

Enclosure 2:

"NuScale DCA Review Focus Areas", PM-1117-57390-NP, Revision 0, nonproprietary version

NuScale Nonproprietary

NuScale DCA

Review Focus Areas



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NuScale DCA Review Focus Areas

Topics for Discussion

- NuScale DCA review focus areas from previous NRC SES meetings (NuScale)
- New issues for October NRC SES meeting (NRC)
- Questions/discussion

NuScale DCA Review Focus Areas

Overview – NuScale DCA Review Focus Areas

- NRC Item 1: Integrated System Validation
- NRC Item 12: Seismic/Structural (Section 3.7/3.8) RAI Response Schedule
- NRC Item 5: Failed Fuel Fraction
- NRC Item 7: CVAP Benchmarking and Testing
- NRC Item 11: Application of ASME Code Requirements
- NRC Item 9 & 15: Reactor Recirculation Valve (RRV) Topics
- NRC Item 19: Containment Integrated Leak Rate Testing
- COL Items for Programmatic or Regulatory Requirements (from June SES meeting) (NuScale identified issue)

NuScale DCA Review Focus Areas

Integrated System Validation

- NuScale design minimizes operator impact on nuclear safety
 - no operator actions required for design-basis events
 - failure to perform actions does not significantly impact CDF or LRF
 - CDF changes from 2.72E-10 to 3.24E-08
 - LRF goes from 1.74E-11 to 2.81E-09
- NUREG-6393: *“The less sensitive the integrated system performance is to human performance. . .the lower the needed sample size.”*

No.	Milestone Description	Date	Owner
1	Public meetings and clarification calls to discuss NuScale position and justification for two trials	10/31/17, 11/2/17, 11/3/17	Complete
2	Submit a revised response to eRAI 8758 documenting NuScale’s position and justification for two trials	November 2017	NuScale

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Seismic/Structural RAI Response Schedule

- Status of RAI responses
 - 37 unilateral DCA changes submitted summer 2017
 - 85% responses completed in 2017 by due date (97 questions)
 - 22 RAI question responses due in 2018 (latest 12/20/2018)
- Status update meetings scheduled to touch base on progress of analysis and RAI responses
- Utilizing standing public meeting slot to discuss staff questions on RAI response

No.	Milestone Description	Date	Owner
1	Status Update Meeting	December 2017	NuScale/NRC
2	Status Update Meeting	February 2018	NuScale/NRC
3	Status Update Meeting	May 2018	NuScale/NRC

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Failed Fuel Fraction

- NuScale established failed fuel fraction based on industry operating experience
- Current TS 3.4.8 is sufficient to meet the criteria in 10 CFR 50.36

No.	Milestone Description	Date	Owner
1	Public meeting with NRC to discuss staff concerns on the failed fuel fraction realistic source term value and the expectation to apply regulatory controls to the design-basis limit.	9/26/17	Complete
2	Follow-up with NRC on NuScale's decision on whether or not NuScale will be creating new conditions in TS 3.4.8 to control the design-basis source term limit	11/13/17	Complete
3	Submit response to eRAI 9161 (question on realistic source term value)	12/12/17	NuScale

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CVAP Testing – Strategy

- Screen for all FIV mechanisms in RPV (acoustic resonance, vortex shedding, fluid elastic instability, turbulent buffeting, leakage flow instability, flutter/gallop)
- Used established textbook analysis methods (M.K. Au-Yang, Blevins) based on decades of nuclear operating experience and ASME Code Appendix N rules
- Conservative assumptions such as increased flow rate, biased boundary conditions, cross-flow forcing functions when flow is parallel
- Screening analyses demonstrated very large margins in excess of hundreds and thousands percent for most components
- Committed to test every component with less than 100% margin

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CVAP Testing – Strategy (cont.)

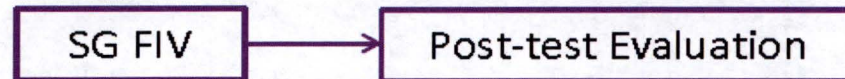
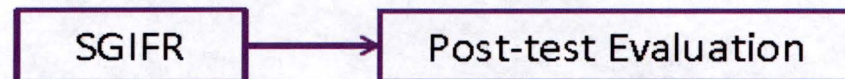
- Significantly lower primary coolant flow rates

Design	Average Velocity (ft/s)				Maximum Design Flow Rate (lb _m /s)	Primary Coolant Loop Transit Time (seconds)
	Steam Generator Gap	Downcomer	Core	Upper Internals Cross Flow		
NuScale	1.2	1.7	3.6	1.5	1,456	60.8
EPR		24	16	30	55,000	9.9
AP1000		19	16	40	34,800	10.3
US-APWR		23	14	30	54,092	12.6
SONGS	18	-	-	-	-	-

- No proprietary scale testing to develop or “benchmark” analytical methodologies
- SIET testing for SG has and will be provided to NRC for audit
- Performing majority of validation testing prior to the start-up testing program

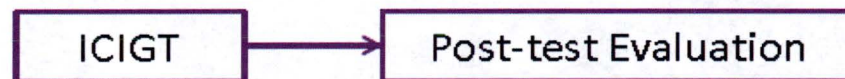
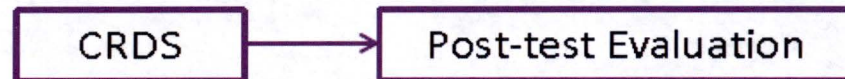
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CVAP Testing (cont.)



Separate Effects Tests

{{ SG FIV Test Specification – Provided for audit }}^{2(d)}



Factory Tests

To be performed following component manufacture and prior to COL installation



Hot Functional Test Period

To be performed after COL installation and before first NPM start-up



Initial Startup Test Period

To be performed during COL first NPM start-up. Final inspections performed after completion of SU tests

COL Item 3.9-1 ensures performance, post-test evaluation, and documentation of the above post-DCA CVAP tests.
Submit CVAP Measurement and Inspection Results Technical Report

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CVAP Testing (cont.)

No.	Milestone Description	Date	Owner
1	Meet with reviewer to describe design and basis for strategy of utilizing open literature, the large margins in the design, and understand reviewer concerns	10/12/17	Complete
2	Submit response to eRAI 8884 that describes NuScale's position (as discussed at SES September meeting)	10/18/17	Complete
3	CVAP audit exit – NRC will provide summary of audit	11/2/17	Complete
4	Waiting for staff feedback on NuScale eRAI 8884 response	TBD	NRC
5	Provide post-processing analysis of SIET-TF2 test data for NRC audit (as discussed at November audit exit meeting)	{{ }} ^{2(d)}	NuScale
6	Submit CVAP Measurement and Inspection Plan Technical Report	July 2018	NuScale
7	CVAP Measurement and Inspection Results Technical Report <ul style="list-style-type: none"> a. First version will be issued 90 days after completion of the first CVAP prototype test b. Subsequent revisions will be issued within 90 days of completing a test c. Final version will be issued following the completion of RXM inspections after initial start-up testing 	TBD	NuScale

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Application of ASME Code Requirements

- NuScale will follow the ASME BPVC “verbatim” as required by 10 CFR 50.55a
- NuScale has chosen to increase the testing and inspection beyond the requirements of the ASME BPVC for some components (e.g., CIVs) based on safety significance
- Those locations with additional testing and inspection requirements will be described in RAI responses

<u>No.</u>	<u>Milestone Description</u>	<u>Date</u>	<u>Owner</u>
1	Submit responses to eRAI 8983	7/30/17	Completed
2	Submit responses to eRAI 9109	11/21/17	NuScale
3	Submit responses to eRAI 9103	11/24/17	NuScale
4	Submit responses to eRAI 9183	12/13/17	NuScale
5	Submit responses to eRAI 9193	12/18/17	NuScale

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RRV Topics

- The “reactor recirc valve” discussion from the September SES meeting encompassed three separate technical concerns
- Three separate topics
 - pipe break location at the RRV weld (now flange)
 - active versus passive failure of the RRV
 - test data for inadvertent actuation of ECCS

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RRV – Pipe Break Location

<u>No.</u>	<u>Milestone Description</u>	<u>Date</u>	<u>Owner</u>
1	Submit response to eRAI 8785 (LOCA LTR Question)	7/19/17	Complete
2	Submit response to eRAI 8776 (LOCA LTR Question 15.06.05-5)	10/18/17	Complete
3	Meet with NRC to discuss changing to the flange design for the RRV (conference call for eRAI 9187 clarification)	10/24/17	Complete
4	Describe intentions to change to flange design in response to eRAI 9187 (Chapter 3 Question)	1/2/18	NuScale
5	Issue new RAI with staff questions on flange design	TBD	NRC
6	Public meeting to review design drawing for flange design and other design specifications	11/28/18	NuScale/NRC
7	Schedule engagement with NRC in February or March 2018 to discuss final change for RRV flange design	Feb/March 2018	NuScale
8	Supplement previous RAI responses that involved the welded RRV design (e.g., 8776)	Feb/March 2018	NuScale

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RRV: Active versus Passive Failure

No.	Milestone Description	Date	Owner
1	Submit response to eRAI 8815 (Chapter 15 Question)	7/21/17	Complete
2	Submit response to eRAI 8820 (Chapter 6 Question)	8/1/17	Complete
3	Submit response to eRAI 8985 (LOCA LTR Question 15.06.06-1)	11/6/17	Complete
4	NRC Audit of the ECCS valve FMEA	December 2017	NuScale

RRV: Test Data for Inadvertent Actuation of ECCS

No.	Milestone Description	Date	Owner
1	Submit response to eRAI 8985 (LOCA LTR Question 15.06.06-1)	11/6/17	Complete
2	Waiting for feedback from NRC on acceptance of RAI response	TBD	NRC

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Containment Integrated Leak Rate Testing

- eRAI 9147 issued on October 25 with 10 questions
- On November 3 audit call, NRC reviewers identified that sufficient information to make safety finding for exemption is not available
 - What information is still needed from NuScale?
 - Is this information captured in eRAI 9147?

No.	Milestone Description	Date	Owner
1	Clarification call to discuss eRAI 9147	10/23/17	Complete
2	Conference call to discuss documents available for audit	11/3/17	Complete
3	Submit responses to eRAIs 9147 and incorporate feedback from NRC clarification call	12/26/17	NuScale

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COL Items

- Topic originally discussed during June SES meeting
- NuScale proposing to remove COL items that duplicate regulatory and programmatic requirements
 - eRAI 8961, Question 20.01-4
 - COL item for a “COL applicant to propose a license condition to verify the development and implementation of the guidance, strategies, and programs for (FLEX) mitigation strategies...”
 - 10 CFR 50.155(b) will require development of ELAP mitigation strategies
 - eRAI 8959, Question 03.09.06-27

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COL Items (cont.)

- COL item for a “COL applicant that references the NuScale design certification will identify any site-specific valves, the implementation milestones, and applicable ASME OM Code (or ASME OM Code Cases) for the preservice and in-service testing programs. These programs will be consistent with the requirements in the latest edition and addenda of the OM Code incorporated by reference in 10 CFR 50.55a in accordance with the time period specified in 10 CFR 50.55a before the scheduled initial fuel load (or the optional ASME Code Cases listed in RG 1.192 that is incorporated by reference in 10 CFR 50.55a).”
- COL item duplicates the requirements in 10 CFR 50.55a(f) and 10 CFR 52.79(a)(11)
 - eRAI 8827, three questions in FSAR Chapter 13
- COL items duplicating 10 CFR 52.79(a)(14) requirement for training program implementation

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Update on Previous NRC SES Meeting Topics

- GDC 17 exemption (NRC Item 3)
- TMI action item that requires the ability to take samples post-accident and to perform radiation and shielding design reviews (10 CFR 50.34(f)(2)(vii) and (viii)) (NRC Item 4)
- Testing and qualification for the ECCS valves and CIVs (NRC Item 10)
- Acceptability of nonsafety-components, such as check valves, to mitigate certain design-basis events (NRC Item 14)
- Control room habitability (NRC Item 23)
- GDC 27 (Return to Power) exemption (NRC Item 21)

NuScale DCA Review Focus Areas

Summary

- Waiting for NRC feedback on the following topics:
 - CVAP testing
 - RRV pipe break location
 - RRV active versus passive failure
 - test data for inadvertent actuation of ECCS
 - proposed markup to electrical topical report SER
 - acceptability of use of nonsafety SSCs in limited cases
 - return to power RAI responses
 - Path forward for resolving review issues
 - early and frequent engagements on developing issues
 - focus on clear communications
 - understanding of the safety concerns
 - develop milestones for each issue where response or action by NuScale is pending
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NuScale DCA Review Focus Areas

New NRC SES Review Issues

- Control room staffing (NuScale Exemption Request #6) (NRC Item 2)
- Reactor vessel flange tool seismic design (NRC Item 6)
- Insufficient seismic analysis information associated with the reactor vessel flange tool (NRC Item 16)
- Control rod drive mechanism drop and control rod alignment tests (NRC Item 8)
- Event escalation due to intentionally opening ECCS valves (NRC Item 13)

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New NRC SES Review Issues

- Load following (NRC Item 17)
- Combustible gas control – no containment monitoring for oxygen or hydrogen concentrations (NuScale Exemption Request #2) (NRC Item 18)
- Containment isolation provisions for piping system lines penetrating containment (NuScale Exemption Request #9) (NRC Item 22)
- 10 CFR 50 Appendix K, ECCS evaluation models (NuScale Exemption Request #10) (NRC Item 20)



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