Assessment of Titanium Cross Sections and Uncertainties for Application in Criticality Safety

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As a neutron absorber, titanium has not commonly been considered for use in nuclear applications such as reactor design and analysis. Rather, it normally appears as a structural material that may be present in fuel cycle facilities or canisters for transport and disposition of nuclear waste. Criticality safety evaluations of systems in which titanium is present require an understanding of the nuclear data and its uncertainty. Titanium cross sections and uncertainties have been revised for application in criticality safety analyses of the Savannah River Site (SRS) actinide removal system. Natural titanium consists of 5 isotopes with thermal capture cross sections ranging from a few barns to nine barns; ^{48}Ti has the largest cross sections and abundance. The ENDF/B-VIIbeta2 titanium evaluations were used in the calculations. While cross-section evaluations are available for the 5 isotopes, uncertainty information exists only for ^{48}Ti. The ENDF/B-VIIbeta2 cross-section uncertainties for ^{48}Ti below 300 keV seem too high in comparison with the experimental uncertainties. A revised uncertainty file has been generated for ^{48}Ti resonance parameters using the retroactive methodology of the code SAMMY. The resulting uncertainties are in fairly good agreements with the experimental values. The impact of these uncertainties in the SRS actinide removal application model has been assessed. The results indicate that the uncertainties calculated with the revised data are a factor of 4 smaller than those obtained with the ENDF/B data. The full paper will describe the methodology used to generate the covariance matrix and the calculations performed with the TSUNAMI sensitivity analysis code.