Lawrence Livermore National Laboratory
7000 East Avenue, L-198, Livermore, California, 94550

SUBJECT: Report on the 2021 ICSBEP and SINBAD Technical Review Group (ZOOM) Meeting

DATE: October 31, 2021

TO: Dr. Angela Chambers, Nuclear Criticality Safety Program Manager, National Nuclear Security Administration / NA-511

FROM: Dave Heinrichs[4], Cihangir Celik[2], Jeff Favorite[1], Gary Harms[3], Mike Zerkle[5]

MEETING TITLE: ICSBEP/IRPhE Technical Review Group and Candidate SINBAD Experiments, OECD NEA: 11-14 October 2021

MEETING LOCATION: On-line, hosted by OECD Nuclear Energy Agency (NEA)

MEETING DATES: October 11-14, 2021

ATTENDEES ON BEHALF OF NCSP: Kelsey Amundson[1], Cihangir Celik[2], Mathieu Dupont[2], Jeff Favorite[1], Gary Harms[3], Dave Heinrichs[4], Soon Kim[4], Geordie McKenzie[1], Thomas Miller[2], Jesse Norris[4], Catherine Percher[4], Nick Thompson[1], Tim Valentine[2], Mike Zerkle[5]

[1]LANL (4), [2]ORNL (3), [3]SNL (1), [4]LLNL (4), [5]NNL (1)

MEETING PURPOSE:

Only one NCSP evaluation was reviewed by members of the ICSBEP Technical Review Group (TRG) constituted from the meeting attendees:

- ALARM-REAC-SST-SHIELD-001: Neutron Fluence and Element 57 Dose Responses to a Bare and Steel-Reflected Pulse of the ORNL Health Physics Research Reactor, Mathieu Dupont (ORNL)

The Technical Review Group accepted the (measured) neutron fluence as the benchmark quantity and recommended the (derived) dose responses be retained in an appendix. Additional details are required on the measurement technique using Bonner Spheres and associated uncertainties. A subgroup was established including Jason Haverkamp (NNL) and Dave Heinrichs (LLNL) to assist in completing this benchmark for resubmission to the ICSBEP in 2022.

As members of the Technical Review Group, the NCSP and other attendees also participated in review of four non-NCSP ICSBEP evaluations and two SINBAD evaluations:

- ALARM-CF-CU-SHIELD-001: Measurement of Fast Neutrons Leakage Spectra from Copper Block with 252Cf Source in Center, Michal Kostal et al., Rež (Czech Republic)

- LEU-COMP-THERM-110: 4.738-wt.% Enriched Uranium Dioxide Fuel Rod Arrays in Water, Surrounded by Steel or Copper Sleeves in Water or in an Aluminum Block, Nicolas Leclaire and N. Dos Santos, IRSN (France)

These benchmarks are excellent and were accepted for publication in the 2021 edition of the ICSBEP Handbook pending adequate resolution of (minor) reviewer comments.

- LEU-COMP-THERM-109: Criticality Experiments in Hexagonal Lattices (1.275 cm Pitch) of VVER-1000 Low Enriched U(3.6% U235)UO2 Fuel Assemblies in Light Water with Seven Void, Silicon Dioxide or Graphite Modules in Center, Tomas Czakoj et al., Rež (Czech Republic)

This benchmark will be resubmitted to 2022 ICSBEP Meeting due to the need for additional uncertainty assessment and independent confirmatory model results. Gary Harms (SNL) will provide general assistance, and Dave Heinrichs (LLNL) and Nicolas Leclaire (IRSN) will provide independent COG and MORET results, which benefits the NCSP benchmark intercomparison project.

- HIMAC: Secondary Neutrons Produced from Thick Targets of C, Al, Cu & Pb, Bombarded by 100-800 MeV/Nucleon He, C, Ne, Ar, Fe, Xe and Si Ion Beams, Shuichi Tsuda et al. (JAEA)

- FNG Cu: FNG Copper Block, Ivo Kodeli, JSI (Slovenia)

Note that these benchmarks were previously presented at the 2019 ICSBEP and SINBAD TRG Meetings as noted in LLNL-MI-796017[1]. The HIMAC benchmark is not applicable to NCSP users as it pertains to ions with energies in excess of 100 MeV/u and TRG recommended additional investigation of uncertainties. The FNG-Cu Block evaluation has been revised to include sample results but still has significant format issues and missing details requiring resolution prior to publication.

- The Benchmark Experiment on Slab Iron with D-T Neutrons for Validation of Evaluated Nuclear Data, CIAE (China)

This last benchmark was not discussed but a subgroup was established to provide comments to the evaluators so that it is sufficiently advanced to allow TRG review in the next meeting. Additionally, the meeting included the following presentations:

- Update on DICE and IDAT tools, Ian Hill (NEA)

- Report on the WPNCS Subgroup 8 on Preservation of Expert Knowledge and Judgement Applied to Criticality Benchmarks, Will Wieselquist (ORNL)

- Update on the ICSBEP TRG Mandate, John Bess (INL)

- Discussion on the Uncertainty and Reviewer's Guides, John Bess (INL)

- Ongoing SINBAD Efforts under the Nuclear Science Committee: WPEC SG47, and Task Force under WPRS, Michael Fleming (NEA)

[1] https://ncsp.llnl.gov/sites/ncsp/files/2021-05/LLNL_ICSBEP_2019_Trip_ReportFrance.pdf

The next ICSBEP/SINBAD/IRPhE meeting will be hosted by NEA on-line on December 6-10, 2021.

MEETING BENEFITS TO THE NCSP:

ICSBEP

The USDOE Office of Defense Programs founded the Criticality Safety Evaluation Project (CSBEP) in 1992 to document and preserve criticality safety benchmark experiments. In 1994, the CSBEP welcomed international participants from France, Hungary, Japan, Russia, and the United Kingdom; and in 1995, the DOE allowed the CSBEP to become an official activity of the OECD NEA to further enhance international participation and changed the name to the ICSBEP. As described in the USDOE NCSP Mission and Vision, Five-Year Execution Plan, and CEdT Manual, the ICSBEP remains an important element of information preservation and dissemination.

SINBAD

The Shielding Integral Benchmark Archive Database (SINBAD) started in the 1990s as a collaboration between the OECD NEA Data Bank and Radiation Safety Information Computational Center (RSICC) at ORNL. At present, SINBAD is a large compendium of 'shielding' integral experiments, which historically was devoted to the collection and preservation of the experimental information with little emphasis on evaluation. A recent and ongoing effort championed by Ivan Kodeli[2], Jožef Stefan Institute, Slovenia, is to review selected contents for the completeness of the experimental information, evaluate the experimental sources of uncertainty, and prepare improved and more modern computer code models. This effort is benefitting the NCSP by providing evaluated shielding benchmark data with uncertainty estimates. A subset of these shielding integral experiment benchmarks benefits NCSP either directly for shielding validation purposes used in the calculation of criticality accident doses, nuclear accident dosimetry, or criticality accident alarm response; or indirectly in validating nuclear data at energies applicable to fission systems. Other contents of the compendium, such as high energy accelerator shielding experiments, are not applicable to NCSP due to their higher energies or other particles.

PURPOSE OF TRAVEL: Not applicable. NEA decided upon an on-line ZOOM meeting due to continuing COVID-19 concerns and restrictions.

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

ATTACHMENT: Agenda, ICSBEP/IRPhE Technical Review Group and Candidate SINBAD Experiments, Online Hosted by OECD NEA, 11-14 October 2021.

DISTRIBUTION:

Angela Chambers, angela.chambers@nnsa.doe.gov
Doug Bowen, bowendg@ornl.gov
Marsha Henley, henleym@ornl.gov

[2] Ivan Kodeli et al., "20 Years of SINBAD (Shielding Integral Benchmark Archive and Database)," Progress in Nuclear Science and Technology, Volume 4 (2014) pp. 308-311; http://www.aesj.or.jp/publication/pnst004/data/308_311.pdf.

PARTICIPANTS:

Attendee	Affiliation	Country
Kelsey Amundson	LANL, NCSP	USA
Julian Atfield	CNL	Canada
John Bess	INL	USA
Kermit Bunde	DOE	USA
Cihangir Celik	ORNL	USA
Yurdunaz Celik	BNRC	Belgium
Tomas Czakoj	Rež	Czech Republic
Adimir dos Santos	IPEN	Brazil
Mathieu Dupont	ORNL, NCSP	USA
Jeff Favorite	LANL, NCSP	USA
Satoshi Gunji	JAEA	Japan
Gary Harms	SNL, NCSP	USA
Jason Haverkamp	NNL	USA
Dave Heinrichs	LLNL, NCSP	USA
Yosuke Iwamoto	JAEA	Japan
Evgeny Ivanov	IRSN	France
Soon Kim	LLNL, NCSP	USA
Anatoly Kochetkov	BNRC	Belgium
Ivo Kodeli	JSI	Slovenia
Michal Kostal	Rež	Czech Republic
Ilya Kuptsov	MEPhI	Russia
Nicolas Leclaire	IRSN	France
Igor Lengar	JSI	Slovenia
Evzen Losa	Rež	Czech Republic
Elijah Lutz	SNL	USA
Claude-Annie Manga	NEA	France
Julie-Fiona Martin	NEA	France
Geordie McKenzie	LANL, NCSP	USA
Dennis Mennerdahl	EMS	Sweden
Thomas Miller	ORNL, NCSP	USA
Jesse Norris	LLNL, NCSP	USA
Alfie O'Neill	CNL	Canada
Pedro Ortega	SEA	Spain
Catherine Percher	LLNL, NCSP	USA
Evgeny Rozhikhin	IPPE	Russia
Lori Scott	NEA	USA
Luka Snoj	JSI	Slovenia
Nick Thompson	LANL, NCSP	USA
Shuichi Tsuda	JAEA	Japan
Tim Valentine	ORNL, NCSP	USA
Tim Watson	NNL	USA
Luke Yaraskavitch	CNL	Canada
Mike Zerkle	NNL, NCSP	USA
Gašper Žerovnik	JSI	Slovenia

Attachment

ICSBEP/IRPhE Technical Review Group and Candidate SINBAD Experiments
OECD NEA: 11 – 14 October 2021

ICSBEP/IRPhE Technical Review Group and Candidate SINBAD Experiments

AGENDA

11 – 14 OCTOBER 2021
Online Hosted by OECD NEA
Meeting Registration: http://www.oecd-nea.org/confdb/confdb/conf?id=478

The meeting material is available on mynea.oecd-nea.org

Contacts
John.Bess@inl.gov (chair)
Julie-Fiona.Martin@oecd-nea.org (technical secretariat)
ClaudeAnnie.MangaCollard@oecd-nea.org (assistant)

Welcome to our virtual Technical Review Group (TRG) meeting!

Times below were selected to try and best support participants worldwide and are reported in Central European Summer Time (CEST) in the agenda below. Daily TRG meetings will run from 14h00 to 18h00 CEST each day. While the initial start time each day is definite, start times for individual evaluations later within that same day are approximate and might be slightly adjusted as the meeting proceeds. A chart providing quick time zone comparisons is included for your convenience:

PDT	MDT	EDT	BRT	BDT	CEST	MSK	JST
05h00	06h00	08h00	09h00	13h00	14h00	15h00	21h00
06h00	07h00	09h00	10h00	14h00	15h00	16h00	22h00
07h00	08h00	10h00	11h00	15h00	16h00	17h00	23h00
08h00	09h00	11h00	12h00	16h00	17h00	18h00	24h00
09h00	10h00	12h00	13h00	17h00	18h00	19h00	01h00
10h00	11h00	13h00	14h00	18h00	19h00	20h00	02h00

Monday, 11 October 2021, ICSBEP TRG			
13h50– 14h00		Join in, test your audio and video, and enjoy a brief chat with colleagues	
14h00-14h15	**SESSION 1:**	**WELCOME AND INTRODUCTION**	
		Welcome and Introduction	J. Bess
	SESSION 2:	**APPROVAL OF NEW ICSBEP EVALUATIONS**	
14h15-16h00	ALARM-CF-CU-SHIELD-001	MEASUREMENT OF FAST NEUTRONS LEAKAGE SPECTRA FROM COPPER BLOCK WITH 252Cf SOURCE IN CENTER	M. Košťál M. Schulc T. Czakoj V. Rypar E. Novák F. Mravec Z. Matěj F. Cvachovec
16h00-16h15		BREAK	
	SESSION 3:	**APPROVAL OF NEW ICSBEP EVALUATIONS (Continued)**	
16h15-18h00	ALARM-REAC-SST-SHIELD-001	NEUTRON FLUENCE AND ELEMENT 57 DOSE RESPONSES TO A BARE AND STEEL-REFLECTED PULSE OF THE ORNL HEALTH PHYSICS RESEARCH REACTOR	M. N. Dupont
18h		ADJOURN	

ICSBEP/IRPhE Technical Review Group and Candidate SINBAD Experiments
OECD NEA: 11 – 14 October 2021

Tuesday, 12 October 2021			
13h50– 14h00		Join in, test your audio and video, and enjoy a brief chat with colleagues	
14h00 – 15h45	**SESSION 4:**	**APPROVAL OF NEW EVALUATIONS (Continued)**	
	LEU-COMP-THERM-110	4.738-WT.%-ENRICHED-URANIUM-DIOXIDE-FUEL-ROD ARRAYS IN WATER, SURROUNDED BY STEEL OR COPPER SLEEVES IN WATER OR IN AN ALUMINUM BLOCK	N. Leclaire N. Dos Santos
15h45 – 16h00		BREAK	
16h00 – 17h45	**SESSION 5:**	**ICSBEP RELATED PRESENTATIONS**	
		Update on DICE and IDAT tools	I. Hill
		Report of the WPNCS Subgroup 8 on Preservation of Expert Knowledge and Judgement Applied to Criticality Benchmarks	W. Wieselquist
		Update on the ICSBEP TRG Mandate	J. Bess
		Discussion on the Uncertainty and Reviewer's Guides	J. Bess
17h45		ADJOURN	

Wednesday, 13 October 2021			
13h50– 14h00		Join in, test your audio and video, and enjoy a brief chat with colleagues	
14h00 – 15h45	**SESSION 6**	**APPROVAL OF NEW EVALUATIONS (Continued)**	
	LEU-COMP-THERM-109	CRITICALITY EXPERIMENTS IN HEXAGONAL LATTICES (1.275 CM PITCH) OF VVER-1000 LOW ENRICHED U(3.6 % U235)O2 FUEL ASSEMBLIES IN LIGHT WATER WITH SEVEN VOID, SILICON DIOXIDE OR GRAPHITE MODULES IN CENTER	T. Czakoj M. Košťál M. Schulc V. Rypar E. Novák
15h45 – 16h00		BREAK	
16h00 – 17h45	**SESSION 7**	**REVIEW OF SINBAD EXPERIMENTS**	
		Ongoing SINBAD Efforts under the Nuclear Science Committee: WPEC SG47, and Task Force under WPRS	M. Fleming
	HIMAC	SECONDARY NEUTRONS PRODUCED FROM THICK TARGETS OF C, AL, CU & PB, BOMBARDED BY 100-800 MEV/NUCLEON HE, C, NE, AR, FE, XE AND SI IONS BEAMS	S. Tsuda D. Satoh T. Kurosawa
17h45		ADJOURN	

Thursday, 14 October 2021			
13h50– 14h00		Join in, test your audio and video, and enjoy a brief chat with colleagues	
14h00 – 15h45	**SESSION 8**	**REVIEW OF SINBAD EXPERIMENTS (Continued)**	
	FNG Cu	FNG COPPER BLOCK	I. Kodeli
15h45 – 16h00		BREAK	
16h00 – 17h45	**SESSION 9**	**DISCUSSION**	
		THE BENCHMARK EXPERIMENT ON SLAB IRON WITH D-T NEUTRONS FOR VALIDATION OF EVALUATED NUCLEAR DATA	CIAE, J. Bess
17h45		ADJOURN	