

Nuclear Data Needs in Support of Advanced Fuel Cycle Research and Development

Distilled from initial sensitivity analyses performed by ANL on respective reactor systems that is being considered by GNEP (see presentation by Massimo Salvatores). Reactor parameters included: keff, Doppler reactivity, coolant void reactivity, burnup, transmutation rate, peak power; Fuel cycle parameters included decay heat, radiation source level, and radiotoxicity. Design target accuracies were adopted from the OECD-NEA study. Criticality safety, and material accounting (safeguards) were discussed in the breakout session. This list should be revisited and updated on an annual basis.

Activity	Near Term (2007-2012)	Long Term (2012 – 2020)	Comments
Cross Section Covariance Data	<ul style="list-style-type: none"> Implement full covariance data file for a broad set of isotopes within ENDF/B-VII. Need an early first (rough) set of data that is generated with a consistent systematic approach. Complete new covariance data over thermal, resonance and high neutron energy ranges for ²³⁵U, ²³⁸U, ²³⁹Pu. Complete covariance for all isotopes of high priority isotopes as established in the ad hoc OECD-NEA working group. 	<ul style="list-style-type: none"> Complete, update and improve covariance files as new data and models becomes available. 	<ul style="list-style-type: none"> Need to increase the number of experts qualified to perform this activity. No specific need for super computing. The availability of covariance data can be used both for design optimization, and for validation experiment planning. Need to reevaluate need for better ²³⁵U resonance data with ENDF/B-VII (JAEA)
Cross Section Evaluations	<ul style="list-style-type: none"> As new data becomes available perform evaluations of actinide fission and capture, fission nu, delayed neutrons, and photon production data. 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Interface between core and reflector in fast reactor is sensitive to the photon transport. May be a super computer need to evaluate resonance data.
Cross Section and covariance processing tools	<ul style="list-style-type: none"> Test and validate the methodology. Extend if necessary. 	<ul style="list-style-type: none"> Update as needed 	<ul style="list-style-type: none">
Actinide Nuclear Data	<ul style="list-style-type: none"> Fission of ²³⁹Pu at 2% accuracy or better Fission of ²⁴¹Pu at 4% accuracy 	<ul style="list-style-type: none"> Provide improvements in minor actinide data as determined from sensitivity analyses. 	<ul style="list-style-type: none"> Assumes isotopically pure targets will be produced as needed to achieve required data

	<ul style="list-style-type: none"> or better Fission of ^{241}Am at 4% accuracy or better Fission of ^{242}mAm at 4% accuracy (less than 1MeV), 10% accuracy (greater than 1 MeV) Delayed neutron fractions, decay constants and spectra Decay data and fission yields for (minor) actinides improvements 	<ul style="list-style-type: none"> Inelastic scattering in structural materials and higher actinides. 	<p>accuracy (ie. ^{240}Pu, ^{242}Pu, ^{241}Am, ^{242}mAm, ^{237}Np)</p>
Material Detection	<ul style="list-style-type: none"> Perform research using mock ups of separation processes. Investigate photon, neutron and passive interrogations techniques. Establish feasibility. Determine data needs after processes have been established. Improved delayed neutron and delayed neutron spectra may be needed. 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Gamma fission, fast neutron fission, gamma-gamma_prime, nuclear resonance fluorescence, etc being considered for material assay measurements, detection of prompt neutrons, delayed neutrons, photons.
Sensitivity Analysis tools	<ul style="list-style-type: none"> Establish working group of experts to collaborate on the development of sensitivity analysis tools, both Monte Carlo and Deterministic. Goal is to establish consistent method of analysis and validation. 	<ul style="list-style-type: none"> Explore potential of relating reactor physics experiments to nuclear model parameters. 	<ul style="list-style-type: none">
Displacement Measurements	<ul style="list-style-type: none"> Perform dpa cross section for structural materials 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Will be performed by GNEP program
Gas production measurements	<ul style="list-style-type: none"> Complete Zr measurement, start Mo measurement. 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Will be performed by GNEP program
Criticality Safety (separations plant) support	<ul style="list-style-type: none"> Critical safe configurations are needed for separations and fuel fabrication processes. Perform sensitivity analysis to establish 	<ul style="list-style-type: none"> 	<ul style="list-style-type: none"> Will be performed by GNEP program

	need for benchmark and/or cross sections measurements.		
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