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Report of Foreign Travel for the 2022 Working Party on Nuclear Criticality Safety (WPNCS)

C. M. Percher

October 21, 2022

Disclaimer

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.

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DATE: October 10, 2022

SUBJECT: Report of Foreign Travel for the 2022 Working Party on Nuclear Criticality Safety (WPNCS)

TO: Dr. Angela Chambers, USDOE Nuclear Criticality Safety Program Manager, National Nuclear Security Administration, NA-ESH-21

FROM: Catherine Percher, Nuclear Criticality Safety Division, Lawrence Livermore National Laboratory

Auspices

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MEETING TITLE:

Working Party on Nuclear Criticality Safety, WPNCS 2022

MEETING LOCATION:

Organisation for Economic Cooperation and Development, 2 Rue André Pascal, 75016 Paris, France

MEETING DATES:

June 27-July 1, 2022

ATTENDEES ON BEHALF OF NCSP:

Catherine Percher, Jesse Norris

BENEFIT OF MEETINGS TO NCSP:

The Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) Working Party on Nuclear Criticality Safety (WPNCS) is the international organization responsible for the administration of the ICSBEP, IRPhE, and SINBAD Projects. ICSBEP, IRPhE, and SINBAD are directly relevant to NCSP IE and IP&D. The WPNCS also establishes subgroups to research problems of relevance to participants from member countries. These subgroups and their relevance to NCSP are identified below, with subgroups whose activities have concluded shown in italics.

No.	Title	NCSP Element
SG-1	*Role of integral experiment uncertainties and covariance data in criticality safety validation*	*AM, IE, ND*
SG-2	*Blind benchmark on MOX damp powders*	*AM*
SG-3	*The effect of temperature on the neutron multiplication for PWR fuel assemblies*	*AM, ND*
SG-4	*Analysis of past criticality accidents*	*AM (multiphysics)*
SG-5	*Experimental needs for criticality safety purpose*	*IE*
SG-6	*Statistical tests for diagnosing fission source convergence and under-sampling in Monte Carlo criticality calculations*	*AM*
SG-7	*On the definition of a benchmark on sensitivity/uncertainty on used fuel inventory*	*AM (burnup credit)*
SG-8	*Preservation of Expert Knowledge and Judgement Applied to Criticality Benchmarks*	*IE, ND*
SG-9	Heterogeneous media / random geometries	AM
SG-10	Nuclear Data Uncertainties on Spent Fuel Inventory	ND
SG-11	Bias and Correlated Data, Comparison of Methods	IE, ND
SG-12	Used Nuclear Fuel Decay Heat	ND

The WPNCS Meeting Agenda is included as Appendix A.

PURPOSE OF MEETINGS:

C. Percher is one of six official United States Delegates to the WPNCS and is a voting member of the working party. The WPNCS meetings allow for an international forum to share knowledge and resources important to the practice of criticality safety. There is considerable interest by the working party in NCSP activities, particularly critical experiment activities to support NCS. As the new chair of ICSBEP, C. Percher gave an update of the benchmark project, including delayed publication of the 2021 and 2022 versions of the handbooks. Additionally, C. Percher compiled and provided the United States country report, which provides an overview of NCS issues affecting the US. The country report is included as Appendix B to this report.

During the week, active subgroups of WPNCS met to advance the goals of the group. C. Percher and J. Norris attended the SFCOMPO Technical Review Group meetings, SG-10 (Nuclear Data Uncertainties on

Spent Fuel Inventory), SG-11 (Bias and Correlated Data, Comparison of Methods), and SG-12 (Used Nuclear Fuel Decay Heat). See WPNCS week schedule (below).

Overview of the schedule of the WPNCS week *(exact time each day subject to change, please check agenda of each meeting)*

<table>
<tr><th></th><th>Mon 27.06</th><th>Tue 28.06</th><th>Wed 29.06</th><th>Thu 30.06</th><th>Fri 01.07</th></tr>
<tr><td>AM</td><td rowspan="2">9:30AM-6PM
Room D
SG12</td><td>9AM-1PM
Room D
SG9</td><td rowspan="2">9AM-6PM
Room D
SFCOMPO</td><td>9AM-1PM
Room D
SG11</td><td rowspan="2">9AM-5:30PM
Room D
WPNCS*</td></tr>
<tr><td>PM</td><td>2PM-6PM
Room D
SFCOMPO</td><td>2PM-6PM
Room D
SG10</td></tr>
<tr><td>Evening</td><td>-</td><td>-</td><td>-</td><td>6PM-8PM
Red Chairs Cocktail, 25th Jubilee of the WPNCS</td><td>-</td></tr>
</table>

**WPNCS members or upon invitation only*

APPENDIX A: WPNCS Meeting Agenda

Time (CEST)	Topic	Speaker
09:00	**Opening session**	
	Welcome, opening remarks	A. Vasiliev (chair)
	25 years of WPNCS by the NEA Director General	William D. Magwood, IV, NEA DG
	Self-introduction of participants	Delegates
09:30	**Administrative items**	
	Vice-chairpersonship	A. Vasiliev (chair)
	Adoption of the agenda	J.-F. Martin (NEA Secretariat)
	Approval of the summary record of previous meeting	J.-F. Martin (NEA Secretariat)
	Review of actions from the previous meeting	A. Vasiliev (chair)
09:55	**Update from activities**	
	Update from the Nuclear Science Committee	T. Ivanova, Head of Division, NEA/SCI
10:15	**Group picture and Coffee break (25')**	
10:40	**Update from activities (ctd)**	
	Subgroup 9: Transport in random geometries	A. Zoia (FR)
	Subgroup 10: Nuclear data uncertainties quantification on spent fuel inventory	C. Carmouze, R. Ichou (FR)
	Subgroup 11: Bias and Correlated Data	A. Hoefer (DE)
	Subgroup 12: used nuclear fuel decay heat	D. Rochman (CH)
12:00	**Lunch break**	
13:30	**Update from activities (ctd)**	
	SFCOMPOTRG	G. Ilas (US)
	ICSBEPTRG	C. Percher (US)
	Open discussion on potential future activities	Delegates
14:20	**Mandate and methods of work**	
	Mandate revision - a proposal	A. Vasiliev (chair)
	Methods of work	A. Vasiliev (chair)
	Update on NEA IT services for delegates (MyNEA)	J.-F. Martin (NEA Secretariat)
15:10	**Coffee break (25')**	
15:35	**Workshops, meetings and conferences**	
	ICNC 2023	S. Gunji (JP)
	ICNC 2027	G. O'Connor (UK)
15:50	**National reports (~45')**	
	Country 1	Speaker 1
	Country 2	Speaker 2
	Country 3	Speaker 3

Time (CEST)	Topic	Speaker
	Country 4…	Speaker 4…
16:30	**Reports from other relevant activities**	
	The Nuclear Criticality Safety Program of the US DoE	D. Bowen (US)
16:50	**Closing session**	
	Date and place of next meeting(s)	A. Vasiliev (chair)
	Any other business	Delegates
	Review of actions	A. Vasiliev (chair)
	Closing remarks	A. Vasiliev (chair)
17:30	**Adjourn**	

Appendix B

US Country Report to the OECD-NEA Working Party on Nuclear Criticality Safety (NCS)

1 July 2022

National Context

The United States (US) has fissile material operations involving all portions of the nuclear fuel cycle. Research in the area of advanced reactor concepts continues to investigate use of fuel with > 5% enrichments, in the area of industrial and government activities the focus is on production and fabrication of reactor fuel with enrichments < 5%, and there is a growing interest in metallic fueled fast reactors, liquid fueled molten salt reactors, fluoride salt-cooled high temperature reactors, and high temperature gas reactors. Government and industry are also pursuing many concepts for accident tolerant fuels in cladding materials, with test rods of accident tolerant fuels currently under irradiation in operating plants. These fuels include coated zirconium alloy and iron-based alloy cladding, and doped uranium oxide and uranium silicide pellets. As the industry grows and develops, many criticality safety issues on the front end and back end of the fuel cycle will need to be addressed. The US Department of Energy (DOE) has stopped the planned MOX fuel fabrication plant, and thus the US has limited need for criticality safety relevant to the transport or storage of MOX fuel.

The future of the spent fuel repository site at Yucca Mountain is uncertain, and in the interim the US is implementing dry cask storage at generator sites and considering potential sites for consolidation of cask storage. In 2016, the US Nuclear Regulatory Commission (NRC) received an application for a Consolidated Interim Storage Facility (CISF) in Andrews County, Texas from Waste Control Specialist (WCS). In January 2017, NRC accepted the application for technical review. In May 2017, WCS requested the review to be placed on hold. In July 2018, Interim Storage Partners (joint venture between Waste Control Specialists and Orano CIS LLC) requested the review be resumed. The NRC completed the review and issued the WCS CISF license in September 2021. In March 2017, Holtec International submitted an application to NRC for a specific license to construct and operate the HI-STORE CISF, to be located in Lea County, New Mexico. The dry cask storage system proposed to be used at the site will be a below-grade design. In February 2018, NRC accepted the application for technical review. NRC also issued a notice of docketing of the application and informed the public of the opportunity to file a written request for a hearing. NRC received intervention petitions and established an Atomic Safety and Licensing Board to rule on the hearing requests. Matters related to the adjudicatory proceeding remain pending. In March 2020, NRC issued a Draft EIS for Holtec International's Proposed CISF for Spent Nuclear Fuel and High-Level Waste in Lea County, New Mexico. NRC anticipates completing its FEIS for the facility in July 2022, and the safety and security reviews in January 2023. Final repository options and overall storage, transport, and disposal systems are being studied by DOE to provide the technical information for future decisions regarding the back end of the fuel cycle.

The NRC has approved several transportation package designs for accident tolerant fuel (ATF) and advanced reactor fuel, is currently evaluating several others, and anticipates multiple similar applications in the near future. These applications are characterized by materials that differ from typical low enriched uranium (LEU) LWR fuels, in both the fuel and cladding, and several of them involve uranium enrichments beyond the 5% typically considered for LWR fuel. The NRC has reviewed the validation of neutron transport codes used for the purposes of conducting criticality safety calculations, as well as the associated proposed minimum margin of subcriticality (MMS), for several NRC-regulated LEU fuel fabrication facilities in support of future plans to possess enrichments higher than 5% for ATF and advanced reactor applications. Additionally, the NRC has reviewed the validation of neutron transport codes used for the purposes of conducting criticality safety calculations, as well as the associated proposed minimum margin of subcritical (MMS), for UUSA's enrichment facility in support of future plans to possess enrichments higher than 5.5% for ATF and advanced reactor applications. However, the NRC has not approved any applications for existing NRC-regulated fuel cycle facilities to actually change enrichment possession limits. Applications to actually change enrichment possession limits are expected in the near future. The NRC has approved several transportation package amendments for ATF lead test assemblies or assembly components, including for fresh fuel assemblies or loose rods up to a uranium enrichment of 8%. The NRC has approved one package design for spent ATF fuel, as well as an amendment to an existing package certificate to allow a higher mass of 20% enriched TRISO fuel particles. The NRC is also currently reviewing a package design for UF_6 with enrichments up to 20%.

The DOE, including its autonomous National Nuclear Security Administration (NNSA), and the NRC each have responsibility for providing regulatory oversight on criticality safety – DOE for operations within the DOE complex and NRC for industry operations. The American Nuclear Society (ANS) is the US professional organization that works to develop consensus standards for criticality safety and organize technical meetings on criticality safety. Each of these organizations develops, sponsors, or supports training classes and workshops to support education and knowledge exchange in the field of criticality safety. The number of universities offering classes and degree certificates focused on criticality safety has risen over the last few years. The Nuclear Criticality Safety Division Topical Meeting (NCSD 2022) was hosted in Anaheim, CA in June of 2022, with 89 technical papers presented. The meeting proceedings will be published by ANS.

Research and Development (R&D) Programmes

The DOE and NRC both support research activities in the area of nuclear criticality safety. The DOE Nuclear Criticality Safety Program (NCSP) has provided a central focus for research and technology development for about 20 years. The DOE NCSP (see http://ncsp.llnl.gov/) has five elements: Integral Experiments, Analytical Methods, Nuclear Data, Information Preservation and Dissemination, and Training and Education. Integral experiments (and hands-on training classes) are conducted at the National Criticality Experiments Research Center (NCERC) in Nevada, run by Los Alamos National Laboratory (LANL), and at Sandia National Laboratories (SNL) in New Mexico.

All four critical experiment machines at NCERC (Planet, Godiva, Comet, and Flattop) are available, and the facility operates as a user facility to help meet national and international program

needs. The SPRF/CX critical assembly at Sandia is available and the Annular Core Research Reactor at Sandia is used to demonstrate the consequences of a criticality accident for course students.

The NCSP has continued to conduct "hands-on" critical experiment training classes at NCERC and SNL during the past year. Each year the NCSP conducts two 2-week training class for NCS practitioners and two 1-week training course for regulators, managers, and operations professionals who need to understand the fundamentals of nuclear criticality safety. The 2-week classes include one week of classroom training at the National Atomic Testing Museum in Las Vegas, NV, followed by one week of hands-on critical experiment training at either SNL or NCERC. The 1-week manager's courses focus on hands-on experience with less technical lectures and are also conducted at SNL or NCERC. Since establishing the NCSP hands-on training courses in 2011, over 600 students have taken the NCS hands-on training courses.

With regard to information preservation and dissemination, the NCSP through the course of its activities is preparing several benchmark evaluations for submission to the International Criticality Safety Benchmark Evaluation Project (ICSBEP) in the upcoming years.

Integral experiment research over the last year has included: completion of a series of thermal plutonium metal experiments sensitive to polyethylene (PE) and polymethyl-methacrylate (PMMA, acrylic, Lucite) thermal scattering laws and a thermal plutonium system with chlorine to provide validation cases for plutonium chloride solution operations. Design work is being completed for multiple different temperature-dependent critical experiments; SNL and Oak Ridge National Laboratory (ORNL) are collaborating on the design of heating and cooling systems for the water of the SNL water lattice and Lawrence Livermore National Laboratory (LLNL) is working with LANL and the United Kingdom's (UK's) National Nuclear Laboratory (NNL) to design a -40 °C variation on the uranium Thermal Epithermal eXperiments (TEX).

With regard to Analytical Methods, Monte Carlo N-Particle (MCNP) and SCALE are key codes used for criticality safety within the DOE complex and are supported by the NCSP, the NRC, and DOE, with nuclear data libraries generated by NJOY and AMPX. A key area of development has been sensitivity/uncertainty methods using continuous energy data and investigating advanced validation methods. Funding to help support processing of Evaluated Nuclear Data Files (ENDF) data for the criticality safety codes is also provided by the NCSP, including expanded cross section covariance data that are available for the key NCS analyses code packages, and support of the transition of nuclear data from the traditional ENDF-6 to the new General Nuclear Database Structure (GNDS) format. The ENDF/B-VIII.0 was released in late 2017 and has many new features including expanded thermal scattering data for reactor grade graphite and pyrolytic carbon needed for advanced reactors as well as water in ice form to temperatures below -40 °C as requested by International Atomic Energy Agency (IAEA) transportation guidelines. LANL participated in the development and recent release of the ENDF/B-VIII.0 nuclear data. ACE files for use with MCNP are now available for download on a public website. Fundamental R&D work that is continuing at LANL includes the investigation and development of: region-dependent sensitivity-uncertainty data for NCS validation, methods to diagnose and accelerate Monte Carlo source convergence, diagnostic tests for under sampling and clustering, the impact of correlated fission

multiplicity models in criticality calculations, studies into the validation for chlorine, exploring the use of machine learning techniques with criticality benchmark sensitivity data to help identify potentially problematic nuclear data, improved fixed-source sensitivity tally capabilities, more efficient particle tracking algorithms for particulate fuel applications, and more.

The SCALE and MCNP teams both provided training classes to US and international participants. Classes in the theory and practice of Monte Carlo criticality calculations with MCNP6 are given regularly at LANL and other sites. A new 1-day training class on the use of sensitivity-uncertainty methods in NCS validation has also been conducted numerous times, by personnel from both LANL and ORNL. In 2021 and early 2022, SCALE offered six weeks of virtual training classes on criticality safety, nuclear data, and uncertainty analysis methods for criticality safety from ORNL, with US and international attendance, which covers the gamut of the computational capabilities starting from nuclear data assessment through to application. The SCALE training courses at ORNL in October-November 2022, which will be offered as in-person events, will include week of training in criticality safety calculations. The 6th annual SCALE Users' Group Workshop at ORNL was successfully held as a hybrid event April 27-29, 2022. A total of 165 participants from 90 organizations in 26 countries attended the meeting and 12 hands-on tutorials on impactful and innovative applications of SCALE were organized during this meeting. In April 2021, an Arrangement was signed between UT-Battelle/ORNL and OECD/NEA to cooperate on the joint organization of conferences at which ORNL intends to conduct training on topics of mutual interest. Cooperation under this Arrangement commenced upon signature and will continue for a period of 3 years until 2024, with ORNL to carry out training on modeling and simulation tools in accordance with the OECD/NEA's needs. Two SCALE courses organized by NEA were remotely held in April 2021. Other two SCALE training courses in nuclear data fundamentals and criticality safety are being planned with NEA as in person events at the NEA Data Bank in November 2022. The MCNP and the Monte Carlo codes in the SCALE code system continue to be highly regarded Monte Carlo codes. MCNP includes the Whisper code to support sensitivity-uncertainty based methods for NCS validation. The SCALE code includes both the TSUNAMI and SAMPLER packages. The TSUNAMI package is used for code validation, gap analysis and has been used for experiment design as the package provides sensitivity-uncertainty and similarity information. SAMPLER extends TSUNAMI's capabilities by including the ability to understand impact to keff from model input parameter uncertainty. There are estimated to be over 20,000 users of MCNP throughout the world with ~1,200 licenses annually processed and distributed by the Radiation Safety Information Computational Center (RSICC) at ORNL in recent years. SCALE is the most highly requested code from the NEA Data Bank, with distributions to over 2000 Data Bank members over the past decade, with mirrored distribution also available from the RIST data center in Japan. Currently, there approximately 11,000 SCALE users in 62 nations.

In the Nuclear Data program element, prioritized nuclear data measurements and evaluations continue to be performed to support NCS operations in the US. The multi-laboratory Nuclear Data Advisory Group (NDAG) prioritizes nuclear data measurements and evaluations supported by the NCSP and coordinates NCSP activities with the US National Nuclear Data Center to assure inclusion in ENDF releases. During the past and recent year, new differential measurements have been performed an enriched metallic ^{90,91}Zr sample. Also, substantial progress has been made to modernize the Rensselaer Polytechnic Institute (RPI) linear accelerator, i.e. increase the neutron

flux and reduce the neutron pulse width. This will enable better experiments in the tens to hundreds keV range (in the resolved resonance range) that is important for many nuclei pertinent to criticality safety. For this, the NCSP has partnered with NNSA Naval Reactors to invest in accelerator refurbishment effort at RPI to ensure the US has a differential data measurement capability for performing needed cross-section measurements. With regard to cross-section evaluation work, the NCSP has completed resonance region evaluations for ^{140,142}Ce and Ta. These new evaluations are undergoing testing and are expected to be available with the next ENDF data library release. The Interagency Nuclear Data Working Group continues multi-faceted funding for new nuclear data evaluations to support a number of priority programmatic needs for the DOE Office of Nuclear Physics, Isotope Program, Office of Nuclear Energy, NNSA/Defense Nuclear Nonproliferation Research and Development, Department of Homeland Security, and Domestic Nuclear Detection Office.

The NRC recently completed long running efforts in the application of burnup credit for spent LWR fuel in transport and storage conditions. This work is now being refined through the use of precision radiochemical assay (RCA) on PWR samples that will provide higher quality high burnup data sets which will allow the opportunity for extrapolation into high burnup applications.

The US DOE and NRC are jointly funding ORNL to conduct precision radiochemical assay (RCA) measurements for obtaining high accuracy code validation data for nuclide inventories in spent nuclear fuel. The high-accuracy characterization of nuclide inventories, particularly in the high-burnup range, is critical for spent fuel storage and transportation, given industry's interest in higher burnup fuel and the existing gaps in validation data for this burnup range. Measurements are under way for 16 PWR spent fuel samples, with seven of these samples having estimated burnups over 60 GWd/tU. Over 50 actinides and fission products of importance to burnup credit criticality, radiation shielding, and decay heat calculations are planned to be measured. For criticality safety, the new measurements will expand the RCA basis used to update NUREG/CR-7108 on depletion code validation, to provide bias and bias uncertainty estimates for several codes using ENDF/B-VII.1 and -VIII.0 cross section libraries. Additionally, the new measurements may be later contributed to expand the SFCOMPO database. Currently, the database includes very high-burnup (>60 GWd/MTU) nuclide inventory data for only three PWR samples.

The NRC is conducting work related to studying and documenting the impacts of High Assay Low Enriched Uranium (HALEU) and Accident Tolerant Fuel (ATF) including Extended Enrichment (EE) and High Burnup (HBU) through the various stages of the nuclear fuel cycle. These research products use the SCALE code to assess the current understanding of fuel performance & neutronics under these various conditions. Recent works completed are highlighted on the NRC's public webpage on ATF and include:

- Studies on the front end of the fuel cycle assessing the HALEU validation basis in fresh fuel transport packages
- Studies determining the impacts of:
    - Extended enrichment and ATF on the staging of fuel fresh & criticality safety

- ATF, extended enrichment and HBU fuel on isotopics, decay heat, and radiation source term effects

Additionally, extensive work is underway to issue a multi-volume SCALE 6.2.4 /ENDF/B-VII.1 validation report, covering criticality safety, reactor physics, spent nuclear fuel, and radiation shielding applications. This validation report will summarize the SCALE validation of these various technical areas while also including the input decks used to support the analyses. Work is also underway to assess the impacts of ATF including EE and HBU on burnup credit.

International Collaborations

The NNSA continues to interact with Atomic Weapons Establishment (AWE) and NNL in the UK and the Commissariat à l'Énergie Atomique (CEA) and L'Institut de Radioprotection et de Sûreté Nucléaire (IRSN) in France to identify and collaborate on nuclear criticality safety issues of mutual interest, such as integral experiments, computational methods, and improved nuclear data. During the past year, the collaborations have resulted in personnel from the US performing collaborative work at IRSN, CEA, and AWE. Within the DOE NCSP, ORNL and Institute for Reference Materials and Measurements (IRMM) collaborate to perform neutron cross-section measurements in the resonance region to address differential data needs identified as important to improvement of nuclear criticality safety analyses. The NCSP has a collaboration agreement with the EU Joint Research Center in Geel, Belgium. Over the last couple of years, differential measurements have been taken with natural La and Ce-142. In FY20, measurements are planned with stable isotopes of Zirconium (Zr-90, 91, 92, 94) per the NCSP 5-year plan.

Under OECD/NEA WPEC, US National Laboratories are worked with other international partners on the CIELO (Collaborative International Evaluated Library Organization) to improve nuclear evaluations, many of which support improved evaluations for nuclear criticality safety. Specifically, the CIELO collaboration has focused efforts on completing new evaluations for ^{235}U, ^{238}U, ^{239}Pu, ^{56}Fe, and ^{16}O.

In addition, the NCSP provides support for the US participation in the ICSBEP. The DOE-NE currently provides support for the US leadership of the ICSBEP, although that funding is expected to be reduced in fiscal year 2023 (FY23).

Future Challenges

Organizations face a continuing challenge to maintain a fully compliant criticality safety program with qualified personnel experienced in both the principles of criticality safety and the fissile material operations, with the need for planning to support the needs of the advanced reactor community. In addition, a challenge is related to the availability of experiments to use for benchmarks in criticality reviews to support analysis of accident tolerant fuels. A further challenge exists related to succession planning for key staff expertise needed to support NCS. To meet this challenge, the NCSP is continuing to invest in succession planning for key NCS technology capabilities that include specialists in integral experiments, nuclear data, and analytical methods.

Holdup residues can contribute significantly to the inventory of nuclear material within process equipment and, at any time, can represent the largest portion of inventory uncertainty. As such, these residues can challenge assumptions and limits needed for nuclear criticality safety. The NNSA has initiated work to establish a safety-related *in situ* nondestructive assay (NDA) program to manage and direct R&D tasks needed to improve NDA capabilities for quantifying nuclear material holdup. A mission and vision document for the NDA technology program is in development and should be published in the coming year.

Input to/from NEA NSC Programmes of Work

The US continues to engage in each of the Expert Groups and Subgroups of the Working Party on Nuclear Criticality Safety as well as in other NEA working parties. US participants are actively engaged or are leading activities within the Nuclear Science Committee WPNCS. The US leadership continues for ICSBEP and SFCOMPO. US leadership is also provided with the Technical Monitor for Uncertainty Analysis for Criticality Safety Assessment overseeing two subgroups. Involvement in other NSC activities include: Working Party on International Nuclear Data Evaluation Co-operation (WPEC), Working Party on Reactor Systems (WPRS), Expert Group on Improvement of Integral Experiments Data for Minor Actinide Management (EGIEMAM-II), Expert Group on Accident Tolerant Fuels for Light Water Reactors (EGATFL), The Working Party on Scientific Issues of the Fuel Cycle (WPFC), Expert Group on Multi-physics Experimental Data, Benchmarks and Validation (EGMPEBV), and WPEC Subgroups: 44 on Investigation of Covariance Data in General Purpose Nuclear Data Libraries, 45 on Validation of Nuclear Data Libraries (VaNDaL) Project, and 46 on Efficient and Effective Use of Integral Experiments for Nuclear Data Validation. Additionally, the US engages with the activities of Committee on the Safety of Nuclear Installations (CSNI) not listed here. These engagements are sponsored by numerous agencies, but the DOE/NNSA or NRC are the primary sponsor of the participants and their contributions.