

# NuScale DC Application Design Basis Failed Fuel Fraction Issue

September 2017

# Purpose of this meeting

- Recap staff actions/interactions on this subject
- Discuss NuScale's technical and regulatory approach in the development of the design basis failed fuel fraction
- Discuss the staff's evaluation of this approach
- NuScale input
- Path forward

# Staff Actions to Date

- This issue was formally identified early in the pre-application phase when NuScale submitted a proposed Topical Report on Effluent Release (GALE Replacement) Methodology (but then the report was withdrawn)
- Identified during the Readiness Assessment in September 2016 as a potential docketing issue
- Documented as a critical issue in the schedule letter dated 5/22/2017
- Discussed with NuScale in public meeting on 4/18/2017 and during audit status meetings
- Issued RAI on 4/25/2017. Evaluated response dated 6/19/2017. Evaluated as closed/unresolved.
- Communicating with NuScale in the meeting today

# NuScale Approach

- NuScale is proposing to use a 0.028% failed fuel fraction as the design basis for the facility while using higher source term values in design basis accident (DBA) analyses and in the TSs
  - This is an order of magnitude less than the source term used in the Chapter 15 DBA analysis
- NuScale's proposal for a lower failed fuel fraction is based on
  - Claimed realistic failed fuel fraction of 0.0028%
    - Based on operating experience from large light water reactors and assumed fuel performance during operation of the NuScale design
  - Multiplication by a factor of 10 for "conservatism"
    - NuScale's proposed consistency with licensing practice for large light water reactors

# NuScale Approach

- NuScale's proposed TS 3.4.8 establishes the acceptable initial conditions for the design basis accident (DBA) source term for dose equivalent Iodine (DEI) and Xenon (DEX)
- NuScale's proposed TS permits operation above the design basis failed fuel fraction but below the DBA initial conditions
- NuScale asserts that a TS restricting operation above the design basis failed fuel fraction assumption is not warranted because it doesn't meet the criteria of 10 CFR 50.36

# Staff Evaluation - Overview

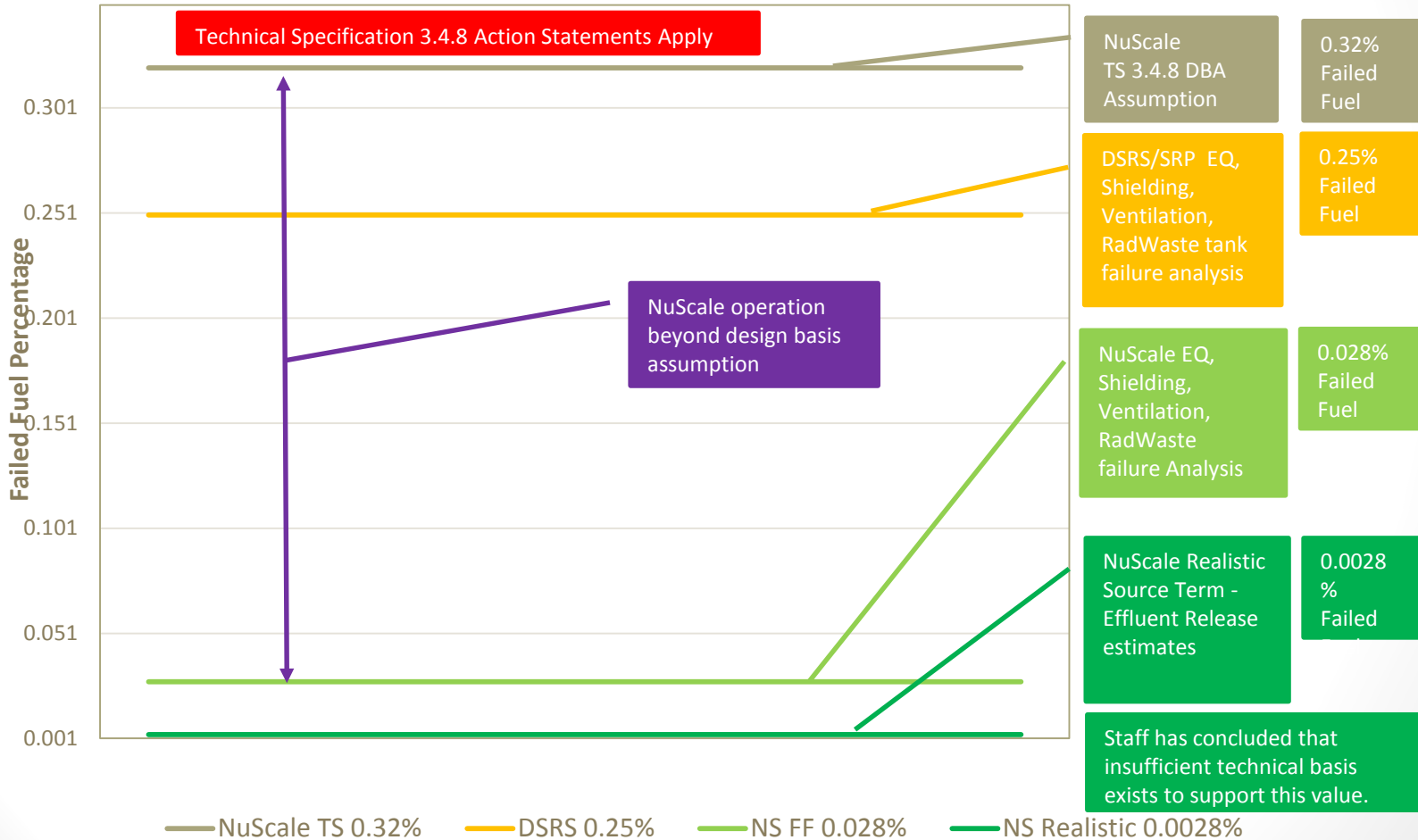
- For an unproven and untested fuel design, a reasonably conservative approach for establishing the technical basis for the design basis failed fuel fraction is necessary
  - Operating experience has shown that fuel failures continue to occur in light water reactors
  - NuScale has not provided sufficient technical basis for its proposed design basis failed fuel fraction
  - NuScale has not proposed regulatory controls to preclude operation above design basis failed fuel fraction

# Staff Evaluation

- NuScale's approach deviates from that approved for all operating reactors and previous design certifications which include a TS that encompasses the design basis failed fuel fraction
  - All operating reactors and design certification applications have assumed 0.25% failed fuel as an assumption in the design of radiation protection design features (higher values for EQ analyses)
- The staff's regulatory approach on this issue has been consistent and is documented in DSRS Chapters 11 and 12
  - The DSRS provides a possible path forward if an applicant wants to use a lower design basis failed fuel fraction that involves adoption of an appropriate TS
- The lower design basis failed fuel fraction is credited in the NuScale design for ensuring that regulatory requirements are met, including 10 CFR Part 20 requirements
- NuScale has not proposed regulatory controls to ensure the plant will be operated in accordance with the design basis radiation protection features
  - Operational programs should not be unduly credited to ensure design basis limits are met

# Comparison of Failed Fuel Percentages

With no Technical Specification, 1.0% Failed Fuel [off scale value] is used for EQ and some Tank Failure Analysis.





# Staff Evaluation (con't)

- NuScale has not provided sufficient information to justify the proposed design basis failed fuel fraction
  - The derivation, including method and data used, of the design basis failed fuel fraction is not technically sufficient
  - Factor of 10 provides less absolute margin when compared to the higher failed fuel fraction assumed for currently licensed plants
- NuScale has not provided sufficient justification to support the direct applicability of operating reactor failed fuel experience to the NuScale design
  - Fuel and core design is different (first of a kind)
  - No operational experience or fuel performance testing with this design
  - Unique manufacturing and operational challenges may occur due to first of a kind fuel design

# Staff evaluation (con't)

- NuScale's approach would permit operation above the assumed design basis failed fuel fraction resulting in
  - A potential unanalyzed condition requiring reliance on operational programs to minimize worker and public exposure instead of design features
  - Potentially exceeding regulatory requirements for on-site and off-site doses and does not provide reasonable assurance that the requirements of 10 CFR Part 20 (ALARA, and minimizing contamination) are met
- In addition, the EQ evaluation of safety-related SSCs has consistently been conducted at the TS limit in implementing the requirements of 10 CFR 50.49 and GDC 4. This evaluation should be conducted at the TS limit.

# Staff Position

- For an unproven and untested fuel design, a reasonably conservative approach for establishing the technical basis for the design basis failed fuel fraction is necessary
- NuScale's approach would permit operation above the assumed design basis failed fuel fraction used in the design of shielding and ventilation systems and is inconsistent with EQ precedence
- As such, appropriate regulatory controls for the design basis failed fuel fraction must be established to provide reasonable assurance the reactor will be operated in accordance with the proposed design basis.
- Once sufficient operational experience and technical information are gathered with its design, NuScale may propose to relax or remove these regulatory controls.

- NuScale Input (as desired)
- Path Forward
- Opportunity for Public Comment
- Closing of Meeting