

DE LA RECHERCHE À L'INDUSTRIE



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

[www.oecd-nea.org/dbdata/hprial](http://www.oecd-nea.org/dbdata/hprial)

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- ✧ Membership
- ✧ Various “reminders”
- ✧ Ongoing actions
  - ✧ SPQ requests from S. Simakov
  - ✧ Missing HP/GP requests for nuclear energy (fission and fusion)
  - ✧ Possible new requests (SPQ and non-energy application)
- ✧ Update of activities relevant to current entries
- ✧ Publication of the status report

## Membership

- Expert members: experimentalists, evaluators, users
- At least 3 representatives of each nuclear data evaluation projects

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## Various “reminders”

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)

## Various “reminders”

- 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 without internal ranking:
    - High Priority (HP), General Purpose (GP) since 2004
    - Special Purpose Quantities (SPQ) since 2014



## Various “reminders”

- The HPRL should continue bridging the gaps between nuclear data producers and nuclear data users
- The HPRL should stay a reference tool in support to experimental, theoretical and evaluation projects aiming at improving nuclear data
- To fulfil this key role the HPRL
  - should be updated more often...
  - should reflect all needs in relevant areas...
  - should reflect advances aiming at answering those needs...



## Various “reminders”

- SG-C mandate extension to June 2018

### **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”.



## Ongoing actions

- Special Purpose Quantity (SPQ) requests from 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 :
      - $(n,g)$ ,  $(n,n')$ ,  $(n,xn)$ ,  $(n,cp)$  for various nuclides
      - Request is to improve a few differential cross sections and many averaged cross sections (either SPA or MXW)
    - Website update should be finalized ASAP



## Ongoing actions

- Missing(?) HP/GP requests for nuclear energy (fission and fusion)
  - Major actinides U-235, Pu-239: nu-bar, PFNS, (n,f), (n,n')
  - 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  $\text{B}_4\text{C}$ :  $^{10}\text{B}(n,t+a)^4\text{He}$
  - Specific needs for ITER/IFMIF/DEMO?
  - HP/GP requests from ND Needs White Paper in the US?
  
- Many discussions but no final/formal request...



## Ongoing actions

- Possible(?) new requests (SPQ and non-energy application)
  - Fission product (n,g) cross sections
  - Improvement of model/data for correlated emission of particles in fission: n and g from light and heavy fragments
  - Beta spectra from  $^{235}\text{U}(n_{\text{th}},f)$  fission fragments (anti-neutrino spectra)
  - Activation cross sections (cf. importance diagram by R.A.Forrest)?
  - Decay data (e.g. TAGS, Pn), fission yields, TSL, standards?
  - SPQ requests from ND Needs White Paper in the US?
  
- Many discussions but no final/formal request...

## Update of activities relevant to current entries

- Mandate's deliverable: *up-to-date online version of HPRL* (with relevant experimental, theoretical and evaluation/validation activities)
  - 2016... → 2017
    - This meeting: update entry status document (draft of Summer 2016)
    - June-September 2017: finalise and approve the status of entries
    - Autumn 2017: update the HPRL website

## Publication of the status report

- 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 advanced/finalised activities (plus outlook)
    - Ongoing activities available online only
  - 2017/2018
    - Publication by NEA

**Thank you for your attention!**



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.

## Current requests (for nuclear reactors)

### ■ Fission cross section

<b>Nuclide</b>	<b>Half-life</b>	<b>XS</b>	<b>Energy range</b>	<b>HPRL status</b>	<b>Comment</b>
<b>Np-237</b>	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)
<b>Pu-240</b>	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)
<b>Pu-242</b>	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)
<b>Cm-245</b>	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, $\gamma$ )	0.5-5.0 keV	HP, <a href="#">see details</a>	Done (IRMM)
U-233	159 ky	(n, $\gamma$ )	Therm.-10 keV	GP, <a href="#">see details</a>	Ongoing (n_TOF)
U-233	159 ky	(n, $\gamma$ )	10 keV-1.0 MeV	GP, <a href="#">see details</a>	Ongoing (n_TOF)
U-235	~stable	(n, $\gamma$ )	100 eV-1 MeV	HP, <a href="#">see details</a>	Could be done again
U-238	~stable	(n, $\gamma$ )	20 eV-25 keV	HP, <a href="#">see details</a>	Done (IRMM, n_TOF)
Pu-239	24 ky	(n, $\gamma$ ), (n,f) $\alpha$ and $\nu\alpha$	1 meV-1 eV	GP, <a href="#">see details</a>	Could be done again
Pu-239	24 ky	(n, $\gamma$ )	0.1 eV-1.35 MeV	HP, <a href="#">see details</a>	Could be done
Pu-241	14 y	(n, $\gamma$ )	0.1 eV-1.35 MeV	HP, <a href="#">see details</a>	Extremely challenging
Pu-242	375 ky	(n, $\gamma$ )	0.5 eV-2.0 keV	GP, <a href="#">see details</a>	Ongoing (n_TOF)
Am-241	432 y	(n, $\gamma$ )	Thermal	HP, <a href="#">see details</a>	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, $\alpha$ )	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, PFn/ $\gamma$ 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)	$\gamma$ spectrum	Therm.-Fast	Fission
Pu-239	(n,f)	$\gamma$ 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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