Enclosure 1:

"Level of Detail for Piping Stress Analysis", PM-0915-17232-NP, Revision 1, nonproprietary version

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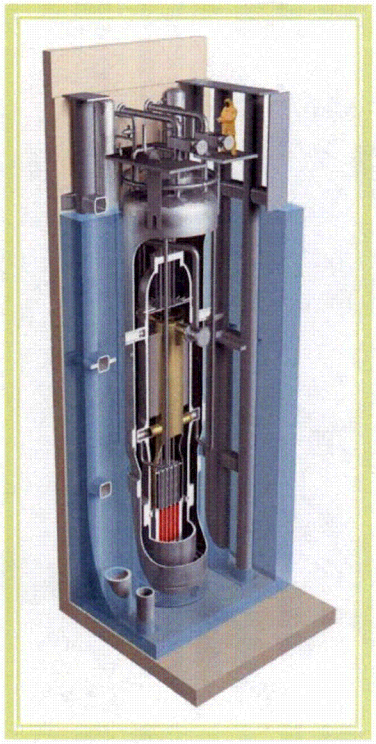
Level of Detail for Piping Analysis



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Manager, NSSS Design

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PM-0915-17232-NP
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Acknowledgement and Disclaimer

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Purpose

- NuScale to provide a description on the level of detail for piping analysis planned for the Design Certification Application (DCA)
- Understand NRC's requirements from "Piping Level of Detail for Design Certification" white paper (March 4, 2014)
- Identify scope necessary for piping design to eliminate the need for piping design acceptance criteria (DAC) in DC application

Acronyms and Abbreviations

Term	Definition
ASME	American Society of Mechanical Engineers
BPV	boiler pressure vessel
BTP	Branch Technical Position
CNV	containment vessel
CVCS	chemical volume control system
CRDM	control rod drive mechanism
DAC	design acceptance criteria
DCA	design certification application
DHRS	decay heat removal system
DSRS	design specific review standard
EAF	environmentally assisted fatigue
FW	feedwater
HELB	high energy line break

Acronyms and Abbreviations

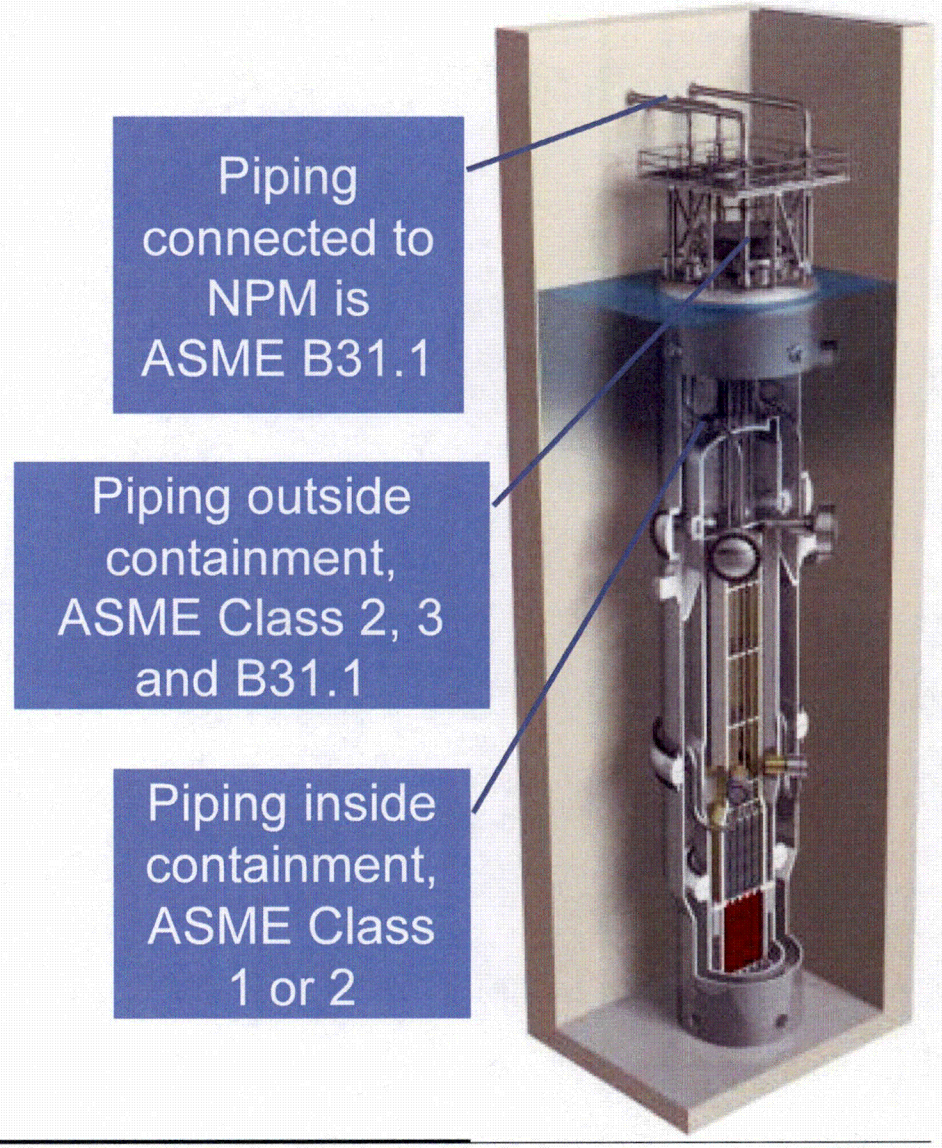
Term	Definition
ISM	independent support motion
ISRS	in-structure response spectra
ITAAC	inspections, tests, analyses, and acceptance criteria
LBB	leak before break
MS	main steam
NPM	NuScale Power module
NPS	nominal pipe size
OBE	operating basis earthquake
P&ID	piping and instrumentation diagram
PZR	pressurizer
RCPB	reactor coolant pressure boundary
RCS	reactor coolant system

Acronyms and Abbreviations

Term	Definition
RPV	reactor pressure vessel
RVI	reactor vessel internals
SAM	seismic anchor motion
SG	steam generator
SIF	stress intensification factor
SR	safety related
SRP	Standard Review Plan
SRSS	square root sum squared
SSC	system, structure, component
SSE	safe shutdown earthquake
SSI	soil-structure interaction
USM	uniform support motion
ZPA	zero period acceleration

NuScale Piping Systems

- NuScale ASME Class 1, 2, and 3 piping is part of the NuScale Power module (NPM)
- Piping inside containment is ASME Class 1 and 2
- Piping connected to NPM is ASME B31.1 or other non-ASME Class piping
- NPM is fabricated in factory, along with all piping



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ASME Class 1, 2 and 3 Piping in NPM

System(1)	ASME Code Class
RCS/CVCS	1 3(2)
SG/MS	2
SG/FW	2
DHRS	2
CRDM Cooling	2(3)
CFDS	2(3)

(1) System acronyms
- CVCS – chemical and volume control system
- SG – steam generator
- MS – main steam
- FW – feedwater
- DHRS – decay heat removal system
- CRDM – control rod drive mechanism
- CFDS – containment flooding and drain system

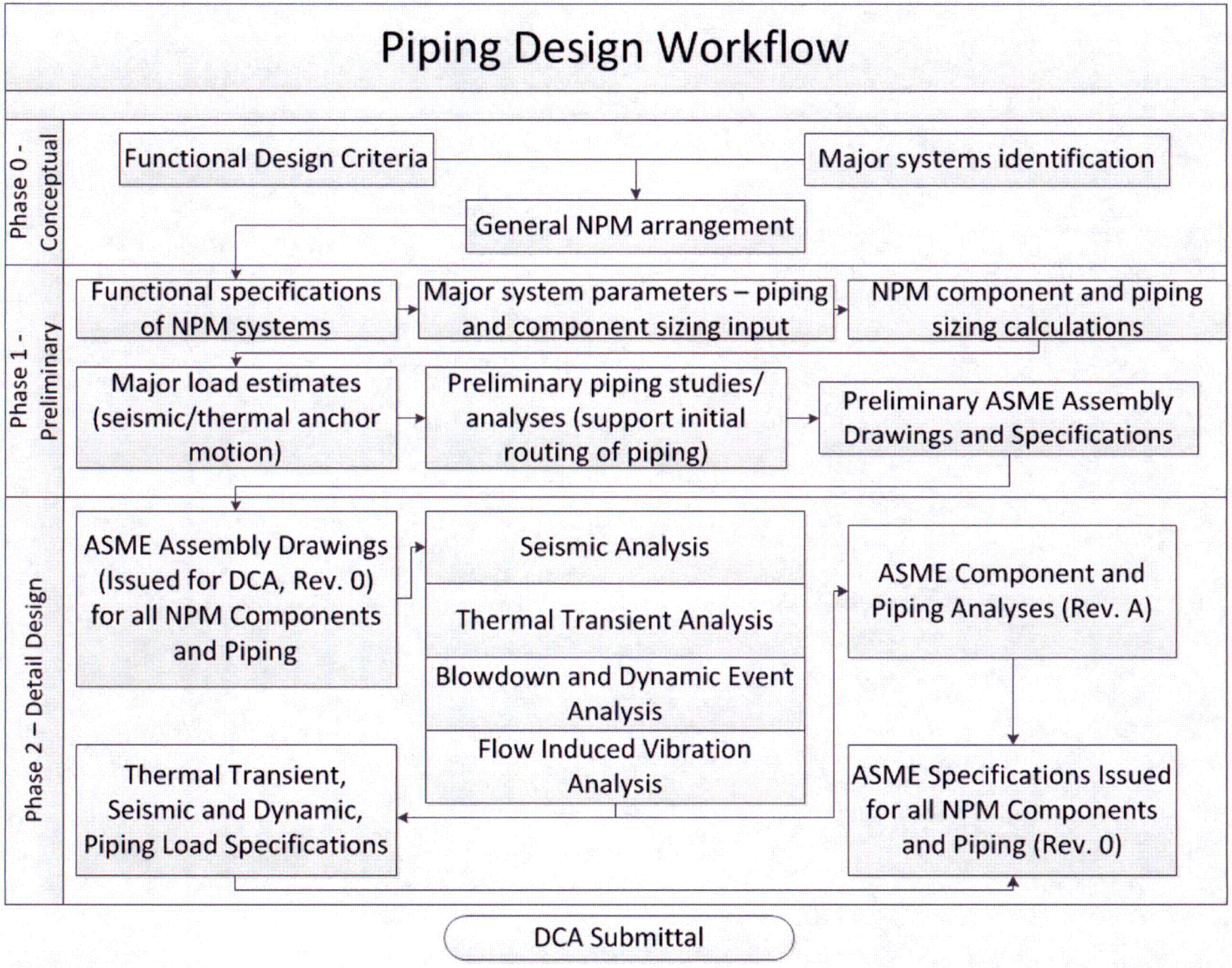
(2) Outside CNV
(3) Inside CNV only

Graded Approach to Level of Detail in Piping Design(1)

- DCA presents essentially complete designs for the overall systems
- ITAAC for the DCA includes verification of design, fabrication, installation, inspection, and testing for ASME BPV Code Class 1, 2, and 3 components and piping
- DCA documents overall methodology to be employed in completing the detailed design for piping systems
- Highest level of detail expected for Class 1 RCPB piping and Class 2 steam and feedwater lines to the first 6-way rigid restraint beyond the isolation valves; less detail for lower safety significance Class 2 and 3 piping

(1) Piping Level of Detail for Design Certification, NRC white paper, March 4, 2014

Pre-DCA Scope



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Piping Design Scope(1)

	ASME Class 1	ASME Class 2/3		NuScale Planned Scope
		≤ 2 NPS	≥ 2.5 NPS	
Functional design criteria for mechanical systems and components	X	X	X	Functional specification(s) of NPM collects design requirements
Preliminary system design description	X	X	X	NPM System Design Description addresses design criteria contained in the NPM Functional Specification
Piping design methodology	X	X	X	Methodology for LBB, HELB, piping design
Simplified piping & instrumentation diagram	X		X	NPM P&ID and interface diagrams

(1) Piping Level of Detail for Design Certification, NRC white paper, March 4, 2014

Piping Design Scope(1)

	ASME Class 1	ASME Class 2/3		NuScale Planned Scope
		≤ 2 NPS	≥ 2.5 NPS	
Process flow diagrams or descriptions	X		X	ASME piping is part of the NPM. Steady-state and transient parameters are provided in specification(s).
Key piping parameters	X		X	ASME piping design specification provides pressure, temperature, and flow
Plant layout and arrangement information	X		X	ASME Code Class 1, 2 and 3 piping is part of NPM. Piping assembly drawings are developed.

(1) Piping Level of Detail for Design Certification, NRC white paper, March 4, 2014

Piping Design Scope(1)

	ASME Class 1	ASME Class 2/3		NuScale Planned Scope
		≤ 2 NPS	≥ 2.5 NPS	
Design specifications for major components connected to piping systems	X			ASME specifications are developed for RPV/SG, RVI, CNV, valves, NPM platform, piping, CRDMs, PZR heater
Preliminary piping stress analyses	X		X	Preliminary piping stress analyses are performed for Class 1 and 2 piping. Detailed ASME piping stress analyses are provided for RCS/CVCS letdown and FW piping.
Preliminary pipe rupture hazards analyses	X		X	Pipe break locations, pipe break analyses, LBB, location of pipe whip/jet devices

(1) Piping Level of Detail for Design Certification, NRC white paper, March 4, 2014

Piping for Stress Analyses

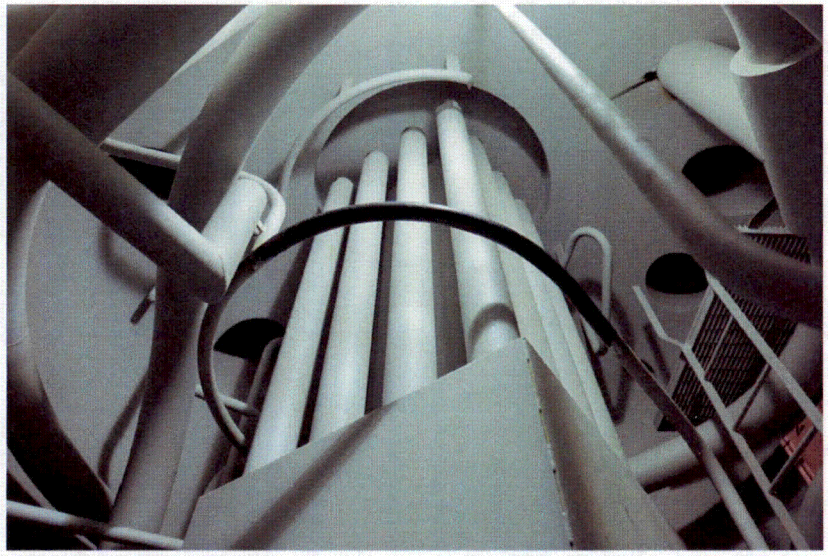
- RCS letdown NPS 2 ASME Class 1 piping
  - representative of all ASME Class 1 piping with respect to loading
  - deadweight, seismic, thermal transient and fatigue
  - NUREG/CR-6909 EAF applies
- FW NPS 4 ASME Class 2 piping
  - typical feedwater cyclic transients
  - important to address pipe rupture hazard
  - bounding loads of all ASME Class 2 piping with respect to LBB

Piping Design

- Questions posed by NRC staff relative to NuScale piping design
  - How does NuScale piping design and stress analyses incorporate the following factors?
    - how accessibility for inservice inspection is provided
    - stress intensification at piping bends
    - thermal expansion
    - seismic design/supports

Accessibility for In-Service Inspections

- Full scale upper module mockup of NPM with piping inside and outside
- Used for spatial arrangement and accessibility studies
- Inspection subject matter expert personnel walk-down



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Piping Stress Intensification

- Stress intensification factors (SIF) for pipe bends
  - follow ASME Code rules, specifically
    - NB-3683.7 and Table NB-3681(a)-1 for Class 1 piping SIFs at bends and elbows, or
    - NC-3673.2 and Table NC-3673.2(b)-1 for Class 2 piping, or
    - ND-3672.2 and Table ND-3673.2(b)-1 for Class 3 piping
  - verify that piping design software employs correct SIFs for code year of choice

Piping Thermal Expansion

- Thermal expansion
  - Pipe stress analysis incorporates thermal expansion by applying appropriate ASME service level temperatures to the system
  - Interpolate values of the thermal expansion coefficient based on the code year specified
  - Piping is evaluated for thermal expansion ΔT (i.e., max piping temp – ambient temp 70°F) including pipe movements due to support attachment point/location

Piping Seismic Analysis

- Piping seismic input
  - Displacement time histories and in-structure response spectra (ISRS) are calculated at representative elevations
    - Obtained from NPM dynamic analysis uses time history method with inputs from building and soil-structure interaction (SSI) analysis
    - ISRS are enveloped and broadened from all SSI analysis cases
    - NPM model is a 3-D shell/solid/beam ANSYS finite element model including fluid structure interaction
- Piping analysis computer codes
  - ANSYS
  - AutoPIPE

Piping Seismic Analysis

- Response spectra analyses for Seismic Category I piping
  - uniform support motion (USM) method for piping supported on NPM
    - inertial and seismic anchor motion (SAM) response combined by absolute sum
  - modal combination (RG 1.92)
    - includes missing mass and rigid response contributions
  - directional combination by SRSS (RG 1.92)
  - independent support motion (ISM) may be used as alternative method for piping supported by both NPM and building
    - one support group for NPM and separate group(s) for building

Piping Seismic Analysis

- Time history may be used as alternative to response spectra analyses
  - 3 directional input in single analysis run
  - ± 15% time step for uncertainty
- Safe shutdown earthquake (SSE) damping
  - 4% (RG 1.61)
- Operating basis earthquake (OBE)
  - equal to 1/3 SSE
  - used for fatigue evaluations per ASME code class requirements
  - 20 full SSE cycles or 312 1/3 SSE cycles

Pipe Rupture Hazard Analysis

- Leak-before-break (LBB) analyses per SRP 3.6.3 for FW and MS piping inside containment
- HELB requirements per SRP 3.6.2 and BTP 3-3 and 3-4
  - jet methodology per mPower DSRS 3.6.2 Appendix A
  - identify high-energy and moderate-energy piping systems subject to HELB
- Dual strategy(1) for meeting HELB
  - design/analysis enforcing BTP guidance (predicated on assuring break exclusion)
  - design pipe whip restraints and jet shield for all typical geometries

(1) Because piping analysis will not be completed for all piping systems until after DCA

Pipe Rupture Hazard Analysis

- Postulate potential locations for HELB on each system
- Identify nearby targets affected by event(s)
  - list SSCs that are safety related, required for safe shutdown, or post-accident monitoring
- Employ typical design options (pipe whip restraints, jet shields) to mitigate potential impact on SSCs
- If break exclusion is assured (SRP 3.6.3 or BTP 3-3 and 3-4), no further effort is required

Summary

- NuScale DCA will include the graded level of detail approach piping design scope that is addressed in the March 4, 2014 NRC "Piping Level of Detail for Design Certification" white paper
- Scoping piping stress analyses will be performed for all Class 1 and 2 piping
- Detailed piping stress analyses will be performed for the Class 1 RCS/CVCS letdown piping and the Class 2 SG/FW piping
- NuScale requests timely NRC feedback on the elimination of the piping design DAC in support of the schedule for DCA submittal

Additional Slides

The following slides provide information as discussed during the closed portion of the September 8th meeting

ASME Class 1, 2 and 3 Piping in NPM

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NPM Piping Systems

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Piping Analysis Detail

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Piping Analysis Details

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Preliminary vs. Detail Calculation

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Systems Needed for Safe Shutdown

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Justification for Selecting RCS Letdown Piping

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Justification for Selecting SG/FW Piping

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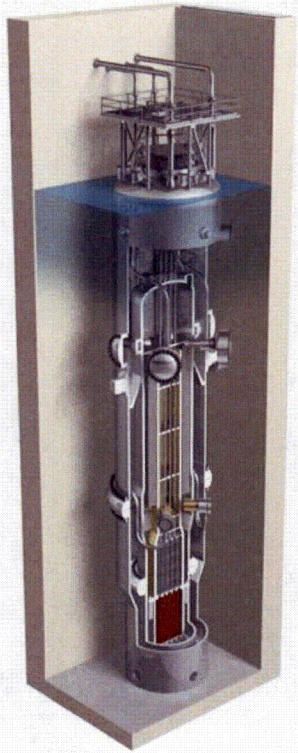

Enclosure 3:

Affidavit, AF-0915-17234

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NuScale Power, LLC

AFFIDAVIT of José N. Reyes, Jr.

I, José N. Reyes, Jr., state as follows:

(1) I am the Chief Technology Officer 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 reveals distinguishing aspects about the Nuscale Power Module for which NuScale develops its piping analysis.

NuScale has performed significant research and evaluation to develop a basis for the Nuscale Power Module 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 entitled "Level of Detail for Piping Stress Analysis." 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 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 September 11, 2015.

José N. Reyes, Jr.