

## Present Status of JENDL Project

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### 1. Revision of JENDL-3

The second revision work of JENDL-3 is still on going. The re-evaluation work for important nuclides will be finished in a couple of months. After compilation of the data, they will be varidated with various benchmark tests from the points of view of nuclear reactors, shielding and fusion neutronics. The modification of minor isotopes will be continued till the end of this year. Main parts of the present revision are as follows:

#### Resonance parameters of main actinides

The resolved resonance parameters of  $^{233}\text{U}$ ,  $^{239}\text{Pu}$  and  $^{241}\text{Pu}$  are replaced with Reich-Moore parameters obtained by Derrien who has been in JAERI since recent 2 years. The upper boundary of the resolved resonance region of  $^{233}\text{U}$ ,  $^{239}\text{Pu}$  and  $^{241}\text{Pu}$  has been expanded up to 150 eV, 2.5 keV and 300 eV, respectively. Those of  $^{235}\text{U}$  and  $^{238}\text{U}$  are also replaced with the parameters taken from ENDF/B-VI and JEF-2.

The unresolved resonance region of  $^{238}\text{U}$  is extended up to 150 keV. The parameters of  $^{235}\text{U}$  are superseded with a new set of average parameters determined so as to reproduce new evaluations of the fission, capture and total cross sections.

#### Major cross sections of main actinides

The inelastic scattering, fission and (n,2n) reaction cross sections of  $^{233}\text{U}$  are reevaluated. The inelastic scattering cross sections of  $^{238}\text{U}$  are also reevaluated. Other cross sections of those nuclides are changed to keep consistency.

#### Fission spectra

Ohsawa developed new formula based on Madland-Nix formalism by considering temperature difference between heavy and light mass fission fragments and multi-chance fission effects. The fission spectra of  $^{235}\text{U}$  and  $^{239}\text{Pu}$  are replaced with his calculations. For some of other nuclides, his calculation might be adopted.

#### Neutrons per fission

The  $\nu_p$  of  $^{235}\text{U}$  is updated by new evaluation.

#### Total cross sections of light-mass and structural materials

The total cross section of Fe in JENDL-3.1 are sharpened in its shape by considering

experimental resolution. It has been confirmed that the modified cross sections were in a better agreement with integral data at Broomstick experiments. This procedure will be applied to Ni and Cr too.

The total cross sections of  $^{14}\text{N}$  and  $^{23}\text{Na}$  are revised on the basis of information from their benchmark tests.

#### Data of fission product nuclides

The capture cross sections and resolved resonance parameters of about 40 fission product nuclides are being updated. For several nuclides, new experimental data are available so that much reliable capture cross sections are given to them.

#### $\gamma$ -ray Production cross sections

The  $\gamma$ -ray production cross section data in JENDL-3 will be updated for several materials, and new evaluation will be added.

#### Other modifications

The neutron emitting reaction data around 14 MeV are important for fusion applications. They are updated in JENDL Fusion File to be described below. Mainly the inelastic scattering cross sections around 14 MeV are modified and particle emission spectra are represented in MF=6. The results for JENDL Fusion File will be taken into JENDL-3.2 too, by approximately giving neutron emission spectra in MF=5.

Other small modifications are made for many nuclides.

## 2. JENDL Special Purpose Files

### JENDL Fusion File

JENDL Fusion File, to represent the DDX of emitted neutrons and charged particles, will store the data for Al, Si, Ca, Ti, Cr, Mn, Fe, Co, Ni, Cu, Zr, Nb, Mo, Pb, Bi, Ge, As, Sn, Sb and W. This file is compiled in the ENDF-6 format applying MF6 representation of DDX. Up to the present, the work has been completed for 15 elements and their isotopes except Ge, As, Sn, Sb and W. The data for nuclides which are lighter than Al and important to fusion neutronics will be taken from JENDL-3.1 without any modifications.

### JENDL Actinide File

JENDL Actinide File will be compiled in coming several years. It will contain the evaluated data for 89 nuclides from  $^{208}\text{Tl}$  to  $^{255}\text{Fm}$  in the neutron energy range from  $10^{-5}$  eV to 20 MeV. The data for 57 nuclides will be taken from JENDL-3 with some modifications if necessary. In 1992, nuclear data evaluation was made for  $^{237}\text{U}$ ,  $^{236}\text{Np}$  and  $^{238}\text{Np}$ . In 1993, the data of minor isotopes of Pu will be evaluated. We are expecting this file will be completed in 1996 or 1997.

#### Photonuclear data file

The evaluation work for Photonuclear Data File is being made for C, N, O, Al, Ti, Fe, Cu, Ta, W, Pb, Bi and U in the  $\gamma$ -ray energy range up to 140 MeV. The results will be compiled in a file in 1993. A bibliographic index to the photonuclear data has been compiled, and will be published as JAERI-M report.

#### KERMA/PKA file

For the KERMA and PKA Spectrum File, a code system ESPERANT has been developed, which calculates DPA cross sections from PKA spectra and makes a data file.

No explicit progress has been made for Activation Cross Section File,  $(\alpha, n)$  Data File, Decay Data File.

### **3. High energy data files**

Data requirements for high energy neutron and proton data are increasing. A couple of movements are existing in Japan to make data files for those requirements. One is evaluation of neutron data up to 50 MeV mainly for structural materials. This work is mainly based on the calculation with GNASH. Another one is a data file for accelerator-driven spallation system. This file will cover the energy range up to 1.5 GeV, incident particles of neutron and proton, and materials important to an intense proton LINAC and sub-critical fuel assemblies. So far, only a few trial evaluations have been made with ALICE-F and auxiliary programs.

Table 1 JENDL Special Purpose Files

File	Contents	Completion	Comment
<b>Below 20 MeV</b>			
Dosimetry	61 R	1991	completed
Gas production	23 E	1991	completed
Activation	~ 1000 R	1993	
( $\alpha,n$ ) reaction	11 E	1993	
Fusion	21 E	1994	
Actinide	89 N	1996	57 nuclei in JENDL-3
<b>High energy data</b>			
Photo-reactions	30 E	1993	up to 140 MeV
Cross sections for ESNIT	19 E	1994	neutrons up to 50 MeV
PKA	46 E	1995	neutrons up to 50 MeV
Neutron-induced reactions	NS	NS	up to 1.5 GeV
Charged particles	NS	NS	up to 1.5 GeV
<b>Others</b>			
Decay data	~ 2000 N	NS	

R: Reactions, N: Nuclides, E:Elements, NS: Not yet specified.

Table 2 Nuclides to be stored in JENDL Actinide File

nuclide	status	nuclide	status	nuclide	status
<sup>209</sup> Tl	x	<sup>210</sup> Pb	x	<sup>210</sup> Bi	x
<sup>210</sup> Po	x	<sup>222</sup> Rn	x	<sup>223</sup> Ra	J3
<sup>224</sup> Ra	J3	<sup>225</sup> Ra	J3	<sup>226</sup> Ra	J3
<sup>228</sup> Ra	x	<sup>225</sup> Ac	J3	<sup>226</sup> Ac	J3
<sup>227</sup> Ac	J3	<sup>227</sup> Th	J3	<sup>228</sup> Th	J3
<sup>229</sup> Th	J3	<sup>230</sup> Th	J3	<sup>231</sup> Th	x
<sup>232</sup> Th	J3,A	<sup>233</sup> Th	J3	<sup>234</sup> Th	J3
<sup>229</sup> Pa	x	<sup>230</sup> Pa	x	<sup>231</sup> Pa	J3
<sup>232</sup> Pa	J3	<sup>233</sup> Pa	J3	<sup>230</sup> U	x
<sup>231</sup> U	x	<sup>232</sup> U	J3	<sup>233</sup> U	J3,A
<sup>234</sup> U	J3	<sup>235</sup> U	J3,A	<sup>236</sup> U	J3
<sup>237</sup> U	New	<sup>238</sup> U	J3,A	<sup>234</sup> Np	x
<sup>235</sup> Np	x	<sup>236</sup> Np	New	<sup>237</sup> Np	J3,B
<sup>238</sup> Np	New,B	<sup>239</sup> Np	J3	<sup>236</sup> Pu	J3
<sup>237</sup> Pu		<sup>238</sup> Pu	J3,B	<sup>239</sup> Pu	J3,A
<sup>240</sup> Pu	J3,A	<sup>241</sup> Pu	J3,A	<sup>242</sup> Pu	J3,B
<sup>244</sup> Pu		<sup>246</sup> Pu	x	<sup>247</sup> Pu	x
<sup>241</sup> Am	J3,B	<sup>243</sup> Am	J3,B	<sup>242m</sup> Am	J3,B
<sup>243</sup> Am	J3,B	<sup>244</sup> Am	J3	<sup>244m</sup> Am	J3
<sup>240</sup> Cm	x	<sup>241</sup> Cm	J3	<sup>243</sup> Cm	J3,B
<sup>243</sup> Cm	J3,B	<sup>244</sup> Cm	J3,B	<sup>245</sup> Cm	J3,B
<sup>246</sup> Cm	J3,B	<sup>247</sup> Cm	J3	<sup>248</sup> Cm	J3
<sup>249</sup> Cm	J3	<sup>250</sup> Cm	J3	<sup>245</sup> Bk	x
<sup>246</sup> Bk	x	<sup>247</sup> Bk	x	<sup>248</sup> Bk	x
<sup>249</sup> Bk	J3	<sup>250</sup> Bk	J3	<sup>246</sup> Cf	x
<sup>248</sup> Cf	x	<sup>249</sup> Cf	J3	<sup>250</sup> Cf	J3
<sup>251</sup> Cf	J3	<sup>252</sup> Cf	J3	<sup>253</sup> Cf	J3
<sup>254</sup> Cf	J3	<sup>251</sup> Es	x	<sup>252</sup> Es	x
<sup>253</sup> Es		<sup>254</sup> Es	J3	<sup>254m</sup> Es	x
<sup>255</sup> Es	J3	<sup>255</sup> Fm	J3		

J3: data exist in JENDL-3, New: new evaluation for JENDL Actinide File has been completed, x: data are not existing in JENDL-3, ENDF/B-VI nor JEF-2, A: major actinide, B: important for the actinide burner reactor.