IAEA 60 Years
Atoms for Peace and Development

IAEA Nuclear Data Section Survey of August 2020

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Survey

- A questionnaire was sent to the INDC members and observers in July-August 2020, to advise on the future programme of the Nuclear Data Section
- This survey was used as input for our planning of the 2022-2023 biennium
- 20 questions, categories:
  - IAEA/NDS Networks: NRDC, NSDD, INDEN
  - Coordinated Research Projects (CRP's)
  - Data Development Projects and Related Meetings
  - Computers: Website, Data handling and distributions
  - New ideas and other topics
- The responses by INDC will be summarized
- Replies by NDS will be given in **RED**

1. NRDC network - EXFOR compilation: Do you have any suggestions for improvements of the EXFOR compilation?

- Investigate automatic input from publishers
- Reconsider keyword and identifiers to make search easier
- More modern project management system
- Quality scoring system for outliers
- Access to EXFORable papers which are not yet compiled
- Many happy collaborators for EXFOR compilation!

NDS:

- Working to make normalization/correction/scoring system more popular and accessible
- Use of maintenance systems like Gitlab discussed in NRDC
- NDS will continue international/regional/national events for training of EXFOR compilers

2. NRDC network - EXFOR: Do you have any suggestions on how EXFOR could be delivered to users in a more diverse way?

- NEA WPEC/SG50 on an automatically readable curated validated experimental reaction database (based on EXFOR) is seen as a good initiative to make EXFOR even more used.
- EXFOR web interface may be based on too specialized nuclear data jargon
- Aim to integrate EXFOR seamlessly into evaluation systems, including AI approaches
- Aim for formats suitable for whole library validation (non-user-interface").

NDS:

- Play important role in WPEC SG-50 to accomplish this
- Investigates other interfaces next to current interface, also API-based

3. NSDD network: Evaluations. In your opinion, what should be the role of the IAEA in the NSDD network?

- IAEA should continue organizing decay data evaluations
- IAEA should hire a qualified and experienced person like Vivian Dimitriou
- Maintain good balance for reactor and medical applications
- Outreach to as many good quality new evaluators as possible

NDS:

- Qualified and experienced person has been hired
- NSDD is responsible for ENSDF database; this database covers all measured nuclei for basic sciences and applications; it is not applications oriented
- Decay data for specific applications are catered to by CRPs and DDPs, and there is balance between CRPs/DDPs for medical and reactor applications: Medical CRP included decay data evaluations for medical applications and the beta-delayed neutron CRP involved decay data for reactor applications and basic sciences.
- Outreach meetings/workshops similar to ICTP are in the future plans

4. What do you think of the development of the LIVECHART and the Isotope Browser? Do you have suggestions for new features to be added?

- Both get many positive replies, suggested improvements are:
  - Links to original research articles
  - Adding mass defect
  - Can we get faster online response?

NDS:

- Open to all improvements that can reasonably accomplished, like the ones above

5. There is the recurring issue of the ever decreasing number of data evaluators for structure and decay. What are possible initiatives that the Section could take in order to foster the creation of new evaluators?

- Problem: Member countries may not see pressing need, they do not employ full-time data evaluators
- NDS should continue sponsoring individual evaluators as part-time job
- Continue ICTP training, IAEA training school if possible
- Use other IAEA tools like CRP, yearly Technical Meeting etc.

NDS:

- Plan to have another NSDD-oriented Workshop at ICTP, preferably "real" but otherwise virtual
- So-called SSA-contracts continue to be issued to consultants
- Outreach activities/training workshops on NSDD evaluations targeting young nuclear scientists in Data Center countries/regions (Japan, India, Europe, Australia)

6. International Nuclear Data Evaluation Network (INDEN) on evaluation of light nuclides, structural materials and actinides will have 3 meetings/year for 2021-2023. The focus is on discussing existing challenges and in-depth technical and methodological issues. Evaluation of light elements (connected to the R-matrix DDP); evaluation of structural materials (Fe, Cu, Ni, ...); evaluation of actinides with focus on the resonance region (Pu isotopes, revisiting U-235, U-233). Do you have any additions or suggestions?

- Focus on reproducibility (documentation, input files) of evaluations
- More focus on covariances, Zr, minor actinides
- More open to more parties in the world
- Look at non-reactor applications: fusion, importance of DDX

NDS:

- Still lot of effort needed on Fe-56, U-235
- Extension to Zr, MA not (yet) done. INDEN is follow-up of CIELO, detailed evaluation effort on few isotopes

7. Completed CRPs. Photonuclear data library and database of gamma-ray strength function; Beta delayed neutron emission; Particle-Induced Gamma ray Emission (PIGE); Primary radiation damage cross section; Charged-particle cross section database for medical radioisotope production and beam monitor reactions; Do you have any comments on completed projects or suggestions for follow-up?

- Photonuclear library needs follow up to improve quality
- Documentation needs to be in sync with CRP pages and related databases

NDS:

- Have worked/will further work on format/processability/applicability of the photonuclear data library, photon strength function database still must be, but will be, stored in consistent database

8. On-going CRPs. RIPL for fission nuclear model codes. Do you have any comments on this ongoing CRP?

- Valuable and should follow the success of earlier RIPL CRP's
- Compilation and systematization is important

NDS:

- This CRP particularly hurt by travel restrictions to, and from, IAEA
- Requires big push forward by the main nuclear model codes

9. Starting CRPs. Fission Yields of neutron induced fission of major actinides (1st RCM in August 2020). Do you have any comments on related starting projects or suggestions for additional activities?

- (Challenging!) Integrate the FY CRP in full nuclear data pipeline from differential reaction measurements to reactor calculations, including SFCOMPO
- New CRP's: Consider proton and alpha induced reactions, nuclear data for fusion applications
- CRP on ionising radiations from decay of medical radioisotopes, including X-rays, beta particles and Auger electrons

NDS:

- Not equipped, nor mandated, to provide full nuclear data pipeline, but should deliver as much components as possible
- Choice on new CRP needs to be made, future projects on proton, alpha particle, fusion and medical are planned, not all as CRP though. TM on (alpha,n) in June 2021

10. Nuclear data for medical applications. NDS has developed: A Web Interface for efficient estimation of medical isotope production: nds.iaea.org/mib; A Medical Portal showing all cross section and decay data: nds.iaea.org/medportal. Can you give us some preferences and priorities for improvement of the medical isotope data? For reactions? For decay data?

- Continue charged particle cross section database for isotope production and beam monitoring
- Continue decay data for medical
- Investigate general nuclear data needs for medical applications

NDS:

- Request for future medical efforts well noted
- Computer-readable medical isotope data library for charged particles aimed for end of 2021: All past high-quality IAEA evaluations + TENDL

11. Data Development Projects. We are currently running: Analysis and evaluation codes for nuclear structure and decay; Decay data for monitoring; Neutron data standards; Nuclear data processing and code intercomparison; R-matrix codes; IBANDL; Thermal scattering; Total Absorption Gamma-Ray Spectroscopy (TAGS); FENDL for fusion; Anti-neutrino data; Maintenance of Electron and Photon interaction data library (EPICS). What is your opinion on the scope of various Data Development Projects?

- Prioritize code development
- Seen as a rather complete list
- Modernization of FENDL approach
- Sequential particle emission below 40 MeV for medical applications

NDS:

- Noted

12. Website Do you have any recommendation for the modernization of the website? Are you currently missing anything from our website?

- Complete redesign advocated: new page should be scrollable, current is too packed with information
- All relevant information is there, but could be reorganised
- “I like the current NDS website”
- Layout of sub-pages should be unified
- More API’s instead of click-to-download
- Improve the in-site search function

NDS:

- Initiatives for new website has started
- Prototype/alternative website to be judged by INDC at next meeting, June 2022.

13. Mirror sites. Is the current set of Mirror sites (China, India, Russia) sufficient and useful? Do we need a revision of NDS policy on Mirror-sites?

- Why do we need mirror sites? (5 responses)
- “I do not use mirror site”
- Mirror site important for China

NDS:

- Mirror site issue requires “firm” decision, which may be country dependent

14. If IAEA allows, should we make code/software available via Git platforms (Github, Gitlab)? If yes, can you give some examples? Do you recommend other services/workflows that should be handled via a git platform?

- Git advocated for CRP's, research networks and EXFOR
- Distribution of code packages via Github or Gitlab
- However: Git useful for codes more than for data

NDS:

- We are using Git for more projects now, several codes now disseminated via Github
- Remember that IAEA is NOT a science-oriented organization but rather Microsoft dominated administrative, i.e. with Git-initiatives we are on our own

15. Do you see a need for some of our data to be also accessible programmatically, via API's? If yes, can you give us some examples of data and possible usage? (Note: this is already underway for EXFOR and ENDF)

- Yes, for EXFOR and ENDF (many replies)
- API for ENSDF, or the decay data on Livechart
- API's should include JSON output

NDS:

- We are working towards different ways of access to our data, with various formats for the output

16. Are you satisfied with, or do you require more, full database distributions? (e.g. "XC4 of full EXFOR","EXFOR for Applications")

- Generally INDC members are satisfied

NDS:

- Good

17. ICTP Workshop. What would be your preference for a topic for an ICTP Workshop?

- Revive the nuclear reaction workshops
- Nuclear data for medical isotope production
- Covariance and uncertainty evaluation
- AI/ML for nuclear reactions and structure

NDS:

- Noted, there is room for ~1 ICTP nuclear data workshop per year

18. Artificial Intelligence and Machine Learning Machine learning is also entering nuclear science now and nuclear data is an obvious branch where it should be introduced over the whole breadth of the field. We want to start with a Consultancy Meeting to advise us on several ND projects. One application is efficient compilation and more efficient testing and use of EXFOR. Do you have any further AI/ML ideas for us?

- EXFOR compilation and testing
- ENSDF evaluation, including translation of old codes

NDS:

- For EXFOR this is underway, to start with for identification of articles to be compiled
- For ENSDF, this needs to be put on the agenda of NSDD

19. Nuclear data for back-end of fuel cycle. We could invest more effort in nuclear data for the safe monitoring, dismantling, decommissioning and disposal of nuclear fuels and waste materials, including n-p-g cross sections, particle emission spectra and decay data in unison. Do you have a particular interest or suggestions for data needs?

- Neutron sources for irradiated fuel
- Nuclear data for minor elements/isotopes of spent fuel, both for nuclear reactions and structure
- Update nuclear data for Th-U cycle
- Uncertainty reduction for waste from structural materials (fission and fusion)

NDS:

- New data development projects planned for both nuclear structure and reactions

20. Any additional comments?

- Easier direct access to data like TENDL on the NDS website
- Extend Medical Isotope Browser
- More nuclear structure data experts in INDC

NDS:

- Noted

Thank you!