UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 30, 2018

MEMORANDUM TO: Samuel S. Lee, Chief
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

FROM: Anthony W. Markley, Senior Project Manager ***/RA/***
Licensing Branch 1
Division of New Reactor Licensing
Office of New Reactors

SUBJECT: AUDIT SUMMARY FOR THE REGULATORY AUDIT OF THE RADIOACTIVE WASTE MANAGEMENT SYSTEM FOR NUSCALE POWER, LLC

NuScale Power, LLC (NuScale), submitted by letter dated December 31, 2016, to the U.S. Nuclear Regulatory Commission (NRC) a Design Control Document for its Design Certification Application (DCA) of the NuScale small modular reactor (SMR) design (Agency wide Documents Access and Management System Accession (ADAMS) No. ML17013A229). The NRC staff started its detailed technical review of NuScale's DCA on March 27, 2017.

The purpose of the NRC's regulatory audit of the Radioactive Waste Management System aspects of the DCA was to: (1) gain a better understanding of the NuScale SMR design; (2) assess submitted information; (3) identify information that will require docketing to support the licensing basis and/or regulatory decisions; and (4) review related non-docketed information to allow the NRC staff to better inform their regulatory decision making.

During Phase I of the DCA review, the NRC staff conducted a safety audit of the Radioactive Waste Management aspects of the DCA. The audit was conducted in accordance with the NRC Office of New Reactors (NRO) Office Instruction, NRO-REG-108, "Regulatory Audits" (ADAMS Accession No. ML081910260). The audit was conducted from June 20, 2017, through November 15, 2017, in accordance with, "Audit Plan for the Regulatory Audit of Chapter 11, "Radioactive Waste Management" for NuScale Power LLC" (ADAMS Accession No. ML17159A685).

The NRC staff focused its review on information related to the unique and novel features of the NuScale SMR design and de-emphasized those aspects found similar to, or that had a lower radiological significance than other large light-water reactor designs. The NRC staff used the supporting information contained in the DCA and NuScale Technical Report TR-1116-52065-NP, Revision 0, "Effluent Release (GALE Replacement) Methodology and Results," to evaluate the analytical results provided in the tables and figures of the application.

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Where clarification was needed, the NRC staff used information available through the audit to examine the methods, models, and assumptions implemented by the applicant to determine the radioactive material content of systems, structures, and components, kinds and quantities of the resultant radiation sources and source terms, types of design features provided to support the radioactive waste management system, and the calculated doses to radiation workers and members of the public.

Enclosed with this memorandum are materials relevant to the closure of this audit. The enclosures are as follows: (1) NuScale Power, LLC, DCA Radioactive Waste Management System Audit Report, (2) Specific Audit Items, (3) Specific Editorial Items, and (4) Requests for Additional Information.

Docket No. 52-048

Enclosures:
1. Audit Report
2. Specific Audit Items
3. Specific Editorial Items
4. Requests for Additional Information

SUBJECT: AUDIT SUMMARY FOR THE REGULATORY AUDIT OF THE RADIOACTIVE WASTE MANAGEMENT SYSTEM FOR NUSCALE POWER, LLC

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U.S. NUCLEAR REGULATORY COMMISSION

NUSCALE POWER, LLC DESIGN CONTROL APPLICATION

RADIOACTIVE WASTE MANAGEMENT SYSTEM AUDIT REPORT

JUNE 20, 2017 – NOVEMBER 15, 2017

1. BACKGROUND

The purpose of this U.S. Nuclear Regulatory Commission's (NRC) regulatory audit was to facilitate the NRC staff's evaluation of information related to its safety analyses for the Radioactive Waste Management System; and to facilitate its safety review of NuScale Power, LLC (NuScale) Design Certification Application (DCA) Chapter 11, "Radioactive Waste Management," as well as the related supporting sections of the application. The NRC staff also:

- Gained a better understanding of the NuScale design,
- Assessed submitted information,
- Identified information that will require docketing to support the licensing basis and/or regulatory decisions,
- Reviewed related non-docketed information to allow the NRC staff to better inform their regulatory decision making, and
- Developed follow-up requests for additional information.

The NRC staff focused its review on information related to the unique and novel features of the NuScale small modular reactor (SMR) design and de-emphasized those aspects found to be similar to large light-water reactors (LWRs). The NRC staff used the supporting information contained in the DCA and NuScale Technical Report (TR)-1116-52065-NP, Revision 0, "Effluent Release (GALE Replacement) Methodology and Results," to evaluate the analytical results provided in the tables and figures of the application. Where clarification was needed, the NRC staff used information available through the audit to examine the methods, models, and assumptions implemented by the applicant to determine the radioactive material content of structures, systems, and components (SSCs), kinds and quantities of the resultant radiation sources and source terms, types of design features provided to support the radioactive waste management system, and the calculated doses to radiation workers and members of the public.

2. Regulatory Basis

The NRC staff's criteria is based on meeting the relevant requirements of the following NRC regulations:

- Title 10 of the *Code of Federal Regulations* (CFR) Part 20, Appendix B
- 10 CFR 20.1101(b), 10 CFR 20.1301, 10 CFR 20.1302, 10 CFR 20.1406
- 10 CFR 50.34, 10 CFR 50.36, 10 CFR 50.48, 10 CFR 50.34a, 10 CFR 50.65

- 10 CFR Part 50, Appendix A, General Design Criteria (GDC) 1, 2, 3, 19, 60, 61, 63, and 64
- 10 CFR 50.34(f)(2)(xiv)(E)10 CFR Part 50, Appendix I
- 10 CFR 52.47(a)(5), 10 CFR 52.47(b)(1), 10 CFR 52.79(a)(3), and 10 CFR 52.79(a)(1),
- 10 CFR 52.17(a)(1), 10 CFR 52.63, 10 CFR 52.80
- 10 CFR 61.55, 10 CFR 61.56
- 10 CFR Part 100
- 40 CFR Part 190

3. Audit Agenda

The NRC staff held 18 meetings with the applicant throughout the audit at the NuScale office in Rockville, Maryland, at the NRC Headquarters, or by telephone with NuScale. The NRC staff used these meetings to facilitate an understanding of the NuScale DCA, and the information the applicant had made available for review by the NRC staff.

June 20, 2017	Entrance Meeting
August 2, 2017	Audit Meeting
August 10, 2017	Audit Meeting
August 17, 2017	Audit Meeting
August 23, 2017	Audit Meeting
August 30, 2017	Audit Meeting
September 6, 2017	Audit Meeting
September 13, 2017	Audit Meeting
September 20, 2017	Audit Meeting
September 27, 2017	Audit Meeting
October 4, 2017	Audit Meeting
October 5, 2017	Failed Fuel Fraction Meeting
October 10, 2017	Audit Meeting
October 11, 2017	Audit Meeting
October 18, 2017	Audit Meeting
October 31, 2017	Audit Meeting
November 7, 2017	Audit Meeting
November 15, 2017	Exit Meeting

4. Audit Participants

NRC Staff Participants:

- Stephen E. Williams (NRO, Chapter 11 Audit Lead)
- Zachary Gran (NRO)
- Richard Clement (NRO)
- Ron LaVera (NRO)
- Edward Stutzcage (NRO)
- Lawrence Burkhart (NRO/RPAC Branch Chief)

- Anthony Markley (NRO, Senior Project Manager)

NuScale (and Other Support Organization) Participants:

- Mark Shaver
- Jon Bristol
- Liz English
- Jim Osborn
- Steve Mirsky
- Paul Guinn
- Greg Myers
- Jennie Wike
- Carrie Fosaaen
- Tom Crabtree
- Steve Pope
- Steve Unikewicz
- Patrick Conley
- Ron Wise

5. Information Made Available by NuScale for Review by the NRC Staff

During the course of the audit, NuScale provided the NRC staff with electronic access to information used in analyzing the NuScale SMR design. The types of information included: calculation packages, LADTAP II input/output (I/O) files, GASPAR II I/O files, RADTRAD I/O files, ORIGEN I/O files, MCNP I/O files, Excel spreadsheets, piping and instrumentation diagrams, technical reports, and other related technical documents that supports information contained in the DCA.

6. Deviations from the Audit Plan

There were no identified deviations from the audit plan.

7. Audit Activities

The NRC staff focused its review on information related to the unique and novel features of the NuScale SMR design and de-emphasized those aspects found to be similar to large LWRs. The NRC staff used the supporting information contained in the DCA and TR-1116-52065-NP to evaluate the analytical results provided in the tables and figures of the application. Where clarification was needed, the NRC staff used information available through the audit to examine the methods, models, and assumptions implemented by the applicant to determine the radioactive material content of SSCs, kinds and quantities of the resultant radiation sources and source terms, types of design features provided to support the radioactive waste management system, and the calculated doses to members of the public.

During the audit, the NRC staff reviewed a range of topics, primarily using the guidance contained in the NuScale Design Specific Review Standard (DSRS) Section 11.1, “Coolant Source Terms” (ADAMS Accession No. ML1130704492); DSRS Section 11.2, “Liquid Waste Management System” (ADAMS Accession No. ML15355A334); DSRS Section 11.3, “Gaseous Waste Management System” (ADAMS Accession No. ML15355A335); DSRS Section 11.4, “Solid Waste Management System” (ADAMS Accession No. ML15355A336); and DSRS Section

11.5, “Process and Effluent Radiological Monitoring Instrumentation and Sampling Systems” (ADAMS Accession No. ML15355A337).

The NRC staff also used the guidance in NUREG-0800, “Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition” (SRP), Branch Technical Position (BTP) 11-3, “Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Plants” (ADAMS Accession No. ML070730202); BTP 11-5, “Postulated Radioactive Release Due to a Waste Gas System Leak or Failure” (ADAMS Accession No. ML12258A115); and BTP 11-6, “Postulated Radioactive Releases Due to Liquid-Containing Tank Failures” (ADAMS Accession No. ML070720635).

The DSRS and SRP are not a substitute for NRC regulations and compliance with them is not required. As an alternative, an applicant may identify any differences between a DSRS section and the design features, analytical techniques, and procedural measures proposed in an application and discuss how the proposed alternative provides an acceptable method of complying with NRC regulations that underlie the DSRS acceptance criteria. Where the DCA contents differed from the guidance contained in the DSRS, the NRC staff reviewed the associated analytical techniques, data and conclusions, associated with the proposed alternative.

Through interactions with the applicant during the NRC staff’s review of the information described above, if additional questions could not be answered, they became either: (1) an editorial item, (2) an audit item, or (3) an RAI. All editorial, audit, or RAIs identified from the audit are attached to the audit report.

8. Audit Exit Summary

The audit exit was held on November 15, 2017, by teleconference. During the exit, the NRC staff described the topical areas reviewed during the course of the audit. The NRC staff also identified the 36 audit items (10 editorial items, 15 audit items, and 11 RAIs). Per the request of the applicant, RAIs were issued for areas for which the NRC staff is seeking additional clarification. audit and editorial items are described in Enclosures 2 and 3.

9. Specific RAIs

After discussions between the NRC staff and the applicant during the audit, the following RAIs were issued as a result of the audit:

- RAI-8750 Branch Technical Position (BTP) 11-6 Postulated accidental liquid tank failure analysis.
- RAI-8751 Regulatory Guide (RG) 1.143 Additional information added to cover all Structures, Systems and Components (SSCs) in DCA.
- RAI-8752 RG 1.110 Cost benefit analysis (CBA).
- RAI-8755 BTP 11-5 Postulated accidental waste gas system leak failure analysis.
- RAI-9161 Realistic Failed Fuel Fraction (RFFF) and Technical Report TR-1116-52065-NP.

- RAI-9236 Determination of Reactor Coolant System (RCS) coolant leakage rate.
- RAI-9238 Type E Variable Clarification.
- RAI-9239 Determining the basis for the dilution flow rates.
- RAI-9240 RG 1.143 System Boundary Clarification.
- RAI-9251 Waste generation rates and storage areas.
- RAI-9253 Tc-99 and tritium source terms.

Enclosure 4 contains a discussion of RAI's 9161, 9253, and 9239 and all have been issued. RAI 9161 has a delayed response that the NRC staff is tracking that also includes RAIs 9253 and 9239.

10. Specific Open Items

The audit resulted in 10 editorial items, 15 audit Items, 11 RAIs for a total of 36 audit items.

11. List of acronyms and abbreviations

ADAMS – Agencywide Documents Access and Management System
AOO – Anticipated Operational Occurrences
BTP – Branch Technical Position
CES – Containment Evacuation System
COL – Combined Operating License
CRVS – Normal Control Room HVAC System
CVCS – Chemical and Volume Control System
DBFFF – Design Basis Failed Fuel Fraction
DCA – Design Certification Application
DSRS – NuScale Design Specific Review Standard
ECL – Effluent Concentration Level
EPRI – Electric Power Research Institute
FFF – Failed Fuel Fraction (DBFFF or RFFF)
FRED – EPRI Fuel Reliability Database
FSAR – Final Safety Analysis Report
GAC – Granulated Activated Charcoal
GDC – General Design Criterion
GRWS – Gaseous Radioactive Waste System
HIC – High Integrity Container
HVAC – Heating Ventilation and Air Conditioning
I/O – Input/Output
ITAAC – Inspections, Tests, Analyses, and Acceptance Criteria
LRWS – Liquid Radioactive Waste System
LWR – Light Water Reactor
NEI – Nuclear Energy Institute
NPM – Nuclear Power Module
NPP – Nuclear Power Plant
NRC – Nuclear Regulatory Commission
NRO – Office of New Reactors

PCUS – Pool Cleanup System
PWR – Pressurized Water Reactor
P&ID – Piping and instrumentation diagrams
RAI – Request for Additional Information
RCS – Reactor Coolant System
RFFF – Realistic Failed Fuel Fraction
RG – Regulatory Guide
RPAC – Radiation Protection and Accident Consequences Branch
RPCS – Reactor Pool Cooling System
RWB – Radioactive Waste Building
RXB – Reactor Building
SFPCS – Spent Fuel Pool Cooling System
SMR – Small Modular Reactor
SSC – Structures, Systems, and Components
SRP – Standard Review Plan (NUREG-0800)
SRST – Spent resin storage tank
SRWS – Solid Radioactive Waste System
TS – Technical Specifications
U.S. – United States
X/Q – Atmospheric Dispersion Factor
10 CFR – Title 10 of the *Code of Federal Regulations*

SPECIFIC AUDIT ITEMS

The audit items listed below are those items identified by the U.S. Nuclear Regulatory Commission (NRC) staff that did not warrant an RAI, but were considered technical issues that NuScale Power, LLC (NuScale) had agreed to incorporate in Revision 1 of the Design Certification Application (DCA). The NRC staff will verify the audit item's inclusion in Revision 1 of the DCA.

Audit Item	DCA Section	NuScale Agenda Item	NuScale Resolution
1	11.1	Section 11.1, Table 11.1-6 values for the radionuclides Nb95 and Ag110m do not agree with the activity listed in Table 11.1-4 multiplied by 10, as do most of the other radionuclides. Table 11.1-6 values shown are 8.3783E-07 microcuries/gram (uCi/g) and 2.5105E-04 uCi/g versus 3.3160E-06 uCi/g and 2.7848E-04 uCi/g, respectively, in Table 11.1-4. Explain these discrepancies and provide a DCA markup to include any changes.	NuScale will annotate Table 11.1-6 in Revision 1 to DCA. NuScale explained that Ag110m contribution was overly conservative. NuScale agreed to change Ag-110m to the value contained in ANSI/ANS- 18.1-1999. This value will be the same for both normal operation and DBA source terms. NuScale also agreed to provide to explanation the values selected for Nb-95. The NRC staff will verify this item in Revision 1 of the DCA.
2	11.2	In Table 11.2-8, there is no summation of the unity rule analysis with the ECLs. Provide a DCA markup to include this information.	NuScale agreed to revise Table 11.2-8 to add the sum of the fraction of ECLs to indicate compliance with 10 CFR 20 Appendix B Note 4. The NRC staff will verify this item in Revision 1 of the DCA.

Audit Item	DCA Section	NuScale Agenda Item	NuScale Resolution
3	11.2	The applicant is requested to address the final sentence in the Chemical Waste paragraph, which states “Administrative controls prohibit the mixing of nitrate containing fluids with demineralizer resins.” a. Where will these admin controls be located? b. Should it be an ITAAC or COL Action item?	NuScale agreed to add a pointer in section 11.2 to direct the reader to this COL Item for admin controls in COL Item 9.2-1. The NRC staff will verify this item in Revision 1 of the DCA.
4	11.2	The applicant is requested to address the following issues that occur on DCA Chapter 11 pages 11.2-8 and 11.2-12. a. On page 11.2-8, following the bullets, the text reads “Refer to the LCW mobile processing equipment skid for additional details on the skid components.” b. On page 11.2-12, the line of text directly above the “Safety Evaluation” section states “See Section 11.2.5 for automatic control features as a result of upset conditions.” c. These two sentences read as actions that need to be taken vice pointers to help the reader.	NuScale agreed to change the meaning of these statements. The NRC staff will verify this item in Revision 1 of the DCA.

Audit Item	DCA Section	NuScale Agenda Item	NuScale Resolution
5	11.2	The applicant is requested to address the following issue that occurs in DCA Sections 11.2, 11.3, and 11.4. a. There's inconsistency with the system's name (LWMS vs LRWS). i. The title and header both state "Liquid Waste Management System," as well as the DSRS. ii. The text uses "liquid radioactive waste system" on the first line and throughout the text. iii. DCA Chapter 1 has both listed on the acronym list. b. The applicant should change all LRWS, GRWS, and SRWS, including all pointer in various sections outside of DCA Chapter 11.	The applicant will use SRP and/or DSRS nomenclature to make these sections consistent throughout the DCA. The NRC staff will verify this item in Revision 1 of the DCA.
6	11.3	In DCA Table 11.3-5, there doesn't seem to be any results/summation of the analysis for compliance with the ECLs. Explanation on what X/Q was used to determine the unci/mL as a footnote to DCA Table 11.3-5.	NuScale agreed to provide additional text in DCA Section text to explain the X/Q value in Table 11.3-5. The NRC staff will verify this item in Revision 1 of the DCA.
7	11.3	In DCA Section 11.3.3 under the heading "Containment Leakage AOO," the NRC staff is seeking information on what specific input values the applicant is referencing from NUREG-0017 for gaseous effluent release AOO.	NuScale agreed to provide additional text in DCA Section 11.1 to provide reference to TR-116-52065. The NRC staff will verify this item in Revision 1 of the DCA.
8	11.3	Include text in DCA Section 11.3 that explains an elevated release.	NuScale agreed to provide additional text in DCA Section 11.3 to describe the stack and the release pathway. The NRC staff will verify this item in Revision 1 of the DCA.

Audit Item	DCA Section	NuScale Agenda Item	NuScale Resolution
9	11.4	Other sources of wet solid waste include spent cartridge filters from the liquid radioactive waste system CVCS and pool cleanup system, TUF and RO filter membranes and rejects from the LRWS, and oily wastes from LRWS. Explain what "rejects" are.	NuScale agreed to provide additional text in DCA Section 11.4.2.2 to describe the TUF and RO from DCA Section 11.2. The NRC staff will verify this item in Revision 1 of the DCA.
10	11.4	Each of the two PSTs is sized to receive spent resins from the LRW demineralizers for at least two years of plant operation, plus the associated flush water. The carbon from the GAC bed is normally transferred directly to a HIC instead of a PST to prevent mixing the carbon with spent resins. Why is this done?	NuScale agreed to provide additional text in DCA Section 11.4 to describe the separation of wastes. The NRC staff will verify this item in Revision 1 of the DCA.
11	11.4	In large how are transportation requirements addressed for solid rad waste and identify the applicable regulations.	NuScale agreed to provide additional text in DCA Section 11.4.2.5.5 to state the transportation requirements are in accordance with NEI Template 07-10A. The NRC staff will verify this item in Revision 1 of the DCA.
12	11.4	Request clarification on what modular equipment is vs mobile equipment. See DCA Section 11.4.2.9	NuScale agreed to provide additional text in DCA Section 11.4.2.9 to clarify the difference between modular equipment and mobile equipment. The NRC staff will verify this item in Revision 1 of the DCA.
13	11.4	Question about why the Spent Resin storage tank is so large. 16,000 gallons (DCA Table 11.4-1) for what appears to be for 450 ft3/yr of waste generation (as found in DCA Section 11.4-3).	NuScale agreed to provide additional text in DCA Section 11.4 to describe the inputs into the Spent Resin Storage Tank. The NRC staff will verify this item in Revision 1 of the DCA.
14	11.2	What is the basis of the flow rates used for 10 CFR Part 20 compliance calculations and 10 CFR Part 50 Appendix I calculations? Section 11.2.3.3 states 2 separate flow rates.	NuScale agreed to provide additional text to describe the different flowrates used in the analysis contained in DCA Section 11.2. The NRC staff will verify this item in Revision 1 of the DCA.

Audit Item	DCA Section	NuScale Agenda Item	NuScale Resolution
15	11.2, 11.3, 11.4	The NRC staff proposed to provide NuScale with standard language to clarify if a systems isolation valve was included in the description for RG 1.143 components. The NRC staff proposed the following standard text: Each radwaste SSC classifications need to address the following information: 1. All components connected to a component classified as a RW-IIa (e.g., piping, pumps, etc.) are also classified as RW-IIa, up to and including the nearest isolation component (e.g., isolation values), on each connection, to the RW-IIa component. 2. All components connected to a component classified as a RW-IIb (e.g., piping, pumps, etc.) are also classified as RW-IIb, up to and including the nearest isolation component (e.g., isolation values), on each connection, to the RW-IIb component. 3. All components connected to a component classified as a RW-IIc (e.g., piping, pumps, etc.) are also classified as RW-IIc, up to and including the nearest isolation component (e.g., isolation values), on each connection, to the RW-IIc component.	NuScale agreed to provide additional text in DCA Section 11.2, 11.3, and 11.4 to define the system boundaries. The NRC staff will verify this item in Revision 1 of the DCA.

SPECIFIC EDITORIAL ITEMS

The editorial items listed below are those items identified by NRC staff that did not warrant an RAI and were minor editorial fixes that NuScale agreed to incorporate in Revision 1 of the DCA. The NRC staff will verify the editorial item's inclusion in Revision 1 of the NuScale DCA.

Editorial No.	Question	NuScale Resolution
1	Clarify/justify the text on page 11.2-4 in the "RCCW Drain Tank," section. On page 11.2-4, the text in the section titled "RCCW Drain Tank" reads "The reactor component cooling water drain tank collects water drained from various RCCWS components prior to maintenance. The RCCWS is normally non-radioactive and is normally returned to the RCCWS as makeup water." Address the following: 1. List the "various RCCWS components" that drain to the tank. By listing the components, the "non-radioactive" claim can be justified. 2. Justify that the water drained from the various RCCWS components is only done "prior to maintenance." 3. Unlike other sections, there is no pointer to another section of the FSAR. Example: the Chemical Waste section on page 11.2-9 refers to Section 9.3.3. Determine if a pointer should be included in the text. Please address these items and provide a markup for the proposed DCA changes.	NuScale agreed to provide a pointer to DCA Section 9.2.2 that describes the various components that drain to the RCCW drain tank. The NRC staff will verify this item in Revision 1 of the DCA.

Editorial No.	Question	NuScale Resolution
2	This enhancement of the Figures in section 11.2 is required to ensure that there is sufficient design information available in accordance with 10CFR50.34a. Enhance the Figures in DCA Tier 2 Section 11.2 "Liquid Waste Management System (LWMS)". On page 11.2-3, the text refers to all of the Figures at the end of the section and reads "Figure 11.2-1a through Figure 11.2-1j provide flow diagrams of the LRWS." With regard to the Figures included in Section 11.2, note the following: 1. Although there are 10 Figures (11.2-1a through 11.2-1j) in total, several of them depict various subsystems of the entire LWMS. In order to accurately review the plant systems portion of the LWMS, include subsystem names in the titles of the Figures. For example: Figure 11.2-1a – Degasifiers, Figure 11.2-1b – Low Conductivity Waste Collection System, Figure 11.2-1c – High Conductivity Waste Collection System, etc. 2. Add pointers to the appropriate Figures throughout the text in Section 11.2. For example: on page 11.2-5, the Low Conductivity Waste System section would include pointers to Figures 11.2-1a and 11.2-1b. On page 11.2-7, the High Conductivity Waste System section would include a pointer to Figure 11.2-1c. Please address these items and provide a markup for the proposed DCA changes.	NuScale agreed to provide DCA Section 11.2 pointers in the text to refer to specific figures in the back of 11.2. The NRC staff will verify this item in Revision 1 of the DCA.
3	Ordered List Punctuation: Whenever there is a bulleted list of items, proper ordered list punctuation should be adhered to. The final item in the list ends with ".". The second to last item ends with ", and". All other items in the list end in a comma. The sentence that leads to the list should end with ":". Examples of this issue can be seen on pages, 11.2-2, 11.2-3, 11.2-5, and 11.2-6. The applicant is requested to perform a global check to ensure the text is accurate.	NuScale agreed to make the editorial changes provided. The NRC staff will verify this item in Revision 1 of the DCA.

4	Initial Capitalization for Systems: Whenever a system appears in the text for the first time, the system name should be spelled out using initial capitalization followed by the acronym in parenthesis. Examples: Reactor Coolant System (RCS) and As Low As Reasonably Achievable (ALARA). Following that first time, only the acronym should be used. Examples of this issue can be found on pages 11.2-1, 11.2-2, and 11.2-4. In the last line of text on page 11.2-14, the text includes “reactor thermal power”. This should be replaced with “RTP”, since “Rated Thermal Power” is a widely understood acronym. The applicant is requested to perform a global check to ensure the text is accurate.	NuScale agreed to make the editorial changes provided. The NRC staff will verify this item in Revision 1 of the DCA.
5	The applicant is requested to address the following editorial issues: Page 11.2-1, First paragraph under Design Bases title, 2nd line. There is no comma needed between “accidents” and “and”. Second paragraph under Design Bases title, the final 2 sentences aren’t complete sentences. Third paragraph under Design Bases – don’t need quotations marks around “as low as reasonably achievable”. Page 11.2-4, Final line of the page – Take out “…processing, if radioactive.” Insert “…processing if found to be radioactive.” Page 11.3-1 First paragraph under Design Bases title, 2nd line. There is no comma needed between “accidents” and “and”.	NuScale agreed to make the editorial changes provided. The NRC staff will verify this item in Revision 1 of the DCA.

Editorial No.	Question	NuScale Resolution
6	The applicant is requested to address an issue regarding the COL Items contained in the text in DCA Sections 11.2, 11.3, and 11.4. While the COL Items in the text do match the text in Table 1.8-2, there is a minor discrepancy that occurs throughout. The word “Applicant” is capitalized in Table 1.8-2, but remains lowercase in the body of the text	NuScale discussed that this change has already been implemented. The NRC staff will verify this item in Revision 1 of the DCA.
7	In DCA Table 11.2-3 the NRC staff notes some of the pathways are not completely described in DCA Section 11.2. The NRC staff notes a description of the waste from the oil separator is not discussed in DCA Section 11.2. Looking for information to understand where this waste pathway is expected to accumulate, and to understand if the figures provided in DCA Section 11.2 accurately reflect the expected waste inputs. In addition the NRC staff notes there is no expected liquid waste input from the detergent waste pathway. Is this intentional or an oversight?	NuScale agreed to delete the 12x NUREG 0017, Table 2-27 Reference for the detergent waste source term contributions. Received clarification on the liquid waste pathways considered. The NRC staff will verify this item in Revision 1 of the DCA.
8	When making reference to the Exclusion Area Boundary (EAB), is the NRC staff to assume that this also is the site boundary? What is the definition of the EAB?	NuScale stated that the EAB and the Site Boundary are used interchangeably. DCA Section 2.1 contains the definition for the EAB. The NRC staff will verify this item in Revision 1 of the DCA.
9	Table 11.4-4 Solid Radioactive Waste System Equipment Malfunction Analysis, sixth item down Spent Resin Storage Tanks (SRSTs) and PSTs, under Results (Consequences) states "The tanks cannot be pressurized to perform pneumatic sluicing to an HIC." Should be "…to perform pneumatic sluicing to a HIC."	NuScale agreed to make the editorial changes provided. The NRC staff will verify this item in Revision 1 of the DCA.
10	DCA Table 11.2-7 shows incorrect total body (5 mrem/yr) and organ (15 mrem/yr) annual doses for compliance with the 10 CFR Part 50, Appendix I ALARA design objectives for all evaluated exposure pathways.	NuScale agreed to correct total body (3 mrem/yr) and organ (10 mrem/yr) annual doses in DCA Table 11.2-7. The NRC staff will verify this item in Revision 1 of the DCA.

REQUESTS FOR ADDITIONAL INFORMATION

The requests for additional information (RAIs) listed below are those items identified by staff that warranted additional investigation by the NRC staff and an RAI was discussed with and agreed upon with NuScale.

Item No.	Request for Additional Information (RAI)	RAI No. - Path Forward
1	The NRC staff and applicant also discussed topics such as the Realistic Failed Fuel Fraction (RFFF), Design Basis Failed Fuel Fraction (DBFFF), Technical Specification 3.4.8, "Reactor Coolant System Specific Activity" surveillance criteria, and the Maximum Hypothetical Accident (MHA) radionuclides and specific activity, as applied to design considerations for ventilation, shielding, Environmental Qualification (EQ), dose estimates for identified post-accident sampling activities, and effluent releases. The DCA information basis comes from the NuScale Technical Report TR-1116-52065-NP, Revision 0, "Effluent Release (GALE Replacement) Methodology and Results." The NRC staff and applicant discussed the RFFF value of 0.0028 percent or 28 parts per million (ppm) described in NuScale Technical Report TR-1116-52065-NP, Revision 0. As a result, the NRC staff requested in Request for Additional Information (RAI) 9161 that the applicant justify the basis of the RFFF and other information in TR-1116-52065-NP. The RFFF impacts (proportionally) normal operating source terms, effluent releases, and occupational and public doses. During the audit, the NRC staff contacted the Electric Power Research Institute (EPRI) for questions on fuel failure data the applicant had applied and cited in TR-1116-52065-NP. Based on information provided by EPRI, the NRC staff found that the source of compiled fuel failure data for U.S. nuclear power plants is from the EPRI Fuel Reliability Database (FRED). Although Technical Report TR-1116-52065-NP presents data and statistical analyses using historical fuel failure data (e.g., early 1970s through 1999), the EPRI source of validated data from FRED only dates back to year 2000. Using ERPI FRED data obtained during the audit, the applicant presented the NRC staff with an updated maximum RFFF value of 0.0066 percent or 66 ppm (from years 2007 through 2016 for U.S. pressurized water reactors (PWRs)). The NRC staff and applicant discussed an acceptable approach to determine a conservative RFFF for the NuScale SMR design, and agreed to use EPRI FRED data from years 2007 through 2016 (10 years) for U.S. PWRs, the maximum fuel failure value determined from those 10 years, and the "outage" fuel failure methodology. The applicant's response to RAI 9161 is expected on August 31, 2018, due to a contract initiated with EPRI to obtain fuel failure data and the need to revise numerous calculations.	RAI 9161 RAI response will be issued by NuScale by August 31, 2018.

Item No.	Request for Additional Information (RAI)	RAI No. - Path Forward
2	The NRC staff reviewed the monitors contained in DCA Section 11.5. The NRC staff reviewed the monitor ranges and requested clarifications about several of the monitoring ranges provided in DCD Table 11.5-1. The NRC staff also reviewed the monitors contained in the control room and the Normal Control Room HVAC System. In review of the committed guidance of RG 1.97 the NRC staff questioned the availability of Type E monitors provided for the control room. The NRC staff and applicant discussed the lack of a Type E monitor for the control room air, however, the applicant stated that the downstream control room heating ventilation and air conditioning monitor would satisfy the Type E requirements, but also acknowledged that it was not currently classified as a Type E monitor. The NRC staff considers that a beta monitor in addition to the area monitor in the control room would satisfy the Type E functions and requirements to meet the committed guidance of RG 1.97.	RAI 9238 RAI issued to NuScale, clarification call resulted in revision of RAI 9238 and re-issuance to NuScale.
3	The NRC staff has determined that the Realistic and design basis source terms in the NuScale design exclude Tc-99, a long-lived and environmentally mobile radionuclide produced in the fuel, which can escape as a fission product into the reactor coolant system for release into the environment. Tc-99 should be included in source terms, environmental transport analyses, and dose assessments, or its exclusion justified. (Question related to NRC eRAI 8750 and NuScale RAIO-0817-55643.) Therefore, the NRC staff requests that NuScale include Tc-99 activities in the fuel, primary and secondary coolant for realistic and design basis source terms in DCD Chapter 11 Tables 11.1-1, 11.1-4, 11.1-5, 11.1-6, and 11.1-7, and TR-1116-25065-NP, or justify its exclusion; include Tc-99 activity in the postulated accidental liquid release source term for the pool surge control system in DCD Chapter 12 Table 12.2-10, or justify its exclusion; and based on the above, provide a DCD and TR-1116-25065-NP markup to include these changes. The NRC staff also determined that the proposed alternate methodology used to calculate the tritium (H-3) production rate in the reactor coolant system (RCS) is non-conservative and underestimates H-3 concentrations in liquid and gaseous effluent releases during normal operations because it does not account for the buildup of H-3 due to recycling of previously used RCS. In the NuScale design, H-3 is the largest calculated water activation production reaction due to more water in the RCS per megawatt generated, higher capacity factor, and higher starting lithium concentration, which results in more H-3 production than a standard light water pressurized reactor. An increase in H-3 concentration results in a proportional increase to offsite public dose. (Question related to NRC eRAI 9270.)	RAI 9253 RAI response will be issued by NuScale by August 31, 2018.

Item No.	Request for Additional Information (RAI)	RAI No. - Path Forward
	Therefore, the NRC staff requests that NuScale provide the method, model, and assumptions used to calculate the H-3 production rate in the RCS to account for H-3 buildup due to recycling of previously used RCS, or justify the current H-3 activity, concentration, and liquid and gaseous effluent release rates are conservative and bounding, and based on the above, provide a DCD and TR-1116-25065-NP markup to include these changes.	
4	The NRC staff determined that the applicant's explanation of parameters were unclear for the liquid dose calculation performed in 10 CFR Part 50, Appendix I. The NRC staff communicated that there was insufficient information in the DCA regarding the liquid dilution flows that are needed to determine if the liquid effluent concentrations released are within regulatory limits. The applicant agreed with the NRC staff's assessment and indicated that additional information for the liquid effluent dilution flows would be provided in DCA Section 11.2.3.3, and DCD Table 11.2-4.	RAI 9239 Currently with NuScale for response.