September 25, 2017

Docket No. 52-048

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Response to NRC Request for Additional Information No. 158 (eRAI No. 8886) on the NuScale Design Certification Application

REFERENCE: U.S. Nuclear Regulatory Commission, "Request for Additional Information No. 158 (eRAI No. 8886)," dated August 08, 2017

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

The Enclosure to this letter contains NuScale's response to the following RAI Question from NRC eRAI No. 8886:

- 09.04.01-1

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

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

Sincerely,

Zackary W. Rad
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Enclosure 1: NuScale Response to NRC Request for Additional Information eRAI No. 8886

Enclosure 1:

NuScale Response to NRC Request for Additional Information eRAI No. 8886

NuScale Power

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

eRAI No.: 8886
Date of RAI Issue: 08/08/2017

NRC Question No.: 09.04.01-1

According to 10 CFR 50 Appendix A, Criterion 5, structures, systems, and components (SSCs) important to safety shall not be shared among nuclear power plants unless it can be showed that such sharing will not significantly impair their ability to perform their safety functions, including, in the event of an accident in one unit, an orderly shutdown and cooldown of the remaining units. 10 CFR 52.47(a)(2) requires sufficient information to permit understanding of the system designs and their relationship to the safety evaluations. In order to satisfy GDC 5, the staff's review on Control Room Ventilation System (CRVS) is intended to assure that sharing of CRVS SSCs in multiple nuclear power module (NPM) plants does not significantly impair their ability to perform their safety functions. This includes the ability to orderly shutdown and cooldown the remaining NPMs in the event of an accident in one NPM.

NuScale FSAR 9.4.1.3 states that CRVS is shared between 12 modules. Control room habitability is not creditable during design basis accidents because both CRVS and Control Room Habitability System are not safety related. Therefore, operators may need be evacuated from the control room during a design basis accident in one NMP and will not be able to shut down the NPMs. The staff requests the applicant to describe how to shutdown multiple modules in the event of an accident in one NPM.

NuScale Response:

The analyses summarized in FSAR Chapter 15 demonstrate that no design basis accidents (DBAs) require the evacuation of the main control room. In the event of a beyond design basis accident that requires the evacuation of the main control room, very little time, on the order of minutes, is required to trip the unaffected reactors from the control room.

The analyses summarized in FSAR Chapter 15 demonstrate that no DBAs result in fuel failure. Radiation dose to the control room is based on the technical specification limit for activity in the reactor coolant system. The introduction of significant quantities of radioactive materials into the control room would require an accident releasing substantial RCS liquid coincident with the failure of either the redundant CRVS radiation monitors or redundant CRVS isolation dampers. Even in such an unlikely scenario, there would be some delay between the release of reactor coolant and the contaminants reaching the control room, allowing the operating staff time to shut the unaffected reactor modules down before the control room became uninhabitable. These design features and operational considerations demonstrate compliance with GDC 5. FSAR Section 9.4.1.3 was modified to clarify that that the CRVS has no functions relative to shutting a module down or maintaining a module in a safe shutdown condition.

The designs of the normal control room HVAC system (CRVS) and the control room habitability system (CRHS) combined provide the control room staff with a highly reliable supply of clean air and protection against airborne radiation. As described in FSAR Sections 6.4 and 9.4.1, the CRVS continually monitors the outside air supply for radiation. If radiation is detected above a threshold level, the supply air is diverted through a filtration system. If high radiation is detected downstream of the filter unit, the redundant control room isolation dampers close (designed to fail closed), and the CRHS begins providing clean air from a bottled supply. No electric power is needed for the isolation dampers to close or for the CRHS to provide air to the control room.

In addition, the CRVS and chilled water system have the combined capability to provide cooled, filtered air to the MCR during a loss of normal AC power. Power for this function is provided by the highly reliable 480 VAC backup power supply system.

NuScale recognizes that, in accordance with practice for Chapter 15 (safety analysis), CRVS and CRHS are not credited to function during a DBA. However, the redundant and diverse design of these combined systems, coupled with their designation as augmented quality (Refer to FSAR Table 3.2-1) results in a very low probability of their simultaneous failure.

Impact on DCA:

FSAR Section 9.4.1.3 has been revised as described in the response above and as shown in the markup provided in this response.

9.4.1.3 Safety Evaluation

As noted in Section 15.0.0, no operator actions are required or credited to mitigate the consequences of design basis events. As such, the operators perform no safety-related functions as defined in 10 CFR 50.2 either during or after the 72-hour period following a design basis accident. Section 19.3 notes that the D-RAP expert panel determined that none of the non-safety systems are risk significant. Therefore, the CRVS is neither a safety-related system as defined in 10 CFR 50.2 nor an RTNSS system as defined in Section 19.3 of NUREG-0800.

The CRVS does not serve a safety-related function or risk-significant function. However, the CRE isolation dampers support the regulatory-required function of the CRHS, which relies on these dampers to isolate the CRE upon a loss of all AC power or if radiation levels are above the design limit of the charcoal filters, or if smoke or toxic gas is detected in the outside air intake.

GDC 2 was considered in the design of CRVS. The CRE isolation dampers are located within the CRE of the CRB which is classified as a Seismic Category I structure at that building elevation. The CRE isolation dampers and the smoke, toxic gas, and radiation detectors that initiate their closure are also designed to Seismic Category I standards. The CRE isolation dampers are protected from floods, tornadoes, hurricanes, tsunamis, seiches, and seismic events to the extent that the CRB is protected from such events. Portions of the CRVS whose failure in an earthquake could adversely impact MCR equipment or personnel are designed to Seismic Category II standards. The remaining portions of the CRB are Seismic Category III (non-seismic).

GDC 3 was considered in the design of the CRVS, which prevents explosive levels of hydrogen from forming in CRB battery rooms.

GDC 4 was considered in the design of CRVS. The CRE isolation dampers perform a required function because they form a portion of the CRE boundary, which allows the CRHS to pressurize the CRE. The CRE isolation dampers are protected from the effects of missiles that may result from equipment failures or tornadoes. The CRB itself is a mild environment with no potential of a credible missile source as the result of equipment failure. Additionally, there is no credible source of a high-energy pipe failure within the CRB that could cause loss of function of the CRE isolation dampers. The CRVS maintains a suitable ambient temperature and humidity for personnel and equipment in the MCR and other areas of the CRB during normal operation and when the nonsafety-related BDGS is available. The CRVS has radiation monitors, toxic gas monitors, and smoke detectors located in the outside air intake and downstream ductwork, which allow the PPS to isolate the CRE and the outside air intake as needed in the event of fires, failures, malfunctions, toxic gas, or high radiation.

RAI 09.04.01-1

GDC 5 was considered in the design of CRVS. ~~Even though the CRVS is shared between multiple reactor modules, the CRVS does~~The CRVS serves the control room, which provides services for all reactor modules. However, the CRVS does not have a function relative to shutting down a reactor module or maintaining it in a safe shutdown condition. Operation of the CRVS does not interfere with the ability to operate or shut down a unit.

Upon detection of smoke or toxic gas in the outside air duct, the outside air isolation dampers are closed to isolate the CRB from the environment. The CRVS is then operated in recirculation mode to provide conditioned air to the occupied areas of the CRB, with no outside air being introduced into the building. The CRB is not pressurized in this mode.

When gaseous or particulate radioactivity in the outside air duct exceeds the high setpoint, the normal outside air flow path is isolated and 100 percent of the outside air is bypassed through the air filtration unit to remove iodine and particulates. If high levels of radiation are detected downstream of the air filtration unit, or if normal AC power is lost to both CRVS air handling units for 10 minutes, or if power is lost to all EDSS-C battery chargers, the CRE is isolated and breathable air is supplied by the CRHS. An additional design feature allows the BDGS to provide power to components necessary for continued operation of the CRVS during a loss of normal AC power.

In normal operation, the CRVS maintains the MCR at a positive pressure relative to the outside environment. In off-normal conditions, the redundant CRE isolation dampers provide a barrier against the surrounding environment. These design features provide compliance with GDC 19.

The CRVS maintains the CRB at a higher pressure than its surroundings, except when in recirculation mode, limiting the amount of contamination that could enter during normal operation. The CRVS includes radiation monitors in the intake ductwork. When a high radiation signal is generated, the normal outside air flow path is isolated and 100 percent of the outside air is bypassed through the CRVS air filtration unit. When high radiation is detected downstream of the AFU, a signal is generated to close the outside air isolation dampers, which prevents further contamination from entering the CRB through this pathway. Thus, the CRVS limits the spread of contamination in compliance with 10 CFR 20.1406(b).

In a station blackout event, the CRE isolation dampers close to form part of the CRE. The CRHS then provides bottled air to the CRE. Along with the CRHS, the CRE isolation dampers ensure that a suitable operating environment is maintained to support operators and equipment in the MCR.

9.4.1.4 Inspection and Testing

Preoperational testing of the CRVS is performed as described in Section 14.2.

The CRVS is provided with adequate instrumentation, temperature, flow, and differential pressure indicating devices to facilitate testing and verification of proper equipment function. Additionally, the CRVS is designed to permit periodic inspection and testing of major components, such as fans, motors, dampers, coils, filters, and ducts to verify their integrity, operability, and capability. CRVS equipment and components are provided with proper access for initial and periodic inspection and maintenance activities.