



**Risk-Informed Process for Evaluations (RIPE) License
Amendment Request for Safety Injection Tank (SIT) LCO**
Pre-Submittal Meeting

Palo Verde Nuclear Generating Station (PVNGS)
January 4, 2024



Agenda

- Introduction
- Case for Action
- Mitigation Plan
- Proposed Technical Specification (TS) Changes
- Background
- Design Features
- RIPE Screening Results
- Risk Insights
- Schedule



Case for Action

- Recent plant operating experience resulted in a station-initiated effort to increase SIT reliability
- 4 examples of unexpected SIT depressurization over the last 2 years across all three units
 - 3 failed open SIT vent valves
 - 1 cracked weld
- 24-hour LCO Action
 - Cycles the organization and does not allow for planning and deliberate execution
 - Potential NOED situation



Mitigation Plan

- Multi-phase effort includes:
 - 1. Increasing the TS allowed outage time**
 2. Increasing the nitrogen cover pressure band (reduction in required pressure adjustments)
 3. Potential vent valve modification to more robust design
- Risk analysis supports a LAR using the RIPE process to increase the allowed outage time for a single safety injection tank out of service



Proposed TS Changes

3.5.1 Safety Injection Tanks (SITs) - Operating

LCO 3.5.1 Four SITs shall be OPERABLE.

APPLICABILITY: MODES 1 and 2,
MODES 3 and 4 with pressurizer pressure \geq 1837 psia.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One SIT inoperable due to boron concentration not within limits. OR One SIT inoperable due to inability to verify level or pressure.	A.1 Restore SIT to OPERABLE status.	72 hours
B. One SIT inoperable for reasons other than Condition A.	B.1 Restore SIT to OPERABLE status.	24 hours 10 days



Proposed TS Changes

3.5.2 Safety Injection Tanks (SITs) - Shutdown

LCO 3.5.2 Four SITs shall be OPERABLE with a borated water volume > 39% wide range indication and < 83% wide range indication;

OR

Three SITs shall be OPERABLE with a borated water volume > 60% wide range indication and < 83% wide range indication.

APPLICABILITY: MODES 3 and 4 with pressurizer pressure < 1837 psia.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required SIT inoperable due to boron concentration not within limits. OR One required SIT inoperable due to inability to verify level or pressure.	A.1 Restore required SIT to OPERABLE status.	72 hours
B. One required SIT inoperable for reasons other than Condition A.	B.1 Restore required SIT to OPERABLE status.	24 hours 10 days



Background

- CE NPSD-994, *CEOG Joint Applications Report for Safety Injection Tank AOT/STI Extension*, May 1995, provided the following information that supported LCO change from 1 hour to 24 hours:
 - Deterministic and probabilistic findings that support 24 hours as being either "risk beneficial" or "risk neutral" in comparison to shorter periods for restoring the SIT to OPERABLE status.
 - Best-estimate analysis for a typical PWR that confirmed that, during large-break LOCA scenarios, core melt can be prevented by either operation of one low pressure safety injection (LPSI) pump or the operation of one high pressure safety injection (HPSI) pump and a single SIT.
 - Plant-specific probabilistic analysis that evaluated the risk-impact of the 24 hour recovery period in comparison to shorter recovery periods.



Design Features

- The SITs are credited for both large and small break LOCAs.
 - The functions of the four SITs are to supply water to the reactor vessel during the blowdown phase of a LOCA, to provide inventory to help accomplish the refill phase that follows thereafter, and to provide Reactor Coolant System (RCS) makeup for a small break LOCA.
 - Each SIT is piped into one RCS cold leg via the injection lines utilized by the High Pressure Safety Injection and Low Pressure Safety Injection (HPSI and LPSI) Systems.
- The SITs are passive components and requires no operator or control action for them to perform their function.
- Each SIT is isolated from the RCS by a motor operated isolation valve and two check valves in series.



RIPE Screening Results

- Applicable guidance documents:
 - NEI 21-01, Rev. 1, *Industry Guidance to Support Implementation of NRC's Risk-Informed Process for Evaluations*, June 2022
 - NRC Guidelines for Characterizing the Safety Impact of Issues, Rev. 2, May 2022
 - TSG-DORL-2021-01, Rev. 3 – NRR Temporary Staff Guidance, *Risk-Informed Process for Evaluations*, September 2023
- PVNGS has implemented Risk-Informed Completion Times [ML19085A525] and 10 CFR 50.69 [ML18243A280]
 - APS qualifies to use the RIPE process
- Issue screened in as adverse, but minimal impact on safety



Risk Insights

A plant specific risk assessment was conducted

- SITs and their safety functions are in the scope of the PVNGS PRA model
 - Quantitative analysis performed for Modes 1 & 2
 - Bounding analysis used to quantify lower Modes (i.e., Modes 3 & 4)
- No risk management actions are required to offset the risk



Risk Insights

The PRA model used reflected the following:

- Fully compliant internal events, flooding, fire and seismic PRA models
- All Other External Hazards listed in RG 1.200, Revision 3, screened out
- Addressed all NRC license conditions from the 10 CFR 50.69 and RICT License Amendments
- No open finding level Facts and Observations (F&Os)
- No newly developed methods
- No additional key assumptions or sources of uncertainty
- PRA model fully compliant with NRC RG 1.200, Revision 3



Risk Insights – Modes 3 & 4

PVNGS does not have a low power/shutdown PRA model to assess the change in CDF and LERF.

- Per NEI 21-01: “Where PRA models are not available, conservative or bounding analyses may be performed to quantify the risk impact (e.g., external events, low power and shutdown).”
- The following references stipulate that when RCS pressure is at 1000 psi that there is negligible probability of a pipe break and it would be appropriate to reduce the at power initiating event frequencies for large and small LOCA when quantifying risk impact of extending the AOT.
 - WCAP-16196-P, *PRA LPSD Transition Risk Notebook*, October 2004
 - WCAP-16560-P, *Assessment of Shutdown Risk and Insights for the PWROG*, October 2006
- Therefore, a bounding conservative analysis associated with extending the AOT will be quantified using the PVGS at-power PRA model with no adjustments to large or small LOCA initiating events.



Risk Insights – Modes 1 & 2

Case	CDF ¹	LERF ¹
PVNGS Baseline	2.62x10 ⁻⁶ /year	1.28x10 ⁻⁷ /year
PVNGS SIT Sensitivity	2.96x10 ⁻⁶ /year	1.31x10 ⁻⁷ /year
Yearly CDF Increase based on 10-day AOT (Downtime freq = 1.22/year)	1.12x10 ⁻⁸ /year	1.07x10 ⁻¹⁰ /year
NEI 21-01 Acceptance Guideline	1.0x10 ⁻⁷ /year	1.0x10 ⁻⁸ /year
NRC RG 1.174 Acceptance Guideline	1.0x10 ⁻⁴ /year	1.0x10 ⁻⁵ /year

Note 1 - Internal events (IE) results are bounding due to IE PRA model using a lower truncation value than the multi-hazard model. Additionally, the increase in risk associated with having a SIT out of service is driven by internal events hazards (large and small LOCA initiating events).

Therefore, extending the Completion Time for Condition B of LCOs 3.5.1 and 3.5.2 from 24 hours to 10 days is not risk-significant and has a minimal impact on safety.



Path to Schedule

- Challenge board w/ NEI – December 15, 2023 (Complete)
- Pre-submittal meeting w/ NRC – January 4, 2024
- Completion of PRA Input – January 2024
- Integrated Decision-Making Panel – January 2024
- Final submittal – late February 2024
- Requested approval – May 2024
- Implementation – June 2024



Questions