Korea Nuclear Data Center (KNDC)

Progress Report for period 2024-2025

Technical Meeting on the International Network of Nuclear Reaction Data Centers (NRDC 2025)
17 - 20 June, 2025

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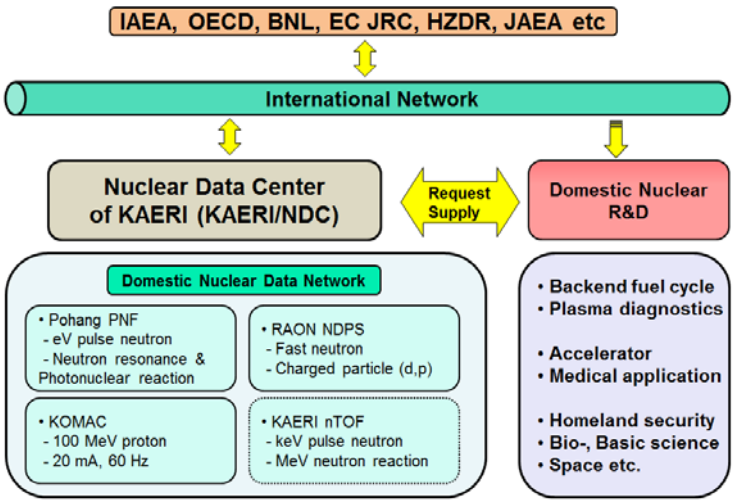
1. General

Korea Nuclear Data Center (KNDC, formerly 'Nuclear Data Evaluation Lab.') was established in 1997 to start research on nuclear data in Korea and joined the International Network of Nuclear Reaction Data Centers (NRDC) in 2000. KNDC at Korea Atomic Energy Research Institute (KAERI) performs the following main tasks:

- Evaluation and method development for nuclear reaction data
- Establishment of processing and validation system of nuclear reaction/covariance data
- Measurement of nuclear reaction data and establishment of measurement facility
- Production and validation of atomic/molecular collision data

The mission of our center includes disseminating the outcomes of cooperation with international networks as well as promoting nuclear data research activities and supporting nuclear/radiation R&Ds in Korea. KNDC is also coordinating the measurement activities using domestic accelerators for producing various nuclear reaction data.



KNDC continues to cooperate with the international nuclear data network as follows:

- Participating in IAEA CRP, TM, and CM on nuclear data evaluation, nuclear data processing and validation, atomic/molecular data network, etc.
- Collecting nuclear reaction measurement data in Korea for EXFOR compilation under the guidance of IAEA/NDS
- Participating in the JEFF and WPEC subgroups of OECD/NEA
- Conducting joint research on evaluation, measurement, and validation of nuclear data with foreign research institutes

As of 2025, KNDC consists of 7 regular staffs, 3 post-retirement researchers, 2 post-doctoral researchers, and 3 Ph.D. students. The latest staff changes include:

- Dr. Tae-Yung SONG retired in July 2024 and joined as a post-retirement researcher in August 2024.

They are working in the following fields:

- Nuclear data evaluation: 2 regular staffs
- Nuclear data measurement: 1 regular staff, 2 post-retirement researchers, and a post-doctoral researcher
- Nuclear data processing/validation/application: 2 regular staffs, a post-retirement researcher, and a Ph.D. student
- Atomic/molecular data production: 2 regular staffs, a post-doctoral researcher, and 2 Ph.D. students

2. EXFOR Activity

We are continuing data compilation for nuclear reaction data obtained in Korea under the guidance of IAEA/NDS. Since the last meeting, 2 Entries have been entered into the EXFOR database and 5 entries have been compiled as listed in Table 1.

Table 1. Compilation statistics of KNDC

No.	TRANS	ENTRY	SUBJECT	STATUS
1	3213	30857	Neutron	EXFOR
2	D143	D7044	Proton	EXFOR
3		30856	Neutron	Compiled

4		D7045	Proton	Compiled
5		D7046	Proton	Compiled
6		30858	Neutron	Compiled
7		G3139	Gamma	Compiled

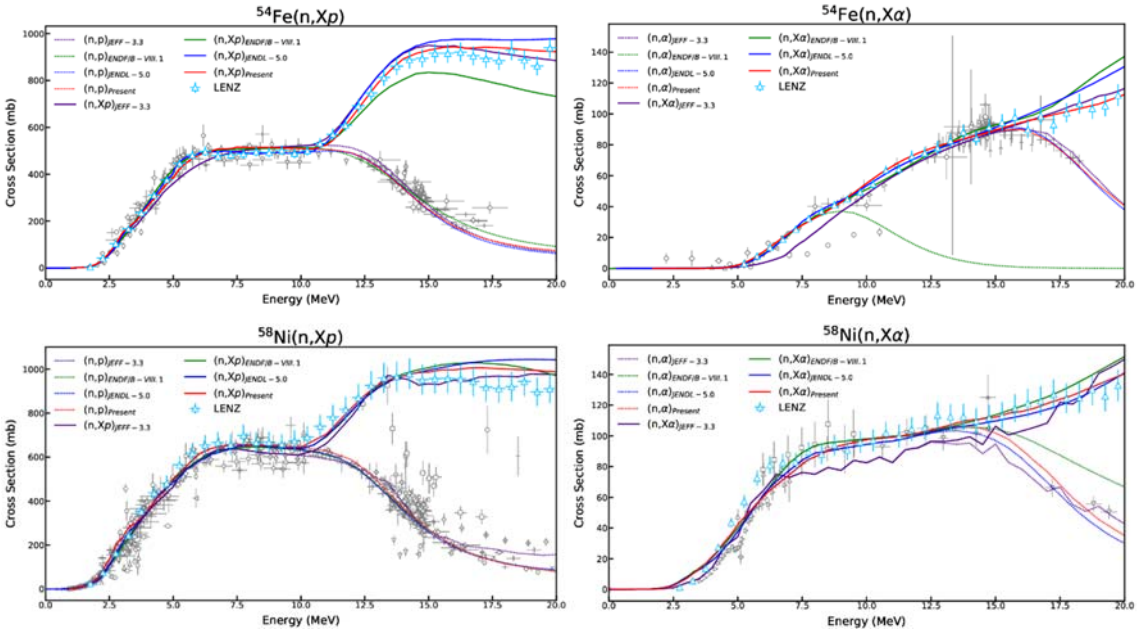
- **Checking Code**

The draft was checked through a tool of JCPRG. (http://www.jcprg.org/exfor/tool/)

3. Nuclear Data Activities

3.1 Evaluation

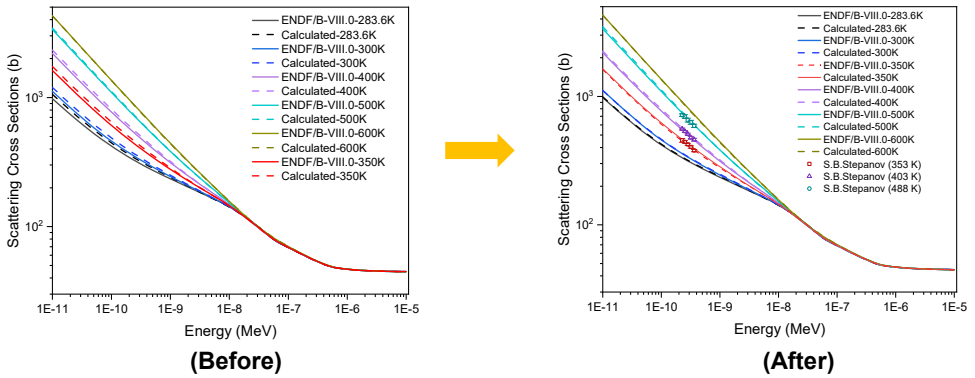
A total 53 evaluated files through the collaborative project with Los Alamos National Laboratory (LANL) were adopted in ENDF/B-VIII.1 release in 2024. These files will provide a more accurate interpretation of angular distributions and energy spectra for secondary charged particles, such as (n,p), (n,α), (n,d), (n,t) and (n,^{3}He). As a follow-up, new evaluations of production cross sections for secondary charged particles such as (n,Xp) and (n,Xα) are continuing with newly measured data from LANL as well as EXFOR. The productions of hydrogen and alpha can cause the structural material to embrittle or swell, which can affect the deterioration of the structure's integrity. Currently, we are focusing on update on several Fe and Ni isotopes.



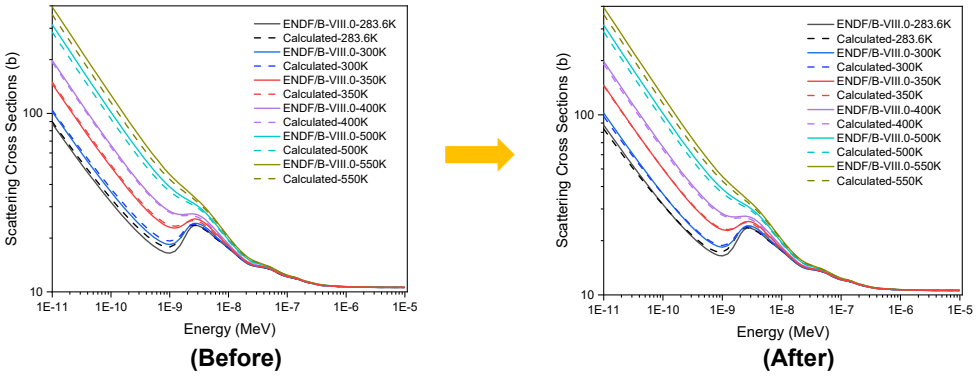
Production cross sections of proton and alpha induced by neutron on ^{54}Fe and ^{58}Ni

In addition to the production cross section of proton and alpha, double differential cross sections are also measured and evaluated to improve the quality of the evaluation file. The methodology acquired while evaluating Fe and Ni will continue to be used to evaluate K, Cu, Cr, Zr, W, etc. which are key materials in the Korean Diverter being developed.

Research on producing thermal neutron scattering data based on molecular dynamics and ab-initio code simulations has been conducted since 2022. The temperature-dependent TSL data of H_2O and D_2O, obtained through GROMACS simulations using the TIP4P/2005f water model, were significantly improved and became comparable to ENDF/B-VIII.0 by adjusting the diffusion constants used in NJOY/LEAPR.



Scattering Cross Sections of H_2O

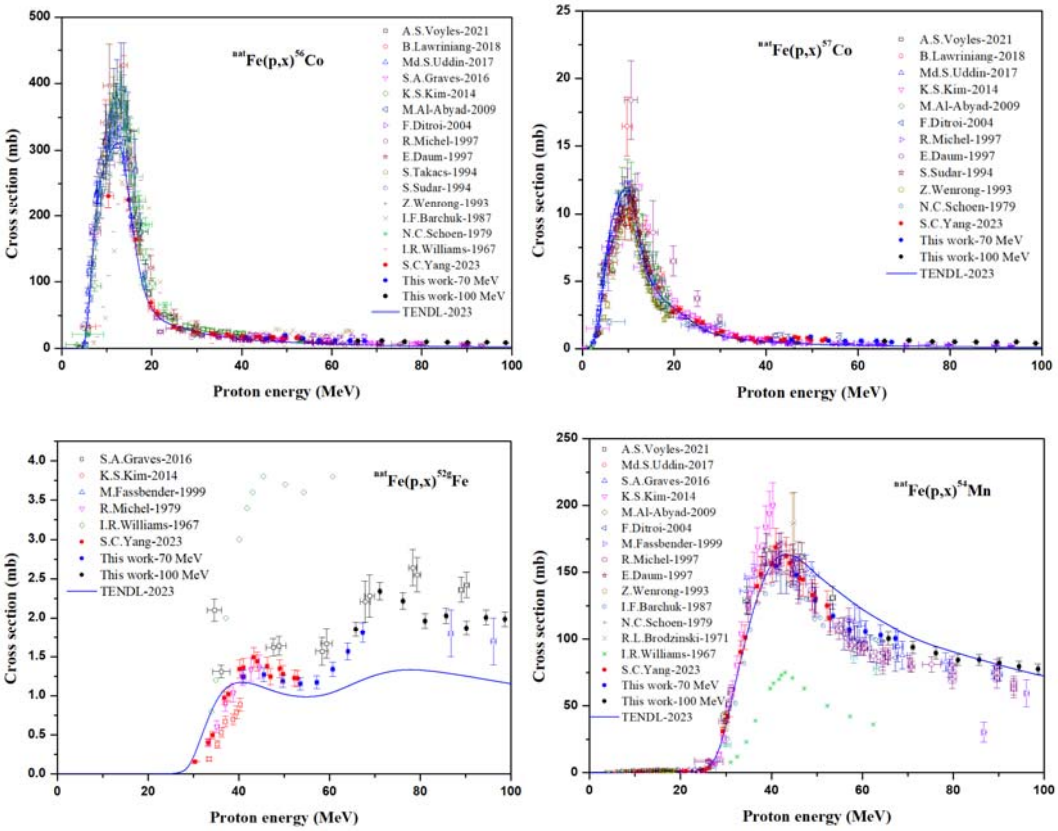


Scattering Cross Sections of D_2O

3.2 Measurement

The production cross sections of $^{nat}Fe(p,x)$ reactions were measured using off-line γ-ray spectrometry and a stacked-foil activation technique. The activation experiment was performed using proton energies up to 100 MeV at the Korea multi-purpose accelerator complex (KOMAC). The measured cross sections were compared with the experimental data

of the literature and the data from the TENDL-2023 library. The production cross sections of ^{nat}Fe(p,x) reactions are useful for facility shielding and are also used in the production of calibration sources and medical isotopes.



3.3 Cooperation

We continue to cooperate with the following experimental groups for nuclear data production in Korea:

- Institute for Basic Science (IBS)
- Kyungpook National University (KNU)
- Sungkyunkwan University (SKKU)

Since the last meeting, no events have been held in collaboration with KNDC, but an event is planned for this year.

- "The 12th Korea-Japan Joint Summer School on Accelerator and Beam Science, Nuclear Data, Radiation Engineering and Reactor Physics" is scheduled to be held in Aomori, Japan, from August 26 to 29, 2025. This event is being supported on the Korean side by KOMAC and KNDC of KAERI. The purpose of this event is to

introduce the latest research activities in accelerators, reactor physics, nuclear data, and related fields in Korea and Japan to graduate students, and to inspire their research motivation.

3.4 Web Service

KNDC provides the following three main web services. These websites are constantly being updated.

- Nuclear Data Chart (http://atom.kaeri.re.kr/nuchart/): nuclide information, nuclear reaction data, cross section data plot and comparison
- Application Library (http://atom.kaeri.re.kr/NDVG/): processed nuclear data library for Monte Carlo (ACE) and deterministic (MATXS) neutron transport codes, processed covariance data (COVFIL), fission product yield and decay data for SCALE
- Atomic Data (http://pearl.kaeri.re.kr/pearl/): atomic database including photoionization cross section, electron impact ionization (EII) rate coefficient, and dielectronic recombination (DR) rate coefficient

3.5 Support for Nuclear/Radiation R&Ds

KNDC supports domestic and foreign nuclear/radiation R&Ds by providing nuclear data related information, how to process nuclear data, working libraries for application, etc. The main support details for 2023 were as follows:

- Advice on plotting the cross sections using the KNDC web service (KAERI)
- Support for the management and operation of the computing server and the use of analysis codes (KAERI)
- Provision of 30K H-in-OrthoH and H-in-ParaH ACE-format TSL libraries based on ENDF/B-VIII.0 for experimental validation using a research reactor (KAERI)
- Advisory support on Th-229 nuclear laser spectroscopy (KAERI)
- Advisory support on decay data and fission product yield data for MSR decay heat analysis, along with provision of decay data extracted from ORIGEN library (KAERI)