Decay Data Library
In ENDF/B-VII

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Methodology

- New ENDF/B-VII.0 decay data library
- Main sources:
  - Evaluated Nuclear Structure Data File (ENSDF), continuously updated
  - 2005 Nuclear Wallet Cards by J. Tuli (NNDC)
- Covers all nuclides from neutron (Z=0) to Rg (Z=111)
- 3830 materials
- Previous version done during 1988-1993 covering 979 materials
Methodology

Use of new Internal Conversion Coefficients (BRICC)  
Better $<E_{CE}>$

$<E_\beta>$ from SPEBETA for 2nd forbidden non-unique transitions

44 days $< T_{1/2} < 1 \times 10^7$ years

$^{36}\text{Cl}$, $^{99}\text{Tc}$, $^{129}\text{I}$, $^{137}\text{Cs}$

Nuclear waste

$T_{1/2}$ from Moller et al.
1 ms to 1 s
Partial $T_{1/2}$ information
No Decay information other than $Q$-value

TAGS (Total Absorption Gamma Spectrometer)

10 s $< T_{1/2} < 2000$ s, $Q_{\text{decay}} > 4$ MeV
Incomplete Decay Scheme

$<E_\gamma>$ and $<E_\beta>$ from integral measurement

48 materials from INEL + 2 ISOLDE/Jyvaskyla
Subject of WPEC Subgroup 25
Decay Heat Calculations

Decay Heat (t)=
\[ \Sigma \lambda_i \times N_i(t) \times E_i \]

- \( E_i \): energy released in decay
- More than 800 nuclides in \( ^{235}\text{U} \) fission
- TAGS=Total Absorption Gamma Spectrometer
- INEL TAGS data significantly improves decay heat calculations

Data: Tobias 1989
- Full: TAGS included
- Dashed: No TAGS

\[ \text{Time} \times \text{Decay Heat (MeV/fission)} \]

- **235\text{U}**
- **Total**
- **Light Particles** \( \beta-, \text{CE, Auger} \)
- **Electromagnetic** \( \gamma_s, \text{x-rays} \)

Time after fission burst (s)
Decay Heat Calculations

Comparison between JEFF 3.1 decay data library (2005) and ENDF/B-VII β2 decay data library (2006)

![Graph showing decay heat calculations for 235U with different decay modes: Total, Light Particles, and Electromagnetic, with different decay data libraries represented by different lines.](image-url)
Decay Heat Calculations

\[ ^{239}\text{Pu} \]

- Total Decay Heat
- Light Particles DH
- Electromagnetic DH
- Data: Tobias 1989
- Full: TAGS included
- Dashed: No TAGS

Time x Decay Heat (MeV/fission) vs. Time after fission burst (s)
$^{239}\text{Pu}$ Sensitivity Study

![Graph showing decay heat over time for $^{239}\text{Pu}$ and various isotopes](image)
239Pu Decay Heat Calculations

Effect of new TAGS data

ENDF/B-VII Decay Data Library

239Pu EM

time x Decay Heat (MeV/fission)

105Tc+104Tc (Valencia) and INEL TAGS
104Tc (Valencia) and INEL TAGS
INEL TAGS only
No Tags
Data: Tobias 1989

Time after fission burst (s)
235U Decay Heat Calculations

105Tc+104Tc (Valencia) and INEL TAGS
104Tc (Valencia) and INEL TAGS
INEL TAGS only
No Tags
Data: Tobias 1989
Summary

- ENDF/B-VII decay data library part of beta 2 release, update will be part of beta 3.
- Sensitivity study to obtain list of priority nuclides
- Close interaction with members of WPEC Subgroup 25 (beta decay and decay heat)

Future

- Decay Heat calculations for fast energies and other actinides
- Review minor actinides decay evaluations
- Close collaboration with experimental groups performing TAGS measurements