Enclosure 2:

"LTC RAI Closure Plan," PM-1118-63594-NP, Revision 0, nonproprietary version

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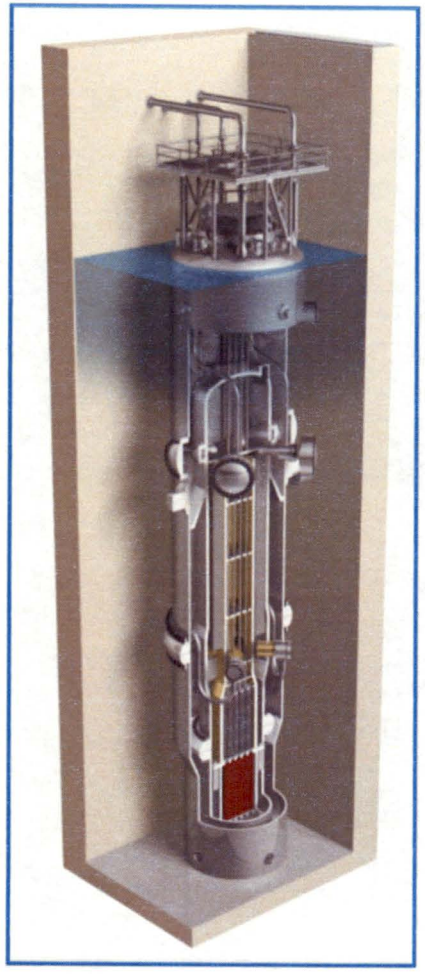
LTC RAI Closure Plan



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Acknowledgement & Disclaimer

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Agenda

1000/1010: Objective of the meeting/ Paul Infanger –
Review upcoming LTC RAI transmittal important technical assumptions to determine if there a technical closure for LTC RAI review with the staff.

1010/1045: LTC Analysis Update

1045/1100: Revised NRELAP5 LTC Model based on LOCA EM Model

1100/1145: LTC RAI Response Trajectory

1145/1200: Notes and followup activities

LTC Analyses Update for incoming RAIs

- Purpose of Model Update
  - Alignment with the updated LOCA EM (**Per RAI 9516 15.26**)
  - Some additional simplifications to improve NRELAP5 performance
    - {{ }}2(a),(c)
  - Address modeling errors (corrective actions) and input changes
- Updated analysis scope
  - {{

    }} 2(a),(c) (determined to be non-limiting)
  - Update calculations to NRELAP5 v1.4
- Revised boundary conditions assumptions
  - Min pool temperature of 65 °F applied (see back up TS)
  - Revised bounding CNV heat removal approach

LTC Analysis Update for incoming RAIs

- Minimum Cooldown Rate (LOCA)
  - Similar assumptions as presented in LTR section 5.3.1
  - Conclusions similar as described in the LTR
    - Non-limiting from a FOM perspective (RCS level, precipitation limits, SAFDLs well bounded by short term transients)
- Maximum Cooldown Rate (LOCA)
  - {{

}}2(a),(c)

  - Pool temperature 65F (see tech spec slide for details)
  - PZR level 52% (low range of normal)
    - Combination of high RCS Tavg and low PZR level creates minimum RCS mass initial condition for LOCA
  - Compressible flow {{ }}2(a),(c)
    - See RAI 9470 15.06.05-10 slide for details
  - Single failure of 1 ECCS division.
- Non-LOCA Sensitivity
  - Non-limiting for any FOM

Tech Spec Changes to Min Pool Temperature for LTC

- LCO 3.5.3 aligned with initial condition assumption of LTC analysis by modifying to require pool bulk average temperature be in the range of ≥ 65 °F and ≤ 110 °F.
  - (Level and Boron Concentration are not affected by this change.)
- Technical Specification 3.5.3, Ultimate Heat Sink (UHS)
- Applicable at all times due to multi-unit function of the UHS
- Corresponding Bases changes to reflect this change, including discussion in Applicable Safety Analyses section.

Alignment of LOCA EM and LTC Model

- The LTC model is derived from the LOCA EM with select nodalization simplifications for the purpose of evaluating quasi-equilibrium conditions over an extended duration.

- The 'coarser' model presented in the LOCA LTR is used with the following changes:
  - {{

}}2(a),(c)

- When modeling the steam generator tube failure event the tube breaks are explicitly modeled.

RAI 9470 15.06.05-10

Question: Provide the justification and basis for using a control system in NRELAP5 to adjust the RVV flow coefficient in the LTC event and evaluate the impact on this methodology as compared to the App K modeling in the LOCA LTR.

Draft Response: The direction of conservative modeling of ECCS capacity is opposite for the short term LOCA transient response versus the long term LOCA response. For the short term LOCA response, sensitivities show that a maximum ECCS capacity is conservative for CHF and RCS level while for the long term LOCA response, minimum ECCS capacity is conservative for evaluating the minimum RCS level response. During LTC phase, both the reactor pressure vessel and containment vessel continue to depressurize with heat removal from the containment wall to the ultimate heat sink (reactor cooling pool) resulting in thermal hydraulic conditions where the pressure drop across the reactor vent valves (RVVs) becomes on the same order of magnitude as the RPV pressure. Under these conditions, there is {{ }}
2(a),(c) to account for the reduction in the RVV capacity.

As detailed in Section 4.1 of LTC TR, {{

}} 2(a),(c)

RAI 9479 15.06.05-5

Question: Revise the method to include DHRS cooling or provide an analysis justification for DHRS isolation that is appropriate for post-LOCA LTC, and provide markups to the TR for necessary changes.

Draft Response: For the purposes of evaluating the minimum RCS temperature, DHRS cooling accounts for up to {{

}} 2(a),(c) in the long term in comparison to the RPV heat loss and ECCS heat removal. This is not a major portion of the overall system energy balance, {{

}} 2(a),(c)

RAI 9516 15.26

Question: Discuss analysis differences between the LTC-EM nodalization of the letdown line break, including the basis and justification for changes to the LOCA-EM model for the conditions noted. Describe how the differences between the model nodalization resulted in the differences between the calculated results. Alternatively, the applicant may provide a detailed technical basis justifying the LTC EM nodalization based on adequately capturing the uncertainty associated with the highly ranked phenomena identified by the PIRT.

Draft Response: The updated LTC NRELAP model is developed from {{

}}2(a),(c)

RAI 9523 15.14

Question: The staff notes that in Section 5.3 of TR-0916-51299, "Demonstration of Results," that no non-LOCA cases for minimum cooldown appear to have been evaluated as was the case for LOCAs. The staff notes that reactor coolant system (RCS) conditions following a non-LOCA transient such as turbine trip or loss of normal feedwater would yield different RCS conditions than a LOCA upon reaching the inadvertent actuation block (IAB) release threshold. Therefore, the staff is requesting additional information or justification as to why a non-LOCA minimum cooldown case was not evaluated. If one has been evaluated, the staff is requesting the applicant update TR-0916-51299 as appropriate. If non-LOCA minimum cooldown case(s) has been evaluated or need to be evaluated, the applicant should address the effect of IAB setpoint uncertainty on the resulting long term cooling acceptance criteria.

Draft Response: The purpose of the LTC technical report is to demonstrate ECCS performance criteria are met for the NuScale design after the point at which recirculation flow has been established from containment, consistent with the phase definitions presented in the LOCA EM LTR. The onset of recirculation flow and therefore the start of LTC occurs after the CNV and RPV are nearly equalized from a liquid inventory and pressure standpoint. At this point, the particular initiating event is not very important to the overall LTC response except for some variance in decay heat due to transient progression and event dependent differences in RCS inventory available for ECCS cooling. Particularly, the non-LOCA progression for the decrease in RCS inventory events creates the limiting scenarios from the perspective of RCS liquid mass and are evaluated to determine if there is any challenge from a core cooling perspective.

The purpose of the minimum cooldown cases presented in the LTC TR is to generally show the short term transient evaluations presented in the LOCA and non-LOCA LTRs are well bounding from a SAFDLs perspective. This is demonstrated in section 5.3.1 for a typical LOCA where the collapsed level results are improved over the nominal LOCA comparison case. {{

}}$^{2(a),(c)}$ For the non-LOCA cases, ECCS transition occurs once DHRS cooling has sufficiently cooled the RCS to cause the necessary depressurization for the IAB to release. This occurs at much lower temperature and pressure conditions than the typical LOCA or IORV such that the presented minimum cooldown scenario bounds the DHRS transition scenarios.

The LTC TR will be updated to include justification as to how the minimum cooldown non-LOCA scenarios are bounded by or sufficiently similar to the presented minimum cooldown results to not require being added to the LTC TR

RAI 9516 15.23

Question:
Since the conditions at the time of ECCS actuation for tests HP-19a and HP-19b may be different for a non-LOCA event which transitions from the DHRS to the ECCS for LTC, the applicability of these tests to the LTC of non-LOCA events should be justified.

Justify the applicability of the NIST-1 HP-19a and HP-19b tests to validate the LTC EM used to simulate the non-LOCA transition from DHRS cooling to long term cooling with the ECCS and provide as discussion or reference to the scaling evaluation performed to show the applicability of these tests to the LTC for the non-LOCA events.

Draft Response: Specific testing validation of the DHRS transition to ECCS event is not necessary because that transient progression sufficiently bounded by the combination of limiting event scenarios presented in the LOCA, non-LOCA and CNV P&T Evaluation submittals. For example, the inadvertent RVV opening events combined with loss of EDSS presented in the LOCA LTR, results in a complete ECCS actuation within a couple of seconds, much sooner than the limiting reactivity and heatup events analyzed in the non-LOCA LTR which do not reach the upper limit for IAB release pressure (1200 psia) in the first 30 minutes of DHRS cooling. The core power and RCS temperature conditions are more limiting for the purposes of evaluating SAFDLs for the IORV event than any event progression where DHRS cooling is established such that no further evaluation or validation is determined to be necessary. This is also true for peak CNV pressure where both LOCA and non-LOCA cases are analyzed to determine the events that include DHRS cooling are bounded by the IORV.

The purpose of the LTC technical report is to demonstrate ECCS performance criteria are met for the NuScale design after the point at which recirculation flow has been established from containment, consistent with the phase definitions presented in the LOCA EM LTR. The purpose of addressing DHRS to ECCS transient progressions in the LTC TR is to demonstrate these event scenarios do not result in more challenging conditions for the purpose of the long term ECCS performance criteria.

RAI 9522 15.13

Question: 1) The second paragraph in Section 5.3.3, states, "As illustrated by the results presented in this section, and sensitivities where ECCS valves opened at the inadvertent actuation block (IAB) release pressure, the effects of steam generator tube failure (SGTF) and DHRS with the maximum cooldown case does not significantly affect the previous maximum cooldown conclusions." The staff is seeking clarification as this paragraph seems to be referring to a case where the IAB opens which is unlikely to be at 24 hours.
2) Figure 5-36 shows that reactor coolant system (RCS) core inlet temperature drops at 40 hours while the other plots in Section 5.3.3 are stable (remain constant). Provide justification as to the change in RCS core inlet temperature at 40 hours.
3) Table 5-1 provides the assumptions associated with the SGTF maximum cooldown case. The staff notes that in Section 5.3, Demonstration of Limit Results, the applicant states that, "100 percent of the American Nuclear Society (ANS) decay heat standard i.e., ANS-73, including actinide contribution, is a conservatively high assumed decay heat assumed in this scenario." The use of a 1.0 multiplier for the maximum cooldown appears to be non-conservative based on the results of the maximum line break cooldown given in Figure 5-18, Riser Collapsed Liquid Level, where a 0.8 decay heat multiplier yielded a lower liquid level. Therefore, the staff seeks clarification as to why the using a 1.0 multiplier is conservative.

Draft Response:
1) The steam generator tube failure results presented in section 5.3.3 of the Long Term Cooling Methodology Technical Report (TR) are from a scenario where AC power is lost but DC power is available such that ECCS actuation is delayed until the 24 hour delay is reached. The statement in question is referring to a sensitivity that isn't presented in the LTC TR where DC power is also assumed unavailable such that the ECCS valves open once the IAB release pressure is reached due to DHRS cooling. The conclusion is that both SGTF scenarios are bounded by the normal LOCA progression from the perspective of minimum RCS level which is consistent with the updated calculation results.
2) Upon ECCS actuation at 24 hours, {{

}}2(a),(c)

3) Sensitivities show that higher decay heat is conservative for minimum level. {{

}}2(a),(c) The updated SGTF calculations apply the same maximum decay heat as the LOCA cases.

RAI 9522 15.13 (cont.)

Question:
4) Based on the discussion in Section 5.1, the SGTF non-LOCA event was chosen due to the loss of inventory. However, the chemical and volume control system line break outside of containment has a greater mass loss than the SGTF. Therefore, the staff is seeking additional information as to why the SGTF would lead to the lowest collapsed liquid level for a non-LOCA event.
5) It is unclear to the staff how the maximum SGTF cooldown event progression prior to ECCS actuation is different than that assumed in FSAR Section 15.6.3, SGTF, especially with regard to the assumption when alternating current (AC) power is lost and the effect on RCS inventory.

Draft Response:
4) The reason the SGTF event presented in the LTC TR is limiting is because the CVCS line break is isolated once low PZR pressure is reached which occurs {{

}}2(a),(c)

5) The SGTF event described in the LTC TR is a stylized transient that primarily evaluates the impact of a bounding low initial RCS inventory condition. Because the PZR level is initialized at the low low PZR level analytical limit of 20%, reactor trip, DHRS actuation and CNV isolation occur immediately along with the tube failure itself. From this point the LTC scenario continues losing inventory to the faulted SG until the primary and secondary pressures equalize. The limiting mass release transient presented in the FSAR section 15.6.3 was initialized at high biased PZR level {{

}}2(a),(c)

RAI 9516 15.24

Question:
NIST-1 HP-19A Test NRELAP5 Assessment

- Provide additional information as to the basis for the prediction of the reactor vessel water level in relation to the containment water level.
- Explain the physical basis for the good prediction of RPV and containment vessel pressures, while the observed thermal stratification and level in the cooling pool is not accurately predicted.
- Identify any areas of uncertainty which could lead to an accurate prediction of reactor vessel and containment pressures while other key phenomena are not predicted well.

Draft Response Outline:

- {{

}}2(a),(b),(c),ECI

RAI 9516 15.25

Question:
NIST-1 HP-19B Test NRELAP5 Assessment

- Describe how the containment atmospheric initial condition affected the test transient response in comparison to the HP-19a test
- Describe why the containment level is within the upper test bound (Figure 4-9) while the predicted RPV level (Figure 4-10) is outside the lower test bound
- Discuss the change in NRELAP5 cooling pool simulation of the upper temperature prediction at approximately 50,000 seconds in Figure 4-16

Draft Response Outline:

- Response will provide additional context to the differences in HP-19A and HP-19B test initial conditions and how the differences affect the test progression
  - {{

    }}2(a),(b),(c),ECI
- Response will provide additional information on {{

  }}2(a),(b),(c),ECI to provide necessary context on test progression assessment conclusions.
- Response will provide additional plots and discussion of cooling pool temperature predictions at upper elevations

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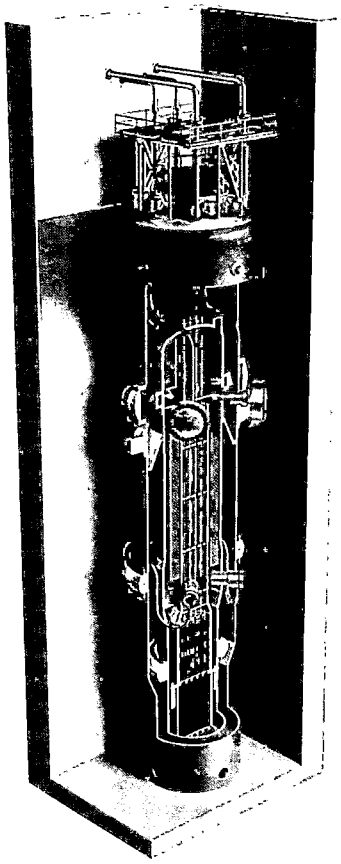

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Enclosure 3:

Affidavit of Zackary W. Rad, AF-1118-63605

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AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

(1) I am the Director of Regulatory Affairs of NuScale Power, LLC (NuScale), and as such, I have been specifically delegated the function of reviewing the information described in this Affidavit that NuScale seeks to have withheld from public disclosure, and am authorized to apply for its withholding on behalf of NuScale.

(2) I am knowledgeable of the criteria and procedures used by NuScale in designating information as a trade secret, privileged, or as confidential commercial or financial information. This request to withhold information from public disclosure is driven by one or more of the following:

(a) The information requested to be withheld reveals distinguishing aspects of a process (or component, structure, tool, method, etc.) whose use by NuScale competitors, without a license from NuScale, would constitute a competitive economic disadvantage to NuScale.

(b) The information requested to be withheld consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), and the application of the data secures a competitive economic advantage, as described more fully in paragraph 3 of this Affidavit.

(c) Use by a competitor of the information requested to be withheld would reduce the competitor's expenditure of resources, or improve its competitive position, in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.

(d) The information requested to be withheld reveals cost or price information, production capabilities, budget levels, or commercial strategies of NuScale.

(e) The information requested to be withheld consists of patentable ideas.

(3) Public disclosure of the information sought to be withheld is likely to cause substantial harm to NuScale's competitive position and foreclose or reduce the availability of profit-making opportunities. The accompanying presentation material reveals distinguishing aspects about the method by which NuScale develops its long term cooling methodology.

NuScale has performed significant research and evaluation to develop a basis for this method and has invested significant resources, including the expenditure of a considerable sum of money.

The precise financial value of the information is difficult to quantify, but it is a key element of the design basis for a NuScale plant and, therefore, has substantial value to NuScale.

If the information were disclosed to the public, NuScale's competitors would have access to the information without purchasing the right to use it or having been required to undertake a similar expenditure of resources. Such disclosure would constitute a misappropriation of NuScale's intellectual property, and would deprive NuScale of the opportunity to exercise its competitive advantage to seek an adequate return on its investment.

(4) The information sought to be withheld is in the enclosed presentation material entitled "LTC RAI Closure Plan." The enclosure contains the designation "Proprietary" at the top of each page containing proprietary information. The information considered by NuScale to be proprietary is identified within double braces, "{{ }}" in the document.

(5) The basis for proposing that the information be withheld is that NuScale treats the information as a trade secret, privileged, or as confidential commercial or financial information. NuScale relies upon

the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC § 552(b)(4), as well as exemptions applicable to the NRC under 10 CFR § 2.390(a)(4) and 9.17(a)(4).

(6) Pursuant to the provisions set forth in 10 CFR § 2.390(b)(4), the following is provided for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld:

(a) The information sought to be withheld is owned and has been held in confidence by NuScale.

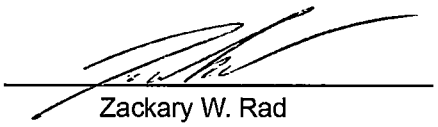
(b) The information is of a sort customarily held in confidence by NuScale and, to the best of my knowledge and belief, consistently has been held in confidence by NuScale. The procedure for approval of external release of such information typically requires review by the staff manager, project manager, chief technology officer or other equivalent authority, or the manager of the cognizant marketing function (or his delegate), for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside NuScale are limited to regulatory bodies, customers and potential customers and their agents, suppliers, licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or contractual agreements to maintain confidentiality.

(c) The information is being transmitted to and received by the NRC in confidence.

(d) No public disclosure of the information has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to NRC, have been made, or must be made, pursuant to regulatory provisions or contractual agreements that provide for maintenance of the information in confidence.

(e) Public disclosure of the information is likely to cause substantial harm to the competitive position of NuScale, taking into account the value of the information to NuScale, the amount of effort and money expended by NuScale in developing the information, and the difficulty others would have in acquiring or duplicating the information. The information sought to be withheld is part of NuScale's technology that provides NuScale with a competitive advantage over other firms in the industry. NuScale has invested significant human and financial capital in developing this technology and NuScale believes it would be difficult for others to duplicate the technology without access to the information sought to be withheld.

I declare under penalty of perjury that the foregoing is true and correct. Executed on November 29, 2018.



Zackary W. Rad