July 3, 2008

To:	J. N. McKamy	Manager, NCSP
From:	J. A. Morman JM	Chair, CSSG
Subject:	**CSSG Response to Tasking 2008-03**	

Criticality Safety Support Group (CSSG) Tasking 2008-03 is summarized in the following excerpt from the tasking statement.

> The CSSG is requested to provide the NCSP Manager with a 'Mission-Need' proposal for a large, multipurpose horizontal split table critical assembly device. Identify data needs and DOE programs that could benefit from such a system in the time frame spanning the years 2010-2040.

In response to this tasking the CSSG met via teleconference on June 26, 2008 to discuss ideas and formulate a table of integral data needs, supporting experiments, and a list of the DOE program elements that could benefit from those experiments. The following people participated in the conference call:

Rick Anderson	Jerry McKamy
Jim Felty	Jim Morman
Ivon Fergus	Davis Reed
Adolf Garcia	Han Toffer
Calvin Hopper	Mike Westfall

The attached table is the result of that meeting plus supplemental information provided to and compiled by Calvin Hopper after the meeting. Transmittal of this information completes CSSG Tasking 2008-03. If further information is provided by CSSG members, the table will be modified and retransmitted. No priority of the experiments or data needs is implied by the order of the items in the table.

cc: CSSG Members
J. Felty
N. Ellis
H. Slemmons
L. Scott

Integral Data Needs Relevant to Experiments on a Large Split-Table Critical Assembly Device*				
No.	What Integral Data is Needed?	What Kinds of Experiments should be done?	What Programs Benefit?	Why?
1	Spent fuel fission product and minor actinides integral experiment demonstrating partitioned computational biases with various neutron-energy spectra	Simulated fission products and minor actinides for spent fuel burn-up credit in heterogeneous lattices and homogeneous slurries and liquids	NE, RW, Yucca Mtn	No complete benchmark data/information is available to address the issues of burn-up credit have substantial economic and programmatic impact on transportation, storage, and processing of spent fuel
2	Low mass waste matrixes (e.g., salt, sand, silicon, sodium bearing, calcined waste, etc.) in intermediate neutron spectra	Primarily containerized homogeneous waste with U and Pu contamination	WIPP, EM Ops, Yucca Mtn(?)	There are limited benchmark data/information is available to address the issues of low mass waste matrixes in sand and none to address salt
3	Pu configurations & interactions with absorber materials	Homogeneous slurries & solutions with absorbing materials	WIPP, EM Ops, NE	This would support additional Pu discards to waste tanks and potential downstream processing
4	Spent pebble-bed fuel in reprocessing and waste matrixes	Homogeneous and heterogeneous configurations	NE	This would support reprocessing designs/ops and waste handling/disposal
5	Waste drums and compactors likely in the thermal to intermediate neutron spectra	Interacting drums either uranium and/or plutonium and other actinides contaminated materials and discards (e.g., soil, protective clothing, equipment and building materials)	Transport, waste processing/compacting EM, NA, WIPP could realize space savings and reduction in number of over-the-road shipments	Limited to no information is available to validate the biases of safety calculations
6	GNEP AFCI	Cryogenic temperature measurements & positive temperature coefficients for Pu solutions	EM, NE, NASA	No benchmark data exists to test these temperature effects. Pu solutions are predicted to have positive temperature coefficients for concentrations below 30 g/l (this affects accident yields).

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7	Intermediate energy fission cross section measurements for 235U, 239Pu, and 233U.	Large scale experiments (of order 6 feet by 6 feet including reflector components). Compare three fissile materials in assemblies where most of the fissions occur between 10 ev and 10 keV neutron energy. These assemblies will be low average fissile density with significant amounts of non-fissile matrix material.	Primarily EM and NA, although NE and other nuclear materials handling offices will need this.	No benchmark data for 239Pu and 233U exist in this region. Very little exists for 235U. Any systems that involve low density fissile plus non-hydrogenous matrices will be likely to have fissions in this region. Such applications include waste disposal (including burial & burners), facility D&D, advanced reactor design, and advanced reprocessing activities.
8	Sodium thermal absorption/scattering experiments	NaCl crystal and solution critical and subcritical measurements	EM	To better chatacterize the influence of sodium on WIPP emplacement
9	Uranium – moly (super KUKLA) HPRR intermediate and thermal energy	Dissolver-like experiments with variable neutron spectra with molybdenum	EM	Molybdenum absorption x-secs are poorly tested in heterogeneous environments such as a metal dissolver
10	Titanium in thermal spectra	Heterogeneous and homogeneous experiments	EM	If the influence of titanium were benchmarked then computational biases could be validated then credit could be taken for the abosrption qualities of Ti thereby demonstrating an additional margin of subcriticality for safety or an increased throughput of waste treatment.
11	Lead reflection used in shipping casks (e.g., 9975 cask)	Generic experiments that test neutron transmission, absorption, scattering and (n xn) influences as reflectors and absorbers among units in an array	EM, RW, NE, NA	Experiments would provide benchmarks for validating criticality safety evaluations for shipping casks, primarily.

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12	233U intermediate spectra systems in support of the ISOTEK 3019 facility	Very concentrated solutions, damp oxides or heterogeneous lattices of 233U metal/oxide and moderators at different 233U-to238U ratios	EM	Experiments would provide benchmarks for validating criticality safety evaluations for processes involving the dilution of 233U at the ISOTEK 3019 facility
13	Address inconsistencies for BeRP Ball and arrays of 235U and 233U uranyl nitrate solutions that strongly disagree with Monte Carlo calculations	Repitition of historic experiments with an effort to better measure the spatial physics parameters (e.g., neutron leakage, scattering, absorption, fluxes, etc.)	NA	These experiments challenge the validity of benchmark evaluations. Experiments are (a) Pu refl by thick Be, (2) uranyl nitrate slab/cylinder intersections, (c) 233U solution arrays.
14	Uranium nitride and refractory materials	General physics experiments to address subcriticality of materials during fabrication, operation, and hypothetical accident conditions	NASA	Various refractory materials and fuels have not been tested to provide benchmarks to validate criticality safety evaluations of fuels fabrication or hypothetical accident conditions (e.g., compaction, moderation, etc.)
15	Variably enriched compounds on the order of 20wt% and weapons and reactor grade MOX considerations	General physics experiments to better characterized homogeneous and heterogeneous systems with variable moderation (under to over-moderated regimes) and enrichments around 20wt%	NE, NA, EM	Information is needed to provide benchmark data for validating NCS evaluations for materials preparation, production, fabrication, utilization and recovery/disposition
16	Electro-refining experiments	Critical or subcritical experiments to examine materials transitions and reactivity influences during electro-refining processes	NE, EM	To better characterize the subcriticality of operations and permit greater degrees of throughput optimization
17	Uranium-graphite-water and other materials impacting S(alpha-beta) models	Systems designed to maximize the impacts of S(a,b) materials, eg, dilute Pu solutions, carbon,etc.	EM, NA	Some S(a.b) models don't exist. Others are not well tested, particularly for dilute Pu solution systems.

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18	Large absorber storage arrays	General physics experiments that can simulate the neutronics of new-concept storage material absorbers (e.g., Borobond)	NA, EM	Densification of storage arrays could reduce the floor area for storage and liberate space for operations thereby reducing facility costs
19	Defense Waste Processing Facility – melter	Pu – glass – water mixtures with Fe, Gd, Na, Mn, B, Si diluents	EM	No benchmark data exists for these materials
20	Instrumentation calibration			
*Any split table measurements should consider the inclusion of sub-critical measurements.				