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Fission Product Yield Modeling and Evaluation

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Although independent and cumulative fission product yields have been a part of evaluated libraries for decades, there have been few updates over the years. The fission product yield sub-library in the ENDF/B-VIII.0 library is still largely based on the evaluation of England and Rider from the mid-90's [1], with only more recent updates to the energy dependence of ^{239}Pu below 2 MeV [2] and fixes to isomeric states and missing fission products [3]. This previous evaluation depends strongly on phenomenological parameter variations and can include robust incident-energy dependence only where enough experimental data are available. However, over the past several years, there have been a wealth of new measurements of independent and cumulative fission product yields, particularly those with short half-lives, and there have been significant improvements in the modeling of prompt and delayed fission observables.

In this talk, we describe recent progress in the improvement of fission product yield calculations, using the BeoH code and the underlying Hauser Feshbach Fission Fragment Decay (HF^{3}D) model, developed at Los Alamos National Laboratory [4,5]. BeoH is a deterministic fission fragment decay code that uses the Hauser-Feshbach statistical model to follow the de-excitation of initial fission fragments through the emission of prompt neutrons and gamma rays, starting from phenomenologically parametrized fission fragment initial conditions. After this emission, a time-independent method, combined with decay data (branching ratios, half-lives, etc.) is used to calculate the cumulative fission product yields. This model, while still relying on phenomenologically parametrized inputs, models the multi-chance fission process without approximations, and therefore, energy-dependent calculations can be performed, even where experimental data are scarce.

We will describe our recent calculations for consistent prompt and delayed fission observables for major and minor actinides, including new work investigating isomeric ratios. We will detail the ongoing evaluation process for energy-dependent fission product yields from thermal up to 20 MeV incident energy and some validation work that has been performed for these new fission product yield calculations. Additionally, we will discuss future perspectives of this work, including highlighting the need for additional data.

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