



Lawrence Livermore National Laboratory
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SUBJECT: Report on the (on-line) 2020 ICSBEP Technical Review Group (WebEx) Meeting

DATE: October 31, 2020

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

FROM: David P. Heinrichs, Nuclear Criticality Safety Division Leader, Lawrence Livermore National Laboratory

MEETING TITLE: 2020 International Criticality Safety Benchmark Evaluation Project (ICSBEP) Technical Review Group (TRG) Meeting

MEETING LOCATION: On-line

MEETING DATES: October 18-23, 2020

ATTENDEES ON BEHALF OF NCSP: David Ames¹, Doug Bowen², Cihangir Celik², Angela Chambers³, Justin Clarity², Riley Cumberland², Teresa Cutler⁴, Jeff Favorite⁴, Joetta Goda⁴, Travis Grove⁴, Gary Harms¹, David Heinrichs⁵, Jessen Hutchinson⁴, Soon Kim⁵, B. J. Marshall², George McKenzie⁴, Alexander McSpaden⁴, Thomas Miller², Jesse Norris⁵, Catherine Percher⁵, Rene Sanchez⁴, Nicholas Thompson⁴, Will Wieselquist², Mike Zerkle⁶

¹SNL (2), ²ORNL (7), ³NNSA (1), ⁴LANL (9), ⁵LLNL (4), ⁶NNL (1)

MEETING PURPOSE:

As shown in the attached agenda, the meeting began on Sunday with a (virtual) social hour. On Monday, the first hour was devoted to protocol and WebEx mechanics. The technical portion of the meeting commenced with a discussion of previously approved evaluations with proposed minor revisions, which were accepted with minimal discussion.

- HEU-MET-THERM-032, One Dimensional Array of Highly Enriched Uranium, Moderated and Reflected by Polyethylene, Luka Snoj, Jožef Stefan Institute (Slovenia)
- IEU-MET-FAST-010, The U9 Benchmark Assembly: A Cylindrical Assembly of U Metal (9% ²³⁵U) with a Thick Depleted-Uranium Reflector, Kermit Bunde
- LEU-COMP-THERM-039, Incomplete Arrays of Water Reflected 4.728-wt%-Enriched Uranium Dioxide Fuel-Rod Arrays, Nicolas Leclaire, IRSN
- LEU-COMP-THERM-078, Water-Moderated Square-Pitched U(6.90)O₂ Fuel Rod Lattices with 0.52 Fuel-to-Water Volume Ratio (0.855 cm Pitch), Gary Harms, SNL



Mike Zerkle and Jeff Favorite are revising the following evaluations which will result in (minor) changes to the benchmark model in U233-COMP-THERM-004 and the simplified model in PU-MET-FAST-001, respectively. Zerkle's changes provide additional details of the fuel rod end fittings, which are unlikely to impact the benchmark-model k-eff. Favorite's changes will require additional description of the cross-section dependency in the implicit transformation (or normalization) bias.

- U233-COMP-THERM-004, D₂O Moderated Lattice of ²³³UO₂-²³²ThO₂, Mike Zerkle, NNL
- PU-MET-FAST-001, Bare Sphere of Plutonium-239 Metal (4.5 at.% ²⁴⁰Pu, 1.02 wt.% Ga), Jeff Favorite, LANL

Four new NCSP evaluations were reviewed by members of the ICSBEP Technical Review Group (TRG) constituted from the meeting attendees. All four NCSP evaluations were "approved" for publication, pending adequate resolution of the review comments, in the next (2020) edition of the International Handbook of Evaluated Criticality Safety Benchmark Experiments:

- HEU-MET-FAST-101, KRUSTY: Beryllium-Oxide and Stainless Steel Reflected Cylinder of HEU Metal, Jeff Favorite, LANL
- HEU-MET-THERM-004, One Dimensional Array of Highly Enriched Uranium, Moderated and Reflected by Lucite, Igor Lengar, Jožef Stefan Institute (Slovenia)
- PU-MET-MIXED-003, TEX Plutonium Assemblies with Tantalum: Plutonium-Aluminum Metal Alloy Plates with Varying Thicknesses of Polyethylene Moderator, Interstitial Tantalum and a Thin Polyethylene Reflector, Catherine Percher, LLNL
- LEU-COMP-THERM-102, Pitch Variation Experiments in Water-Moderated Square-Pitched U(6.90)O₂ Fuel Rod Lattices with Fuel to Water Volume Ratios Spanning 0.08 to 0.67, Gary Harms, SNL

As members of the Technical Review Group, the NCSP and other attendees also participated in review of five non-NCSP evaluations, one of which was "approved" for publication, pending adequate resolution of the review comments:

- LEU-COMP-THERM-106, 4.728-wt.%-Enriched-Uranium-Dioxide-Fuel-Rod Arrays in Water, Reflected or Separated by Various Structural Materials (Sodium Chloride, Rhodium, PVC, Molybdenum, Chromium, Manganese), Nicolas Leclaire, IRSN (France)

These MIRTE 2.2 experiments are similar to the MIRTE 1 experiments approved in the previous TRG meeting for publication in 2019 edition of the ICSBEP Handbook. Note that MIRTE 1 was partially funded by NCSP, whereas MIRTE 2 had no NCSP funding.

The four non-NCSP evaluations that were not approved but may be submitted again next year pending significant corrections and additions are:

- MIX-MET-FAST-016, Zeus: Fast-Spectrum Critical Assembly with a Mixed Core of Highly Enriched and Natural Uranium Containing Lead Supported by a Copper Reflector, Akito Oizumi JAEA



- PU-MET-FAST-047, The Jupiter Experiments: Plutonium Metal Plates Moderated by Lead and Reflected by Copper, Alexander McSpaden, LANL
- LEU-COMP-THERM-109, LR(0)-VVER-RESR-005, Criticality Experiments in Hexagonal Lattices (1.275 cm Pitch) of VVER-1000 Low Enriched U(3.3 wt.% U²³⁵)O₂ Fuel Assemblies in Light Water with Seven Void, Silicon Dioxide or Graphite Modules in Center, Michal Košť'al, Research Center Řež (Czech Republic)
- ALARM-CF-FE-SHIELD-002, Measurement of Fast Neutron Leakage Spectra from Iron Spheres with ²⁵²Cf Source in Center, Michal Košť'al, Research Center Řež (Czech Republic)

The ICSBEP meeting also included discussions of the following topics:

- Kotaro Tonoiki (JAEA) has replaced Stephane Evo (IRSN) as Chair of the OECD NEA Working Party on Nuclear Criticality Safety (WPNCS).
- WPNCS SG-8, Review/Classification of Benchmark Quality, by Will Wieselquist (ORNL)
- Distribution of Code Inputs Derived from ICSBEP/IRPhEP Benchmarks by Ian Hill (NEA) and ownership rights.
- WebEx screen capture for a photograph of the TRG participants which will be available for downloading from "myNEA" at https://mynea.oecd-nea.org/cms/jcms/t1_2007057/en/icsbep-technical-review-group-2020.
- The 2019 (DVD) edition of the ICSBEP Handbook is expected to be available November 2020.

The meeting adjourned following announcement that the next meeting will be convened on October 11-15, 2021 at OECD NEA Headquarters.

MEETING BENEFITS TO THE NCSP:

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 C_{ED}T Manual, the ICSBEP remains an important element of information preservation and dissemination.

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



PARTICIPANTS:

An advantage of WebEx is that it provides a real time list of participants, which was checked sporadically during the meeting with attendee participation as noted below.

Attendee	Affiliation	Participation
Ayodeji Alajo		W
David Ames	SNL, NCSP	M Tu W Th F
Kelsey Amundson	DNFSB	M Tu W Th F
Julian Atfield	Canadian Nuclear Laboratories	M Tu W Th F
John Bess	INL	S M Tu W Th F
Doug Bowen	ORNL, NCSP	M
Mariya Brovchenko	IRSN	M Tu W
Cihangir Celik	ORNL, NCSP	S M Tu W Th F
Angela Chambers	NNSA, NCSP	M Th
Joseph Christensen	DOE-ID	M Tu Th
Justin Clarity	ORNL, NCSP	M Tu W Th F
Riley Cumberland	ORNL, NCSP	M Tu W Th F
Theresa Cutler	LANL, NCSP	M Tu Th F
Tomáš Czakoř	Řeř (Czech Republic)	Th
Isabelle Duhamel	IRSN	M Tu F
Matthieu Dupont	IRSN	M Tu W Th F
Jeff Favorite	LANL, NCSP	S M Tu W Th F
Joetta Goda	LANL, NCSP	M Tu W Th
Travis Grove	LANL, NCSP	Tu
Satoshi Gunji	JAEA	M Tu W Th F
Gary Harms	SNL, NCSP	M Tu W Th F
Jason Haverkamp	NNL	S M Tu W Th F
David Heinrichs	LLNL, NCSP	S M Tu W Th F
Deb Hill	NNL	M Tu Th F
Ian Hill	NEA	S M Tu W Th F
Jesson Hutchinson	LANL, NCSP	S M Tu W Th
Evgeny Ivanov	IRSN	M Tu W Th F
Tatiana Ivanova	NEA	S
Timothy Jackson	Y-12	M Tu F
Soon Kim	LLNL, NCSP	S M Tu W Th F
Anatoly Kochetkov	SCK CEN (Belgium)	S Tu W Th
Ivo Kodeli	JSI (Slovenia)	S M W Th F
Michal Kořt'ál	Řeř (Czech Republic)	S M Tu
Nicolas Leclaire	IRSN	S M Tu W Th F
Igor Lengar	JSI (Slovenia)	S M Tu W
Evzen Losa	Řeř (Czech Republic)	Th F
Elijah Lutz		M W F
B. J. Marshall	ORNL, NCSP	M Tu W Th F
Julie-Fiona Martin	NEA	S M Tu W
George McKenzie	LANL, NCSP	M Tu W Th
Alexander McSpaden	LANL, NCSP	M Tu Th
Dennis Mennerdahl	EMS (Sweden)	S M Tu W Th F
Thomas Miller	ORNL, NCSP	Tu F



Jesse Norris	LLNL, NCSP	M Tu W Th F
Akito Oizumi	JAEA (Japan)	M Tu W Th F
Alfie O'Neill	NNL (United Kingdom)	M Tu Th F
Pedro Ortego	SEA (Spain)	S M Tu Th F
Catherine Percher	LLNL, NCSP	M Tu W Th F
Bojan Petrovic	Georgia Tech.	M W
Evgeny Rozhikhin	IPPE (Russia)	S M Th
Rene Sanchez	LANL, NCSP	Tu
Adimir dos Santos	IPEN (Brazil)	S M Tu W Th F
Lori Scott	INL, NEA	S M Tu W Th F
Luka Snoj	JSI (Slovenia)	M Tu W
Aslak Stubsgaard	Copenhagen Atomics (Denmark)	M
Sikorin Svyatoslav	JIPNR (Belarus)	M W Th
Jean-Christophe Sublet	IAEA (Austria)	M Tu W Th F
Nicholas Thompson	LANL, NCSP	M Tu W Th F
Anatoly Tsibulia	IPPE (Russia)	Tu W Th
Will Wieselquist	ORNL, NCSP	M Tu
Luke Yaraskavitch	Canadian Nuclear Laboratories	M Tu W Th F
Mike Zerkle	NNL, NCSP	S M Tu W Th F

OPINION:

The WebEx venue and “myNEA” server worked surprisingly well thanks to the technical expertise of Ian Hill (NEA) and the attendees adhering to meeting protocols such as “raising your hand” in WebEx rather than talking over other participants.

What was lost was discussion of other business during breaks and after-hours regarding ongoing collaborations and future plans, as well as lost opportunities for private mentoring of younger evaluators and reviewers. Further, the WebEx venue enabled participants to opt out of many reviews whereas the entire TRG is held hostage in an in person meeting which increases the quality of the reviews.

The JAEA/LANL and Řež evaluations would have benefitted from reviews by more experienced evaluators as these evaluations were far from ready. In the case of the JAEA/LANL evaluations, the external reviewer should have been independent and not affiliated with either JAEA or LANL.

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:

Final Agenda, International Criticality Safety Benchmark Evaluation Project (ICSBEP), ICSBEP Annual Technical Review Group (TRG) Meeting, OECD NEA: 18-23 October 2020

Distribution:

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ICSBEP Annual Technical Review Group (TRG) Meeting OECD NEA: 18 – 23 October 2020

International Criticality Safety Benchmark Evaluation Project (ICSBEP)

FINAL AGENDA

18 – 23 OCTOBER 2020

Online Hosted by OECD NEA

Meeting Registration: [http://www.oecd-nea.org/confdb/conf?id=440](http://www.oecd-nea.org/confdb/confdb/conf?id=440)

Welcome to our first ever 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 approximately 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:

<u>PDT</u>	<u>MDT</u>	<u>EDT</u>	<u>BRT</u>	<u>BDT</u>	<u>CEST</u>	<u>MSK</u>	<u>JST</u>
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

Sunday, 18 October 2020

18h00 – 19h30

VIRTUAL SOCIAL

WELCOME AND INTRODUCTIONS

Everyone

ICSBEP Annual Technical Review Group (TRG) Meeting OECD NEA: 18 – 23 October 2020

Monday, 19 October 2020

14h00 – 14h20	SESSION 1:	SUMMARY OF REVISIONS	John Bess
	HEU-MET-THERM-032	One Dimensional Array of Highly Enriched Uranium, Moderated and Reflected by Polyethylene [Revised sample MCNP input decks for compatibility with modern versions of MCNP.]	Luka Snoj
	IEU-MET-FAST-010	The U9 Benchmark Assembly: A Cylindrical Assembly of U Metal (9% ²³⁵ U) with a Thick Depleted-Uranium Reflector [Provided a detailed MCNP model of the as-built experiment with ENDF/B-VIII.0 results as Appendix E.]	Kermit Bunde
	LEU-COMP-THERM-039	Incomplete Arrays of Water-Reflected 4.728-wt.-%-Enriched Uranium Dioxide Fuel-Rod Arrays [Updated sample calculation results in Section 4.]	Nicolas Leclaire
	LEU-COMP-THERM-078	Water-Moderated Square-Pitched U(6.90)O ₂ Fuel Rod Lattices with 0.52 Fuel-to-Water Volume Ratio (0.855 cm Pitch) [Updated Figures 15–29 in Section 1 to fix an error and ensure conformity with similar modern benchmarks.]	Gary Harms
	U233-COMP-THERM-078 [ETA-HWR-EXP-002]	D ₂ O Moderated Lattice of ²³³ UO ₂ - ²³² ThO ₂ [Updated Section 3 Table 20 and Figure 24 to clarify benchmark model description for modeling fuel rod end fittings.]	Mike Zerke
14h20 – 14h35	SESSION 2:	REVISION DISCUSSION	John Bess
	PU-MET-FAST-001	Bare Sphere of Plutonium-239 Metal (4.5 at. % ²⁴⁰ Pu, 1.02 wt. % Ga) [Revision of simple benchmark model description due to updates in nickel cross section library data in ENDF/B-VIII.0.]	Jeff Favorite
14h35 – 14h40	BREAK		
14h40 – 16h30	SESSION 3:	APPROVAL OF NEW EVALUATIONS	
	HEU-MET-FAST-101 KRUSTY-SPACE-EXP-001	KRUSTY: Beryllium-Oxide and Stainless-Steel Reflected Cylinder of HEU Metal	LANL
16h30 – 16h35	BREAK		
16h35 – 17h30	SESSION 4:	DISCUSSION	
		Distribution of Code Inputs Derived from ICSBEP/IRPhEP Benchmarks	Ian Hill
		WPNCs SG-8 – Review/Classification of Benchmark Quality	Will Wieselquist

Tuesday, 20 October 2020

14h00 – 15h50	SESSION 5:	APPROVAL OF NEW EVALUATIONS (Continued)	
	HEU-MET-THERM-004	One Dimensional Array of Highly Enriched Uranium, Moderated and Reflected by Lucite	IJS
15h50 – 16h00	BREAK		
16h00 – 17h50	SESSION 6:	APPROVAL OF NEW EVALUATIONS (Continued)	
	PU-MET-MIXED-003 PU-MET-FAST-049 PU-MET-THERM-003	TEX Plutonium Assemblies with Tantalum: Plutonium-Aluminum Metal Alloy Plates with Varying Thicknesses of Polyethylene Moderator, Interstitial Tantalum and a Thin Polyethylene Reflector	LLNL

ICSBEP Annual Technical Review Group (TRG) Meeting OECD NEA: 18 – 23 October 2020

Wednesday, 21 October 2020

14h00 – 15h50	SESSION 7:	APPROVAL OF NEW EVALUATIONS (Continued)	
	MIX-MET-FAST-016	Zeus: Fast-Spectrum Critical Assembly with a Mixed Core of Highly Enriched and Natural Uranium Containing Lead Surrounded by a Copper Reflector	JAEA
15h50 – 16h00	BREAK		
16h00 – 17h50	SESSION 8:	APPROVAL OF NEW EVALUATIONS (Continued)	
	LEU-COMP-THERM-102	Pitch Variation Experiments in Water-Moderated Square-Pitched U(6.90)O ₂ Fuel Rod Lattices with Fuel to Water Volume Ratios Spanning 0.08 to 0.67	SNL

Thursday, 22 October 2020

14h00 – 15h50	SESSION 9:	APPROVAL OF NEW EVALUATIONS (Continued)	
	PU-MET-FAST-047	The Jupiter Experiments: Plutonium Metal Plates Moderated by Lead and Reflected by Copper	LANL
15h50 – 16h00	BREAK		
16h00 – 17h50	SESSION 10:	APPROVAL OF NEW EVALUATIONS (Continued)	
	LEU-COMP-THERM-109 LR(0)-VVER-RESR-005	Criticality Experiments in Hexagonal Lattices (1.275 cm Pitch) of VVER-1000 Low Enriched U(3.3 wt.% U ²³⁵)O ₂ Fuel Assemblies in Light Water with Seven Void, Silicon Dioxide or Graphite Modules in Center	CVR

Friday, 23 October 2020

14h00 – 15h50	SESSION 11:	APPROVAL OF NEW EVALUATIONS (Continued)	
	LEU-COMP-THERM-106	4.728-wt.%-Enriched-Uranium-Dioxide-Fuel-Rod Arrays in Water, Reflected or Separated by Various Structural Materials (Sodium Chloride, Rhodium, PVC, Molybdenum, Chromium, Manganese)	IRSN
15h50 – 16h00	BREAK		
16h00 – 17h50	SESSION 12:	APPROVAL OF NEW EVALUATIONS (Continued)	
	ALARM-CF-FE-SHIELD-002 SINBAD ID TBD	Measurement of Fast Neutrons Leakage Spectra from Iron Spheres with ²⁵² Cf Source in Center	CVR
17h55 – 18h00	SESSION 13:	CONCLUSION	
		Next Technical Review Group Meetings: 11-15 October 2021	Tatiana Ivanova
		Adjourn	John Bess