October 19, 2021 Docket No. 99902078

U.S. Nuclear Regulatory Commission
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SUBJECT: NuScale Power, LLC Submittal of Presentation Materials, "SDA Pre-Application Presentation: NuScale SDA Topical Reports – Rod Ejection Methodology, Subchannel Methodology (Open Session)," PM-108128, Revision 0

NuScale Power, LLC (NuScale) has requested a meeting with the NRC technical staff on October 21, 2021, to discuss NuScale Standard Design Approval topical reports, Rod Ejection Methodology and Subchannel Methodology.

The purpose of this submittal is to provide presentation materials to the NRC for use during this meeting.

The enclosure to this letter is the nonproprietary presentation entitled, "SDA Pre-Application Presentation: NuScale SDA Topical Reports – Rod Ejection Methodology, Subchannel Methodology (Open Session)."

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

If you have any questions, please contact Rebecca Norris at 541-452-7539 or at RNorris@nuscalepower.com.

Sincerely,

Mark W. Shaver
Manager, Licensing
NuScale Power, LLC

Distribution: Michael Dudek, NRC
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Enclosure: "SDA Pre-Application Presentation: NuScale SDA Topical Reports – Rod Ejection Methodology, Subchannel Methodology (Open Session)," PM-108128, Revision 0

Enclosure:

"SDA Pre-Application Presentation: NuScale SDA Topical Reports – Rod Ejection Methodology, Subchannel Methodology (Open Session)," PM-108128, Revision 0

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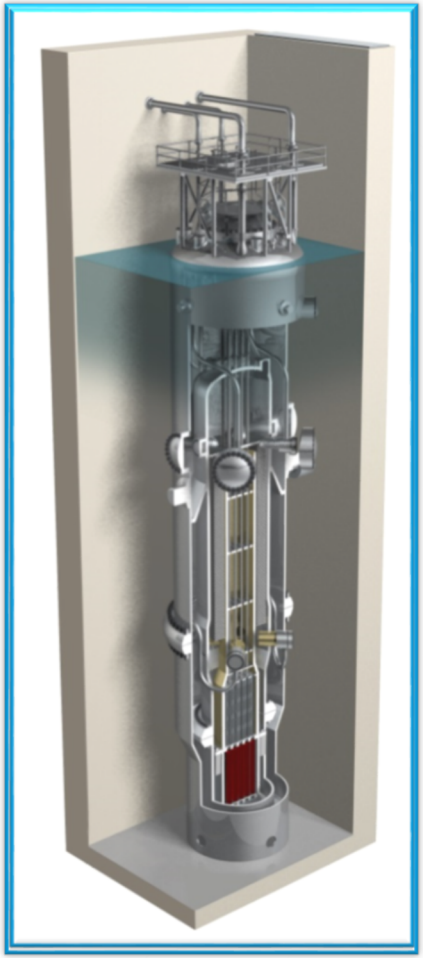
SDA Pre-Application Presentation



NuScale SDA Topical Reports

Rod Ejection Methodology
Subchannel Methodology

(Open Session)

October 21, 2021

PM-108128
Revision:0

Template #: 0000-21727-F01 R7

Introductions & Opening Remarks

Presenters

Kris Cummings
Licensing Engineer

Kenny Anderson
Nuclear Fuels Engineer

Ken Rooks
Safety Analysis Engineer

Meeting Purpose

- Pre-application engagement for forthcoming topical reports
  - Rod Ejection Accident Methodology – revision of existing topical report
  - Subchannel Analysis Methodology – supplement to existing topical report
  - estimated submittal in December 2021
- Provide NRC management and staff with a high-level overview of approach for methodologies to support SDA Ch. 15 safety-analysis.
- Solicit preliminary NRC staff feedback on proposed approach in future topical report submittal.

Subchannel Methodology Supplement

Overview of TR-0915-17564-P-A, Rev 2

- VIPRE-01 use for steady-state and transient analysis
- Methodology fulfills requirements of VIPRE-01 generic safety evaluation report (SER) limitations
- Methodology application and treatment of uncertainties
- Objective: Critical Heat Flux and Fuel Centerline Melt
- General methodology approach:
  - Input uncertainties treated independently; no credit for statistical randomness
  - Conservative basemodel development
  - Generic cycle-independent radial power distribution
  - Bounding axial power shapes
  - Detailed radial and axial nodalization evaluations
  - Detailed checklist to ensure compliance with method

Methodology Changes

- Changes from TR-0915-17564-P-A, Rev 2:
  - Treatment of uncertainties - statistical instead of deterministic approach
  - Radial power distribution
  - Radial nodalization
  - Axial nodalization
- Unchanged:
  - Fuel conduction
  - Grid and frictional losses
  - Cross-flow and mixing
  - Qualification (Validation and Applicability)

Statistical vs. Deterministic

- **Deterministic:** Event analysis input uncertainties (power distributions, boundary conditions, tolerances, etc.) are biased independently in the limiting direction.
- **Statistical:** All uncertainties associated with both CHF correlation and event analysis inputs are statistically treated in order to determine the CHF analysis limit.
  - Statistical approach still accounts for all uncertainties with 95% probability at the 95% confidence level
  - Treating variables as independent instead of dependent

Axial and Radial Power

- Range of axial and radial power distributions allowed by operations not treated statistically
- Variations possible from: exposure, power, boron concentration, control rod insertion, axial offset, etc.
- As in existing methodology:
  - Radial power distribution: Artificially created to preserve measured Technical Specification allowed radial peaking and minimize beneficial cross-flow in analysis
  - Axial power distribution: Search performed for limiting shape allowed by axial offset

Rod Ejection Revision

Overview of TR-0716-50350-P-A, Rev. 1

- Methodology for modeling rod ejection accident (REA)
- Bounding reactivity initiated accident (RIA) from General Design Criteria (GDC) 28
- REA is unique in comparison to other Ch. 15 events
  - SIMULATE-3K: Transient nuclear physics simulations
  - NRELAP5: Transient systems thermal-hydraulics
  - VIPRE-01: Transient detailed core thermal-hydraulics
  - Adiabatic Fuel Model: Conservative analytical model of fuel enthalpy and temperature
- Unique acceptance criteria from RG 1.77, NUREG-800
- Justification for software, acceptance criteria, applicability, and treatment of uncertainties

Rod Ejection Accident Methods

- Changes from TR-0716-50350-P-A, Rev. 1:
  - Replacement of Regulatory Guide (RG) 1.77 with RG 1.236
  - Change to pellet clad mechanical interaction (PCMI) fuel failure acceptance criteria from RG 1.236
  - Calculation of fuel enthalpy and temperature via VIPRE-01
  - Subchannel statistical analysis limit
  - Generic NRELAP5 analysis of pressurization
- Unchanged:
  - SIMULATE-3K analysis and uncertainty treatment
  - Qualification (Validation and Applicability)

VIPRE-01 Fuel Model

- Switch to VIPRE-01 is included in the generic subchannel method and qualification
- Fuel design specific calibration of fuel heat-transfer includes example bounding REA cases
  - NuScale prevention of fuel failure minimizes consequences
- Slightly improved results between models (VIPRE-01 vs. adiabatic), as expected.

Generic NRELAP5 Analysis

- NuScale no fuel failure criteria greatly constrains possible systems thermal-hydraulic consequences
- Pressure acceptance criteria generically satisfied

Conclusions

- Scheduled for submittal December 2021
- Results from calculations utilizing these methodologies will be contained in Chapter 4 and 15 of NuScale's SDA
- Subchannel:
  - Statistical treatment of uncertainties allows for improved results while maintaining overall robust analysis approach
- Rod Ejection:
  - Simplified analysis structure (generic NRELAP5 and VIPRE-01 fuel calculations) and updates to incorporate RG 1.236 changes
- Improved methods maintain conservative results

Acronyms

CHF	Critical Heat Flux
GDC	General Design Criteria
REA	Rod Ejection Accident
RG	Regulatory Guide
RIA	Reactivity Initiated Accident
SDA	Standard Design Approval
SER	Safety Evaluation Report

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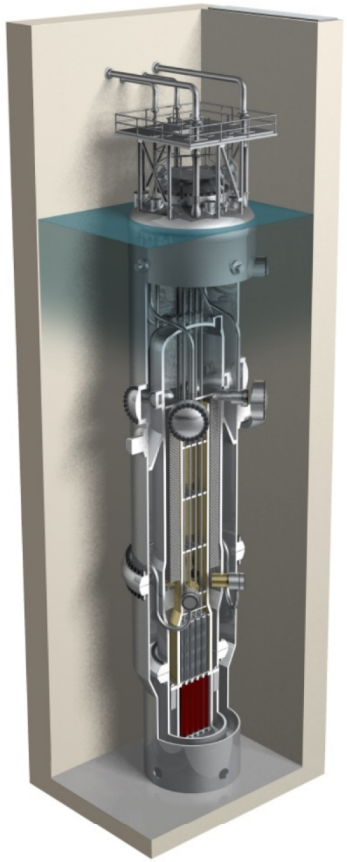

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