Southern Nuclear

Farley Nuclear Plant License Amendment Request – Removal of Encapsulations from Recirculation Suction Valves

June 24, 2021

Meeting Purpose

Discuss Farley license amendment request (LAR) to remove encapsulations from recirculation suction valves and provide the opportunity for feedback, with the goal of identifying any areas that may require additional documentation or justification.

Meeting Agenda

- LAR Summary Description
- System Design and Operation
- Current Licensing Basis Requirements
- Reason for Proposed Change
- Description of Proposed Change
- Technical Evaluation of Proposed Change

LAR Summary Description

LAR Summary

- Change the facility as described in the Updated Final Safety Analysis Report (UFSAR) to allow removal of encapsulation vessels and associated guard piping installed around the first Containment Spray (CS) and first Residual Heat Removal (RHR) / Low Head Safety Injection (LHSI) motor-operated gate isolation valves and the upstream suction piping.
- SNC determined that the proposed change involves a “more than minimal” increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety previously evaluated in the final safety analysis report (as updated) (per § 50.59(c)(2)(ii)).
- Aspects of this change that are not determined to be “more than minimal” will be addressed separately and are outside the scope of this LAR.
- Implementation of modifications will occur in support of valve access activities for the spring 2022 and fall 2023 refueling outages for Unit 2, and for the fall 2022 and spring 2024 refueling outages for Unit 1

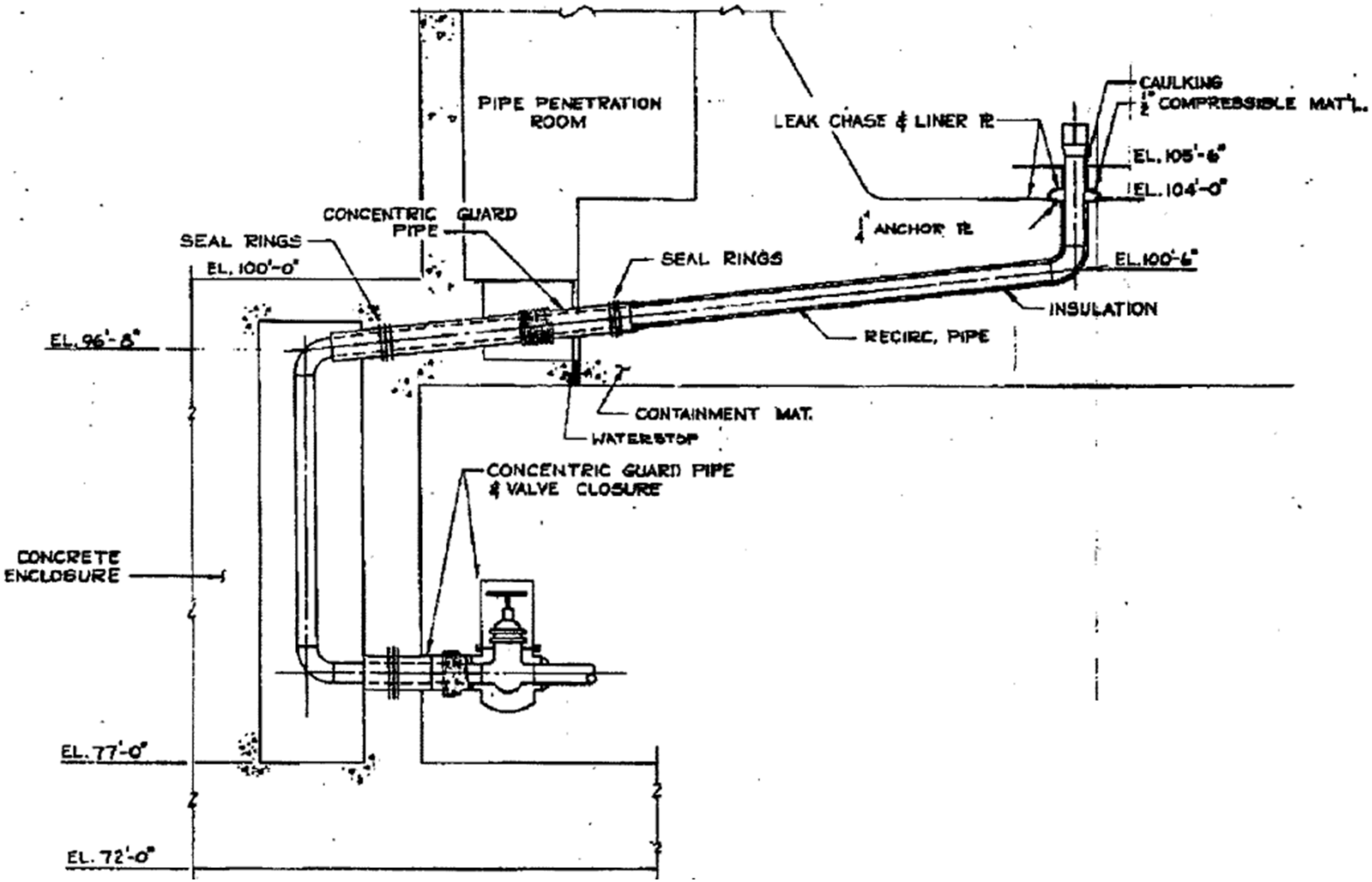
System Design and Operation

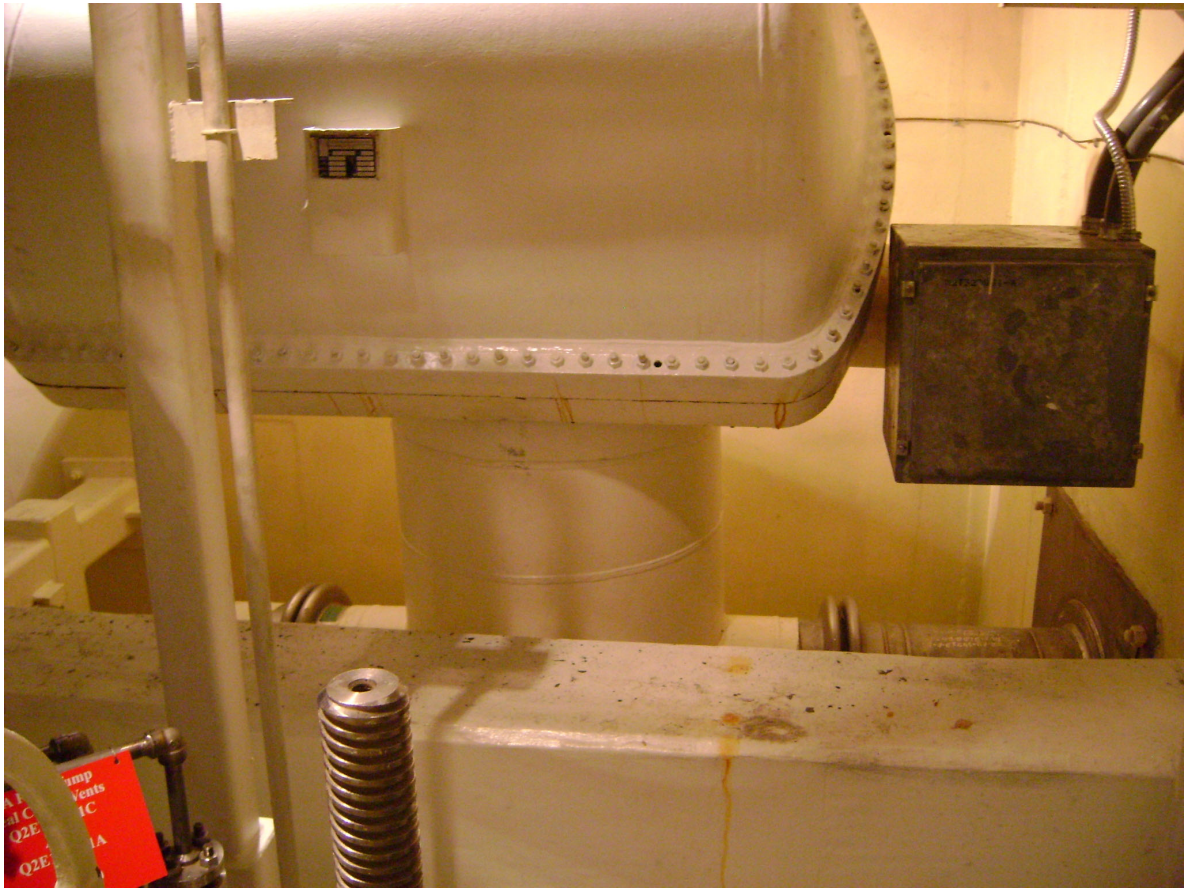
System Design and Operation

- The encapsulation vessels are carbon steel and connected to the guard piping upstream and downstream with welded expansion joints.
- The guard piping extends through the wall of the vertical concrete pipe chase.
- The suction piping with guard piping surrounding it routes from the pipe chase encased in concrete through the piping penetration room (access trench) and terminates at the containment base mat.
- The suction piping and guard piping are welded to the containment liner plate.
- Each encapsulation vessel forms a leak-tight compartment just downstream of the first isolation valve outside of containment with a guard pipe end cap weld to the process pipe.
- The encapsulation vessel together with guard piping and chase ensure that, in the unlikely event of leakage from the emergency sump suction piping, the long-term recirculation phase core cooling is not impaired by a significant loss of inventory.

System Design and Operation

- There are four encapsulation vessels per unit, one for each of the first isolation valves in the containment sump post-LOCA recirculation path outside of containment.
- Each train of these systems is physically separated from the other by watertight compartments.
- Each system within a train is further separated into watertight compartments to protect from common mode flooding.
- The encapsulation and guard piping provides a pressure boundary to capture and limit leakage from a passive single failure in the containment emergency sump suction line from the underside of the containment liner up to and including the first sump suction isolation valve in each CS and RHR/LHSI system.


PIPE PENETRATION ROOM
LEAK CHASE & LINER PL
CAULKING
½" COMPRESSIBLE MAT'L.
EL. 105'-6"
EL. 104'-0"
¼" ANCHOR PL
CONCENTRIC GUARD PIPE
SEAL RINGS
EL. 100'-0"
SEAL RINGS
EL. 100'-6"
INSULATION
RECIRC. PIPE
EL. 96'-8"
CONTAINMENT MAT.
WATERSTOP
CONCENTRIC GUARD PIPE & VALVE CLOSURE
CONCRETE ENCLOSURE
EL. 77'-0"
EL. 72'-0"



Current Licensing Basis Requirements

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- Encapsulations are credited to meet GDC-56, which states (underline added for effect):

  Criterion 56 - Primary containment isolation. Each line that connects directly to the containment atmosphere and penetrates primary reactor containment shall be provided with containment isolation valves as follows, <u>unless it can be demonstrated that the containment isolation provisions for a specific class of lines, such as instrument lines, are acceptable on some other defined basis</u>:
- FNP credits encapsulation and associated guard piping to meet “other defined basis”
- FNP method for meeting GDC-56 is consistent with ANSI N271-1976 section 3.6.5, which is endorsed by RG 1.141
- FNP design incorporates a pair of automatic motor operated valves in series outside containment for each sump suction line. During normal operation and during the recirculation mode post-LOCA, the suction lines will be water-filled.

Reasons for Proposed Change

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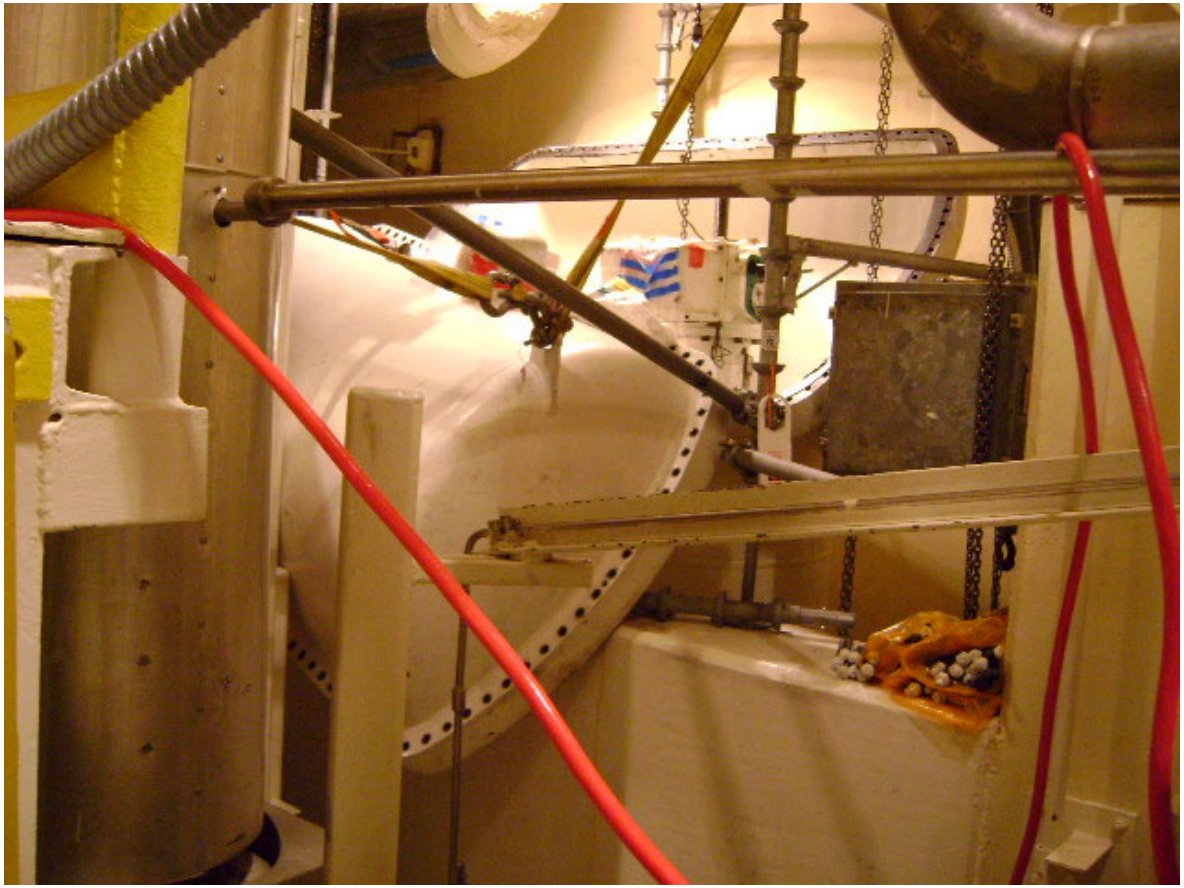
- There are significant maintenance hardships associated with inadequate laydown space for the encapsulation vessel access covers which weigh approximately 2000 lbs.
- Encapsulation vessels require time consuming and arduous rigging evolutions to position the access cover to allow access for maintenance and inspections.
- Rigging evolutions and working under a suspended load create an industrial safety hazard to craft personnel which cannot be eliminated due to the confined space available above and around the encapsulation vessels (lower shield wall, room cooler and associated piping overhead, redundant isolation valve adjacent, conduits, reach rods, etc.).
- Radiation exposure to craft personnel can be significantly decreased with the permanent removal of encapsulation vessels.
- There is significant heat stress on the craft personnel due to the physical nature of the rigging and removing/securing of multiple bolts for the access covers.

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Description of Proposed Change

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- Change the facility as described in the UFSAR to allow removal of the encapsulation vessels around the first isolation valves in the recirculation suction lines for the CS and RHR/LHSI systems and the associated guard piping.
- Design will be in accordance with the Acceptance Criteria discussed in NUREG-0800 Chapter 6, Section 6.2.4, Revision 3 for meeting the applicable GDC requirement.
- Acceptance criteria to meet GDC-56 states, in part:

  > If, in lieu of housing, the piping and valve are designed to preclude a breach of piping integrity, the design should comply with SRP Section 3.6.2 requirements. Design of the valve or the piping compartment should provide the capability to detect and terminate leakage from the valve shaft or bonnet seals.

Technical Evaluation

Technical Evaluation - SRP Acceptance Criteria

- Latest NUREG-0800, Rev 3 SRP acceptance criteria include two criteria that should be met in lieu of a housing:
  1. The design should comply with SRP Section 3.6.2 requirements to preclude a breach of piping integrity, and
  2. The design of the valve or the piping compartment should provide the capability to detect and terminate leakage from the valve shaft or bonnet seals.
- Both of these are criteria are addressed in following slides

Technical Evaluation - SRP Section 3.6.2 requirements

- The containment emergency sump suction lines are classified per ANS Safety Class 2a.
- The piping is designed to ASME Section III, Class 2 requirements.
- The piping and its support are designed to Seismic Category I classification.
- The design will comply with the SRP Section 3.6.2 requirements to preclude a breach of piping integrity.
- The LAR will document that the containment emergency sump suction lines, up to and including the first isolation valve, meet or exceed the piping stress analyses requirements and methodology of Branch Technical Position (BTP) 3-4.

Technical Evaluation - Capability to Detect and Terminate Leakage from the Valve Shaft or Bonnet Seals

- Remote leakage detection and isolation of the passive single failure leakage is met by the existing design features without any modifications.
- Flanged gasket and valve leakage rates are less severe than the pump seal failure leakage rate of 50 gpm discussed in FSAR Section 6.3.2.11.
- Leakage detection and response times for valve leakage are bounded by the current design pump seal failure leakage.
- Detection of significant leakage would be annunciated in the control room by a demand signal for a pump room sump pump to operate.
- Leakage from the isolation valve packing or bonnet to body seal will be terminated with remote operator action from the control room by securing the affected train and closing the isolation valve to isolate the leakage path from the containment emergency sump.
- Any portion of the postulated leakage which becomes airborne will be processed by the safety related Penetration Room Filtration System as credited in the current licensing basis.

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