR?  Yes  No

Create the possibility for an accident of a different type than any evaluated in the SAR?  Yes  No

Increase the probability of a malfunction of equipment important to safety evaluated in the SAR?  Yes  No

Increase the consequences of a malfunction of equipment important to safety evaluated in the SAR?  Yes  No

Create the possibility for a malfunction of a different type than any evaluated in the SAR?  Yes  No

**Will the modification:**

Reduce the margin of safety as defined in the basis for any technical specification?  Yes  No

**PROVIDE AN ATTACHMENT TO SUBSTANTIATE ALL YES AND NO ANSWERS.**

Prepared by/date: K. W. Sander 11/15/91

Reviewed by/date: James R. Thud 11/15/91

NSM-ON-1,22861 (LPI COOLER MODIFICATION SCOPE CHANGES)

- 09/01/89 Design Study ONDS-0228 Results Completed  
(Switchover Mode Elimination Evaluation)  
estimated cost for replacement of tube side channels:  
Unit 1 - \$278,150  
Unit 2 - \$284,150
- 09/06/90 Design Study ONDS-0204 Results Received  
(RBVU Coil Replacement Evaluation)  
Determination made that no additional LPI Cooler  
capacity required.
- 10/16/90 Modification Requests approved (ON-1,22861)
- 12/07/90 Initial Scope Document (3 Options Presented)
- OPTION 1 - a. Replace tube side channel on A & B Coolers  
b. Add flanges to A & B Cooler LPI inlet and  
outlet piping  
c. Add shell side inspection port on both  
A & B Coolers  
d. Replace LP-19 and LP-21 (valves and operators)  
e. Add two relief valves
- OPTION 2- a. Replace tube side channel on A Cooler  
b. Add flanges to A Cooler on LPI inlet and  
outlet piping  
c. Add shell side inspection port to A Cooler  
d. Replace LP-19 and LP-21 (valves & operators)  
e. Add two relief valves
- OPTION 3 - a. Replace tube side channel on A & B Cooler  
b. Add flanges to A & B Cooler LPI inlet and  
outlet piping  
c. Add shell side inspection port to A & B Cooler  
d. Replace LP-19, 20, 21, 22 (valves and operators)  
e. Add two relief valves
- ALL OPTIONS included installation of a monorail above each cooler to  
aid in removing/installing channel and cover.
- 01/03/91 OPTION 3 from Initial Scope Document Chosen  
(estimated cost was approximately \$700,000/unit)
- 01/16/91 Revision 1 to Initial Scope Document  
Contents were same as OPTION 3 listed above with the following  
addition: replace relief valves LP-26, 27, 36, & 37; delete the shell  
side inspection ports.
- 02/13/91 Modification placed on hold by G. E. Rothenberger for  
further cost evaluation and scope definition.
- 03/18/91 Revision 2 to Initial Scope Document  
(Enhanced the description provided by Revision 1...  
no new additions to scope)
- 06/04/91 Revision 3 to Initial Scope Document  
Same as Revision 2 with the following addition:  
Redesign LP-19,20 enclosure boxes to accommodate larger  
replacement valves.

- 09/26/91 Station notified of additional piping changes that would be added to scope of modification. Addition included replacement of an estimated 150-200 ft. of 10 inch piping per unit. The piping requiring replacement was described as follows:
- a. Piping between B LPI Pump and B LPI Cooler including branch to LP-10
  - b. Piping between LP-11 and A Cooler including branch to outlet of LP-94
- 10/08/91 New Cost Estimate Results Received  
Unit 1 - \$2,116,600  
Unit 2 - \$1,698,700
- 10/10/91 Station Requested DE to start on new reduced scope for the modification
- 10/18/91 Revision 4 to Initial Scope Document  
Scope redefined as follows:
- a. Replace tube side channel on A Cooler
  - b. Add flanges to A Cooler LPI inlet and outlet piping
  - c. Add monorail over each cooler and cover plate
  - d. Replace relief valve LP-36
  - e. Replace piping from LP-11 to A Cooler inlet
  - f. Install new suction line from inlet side of LP-4 to inlet side of LP-74 and LP-75
- 10/31/91 PCA 1573 Approved for Scope Changes



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### Purpose

The purpose of this calculation is to determine if NSM ON-22861/0 will create any unreviewed safety questions (USQs) using the criteria of 10 CFR 50.59, paragraph (a)(2). This calculation is QA Condition 1 because it determines the presence or absence of a USQ.

### Modification Description

Upgrade the "A" Low Pressure Injection (LPI) cooler by replacing the tube side channel. Add flanges to the "A" cooler's inlet and outlet piping to aid in removal of the channel heads if future removal is necessary. Relocate thermowell LPITX0236 from the present location underneath the channel head to the vertical run on the suction side of the cooler. Add a monorail near the "B" cooler to aid in removing and installing the channel end cover for preventative maintenance. A monorail for the "A" cooler was added by Exempt Change OE-3438 (Reference 3).

Replace relief valve LP-36 with a relief valve that will relieve at a higher set pressure. Replace piping between valve LP-11 to the "A" cooler. Add new piping from just upstream of LP-4 to upstream of LP-74 and LP-75 (Reference 3).

This modification will upgrade portions of the "A" train of the LPI System so that it will be capable of operating at higher pressures. Normal lineup of the "A" LPI train of the Decay Heat Removal System will be allowed after this modification is implemented, thus eliminating the single failure potential which currently exist because of the switchover mode of operation. The purpose of this modification is to use the switchover mode as an alternate method of cooling, not to eliminate the switchover mode as an option for decay heat removal during the early stages of cooldown (Reference 3).

This calculation does not evaluate procedure changes associated with the new operating alignment.

### Safety Review

The LPI System removes decay heat from the core and sensible heat from the Reactor Coolant System (RCS) during the latter stages of cooldown. The system also maintains the reactor coolant temperature during refueling, and provides a means for filling and draining the fuel transfer canal. In the event of a loss of coolant accident (LOCA), the system injects borated water into the reactor vessel for long term emergency cooling (Reference 1).

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Sheet 2

By KWS Date 11/15/91

The LPI System is part of the Emergency Core Cooling System (ECCS). The ECCS is designed to tolerate a single active failure (short term) or single active or passive failure (long term) (Reference 1, Section 6.3.1).

For Oconee Units 1 and 2 when certain RCS temperature and pressure conditions are reached, decay heat removal will be initiated by aligning one decay heat cooler to the reactor coolant outlet line. This cooler discharge flows into the suction of one pump which returns the fluid to the reactor vessel. After the RCS pressure has been reduced to a certain lower pressure, the system is realigned so that two pumps take suction from the reactor outlet line and discharge through two coolers (Reference 1). This initial operating alignment is called the switchover mode and is currently needed during the initial transition into decay heat removal because the design pressure of the LPI coolers are lower than the minimum RCS pressure plus LPI pump head.

The purpose of this NSM is to qualify and upgrade the "A" LPI train for higher design conditions and decay heat removal operating conditions. The upgrade or qualification is for the system's piping, valves, coolers, and instruments between the LPI pumps and the Reactor Coolant System (References 3 and 5). The LPI piping and valves are subjected to more severe conditions during decay heat removal operation than during emergency operation and, therefore, operate well within the design conditions during accidents (Reference 1, Section 6.3.2.3.1).

The new cooler tube side channels are QA Condition 1 and will not degrade the QA Condition 1 coolers. The seismic effects on the coolers due to the new channel heads have been reviewed and determined to be acceptable by the coolers' manufacturer. The pressure boundary is not degraded by the cooler channel head change (Reference 5). Coolers are still designed to ASME Section VIII, ASME Section III Class 3 (Reference 1, Tables 6-9 and 9-9, and Reference 5). The coolers also meet FSAR Section 6.3.2.3.3 design and testing requirements (Reference 1 and 5).

All new components with surfaces in contact with water containing boric acid are made of stainless steel to protect them from corrosion and deterioration (Reference 1, Section 6.3.2.5 and Reference 5). The new piping is protected from Reactor Building missiles (Reference 1, Section 6.3.2.7.2 and Reference 5). The pressure drop and flow rate for the cooler changes and pipe changes are acceptable for the decay heat removal and engineered safeguards modes of operation. The modified cooler, pipe changes and additions, and new relief valve are acceptable for the new design conditions (Reference 5). Existing instrumentation was

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Sheet 3

By KWS

Date 11/15/91

determined to be acceptable for the new design conditions (Reference 9). No cable additions or changes were made (Reference 5). The monorail is designed QA Condition 4 to prevent seismic interaction with safety related equipment (Reference 6). The pipe stress analysis is complete. The support design has been completed (References 7 and 8). The new pipe is in the LPI pump room and thus will not add a significant additional source of post accident or normal operational radiological exposure in a new area (Reference 5).

The new pipe and valve lineup changes will not inhibit train separation if active or passive failure mechanisms occur (Reference 3). The modification does not adversely affect the flow path from the LPI discharge to high pressure injection (HPI) pump suction (Reference 2, Section 3.3 bases and Reference 5). The emergency operating mode (ES) of the LPI System, that provides flow from the Borated Water Storage Tank also is not adversely affected (Reference 5). Changes in the lineup for mitigation of a 10 CFR 50 Appendix R fire event are also specified (Reference 3).

#### USO Evaluation

As a result of this modification:

- 1) May the probability of an accident previously evaluated in the SAR be increased?

No. This change does not create any conditions or events which lead to accidents previously evaluated in the SAR.

- 2) May the consequences of an accident previously evaluated in the SAR be increased?

No. The ability of the LPI System to mitigate LOCAs and Appendix R fires is not adversely affected.

- 3) May the possibility of an accident which is different than any already evaluated in the SAR be created?

No. No accidents different than already evaluated in the SAR are postulated.

- 4) May the probability of a malfunction of equipment important to safety previously evaluated in the SAR be increased?

No. The new cooler tube side channels are QA Condition 1 and will not degrade the QA Condition 1 coolers. The seismic effects on the coolers due to the new channel heads have been

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Sheet 4

By KWS Date 11/15/91

reviewed and determined to be acceptable by the coolers' manufacturer. The pressure boundary is not degraded by the cooler channel head change. Coolers are still designed to ASME Section VIII, ASME Section III Class 3. The coolers also meet FSAR Section 6.3.2.3.3 design and testing requirements.

All new components with surfaces in contact with water containing boric acid are made of stainless steel to protect them from corrosion and deterioration. The new piping is protected from Reactor Building missiles. The pressure drop and flow rate for the cooler changes and pipe changes are acceptable for the decay heat removal and engineered safeguards modes of operation. The modified cooler, pipe changes and additions, and new relief valve are acceptable for the new design conditions. Existing instrumentation was determined to be acceptable for the new design conditions. No cable additions or changes were made. The monorail is designed QA Condition 4 to prevent seismic interaction with safety related equipment. The pipe stress analysis is complete. The support design has been completed.

The new pipe and valve lineup changes will not inhibit train separation if active or passive failure mechanisms occur. The modification does not adversely affect the flow path from the LPI discharge to high pressure injection (HPI) pump suction. The emergency operating mode (ES) of the LPI System, that provides flow from the Borated Water Storage Tank also is not adversely affected.

- 5) May the consequences of a malfunction of equipment important to safety previously evaluated in the SAR be increased?

No. The function of the LPI System has not changed. A passive failure of the LPI coolers and adjoining pipe components is already postulated for qualified components so malfunctions of the equipment affected by this modification will not create any additional radiological release.

- 6) May the possibility of malfunctions of equipment important to safety different than any already evaluated in the SAR be created?

No. No new failure modes are postulated. The new pipe is in the LPI pump room and thus will not add a significant additional source of post accident or normal operational radiological exposure in a new area.



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Sheet 5

By KWS Date 11/15/91

- 7) Will the margin of safety as defined in the bases to any Technical Specification be reduced?

No. This modification does not adversely affect any plant safety limits, set points, or design parameters.

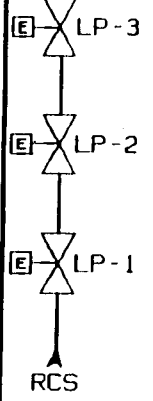
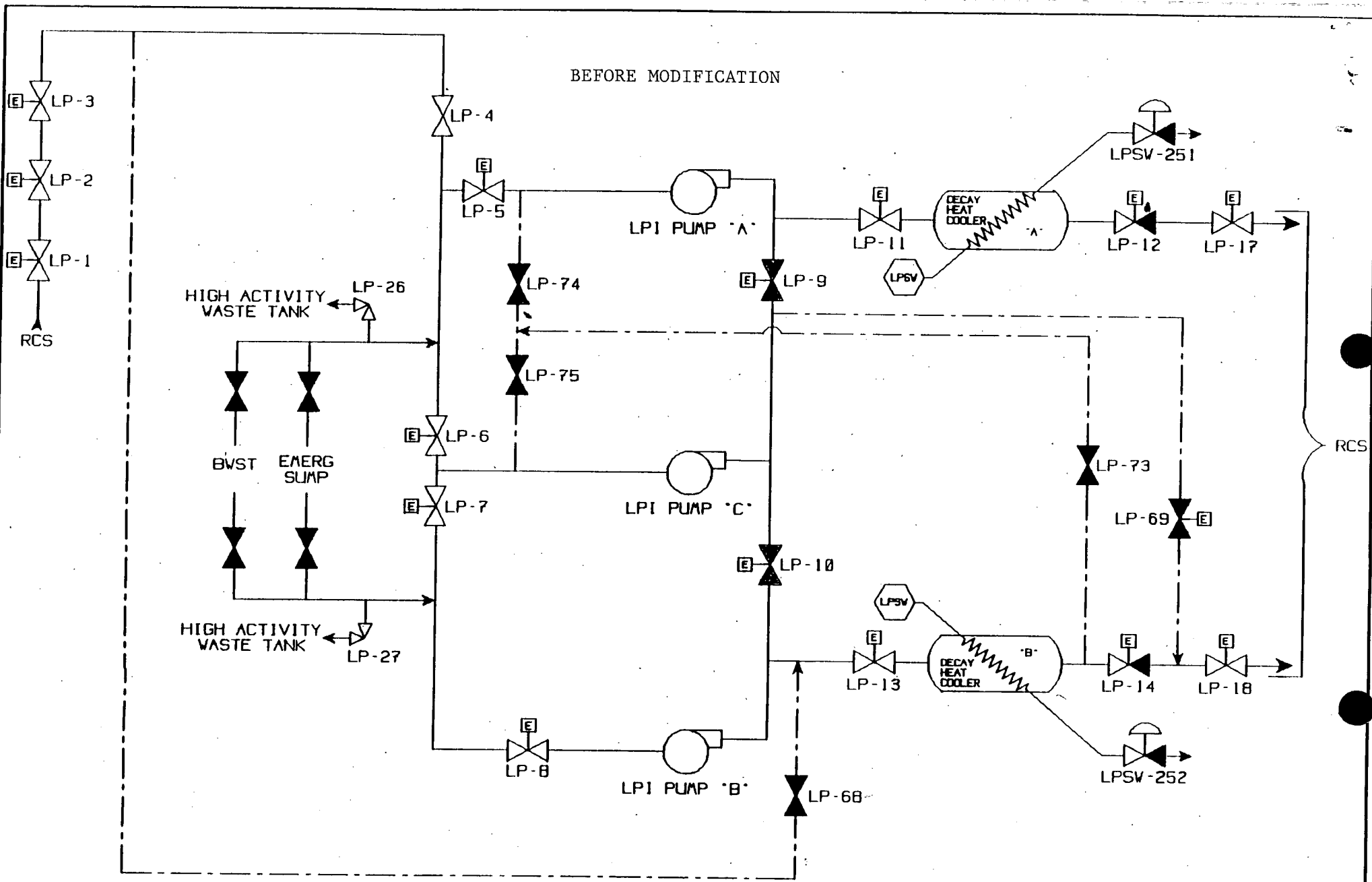
#### Conclusions

This modification involves no USQs or safety concerns. No technical specification changes are required. FSAR Table 6-4, Table 6-9, Section 9.3.3.2.1, and Table 9-9 need to be revised to reflect the new design conditions and to reflect the additional LPI operating modes. FSAR Section 6.3.2.3.8 needs to be revised to reflect the new relief valve set pressure. This calculation does not evaluate procedure changes associated with the new operating alignment.

#### References

- 1) Oconee Nuclear Station Final Safety Analysis Report (FSAR), 1990 Update, Sections 3.1.44, 5.4.7.1, 6.3, 9.3.3, 15.0.
- 2) Oconee Nuclear Station Technical Specifications, as amended to 9/16/91, Sections 3.3, 4.5.
- 3) Revision 0 to the final scope document for NSM ON-22861/0 dated 11/15/91.
- 4) Flow diagrams OFD-102A-2.1 (Revisions 7 and 7A), OFD-102A-2.2 (Revisions 10 and 10A).
- 5) Conversation on 11/15/91 between C. G. "Beau" Abellana (MOSA) and Ken Sandel (MONE), providing additional details on NSM ON-22861/0.
- 6) Conversation on 10/3/91 between Denise Simmons (COCE) and Ken Sandel (MONE), stating that QA Condition of monorail is QA Condition 4.
- 7) Conversation on 11/15/91 between Bill DeVore (COPA) and Ken Sandel (MONE), stating pipe stress analysis is complete.
- 8) Conversation on 11/15/91 between Todd Heavner (COPS) and Ken Sandel (MONE), stating support design is complete.
- 9) Memo dated 11/6/91 from Terry Harbinson (EOPE) to Bo Abellana (MOSA), stating instruments are suitable for higher design conditions (Memo is included in reference 3).

ON22861.KWS



HIGH ACTIVITY WASTE TANK  
LP-26

EWST  
EMERG  
SUMP

HIGH ACTIVITY WASTE TANK  
LP-27

LPI PUMP "A"

LPI PUMP "C"

LPI PUMP "B"

DECAY HEAT COOLER "A"

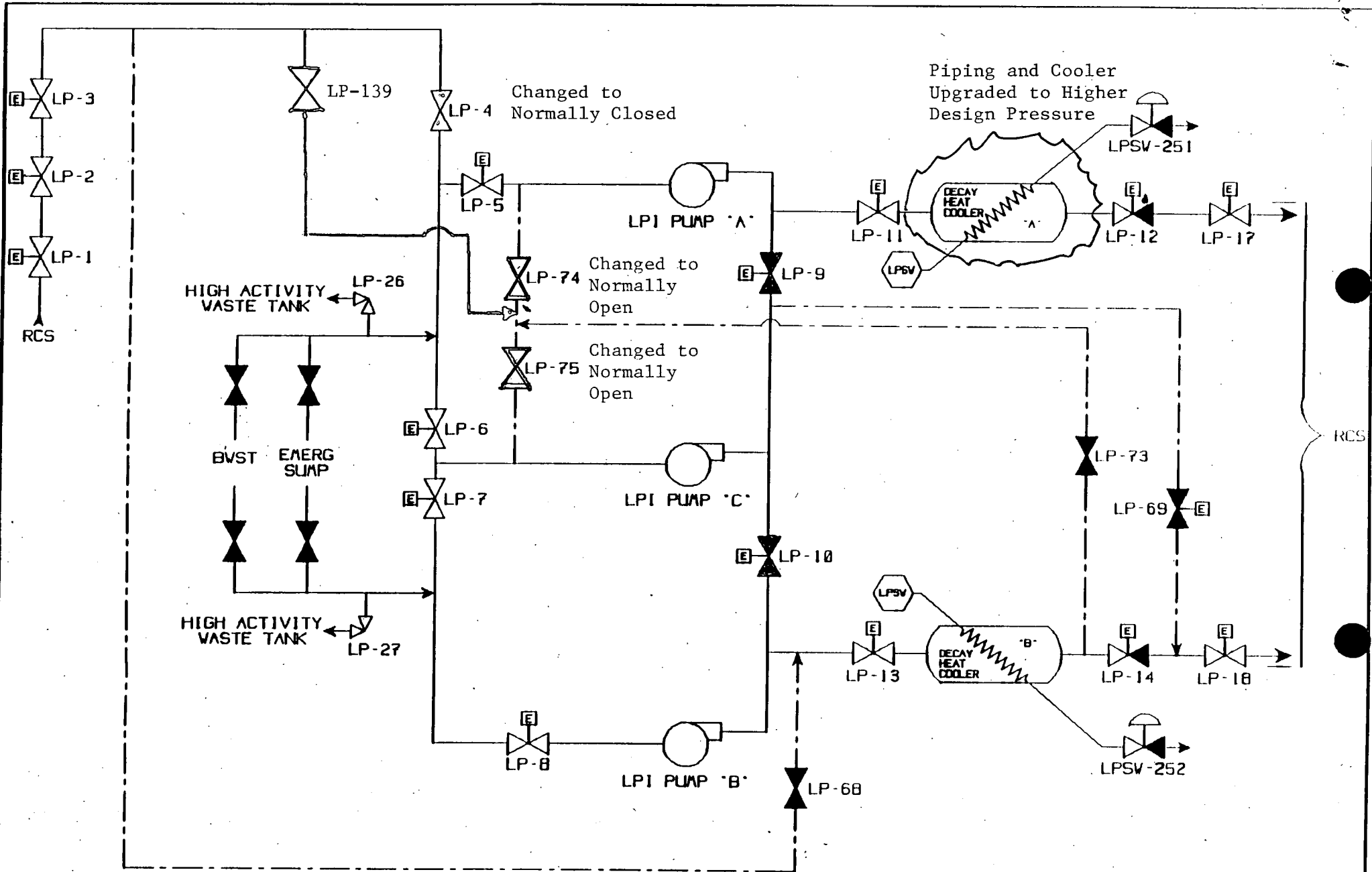
DECAY HEAT COOLER "B"

LPSV-251

LPSV-252

RCS

AFTER MODIFICATION



OCONEE  
LOW PRESSURE INJECTION SYSTEM