An Overview of Nuclear Data Needs for Nuclear Energy Applications

CINR Annual Planning Webinar - August 2018
NUCLEAR DATA NEEDS FOR NUCLEAR ENERGY APPLICATIONS

- Many nuclear data measurements and evaluations are decades old and updates are needed, especially for new high-fidelity analysis approaches and emerging nuclear energy systems.

- Nuclear data measurements are very complex, yet only a few neutron scattering facilities remain, and new capabilities are needed.

- Changes in cross section data from one ENDF evaluation to the next can have a significant impact on design, licensing, and operational decisions including:
  - ENDF/B-VII.1 updates to uncertainties in $^{235}$U and $^{239}$Pu ν change the uncertainty in used fuel systems and affect applicability of benchmark experiments for validation.
  - ENDF/B-VII.1 update to $^{35}$Cl(n,p) reaction leads to 1000s of pcm reactivity change for fast-spectrum molten chloride salt reactors.
  - Missing nuclear data or older evaluations with large uncertainties for materials of interest can be a limiting factor in the design of advanced reactors.
  - Pending thermal scattering data for graphite leads to a 900 pcm improvement in reactivity of TREAT with similar effects for HTGR and FHR systems.
  - Many other nuclear data needs can be demonstrated through the use of sensitivity/uncertainty methods for relevant applications.
MS-NE-2: Improvements to address nuclear data needs that are clearly demonstrated to be a limiting factor in nuclear fuel and reactor design, analysis, safety, and licensing calculations in NE missions areas. (TPOC – Brad Rearden, reardenb@ornl.gov)

- Proposals are sought for achieving relevant nuclear data improvements that address one or more stated needs by developing and demonstrating the enhancements through the entire nuclear data pipeline, from:
  - 1) new nuclear data measurements
  - 2) evaluation in the appropriate format (e.g. ENDF)
  - 3) inclusion of nuclear data covariances
  - 4) processing into usable forms for application codes
  - 5) confirmation of improved predictions and uncertainties through application studies and validation; and
  - 6) deployment through the National Nuclear Data Center at BNL for inclusion by external users in quality-assured design, analysis, safety, and licensing calculations

- Use of sensitivity and uncertainty analysis methods in proposed efforts is encouraged to demonstrate these needs and how they are being met

- Many nuclear data needs for NE may be found in the NEA Nuclear Data High Priority Request List (HPRL) (https://www.oecd-nea.org/dbdata/hprl/); also of interest:
  - continued investigations of thermal scattering data in high-temperature graphite, thermal scattering data for fluorine-based molten salt reactors, and chlorine reactions for fast spectrum molten salt reactors
  - documented needs for industry and DOE-NE missions especially as aligned with GAIN (e.g., NEAMS, CASL, ART, TREAT, FCR&D, LWRS)

- Partnerships with national laboratories and especially industry are strongly encouraged
Questions?