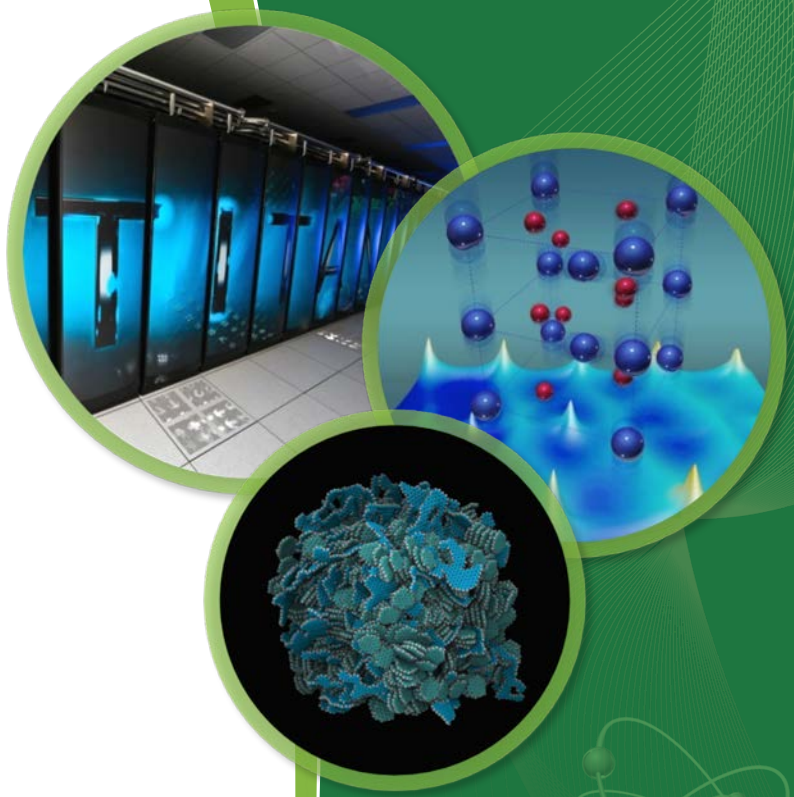
Development of Criticality Safety Validation Guidance for NRC-Regulated Activities



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NCSD 2017 Topical Meeting
Carlsbad, New Mexico
September 10 – 15, 2017

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Outline

1. Purpose of the project (What it is and what it is not)
2. Reference documents to be included
3. Areas for improved guidance
4. Plans – NUREG/CR outline and schedule

Purpose of the project

- Several guidance documents exist for performing validation for NCS applications
- Most frequently cited documents:
  - Were published in the late 1990s or early 2000s
  - Do not incorporate sensitivity/uncertainty (S/U) methods
- NRC reviews have identified issues:
  - Inappropriate experiment selection
  - Trending analysis lacking or insufficient
  - Calculation and/or application of bias and bias uncertainty
  - Gaps and weaknesses in validation or documentation

Purpose of project – what it is

- Provide updated guidance on performing validation of computational methods for use in NCS applications
- Consolidate guidance from several different documents
- Improve (clarify) guidance in some areas and expanded guidance in limited, specific areas as discussed later
- Develop guidance that is applicable to all systems containing fissile material

Purpose of project – what it is not

- The project is *not* intended to:
  - Eliminate currently acceptable approaches to validation
  - Address isotopic validation for burnup credit applications
  - Add burdensome requirements
  - Introduce significant changes to current validation guidance

Reference documents included

- Validation guidance documents
  - NUREG/CR-6361 (Lichtenwalter, Bowman, DeHart, Hopper)
  - NUREG/CR-6698 (Dean and Tayloe), similar to Savannah River methods documented in Kimball and Trumble's 1997 NCSD paper
- S/U method documents
  - SCALE 6 NT article (Rearden, Williams, Jessee, Mueller, Wiarda)
  - 2004 NS&E article (Broadhead, Rearden, Hopper, Wagschal, Parks)
  - 2015 NS&E article on Whisper methodology (Kiedrowski and Brown)

Areas for improved guidance

- Improved guidance should help both applicants and reviewers
- Trending analysis:
  - No guidance is currently available in the open literature
  - Accepting/rejecting trends using rigorous statistical tests
- Normality testing:
  - Many methods require normal distributions
  - Comparison of statistical tests
- NOTE: Detailed guidance is not written, reviewed, or approved by NRC staff so it will not be discussed at this time

Plans for NUREG/CR document

- Draft NUREG/CR due to NRC by the end of October, 2017
- NRC's review, comment resolution, and publication process will take weeks to months
- Final publication of NUREG/CR is anticipated in 2018

Outline

1. Introduction and background
2. Purpose of validation
3. Computational method definition
4. Safety analysis model characterization
5. Critical experiment selection
6. Determination of bias and uncertainty
7. Applicability of validation
8. Identification of weaknesses and gaps
9. Documentation
10. Use of validation results
11. Additional resources
12. References

Questions?