STATUS OF THE LEVEL 3 PRA STANDARD (ASME/ANS RA-S-1.3)

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2021 International MACCS User's Group (IMUG) Meeting

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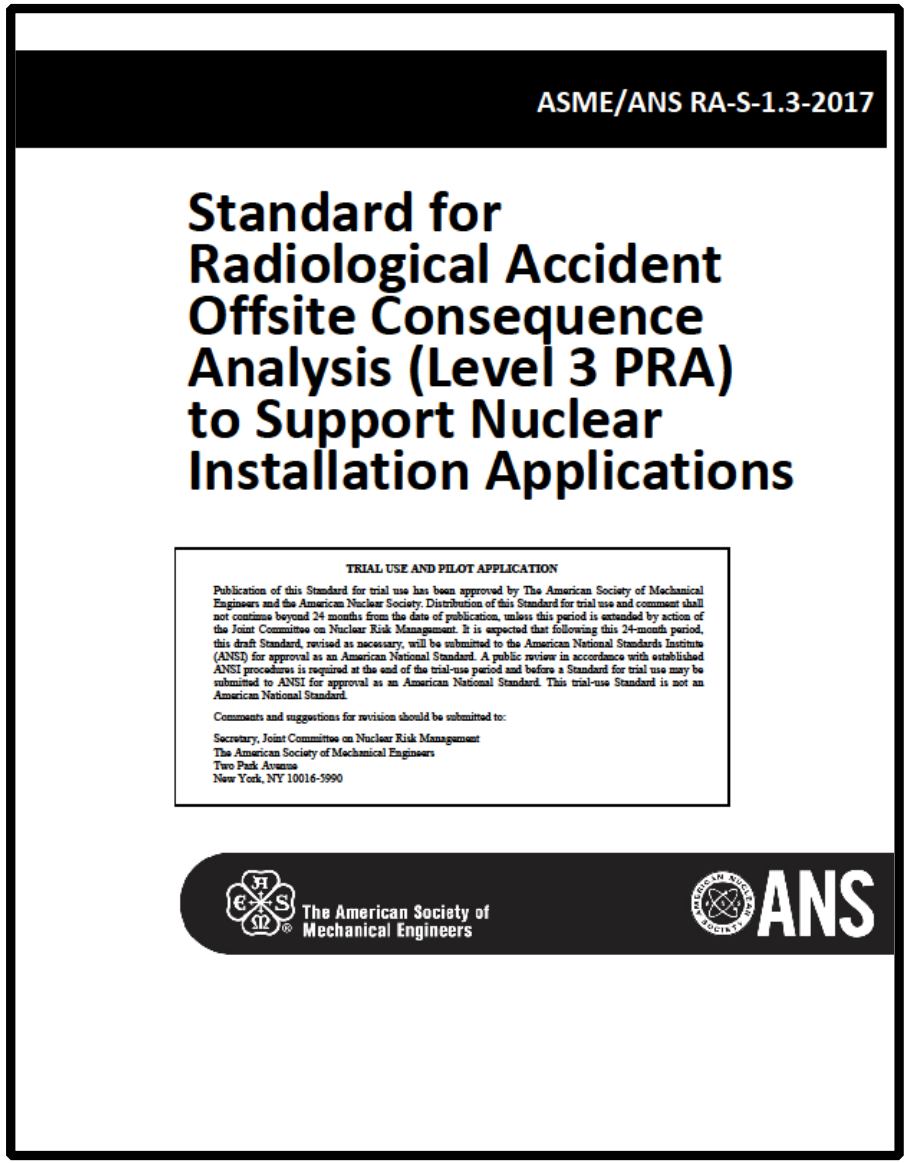

OVERVIEW

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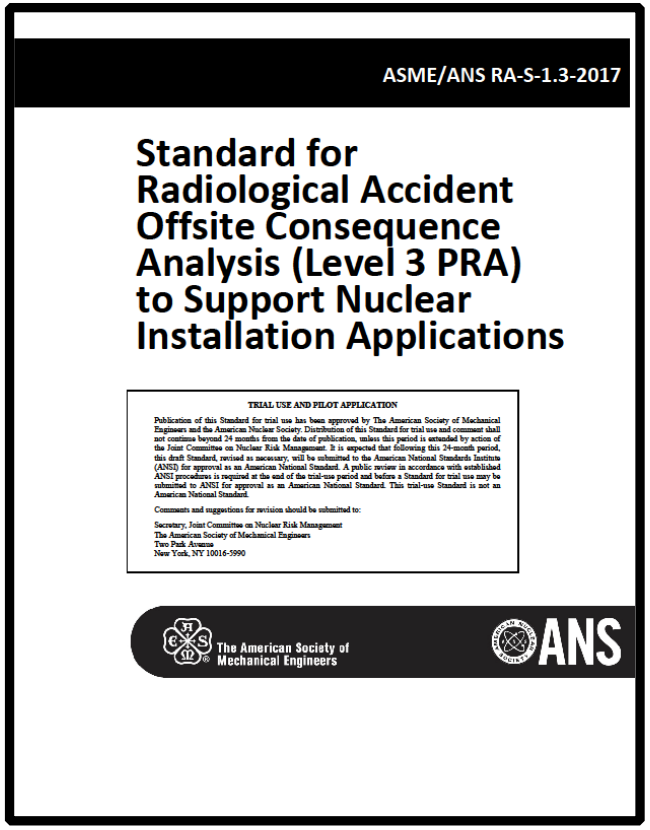

INTRODUCTION

- ASME/ANS RA-S-1.3-2017 Level 3 PRA Standard
  - "Standard for Radiological Accident Offsite Consequence Analysis (Level 3 PRA) to Support Nuclear Installation Applications"
- Provide a "facility / technology neutral" set of requirements for performing a consequence analysis for accidental atmospheric radiological release to support risk-informed applications
- Developed with Light Water Reactors (LWRs) in mind, but can be used to support other sources of atmospheric releases
- When combined with the results of Level 1 & Level 2 PRAs, the Level 3 consequence analysis results can be used to estimate the overall risk of adverse impacts (e.g., health effects, economic impacts), accounting for mitigation measures (evacuation, sheltering, land interdiction, etc.)

BACKGROUND

- Level 3 PRA Standard effort began in 2005
- ~10 engineers / professionals with experience representing
  - Utilities
  - Consultants
  - U.S. NRC
  - National Laboratories
  - International participation solicited, but minimal
- 12-year writing and balloting process to achieve Trial Use & Pilot Application (TUPA) version (mid-2017)
  - Two trial uses of the draft standard occurred in 2015-16
    - NRC Level 3 PRA Project Peer Review conducted in November 2015
    - UK ABWR Peer Review conducted in May 2016
- Three-year TUPA period ended mid-2020
  - With no new trial applications

BACKGROUND (continued)

- The other PRA Standards (e.g., Level 1/LERF) have been working through significant revisions and consistency efforts
  - Elimination of Capability Category III
  - Revised Action Verbs
  - Moving Notes to Non-Mandatory Appendices for clarity
- PRA Standard for Advanced Non-LWR Power Plants was developed and released (ASME/ANS RA-S-1.4-2021)
  - Integrated PRA Standard to support designs that do not have traditional Level 1 and Level 2 metrics (e.g., CDF, LERF)
  - Addressed multiple plant operating states and hazards
  - Level 3 requirements were based on the 2017 Level 3 PRA Standard TUPA version
  - Piloted on a number of non-LWR designs

Technical Content Areas

- Eight technical elements for the conditional consequence, and one for risk integration

1. **Radionuclide Release Characterization (RE)** – Requirements to ensure the radiological release(s) are properly defined (e.g., quantity, duration, height, energy, timing, frequency).
2. **Protective Action Parameters and Other Site Data (PA)** – Requirements to ensure that the impact of protective actions (e.g., evacuation) and other site data (e.g., population distribution) are defined.
3. **Meteorological Data (ME)** – Requirements to ensure that appropriate meteorological data (e.g., wind speed, wind direction) are compiled and used.
4. **Atmospheric Transport and Dispersion (AD)** – Requirements to ensure that an appropriate dispersion methodology and data are used in order to determine airborne concentration and ground deposition.
5. **Dosimetry (DO)** – Requirements to ensure that appropriate dose pathways, receptors and applicable dose conversion factors are used**.**

Technical Content Areas

- Technical elements (continued)
  6. **Health Effects (HE)** – Requirements to ensure that radiological human health effects are appropriately computed.
  7. **Economic Factors (EC)** – Requirements to ensure that economic factors (e.g., evacuation costs, crop losses, land value) are appropriately computed.
  8. **Conditional Consequence Quantification and Reporting (QT)** – Requirements to ensure that the quantification of the conditional consequences are properly performed and adequately documented.
  9. **Risk Estimation (RI)** – Requirements to ensure that the risk estimation based on the combined results of the consequence analysis and the Level 1/2 analysis is computed adequately.
- Other requirement areas include Peer Review, Configuration Control, Newly Developed Methods, and Expert Judgment

Technical Content Areas

- Each technical element is composed of High Level Requirements (HLRs) and Supporting Requirements (SRs), for example
  - **HLR-AD-D The analysis shall accommodate temporal and spatial changes in meteorological conditions.**

Index No. AD-D	Capability Category I	Capability Category II
AD-D1 Meteorological Condition Variability	USE a transport and dispersion model without spatial or temporal meteorological variability.	USE a transport and dispersion model that includes varying meteorology and straight-line direction for each release time period (i.e., segmented plume).
AD-D2 Multiple Plumes	USE a transport and dispersion model with a single plume.	USE a transport and dispersion model with multiple plumes.

STATUS

- Level 3 PRA Standard is currently being revised for consistency with latest versions of other PRA Standards and PRA Standard content guidelines
  - Elimination of Capability Category III
  - Approved Action Verbs
  - New Supporting Requirements for Configuration Control & Newly Developed Methods
  - Organization of material (e.g., various sections coalesced into new Part 1, moving notes to non-mandatory “commentary” appendix)
- Also revising requirements and commentary based on continued technical reviews

ANTICIPATED SCHEDULE

- October 2021 - Complete on-going Working Group revision
- November/December 2021 – PRA Standard Readiness Review
- January/February 2022 – Resolve Readiness Review Comments
- March/April 2022 – Balloting Process
- May/Jun 2022 – Resolve Ballot Comments
- July 2022 – Recirculation Ballot
- August 2022 – Higher Level Ballot Approvals
- September 2022 – Public Comment Period
- October/November 2022 – Editing
- December 2022 - Publication

L3 PRA Std vs NLWR Std

- NLWR PRA Standard is an integrated standard since traditional Level 1 & Level 2 PRA metrics (e.g., CDF, LERF) may not be applicable
  - Includes Level 3 PRA based quantitative screening
  - Contains Level 3 PRA consequence requirements generally consistent with the Level 3 PRA Standard
- Advanced NLWR plants/designs will be using the NLWR PRA Standard from initiators to release, so using it for Level 3 consequence analysis requirements is the logical choice
- For risk-informed applications where Level 1 or Level 2 PRA Standards are being used, the Level 3 PRA Standard would readily apply
- If there is no Level 1 or Level 2 PRA completed, the Level 3 PRA Standard can still be applied provided the source term release can be defined (e.g., radiological dispersion device)

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Questions?

