

DE LA RECHERCHE À L'INDUSTRIE



WPEC Subgroup C —— HPRL —— High Priority Request List for Nuclear Data

www.oecd-nea.org/dbdata/hprl

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 - ✧ SPQ dosimetry requests from IAEA
 - ✧ Missing HP/GP requests for nuclear energy (fission and fusion)
 - ✧ Possible new requests (SPQ and non-energy application)
- ✧ Follow-up work on requests
 - ✧ Update of activities relevant to current entries
 - ✧ Publication of the status report
- ✧ Outlook

Background and current mandate

Objective: *Stimulation and guidance of experimental and evaluated nuclear data activities for nuclear applications*

- < 1990s: World Requests for Nuclear Data (WRENDA)
 - National/regional requests compiled by IAEA
 - Applications: fission, fusion, ADS, medical, etc.
- > 1990s: Compilation/maintenance activities moved to NEA HPRL
 - The list became too long with many poorly defined or ill posed requests
 - Ranking was no longer possible or too subjective
- 2003: Reset and creation of a new list with modified procedures... (cf. paper by D. Smith *et al.* in ND2004 proceedings)



Background and current mandate

- Since 2004, HPRL is more than just a compilation of requests:
 - (Nominative) Requests are reviewed and screened by Subgroup C
 - Requests are driven by applications: detailed justification and impact study are mandatory for HP/GP
 - Requests are targeted to nuclear data improvement (which may require new modelling/evaluation, most often based on new measurements)
 - Accurate definition of the request: reaction, quantity (XS, DDX, RP, etc.), energy, accuracy, etc.
 - Few categories only, without internal ranking:
 - High Priority (HP), General Purpose (GP) since 2004
 - Special Purpose Quantities (SPQ) since 2014

The expert group is responsible for managing the activities related to the HPRL, in particular for guaranteeing that the entries are up-to-date and well-motivated by current interests in the field of nuclear energy and other nuclear applications. The group is also responsible for stimulating follow-up to the entries and collecting the feedback provided by any of the related activities that may further the resolution of a request. The expert group will work mainly by electronic mail exchanges. Physical meetings will be held typically once a year.

The HPRL is organized as follows:

1. The List consists of one list with truly high priority requests, a list with general requests and a list with special purpose quantities divided in categories. This third list is an extension to the present List.
2. Stringent criteria are applied for entries on the lists. These will be evaluated by the Expert Group that will take the final decision for adopting a request.
3. A “high priority request” is justified by quantitative sensitivity studies (or the equivalent) and sufficiently documented.
4. A “general request” is well motivated for a specific quantity on a specific nucleus and is documented, but lacks a detailed backing by a sensitivity analysis or an impact study.
5. A “special purpose request” in a well-defined category is of interest to a recognized important subfield of applied nuclear science for which it is essential to stimulate new activity. Such a request may not satisfy the criteria as in the case of points 3. and 4.

The request lists will be subjected to periodic review to monitor progress and determine whether each individual request should continue to be included in these lists.



Background and current mandate

Deliverables

- A report on the status of all requests describing completed activities and outlook.
- An up-to-date online version of the “High Priority Request List for Nuclear Data”.

Background and current mandate

- The HPRL should bridge the gap between nuclear data users and nuclear data producers (evaluators and experimentalists)
- The HPRL is a reference tool in support to experimental, theoretical and evaluation projects aiming at improving nuclear data
- To fulfil these key roles the HPRL
 - should be updated frequently...
 - cf. website updates for SPQ form and IAEA dosimetry requests
 - should reflect all needs in relevant areas...
 - cf. ongoing efforts to add new or “missing” requests
 - should reflect advances aiming at answering those needs...
 - cf. ongoing efforts to compile relevant experimental/evaluation activities

Membership and participation

- Expert members: experimentalists, evaluators, users
- At least 3 representatives of each nuclear data evaluation projects
 - JEFF: A.Plompen, E.Dupont, G.Rimpault
 - ENDF: Y.Danon
 - JENDL: O.Iwamoto, H.Harada, T.Iwasaki, K.Yokoyama, and A.Kimura (new)
 - BROND: V.Pronyaev, V.Koscheev
 - CENDL: Zhigang Ge, Sun Weili, and “ntof@ciae” (Xichao Ruan)
 - IAEA: A.Koning
 - KAERI: Y-O.Lee

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JEFF

ENDF

JENDL

BROND

CENDL

IAEA

KAERI

NEA



Current interests from users

- Special Purpose Quantity (SPQ) requests from IAEA (S. Simakov)
 - *“Proposals for new measurements for IRDFF community and HPRL”*
 - <https://www-nds.iaea.org/IRDFFtest/HPRL.pdf>
 - More than 50 new entries relevant for dosimetry applications :
 - (n,γ) , (n,n') , (n,xn) , (n,cp) for various nuclides
 - Requests are to improve (a few) differential cross sections and (many) averaged cross sections, either SPA or MXW xs
- Website updates (SPQ form and request) should be finalized ASAP

Current interests from users

- Possibly missing HP/GP requests for nuclear energy (fission and fusion)
 - Major actinides U-235, Pu-239: nu-bar, PFNS, (n,f), (n,n')
 - also investigate needs for more accurate/extended IAEA standards
 - Improved RP accuracy (low/high temperature measurements)
 - Sodium activation: $^{23}\text{Na}(n,\gamma)^{24}\text{Na}$, $T_{1/2} \sim 15\text{h}$
 - Tritium production in B_4C : $^{10}\text{B}(n,t+\alpha)^4\text{He}$
 - Specific needs for ITER/IFMIF/DEMO
 - $^{39}\text{K}(n,p)^{39}\text{Ar}$, $T_{1/2} \sim 269$ years, request under discussion
 - HP/GP requests from ND Needs White Paper in the US
 - consensus to improve inelastic cross section of actinides

- Many discussions, but no final/formal request yet...

Current interests from users

- Possible new requests (SPQ and non-energy application)
 - Fission product (n, γ) cross sections
 - Improvement of model/data for correlated emission of particles in fission: n and γ from light and heavy fragments
 - Decay data (e.g. TAGS, P_n), fission yields, TSL?
 - Activation cross sections (from importance diagrams by R.Forrest)?
→ relative importance only, absolute ranking is missing
 - SPQ requests from ND Needs White Paper in the US?

- Many discussions, but no final/formal request yet...



Follow-up work on requests

- Mandate's deliverable: *“up-to-date online version of the HPRL”* (with relevant experimental, theoretical and evaluation/validation activities)
 - 2016... → 2017
 - Draft document compiling feedback available and being updated
 - June-September 2017: finalise and approve the status of entries
 - Autumn 2017 (pending publication of ND2016 proceedings): update of the entry status on the HPRL website
 - Starting from 2018
 - Yearly update

Follow-up work on requests

- Mandate's deliverable: *“report on the status of all requests describing completed activities and outlook”*
 - 2017: Finalisation of the report
 - Essentially based on web contents including information based on the feedback forms circulated in 2014
 - Limited to finalised/published activities (plus outlook)
 - Information on work in progress available online only
 - 2018
 - Publication by NEA

Outlook

- HPRL is still relevant
 - To stimulate/guide nuclear data improvements for nuclear applications;
 - As a reference tool in support to experimental, theoretical and evaluation projects;
 - To bridge the gap between nuclear data users and producers.

- A few issues should be addressed
 - Nuclear data users representation/participation in SG-C (2017)
 - Website updates, including update of entry status (2017)
 - Missing requests (and outreach?) for energy applications (2017)
 - Outreach/requests for non-energy applications (2017-2018)
 - Networking, communication in various newsletters
 - Joint NEA-IAEA HPRL?

Thank you for your attention!



HPRL governance, contents

- HPRL is managed by WPEC Subgroup C
 - Expert members: experimentalists, evaluators, users
 - Representatives of evaluation projects: JEFF, ENDF/B, JENDL, etc.
- 3 categories of requests
 - HP (High Priority): justification documentation must be associated with a quantitative impact study, e.g. sensitivity and uncertainty analyses
 - GP (General Purpose): justification documentation may be associated with a qualitative impact study only
 - SPQ (Special Purpose Quantities): justification documentation, but requests of generic value that cannot be individually supported by impact studies, e.g. decay data, fission yields, activation xs...

Current requests (for nuclear reactors)

■ Fission cross section

Nuclide	Half-life	XS	Energy range	HPRL status	Comment
Np-237	2 My	(n,f)	200 keV-20 MeV	HP, see details	Done (n_TOF)
Pu-238	88 y	(n,f)	9 keV-6 MeV	HP, see details	Could be done (EAR2)
Pu-240	6.6 ky	(n,f)	0.5 keV-5 MeV	HP, see details	Done (n_TOF)
Pu-241	14 y	(n,f)	0.5 eV-1.35 MeV	HP, see details	Could be done (EAR2)
Pu-242	375 ky	(n,f)	200 keV-20 MeV	HP, see details	Done (IRMM, n_TOF)
Am-241	432 y	(n,f)	180 keV-20 MeV	HP, see details	Done (n_TOF)
Am-242m	141 y	(n,f)	0.5 keV-6 MeV	HP, see details	Target availability?
Cm-244	18 y	(n,f)	65 keV-6 MeV	HP, see details	Could be done (EAR2)
Cm-245	8.5 ky	(n,f)	0.5 keV-6 MeV	HP, see details	< 1 MeV at n_TOF

Current requests (for nuclear reactors)

■ Capture cross section

Nuclide	Half-life	XS	Energy range	HPRL status	Comment
Hf-nat	stable	(n, γ)	0.5-5.0 keV	HP, see details	Done (IRMM)
U-233	159 ky	(n, γ)	Therm.-10 keV	GP, see details	Ongoing (n_TOF)
U-233	159 ky	(n, γ)	10 keV-1.0 MeV	GP, see details	Ongoing (n_TOF)
U-235	~stable	(n, γ)	100 eV-1 MeV	HP, see details	Could be done again
U-238	~stable	(n, γ)	20 eV-25 keV	HP, see details	Done (IRMM, n_TOF)
Pu-239	24 ky	(n, γ), (n,f) α and $\nu\alpha$	1 meV-1 eV	GP, see details	Could be done again
Pu-239	24 ky	(n, γ)	0.1 eV-1.35 MeV	HP, see details	Could be done
Pu-241	14 y	(n, γ)	0.1 eV-1.35 MeV	HP, see details	Extremely challenging
Pu-242	375 ky	(n, γ)	0.5 eV-2.0 keV	GP, see details	Ongoing (n_TOF)
Am-241	432 y	(n, γ)	Thermal	HP, see details	Done (IRMM, n_TOF)

Current requests (for fission/fusion reactors and others)

■ Cross sections

Nuclide	Reaction	Quantity	Energy range	Field
Si-28	(n,np)	Cross section	Thres. -20 MeV	Fusion
Cr-52	(n,x d,t)	Cross section	Thres. -65 MeV	Fusion
O-16	(n, α)	Cross section	2 MeV-20 MeV	Fission
Na-23	(n,inl)	Cross section	0.5 MeV-1.3 MeV	Fission
Si-28	(n,inl)	Cross section	1.4 MeV-6 MeV	Fission
Fe-56	(n,inl)	Cross section	0.5 MeV-20 MeV	Fission
Pb-206	(n,inl)	Cross section	0.5 MeV-6 MeV	Fission
Pb-207	(n,inl)	Cross section	0.5 MeV-6 MeV	Fission
U-238	(n,inl)	Cross section	65 keV-20 MeV	Fission
Au-197	(n,tot)	Cross section	5 keV-200 keV	Standard

Current requests (for fission/fusion reactors and others)

■ DDX, PF n / γ S, nu-bar

Nuclide	Reaction	Quantity	Energy range	Field
H-1	(n,el)	xs, $d^2/d\theta dE'$	10 MeV-20 MeV	Standard
H-2	(n,el)	$d^2/d\theta dE'$	0.1 MeV-1 MeV	Fission
Fe-56	(n,xn)	d/dE'	7 MeV-20 MeV	ADS
U-235	(n,f)	γ spectrum	Therm.-Fast	Fission
Pu-239	(n,f)	γ spectrum	Therm.-Fast	Fission
Am-243	(n,f)	n spectrum	Therm. -10 MeV	ADS
Cm-244	(n,f)	n spectrum	Therm. -10 MeV	ADS
U-233	(n,f)	nu-bar	Therm.-10 keV	Fission
Pu-240	(n,f)	nu-bar	200 keV-2 MeV	Fission

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