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RA-22-0089 10 CFR 50.90

April 14, 2022

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Duke Energy Carolinas, LLC
Oconee Nuclear Station (ONS), Units 1, 2, and 3
Docket Numbers 50-269, 50-270, and 50-287
Renewed Facility Operating License Nos. DPR-38, DPR-47, and DPR-55

Subject: Response to Request for Additional Information (RAI) Regarding Application to Revise Technical Specification 3.7.7, "Low Pressure Service Water (LPSW) System," to Extend the Completion Time for One Required Inoperable LPSW Pump on a Temporary Basis

By letter dated September 2, 2021 (Agencywide Document Access and Management System (ADAMS) Accession No. ML21245A210), Duke Energy Carolinas, LLC (Duke Energy), submitted a license amendment request (LAR) for Oconee Nuclear Station (ONS) Units 1, 2, and 3. The proposed change would revise Technical Specification (TS) 3.7.7, "Low Pressure Service Water (LPSW) System," to extend the Completion Time associated with one required inoperable LPSW pump on a temporary basis. Specifically, the proposed change would add a Note modifying the Completion Time associated with TS 3.7.7, Condition A, Required Action A.1 to 288 hours during ONS Unit 2, Refuel 31 (Fall 2023) to allow for the tie-in and testing of an alternate suction source to the shared Unit 1 and Unit 2 'A' and 'B' LPSW pumps.

The U.S. Nuclear Regulatory Commission (NRC) staff reviewed the LAR and determined that additional information is needed to complete their review. Duke Energy received the request for additional information (RAI) from the NRC through electronic mail on March 4, 2022 (ADAMS Accession No. ML22053A262).

Attachment 1 provides Duke Energy's response to the RAI questions. The information contained within this response does not change the No Significant Hazards Consideration provided in the original LAR submittal. Attachment 2 provides the existing TS pages marked to show the proposed change and supersedes Attachment 2 from the original LAR entirely. Attachment 3 provides retyped (clean) TS pages. Attachment 4 provides an existing TS Bases page marked to show the proposed change for information only.

No regulatory commitments are contained in this submittal.

If there are any questions or if additional information is needed, please contact Mr. Lee Grzeck, Manager – Nuclear Fleet Licensing (acting) at 980-373-1530 or Lee.Grzeck@duke-energy.com.

I declare under penalty of perjury that the foregoing is true and correct. Executed on April 14, 2022.

Sincerely,

Steven M. Snider
Vice President
Oconee Nuclear Station

Attachments:

1. Response to Request for Additional Information
2. Technical Specifications Markup
3. Revised (Clean) Technical Specifications
4. Technical Specifications Bases Markup (Information Only)

cc w/enclosure and attachments:

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ATTACHMENT 1

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

Background

By letter dated September 2, 2021 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML21245A210) Duke Energy Carolinas, LLC (Duke Energy), submitted a license amendment request (LAR) to revise Technical Specification (TS) 3.7.7, “Low Pressure Service Water (LPSW) System,” to extend the Completion Time for one required inoperable LPSW Pump on a temporary basis for Oconee Nuclear Station (ONS), Units 1, 2, and 3. Specifically, the proposed change would add a Note modifying the Completion Time (CT) associated with TS 3.7.7, Condition A, Required Action A.1, to 288 hours during ONS Unit 2, Refuel 31 (Fall 2023) to allow for the tie-in and testing of an alternate suction source to the shared Unit 1 and Unit 2 ‘A’ and ‘B’ LPSW pumps. In its submittal, Duke Energy stated that the alternate suction source to the shared Unit 1 and Unit 2 ‘A’ and ‘B’ LPSW pumps is needed to permit draining of the Condenser Circulating Water (CCW) System cross-connect header for the replacement of three CCW valves.

The U.S. Nuclear Regulatory Commission (NRC) staff determined that an audit was needed to review the proposed LAR. By letter dated January 6, 2022 (ADAMS Accession No. ML21362A753), the NRC staff issued the Audit Plan. On February 10, 2022, the NRC staff conducted an audit in accordance with the Audit Plan. The NRC staff subsequently determined that additional information is needed to complete its review of the LAR. Duke Energy received the request for additional information (RAI) from the NRC through electronic mail on March 4, 2022 (ADAMS Accession No. ML22053A262).

Technical Specifications Branch (STSB)

Regulatory Basis

Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50 Section 50.36(c)(2)(i) states, in part:

> “Limiting conditions for operation [LCO] are the lowest functional capability or performance levels of equipment required for safe operation of the facility. **When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met**.” [Emphasis added]

Issue

The information requested below is necessary to understand if the extension of time permitted to follow remedial action when the LCO is not met is acceptable. The licensee’s amendment request provides an evaluation justifying the licensee’s ability to perform the modification safely with only the Unit 1 and 2 “C” LPSW pump operable. Sections 3.2 and 3.3 of the licensee’s LAR show that its safety basis and risk assessment rely significantly on utilizing a capability to cross-connect the Unit 3 LPSW pumps to supply Unit 1’s loads should the “C” LPSW pump fail during the Unit 1 and 2 LPSW modification. As stated in Section 3.2 of their LAR, “This cross connect is the “ACTION/EXPECTED RESPONSE” for a loss of Unit 1 and 2 LPSW pumps in ONS procedure AP/1/A/1700/024, ‘Loss of LPSW.’” As described, the cross-connect method would be used preferentially over natural circulation in the steam generators to remove decay heat.

The Oconee Tech Spec LCO 3.7.7 requires the LPSW to be operable. More specifically, it requires Units 1 and 2 LPSW to be operable and Unit 3 LPSW to be operable. The reason Units 1 and 2 are called out together in the LPSW LCO is because they are licensed to share their LPSW systems. Unit 3 appears to have a different design basis requirement and is not licensed to share with Units 1 and 2 in the same manner. Oconee TS Bases for LCO 3.7.7, states, "The LPSW system for Unit 1 and Unit 2 is shared and consists of three LPSW pumps which can supply multiple combinations of pathways to supply required components. The LPSW system for Unit 3 consists of two LPSW pumps which can supply multiple combinations of pathways to supply required components."

The Conditions in LCO 3.7.7 define Required Actions to be taken in the event of a loss of one required LPSW pump for Units 1 and 2 (restore the required LPSW pump within 72 hours). Based on the above, the NRC staff requests the following information:

STSB RAI No. 1

LCO 3.7.7 has no Condition and associated Required Actions for loss of all LPSW pumps in Units 1 or 2. Please explain if this means during a loss of all LPSW situation in Units 1 or 2, the plant would be in LCO 3.0.3, that states:

> **When an LCO is not met and** the associated ACTIONS are not met, **an associated ACTION is not provided**, or if directed by the associated ACTIONS, **the unit shall be placed in a MODE or other specified condition in which the LCO is not applicable**. [Emphasis added]

Duke Energy Response to STSB RAI No. 1

Yes, a loss of LPSW for the shared Units 1 and 2 LPSW system would result in declaring LCO 3.0.3 for both units (assuming both units are in the Mode of Applicability for TS 3.7.7). More specifically, with both Units 1 and 2 in the TS 3.7.7 Mode of Applicability, two inoperable shared Unit 1 and Unit 2 LPSW pumps would result in declaring LCO 3.0.3 for both Units 1 and 2.

For the proposed change, Unit 2 will be defueled with the appropriate LPSW loads secured. Therefore, ONS LCO 3.7.7 will require two shared Unit 1 and Unit 2 LPSW pumps to be operable. The 'A' and 'B' LPSW Pumps for Units 1 and 2 will be inoperable during the proposed change and Condition A ("One required LPSW pump inoperable.") will be entered. Should the remaining 'C' LPSW Pump for Units 1 and 2 become inoperable (i.e., a loss of LPSW for Units 1 and 2), then Unit 1 would declare LCO 3.0.3, as stated above, because an associated TS Action is not provided for two required LPSW pumps inoperable. Since Unit 2 is defueled for the proposed change, LCO 3.0.3 would not be declared for Unit 2.

STSB RAI No. 2

LCO 3.7.7 does not provide any Condition or Required Actions that allow Unit 3 to share its LPSW pumps with Units 1 or 2. Please explain if this means when Unit 3 is cross connected to Unit 1 or 2, Unit 3 would be in LCO 3.0.3 while sharing LPSW between Unit 3 and the other two units.

Duke Energy Response to STSB RAI No. 2

No, for the configuration associated with the proposed change (i.e., Unit 2 defueled with appropriate loads secured on Unit 2), Unit 3 would not declare LCO 3.0.3 for a loss of LPSW on Unit 1 whereby the LPSW cross-connect would be utilized. The LCO for TS 3.7.7 requires two Unit 3 LPSW pumps to be operable to provide the required redundancy to ensure that the system functions to remove post-accident heat loads, assuming a single failure occurs coincident with a loss off offsite power. One flow path for Unit 3 is also required to be operable, meaning that the piping, valves, heat exchangers, and instrumentation and controls required to perform the safety related function for Unit 3 are required to be operable. The LCO for TS 3.7.7 was established to satisfy Criterion 3 of 10 CFR 50.36. For the proposed change, Unit 2 will be defueled with appropriate LPSW loads secured. On a postulated loss of LPSW for the shared Units 1 and 2 LPSW system (i.e., 'A', 'B' and 'C' LPSW pumps are all inoperable) and the cross-connect established per procedure AP/1/A/1700/024, "Loss of LPSW," for Unit 3 to provide LPSW flow to Unit 1, the following applies with respect to the application of TS 3.7.7 for Unit 3:

- One Unit 3 flow path is operable. All associated components in the flow path are operable to support the safety related function for Unit 3. All Surveillance Requirements associated with TS 3.7.7 continue to be met for Unit 3 when the cross-connect is established.
- One Unit 3 LPSW pump is inoperable. In the cross-connect configuration, one of the Unit 3 LPSW pumps would now be supporting Unit 1 loads and would not be performing the heat removal function for Unit 3. There would no longer be the required redundancy to ensure that the Unit 3 LPSW system can function to remove post-accident heat loads, assuming the worst case single active failure occurs coincident with a loss of offsite power. However, the other Unit 3 LPSW pump would be operable and adequate to perform the LPSW system specified function for Unit 3.
- Based on the preceding two bullets, ONS Unit 3 would declare the LCO for TS 3.7.7 not met because only one LPSW pump for Unit 3 is considered operable and two are required to be operable. Condition A ("One required LPSW pump inoperable.") would be entered for Unit 3 because overall reliability is reduced due to the Unit 3 LPSW system support for Unit 1. However, the redundant LPSW pump is adequate to perform the specified function for Unit 3 (i.e., there is no loss of function).

For the proposed change with Unit 2 defueled and appropriate loads secured on Unit 2 and the above scenario where the cross-connect is implemented for a loss of LPSW on Unit 1, the LCO of TS 3.7.7 is not met for Unit 3. However, an associated Action is provided (i.e., Action A). Therefore, Unit 3 would not declare LCO 3.0.3.

STSB RAI No. 3

It appears that the loss of all LPSW in Unit 1 would be a beyond-design-basis event (i.e., it is not analyzed in the Oconee FSAR). The licensee has developed Emergency Operating Procedures to provide operators with a procedure to mitigate this event. As stated in Section 3.2 of the LAR, the procedure directs the operators to cross-connect Unit 3 LPSW to provide the safety-related loads in Unit 1. Cross-connecting Units 1 and 3 does not appear to have a corresponding Condition in the LPSW LCO. Please explain if the use of the cross-connect would place one or both of the units in an unanalyzed condition.

Duke Energy Response to STSB RAI No. 3

Based on discussions during the February 10, 2022 virtual regulatory audit and a follow-up audit closure call on March 4, 2022, Duke Energy understands the term “unanalyzed condition” to mean a condition that is not described in the UFSAR analysis or derived from any UFSAR analysis. In that context, yes, cross-connecting Unit 3 LPSW to Unit 1 LPSW is unanalyzed because the cross-connect design feature is not credited to mitigate the consequences of events considered in Oconee’s design basis accident (DBA) and transient analyses, as presented in Chapters 6 and 15 of the Oconee UFSAR.

However, cross-connecting LPSW between Units 1&2 and Unit 3 is scoped into the Maintenance Rule as a specific function for the ONS LPSW System to satisfy 10 CFR 50.65 licensing basis requirements.

Compensatory Measure #1

The capability to cross-connect the Unit 3 LPSW system to support Unit 1 in the event that the remaining ‘C’ LPSW pump becomes inoperable is a compensatory measure for the proposed change to temporarily extend the Completion Time for one required LPSW pump inoperable for Unit 1. That is, Duke Energy is seeking NRC review and approval of an extended Completion Time for one required inoperable LPSW pump on a one-time temporary basis with the cross-connect available as a compensatory measure, should a loss of all LPSW on Unit 1 occur.

STSB RAI No. 4

Since the licensee would rely on the LPSW cross-connect to mitigate a loss of all LPSW on Unit 1 and 2, please describe what compensatory measures would be taken to ensure the availability of the Unit 3 LPSW trains (e.g., protect both Unit 3 LPSW trains and required equipment during the Unit 1 and 2 modification window). In addition, to minimize a loss of all LPSW condition, please describe what compensatory measures would be taken to ensure the Unit 1 and 2 pumps maintains operability.

Duke Energy Response to STSB RAI No. 4

Compensatory Measure #2

For the proposed change, the following equipment will be protected as a compensatory measure in accordance with the ONS Protected Equipment Program outlined in procedure AD-OP-ALL-0201, to ensure the operability of the Unit 1&2 C LPSW Pump and the Unit 3 LPSW Trains, including the capability to cross-connect LPSW Systems:

- Unit 1&2 C LPSW Pump
- 2TC-11 (C LPSW Pump Breaker)
- C LPSW Pump Switch
- 3A LPSW Pump
- 3B LPSW Pump
- 3TC-11 (3A LPSW Pump Breaker)
- 3TD-12 (3B LPSW Pump Breaker)
- 3A LPSW Pump Switch
- 3B LPSW Pump Switch
- LPSW-1095 (Unit 1&2 To Unit 3 LPSW X-Connect Block Valve)

Compensatory Measure #3

In addition to protecting the above equipment, ONS will develop an Elevated Risk Activity Plan as a compensatory measure in accordance with AD-WC-ALL-0410 (Work Activity Integrated Risk Management), for the implementation of the alternate suction source to the shared Unit 1 and Unit 2 'A' and 'B' LPSW pumps. This plan will require assigned management oversight, documentation of identified risks associated with implementing the alternate suction source, and mitigation strategies and responsibility for each of the identified risk items.

Attachment 2 of this submittal reflects that the proposed 288-hour Completion Time is contingent upon implementation of the above compensatory measures.

STSB RAI No. 5

Please describe what compensatory measures would be taken to ensure the availability of sufficient qualified operators to be able to simultaneously shutdown Units 1 and 3 should they both end up in LCO 3.0.3 or in the postulated scenario of a loss-of-coolant accident (LOCA)/loss of offsite power in one unit and an orderly shutdown in the other.

Duke Energy Response to STSB RAI No. 5

ONS Selected License Commitment (SLC) 16.13.1, "Minimum Station Staffing Requirements," prescribes the minimum station staffing when two units are in Modes 1-4 and are being operated from two Control Rooms. SLCs constitute Chapter 16 of the ONS UFSAR. The minimum staffing required by SLC 16.13.1 alone is sufficient to simultaneously shutdown Units 1 and 3 or to mitigate a LOCA/LOOP on one unit and commence an orderly shutdown of the second.

Compensatory Measure #4

In addition to the staffing prescribed by SLC 16.13.1, a compensatory measure for the proposed change will be to staff 1 additional Shift Manager (SM) qualified individual, who will assist the shutdown of the least affected unit, and 2 additional Auxiliary Operators (AOs), which will be briefed and have paperwork in hand to open the cross-connect valve LPSW-1095 if needed.

These additional operators will be supporting Unit 2, Refuel 31 (Fall 2023) but will not be assigned tasks that would hinder their capability to respond in a timely manner. The Elevated Risk Activity Plan initiated for the implementation of the alternate LPSW suction source (i.e., Compensatory Measure #3 described in response to STSB RAI No. 4 above) will include this compensatory measure for staffing. The staffing of 1 additional SM and 2 additional AOs will be in place for the entire duration of the planned entry into TS 3.7.7, Condition A associated with the proposed change.

Attachment 2 of this submittal reflects that the proposed 288-hour Completion Time is contingent upon implementation of the above compensatory measure.

STSB RAI No. 6

The requested approval of the extended CT is solely for the completion of the modifications to the Unit 1 and 2 LPSW system. Please confirm any compensatory measures that will be taken to ensure configuration control in parallel with or subsequent to the tie in testing of an alternate suction path that could render LPSW inoperable and inappropriately extend the completion time beyond the time necessary to complete the modification being evaluated.

Duke Energy Response to STSB RAI No. 6

Compensatory Measure #5

At the completion of the final tie-in and testing of the alternate suction source to the shared Units 1 and 2 ‘A’ and ‘B’ LPSW pumps, the TS 3.7.7 Action statement (i.e., Condition A for one required inoperable LPSW pump) will be exited immediately, as the LCO for Unit 1 would be considered met at that point in time. As discussed during the February 10, 2022 virtual audit and the follow-up audit closure call on March 4, 2022, the following will be added to the TS 3.7.7 Bases for configuration control regarding the proposed TS Note:

> “The NOTE expires at 288 hours or upon completion of the tie-in and satisfactory testing of an alternate suction source to the shared Unit 1 and Unit 2 LPSW Pumps A and B, whichever comes first.”

Attachment 4 of this submittal provides the TS 3.7.7 Bases change (i.e., Compensatory Measure #5). Attachment 2 of this submittal reflects that the proposed 288-hour Completion Time is contingent upon implementation of the above compensatory measure.

Mechanical Engineering and Inservice Testing Branch (EMIB)

During an audit, the licensee described the temporary alternate LPSW suction source to be installed to support the planned CCW valve replacement activity. The licensee stated that two butterfly valves will be installed in the temporary alternate LPSW suction source. The licensee stated that one of those butterfly valves will remain installed after the alternate LPSW suction source is removed following completion of the valve replacement activity. The licensee also discussed the functions of the LPSW-1095 valve, that could provide LPSW from Unit 3 to Unit 1 and 2 if the LPSW C pump failed, but was not able at the time, to discuss the design and performance of this valve. As part of the audit, the licensee subsequently made available plant documentation related to the valve type and size, function, and testing of LPSW-1095.

EMIB RAI No. 1

Please provide the following information regarding the two butterfly valves to be part of the temporary alternate LPSW suction source: (a) the functions of the two butterfly valves; (b) testing activities to demonstrate the capability of the two butterfly valves to perform its functions; and (c) the applicability of the two butterfly valves to the Inservice Testing (IST) Program and the basis for that applicability.

Duke Energy Response to EMIB RAI No. 1, Part (a)

ONS Engineering Change (EC) 419099 will install the alternate suction source piping which will contain two new valves, CCW-518 and 1CCW-541. These valves are VELAN 36-inch, flanged, triple offset butterfly valves with a manual Limitorque gearbox operator. These valves are a passive component which have no active safety function other than to provide a safety related system pressure boundary. When installed in the closed position there is no reliance on the valve seat to form a safety related pressure boundary and are installed merely to provide an isolation function while the new piping system is installed. When the alternate suction source piping is placed into service, valves CCW-518 and 1CCW-541 are placed in the OPEN position and locked, providing a flow path to the suction for the shared Unit 1 and Unit 2 A/B LPSW pumps.

Duke Energy Response to EMIB RAI No. 1, Part (b)

The Modification Test Plan (MTP) for EC 419099 will require demonstration that the valves can be open and closed successfully with the manual gear operator. The MTP will also require an in-service leak test be performed when the system is returned to service. Additionally, the MTP will verify the hydraulic performance of the alternate suction source piping system to meet the requirements for performance of the shared Unit 1 and Unit 2 A/B LPSW pumps. There are no active safety related functions which require testing.

Duke Energy Response to EMIB RAI No. 1, Part (c)

Valves CCW-518 and 1CCW-541 perform no active safety function and have no seat leakage requirement; accordingly, they are considered exempt per ASME OM Code 2004 Edition with 2006 Addenda, Subsection ISTC-1200(c) as these valves are used for system or component maintenance.

EMIB RAI No. 2

Please provide the following information regarding the permanent butterfly valve that will remain installed after the temporary alternate LPSW suction source is removed: (a) the functions of the butterfly valve; (b) testing activities to demonstrate the capability of the butterfly valve to perform its functions; and (c) the applicability of the butterfly valve to the IST Program and the basis for that applicability.

Duke Energy Response to EMIB RAI No. 2, Part (a)

ONS EC 419099 will install the alternate suction source piping and will eventually remove all but valve CCW-518 and piping tee assembly located at the East end of the shared Unit 1 and Unit 2 A/B LPSW pump suction header. Once the piping is removed with CCW-518 and the downstream flange piping tee remaining, valve CCW-518 will be in the locked closed position, and any valve seat leakage will be contained within the downstream safety related piping tee. Valve CCW-518 is a passive component and has no active safety function other than to provide a safety related system pressure boundary and has no seat leakage requirement; accordingly, it is considered exempt per ASME OM Code 2004 Edition with 2006 Addenda, Subsection ISTC-1200(c) as this valve is used for system or component maintenance.

Duke Energy Response to EMIB RAI No. 2, Part (b)

The MTP for EC 419099 will require demonstration that valve CCW-518 can be open and closed successfully with the manual gear operator. The MTP will also require an in-service leak test be performed for the blind flanges which are installed on the remaining piping tee when the alternate suction source piping has been removed. There are no active safety related functions which require additional testing.

Duke Energy Response to EMIB RAI No. 2, Part (c)

Valve CCW-518 performs no active safety function and has no seat leakage requirement; accordingly, it is considered exempt per ASME OM Code 2004 Edition with 2006 Addenda, Subsection ISTC-1200(c) as this valve is used for system or component maintenance.

EMIB RAI No. 3

Please provide the following information regarding the LPSW-1095 valve assembly. (a) type of valve (including disk) and actuator; (b) valve operating method in the open and close directions (such as electrical, manual handwheel, or actuator gearbox handwheel), (c) stroke time of the valve; (d) operating history of the valve (such as performance challenges, pressure locking, and thermal binding); (e) safety-related functions and high safety significant functions that are not classified as safety-related; (f) application of the IST requirements for this valve specified in 10 CFR 50.55a including the applicable provisions of the American Society of Mechanical Engineers (ASME) Operation and Maintenance of Nuclear Power Plants, Division 1, OM Code: Section IST (OM Code); and (g) periodic assessment of the capability of this valve to perform its functions as credited at Oconee.

Duke Energy Response to EMIB RAI No. 3, Part (a)

Per a Duke Energy drawing, LPSW-1095 is a PermaSeat, 24" Class 150 valve with manual operator. The valve is an Enertech butterfly valve, and the disk material is SA-351 Gr. CF8M.

Duke Energy Response to EMIB RAI No. 3, Part (b)

The valve is opened and closed by manipulating the chained handwheel attached to the actuator gearbox.

Duke Energy Response to EMIB RAI No. 3, Part (c)

ONS Design Basis Document (DBD) OSS-0254.00-00-1039, "(Mech) Design Basis Specification for the Low-Pressure Service Water System," identifies this manual valve is not active for Chapter 15 or Other Scoping Events. Operation of the valve is identified as a Time Critical Operator Action in the referenced DBD. The valve should be opened within 60 minutes following a Loss of LPSW on Units 1 & 2 or Unit 3 to allow either LPSW system to supply essential loads. Procedure PT/0/A/0120/033 is used to verify Time Critical Operator Action response time for opening of LPSW-1095 with the last performance of this procedure documenting a completion time of 14.72 minutes as documented in Enclosure 13.52. This time includes the operator dispatch time to the valve in conjunction with the actual valve stroke time verification as performed in PT/0/A/0251/026, "LPSW Cross-Connect Flush." The last valve stroke time verification for LPSW-1095 resulted in a valve stroke time of 152.25 seconds.

Duke Energy Response to EMIB RAI No. 3, Part (d)

LPSW-1095 was installed on September 7, 2005. The following provides the operating history for the valve:

- A restraining device for the chain operated valve handwheel was installed on May 9, 2011.
- Maintenance of the valve operator was required in 2012 due to the handwheel spinning freely/grease leak.
- The valve was found not fully closed during hydraulic isolation on May 22, 2012. A worn segment gear (worn/broken teeth) was identified, and the condition was repaired by installing a new operator on June 4, 2012.
- A minor oil leak from the valve gearbox was reported on July 8, 2016, that required cleaning.

Duke Energy Response to EMIB RAI No. 3, Part (e)

Valve LPSW-1095 is not identified in the ONS DBD for the LPSW System with an active safety related function for Chapter 15 or other scoping events. As described in UFSAR section 9.2.2.1, the LPSW System is designed such that no single component failure will impair emergency safeguards operation. ONS Units 1 and 2 share three 15,000 gal./min LPSW pumps. For Unit 3, there are two 15,000 gal./min. LPSW pumps.

Despite the aforementioned LPSW system single component failure considerations, valve LPSW-1095 provides the capability following a loss of LPSW on Units 1 and 2 or Unit 3 to allow either LPSW system to supply the essential loads. This manual cross connect capability for Loss of LPSW is identified as a Time Critical Operator Action in the system DBD. The capability to cross-connect the Unit 3 LPSW system to support Unit 1 in the event that the remaining 'C' LPSW pump becomes inoperable is a compensatory measure for the proposed change to temporarily extend the Completion Time for one required LPSW pump inoperable for Unit 1.

Duke Energy Response to EMIB RAI No. 3, Part (f)

LPSW-1095 is not included in the current ONS Inservice Testing Program. The LPSW System DBD does not credit the valve with an active Chapter 15 function, or event mitigation function. The valve is being evaluated for inclusion in the IST Program Plan for the next interval as a passive, normally closed manual valve that separates the Units 1 and 2 LPSW system from the Unit 3 system.

Duke Energy Response to EMIB RAI No. 3, Part (g)

The LPSW System DBD identifies that LPSW-1095 specifies that this normally closed valve is the subject of a Time Critical Operator Action and should be opened following a loss of LPSW on Units 1 and 2 or Unit 3 to allow either LPSW system to supply the essential loads. Periodic testing is performed to monitor performance of this Maintenance Rule (i.e., 10 CFR 50.65) function of the LPSW System for providing backup LPSW between the Units 1/2 and Unit 3 systems. This testing is performed under procedure PT/0/A/0251/026, "LPSW Cross-Connect Flush." LPSW-1095 must be operated (opened) during the quarterly flush of the 24-inch LPSW Cross-Connect between Unit 1/2 and Unit 3 for not only Maintenance Rule purposes, but also due to the ONS response to Generic Letter 89-13. Component acceptance is demonstrated by ensuring the valve cycles freely, without restriction. Every 2 years, the time required to open the valve is timed and this time is forwarded to the Emergency Operations Procedure (EOP) group at ONS for Time Critical Operator Action verification considerations.

Nuclear Systems Performance Branch (SNSB)

Regulatory Basis

Updated Final Safety Analysis Report (UFSAR), Section 3.1.6, “Criterion 6 - Reactor Core Design (Category A),” states, in part:

> The reactor core shall be designed to function throughout its design lifetime without exceeding acceptable fuel damage limits which have been stipulated and justified. The core design, together with reliable process and decay heat removal systems, shall provide for this capability under all expected conditions of normal operation with appropriate margins for uncertainties and for transient situations which can be anticipated, including the effects of the loss of power to recirculation pumps, tripping out of a turbine generator set, isolation of the reactor from its primary heat sink, and loss of all off-site power.

UFSAR, Section 3.1.10, “Criterion 10 - Containment (Category A),” states, in part:

> Containment shall be provided. The containment structure shall be designed to sustain the initial effects of gross equipment failures, such as a large coolant boundary break, without loss of required integrity and, together with other engineered safety features as may be necessary, to retain for as long as the situation requires the functional capability to protect the public.

UFSAR, Section 3.1.41, “Criterion 41 – Engineered Safety Features Performance Capability (Category A),” states, in part:

> Engineered safety features such as Emergency Core Cooling and Containment Heat Removal Systems shall provide sufficient performance capability to accommodate partial loss of installed capacity and still fulfill the required safety function. As a minimum, each engineered safety feature shall provide this required safety function assuming a failure of a single active component.

UFSAR, Section 3.1.49, “Criterion 49 – Containment Design Basis (Category A),” states, in part:

> The containment structure, including access openings and penetrations, and any necessary containment heat removal systems shall be designed so that the containment structure can accommodate without exceeding the design leakage rate, the pressures and temperatures resulting from the largest credible energy release following a loss-of-coolant accident, including a considerable margin for effects from metal-water or other chemical reactions that could occur as a consequence of failure of Emergency Core Cooling Systems.

UFSAR, Section 3.1.52, “Criterion 52 – Containment Heat Removal Systems (Category A),” states, in part:

> Where active heat removal systems are needed under accident conditions to prevent exceeding containment design pressure, at least two systems, preferably of different principles, each with full capacity shall be provided.

SNSB RAI No. 1

Section 2.2 of the LAR states that the LPSW system supplies cooling water to the safety-related reactor building cooling units (RBCUs) system and the low-pressure injection (LPI) system coolers. These systems are used to mitigate the consequences of a LOCA.

In a scenario when only LPSW C pump is available while Unit 1 is in LCO 3.7.7 for up to 288 hours, if a worst case design basis accident (DBA) occurs (the worst case design basis accident involves a LOCA/loss of offsite power with a loss of instrument air as described in UFSAR Section 9.2.2.2.3, page 9.2-7 last paragraph) and if the LPSW C pumps fails, a beyond design basis (defense-in-depth) capability to cross-connect the Unit 3 LPSW pump to supply Unit 1 safety related RBCU and LPI system loads will be used. Since the cross-connect is a beyond-design-basis capability proposed to be used for mitigating a DBA, the NRC staff request the following information regarding the capability of the Unit 3 to Unit 1 cross-connect.

(a) Assuming the LPSW C pump fails at any time from 0 to 288 hours, please describe how much time it takes to establish the required LPSW flow to Unit 1 safety-related systems from the cross-connect.

(b) During the period in response to (a) containment cooling would stop completely. The UFSAR analysis of record (AOR) Figures 6-36 and 6-37 appears to indicate containment pressure and temperature profiles may reverse. With the same analysis inputs and assumptions as in the AOR, provide the containment analysis pressure and temperature profiles, peak pressure, and vapor temperature for the worst-case assuming failure of the LPSW C pump at any time from 0 to 288 hours.

(c) Confirm that the analysis in (b) shows that the containment peak pressure and peak vapor temperature are bounded by the AOR values in UFSAR Figures 6-36 and 6-37, respectively.

(d) In case the containment peak pressure exceeds its AOR value, confirm that it is bounded by the TS Integrated Leak Rate Test (ILRT) Pressure, and the containment design pressure.

(e) In case the containment peak vapor temperature exceeds its AOR value, confirm that

- it remains bounded by the AOR equipment qualification temperature profile.
- the peak containment wall temperature based on the peak vapor temperature remains bounded by the AOR containment structural design temperature.

(f) Due to the absence of LPSW flow to RBCU and LPI coolers for the period in (a) during anytime between 0 to 288 hours, show that the worst-case sump temperature profile remains bounded by the AOR temperature profile. If it is not bounded, please provide the following:

I. Revised sump temperature profile.
II. Available net positive suction head (NPSH) profile(s) for the pumps that draw water from the sump during the LOCA recirculation phase.
III. Minimum NPSH margin for the pumps in (ii) and the containment accident pressure (CAP) below the vapor pressure at sump temperature used in calculating this margin.

Duke Energy Response to SNSB RAI No. 1, Part (a)

Flow to the Unit 1 safety-related loads will be established once the time critical operator action to cross-connect Unit 1&2 LPSW with Unit 3 LPSW is complete. The action has been verified utilizing ONS procedure PT/0/A/0120/033, “Time Critical Action Verification,” to be 14.72 minutes, which includes dispatch and local task time.

Duke Energy Response to SNSB RAI No. 1, Part (b)

Figures 1-7 below are provided for Large Cold-Leg Break LOCA scenarios with the LPSW C pump failure assumed at three different times:

1) Case R – LPSW C pump failure at t=0
2) Case R1 – LPSW C pump failure at t=10,000 seconds. This is at the approximate time when Reactor Building (RB) pressure / vapor temperature trends have reached their peak values after sump recirculation mode has been entered.
3) Case R2 – LPSW C pump failure assumed at t=7 days. For the AOR, it is assumed that RBS pumps are terminated at this point in the transient. The termination of those spray pumps causes a decrease in steam condensation in the RB atmosphere, leading to a short duration where RB vapor temperatures increase.

In all Figures presented, the cases with postulated LPSW C pump failures are overlaid with the AOR results (UFSAR Figures 6-36 and 6-37). For Case R2, time scales are modified in Figure 6 to facilitate comparison. Also, restoration of LPSW flow to the RBCUs / LPI coolers is assumed to occur 15 minutes after the postulated LPSW C pump failure based on the response to RAI 1(a) above.

For all three cases, the peak pressure and vapor temperature values shown in UFSAR Figures 6-36 and 6-37 are not impacted. This is because these peak values occur early in the transient (about 20 seconds after the LOCA occurs), well before RBCUs are assumed to initiate in the AOR. For Case R with the LPSW C pump failure assumed to occur at t=0, the time delay in restoring LPSW flow to the RBCUs of 15 minutes means that only 10 minutes of RBCU cooling is lost (RBCU initiation is assumed to occur at t=5 minutes in the AOR).

The time when RB peak pressure / vapor temperature values are reached is also well before sump recirculation mode is entered, so any postulated failure affecting LPSW flow to the LPI coolers has no impact at this early stage of the transient.

FIGURE 1

Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure

Long Term Containment Temperature Response

Case R (0 to 900 sec loss)

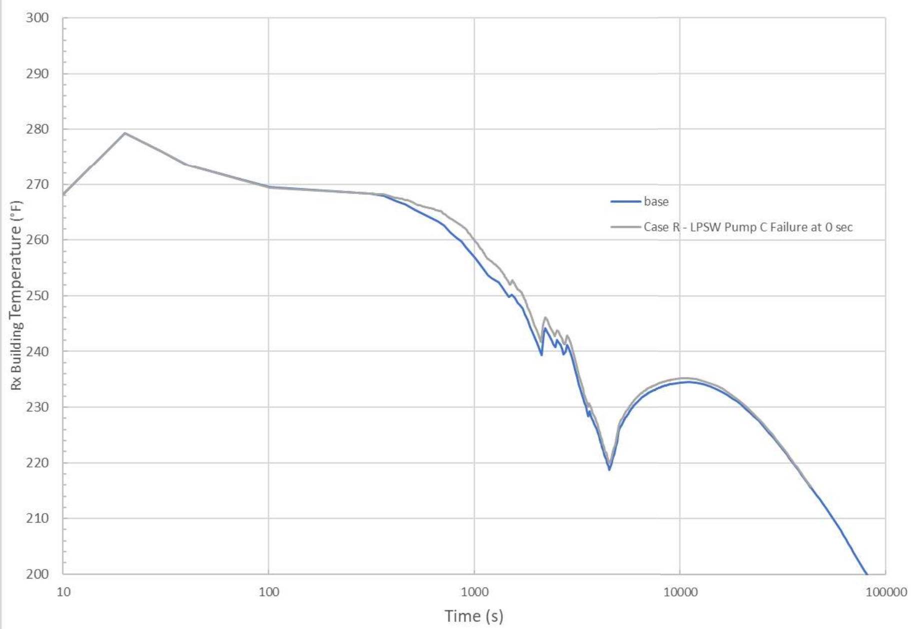
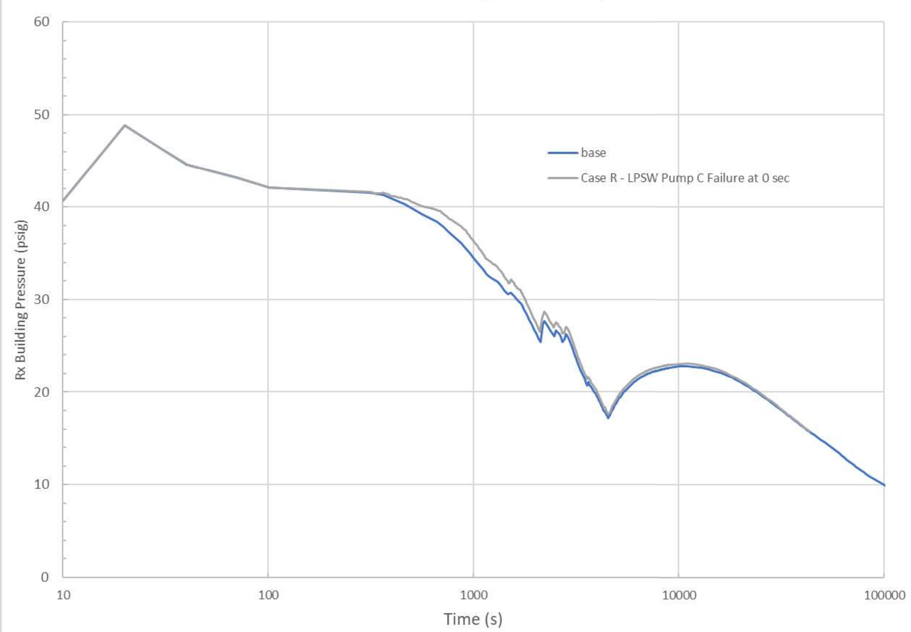


FIGURE 2

Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure

Long Term Containment Pressure Response

Case R (0 to 900 sec loss)



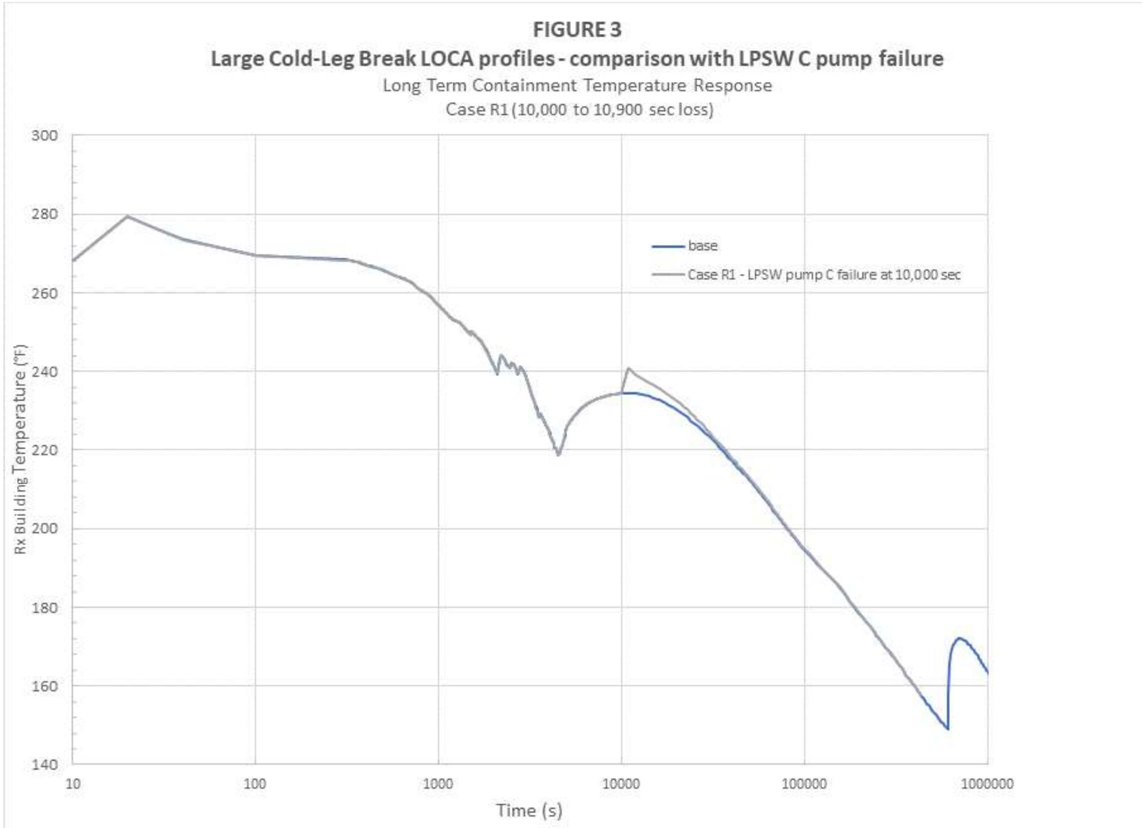


FIGURE 3
Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure
Long Term Containment Temperature Response
Case R1 (10,000 to 10,900 sec loss)
Rx Building Temperature (°F)
Time (s)
base
Case R1 - LPSW pump C failure at 10,000 sec
300
280
260
240
220
200
180
160
140
10
100
1000
10000
100000
1000000

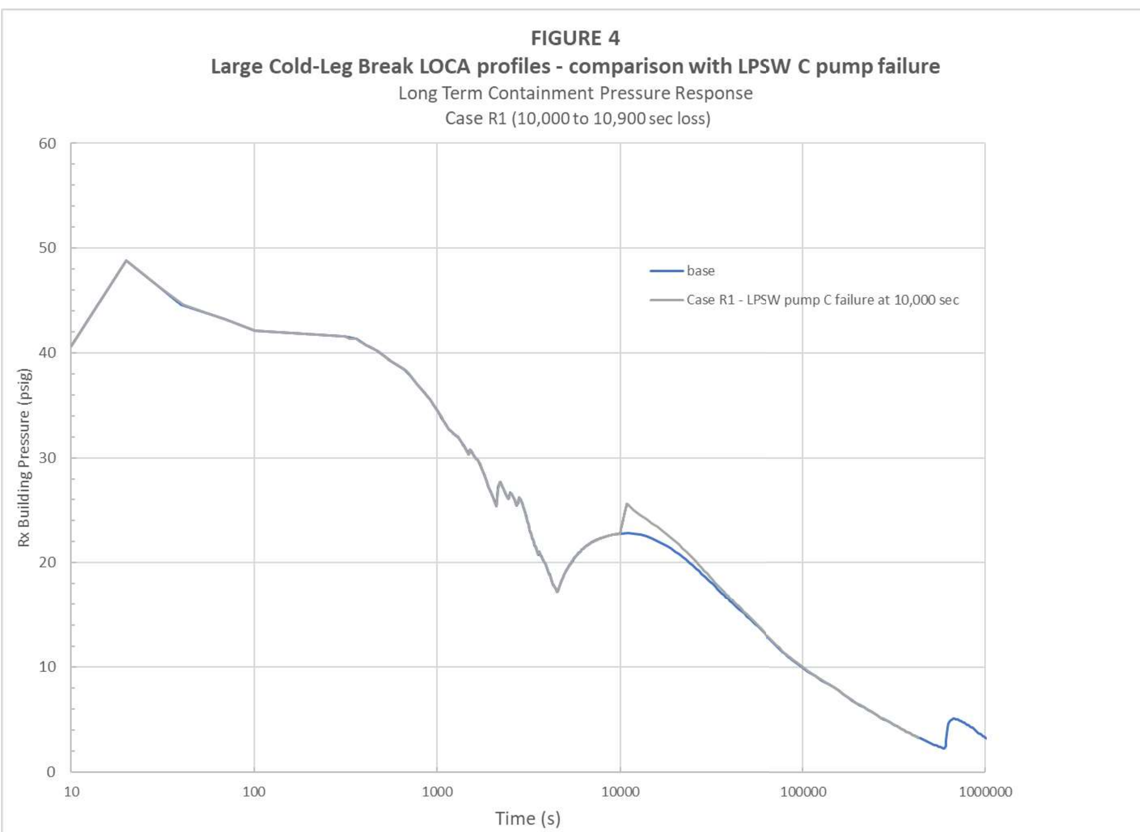


FIGURE 4
Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure
Long Term Containment Pressure Response
Case R1 (10,000 to 10,900 sec loss)
Rx Building Pressure (psig)
Time (s)
base
Case R1 - LPSW pump C failure at 10,000 sec
60
50
40
30
20
10
0
10
100
1000
10000
100000
1000000

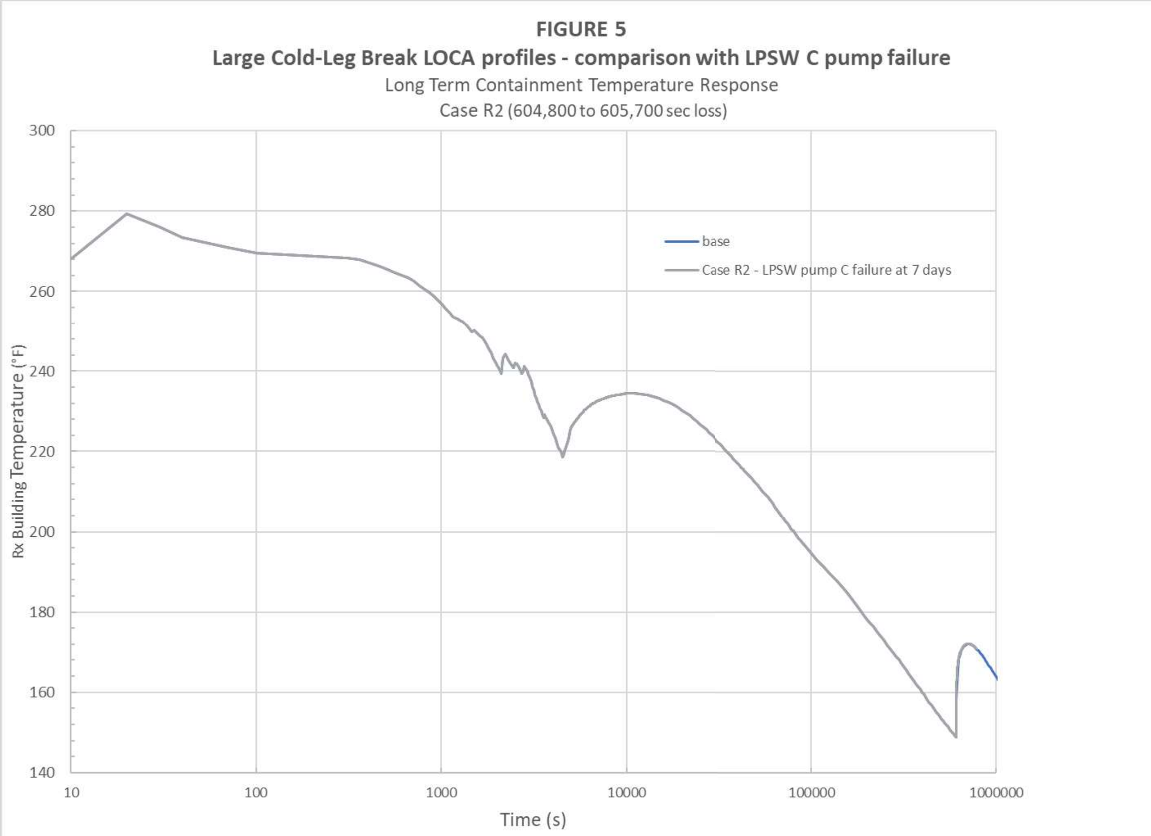


FIGURE 5
Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure
Long Term Containment Temperature Response
Case R2 (604,800 to 605,700 sec loss)
Rx Building Temperature (°F)
300
280
260
240
220
200
180
160
140
10
100
1000
10000
100000
1000000
Time (s)
base
Case R2 - LPSW pump C failure at 7 days

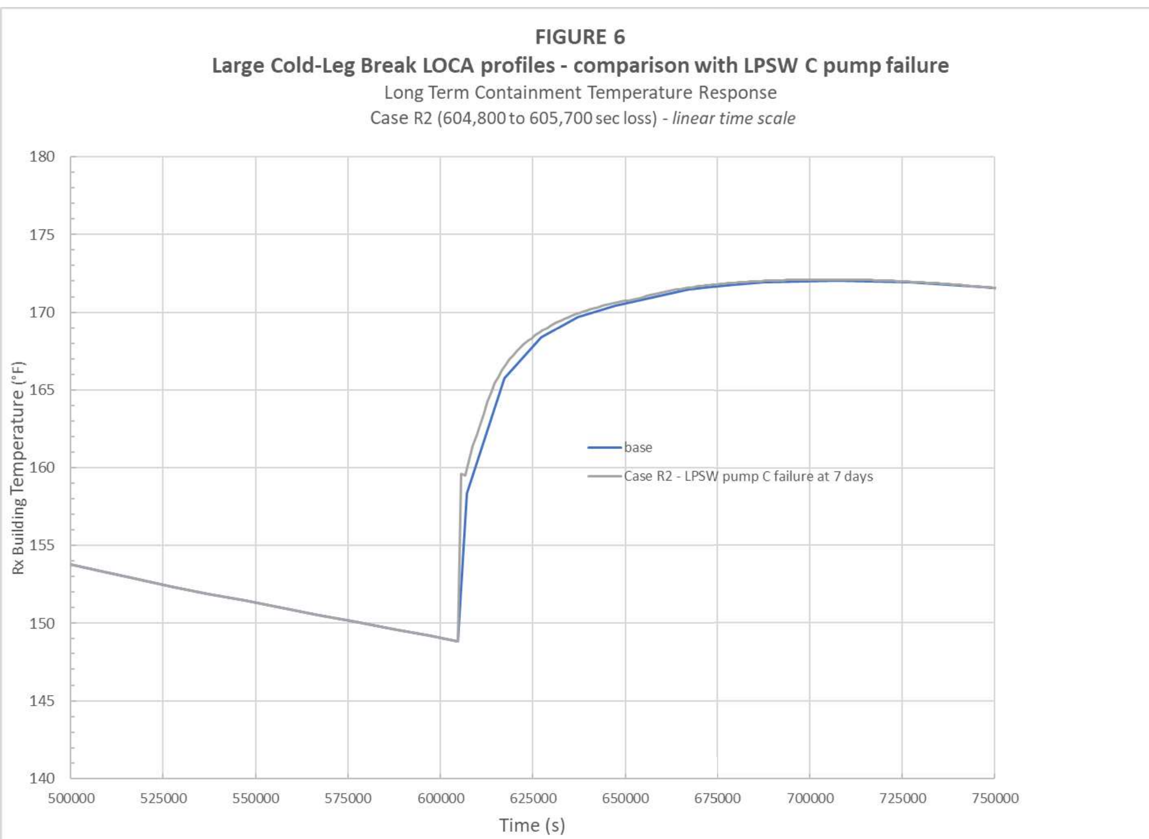
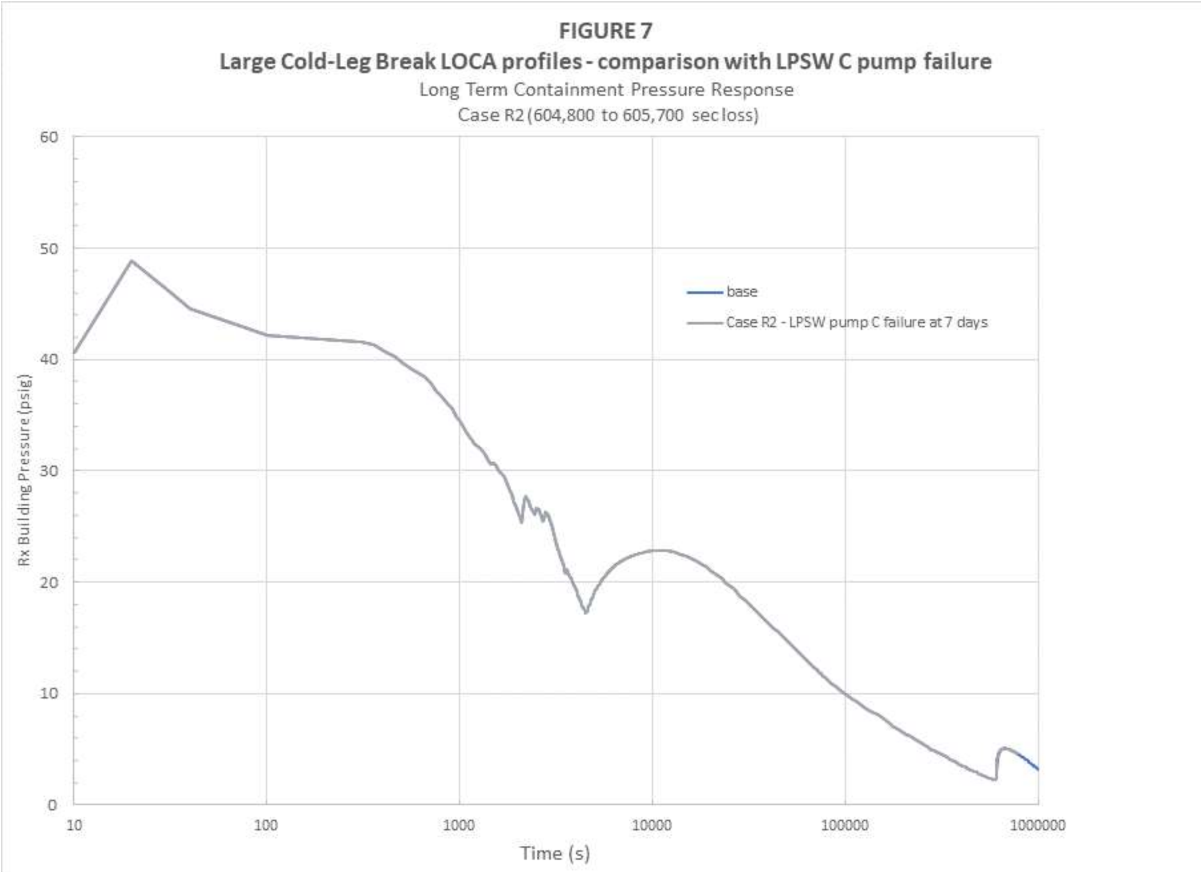


FIGURE 6
Large Cold-Leg Break LOCA profiles - comparison with LPSW C pump failure
Long Term Containment Temperature Response
Case R2 (604,800 to 605,700 sec loss) - linear time scale
Rx Building Temperature (°F)
180
175
170
165
160
155
150
145
140
500000
525000
550000
575000
600000
625000
650000
675000
700000
725000
750000
Time (s)
base
Case R2 - LPSW pump C failure at 7 days



Duke Energy Response to SNSB RAI No. 1, Part (c)

Based on the response to RAI 1(b), it is confirmed that for all cases executed for the 1(b) response, the containment pressure and peak vapor temperature values are bounded by the AOR values shown in UFSAR Figures 6-36 and 6-37.

Duke Energy Response to SNSB RAI No. 1, Part (d)

N/A – see 1(c) response above.

Duke Energy Response to SNSB RAI No. 1, Part (e)

N/A – see 1(c) response above.

Duke Energy Response to SNSB RAI No. 1, Part (f), I.

The large hot-leg break LOCA containment response provides the limiting RB conditions for LPI/RBS NPSH and minimum overpressure at the time sump recirculation mode is entered. For this break location, RB pressures are lower and sump temperatures are higher compared to cold-leg break LOCA containment responses. This leads to more limiting conditions for LPI/RBS pump NPSH consideration.

This containment response analysis is not discussed within Chapter 6 of the UFSAR. A considerable number of hot leg cases were previously executed to ensure that at least 0.44 psi of overpressure would be available upon entry into sump recirculation mode for all large hot-leg break LOCAs. The initial conditions (initial RB pressure, temperature, LPSW temperature, etc.) as well as boundary conditions such as RBCU capacities were varied in these cases to justify that amount of RB overpressure would be available following the worst-case design basis accident. Therefore, no one single case can be determined to be the “Analysis of Record” for the large hot-leg break LOCA.

A representative case with the following initial condition assumptions is selected for comparison purposes within this RAI response:

- Initial RB pressure = 15.9 psia (1.5 psig)
- Initial RB temperature = 152°F
- RBCU capacity = 120E6 Btu/hr (roughly two RBCUs operating at 75% capacity)
- LPSW temperature = 86.5°F
- BWST temperature = 105°F

All other assumptions made in this representative case, such as mass and energy release and single failure assumptions, are retained for this comparison.

The postulated LPSW C pump failure is assumed to occur at t=0 seconds. Similar to the large cold-leg break LOCA analysis discussed in the 1(b) response, this leads to a loss of RBCU cooling for 15 minutes at the beginning of the transient. The RBCUs are not assumed to initiate until 5 minutes into the transient.

It was determined through sensitivity analysis that assuming the LPSW pump C failure at times later than t=0 led to results that were bounded by those with the t=0 failure assumption. Therefore, the t=0 LPSW pump failure case at is the only one discussed.

The Reactor Building sump temperature results for the large hot-leg break LOCA case are shown in Figure 8. This trend is overlaid from the case without the postulated LPSW C pump failure. The sump temperature difference is small at first, but gets larger until the time of switchover to sump recirculation mode. This difference reaches a maximum value of about 3°F. This difference will start to decrease further into the transient as RBCU/LPI cooling will compensate for the difference. This will allow the sump temperature differences to decrease over time, and for the trends to converge.

At the time when sump recirculation mode is entered (2677 seconds), the sump temperature in the case with the LPSW C pump failure has decreased to 242.3°F. This is about 3°F warmer than the same time in the base case, where the sump temperature is 239.4°F at this time.

It should be noted that the parameter of concern to examine in the hot-leg break LOCA containment response is not solely the sump temperature. Available pump NPSH is a function of sump temperature as well as containment pressure. The postulated LPSW pump failure causes sump temperature to increase (relative to the base case), but it also causes RB pressure to increase. This trend is shown in Figure 9. Both of these impacts would be expected by a degradation of the RBCUs capacity to remove energy from the RB for a 900 second interval during injection phase from the Borated Water Storage Tank (BWST).

FIGURE 8
OCONEE NUCLEAR STATION
HOT LEG BREAK ANALYSIS FOR NPSH REQUIREMENTS
INITIAL BUILDING CONDITIONS @ 15.9 PSIA AND 152°F WITH 100% RH
LOSS OF REACTOR BUILDING SPRAY PUMP
RBCU = 120E6 BTU/HR, LPSW = 86.5°F, BWST = 105°F

LPSW pump "C" failure comparison

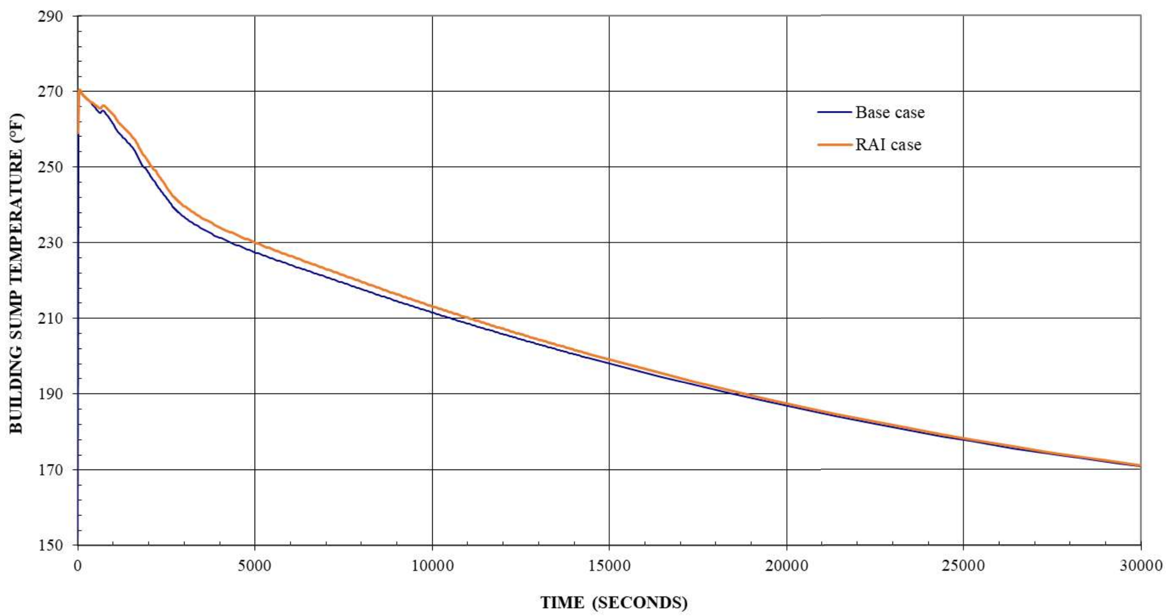


FIGURE 9
OCONEE NUCLEAR STATION
HOT LEG BREAK ANALYSIS FOR NPSH REQUIREMENTS
INITIAL BUILDING CONDITIONS @ 15.9 PSIA AND 152°F WITH 100% RH
LOSS OF REACTOR BUILDING SPRAY PUMP
RBCU = 120E6 BTU/HR, LPSW = 86.5°F, BWST = 105°F

LPSW pump "C" failure comparison

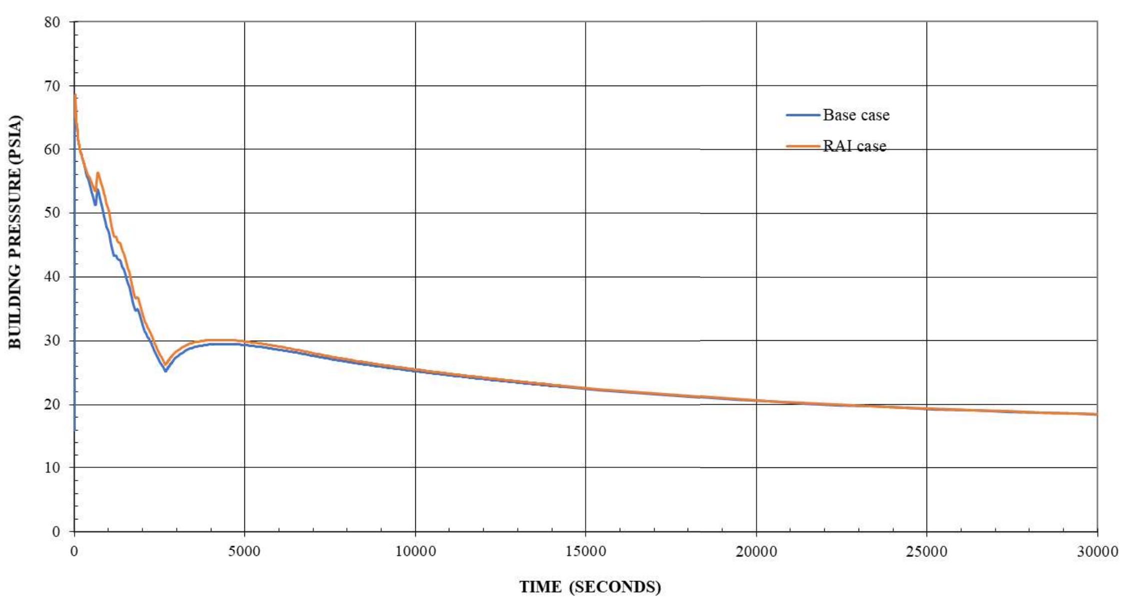
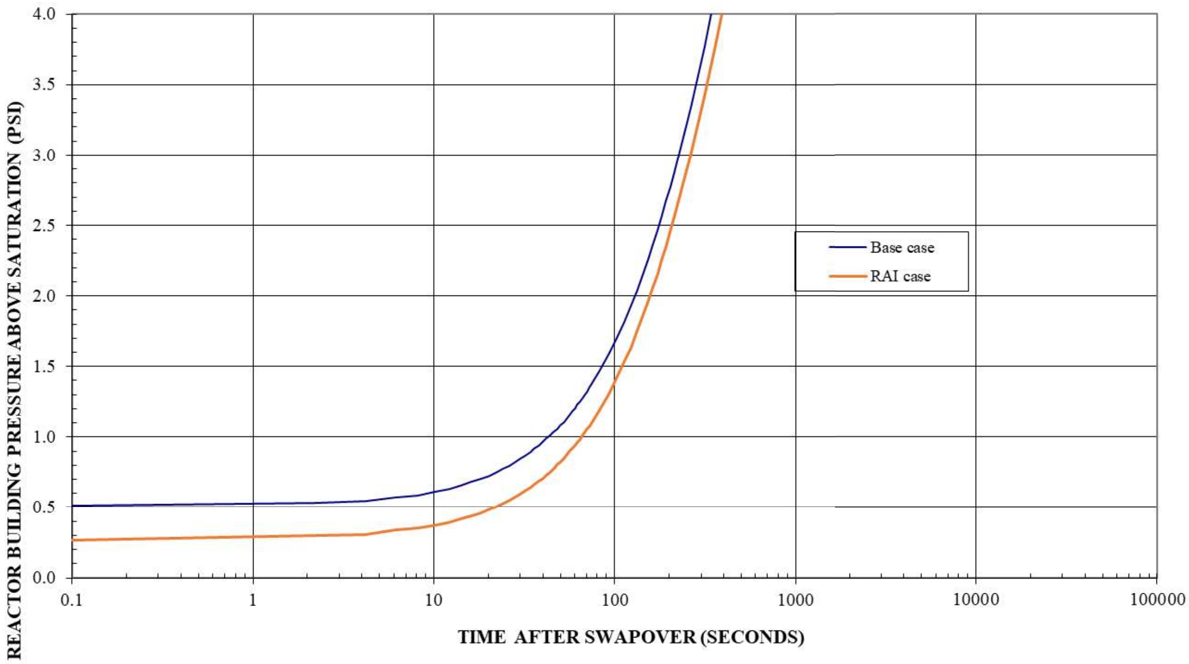


FIGURE 10
OCONEE NUCLEAR STATION
HOT LEG BREAK ANALYSIS FOR NPSH REQUIREMENTS
INITIAL BUILDING CONDITIONS @ 15.9 PSIA AND 152°F WITH 100% RH
LOSS OF REACTOR BUILDING SPRAY PUMP
RBCU = 120E6 BTU/HR, LPSW = 86.5°F, BWST = 105°F



Duke Energy Response to SNSB RAI No. 1, Part (f), II.

Due to passive flow restrictors, Reactor Building overpressure during accident conditions is not required to meet LPI pump NPSH requirements. NPSH requirements for all Oconee LPI pumps are met using the saturation pressure of the sump water.

Since no overpressure is credited in any LPI pump NPSH calculations, the impact of the postulated LPSW “C” pump failure discussed above will be limited to the RBS pumps.

Since the sump water temperature is always decreasing once sump recirculation mode is entered (per Figure 8), the limiting point with respect to NPSH calculations (maximum sump temperature) is at the point of switchover when the RBS pumps start to take suction from the sump. Also at this point, RB pressure is at an inflection point where it starts to increase (per Figure 9). Therefore, since it is known that $NPSH_a$ will be at its minimum value at the point when sump recirculation is entered, there are no $NPSH_a$ profiles (NPSH as a function of time) developed. The value for $NPSH_a$ is only calculated at the point of switchover to sump recirculation mode.

The amount of RB overpressure at the time sump recirculation mode is entered is calculated as follows:

RB overpressure = (26.298 psia) – (P_{sat} at RB sump temperature)
RB overpressure = (26.298 psia) – (Psat at 242.28°F)
RB overpressure = (26.298 psia) – (26.031 psia)

RB overpressure = 0.267 psi or ~0.27 psi

When compared to the 0.44 psi overpressure credited previously, the postulated LPSW C pump failure would result in a reduction of (0.44 - 0.27) psi, or about 0.17 psi of available RB overpressure.

This overpressure reduction is subtracted from previous calculations which credited the 0.44 psi value. The 0.17 psi reduction in available overpressure should be converted to feet of liquid and then subtracted from the existing $NPSH_a$ values.

A conversion factor for psi to feet of water of 2.318 is used. This conversion factor assumes that the specific volume of the water is

$2.318\ (\text{ft} / (\text{lb/in}^2)) / 144\ (\text{in}^2 / \text{ft}^2) = 0.01610\ \text{ft}^3 / \text{lb}$

This specific volume applies to water at about 238°F. Since the specific volume of water at 242°F only varies from water at 238°F by <0.2%, this difference in the specific volumes of the sump water between cases is considered to be negligible.

The conversion of the 0.17 psi reduction in overpressure to feet of head is shown below:

$NPSH_a$ reduction = $(0.17\ \text{lb/in}^2) \times (2.318\ \text{ft} / (\text{lb/in}^2)) = 0.394\ \text{ft}$

This value is conservatively rounded up to 0.40 ft.

A profile for the available Reactor Building overpressure (as a function of time after sump recirculation mode is entered) is shown in Figure 10. This trend is overlaid from the case without the postulated LPSW "C" failure. The reduction in overpressure just after switchover to sump recirculation mode is shown in this trend. The amount of available RB overpressure increases to >2 psi within several minutes.

The $NPSH_a$ values for the Unit 1 RBS pumps at this point with the RB overpressure credit reduced by 0.40 ft are calculated to be

Unit 1 RBS Pump A: 18.01 ft
Unit 1 RBS Pump B: 17.64 ft

Duke Energy Response to SNSB RAI No. 1, Part (f), III.

When this overpressure reduction is applied to the "Available Head" and "$NPSH_a$" terms in existing calculations, the Unit 1 NPSH Margin results would be adjusted as follows for the postulated LPSW C pump failure:

TABLE 1
ONS Unit 1 RBS pumps - NPSH margin re-calculation
with 0.40 ft reduction in RB overpressure credit

		RBS Pump Flow	Flow Model Available Head	RBES Strainer Head Loss	NPSHa	NPSHr	NPSH Margin
Unit	Train	gpm	ft	ft	ft	ft	ft
1	A	1197.88	18.11	0.1	18.01	17.25	0.76
1	B	1195.56	17.74	0.1	17.64	17.20	0.44

AR #02422709 has been added to the Duke Energy Nuclear Corrective Action Program to update Oconee UFSAR Table 6-33. This table will be updated to show LPI / RBS pump $NPSH_a$ and $NPSH_r$ values for the current plant configuration.

SNSB RAI No. 2

Please provide the impact on the analysis results of each of the transient and accident cases listed in UFSAR Table 15-32, due to the unavailability of LPI system for the temporary period in response to SNSB-RAI 1(a) from 0 to 288 hours.

Duke Energy Response to SNSB RAI No. 2

Cooling for the LPI system is credited in several events listed in UFSAR Table 15-32. These are during the cooldown portions of the dose consequence analyses for the Section 15.6 Locked Rotor, Section 15.9 Steam Generator Tube Rupture, Section 15.12 Rod Ejection, Section 15.13 Steam Line Break, and Section 15.17 Small Steam Line Break. The LPI system is also credited for cooling during the sump recirculation phase of the Section 15.14 Loss of Coolant Accident. The unavailability of LPSW flow to the LPI system for a short duration (i.e., 15 minutes) will not impact the dose consequences analyses.

The Section 15.14 LOCAs address the acceptance criteria provided in 10 CFR 50.46. The limiting results for the first four criteria are demonstrated during the cold leg injection phase of the event, during which cooling of the LPI system is not credited. Thus, the analyses to demonstrate these criteria are not impacted. The remaining criteria, long term core cooling, is demonstrated during the sump recirculation phase of the event. The credited means for addressing an increasing boron acid concentration are not impacted by the availability of LPI system cooling. Oconee uses passive flow paths and the alignment of active flow paths from the hot leg to the containment sump to mitigate boron acid concentration and ensure long term core cooling. During the 15-minute loss of LPI cooling, continued LPI flow would ensure adequate circulation and core cooling.

For a range of smaller break sizes, the LPI fluid temperature is important for the operation of the HPI pumps. Two of the three HPI pumps may be aligned to take suction from the LPI system during the sump recirculation phase of a LOCA, leaving one HPI pump in reserve. LPI system cooling is integral to maintaining the operating HPI pumps. For these smaller break scenarios where the sump fluid temperature exceeds 200F at the time LPI cooling is lost, operator action would be required based on LPI heat exchanger outlet temperature to secure the operating HPI pumps until cooling is restored. For these scenarios steam generator cooling would remain available.

SNSB RAI No. 3

Considering a worst case DBA in Unit 1 during which the cross-connect is supplying cooling water to Unit 1 from one of the two Unit 3 LPSW pumps, in conjunction with loss of offsite power (LOOP) in Unit 3, when one LPSW pump is unavailable due to being cross-connected, discuss how Oconee will be able to ensure that adequate decay heat removal capability will be available for Unit 3 to bring it to Mode 5.

Duke Energy Response to SNSB RAI No. 3

When Unit 1 experiences a LOCA/LOOP, procedure EP/1/A/1800/001 (Unit 1 Emergency Operating Procedure), Enclosure 5.1, will be performed and will isolate non-essential LPSW loads and align LPSW to required equipment. The following Unit 1 LPSW loads will be placed into service and will remain in service with the following typical and required flow rates:

LPSW System Load	Typical Flow Rate (gpm)	Required Flow Rate (gpm)
1A and 1B Low Pressure Injection Coolers	9200	6000
1A, 1B and 1C Reactor Building Cooling Units	2800	2550
Unit 1 Normal Component Cooling Cooler	1300	0
A Siphon Seal Water Header	135	15
1A and 1B Motor Driven EFW Pump Motor Coolers	200	60
High Pressure Injection Pump Motor Coolers	15	7
Total	**13650**	**8632**

With Unit 3 experiencing a LOOP performance of a natural circulation cooldown to bring Unit 3 to Mode 5, the following LPSW loads are expected (loads with Note (1) applied below can be isolated prior to placing the Low Pressure Injection Coolers in service to raise LPSW header pressure and flow rates to other components):

LPSW System Load	Flow Rate at T-0 (gpm)	Flow Rate when starting LPI (gpm)
3A and 3B Low Pressure Injection Coolers	0	6000
3A, 3B and 3C Reactor Building Cooling Units	3000	3000
Unit 3 Reactor Building Auxiliary Coolers (1)	1000	1000 (1)
Unit 3 RCP Motor and Bearing Oil Coolers (1)	1500	1500 (1)
Unit 3 Component Cooling Cooler	1200	1200
3A and 3B Motor Driven EFW Pump Motor Coolers	200	200
Unit 3 Non-Essential Header (1)	3000	1000 (1)
B Siphon Seal Water Header	135	135
High Pressure Injection Pump Motor Coolers	15	15
Total	**10,050**	**14,050**
Note: (1) - These loads can be isolated to gain additional margin 3 hours after LOOP occurs. The loads are included in the calculated flow rate since the EOP does not direct isolation.		

Using the highest flow rates from Unit 1 and Unit 3, the required LPSW Flow is 27,700 gpm. The 3A and 3B LPSW Pumps have a design flow rate of 15,000 gpm each. The above Unit 3 LPSW highest flow rates are below the design flow rates for the 3A and 3B LPSW Pumps. Unit 3 can obtain 3500 gpm of additional margin, by isolating the Note 1 loads.

As shown above, the capacity of the Unit 3 LPSW pumps is adequate for decay heat removal capability to bring Unit 3 to Mode 5.

Containment and Plant Systems Branch (SCPB)

<u>Regulatory Basis</u>

The regulations in 10 CFR 50.36(c)(2) requires that TSs contain LCOs, which are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When an LCO of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the TSs until the LCO can be met. Typically, the TSs require restoration of equipment in a timeframe commensurate with its safety significance, along with other engineering considerations.

The regulations in 10 CFR 50.36(b) states, in part, “The technical specifications will be derived from the analyses and evaluation included in the safety analysis report, and amendments thereto.” In determining whether the proposed TS remedial actions should be granted, the Commission will apply the “reasonable assurance” standards of 10 CFR 50.40(a) and 50.57(a)(3).

The regulations in 10 CFR 50.65(4) states:

> Before performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and corrective and preventive maintenance), the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The scope of the assessment may be limited to structures, systems, and components that a risk-informed evaluation process has shown to be significant to public health and safety.

Issue

Section 3.2 of the LAR states the following:

> The required window to complete the tie-in and perform a functional test of the alternate suction source is projected to require 288 hours, which exceeds the TS 3.7.7 Completion Time for Required Action A.1 of 72 hours. Although operability of the single Units 1 and 2 ‘C’ LPSW Pump can provide for the specified safety function of the system for Unit 1, ONS has the capability to procedurally cross connect the ONS Unit 3 LPSW pumps to the ONS Unit 1 and 2 LPSW header by opening valve LPSW-1095 should the ‘C’ LPSW Pump become inoperable.”

During an audit, the licensee stated that the above cross connect would take about 15 minutes to complete, which includes dispatch and local task time.

As stated in UFSAR Section 9.2.2, “Cooling Water Systems,” LPSW system provides cooling water to reactor building cooling units, decay heat removal coolers, high pressure injection pump motor bearing coolers, and motor-driven emergency feedwater pump motor air coolers. The reactor building cooling units provide containment heat removal and decay heat removal coolers provide cooling to low pressure injection in reactor building emergency sump recirculation mode operation of low-pressure injection system following postulated LOCAs as discussed in UFSAR Chapter 6. Of the transients and accidents analyzed in UFSAR Chapter 15, steam generator tube rupture and small-break LOCA credit high pressure injection system for inventory control during the initial phase and steam line break accident credits motor-driven emergency feedwater system.

SCPB RAI No. 1

To determine the increase in risk that may result from extending TS 3.7.7, Condition A, Required Action A.1 to 288 hours, please provide responses to the following questions related to the capability of the Unit 3 LPSW pumps to compensate for a scenario where a transient or an accident occurs and LPSW C pump fails:

(a) Explain the methods (i.e., engineering judgement, flow calculations, or flow measurements during testing) used to establish that the LPSW cross-connect from Unit 3 to Unit 1 can provide adequate flow for functions necessary to mitigate accidents or shutdown Unit 1. Discuss the ability to support the specific LPSW safety functions (i.e., cooling of high pressure injection pumps, emergency feedwater pump motor cooling, reactor building cooling units, and low-pressure injection system coolers) on a best estimate basis, consistent with the risk management program established to meet 10 CFR 50.65(a)(4).

(b) Explain the dependency of the high pressure injection pumps and EFW pump motors on LPSW cooling considering the time to cross-connect Unit 3 LPSW.

Duke Energy Response to SCPB RAI No. 1, Part (a)

The hydraulic models for the LPSW system used to evaluate the LOCA/LOOP response are separate for the Unit 1/Unit 2 and Unit 3 systems. Within these analyses is an evaluation of various data for the effects of the two systems being cross connected that concludes there is no flow division away from the LOCA unit. The basic supposition is that all TS required pumps are available and a single failure (pump or electrical bus) occurs on the LOCA unit. Aside from flow rates, the analysis predicts the LPSW header pressure for the LPSW system associated with the LOCA unit. Periodic performance testing shows that the normal header pressure is roughly the same for both systems. When Engineered Safety Features Actuation System (ESFAS) actuation occurs with the postulated single failure that results in one LPSW pump failing to start, it is assumed that the LPSW system associated with the LOCA unit will experience a slight lowering in header pressure. Thus, the LPSW system associated with the non-LOCA unit would reasonably be expected to provide some flow to the LOCA unit. This flow is not credited in any analysis since the LPSW systems are modeled independently. Note that engineering judgment is applied here, as the analysis does not assume the Unit 1/Unit 2 ‘A’ and ‘B’ LPSW pumps are inoperable, along with a failure of the ‘C’ LPSW pump.

One LPSW pump per unit must operate to supply loads, whether normal or accident. The configuration for the proposed change with Unit 1 in TS 3.7.7, Condition A (One required LPSW pump inoperable), and assuming a single failure of the remaining ‘C’ LPSW Pump, results in an unanalyzed scenario relative to mitigating a design basis accident or transient. However, since Unit 2 will be defueled in conjunction with the proposed change with necessary loads isolated, there is reasonable assurance that starting the non-running Unit 3 LPSW pump as part of the Loss of LPSW Abnormal Procedure would make up for most of the flow loss when the systems are cross connected. Once two LPSW pumps are operating for two units (in this case Units 1 and 3) with LPSW demands, flow rates near those in the existing analyses would be expected.

To further support the adequacy of the LPSW cross-connect, a periodic test is run that places the LPSW cross connect in service with the Unit 1/Unit 2 LPSW system supplying all three units (i.e., the U-3 LPSW pumps are turned off). The main purpose of this test is to flush the cross connect line, but also serves to exercise the manual cross connect valve, LPSW-1095, and demonstrates that the three Unit 1/Unit 2 LPSW pumps can supply the demands of three units operating normally. One of the criteria in the test is to maintain LPSW header above 73 psig in order to prevent an auto-start of non-running LPSW pumps. This test is successfully performed with regularity and header pressure is maintained well above what accident analysis predicts would exist during an event. Even though the test is configured to use the Unit 1/Unit 2 LPSW system to supply Unit 3, it would be expected that the two Unit 3 LPSW pumps could supply any two units since the cross connect piping is a 24” line with no check valves in the line. For a given unit’s flow demands, which should be similar from unit to unit, the pressure drop in the cross connect piping would be the same regardless of the direction of flow. Thus, by engineering judgment, it is expected that two pumps on the Unit 3 LPSW system could carry the loads for any two units, when the third unit is defueled and appropriate loads isolated, as will be the case for the proposed change.

Duke Energy Response to SCPB RAI No. 1, Part (b)

The ONS High Pressure Injection (HPI) pumps use LPSW as the normal means to cool the motor’s upper thrust bearing. LPSW is backed up by HPSW, which will be supplied from the Elevated Water Storage Tank (EWST) if the HPSW pumps are not running. Sufficient inventory exists in the EWST to support placing the LPSW cross-connect in service since the time to align is much shorter than the time before the EWST requires refilling. LPSW also provides cooling water to the Motor Driven Emergency Feedwater pump (MDEFWP) motor air coolers and there is no backup; however, a Turbine Driven Emergency Feedwater pump exists that is also backed up by HPSW and would be available until the LPSW cross connect is placed in service. Additional EFW system redundancy includes:

- Ability to manually cross connect EFW systems between all three units.
- Full capacity SSF Auxiliary Service Water (ASW) pump capable of feeding all 3 unit’s steam generators simultaneously.

ATTACHMENT 2

MARKED-UP TECHNICAL SPECIFICATIONS PAGES

[2 pages follow this cover page]

3.7 PLANT SYSTEMS

3.7.7 Low Pressure Service Water (LPSW) System

LCO 3.7.7 For Unit 1 or Unit 2, three LPSW pumps and one flow path shall be OPERABLE.

For Unit 3, two LPSW pumps and one flow path shall be OPERABLE.

The LPSW Waterhammer Prevention System (WPS) shall be OPERABLE.

--NOTE--
With either Unit 1 or Unit 2 defueled and appropriate LPSW loads secured on the defueled Unit, such that one LPSW pump is capable of mitigating the consequences of a design basis accident on the remaining Unit, only two LPSW pumps for Unit 1 or Unit 2 are required.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required LPSW pump inoperable.	A.1 Restore required LPSW pump to OPERABLE status.	TS 3.7.7-1 INSERT 72 hours
B. LPSW WPS inoperable.	B.1 Restore the LPSW WPS to OPERABLE status.	7 days
C. Required Action and associated Completion Time of Condition A or B not met.	C.1 Be in MODE 3. <u>AND</u> C.2 Be in MODE 5.	12 hours 60 hours

TS 3.7.7-1 INSERT

-------------NOTE-------------
During Unit 2, Refuel 31 with Unit 2 defueled, appropriate LPSW loads secured, and contingent on implementation of the compensatory measures described in Attachment 1 of letter RA-22-0089 dated April 14, 2022, the the Completion Time is 288 hours for the tie-in and testing of an alternate suction source to the shared Unit 1/2 LPSW Pumps A and B.

ATTACHMENT 3

REVISED (CLEAN) TECHNICAL SPECIFICATIONS

[3 pages follow this cover page]

3.7 PLANT SYSTEMS

3.7.7 Low Pressure Service Water (LPSW) System

LCO 3.7.7 For Unit 1 or Unit 2, three LPSW pumps and one flow path shall be OPERABLE.

For Unit 3, two LPSW pumps and one flow path shall be OPERABLE.

The LPSW Waterhammer Prevention System (WPS) shall be OPERABLE.

---NOTE---
With either Unit 1 or Unit 2 defueled and appropriate LPSW loads secured on the defueled Unit, such that one LPSW pump is capable of mitigating the consequences of a design basis accident on the remaining Unit, only two LPSW pumps for Unit 1 or Unit 2 are required.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required LPSW pump inoperable.	A.1 Restore required LPSW pump to OPERABLE status.	-------------NOTE------------ During Unit 2, Refuel 31 with Unit 2 defueled, appropriate LPSW loads secured, and contingent on implementation of the compensatory measures described in Attachment 1 of letter RA-22-0089 dated April 14, 2022, the Completion Time is 288 hours for the tie-in and testing of an alternate suction source to the shared Unit 1/2 LPSW Pumps A and B. --------------------------------- 72 hours

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION		COMPLETION TIME
B. LPSW WPS inoperable.	B.1	Restore the LPSW WPS to OPERABLE status.	7 days
C. Required Action and associated Completion Time of Condition A or B not met.	C.1	Be in MODE 3.	12 hours
	<u>AND</u>		
	C.2	Be in MODE 5.	60 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.7.7.1	Verify LPSW leakage accumulator level is within Water levels between 20.5” to 41”. During LPSW testing, accumulator level > 41” is acceptable.	In accordance with the Surveillance Frequency Control Program
SR 3.7.7.2	-------------------------NOTE-------------------------- Isolation of LPSW flow to individual components does not render the LPSW System inoperable. --- Verify each LPSW manual, and non-automatic power operated valve in the flow path servicing safety related equipment, that is not locked, sealed, or otherwise secured in position, is in the correct position.	In accordance with the Surveillance Frequency Control Program
SR 3.7.7.3	Verify each LPSW automatic valve in the flow path that is not locked, sealed, or otherwise secured in position, actuates to the correct position on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.7.7.4	Verify each LPSW pump starts automatically on an actual or simulated actuation signal.	In accordance with the Surveillance Frequency Control Program
SR 3.7.7.5	Verify LPSW leakage accumulator is able to provide makeup flow lost due to boundary valve leakage.	In accordance with the Surveillance Frequency Control Program
SR 3.7.7.6	Verify LPSW WPS boundary valve leakage is ≤ 20 gpm.	In accordance with the Surveillance Frequency Control Program

ATTACHMENT 4

TECHNICAL SPECIFICATIONS BASES MARKUP (INFORMATION ONLY)

[1 page follows this cover page]

BASES

LCO (continued)	The LPSW WPS is considered OPERABLE when the associated leakage accumulator, relief valves, seat leakage limits for check valves and pneumatic discharge isolation valves, closure capability of pneumatic discharge isolation valves, and opening capability of the controllable vacuum breaker valves are OPERABLE.
APPLICABILITY	In MODES 1, 2, 3, and 4, the LPSW System is a normally operating system that is required to support the OPERABILITY of the equipment serviced by the LPSW System. Therefore, the LPSW System is required to be OPERABLE in these MODES. In MODES 5 and 6, the OPERABILITY requirements of the LPSW System are determined by the systems it supports.
ACTIONS	A.1 If one required LPSW pump is inoperable, action must be taken to restore the required LPSW pump to OPERABLE status within 72 hours. In this Condition, the remaining OPERABLE LPSW pump(s) are adequate to perform the heat removal function. However, the overall reliability is reduced because a single failure in the OPERABLE LPSW pump(s) could result in loss of LPSW system function. The 72 hour Completion Time is based on the redundant capabilities afforded by the OPERABLE pump, and the low probability of a DBA occurring during this period. The Completion Time is modified by a NOTE indicating that the Completion Time during Unit 2, Refuel 31 is 288 hours for the tie-in and testing of an alternate suction source to the shared Unit 1 and Unit 2 LPSW Pumps A and B. An alternate suction source to the shared Unit 1 and Unit 2 LPSW Pumps A and B is needed for replacement of Condenser Circulating Water (CCW) System valves. This 288-hour Completion Time is an exception to the normal 72 hour Completion Time and shall only be utilized during Unit 2, Refuel 31 when Unit 2 is defueled with appropriate LPSW loads secured for the final tie-in and testing of the alternate suction source. For all other instances of an inoperable required LPSW pump, the 72-hour Completion Time applies. The NOTE expires at 288 hours or upon completion of the tie-in and satisfactory testing of an alternate suction source to the shared Unit 1 and Unit 2 LPSW Pumps A and B, whichever comes first.