https://doi.org/10.61092/iaea.0nt4-9rvy

IAEA

International Atomic Energy Agency

INDC(NDS)-0764
Distr. AC,AD,AL,G,J,SZ

INDC International Nuclear Data Committee

Compilation of Nuclear Data Experiments for Radiation Characterisation (CoNDERC)

Summary Report

IAEA Headquarters, Vienna, Austria

6 – 9 August 2018

Prepared by

M. Gilbert and J.-C. Sublet

August 2018

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Printed by the IAEA in Austria

August 2018

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Compilation of Nuclear Data Experiments for Radiation Characterization (CoNDERC)

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Prepared by

Mark Gilbert and Jean-Christoph Sublet

Abstract

The purpose of the project entitled Compilation of Nuclear Data Experiments for Radiation Characterisation (CoNDERC) is to transfer into technology the experimental integral radiation information that can be used as part of the Validation and Verification processes of nuclear model and code systems, and to provide various schema to perform the necessary V&V processes. The IAEA will task, organize institutions to construct several of these databases based on their own extensive V&V activities mainly associated with inventory and source term codes.

August 2018

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1. Introduction

The purpose of the CoNDERC project is to transfer into technology the experimental radiation information that can be used as part of the Validation and Verification (V&V) processes of nuclear data and to provide standardized schema to perform the V&V up to the engineered level. The IAEA will task, organize institutions to construct several of these benchmarks based on their own extensive V&V activities associated with, for example, data evaluation, inventory calculations and source-term simulation, but also outreaching to the engineered systems.

2. Proceedings

Nuclear data validation efforts with FISPACT-II – Mark Gilbert, UKAEA

This presentation described the various V&V exercises developed and performed over several years at UKAEA in support of the development of the FISPACT-II inventory simulation system. The FISPACT-II code can read, process, and utilize any of the latest international libraries in ENDF-6 format, including TENDL-2017, ENDF/B-VIII.0, JEFF-3.3, and JENDL-4.0. The validation exercises performed with each new release of FISPACT-II and/or a major new library include a decay-heat benchmark against experiments performed at the Fusion Neutron Source (FNS) at JAEA. These experiments form a unique and extensive set of time-resolved, accurate decay heat measurements for a wide range of materials exposed to a 14 MeV fusion neutron source for either 5 minutes or 7 hours. The experimental details were meticulously recorded, which has allowed UKAEA to precisely define a set of simulations to faithfully simulate each of the material experiments. The resulting comparisons (between experiment and simulation) test the ability of FISPACT-II combined with a particular nuclear data library to predict the compositional changes in materials under 14 MeV neutrons. In many cases the latest nuclear data libraries perform well, but there are notable examples (Iridium, Indium, and Palladium were highlighted in the presentation) where one, two, or even all of the widely used international nuclear cross section libraries fail to reproduce the experimental decay heat. This benchmark, properly transformed into an open access database, can be used to validate and improve future nuclear data libraries. Discussion of the FNS decay heat experiments highlighted the potential uncertainties in the calculated (by JAEA) neutron spectra assumed for the experiments, which was normalized to the $^{27}Al(n,\alpha)$ reaction. At thermal energies the uncertainty may mitigate the underperformance of libraries where thermal capture cross sections dominate.

UKAEA also performs benchmarks against available fission pulse decay heat experiments, cross section comparisons against both integral and differential (EXFOR) data, and comparisons with the KADoNiS library of Maxwellian-averaged neutron cross sections. These benchmarks were discussed further by Jean-Christophe Sublet (see below), it was noted that some of the KADoNiS data may not be suitable to become part of an IAEA-approved benchmark because part of the data is uncertain as based on model simulation extrapolated from limited experimental measurements.

The International Radiation Characterization Project: User's point of view – Oscar Cabellos, UPM

This presentation gave an overview of current nuclear benchmark databases used for nuclear data validation. International projects such as ICSBEP, IRPhEP, SINBAD and SFCOMPO which are official activities at different Working Parties at the NEA/Nuclear Science Division were presented. It also described the extensive compilation of experimental nuclear reaction data in EXFOR database that have been already used for it (e.g. resonance integrals, Maxwellian-averaged neutron cross sections, …). These collections of benchmarks and experiments are compiled into standardized format that has allowed to validate calculation techniques and nuclear data.

Gaps in these experimental databases for radiation characterization were highlighted, in particular to predict nuclear transmutation (and related magnitudes, such as dose rate) in different neutron environments. This was exemplified in the description of two benchmarks used as part of the ACAB code validation at UPM/UNED that are not part of those databases: 1) experimental studies of concrete activation at the National Ignition Facility using the Rotating Target Neutron Source, and 2) integral experiments used to demonstrate the prediction capability of activation codes in IFMIF. In addition, delayed neutron emission was identified as other interesting type of benchmark for the validation of fission yields and decay nuclear data.

For radiation characterization, a few examples of current experimental data were presented. This compilation of experiments has a great value for this project because they have been extensively used in validation and verification of activation codes (e.g. UKAEA activities for validation of TENDL and EAF data libraries using FISPACT code): 1) Integro-differential data, 2) Maxwellian-averaged neutron-induced cross-sections, and 3) fission pulse decay heat experiments. He also presented other databases: 1) thermal cross-sections and Q0 values used in activation techniques, and 2) resonance integrals compiled in EXFOR.

It was recommended to avoid duplication of information and efforts with other existing projects using reference or links as appropriate, and the necessity to join efforts between experts on nuclear data validation and evaluators/users of current Handbooks for helping this project. The new Radiation & Characterization database should consist in a repository of benchmarks well referenced or documented to ensure the reproducibility, traceability and transparency of results. This repository should also contain tools and codes helping to quickly assess new results, and detailed procedures or guidelines to judge validation.

Role of event reconstruction algorithm and new radiation sources – Ogawa Tatsuhiko, JAEA

The presentation described the event generation sheme and reconstruction employed in the PHITS code, which can handle TeV energies. Calculation of event-by-event quantities is one of the most important elements in radiation transport simulations. It is vital for calculation of radiation-induced displacement damage, estimation of semiconductor device soft-errors, evaluation of KERMA factors, etc. For neutron transport calculation based on inclusive cross section data, sophisticated algorithm is required to recover event-by-event quantities. Several algorithms have been developed and incorporated to nuclear data processing codes and radiation transport codes. Comparison of the algorithms will be useful for improvement of radiation transport algorithms and accurate calculation of radiation impact.

Emergence of new radiation sources poses additional problems for radiation safety. By contrast to the conventional photon sources, the secondary radiation produced by laser-Compton scattering photons has anisotropy owing to its polarization. Another example is neutron production by Li(p,n) or Be(p,n) reactions which are used for compact accelerator-based neutron sources. It is high time to clarify whether existing experimental data, reaction models and evaluated data are good enough to evaluate the source terms in the emerging accelerator facilities.

ICSBEP … more than just k_{eff} – Skip Kahler, Kahler Nuclear Data Services, LLC (LANL, retired)

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) has published and annually updated a Handbook of evaluated criticality safety benchmark experiments. The primary emphasis of these evaluations is to allow computer models to be defined for the purpose of assessing the ability to accurately predict criticality for a variety of fuel systems (various 235U enrichments, 239Pu, 233U, mixed U-Pu), various fuel forms (metal, compound, solution) and spectral conditions. The Handbook has grown over the years to now include over 500 evaluations with near 5000 specific critical or subcritical configurations. A database search tool, DICE, is available to aid users in finding specific evaluations.

Other data of interest, such as reaction rate (or spectral indices) rarely appear in ICSBEP evaluations, nor are the appropriate keywords defined to permit these data to be identified by DICE. Such data are available for several LANL critical assemblies, including Godiva (HEU-MET-FAST-001), Flattop-25 (HEU-MET-FAST-028), Jezebel (Pu-MET-FAST-001), Flattop-Pu (Pu-MET-FAST-006) and Big-10 (IEU-MET-FAST-007). The DICE database search tool identifies a fundamental physics evaluation, FUND-IPPE-FR-MULT-RRR-001, as another source of reaction rate data. An under-utilized resource which may provide additional data is the companion activity, the International Reactor Physics Benchmark Evaluation Project (IRPhEP), although this may be "too integral" to be useful for nuclear data benchmarking.

V&V for Radiation Characterization Codes at Oak Ridge National Laboratory – Past experience and benchmark needs – Ian Gauld, ORNL

Validation of transmutation codes used for radiation characterization and source term analysis relies on experimental benchmarks that are not currently part of existing databases. As part of the ORIGEN code validation at Oak Ridge National Laboratory, a series of benchmarks has been compiled to validate nuclide compositions and activities in irradiated materials and the gamma, neutron, beta and alpha radiation emission rates and spectra. The presentation covered existing databases including the spent fuel composition database SFCOMPO and SINBAD that are currently used for validation and highlighted gaps where available measurements have not been compiled or evaluated to date. These measurements include spent fuel calorimeter experiments and burst fission experiments for validation of decay energy release, gamma ray emissions, and beta emissions at very short decay times. Many of these experiments are used as the basis for national and international decay heat standards, e.g., ANSI/ANS-5.1 and ISO 10645.

One of the primary goals for this project should be to ensure these data are archived for the next generation of researchers, to compile the data so it is more readily accessible to users in the international community, to develop models and code inputs to facilitate use of the data and provide a central website portal to access the data. Because some benchmark experiments are part of existing database activities of the NEA, it will be important to communicate and coordinate new benchmarks with ongoing activities to avoid overlap and duplication of activity. This project should identify what is useful in other databases and reference/link to them as appropriate.

While these experiments have been applied by developers to validate their code systems, they are not routinely applied for nuclear data testing by data evaluators. Another important goal of this project should be to also make the integral experiments available to evaluators in a form that facilitates the expanded use of integral radiation characterization measurements as a part of routine nuclear data evaluation. The IAEA already manages websites containing nuclear databases with experimental data, such as EXFOR, and the data community would benefit from IAEA leadership in this area.

ICSEP benchmarking…reaction rates – Dimitri Rochman, PSI

This presentation highlighted the SIMULATE code systems and highlighted that simulations for normal reactor operations generally have C/E values around 1. These simulations are only marginally influenced by variations in nuclear data. On the other hand, predictions for abnormal events and transients are often not close to measurements and there is a large uncertainty band associated with varying the nuclear data.

As mentioned by Kahler, the ICSBEP contains other evaluated data than keff values. One can find for a limited number of experiments quantities such as reaction rates, or activation measurements. A good example is the Jezebel experiment (pmf1), for which three reaction rates are also provided: F28/F25 (measurement of the ratio of the fission cross sections of ^{238}U over ^{235}U), F49/F25 (same for ^{239}Pu instead of ^{238}U), and F37/F25 (with ^{237}Np instead of ^{238}U). One can also find such data for Godiva (hmf1), or Bigten (imf7). Such additional data can be useful from the nuclear data point of view, allowing adjustments of cross sections using such integral quantities. From users' point of view, reaction rates are regularly measured in the core of power plants to determine the 3D power map, emphasizing that the basic knowledge of such cross-section ratios are of prime importance. Up to now, these quantities in ICSBEP have been partially left aside (due to larger experimental uncertainties than for keff, or due to a need of better experimental description). The perception of the usefulness of the data is nevertheless changing, as for instance presented in the recent paper by Pelloni et al. (ANE 121(2018)361).

It was noted that reactor calculations often have adjustments and corrections to match experiment which dilutes the influence of nuclear data, and it may be difficult to define benchmarks based on such systems.

Verification & Validation exercises in support of radiation characterisation – Jean-Christophe Sublet, IAEA

The presentation describes a large set of validation exercises of decay heat and inventory predictions for fission events, integro-differential verification and validation exercises in diverse irradiation fields assembled and compiled by the UKAEA. The experimental databases having been assembled over decades, it also defines the source of the experimental information and the modern calculational scheme to be deployed to performed the validation exercises, that lead to a calculated over experimental C/E values. Quite uniquely both quantities, C and E, have associated uncertainty.

http://www.ccfe.ac.uk/FISPACT-II/documentation/reports/UKAEA-R18003.pdf

http://www.ccfe.ac.uk/FISPACT-II/documentation/reports/UKAEA-R18004.pdf

http://www.ccfe.ac.uk/FISPACT-II/documentation/reports/UKAEA-R18005.pdf

NJOY2016 (and NJOY2012) Status – Skip Kahler, Kahler Nuclear Data Services, LLC (LANL, retired)

NJOY2016 is the current production version of the NJOY Nuclear Data Processing Code System. Version 39, dated July 3, 2018, is the current code release at the time of this meeting. The prior code version, NJOY2012, nearing end-of-life support. NJOY2016 is freely available under the BSD 3-clause license. As opposed to NJOY2012 and earlier code releases, NJOY2016 is now maintained/distributed through GitHub. NJOY2016 can process all evaluations that follow the legacy "card image" ENDF-6 format. A successor code, NJOY21 will handle both legacy card-image formatted evaluations as well as evaluations provided in the new "Generalized Nuclear Data" (GND) format. The latest LANL sanctioned version of NJOY2012 was released prior to ENDF-6 format revisions to the new pfns multiplicity spectra and so this code release cannot process the latest ENDF/B-VIII.0 235U and 239Pu. A private update file has been provided to the IAEA that produces a NJOY2012 code version consistent with NJOY2016.39.

Spectral indices – Jean-Christophe Sublet, IAEA

Spectral indices embody direct measurement made in a defined environment. The collapsed cross-sections depend strongly on the nature of the projectile spectra, and so it is important to use the appropriate spectrum together with the appropriately-weighted cross-section data. With the advances of modern simulation software and high resolution spectra the user need to be reminded of the importance of the tails, low or high-energy ones, on the reaction rates. In essence the particle spectrum profile, through the collapsing process, emphasizes the energy region of most importance for each application. Up to 50 typical reference input spectra have been be compiled well served by a universal 1102 groups structure, that allow to capture well all energy ranges; from the first set of resonances to the steepest high energy threshold.

http://fispact.ukaea.uk/wiki/Reference_input_spectra

3. Discussion

Key elements of the project are:

1. Identify and compile a set of radiation characterization benchmarks – both computational and experimental - including: spectral indices, reaction rates, decay heat, resonance integral, particle emissions (source terms), etc.

2. Assess and review the data, including quantification of uncertainties, then compile the data into computer format for dissemination

3. Perform simulations of each benchmark with the suitable code system and selected nuclear libraries and produce a database/repository of the necessary input files to repeat those simulations for other nuclear data libraries.

Benchmarks that could be assessed in this project:

1. JAEA time dependent Fusion Neutron Source decay heat experiments (73 materials, 2/3 irradiation campaigns)
2. UCB DT-source NIF concrete (gamma dose rate)
3. FZKa 6764 (steel) – isotopic composition measurements
4. Li(p,n) (up to 150 MeV) angular neutron yields
5. Fission pulse decay heat experiments
6. Fission delayed neutron experiments
7. Selected criticality experiment with reaction rates (ICSBEP, IRPhEP, REAL-IAEA)
8. Experimental MACS from KADoNiS

9. Spectrum-averaged xs in selected reference spectra (e.g. Cf-252, U-235)
10. Resonance integrals (based on the Atlas and other experiments, compilation)
11. Resonance integrals and thermal xs based on kayzero database for NAA
12. Time dependent gamma spectral measurements from PNNL (fission) and UK (fusion)
13. (gamma, n) experimental data (Laser-compton scattering from TUNL and New Subaru)
14. Integro-differential benchmark (from EXFOR or otherwise)
15. Shielding and fusion leakage benchmarks from SINBAD (including models)
16. Reference spectra for computational analysis
17. …

4. Actions and distribution of responsibilities

4.1 FNS decay-heat benchmark
1. Mark Gilbert (UKAEA)
2. Jean-Christophe Sublet (IAEA)
3. Compilation of experimental data, review, methodology

4.2 NIF concrete
1. Review, compile, contact source (Oscar Cabellos)

4.3 FZK steel isotopic composition measurements
1. Review, compile, contact source (Oscar Cabellos)

4.4 Li(p,n) angular neutron yields
1. T. Ogawa (JAEA) – compilation of experimental data and compare to evaluated data
2. Including comparison to data in SINBAD (with A. Trkov)
3. Plus AMS measurements (R. Capote)

4.5 Fission pulse decay heat experiments
1. Ian Gauld (ORNL) and Jean-Christophe Sublet (IAEA)
2. Review and compile known experiments (assess completeness)

4.6 Fission delayed neutron experiments
1. Decay data compilation (O. Cabellos)

4.7 Selected criticality experimental RR
1. Compilation and review of Benchmarks from ICSBEP and IRPhEP by Skip Kahler, D. Rochman, A. Trkov
2. Additional cases from REAL-IAEA (A. Trkov)

4.8 Experimental MACS (KADoNiS)
1. Compilation of data (Jean-Christophe Sublet, IAEA)
2. Review (IAEA)

4.9 Spectrum-averaged xs in reference spectra (Cf-252 & U-235)
1. Roberto Capote (IAEA)

4.10 Resonance integrals and thermal xs (Atlas and experiments)
1. Dimitri Rochman (PSI)
2. Marco Verpelli (IAEA)

4.11 Resonance integrals (kayzero) + thermal xs
1. A. Trkov (IAEA)
2. Compilation of data from kayzero

4.12 Time dependent gamma spectral measurements
1. Ian Gauld (ORNL) (fission measurements)
2. Mark Gilbert (UKAEA) – fusion (ASP/AWE)
    a. Review of experimental results and their suitability

4.13 (gamma,n) experimental data

1. T. Ogawa (JAEA)
2. Review of data in EXFOR (check consistency and completeness)

4.14 Integro-differential benchmark

1. Jean-Christophe Sublet (IAEA)
2. Mark Gilbert (UKAEA)
3. Review of appropriateness of data inclusion
4. Extension of analysed reactions to include latest EXFOR

4.15 Leakage benchmarks

1. From SINBAD and ICSBEP (IAEA, A. Trkov, R. Capote)

4.16 Reference spectra for computational analysis

1. Compilation (Jean-Christophe, IAEA) and review (everyone)

4.17 …

5. Overview and recommendations

Recommended requirements and format of a 'Benchmark'

- Everything necessary should be freely available for dissemination via IAEA hosting site (or available via links from other sources)
- IAEA should develop a hosting site as a matter of urgency and this should be reviewed at a follow-up TM
- Identification of the potential end-users, applications
- Compiled (experimental) data – suitable computer format (ascii, spreadsheet, or …)
- Description of methodology to perform calculations (how to use models)
- Reference input files (for specified version of codes, etc.) and scripts to perform calculation to compare with measured data
- Example results should be included – one instance of complete benchmark analysis

It is recommended to have a review, after initial compilation efforts, to make data used in the analysis consistent with other databases (i.e. linking to existing where appropriate instead of duplication), and, where appropriate, to update those databases (e.g. EXFOR). The expert group recommends that IAEA initiates contact with those responsible for other related databases/projects (e.g. NEA NSC activities [T. Ivanova, I. Hill], ICSBEP [John Bess], SINBAD [R.E. Grove, I. Kodeli],…) – to keep them informed of these activities, promote cooperation, and provide recognition as appropriate.

6. Workplan

The Institutes and IAEA having agreed on the scope of each activities, the institute will be responsible for designing the frameworks, databases and delivering them with documentation ready for dissemination via IAEA's portal.

UKAEA

- Construct a self-contained benchmark database for the decay-heat measurements from the JAEA FNS facility, including the experimental data of material composition, irradiation conditions (spectra and fluxes), measurement times, and decay values. Detailing of the simulation methodology and exemplification using input/outputs from FISPACT-II.

- Review of the gamma-spectrum data recorded at the 14 MeV neutron source at AWE. Is the experiment sufficiently robust to produce an international benchmark? Coordination with ORNL regarding creation of joint fission/fusion benchmark of gamma-spec simulations.
- Review of integro-differential benchmark, including how to make it consistent with EXFOR. Identification of data outside of EXFOR that should be considered.

UPM

- Review the status of experimental benchmarks used for validation of ACAB activation code in different neutron environments: 1) Experimental studies of concrete activation at the National Ignition Facility using the Rotating Target Neutron Source, and 2) Activity measurements obtained from the Karlsruhe Isochronous Cyclotron for structural materials irradiated in a neutron spectrum similar to International Fusion Materials Irradiation Facility (IFMIF).
- Review the status of fission delayed neutron experiments within the activities recently launched by IAEA on Benchmarking new evaluated beta-delayed neutron data, coordinated by P. Dimitriou.

ORNL

- Compile calorimeter and spectroscopic measurements of decay heat from burst fission of actinides (U233, 235U, 238U, Pu239, Pu241, Np237, Th232) in thermal and fast neutron spectra. Coordinate with UKAEA to document all available measurement data acquired from past benchmark activities.
- Review high-resolution delayed gamma spectral measurements following burst fission made under a PNNL program for use in validation studies and inquire on permissions to integrate these data in the IAEA CoNDERC database.
- Develop input models for the analysis of burst fission experiments.

PSI

- Prepare a database containing the thermal neutron capture data and resonance integral from the Atlas of Neutron Resonances 6th edition.
- Provide a list of integral benchmarks with reaction rates from the ICSBEP and IRPHE

JAEA

- Review of the measured and evaluated neutron energy spectra of ^{7}Li(p,n) to clarify in what conditions the data are still missing. The data are compared to clarify their accuracy.
- Review of the double differential yield of neutrons produced by polarized photons with particular focus on the angular dependence. Clarify whether currently-available data are abundant enough to design radiation shielding of polarized photon source facilities.

Kahler Nuclear Data Services, LLC

- Consolidate reaction rate data that are currently spread among various sources such as (i) the ICSBEP and IRPhEP Handbooks, (ii) the CSEWG benchmark book, (iii) peer reviewed literature, and (iv) internal laboratory reports into a single database.
- Develop sample MCNP input decks for these benchmarks that, after suitable peer review, can be shared with the technical community.

Sandia

The National Laboratory has extensive model data using MCNP and measured reaction rates for the following configurations:

- Sandia Pulsed Reactor (SPR-III), a 235U fast burst reactor (FBR) cavity
- central cavity of the Annular Core Research Reactor (ACRR), an under-moderated pool-type reactor
- Pb-B4C bucket in the ACRR cavity, a filtered high energy spectrum
- polyethylene-lead-graphite bucket in the ACRR cavity, a moderated pool-type neutron reactor environment
- ACRR Cd-Polyethylene bucket
- ACRR Fueled-Ring External Cavity (FRECC)
- ACRR water-moderated central cavity

These will be made available to the compilation.

IAEA

The IAEA-NDS will task, organize institutions to construct several of the above databases based on their own extensive V&V activities associated with their inventory and source term codes infrastructure. It will use its own internal resources to assemble some databases and provide the necessary web portals resources for hosting, visualising and disseminating the products of the related activities.

List of Participants

Elected Chairman: Oscar Cabellos

Elected Rapporteur: Mark Gilbert

F4-CS-1703599

Consultants meeting on the Compilation of Nuclear Data Experiments for Radiation Characterization (CoNDERC)

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Consultancy Meeting on

Compilation of Nuclear Data Experiments for Radiation Characterisation (CoNDERC)

6th – 8th August 2018, IAEA Headquarters, Vienna, Austria

Room M 0E 69

AGENDA

02/08

Monday August 6th, Room M0E69

08:30 – 09:30 Registration (IAEA Registration desk, Gate 1)

09:30 Welcoming address – Arjan Koning, SH-NDS

Introduction, Scope of the CM - J.-Ch. Sublet, UH-NDSU

Election of chairman and rapporteur

Adoption of agenda, administrative matters

10:00 "Nuclear data validation efforts with FISPACT-II" UKAEA, Mark Gilbert

10:45 Coffee Break

11:00 "On the International Radiation Characterization Project: User's point of view" UPM, Oscar Cabellos

11:45 "Role of event reconstruction algorithm and new radiation sources" JAEA, Ogawa Tatsuhiko

12:30 Lunch

14:00 "ICSBEP Benchmarks ... more than just keff", Kahler Nuclear Data Services, LLC,

Skip Kahler

14:45 "V&V for Radiation Characterization Codes at Oak Ridge National Laboratory – Past experience and benchmark needs" ORNL, Ian Gauld

15:30 Coffee Break

15:45 "ICSEP benchmarking…reaction rates" PSI, Dimitri Rochman

17:00 End of Day One

Tuesday August 7th, Room M0E69

09:30	"Verification & Validation exercises in support of radiation characterisation" IAEA Jean-Christophe Sublet
10:15	Discussion: Best practices, simulation tools
10:30	Coffee Break
10:45	"NJOY2016 (and NJOY2012) Status", Kahler Nuclear Data Services, LLC, Skip Kahler
12:30	Lunch
14:00	"Spectral indices", IAEA, Jean-Christophe Sublet
14:30	Discussion: Spectral indices
15:30	Coffee Break.
15:45	Discussion: Integro-differential approach
17:00	End of Day two
19:00	Evening Meal, "REMBETIKO IM DONAUINSEL" Neue Donau, 1220 Wien

Wednesday August 8th, Room M0E69

09:30	Discussion: Decay heat experiments
10:30	Coffee Break
10:45	IAEA IHLab Isotope Hydrology Laboratory visit
12:30	Lunch
14:00	Discussion: Available experiments
15:30	Coffee Break
15:45	Discussion: Available experiments
17:00	End of Day three

Thursday August 9th, Room M0E69

09:30	Discussion: new tools
10:30	Coffee Break
10:45	Discussion: Workplan
12:30	Lunch
14:00	Final remarks and review
15:00	Close of meeting

Presentations

All presentation materials are available on the web page for this meeting:
https://int-nds.iaea.org/index-meeting-crp/CMconderc/

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