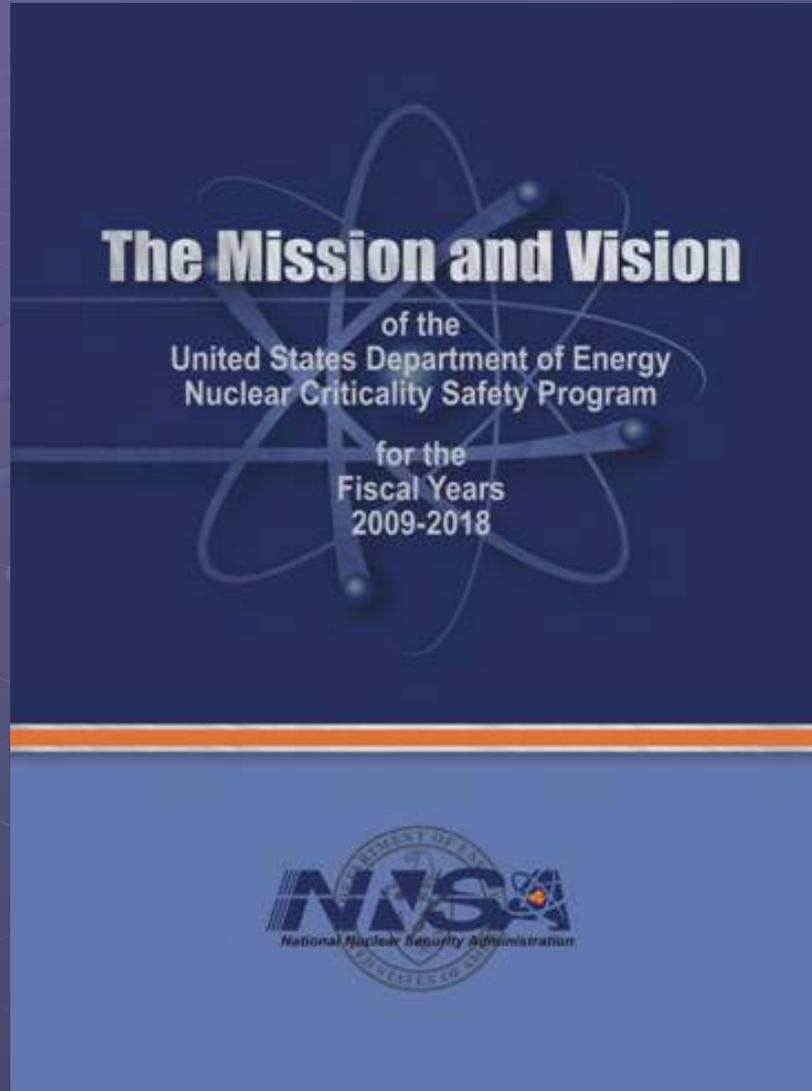


# The Mission and Vision of the U.S. Department of Energy Nuclear Criticality Safety Program

OECD-NEA Workshop on Future  
Criticality Safety Research Needs

September 21, 2009

# The NCSP Mission & Vision



# The NCSP Mission & Vision

## ● THE NCSP MISSION

- The NCSP mission is to provide ***sustainable expert*** leadership, direction, and the technical infrastructure necessary to develop, maintain and disseminate the essential technical tools, training and data required to support ***safe, efficient*** fissionable material ***operations*** within the U.S. Department of Energy (DOE).

## ● THE NCSP VISION

- The NCSP will be a ***continually improving, adaptable, and transparent*** program that ***communicates*** and ***collaborates*** globally to incorporate technology, practices and programs to be ***responsive*** to the essential technical needs of those responsible for developing, implementing, and maintaining nuclear criticality safety.

# NCSP Technical Elements

- International Criticality Safety Benchmark Evaluation Project (ICSBEP) – Reference Technical Data for Criticality Safety Engineers Worldwide
- Analytical Methods – Maintain and improve the Production Codes and Methods for Criticality Safety Engineers (e.g. MCNP, SCALE, & COG)
- Nuclear Data – Perform Measurements of Basic Nuclear (Neutron) Physics Cross-Sections and Generate New Evaluated Cross-Section Libraries and Covariance Data for Use in Production Criticality Safety Codes
- Integral Experiments – Critical and Subcritical Experiments at the Critical Experiments Facility (CEF) Now Being Stood Up at the Device Assembly Facility (DAF) in Nevada, the Restarted Sandia Critical Facility, and at Valduc (MIRTE)– provides integral tests of codes and data
- Information Preservation and Dissemination (IPD) – Protects Valuable Analyses and Information Related to Criticality Safety
- Training and Education – Web-based training modules and the Hands-On Criticality Safety Course at LLNL for the Department's Criticality Safety Engineers, Line Management, and Oversight Personnel

# Analytical Methods Vision

The AM element will sustain state-of-the-art radiation transport modeling capabilities and the expertise necessary to develop, maintain and disseminate the analytical tools and data libraries in a manner that is responsive to the needs of those responsible for developing, implementing, and maintaining criticality safety.

# Five-Year Goals for AM

- Perform analyses for criticality safety evaluations
- Perform sensitivity/uncertainty analyses
- Design experiments
- Analyze benchmarks
- Develop approaches and tools for analysis of accidents
- Analyze shielding and criticality accident alarm systems coverage
- Analyze burnup/depletion
- Participate in Critical-Subcritical Experiment Design Team (C<sub>E</sub>dT) process

# Planned FY10 AM Tasks

- \$2.5M invested at LLNL, LANL, and ORNL
- Maintain COG, MCNP, and SCALE/TSUNAMI and provide user assistance
- Major sponsor of the ORNL RSICC
- Provide nuclear data files using NJOY and AMPX in ENDF/B modern formats
- Design a Criticality Accident Detector benchmark experiment to conduct at CEA/Valduc using SILENE

# Nuclear Data Vision

The ND element will sustain world-class expertise and capabilities to continually improve and disseminate measured and evaluated differential cross-section and covariance data in a manner that is responsive to the needs of those responsible for developing, implementing, and maintaining criticality safety.

# Five Year Goals for ND

- Measured cross-section data
- Calculated, evaluated, and performance tested cross-section data
- Automated data validation incorporating the breadth of ICSBEP benchmark data, developed sensitivity/uncertainty tools, cross-section, covariance, and integral data to reduce predicted uncertainties in a rigorous defensible method which identifies and quantifies true data needs.

# Planned FY10 ND Tasks

- \$1.8M invested at ANL, BNL, LANL, LLNL and ORNL
- Conduct needed cross-section measurements at various facilities
- Maintain SAMMY
- Conduct data analysis of Gd and Dy measurements made at RPI
- Total delayed gamma files for ENDF-VI for  $^{235}\text{U}(n,f)$  reactions
- Nuclear data evaluation and testing supporting CSWEG and new ENDF files

# Integral Experiments Vision

The IE element will provide a sustainable infrastructure and a systematic, interactive process to assess, design, perform, and document integral criticality safety-related benchmark-quality experiments to support, safe, efficient fissionable material operations.

# Five Year Goals for IE

- Fully functional  $C_E dT$  process
- Fully staffed CEF at DAF with succession planning
- Fully functional CEF at DAF
- New projects development
  - Solution assembly
  - General-purpose horizontal split table
  - Radiochemistry/processing
  - Low scatter facility
  - Security posture to accommodate uncleared personnel and foreign nationals at US facilities

# Planned FY10 IE Tasks

- \$7M invested at INL, LLNL, LANL, SNL and ORNL
- Maintain capability to perform 7% water moderated/reflected criticals at the Sandia Critical Experiments Facility (establish training capability for uncleared personnel)
- Integrate TSUNAMI into  $C_E dT$  process
- Participate in the Valduc/SILENE dosimetry exercise in October, 2009
- Startup CEF at DAF in 2010!!!

# Collaboration with CEA and IRSN

- Close to finalizing an agreement in principle between the NNSA, CEA and IRSN to jointly refurbish and operate a criticality experiments facility at Valduc
  - New actinide solution (Pu/U/Am) super-prompt critical assembly to replace existing SILENE
  - Large horizontal split table capability
  - Refurbishment phase runs from FY11-18 and the operational phase runs for at least ten years beginning in FY19
- Ongoing MIRTE experiments with IRSN, CEA, AREVA, and ANDRA

# A Possible Future

Imagine, we can see the renaissance of criticality safety experiments within the next 10 years:

- General purpose fast-burst and dry system critical experiments facility at CEF/DAF
- Special purpose experiment and training critical experiments facility at SNL
- General purpose actinide solution super-prompt critical assembly and large split-table capability at Valduc
- Supports safety and efficiency of new generation reactor designs, advanced fuel cycles, waste disposal, criticality accident response and detection, military applications, and nuclear counter-terrorism applications
- Fully integrated research program with integral experiments, state of the art sensitivity/uncertainty analysis, nuclear data processing, and benchmark analysis, and hands-on training at all facilities