Status of the JENDL Project
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J. Katakura
Nuclear Data Center
Nuclear Science and Engineering Directorate
Japan Atomic Energy Agency
Japanese Nuclear Data Committee

- Subcommittee on Nuclear Data (K. Shibata)
  - High Energy Nuclear Data Evaluation WG (N. Watanabe)
  - FP Nuclear Data Evaluation WG (K. Shibata)
  - ENSDF Group (H. Iimura)
  - Editorial Group of Nuclear Data News (T. Nakagawa)

- Subcommittee on Reactor Constants (N. Yamano)
  - Reactor Integral Test WG (M. Ishikawa)
  - Shielding Integral Test WG (N. Yamano)
  - WG on Preservation of Reactor Physics Experimental Data (T. Misawa)
  - Decay Heat Evaluation WG (T. Yoshida)
  - WG on Evaluation of Nuclide Generation (K. Suyama)
Recent Achievement

- Minor update of JENDL/AC-2008
  - $^{233}\text{U}$, $^{234}\text{U}$, $^{237}\text{Np}$, $^{239}\text{Pu}$, $^{241}\text{Am}$, $^{242}\text{Cm}$
  - Covariance data

- Progress of light, medium-heavy and FP nuclides data evaluation
  - Light nuclides
    - $^9\text{Be}$, $^{10}\text{B}$ and $^{16}\text{O}$
  - Resolved resonance parameters
    - $^{90,91}\text{Zr}$, $^{139}\text{La}$, $^{133}\text{Cs}$, etc.
  - Medium-heavy nuclides
    - $^{52}\text{Cr}$, $^{56,57}\text{Fe}$, $^{63,65}\text{Cu}$, $\text{W}$ etc.
Evaluation of Actinoid nuclides

- Covariance data
  - resonance parameters, fission cross sections, capture cross sections and number of prompt neutron
  - For 18 nuclides for 79 actinoid nuclides
  - CCONE + KALMAN

- Re-examination
  - $\nu_d$: $^{233}\text{U}$
  - $\nu_p$: $^{239}\text{Pu}$, $^{242}\text{Cm}$
  - Resonance: $^{234}\text{U}$, $^{237}\text{Np}$, $^{239}\text{Pu}$, $^{241}\text{Am}$, $^{242}\text{Cm}$
Covariances of actinoid nuclides

CCONE + KALMAN
Evaluation of light nuclides

- $^9\text{Be}$
  - Total and elastic scattering cross sections in the energy region from 85 keV to 890 keV.

- $^{10}\text{B}$
  - $^{10}\text{B}(n,t)^2\alpha$ reaction cross section for tritium production for PWR.

- $^{16}\text{O}$
  - Total and elastic scattering cross sections using R-matrix theory below 3 MeV.
Total cross section of $^{16}$O

![Graph showing the total cross section of $^{16}$O as a function of incident energy.]
FP nuclides

- Resolved resonance parameters
  - $^{90,91}\text{Zr}$ and $^{139}\text{La}$
  - New data from n_TOF experiments
  - $^{133}\text{Cs}$
  - Feedback from PIE analyses for LWR

- Above resonance region
  - Calculation by CCONE
  - Ag, Cs, Eu, Gd and Dy isotopes
  - Calculation by POD
  - As, Se, Y, Zr, Nb and Mo isotopes
$^{109}\text{Ag}(n,p)$
$^{133}\text{Cs}(n,2n)$
Medium and heavy nuclides

- Newly evaluated data
  - $^{59}\text{Fe}$ and $^{59}\text{Ni}$
    - $^{58}\text{Ni}(n,\gamma)^{59}\text{Ni}(n,\alpha)$ for radiation damage of stainless steel
    - $^{59}\text{Fe}(n,\gamma)^{60}\text{Fe}$ for astrophysics and radioactive waste ($T_{1/2}$ of $^{60}\text{Fe} = 1.5 \times 10^6 \text{ y}$)

- Re-evaluation
  - $^{52}\text{Cr}$, $^{56,57}\text{Fe}$, $^{63,65}\text{Cu}$ and W isotopes
### JENDL High Energy File


- Nuclear data of neutron- and proton-induced reactions up to 3 GeV for 106 nuclides.

<table>
<thead>
<tr>
<th>Priority (No.)</th>
<th>Nuclides</th>
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<tbody>
<tr>
<td>1st (39)</td>
<td>$^1$H, $^{12}$C, $^{14}$N, $^{16}$O, $^{27}$Al, $^{50}$Cr, $^{54}$Fe, $^{58}$Ni, $^{63}$Cu, $^{180}$W, $^{196}$Hg, $^{204}$Pb, $^{209}$Bi, $^{235}$U</td>
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<tr>
<td>2nd (43)</td>
<td>$^9$Be, $^{10,11}$B, $^{24,25,26}$Mg, $^{28,29,30}$Si, $^{39,41}$K, $^{40,42,43,44,46,48}$Ca, $^{46,47,48,49,50}$Ti, $^{51}$V, $^{55}$Mn, $^{59}$Co, $^{92,94,95,96,97,98,100}$Mo, $^{238,239,240,241,242}$Pu</td>
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<tr>
<td>3rd (40)</td>
<td>$^2$H, $^6,7$Li, $^{13}$C, $^{19}$F, $^{23}$Na, $^{35,37}$Cl, $^{35,38,40}$Ar, $^{64,66,67,68,70}$Zn, $^{69,71}$Ga, $^{70,72,73,74,76}$Ge, $^{75}$As, $^{89}$Y, $^{181}$Ta, $^{197}$Au, $^{232}$Th, $^{233,234,236}$U, $^{237}$Np, $^{241,242,242m,243}$Am, $^{243,244,245,246}$Cm</td>
</tr>
<tr>
<td>4th (10)</td>
<td>$^{15}$N, $^{18}$O, $^{74,76,77,78,80,82}$Se, $^{113,115}$In</td>
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</table>
Fission Yields

Based on the evaluation of ENDF file with some modification
- 60 fission types

Modification:
- Addition of ternary fission product yields
- Number of FP nuclides concides with that of JENDL FP Decay Data File
- Re-calculation of cumulative yields based on the decay chains of JENDL FP Decay Data File
Ternary Fission Yields

- Data from ENDF and JEFF
  - Element Yields (T.R. England and B.F. Rider)
  - Ratios of Mass Yields (R.W. Mills)
- Combining above data, nuclide yields from $^1\text{H}$ to $^7\text{Li}$ were calculated and included.
- Addition of some FP nuclides yields

$$FY(A,Z) = N \cdot \int_{z-0.5}^{z+0.5} \frac{1}{\sqrt{2\pi\sigma^2}} \cdot e^{-0.5\left(\frac{z-z_p(A)}{\sigma}\right)^2} \, dz$$

- $Z_p(A)$, $\sigma$ and ratios of Isomer/Ground states: from England-Rider
Benchmark Tests for JENDL-4

- ZPPR,
- BFS,
- MOZART (ZEBRA),
- JOYO-MKI, MK-II,
- FCA,
- CIRABO (MASURCA)
- SEFOR
- LANL Small Reactors,
- PIE of MA Samples

- ICSBEP Benchmark (930 cases),
- IRPhEP Benchmark,
- TCA, FCA,
- STACY, TRACY,
- JRRs, HTTR,
- KUCA,
- TRX, KRITZ, VENUS, HTR10,
- MISTRAL, BASALA, FUBILA,
- PIE of LWR Spent Fuels

![Graph showing C/E (keff) vs. ICSBEP Benchmark (MIX-COMP-THERM) results]
PIE analysis for MA samples in JOYO-MKII

![Graph showing PIE analysis results for various MA samples in JOYO-MKII. The graph compares JENDL-3.3 and J-Actinide models.](Image)
Development of sensitivity analysis system

- Sensitivity of integral data (C/E) to nuclear data
- Sensitivity coefficients for various kinds of reactor systems
- For feedback to nuclear data evaluation
- Web based application
- To be completed by the end of FY2009

\[
\frac{\Delta R}{R} \approx \sum_i \left[ S_i \times \frac{(\sigma_{2,i} - \sigma_{1,i})}{\sigma_{1,i}} \right]
\]

\( i = \text{nuclide, reaction, neutron energy etc.} \)
2008 Nuclear Data Symposium

- Held on the 20-21 of November, 2008 (78 participants)
- Organized and sponsored by Nuclear Data Division of AESJ.
- Tutorials
  - Nuclear data for reactor dosimetry and neutron spectrum adjustment method by T. Iguchi (Nagoya University)
  - Nuclear reaction model calculation code CCONE by O. Iwamoto (JAEA)
- Oral topics
  - Development of JENDL-4
  - Benchmark tests for JENDL-4
  - Other Nuclear Data Activities
- 23 poster presentations