IAEA
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INDC International Nuclear Data Committee

DECAY DATA FOR MONITORING APPLICATIONS

Summary Report of the Technical Meeting

IAEA Headquarters, Vienna, Austria
18-21 July 2022

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East Lansing, MI, USA

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Contents

1. Introduction

The third Technical Meeting on Decay Data for Monitoring Applications was held from 18 to 21 July 2022 at the IAEA Headquarters, Vienna, with a virtual component. Together with two IAEA staff, Paraskevi Dimitriou and Marco Verpelli, Tibor Kibedi (Australia), Filip Kondev (USA) and Jagdish Tuli (USA), participated in person while Jun Chen (USA), Alexandru Negret (Romania), Alan Nichols (UK), Balraj Singh (Canada), and Daniel Lopez Aldama (IAEA Consultant) attended remotely.

The purpose of the meeting was to review the progress made since the previous meeting in March 2021 in the evaluation and review of the decay data identified as priority radionuclides for monitoring. The list of priority radionuclides given by the Comprehensive Nuclear Test-Ban Treaty Organization (CTBTO), as well as the assignments undertaken by the members of the project were published in Ref. [1]. This document serves as a reference document for the project including a description of the goals and scope of the project, the guidelines describing the evaluation procedure and methodology as well as the list of assignments of evaluations and reviews and their expected submission dates.

The meeting was opened by Arjan Koning, Head of the Nuclear Data Section, who welcomed the participants to the meeting and emphasized the importance of the project and its deliverables for a range of monitoring activities of both the CTBTO and the IAEA. The project officer, Paraskevi Dimitriou (IAEA), outlined the goals of the meeting, Filip Kondev (ANL) and Jun Chen (MSU) were elected Chair and Rapporteur of the meeting, respectively. The meeting agenda was approved without changes.

A summary of the status of evaluations and reviews as reported by participants is given in Section 2 while Section 3 includes the summary of the technical discussions. The meeting agenda and list of participants is given in Appendix 1 and 2, respectively.

2. Status reports

The status of the evaluations and reviews is given in the table below. Participants also provided time estimates for the submission of the remaining evaluations and reviews which have been included in the assignment spreadsheet.

Name	Evaluation (Reviewer in brackets)	Review (Evaluator in brackets)
F. Kondev	• ^{141}Ce is completed and reviewed (J. Chen). • ^{103}Ru and ^{140}Ba are in progress.	New assignments: ^{99}Mo/^{99m}Tc, ^{131}I, ^{133}I, ^{135}Xe, ^{147}Nd, ^{106}Rh, ^{144}Pr
A. L. Nichols	• ^{99}Mo/^{99m}Tc remain underway and incomplete. • ^{144}Ce is completed and reviewed (B. Singh); re-evaluation is partially completed. • ^{127}Sb is completed and awaiting review (T. Kibedi).	• ^{131m}Te is completed; re-assessed by evaluator (B. Singh). • ^{137}Cs is completed; re-assessed by evaluator (T. Kibedi).
T. Kibedi	• ^{137}Cs will be completed and reviewed in August 2023. • ^{136}Cs is underway. • ^{131}I is re-assigned to Balraj Singh.	• ^{105}Rh is underway. • ^{127}Sb is underway. • ^{143}Ce is underway.
P. (Vivian) Dimitriou	• ^{106}Ru is completed and reviewed (B. Singh). • ^{139}Ce is completed and reviewed (J. Chen). • ^{132}Te is completed and under review (B. Singh). • ^{133}Xe is underway. • ^{133m}Xe is underway.	• ^{95}Nb is completed; re-assessed by evaluator (J. Tuli) • ^{126}Sb is underway. • New assignment: ^{132}I
A. Negret/S. Pascu	• ^{133}I is completed and under review [review/post-review revision completed and submitted after the meeting]. • ^{140}La is underway. [submitted post-meeting].	
J. Chen	• ^{115}Cd is completed and reviewed (J. Tuli). • ^{115m}Cd is completed and under review (J. Tuli). • ^{126}Sb is completed and under review (P. Dimitriou).	• ^{95}Zr is completed; re-assessed by evaluator (J. Tuli). • ^{141}Ce is completed; re-assessed by evaluator (F. Kondev). • ^{139}Ce is completed; with evaluator (P. Dimitriou). • New assignment: ^{103}Ru, ^{133}Xe, ^{133m}Xe.

Name	Evaluation (Reviewer in brackets)	Review (Evaluator in brackets)
B. Singh	• ^{105}Rh is completed and under review (T. Kibedi). • ^{131m}Te is completed and reviewed (A. Nichols). • ^{135}Xe is completed and under review (F. Kondev). • ^{143}Ce is completed and under review (T. Kibedi). • ^{143}Pr is completed and under review (J. Tuli). • ^{147}Nd is completed and waiting for new results until June 2023. • New assignment: ^{106}Rh, ^{131}I, ^{132}I	• ^{97}Zr is completed; re-assessed by evaluator (J. Tuli). • ^{106}Ru is completed; re-assessed by evaluator (P. Dimitriou). • ^{132}Te is underway. • ^{144}Ce is completed and with evaluator (A. Nichols).
J. Tuli	• ^{95}Zr is completed and reviewed (J. Chen). • ^{95}Nb is completed and reviewed (P. Dimitriou). • ^{97}Zr is completed and reviewed (B. Singh).	• ^{115}Cd is completed; re-assessed by evaluator (J. Chen). • ^{115m}Cd is underway. • New assignment: ^{143}Pr
S. Lalkovski	• *^{144}Pr*	• *^{140}La and ^{140}Ba*

* New assignments: evaluation of ^{144}Pr was assigned to S. Lalkovski and the review to F. Kondev; reviews of ^{140}Ba and ^{140}La were assigned to S. Lalkovski. [S. Lalkovski agreed to do the evaluation and reviews after being contacted post meeting].

3. Technical discussions

While the project is well under way with more than 40% of the evaluation and review work completed or in an advanced stage, most of the discussions involved details of the evaluation and review process, as well as the two codes that will be used to obtain the derived quantities after the main evaluation has been completed (BetaShape, NS_RadList). A summary of the issues that were discussed is given in the following.

- Uniformity of evaluated data: different opinions were expressed by the participants.
    o There was general agreement that an effort should be made to make all the evaluated decay data sets look uniform.
    o However, this may not be straightforward or a matter that can be taken care of by an editorial review because different evaluators and reviewers have different styles.
    o It was proposed that the editing should be done by the editor, and that the role of the coordinator was to check the evaluations and intervene only when there was a disagreement between evaluator and reviewer.
    o According to another opinion, all suggested changes to the data files should be introduced by the evaluators.
- Evaluation policy
    o Evaluators should follow the evaluation policy and evaluate all the data even if there aren't any new measurements and the decay data are well known.

- Communication
    - o All email communications between the evaluator and reviewer should include the coordinator in carbon copy.
- Literature checks
    - o All references should be checked and consulted according to the data evaluation policy.
    - o There are cases where very important references have been missed and even the reviewer didn't notice.
- Reviews
    - o The reviews are just as non-uniform as the evaluations. Some are very thorough and detailed, and some are superficial.
    - o Evaluators and reviewers should work together in this project to improve the evaluation.
- BrICC code
    - o According to the policy: theoretical ICC from BrIcc should be put in the CC field once Mult and MR are known, unless there is an E0 component.
    - o Evaluators should check if they used the most recent version of BrIcc which gives ICC uncertainties.
    - o Gamma "S G" continuation records should be kept and not removed.
    - o The BrIcc code should be run at the end once the decay scheme has been completed with the necessary information and the 1.4% uncertainty from theory should be mentioned, as discussed in a previous NSDD meeting.
- New $T_{1/2}$ evaluation of ^{137}Cs: only 5 values were selected for the averaging procedure
    - o the arguments for selecting some measurements and rejecting others should be included in the data file in a concise way.
    - o According to another opinion, users should not be confused with the details of the selection of the measured data.
- BetaShape code
    - o Evaluators can run BetaShape by themselves when evaluating the decay data. However, the code will be run at the end of the evaluation/review process, centrally, for all the files that were submitted using LOGFT code and the data files will be returned to the evaluators to check and make comments.
    - o Evaluators should use the latest version of BetaShape which treats EC.
    - o Shape-factors from BetaShape should be inserted into the beta decay datasets in the continuation record following an agreed format. [Sec. note. A format for including shape factors was submitted by X. Mougeot after the 24th NSDD Meeting 24-28 Oct. 2022].
    - o Spectra obtained from BetaShape will be stored in a separate shared folder.
    - o However, the code should handle non-numerical uncertainties just like the other ENSDF codes before being used for the project. [Sec. A request was formally submitted at the 24th NSDD meeting as a pre-requisite for BetaShape to be adopted by the NSDD network for ENSDF evaluations-it is expected to be implemented in the code by the end of 2022].
- NS_RadList code – atomic radiation data
    - o M. Verpelli and T. Kibedi will run BrIccEmis/NS_RadList on all the final files at the end of the evaluation/review process. The resulting output files will be made available to all evaluators for further comments.

- o Spectra (.spe files) from NS_RADLIST will be stored in a separate shared folder, just like the spectra obtained from BetaShape.
- Asymmetric uncertainties in atomic radiation intensities from NS_RADLIST
  - o Evaluators should symmetrize the asymmetric uncertainties of the intensities if the upper and lower uncertainties differ by <5% and should also adopt the uncertainty rounding limit = 35.
  - o There are no uncertainties in the mean energies in the NS_RADLIST output since they (mean energies) are derived from averaging over the spectrum.
- Java-NDS code
  - o The order of Auger and X-ray data tables in the Java-NDS output file should be changed: the X-ray data table should go first and then the Auger data table (since X ray data are more important); the generic footnotes for X-ray and Auger tables should be removed as they are misleading.
  - o A new generic footnote should be introduced for the uncertainties in the radiation intensities to indicate that they are deduced by propagating nuclear uncertainties only.
- GABS and GLSC codes
  - o Use "X" flag at column 79 in ENSDF to mark gammas used for normalization. The ENSDF manual should be updated accordingly. [Sec. note. A new label was adopted at the 24th NSDD Meeting, 24-28 Oct. 2022: use label "N" in column 79 to mark gammas used for normalization. To be implemented in both GABS and GLSC codes]
  - o %IG should be given by running GABS, instead of using NR to normalize relative Ig which could overestimate uncertainties for gammas used to deduce NR.
- Deadlines
  - o Deadlines were provided where possible for each evaluation and review and were included in the assignment spreadsheet. The deadlines for the next milestones of this project are as follows:
  - o Completion of evaluations and reviews: 31 December 2023
  - o Calculation of atomic radiation data: 31 December 2023
  - o Submission of final publication: 31 December 2024.

4. Summary

The third IAEA Technical Meeting of the project Decay Data for Monitoring Applications was held in a hybrid format from 18 to 21 July 2022. As the project is advancing towards completion (expected end date December 2023), final details of the evaluation, review and data production processes were discussed. The timeline for submission of the remaining evaluations and reviews was discussed and agreed. Additional support from a new candidate member of the project was discussed to expedite the evaluation and review of all the priority radionuclide data in time for the agreed deadline.
The final meeting of the project will be held in autumn 2023.

References

[1] J. Chen, F.G. Kondev, P. Dimitriou, in „Summary Report of the Technical Meeting on Improving Decay Data for Monitoring Applications", 24-26 March 2021, INDC(NDS)-0828 (https://www-nds.iaea.org/publications/indc/indc-nds-0828/)

Appendix 1: Adopted Agenda

IAEA Technical Meeting on Decay Data for Monitoring Applications
18 – 21 July 2022
IAEA, Vienna
MOE67 (virtual component)

ADOPTED AGENDA

Monday, 18 July (13:00 – 17:00, open 12:45 Vienna time)

13:00	**Opening of the meeting,** Arjan Koning / NDS Section Head	
	Welcome and Introduction, Paraskevi (Vivian) Dimitriou / Scientific Secretary	
	Election of Chair and Rapporteur(s), Adoption of Agenda	
	Participants' Reports	*Breaks as needed*
	- F. Kondev - A.L. Nichols - B. Singh - T. Kibedi - J. Chen - P. Dimitriou - A. Negret	

Tuesday, 19 July (13:00 – 17:00, open 12:45 Vienna time)

13:00	**Participants' Reports** cont'	*Breaks as needed*
	Roundtable discussion	
	- Next phase: how to proceed	
	o BetaShape	
	o Brlccemis	
	- Final deadline for evaluations	
	- Additional support	
	- Other issues	

19:00 Dinner at a restaurant (separate information)

Wednesday, 20 July (13:00 – 17:00, open 12:45 Vienna time)

13:00	**Roundtable discussion** cont'	*Breaks as needed*

Thursday, 21 July (13:00 – 17:00, open 12:45 Vienna time)

13:00	**Roundtable discussion** cont'	*Breaks as needed*
	Drafting of the meeting summary report & actions	
	Closing of the meeting	

Appendix 2: Participants' List

IAEA Technical Meeting on Improved Decay Data for Monitoring Applications
18-21 July 2022
Vienna, Austria

PARTICIPANTS

Country	Name	Surname	Affiliation	Email
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