NRC Support for SCALE: Past, Present, and Future

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Overview

• Background
• NRC and SCALE History:
  - 1970s
  - 1980s
  - 1990s
  - 2000s
• NRC and SCALE Today
• The Future
Background

Division of Spent Fuel Management:

- Within the Office of Nuclear Material Safety and Safeguards (NMSS)
- Transportation of Radioactive Material – 10 CFR Part 71
- Storage of Spent Nuclear Fuel – 10 CFR Part 72
Background

Division of Spent Fuel Management

• ~70 staff, including 11 dedicated to shielding and criticality analysis (Criticality, Shielding, and Risk Assessment Branch)

• Handle around 80–100 licensing actions per year
  - General and site-specific Part 72 licenses
  - Type B and AF transportation package designs
Background

Division of Spent Fuel Management

Michael Layton
Director

Anthony Hsia
Deputy Director

John McKirgan
Licensing

Yoira Diaz-Sanabria
Containment, Structural, and Thermal

Meraj Rahimi
Renewals and Materials

Travis Tate
Criticality, Shielding, and Risk Assessment

Patricia Silva
Inspections and Operations
Background

Current NRC/DSFM Contract with ORNL:
• SCALE Maintenance
• Technical Assistance
• Training
• SCALE Development
• Regulatory Assistance
• ANSI N14 Administration
The 70s

- Pre-NRC: ORNL assists Atomic Energy Commission (AEC) with use of codes and data for criticality, shielding, and heat transfer analyses of transportation packages
- NRC staff proposed development of an easy-to-use analysis system incorporating technical capabilities of individual modules
- First contract in place for “Standardized Computer Analyses for Licensing Evaluation” (SCALE) in 1976
The 70s

SCALE Development Criteria:

• Focus on applications related to fuel facilities and transportation packages
• Use established codes and data
• Input format suitable for occasional or novice user
• Control modules to automate use of multiple codes and data sets
• Documentation and public availability
SCALE – The Original
The 80s

SCALE Revision 0: July 1980

• Standard Composition Library
• Cross–section processing
• KENO
• ORIGEN
• MORSE
• HEATING
The 80s

- SCALE 1: January 1982
- SCALE 2: June 1983
- SCALE 3: December 1984

DOE support beginning in 1987
The 90s

SCALE 4 – 4.4

• SCALE 4.1 – 1992
• SCALE 4.2 – 1994
• SCALE 4.3 – first (partial) PC version – 1995
• SCALE 4.4 – 1998
  – Full PC version
  – Y2K compatible
The 90s

- CSASIN – 1st PC-based GUI for criticality input
  - MS-DOS based
- CSPAN for criticality / ESPN for shielding
  - Windows 95, 98, or NT
- ORIGEN–ARP
- KENO VI
The 2000s

SCALE 4.4a, 5.0, 5.1
- GeeWiz
- KENO 3D
- STARBUCS
- TRITON/NEWT
- MAVRIC/Monaco
- Continuous–energy cross sections (KENO VI, Monaco)
Now

- SCALE 6.2 (and 6.2.1/6.2.2)
  - Fulcrum interface
  - Origami and Reactor Libraries
- UNF–ST&DARDS
  - Design basis templates
  - Licensing approach
- CISF dose map support
The Future

• UNF–ST&DARDS:
  – “Templates” for standard cask shielding, criticality and thermal analyses
  – Possibly for other configurations

• Shift / parallel sequences

• Fulcrum enhancements
  – 3D visualization
  – Input assistance
SCALE People

ORNL Project Managers:

• Mike Westfall
• Cecil Parks
• Steve Bowman
• Brad Rearden

NRC Contract Managers:

• Dick Odegaarden
• George Bidinger
• Earl Easton
• Marissa Bailey
• Carl Withee
• Drew Barto
Questions?