July 13, 2020 Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Submittal of Draft "Operator Licensing and Examination Standard for NuScale Small Modular Reactors"

REFERENCES:
1. Summary of July 31, 2019 Public Meeting with NuScale Power, LLC to Discuss Operator Licensing Examination Topics, August 27, 2019 (ML19239A049)
2. Summary of October 16, 2019 Public Meeting with NuScale Power, LLC to Discuss Knowledge and Abilities Catalog, October 30, 2019 (ML19301B256)

NuScale has developed a draft operator licensing and examination standard for NuScale Small Modular Reactors to be used for consideration for input to the NuScale section of NUREG-1021 for NRC operator licensing examination.

Enclosure 1 contains the "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.3: Operating Exam, Walkthrough Part."

Enclosure 2 contains the "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.7: Operating Exam, Simulator Test Part."

Enclosure 3 contains the "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 4.4: Written Exam."

NuScale Power, LLC (NuScale) hereby submits Revision 0 of the "Operator Licensing and Examination Standard for NuScale Small Modular Reactors," Sections 3.3, "Operating Exam, Walkthrough Part," Section 3.7, "Operating Exam, Simulator Test Part," and Section 4.4, Written Exam." The purpose of this submittal is to provide this information for input into the NuScale specific sections of NUREG-1021.

This letter makes no regulatory commitments and no revisions to any existing regulatory commitments.

If you have any questions, please contact Nadja Joergensen at 541-452-7338 or at njoergensen@nuscalepower.com.

Sincerely,

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Enclosure 1: "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.3: Operating Exam, Walkthrough Part," Revision 0
Enclosure 2: "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.7: Operating Exam, Simulator Test Part," Revision 0
Enclosure 3: "Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 4.4: Written Exam," Revision 0

Enclosure 1:

"Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.3: Operating Exam, Walkthrough Part," Revision 0

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Operator Licensing and Examination Standard for NuScale Small Modular Reactors

Section 3.3: Operating Exam, Walkthrough Part

NuScale Pressurized Water Small Modular Reactors

July 2020

Revision 0

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3.3 Walkthrough Operating Examination Process

A. Purpose

This document provides recommendations from NuScale on the guidelines for developing and administering the plant walkthrough part of operating tests for NuScale facilities that meet the requirements of 10 CFR 55.45, “Operating tests,” including the use of reactor plant simulation facilities and the conduct of multi-unit evaluations.

The second part of a NuScale exam, “Operating Test,” is a simulator test portion. The recommendations for the simulator test part of the operating test are provided in a separate document, “Section 3.7: Operating Exam, Simulator Test Part.”

B. Background

To the extent applicable, the operating test will require the applicant to demonstrate an understanding of, and the ability to perform, the actions necessary to accomplish a representative sampling of the thirteen items identified in 10 CFR 55.45(a). All thirteen items do not need to be sampled on every operating test. The structure of the walkthrough part of the operating test is dictated, in part, by 10 CFR 55.45(b). Specifically, that part of the operating test will be administered as a plant walkthrough. NuScale is not recommending any changes or exceptions to these requirements.

The individual walkthrough examination is commonly referred to as job performance measures (JPMs) and these two terms are used interchangeably throughout this document.

For reactor operator (RO) candidates, this part of the examination focuses on tasks and associated systems in which licensed operators are involved in directing local field actions during implementation of the three critical safety function (CSF) procedures and the four defense-in-depth (D-I-D) procedures. At least one of the items tested requires the applicant to demonstrate the ability to enter a radiologically controlled area.

For senior reactor operator (SRO) candidates, this part of the examination focuses on tasks associated with implementing the site emergency plan, the equipment control administrative processes, and site fuel handling evolutions. The SRO-Instant (SRO-I) candidates are required to perform both the RO and SRO JPMs. The SRO-Upgrade (SRO-U) candidates have already performed RO JPMs on their previous RO walkthrough, so are only required to perform the SRO JPMs.

C. Job Performance Measure Development

The JPMs used for NuScale exams generally follow the format and style of JPMs used in existing fleet exams. Additional recommendations are provided below:

1. Job Performance Measure Attributes

a. The RO walkthrough JPMs are based on the local field actions in the CSF and D-I-D emergency operating procedures (EOPs). These are identified in the NuScale Learning Objective Based Knowledge, Skills, and Ability (LOB/KS&As) catalog, by EOP training phase standard learning objective EOP-C-[XX]-EO09:

- “DESCRIBE the local field actions within the [CSF/D-I-D procedure name] EOP that are used to mitigate the condition:”

- Each of the three RO JPMs are taken from a different EOP. See Form 1 – Reactor Operator Walkthrough Outline.
- These learning objectives are identified in the LOB/KS&A catalog, in the “JPM” column with an "R" designation.

b. The SRO walkthrough JPMs are based on administrative controls and operating practices associated with SRO-license level responsibilities within three topical areas: Site Emergency Plan, Equipment Control, and Fuel Handling. Learning objectives that allow SRO candidates to be evaluated in these three areas are identified in the LOB/KS&As catalog, in the column with an “S” designation. These are associated with a performance-based activity as opposed to testing general knowledge items like the written examination. Each of the three SRO JPMs are taken from a different topical area. See Form 2 – Senior Reactor Operator Walkthrough Outline. A general description of each area is provided below:

- Site Emergency Plan includes: Emergency Action Level Classification, Emergency Plan Implementation, and Non-emergency Reporting Manual. The associated LOB/KS&As are from the Administrative Training phase, within the Emergency Plan topic area.
- Equipment Control includes: Configuration Control, Chemistry Controls, Danger Tagging Program, Equipment Out of Service, Work Control, and Industrial Safety and Health. The associated LOB/KS&As are from the Administrative Training phase, within the Equipment Control topic area.
- Fuel Handling includes: Module Movement and Disassembly, New and Spent Fuel Movement and Handling, and Module Drop or Fuel Handling Casualties. The associated LOB/KS&As are from the Integrated Operating Procedures Training phase, within the Unit Refueling Integrated Operating Procedure topic area, from the Plant Systems Phase within the Fuel Handling Equipment system topic area, and from the Abnormal Operating Procedures Training phase within the Heavy Lift or Fuel Handling Accident Abnormal Operating Procedure topic area.

c. To maintain test integrity, every exam includes new or significantly-modified JPMs to ensure the applicant has not had the opportunity to rehearse or practice the JPMs:

- at least one JPM on each exam is new or modified
- no more than one JPM on each exam may have been used on the previous two NRC exams

d. At least one JPM on each exam requires the applicant to enter a radiological controlled area.

- For SRO-I candidates this can be satisfied by either one of their RO JPMs or one of their SRO JPMs.

e. The JPMs will identify an overall “task standard,” and include checkpoints, important observation points, and cues to facilitate the observer evaluating the JPMs. See Form 3 – Job Performance Measure Guide.

2. Bases for Job Performance Measure Attributes

a. The bases for the number of JPMs for a NuScale plant Operator License is as follows:

- There are fewer JPMs recommended for the NuScale Operator License exam than used in existing fleet exams.
    - The NuScale plant design is both simple and passive with no manual actions necessary to ensure nuclear safety. All of the analyzed operator actions are used to mitigate beyond-design-basis events. No operator action is required to reach or maintain a safe, stabilized condition for any design basis accident (DBA).
    - Single operator errors of both omission and commission were considered and analyzed in the transient and accident analyses of FSAR Chapter 15. The NuScale design limits operator error consequences to be less severe than the worst-case component single failure. The NuScale plant is a passive design that requires no operator action for 72 hours after any design basis event. Automated actions place and maintain the unit in a safe state for at least 72 hours after a design basis event (DBE) even with assumed failures. Operator actions directed by procedure make the consequences of an event less severe, but failure to take one of these actions cannot make the consequences worse than the bounding FSAR Chapter 15 analysis.

b. The basis for selecting the topical areas of the RO walkthrough exam is as follows:

- The Concept of Operation uses the RO position to direct local field actions performed by non-licensed operators during implementation of the CSF procedures and D-I-D procedures. Testing the ability to perform these actions ensures that the applicant is familiar with the design and operation of systems located outside the main control room. It also tests the ability of the applicant to direct non-licensed operators in the performance of those tasks.

c. The bases for selecting the topical areas of the SRO walkthrough exam are similar to those for existing fleet plant exams:

- There are significant differences between the knowledge required of RO and SRO applicants with respect to the Emergency Plan. The SRO applicants must demonstrate additional knowledge based upon their responsibility to direct and manage the implementation of the emergency plan implementing procedures (EPIPs) during the initial phases of an emergency. As a result, SRO applicants should have a more detailed understanding of the EPIPs, in general, and should be familiar with event classification procedures, communication requirements and methods. This topic may be evaluated by linking a walkthrough question to a simulator transient that requires implementation of the emergency plan. Such a question may be asked immediately following a simulator scenario.
- In general, SROs have more administrative responsibilities than ROs. Also, SROs have a unique role to authorize and oversee station work activities as they relate to important plant equipment. Given the fewer number of operator actions associated with mitigation of design bases and beyond-design-basis events, more focus is given

to the administrative responsibilities of the senior operator associated with maintaining the plant in a safe operating condition.

- The subject of fuel handling has specific emphasis for the SRO applicants. They are required to evaluate topics, such as core alterations, new and spent fuel storage and movement, the use of the fuel handling equipment, and fuel handling casualties. They are also responsible for the oversight of fuel handing evolutions.

D. Administering the Walkthrough Exam

The administration of walkthrough JPMs used for NuScale exams follows the process for administering JPMs used in existing fleet exams.

E. Grading the Walkthrough Exam

1. Walkthrough Job Performance Measure Grading

a. The grading of individual JPMs administered during the Operating Test follows the process and practices using in existing fleet exams.

- The performance of the candidate during each JPM is evaluated as “Satisfactory” or “Unsatisfactory.”
- Performance-based follow-up questions may be used to clarify or confirm an applicant’s understanding, in a manner consistent with existing fleet practices.

2. Overall Grading of the Operating Exam

a. The grading of the “Operating Test” is a combined score of the simulator scenario and the individual walkthrough. See Form 4 – Operating Test Exam Score.

- Each RO and SRO-I applicant performs three individual RO job performance measures.
- Each SRO-I and SRO-U applicant performs three individual SRO job performance measures
- Each RO and SRO applicant performs at least seven, and no more than twelve scenario events as part of their Operating Test. (See “Section 3.7, Operating Exam, Simulator Test Part”).

b. Applicants are required to successfully complete 80% of the total number of scenario events and individual JPMs in order to pass the Operating Test part of the exam.

3. Bases for Grading Methodology of the Operating Exam

a. Combining the scoring of the two parts of the operating test allows emphasis to be placed on evaluating of crew dynamic situations over individual actions.

- 10 CFR 55.45(13) specifically requires that the operating test be used to “demonstrate the applicant’s ability to function within the control room team…” This can be best performed in a dynamic setting, such as the simulator scenarios. The scenario events also allow testing of the 10 CFR 55.45(12) requirement to “demonstrate the knowledge and ability as appropriate to the assigned position to

assume the responsibilities associated with the safe operation of the facility" in a dynamic setting.

- Testing an applicant's ability to implement evolutions and mitigating actions in a control room design with low operational complexity and high levels of automation make it overly challenging to develop JPMs that are meaningful and provide a basis for evaluating applicant performance.

Section 3.3, Form 1 – Reactor Operator Walkthrough Outline

NuScale SMR Reactor Operator License Walkthrough Examination Outline			
Facility		Date of Exam	
Training Phase	Topic Area	JPM Title	Type Code
Critical Safety Function EOP Local Actions	Containment Integrity		
	Reactivity		
	Core Heat Removal		
Defense-in-Depth EOP Local Actions	Electrical Distribution		
	RCS Inventory		
	Secondary Heat Removal		
	Post Trip Actions		
			(3) Total RO JPMs
(N)ew or (M)odified (≥ 1) (P)revious 2 NRC exams (≤ 1) (R)CA entry (≥ 1)			

Section 3.3, Form 2 – Senior Reactor Operator Walkthrough Outline

NuScale SMR Senior Reactor Operator License Walkthrough Examination Outline			
Facility		Date of Exam	
Training Phase	Topic Area	JPM Title	Type Code
Fuel Handling	Fuel Handling Equipment Plant Systems		
	Unit Refueling Integrated Operating Procedure		
Equipment Control	Configuration Control		
	Chemistry Controls		
	Danger Tagging Program		
	EOOS (work-risk) Program		
	Work Control Program		
	Industrial Safety & Health Program		
Emergency Plan	Classification		
	Implementation		
	Non-Emergency Reporting		
			(3) Total SRO JPMs
(N)ew or (M)odified (≥ 1) (P)revious 2 NRC exams (≤ 1) (R)CA entry (≥ 1) (not required for SRO-I applicants if already sampled as part of RO exam)			

Section 3.3, Form 3 – Job Performance Measure Guide

NuScale SMR Operator License Job Performance Measure Guide		
Facility		License Level: □ RO □ SRO
JPM Title		
Training Phase/ Topic Area		
LOB K/S/A		
Method of Testing	☐ Plant ☐ Refuel Simulator ☐ Simulator	
Plant Location		
Validation Time		
Task Standard		
Required Materials/ References		
☐(N)ew ☐ (M)odified ☐ (P)revious 2 exams ☐ (R)CA entry		

Job Performance Measure Initiating Cue
[Information provided to applicant]

JPM Performance Information

* Denotes critical steps

Step No	Performance Step:
Standard	
Comment	

Step No	Performance Step:
Standard	
Comment	

Step No	Performance Step:
Standard	
Comment	

Step No	Performance Step:
Standard	
Comment	

Completion/ Terminating Cue	
Comment	

Section 3.3, Form 4 – Operating Test Exam Score

NuScale SMR Operating Test Exam Score		
Applicant's Name	Docket Number	Date of Exam
Exam Type: □ RO □ SRO-I □ SRO-U		

Overall Operating Exam Score Summary			
Scenario No.	Event No.	Event Title	S/U
Write-In Events (if required)			

Walkthrough Exam Score Summary		
	JPM Title	S/U
RO Walkthrough JPMs*		
SRO Walkthrough JPMs**		
* RO JPMs not required for SRO-U candidates ** SRO JPMs not required for RO candidates		

Operating Test Total	
# of Successful Scenario Events and JPMs	
Total # of Scenario Events and JPMs	
Applicant Grade (%)	

Enclosure 2:

“Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 3.7: Operating Exam, Simulator Test Part,” Revision 0

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Operator Licensing and Examination Standard for NuScale Small Modular Reactors

Section 3.7: Operating Exam, Simulator Test Part

NuScale Pressurized Water Small Modular Reactors

July 2020

Revision 0

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3.7 Operating Examination Simulator Scenario Process

A. Purpose

This document provides recommendations from NuScale on the guidelines for developing and administering the simulator demonstrative scenario part of the operating tests for NuScale facilities that meet the requirements of 10 CFR 55.45, "Operating tests," including the use of reactor plant simulation facilities and the conduct of multi-unit evaluations.

The second part of a NuScale operating test is an individual plant walkthrough portion. The recommendations for the individual walkthrough part of the operating test are provided in a separate document, "Section 3.3: Operating Exam, Walkthrough Part."

B. Background

To the extent applicable, the operating test requires the applicant to demonstrate an understanding of, and the ability to perform, the actions necessary to accomplish a representative sampling of the thirteen items identified in 10 CFR 55.45(a). All thirteen items do not need to be sampled on every operating test. The simulator scenario portion of the operating test implements 10 CFR 55.45(a)(1) through (a)(9) and (a)(11) through (a)(13). The simulator operating test, or simulator test, is administered on an NRC-approved or plant-referenced simulator. NuScale is not recommending any changes or exceptions to these requirements.

A simulator test consists of a set of simulator scenarios and each scenario consists of a set of scenario events. The scenarios are administered in a team format with the license applicants filling the reactor operator (RO) and senior reactor operator (SRO) license positions, as appropriate, on an operating crew. This format enables the examiner to evaluate each applicant's ability to function within the control room team as appropriate to the assigned position in such a way that the facility licensee's procedures are adhered to and that the limitations in its license and amendments are not violated (refer to 10 CFR 55.45(a)(13)).

C. Simulator Scenario Development

The simulator scenarios developed for NuScale operating tests generally follow the format and style of scenarios used in existing fleet operating tests. Additional recommendations are provided below:

1. Scenario Attributes

a. Each scenario shall include the following attributes:

- At least one significant change in power level on an operating unit.
- At least one normal evolution or surveillance activity that manipulates plant equipment.
- Two or three component failures or automation failures.
- At least one opportunity to perform a technical specification (TS) operability determination.
- At least one major plant transient for at least one unit.

- At least two plant conditions that require the Control Room Supervisor (CRS) to demonstrate SRO oversight.

Further information concerning these attributes is provided in Attachment 1 - Simulator Scenario Attributes.

b. Scenario events:

- Scenarios are intended to take 60 to 90 minutes to conduct. The number of events in each scenario is variable, based on the time necessary for the crew to implement or respond.
- In addition to the scenario attributes listed in Section 1.a. above, enough scenarios and scenario events are used in each exam such that each applicant is evaluated performing between 7 and 12 scenario events as part of their operating test.
- Each scenario event includes pre-identified event standard criteria, similar to existing fleet job performance measure (JPM) task standards.
    - The event standard identifies the expected end point or outcome of the event that the applicants are expected to reach. As an example, the event standard for an event to perform a shutdown of an individual unit would be that the unit's main turbine is shutdown, all control rods are inserted, and the Nuclear Power Module is in MODE 2.
    - Procedure steps and important actions expected to be used during the event are pre-identified in the scenario guide. This identifies significant steps and actions required to accomplish the event standard criteria.
    - Section E below provides guidance for the situation in which the event standard criteria are satisfied, but some procedure steps or actions were not implemented as expected.

c. To maintain test integrity, every scenario is new or significantly modified to ensure the applicant has not had the opportunity to rehearse or practice the scenario.

- Due to the limited number of NuScale Emergency Operating Procedures, the EOPs are exempt from the overlap limit. To the extent practical, the starting operating situations, initiating conditions, affected unit, and parts of the EOP exercised are varied to maintain test integrity.
- Because of a limited number of methods for adding reactivity, reactivity manipulations events are exempt from this overlap limit.

2. <u>Bases for scenario attributes</u>

a. The differences in scenario attributes between NuScale plant exams and existing fleet plant exams reflect the different operating parameters and characteristics of the plants.

- The ability of the ROs to implement the highly-automated, embedded electronic procedures is examined in the operating test.

- The NuScale plant is a multi-unit facilities controlled from a single control room. The content of the operating test is varied to cover elements of single unit operation versus multi-unit operational concepts.
- Automations are used to a greater extent at NuScale plants, so automation failures are included in scenario attributes.
- A requirement to include situations and conditions under which SRO oversight can be evaluated is specifically added because the NuScale control room design allows the RO watch positions to address a greater extent of situations than existing fleet designs.

D. Administering the Simulator Test

Simulator scenarios administered as part of NuScale exams generally follow the practices used in existing fleet exams. Additional recommendations are provided below:

1. Crew composition

a. Each RO, SRO-instant (SRO-I) and SRO-upgrade (SRO-U) applicant is evaluated in the following required positions during the exam:

- The RO applicants are tested in either the RO2 or the RO3 position.
- The SRO-I applicants are tested at least once in either the RO2 or RO3 position and at least once in the CRS position.
- The SRO-U applicants are tested at least once in the CRS position and may perform additional scenarios as either CRS or RO2/RO3.
    - The SRO-U applicants are given credit for their previous RO license evaluation and experience. They are not normally required to manipulate the controls unless they are assigned to either of the evaluated RO positions.

b. Surrogate operators are used for the RO1 position during the simulator demonstrative exam. Other surrogate operators are used only when they are necessary to complete an operating crew.

- If an applicant would be exposed to only one additional scenario above the minimum required, a surrogate operator is not used in place of a license applicant. However, no applicant is required to participate in more than one scenario above the minimum required, in which case, a surrogate operator is used.
- All surrogate operators are briefed regarding the content of the scenarios and their expected actions in every event.
- The surrogate operators do not need to be licensed at the facility, but they must have the knowledge and abilities required to assume the full responsibilities of the roles they take in the operating test. Surrogates do not take a proactive role in assisting or coaching the applicants because such interventions would hinder the examiners' ability to evaluate the applicants' competence.

c. Only one individual (applicant or surrogate) is allowed to fill the senior operator position during the simulator operating test. This position, typically referred to as the shift supervisor, control room supervisor, or unit supervisor, is the senior licensed operator immediately responsible for control of the unit. One of the facility licensee simulator operators typically takes the role of other on-shift positions (e.g., shift manager, work control supervisor, or assist/third control room operator), whether licensed or not.

2. Bases for Scenario Crew Composition

a. The control room staff positions used for the NuScale plant design are different than the positions used at existing fleet plants. This is provided in "Concept of Operations," RP-0215-10815. Notably, an additional reactor operator, RO1, is responsible for monitoring of all 12 units and balance of plant systems. In this role, the additional operator would not be expected to perform meaningful actions in transient and off-normal conditions. The evaluated positions, excluding RO1, and the use of surrogates are aligned to the roles and responsibilities of the NuScale crew members.

E. Grading the Simulator Test

1. Scenario grading

a. The evaluation of the simulator scenario is based on the completion of scenario events, instead of using the competency-based grading scheme as in existing fleet exams.

- Each event of a scenario is not credited to all crew members, only to the applicants that take some observable action during the course of the event. Some events will allow more than one, or all, crew members to be credited. The applicants who are expected to respond are pre-identified in the scenario guide. As examples:
    - An event with a component failure on a unit controlled by RO2 and requires the CRS to evaluate TS operability, would be credited to both the CRS and RO2.
    - An event in which all non-safety I&C control is lost, RO2 and RO3 simultaneously trip all 12 units and initiate decay heat removal, and the CRS evaluates plant response on the safety display and indication cabinets, would be credited to all three crew members.

b. Write-in events:

- Not all operator actions can be predicted when developing a simulator scenario. A write-in event could occur if the crew or an applicant does not perform an event in the way it was scripted. The following are examples of write-in events that could occur during a scenario:
    - A crew member responds to an event when the scenario script intended another applicant to respond.
    - An applicant or the entire crew responds differently than expected during the event.

- Write-in events are evaluated as successful or not successful and count toward the overall operating test score like any other scenario event. Write-in events are assigned to the appropriate applicant at the completion of the exam using "Form 4 – Operating Test Exam Score" in "Section 3.3: Operating Exam, Walkthrough Part."
- If the crew or an applicant responds to the event in a manner that causes the conditions of the task standard to no longer apply, then that event can be marked as N/A. This would no longer be credited toward the total events of affected applicants.
- If necessary, a scenario that goes off script may be halted and an additional scenario may be performed to ensure all applicants are exposed to the required scenario elements.

c. The grading of the operating test is a combined score of both the simulator scenario and the individual walkthrough.
   - Each RO and SRO applicant performs 7 to 12 scenario events as part of their operating test.
   - Each RO and SRO-I applicant performs three individual RO job performance measures.
   - Each SRO-I and SRO-U applicant performs three individual SRO job performance measures.

d. Applicants are required to successfully complete 80% of the total number of scenario events and individual JPMs in order to pass the operating test part of the exam. See "Form 4 – Operating Test Exam Score" in "Section 3.3, Operating Exam, Walkthrough Part."

2. <u>Bases for Grading Methodology of the Operating Test</u>

a. Combining the scoring of the two parts of the operating test allows emphasis to be placed on evaluation of crew dynamic situations more than individual actions.
   - 10 CFR 55.45(13) specifically requires that the operating exam be used to "demonstrate the applicant's ability to function within the control room team…". This can be best performed in a dynamic setting, such as the simulator scenarios. The scenario events also allow testing of the 10 CFR 55.45(12) requirement to "demonstrate the knowledge and ability as appropriate to the assigned position to assume the responsibilities associated with the safe operation of the facility" in a dynamic setting.
   - Testing of the applicant's ability to implement evolutions and mitigating actions in a control room design with low operational complexity and high levels of automation make it overly challenging to develop JPMs that are meaningful and provide a basis for evaluating applicant performance.

Section 3.7, Attachment 1 – Simulator Scenario Attributes

Some characteristics of a scenario can be quantified, and generally have a bearing on the complexity and level of difficulty of the scenario. The following discussion describes these characteristics:

a. Significant change in power level

   A significant change in power level is one that changes unit output power by greater than 10 percent. For NuScale plants, the change in power can be performed using a single unit or using multiple units. When a load-following maneuver using multiple units is performed, a 10-percent change in total station output is sufficient to be considered significant. The change can be a power increase or a power decrease. If the evolution is used as a backdrop to stage component or automation failures, or major plant transient situations, it does not need to wait for the power level change to complete, provided that at least a 10-percent power change has occurred. The initiating condition for the change in power level can be any normal evolution, component failure, automation failure, or abnormal event that requires the operator to perform a controlled power or reactivity event. The initiating condition may be pre-planned as a turnover item to the crew or can be provided by a pre-scripted cue.

b. Normal evolutions

   Normal evolutions are evolutions in which an applicant, acting in their role as a member of the control room crew team, performs a routine control room activity to support plant operation, as opposed to responding to malfunctions and casualty situations. Examples of normal evolutions include: routine rotation of major system components, generator synchronization and loading, technical specification surveillances, and operating station electrical components, such as backup diesel generators and alternate AC power sources. The evolution can be performed using automation or manipulating individual components directly from the human-system interface. Normal evolutions can also be used as a backdrop to other events, such as significant changes in power levels.

c. Component failure

   Component failures are any pump, motor, valve, or other failure used to initiate the events that constitute a scenario, including those initiated after EOP entry. Electrical system individual component failures are also included in this category. To count as a component failure, it must involve an opportunity for an operator to take some mitigating action. For example, an anticipated transient without scram or an anticipated transient without trip is a single malfunction, regardless of how many instructions a simulator operator must program to produce it. Components that are placed out of service at the beginning of a scenario as part of the shift turnover conditions, and of which the crew is made aware, are not considered component failures. Instrument channel failures that do not require operator response also do not count as component failures, although they may count as technical specification operability determinations.

d. Automation failure

   Automation failures are considered similarly to component failures in the exam. The failure must cause an opportunity for the applicant to respond. Simply verifying that the

automation correctly halted without operator action is not credited, but operator action to halt the automation would be credited. NuScale plants use automations that are simple, such as swapping pumps, and those that are more complex, such as performing a unit cooldown and depressurization. Both types of automation failure are acceptable for the examination, as long as the failure results in an operator response.

e. Technical Specification Operability Determination

Each scenario shall require at least one condition or situation where the SRO candidate is required to recognize and interpret the TS. This recognition and interpretation can also be incorporated into the scenario by designating TS-related equipment that is out of service at the start of the scenario.

f. Major Plant Transient

Each scenario evaluates the operator's ability to respond to a major plant transient event to one or more NPMs. A major transient is one that leads to an automatic or manual protective system actuation, such as a reactor trip or engineered safety feature system actuation. For NuScale plants, this requires use of the Critical Safety Function EOPs and the Defense-In-Depth EOPs. This attribute should reflect the conditions that have measurable actions that the crew must take. Moreover, use of the Post-Trip Response Defense-In-Depth procedure is not counted unless actions beyond the standard post-trip actions are required, such as EOP Procedure "(PE-2); Main generator fails to open."

g. Senior Reactor Operator oversight

Each scenario shall include at least one plant condition that requires the SRO candidate in the CRS role to demonstrate SRO oversight. Examples of SRO oversight include:

- Multi-unit events in which degrading or off-normal plant conditions require prioritization of actions to be taken on more than one unit. Response to failures of common plant systems such as the reactor component cooling water system, site cooling water system, circulating water system, or instrument air system , are examples. Failures of common components within some electrical systems are also considered.
- Events that occur simultaneously at different units, causing the SRO to prioritize control room resources used in the response. The events can include prioritization of normal evolutions against transient conditions. As an example; an environmental event such as an earthquake could occur, while a unit heatup and pressurization is already in progress. The CRS would have to prioritize the normal evolution with responding to the earthquake. Additional complications of component or automation failures can be added to the event to allow an opportunity for the SRO to exercise oversight and command and control.
- Component or automation failures that cause multiple cautions or alarms and require prioritization of crew response. For example, a scenario event for responding to reactor coolant system leakage into containment would cause reactor coolant system leakage alarms, containment pressure and temperature alarms, chemical and volume control system flow alarms, and containment evacuation system alarms. The SRO applicants are responsible to exercise oversight to prioritize crew response,

including prioritization of the use of individual alarm response procedures with the use of integrated abnormal operating procedures to mitigate the conditions.

Section 3.7, Form 1 – Scenario Outline

NuScale SMR Scenario Outline		
Facility	Scenario No.	Date of Exam
Examiners: _____ _____ _____	Operators: _____ _____ _____	
Initial Conditions:		
Turnover:		

Event No.	Event Type*	Event Description	Position

(S)ignificant power change, (N)ormal evolution, (C)omponent failure, (A)utomation failure, (TS)Operability determination, (M)ajor plant transient, (SRO)Oversight

Section 3.7, Form 2 – Scenario Attribute Checklist

NuScale SMR Scenario Attribute Checklist															
Facility											Date of Exam				
Applicant	License Type	Event Type	Scenarios												Total events (7 - 12)
			1			2			3			4			
			Crew Position			Crew Position			Crew Position			Crew Position			
			CRS	RO2	RO3	CRS	RO2	RO3	CRS	RO2	RO3	CRS	RO2	RO3	
	☐RO	(S)													
	☐SROI	(N)													
	☐SROU	(C/A)													
		(C/A)													
		(C/A)													
		(TS)													
		(M)													
		(SRO)													
	☐RO	(S)													
	☐SROI	(N)													
	☐SROU	(C/A)													
		(C/A)													
		(C/A)													
		(TS)													
		(M)													
		(SRO)													
	☐RO	(S)													
	☐SROI	(N)													
	☐SROU	(C/A)													
		(C/A)													
		(C/A)													
		(TS)													
		(M)													
		(SRO)													

	☒RO ☐SROI ☐SROU	(S)													
		(N)													
		(C/A)													
		(C/A)													
		(C/A)													
		(TS)													
		(M)													
		(SRO)													
(S)ignificant power change, (N)ormal evolution, (C)omponent failure, (A)utomation failure, (TS) Operability determination, (M)ajor plant transient, (SRO) Oversight															

Section 3.7, Form 3 – Scenario Guide

Scenario Summary: [Describe the overall sequence of events that occur during the scenario]

SCENARIO OVERVIEW		
Event #	**Unit**	**Event Description**

Simulator Setup:		
Initial Conditions: • [as needed]		
MALFUNCTION SUMMARY	**SEVERITY**	**RAMP**
Additional Information:		

Turnover Information: **Provide the following information:**
Turnover from off-going crew • Plant status – [provide plant status for all units and common plant equipment] • TS LCO's in affect: [As provided] • Tagging: [As provided] • Schedule: [as provided] • WCC to authorize the following during the shift. These are not events but will add communication to the crew throughout the scenario: - [as provided]

Event Description

EVENT 1 DESCRIPTION
[provide summary of event 1]

BOOTH OPERATOR	PLANT/CREW RESPONSE	NOTES	Position Checklist	
MALFUNCTION/TRIGGER Trigger 1: [TBD]				
CUE/ALARM/NOTIFICATION/ WARNING:				

EVENT STANDARD	

EVENT CONTINUATION/TERMINATION CRITERIA	

[add events as required]

Scenario Aids Checklist

The following simulator aids will be used during this scenario. This checklist provides a list of the aids attached. Verify current revisions of simulator aids are used and update scenario summary in VISION if applicable tasks have been revised and scenario content requires revision.

SCENARIO AIDS ATTACHED	INITIALS
Scenario Performance Log	
Turnover Sheet	
Reactivity Form	

Enclosure 3:

"Operator Licensing and Examination Standard for NuScale Small Modular Reactors Section 4.4: Written Exam," Revision 0

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Operator Licensing and Examination Standard for NuScale Small Modular Reactors

Section 4.4: Written Exam

NuScale Pressurized Water Small Modular Reactors

July 2020

Revision 0

Table of Contents

4.4 Written Examination

A. Purpose

This document provides recommendations from NuScale on the guidelines for preparing written examinations for the initial licensing of reactor operators (ROs) and senior reactor operators (SROs) at power reactor facilities based on the NuScale Small Modular Reactor (SMR).

B. Background

The written examination part of a NuScale operator license exam for ROs and SROs is dictated by 10 CFR 55.41, “Written Examinations: Operators,” and 10 CFR 55.43, “Written Examinations: Senior Operators,” respectively. Each examination shall contain a representative selection of questions concerning the knowledge and abilities (K/As) and skills needed to perform duties at the desired license level. Both the RO and SRO examinations sample the 14 items specified in 10 CFR 55.41(b), and the SRO examination also samples the seven additional items specified in 10 CFR 55.43(b). NUREG-1021, “Operator Licensing Examination Standards for Power Reactors,” provides the guidance to ensure the examination includes a representative sample of the items specified in the regulations.

The Learning-Objective-Based Knowledge, Skills, and Abilities (LOB-KS&As) Catalog for NuScale plant designs is used as the basis for developing content-valid operator licensing examinations for NuScale Small Modular Reactor (SMR) plant designs.

C. Size of the written exam

1. Number of exam questions

The recommended size for the NuScale operator license written exam is 65 questions–50 RO questions and 15 SRO questions.

a. All RO license applicants and direct SRO candidates are administered the 50 RO questions.
b. Direct SRO and SRO upgrade (SRO-U) candidates are administered the 15 SRO questions.
c. The SRO-U candidates may apply for a waiver of the RO portion of the exam, given that they have previously passed an RO licensing examination covering the topics specified in 10 CFR 55.41(b).

2. Bases for number of exam questions

The recommended reduction in size of the NuScale operator license written exam as compared to the existing fleet exam size is based on the following.

a. There are fewer plant systems in the NuScale SMR plant design as compared to the existing fleet. Within those plant systems, NuScale engineered safety features (ESF) systems are passive systems, which use fewer components than other plant designs.

- Number of plant systems

NuScale	43
Existing fleet PWR	~ 50
Existing fleet BWR	~ 67

- Comparison of ESF core heat removal systems

NuScale	ESF plant systems • DHRS • ECCS • UHS	• No AC or DC power required ○ DHRS and ECCS rely on a small number of hydraulic valves that fail to the actuated position. The valves do not require repositioning after initial actuation. • UHS has no movable components. • ESF systems provide core cooling indefinitely without operator action.
Existing fleet PWR	ESF systems • RHRS (low head injection) • Safety Injection (SI) (intermediate head injection) • SI accumulators • CVCS (high head injection) • CBS (Containment Building Spray) • Emergency Feedwater (EFW) Required support systems • Service water • Component cooling water • Emergency diesel generator	• Requires both AC and DC power. • Most systems rely on pumps and valves, which typically require repositioning to actuate. • Valves typically must be repositioned after actuation.

Existing fleet BWR	ESF systems • High Pressure Core Spray (HPCS) • Low Pressure Core Spray (LPCS) • Reactor Core Isolation Cooling (RCIC) • Residual Heat Removal (RHR) • Automatic Depressurization System (ADS) Required support systems • Service water • Component cooling water • Emergency diesel generator	• Requires both AC and DC power. • All systems rely on pumps and valves, which typically require repositioning to actuate. • Valves typically must be repositioned after actuation.

b. The technical specifications (TS) for the NuScale SMR plant design are smaller than those of the existing fleet.
   - NuScale TS only have eight sections instead of nine sections.
     i. There is no ELECTRICAL SYSTEMS section, because there is no safety-related AC or DC power.
   - Most NuScale TS sections have fewer Limiting Conditions for Operation (LCOs) than existing fleet PWRs.

Technical Specification Section	# of LCOs		
	NuScale	AP1000	Existing Fleet PWR
Reactor coolant system	9	17	~16
Passive cooling systems/ECCS	3	8	~ 6
Containment	2	9	~ 10
Plant systems	2	12	~ 11
Refueling	2	5	~ 10

c. The number of abnormal operating procedures (AOPs) and emergency operating procedures (EOPs) in the procedure network at NuScale plants is less than typical plant procedure sets.
   - Number of AOP and EOP procedures

	NuScale	Existing fleet PWR	Existing fleet BWR
AOPs	18	~ 31	~ 25
EOPs	7	~ 22	~ 16

D. Scope of the written exam

1. Topic areas tested in the written exam

The Learning-Objective-Based Knowledge, Skills, and Abilities (LOB/KS&As) Catalog is used as the basis for developing content-valid operator licensing examinations for NuScale SMR plant designs. Those learning objectives that are testable on the operator licensing exam are identified as “selected” in the catalog, similar to how the existing fleet catalog uses importance ratings to identify which knowledge and abilities (K&A) are testable.

The question topics are randomly chosen from the “selected” learning objectives in a manner consistent with existing fleet practices.

The organization of the NuScale catalog is aligned with the phases of an initial license operator training program. The distribution of question topic areas within the written exam also are aligned to the training program phases.

a. Learning objectives from classroom lessons, scenario guides, and qualification guides are included within the scope of the written exam.
b. The recommended number of questions tied to each topic area is found on Form 1 - Written Examination Outline.
c. Learning objectives can be added to or rejected from the selectable pool using Form 2 - Record of Rejected and Added Learning Objectives, or from using the comparable guidance in NUREG-1021.

2. Bases for distribution of written exam content

a. The existing fleet PWR, BWR, and AP1000 K&A catalog is laid out according to safety functions and emergency and abnormal plant evolutions. The distribution of the number of questions for each of these areas is set by separately dividing the systems and procedures into tiers and groups as described in NUREG-1021. More questions are chosen from Group 1 items than Group 2 in both tiers.

   The distribution of NuScale exam questions is based on and aligned with the NuScale LOB/KS&A catalog layout, which is organized by the training phases and topic areas used in typical industry systematic approach to training (SAT)-based training programs. Those training phases and topic areas are shown on Form 1 - Written Examination Outline. The distribution of the number of questions in each topic area is set according to the content of that area. Examples are: System Technical Specification information is taught in the plant system classroom courses; station administrative programs are taught in the Admin phase; and, Integrated Operating procedures, AOPs, and EOPs are taught in other specific training phases.
b. Including learning objectives from each training setting used in SAT-based training programs (classroom, simulator scenario guides, and in-plant [qualification] guides), ensures the broad spectrum of KS&As used when operating a NuScale SMR plant are included within the exam scope. Specifically, the classroom learning objectives tend to focus on operational knowledge, while the scenario guides and in-plant qualification guides are more focused on skills and abilities.

3. Generic Fundamental Examination questions

a. Generic Fundamental training phase questions are included in the NuScale written exam. There are two topic areas in this category: theory and components. The questions for these are randomly chosen as follows.

- The number of questions from each topic area is provided on Form 1 - Written Examination Outline.
- The GFE Reactor Theory and Thermodynamics K&As are used to select theory-based questions without links to specific plant systems.
- The GFE Component K&As are randomly selected then linked back to operationally relevant plant systems. The GFE component questions should not overlap with any other plant system question on the written exam. If required, a K&A may be rejected and a new component or plant system question selected using Form 2 - Record of Rejected and Added Learning Objectives to avoid overlap concerns.

4. Bases for including Generic Fundamentals Examination questions

a. The inclusion of GFE questions into the written exam is based on a program being piloted by the existing fleet to incorporate GFE content into their license operator written exam. The intent for the NuScale exam is to roughly mirror the ratio used in the pilot between the number of GFE questions to the total number of questions, adjusting for the difference in recommended exam size.

E. Construction of examination questions

1. Written examination question format and style

The written exam questions used for NuScale generally follow the format and style of existing fleet exams.

a. All test questions are in the multiple-choice format described. Each question has four possible answer choices and is worth one point.
b. The ratio of low-cognitive to high-cognitive questions used for the NuScale written exam mirror the existing fleet written exams.

- In order to maintain examination quality and consistency, between 50 and 60 percent of the questions on the RO examination (25–30 questions) and at least 50 percent of the questions on the SRO-only portion of the examination (eight questions) are written at the comprehension/analysis level. The SRO examination, overall, exceeds 60 percent because the K&A categories emphasized on the SRO-only examination are generally consistent with the higher cognitive levels.

c. The ratio of bank and new questions used for the NuScale written exam mirror the existing fleet written exams.

- Take no more than 75 percent of the questions for the examination (i.e., 37 questions for the RO and 11 questions for the SRO-only) directly from the facility licensee's or any other written examination question bank without significant modification.
- If the bank contains more than one question that fits a specific K&A statement, randomly select from among the available questions unless there is an appropriate basis for selecting a specific question (e.g., a particular question has a higher cognitive level, has better discrimination validity, is more operationally oriented, or addresses site-specific priorities).
- Write at least five new questions (three for the RO examination and two for the SRO-only) for each exam.
- Select the remaining questions for the examination (nominally 10 for the RO and two for the SRO-only) from the facility licensee's or *any* other bank, but significantly modify each question by changing at least one pertinent condition in the stem and at least one distractor.

2. Bases for changes to numbers of question types

a. The small adjustments to the numbers of required comprehensive/analysis level questions and bank questions within each requirement are recommended to maintain a proportional alignment of question types with the existing fleet exam while incorporating the change in exam size.

3. Senior Reactor Operator examination questions

a. The SRO exam questions meet the current, existing, fleet question standards. Learning objectives to be considered for this portion of the exam are identified as "SRO LO" in the LOB/KS&A catalog. Generally, these are selected from the following sources:

- Plant Systems
  - The SRO plant system questions for NuScale exams are associated with TS bases. These are tied to plant system standard learning objective E010; "Given various operating conditions, RECOGNIZE the Technical Specifications and Technical Requirements operational limitations and actions associated with the [plant system] (including TS bases for SRO only)." Not all plant systems include Technical Specifications or Technical Requirements. The plant systems that have learning objectives included in this category are identified in Form 1 - Written Examination Outline.
  - All of the fuel handling system plant system standard learning objectives that are categorized as within the scope of the SRO part of the NRC written operating exam.
  - The topic areas for the three plant system questions should be randomly selected from the five plant system topic areas. The GFE components are tested as part of the RO written exam only.

- All of the Administrative Program Phase, Integrated Operating Procedure, AOP, or EOP standard learning objectives that are categorized as within the scope of the NRC written operating exam and that are tied to an SRO task.
    - Each of the four administrative topic areas are tested once. The fifth administrative topic is randomly selected from the four administrative topic area areas.

4. <u>Bases for changes to distribution of Senior Reactor Operator exam questions</u>

a. The alignment of SRO questions to the training program topic areas provided above is done to reflect the location of SRO learning objectives within the NuScale LOB/KS&As catalog.

Section 4.4, Form 1 – Written Examination Outline

NuScale SMR Operator License Written Examination Outline					
Facility			Date of Exam		
Training Phase	Topic Area	RO LOB/KS&A	Total	SRO Only LOB KS&As	Total
Generic Fundamentals	Reactor Theory		(2)	N/A	
	Thermodynamics		(2)		
Plant Systems	Primary		(6)		(3)
	Secondary		(5)		
	I & C		(5)		
	Electrical		(4)		
	Auxiliary		(4)		
	GFE Components		(2)	N/A	
Administrative	COO		(1)		(5)
	Equip. Control		(1)		
	Radiation Control		(1)		
	Emergency Plan		(1)		
Integrated Operating Procedures	Power Operation		(1)		(2)
	Unit Shutdown		(1)		
	Unit Refueling		(1)		
	Unit Startup		(1)		
	Critical Approach		(1)		
Abnormal and Emergency Operating Procedures	AOP		(6)		(2)
	EOP		(5)		(3)
		Total Exam Points	(50)		(15)

NuScale SMR Operator License Written Examination Outline Generic Fundamentals - Theory			
GFE Training Phase	Topic Area		GFE K&A tested
Reactor Theory	1	Neutrons	
	2	Neutron Life Cycle	
	3	Reactor Kinetics and Neutron Sources	
	4	Reactivity Coefficients	
	5	Control Rods	
	6	Fission Product Poisons	
	7	Fuel Depletion and Burnable Poisons	
	8	Reactor Operational	
			Reactor Theory sub-total (2)
Thermodynamics Theory	1	Thermodynamics Units and Properties	
	2	Basic Energy Concepts	
	3	Steam	
	4	Thermodynamic Process	
	5	Thermodynamic Cycles	
	6	Fluid Statics and Dynamics	
	7	Heat Transfer	
	8	Thermal Hydraulics	
	9	Core Thermal Limits	
	10	Brittle Fracture and Vessel Thermal Stress	
			Thermodynamic Theory sub-total (2)
			Group Point total (4)

NuScale SMR Operator License Written Examination Outline Plant Systems – page 1 of 3				
Plant System Training Phase	System		RO LOB/KS&As tested	SRO LOB/KS&As tested
Primary Systems	1	BAS		
	2	CES		
	3	CFDS		
	4	CNTS		
	5	CRDS		
	6	CVCS		
	7	DHRS		
	8	ECCS		
	9	FHE		
	10	MHS		
	11	RCCWS		
	12	RCS		
	13	UHS		
Primary Systems sub-total			(6)	
Secondary Systems	1	ABS		N/A
	2	CARS		
	3	CPS		
	4	FWS		
	5	MSS		
	6	SGS		
	7	TGS		
Secondary Systems sub-total			(5)	
Instrument and Control Systems	1	ICIS		N/A
	2	MCS		
	3	MEMS		
	4	MPS		
	5	NMS		
	6	PCS		N/A
	7	PPS		
	8	SDIS		
	9	SMS		
	10	RMS		
Instrument and Control Systems sub-total			(5)	

NuScale SMR Operator License Written Examination Outline Plant Systems – page 2 of 3				
Plant System Training Phase	System		RO LOB/KS&As tested	SRO LOB/KS&As tested
Electrical Systems	1	BPSS		N/A
	2	EDSS		
	3	NDS		
	4	EHVS		
	5	ELVS		
	6	EMVS		
	7	PLS		
Electrical Systems sub-total			(4)	
Auxiliary Systems: Pool Systems	1	PCUS		N/A
	2	PLDS		
	3	PSC		
	4	RPCS		
	5	SFPCS		
Auxiliary Systems: Primary Auxiliary Systems	6	GRWS		N/A
	7	LRWS		
	8	PSS		
	9	SRWS		
Auxiliary Systems: Balance of Plant Auxiliary Systems	10	BPDS		N/A
	11	DWS		
	12	FPS		
	13	SCWS		
	14	UWS		
Auxiliary Systems: Ventilation Systems	15	CRHS		N/A
	16	CRVS		
	17	RBVS		
	18	RWBVS		
	19	TBVS		
Auxiliary Systems sub-total			(4)	

NuScale SMR Operator License Written Examination Outline Plant Systems – page 3 of 3				
Plant System Training Phase	System		RO LOB/KS&As tested	SRO LOB/KS&As tested
GFE Components	1	Valves		N/A
	2	Sensors and Detectors		
	3	Controllers and Positioners		
	4	Pumps		
	5	Motors and Generators		
	6	Heat Exchanger & Condensers		
	7	Demineralizers and Ion Exchangers		
	8	Breakers, Relays, and Disconnects		
GFE Components sub-total			(2)	
Plant Systems Group Point Total			(26)	(3)

NuScale SMR Operator License Written Examination Outline Administrative Programs Phase					
Administrative Programs Training Phase	Program		RO LOB/KS&As tested		SRO LOB/KS&As tested
Conduct of Operations	1	Conduct of Operations			
	2	Work Hour Regulations & Fitness for Duty			
	3	Procedure Use and Adherence			
	4	TS Use			
	5	TS Admin			
	6	Technical Requirements Manual (TRM)			
	7	Operability Determinations			
	8	Fire Plans			
			Conduct of Ops sub-total	(1)	(1 - 2)
Equipment Control	1	Configuration Control			
	2	Chemistry Controls			
	3	Danger Tag Out			
	4	Equipment Out of Service			
	5	Work Control			
	6	Industrial Health and Safety			
			Equipment Control sub-total	(1)	(1 - 2)
Radiation Control	1	Rad Exp			
	2	Liquid and Gaseous Release			
			Radiation Controls sub-total	(1)	(1 - 2)
Emergency Plan	1	EAL Classification			
	2	E-plan			
	3	Non-Emergency Reporting			
			Emergency Plan sub-total	(1)	(1 - 2)
			Admin Group Point Total	(4)	(5)

NuScale SMR Operator License Written Examination Outline Integrated Operating Procedure (IOP) Phase				
Procedure		RO LOB/KS&As tested		SRO LOB/KS&As tested
1	Power Operations IOP			
2	Unit Shutdown IOP			
3	Refueling Operation IOP			
4	Unit Startup IOP			
5	Critical Approach & Turbine Generator phase-on (part of unit startup IOP)			
		IOP Group Totals	(5)	(2)

NuScale SMR Operator License Written Examination Outline Abnormal Operating Procedure Phase			
Procedure		RO LOB/KS&As tested	SRO LOB/KS&As tested
1	Acts of Nature - Earthquake		
2	Acts of Nature - Weather		
3	Containment In-leakage		
4	Degraded Main Condenser Vacuum		
5	Fire Response		
6	Heavy Lift or Fuel Handling Accident		
7	Loss of Off-Site Power		
8	Main Control Room Evacuation		
9	Reactor Coolant Leakage		
10	Security – Event Response		
11	Security – Airborne Attack Threat		
12	Control Rod Malfunction		
13	Control Room Habitability Initiation		
14	Loss of Spent Fuel Pool Cooling		
15	Non-safety I&C interface Malfunction		
16	RCCWS Abnormal Ops		
17	SCWs Abnormal Ops		
18	Turbine Trip w/o Reactor Trip		
		AOP Group Totals (6)	(2)

NuScale SMR Operator License Written Examination Outline Emergency Operating Procedure (EOP) Phase				
Procedures			RO LOB/KS&As tested	SRO LOB/KS&As tested
Critical Safety Functions	1	Containment Integrity		
	2	Reactivity		
	3	Core Heat Removal		
Defense-in-Depth Functions	4	Electrical Distribution		
	5	RCS Inventory		
	6	Secondary Heat Removal		
	7	Post Trip Actions		
		EOP Group Totals	(5)	(3)

Section 4.4, Form 2 – Record of Rejected and Added Learning Objectives

Rejected and Added Learning Objectives		
Training Phase	Learning Objective/Sub-Objective	Reason for Rejection/Addition