RAIO-0819-66755

August 23, 2019

Docket No. 52-048

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 523 (eRAI No. 9682) on the NuScale Design Certification Application

REFERENCES:
1. U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 523 (eRAI No. 9682)," dated June 06, 2019
2. NuScale Power, LLC Response to NRC "Request for Additional Information No. 523 (eRAI No.9682)," dated July 26, 2019
3. NuScale Power, LLC Response to NRC "Request for Additional Information No. 523 (eRAI No.9682)," dated July 31, 2019

The purpose of this letter is to provide the NuScale Power, LLC (NuScale) response to the referenced NRC Request for Additional Information (RAI).

The Enclosures to this letter contain NuScale's response to the following RAI Question from NRC eRAI No. 9682:

- 12.03-66

The responses to RAI Questions 12.03-64, 12.03-64 and 12.03-67 were previously provided in References 2 and 3. This completes all responses to eRAI 9682.

Enclosure 1 is the proprietary version of the NuScale Response to NRC RAI No. 523 (eRAI No. 9682). NuScale requests that the proprietary version be withheld from public disclosure in accordance with the requirements of 10 CFR § 2.390. The enclosed affidavit (Enclosure 3) supports this request. Enclosure 2 is the nonproprietary version of the NuScale response.

This letter and the enclosed responses make no new regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions on this response, please contact Carrie Fosaaen at 541-452-7126 or at cfosaaen@nuscalepower.com.

Sincerely,

Zackary W. Rad
Director, Regulatory Affairs
NuScale Power, LLC

Distribution: Gregory Cranston, NRC, OWFN-8H12
Samuel Lee, NRC, OWFN-8H12
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 9682, proprietary

Enclosure 2: NuScale Response to NRC Request for Additional Information eRAI No. 9682, nonproprietary

Enclosure 3: Affidavit of Zackary W. Rad, AF-0819-66756

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Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 9682, proprietary

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Enclosure 2:

NuScale Response to NRC Request for Additional Information eRAI No. 9682, nonproprietary

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Response to Request for Additional Information
Docket No. 52-048

eRAI No.: 9682
Date of RAI Issue: 06/06/2019

NRC Question No.: 12.03-66

Regulatory Basis:

10 CFR 50.44(c)(4) requires that equipment must be provided for monitoring hydrogen and oxygen in the containment. The equipment must be functional, reliable, and capable of continuously measuring the concentration of hydrogen and oxygen in the containment atmosphere following significant beyond design-basis accidents, for accident management, including emergency planning.

10 CFR 50.34(f)(2)(vii) requires that applicants perform radiation and shielding design reviews of spaces around systems that may, as a result of an accident, contain accident source term radioactive materials, and design as necessary to permit adequate access to important areas.

10 CFR Part 20 establishes standards for protection against ionizing radiation resulting from activities conducted under licenses issued by the Nuclear Regulatory Commission. In addition, 10 CFR Part 20, Subpart C, establishes the occupational dose limits.

In addition, while NUREG-0737 doesn't establish regulatory requirements for the NuScale application, NUREG-0737, Section II.B.2, provides context regarding the actions that should be considered in addressing the requirement of 10 CFR 50.34(f)(2)(vii). NUREG-0737, Section II.B.2, indicates that any area which will or may require occupancy to permit an operator to aid in the mitigation of or recovery from an accident are areas that should be reviewed to ensure that adequate access is permitted. Furthermore, Section II.B.2 provides numerous examples of areas that should be considered for this evaluation, these areas include to the hydrogen control system and containment isolation reset control area. These examples clearly

specify that actions associated with hydrogen control and isolation of containment should be considered as actions necessary for consideration to meeting 10 CFR 50.34(f)(2)(vii). Furthermore, Section II.B.2 indicates that the dose criteria used for this evaluation should be 5 rem.

Background:

On January 31, 2019, NuScale submitted an exemption request from 10 CFR 50.34(f)(2)(viii). NuScale indicates in the exemption request that part of the basis for the exemption is because the NuScale design includes the capability to perform hydrogen and oxygen monitoring in accordance with 10 CFR 50.44(c)(4). NuScale describes the process for conducting hydrogen and oxygen monitoring in the FSAR and in TR-0716-50424, "Combustible Gas Control." However, while NuScale requests an exemption from 10 CFR 50.34(f)(2)(viii) based in part on the ability to perform hydrogen and oxygen monitoring, NuScale has not demonstrated an ability to perform hydrogen and oxygen monitoring within applicable Part 20 Occupational Dose Limits. Therefore, it is apparent that the applicant needs to demonstrate that the design meets the requirements of 10 CFR 50.44(c)(4) and 10 CFR 50.34(f)(2)(vii) by adequately demonstrating safe access to perform the necessary actions to conduct hydrogen and oxygen monitoring.

Issue:

In order for staff to conclude that actions associated with hydrogen and oxygen monitoring can be performed in accordance with NRC requirements, the staff needs additional information.

Requests:

1. Provide information demonstrating the ability of operators to perform post-accident hydrogen and oxygen monitoring following a significant beyond design-basis accident. The response should discuss all necessary manual actions, the locations and expected durations of these actions, including any actions necessary to prevent an uncontrolled release of radioactive material. The source term assumed for this analysis must be based on a significant beyond design-basis accident. The response should consider all significant sources of radiation exposure (including airborne radioactive material) and access and egress to areas. The evaluation should provide assurance that manual actions can be conducted without exceeding the 5 rem occupational dose limits in Part 20.

2. Provide, drawings which demonstrate the flow path, including equipment, which

would establish the continuous monitoring of hydrogen and oxygen in containment following a beyond design basis accident.

NuScale Response:

Response to Request #1.

Introduction:

The NuScale design includes equipment that provides the capability for monitoring hydrogen and oxygen in containment during significant beyond design-basis accident conditions. This equipment is capable of continuously measuring the concentration of hydrogen and oxygen in the containment atmosphere following a significant beyond design-basis accident (reference the NuScale technical report TR-0716-50424 "Combustible Gas Control").

No manual operator action is expected or planned at the containment sampling system skid, which is located on Elevation 100' of the Reactor Building. The containment sampling system equipment can be operated remotely from the main control room. The containment sampling system is powered by the on-site AC power source, which has the backup diesel generator as backup power source in a loss of normal AC power event.

There is also no anticipated need for re-isolating containment after opening containment to perform hydrogen and oxygen monitoring. In the case of postulated potential hydrogen monitoring system leaks, FSAR Section 9.3 describes that this system is used during normal operations, therefore system leaks would be identified and corrected during normal operations. Therefore, it is reasonable to assume that the system's integrity is intact during an accident. In addition, unexpected or unanticipated actions taken by plant personnel to address plant conditions will be guided and managed by the emergency response organization, consistent with 10 CFR 50.47(b). For actions related to hydrogen monitoring, NuScale's analyses have shown that there is no credible threat to containment integrity due to combustible gases for the first 72 hours post-event. Therefore, a 72 hour time frame allows for the development of unplanned action plans by the emergency response organization appropriate for the situation. Consequently, operator dose evaluations for potential emergency actions that are either not known or unplanned do not need to be performed.

Responsibilities of the site licensee emergency response organization include the development of ad hoc activities that provide reasonable assurance that the health and safety of the public is not endangered.

Unanticipated or unplanned actions are not within the scope of needing a formal, design phase operator dose evaluation. Therefore, the only operator action potentially within the scope of needing such a dose evaluation is the action to manually open the CES CIVs to establish the hydrogen and oxygen monitoring flow path. However, according to Regulatory Guide 1.183, because the hydrogen and oxygen monitoring equipment are provided only for the purposes of severe accident monitoring and are not credited in any design basis accident, operator radiological exposure consequences need not be evaluated. The basis for this is analogous to the approach in Regulatory Guide 1.183 pertaining to offsite radiological consequences of containment purging operations (related to combustible gas or pressure control), which states that radiological consequences of containment purging operations need not be evaluated if the installed containment purging capabilities are maintained for purposes of severe accident management and are not credited in any design basis analysis. The NuScale design does not credit the hydrogen monitoring system in any design basis accident, and is maintained only for the purpose of severe accident management, therefore the radiological consequences do not need to be evaluated. Notwithstanding, to demonstrate that the NuScale design provides large margins for such operator actions, a scoping calculation was performed to evaluate the local post-accident dose rates in the areas for accessing the assumed operator actions for initiating containment gas monitoring.

Background:

To initiate post-accident containment gas monitoring, following a significant beyond design-basis accident, the operator aligns the containment evacuation system (CES), the process sampling system (PSS), and the containment flood and drain system (CFDS) to create a closed loop. This closed loop requires opening of CES and CFDS containment isolation valves (CIVs) to discharge gas from the containment vessel (CNV) to CES, route it to the containment monitoring system skid equipped with online hydrogen and oxygen monitors, and return the gaseous stream back to the CNV via the PSS process effluent line connected to CFDS piping. This closed loop eliminates discharging radioactive effluent to the environment.

If there is an active containment isolation signal (CIS) still in place (RCS temperature greater than 200°F), the CES CIVs need to be manually opened by operators at the CIV hydraulic control skids. The CFDS CIVs can be opened from the MCR utilizing the override switch. The CIV hydraulic control skids are located at two separate locations (for division separation), one in the steam gallery on Elevation 100' and one in the mechanical equipment area on Elevation 126' of the Reactor Building (RXB). Opening the CES CIVs requires operator actions at both hydraulic control skids, if there is an active CIS in place.

Opening the CIVs to establish flow through the online hydrogen and oxygen gas analyzer can be performed with minimal radiation exposure because most of the assumed core damage source term will be confined to the affected module and the Reactor Building pool room (from containment leakage). The hydraulic skids on the RXB 100' elevation are used to open the first CIV, then the hydraulic skids on the RXB 126' elevation are used to open the second CIV. The two containment isolation valves are in series, therefore fluid cannot flow until both CIVs are opened. Fluid from the CNV will still not flow to the hydrogen monitor until the other system valves are opened, which can be remotely operated. Because the second CIV can be opened on the RXB 126' elevation, there is additional shielding from the potential accident source term on the RXB 100' elevation. Therefore, the operator has the ability and time to egress the area without being near the containment gaseous source term.

Scoping Calculation:

An engineering scoping calculation has been performed to evaluate the potential for dose rates near the RXB 100' elevation hydraulic skid (the limiting location). The result of this calculation indicate an increase of {{ }}$^{2(a)(c)}$ mrad/hr (mrad assumed to be equivalent to mrem) to the design basis dose rates of <0.25 mrem/hr (maximum radiation zone of I in FSAR Figure 12.3-1g). The increase in the area dose rate considers core damage source term shine contributions from:

- CNV Vapor,
- Active HVAC exhaust duct, or Bioshield Envelope and Pool Room airborne sources (whichever is larger).

The CNV vapor space is assumed to contain 100% of the released radioisotopes from the core damage event to the CNV, as listed in Table 1. This activity is assumed to be in vapor form and located in the upper CNV, to maximize the potential dose rates into the RXB 100' elevation steam gallery. Penetration design of the RXB pool wall on the 100' elevation was accounted for by increasing the CNV shine from a core damage event to the radiation zone's upper boundary (2.5 mrem/hr), consistent with COL item 12.3-8.

The assumption of an active HVAC system exhausting the bioshield envelope airborne activity (nobles and halogens) into the RXB 100' elevation was evaluated by simulating a 16 gauge, 2ft x 2ft x 30ft rectangular duct near the ceiling. The isotopic inventory assumed to be within the duct is listed in Table 1, which is selected to represent the limiting source photon energy release between the onset of the event and 72 hours after onset. The HVAC source term is calculated assuming the CNV leakage is collected instantaneously and volumetrically distributed by the HVAC flow rate. CNV leakage of 0.2%/day was applied to noble gases and halogens, and was

determined to adequately account for potential beyond design basis accident source term that could be moved by an active HVAC system for the following reasons:

A. Noble gases and volatile halogens have the greatest potential for leaking from an intact CNV, and subsequently stay suspended in the airspace of the bioshield envelope

B. The inventory released to the CNV vapor space experiences many credited removal mechanisms including thermophoresis, diffusiophoresis, and sedimentation such that only a small fraction of non-gaseous fission products remain in the CNV vapor space an hour after the end of the release from the core. Non-credited removal mechanisms include plate out and precipitation in the CNV such that most of the non-gaseous material will collect on the CNV walls and in the liquid coolant in the sump during the release to the CNV. The CNV leakage is the result of microscopic holes in seals and valve seats creating a torturous path for vapors leaking from the CNV resulting in additional limitations for particulates to exit the CNV to the bioshield envelope. In addition, the bioshield envelope will be a humid environment , which will further inhibit the prolonged presence of non-gaseous fission products. Thus, of the aerosol released to the CNV, there is limited potential for the non-gaseous inventory to leak to the bioshield envelope, and even less potential for the non-gaseous inventory to be transported by an active HVAC system.

C. Finally, the characteristics that limit particulates from reaching the HVAC system will also reduce particulate halogens and reactive volatile forms of iodine. Therefore, assuming 100% of the halogens in the CNV leakage are collected by an active HVAC system will more than account for any minor contribution of other particulates.

The airborne activity in the bioshield envelope and the pool room is determined using the CNV leakage source term and distributing it within the available air volume. The airborne activity in the bioshield envelope conservatively assumes the presence of other fission and activation product particulates, although the presence of such particulates outside of the CNV is very limited by natural processes, as described above.

For dose calculations, the more limiting contributor of the HVAC duct and the bioshield - pool room airborne source terms is utilized, because there won't be shine from both the bioshield envelope and the HVAC duct, simultaneously.

The isotopic inventories listed in Table 1 include daughter product in-growth calculated using ICRP-107 branching fractions.

{{

}}2(a),(c)

{{

}}2(a),(c)

{{

}}2(a)(c)

Table 2 provides the shielding parameters used in the scoping calculation for determining beyond design basis (core damage) accident dose rates to the steam gallery on the RXB 100' elevation.

{{

}}2(a)(c)

The results of this scoping calculation in Table 3 indicate that the area dose rates in the vicinity of the CIV hydraulic skid on the RXB 100' elevation are manageable.

{{

}}2(a)(c)

The dose rate at the RXB 126' elevation would be less than the RXB 100' elevation due to additional shielding from the concrete floor, therefore assuming that the dose rates at both locations are the same {{ }}[2(a)(c)] is conservative.

Conclusion:

Therefore, an operator has more than {{ }}[2(a)(c)] to conduct the local, manual operations related to containment gas monitoring before the radiation exposure to the operator would approach 5 rem. These are the maximum dose rates for the first 72 hours and demonstrates there is adequate margin in the NuScale design to account for uncertainties.

Response to Request #2.

The flow path used to monitor for hydrogen includes portions of the CES, PSS and CFDS. These systems are depicted in FSAR Figures 9.3.6-1, 9.3.2-1, and 9.3.6-2, respectively. The flow path is shown below using red lines:

Figure 9.3.6-1: Containment Evacuation System Diagram

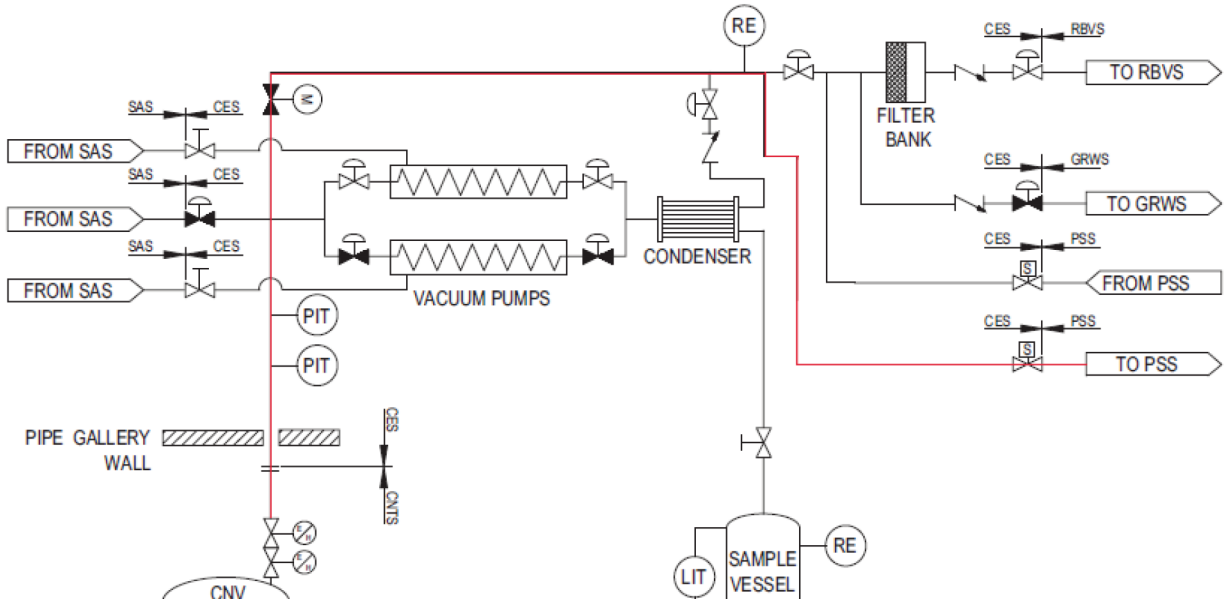
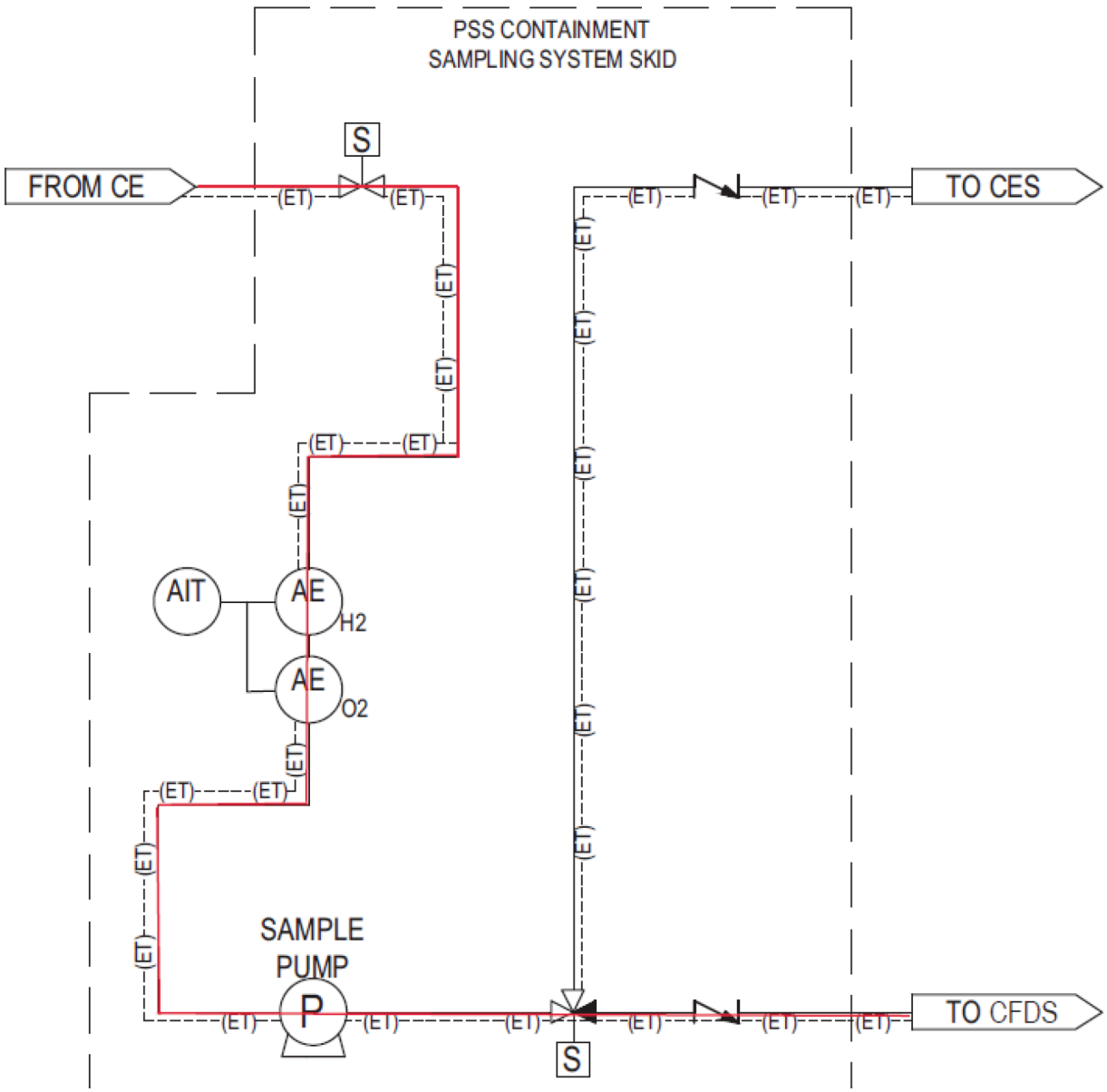
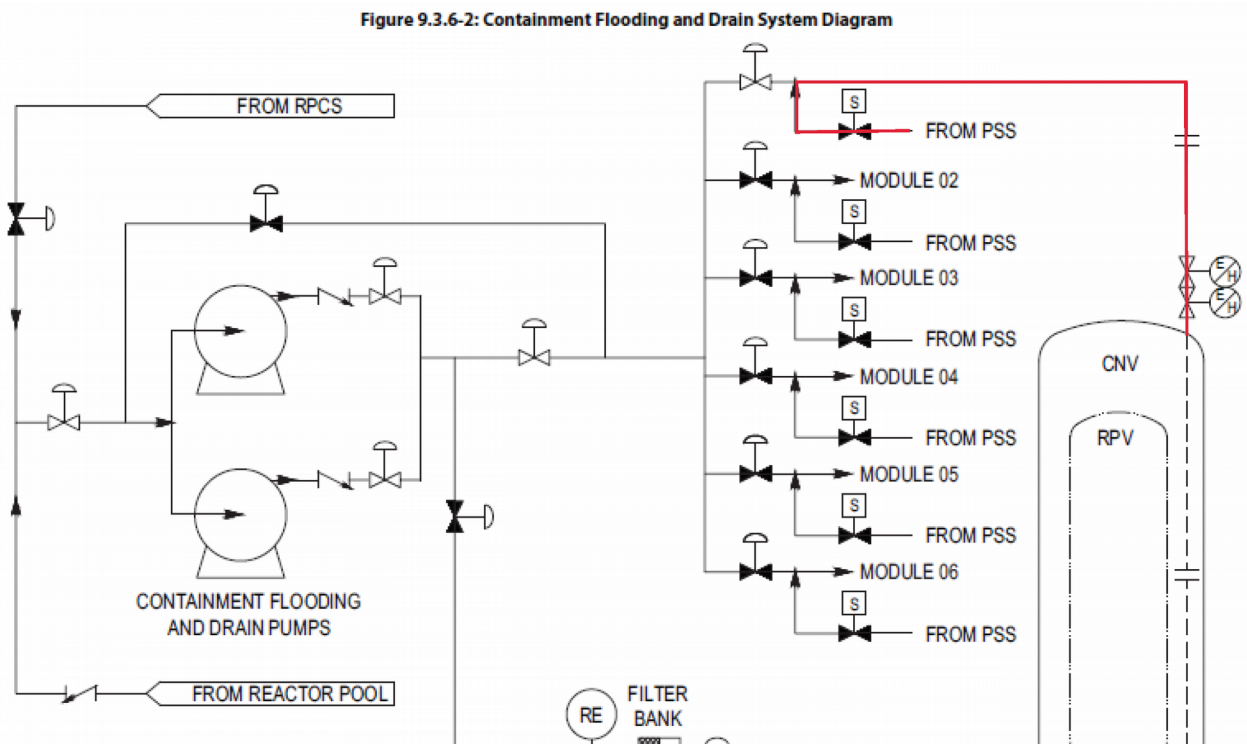


Figure 9.3.2-1: Containment Sampling System Diagram





Impact on DCA:

There are no impacts to the DCA as a result of this response.

Enclosure 3:

Affidavit of Zackary W. Rad, AF-0819-66756

NuScale Power, LLC

AFFIDAVIT of Zackary W. Rad

I, Zackary W. Rad, state as follows:

1. I am the Director, 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 Request for Additional Information response reveals distinguishing aspects about the method by which NuScale develops its area dose rates.

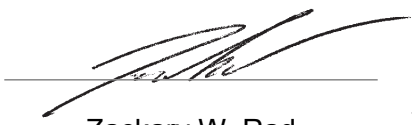
    NuScale has performed significant research and evaluation to develop a basis for this method and has invested significant resources, including the expenditure of a considerable sum of money.

    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 response to NRC Request for Additional Information No. 523, eRAI 9682. 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 August 23, 2019.



Zackary W. Rad