US DOE NCSP Nuclear Criticality Safety Engineer Hands-on Training and Education Course

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Coordinator

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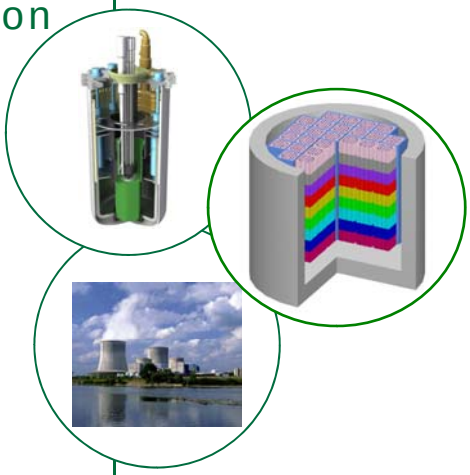


U.S. DEPARTMENT OF ENERGY

OAK RIDGE NATIONAL LABORATORY
MANAGED BY UT-BATTELLE FOR THE DEPARTMENT OF ENERGY

Discussion topics

- US DOE NCSP Nuclear Criticality Safety Engineer Hands-on Training and Education Course (T&EC)
  - Purposes
  - Development
  - Description
  - Schedule
  - Registration request

Purposes of T&EC

- Meet US DOE NCSP Mission and Vision* objectives for T&EC by
  - Providing DOD or DOE security cleared or non-cleared nuclear criticality safety engineers and managers with quality uniform training and education regarding “hands-on” sub-critical and critical experiments training and classroom education on the application of DOE HQ interpretations and positions regarding such topics as regulations, guides, orders, standards, utilization of non-destructive analysis results, safety evaluations and analyses, and other topics as judged appropriate by the US DOE NCSP Manager

* See http://ncsp.llnl.gov/NCSP-MV-COMPRESSED.pdf

Purposes of T&EC (cont.)

- Accommodate training and education recommendations from the
  - US DOE NCSP Criticality Safety Support Group (CSSG)* and
  - US DOE NCSP Criticality Safety Coordinating Team (CSCT)*
- Deliver multiple future two-week nuclear criticality safety engineer hands-on subcritical and critical experiments training and education courses

* See http://ncsp.llnl.gov/cssgMain.html

Purposes of T&EC (cont.)

- Provide a DOE-consistent level of DOE interpretation, understanding, awareness and applications regarding
  - DOE Rules, Orders, Standards, Guides, ANS Standards
  - Performance of Criticality Safety Evaluations
  - Hazards Analysis Methods and Implementation/maintenance of NCS Controls
- Ensure versatility for cleared and uncleared students
- Provide alternate/backup facility capabilities for hands-on training
- Provide experimental hands-on training addressing
  - Characteristics of Neutron Multiplying Systems
  - Discussion of
    - Theory
    - Implications for the Safety of Fissionable Material Operations

Development responsibilities for the T&EC include

- **Oak Ridge National Laboratory (ORNL) for structuring, organizing and coordinating development**
- **US DOE NCSP Criticality Safety Support Group* (CSSG) and Criticality Safety Coordinating Team* (CSCT) for suggesting and reviewing T&EC content and materials**
- **Providing facility support and instruction/development by:**
  - **Los Alamos National Laboratory (LANL) TA-55/PF-4**
  - **Sandia National Laboratories (SNL) Sandia Pulse Reactor Facility/Critical Experiments (SPRF/CX)**
  - **Nevada National Security Site (NNSS) Device Assembly Facility (DAF), National Critical Experiments Research Center (NCERC) - LANL and Lawrence Livermore National Laboratory (LLNL)**

*** See http://ncsp.llnl.gov/cssgMain.html**

Description of future two-week US DOE NCSP NCSE T&EC

- First week classroom education, exercises and facility tours and training at LANL and TA-55/PF-4
- Second week hands-on subcritical and remote-assembly critical experiments training at either
  - NNSS DAF NCERC (currently for Q-cleared)

    or
  - SNL SPRF/CX (currently for DOE Q-cleared, L-cleared and uncleared)

First week classroom education, exercises and facility tours and training at LANL and TA-55/PF-4 include

- **Tours of & training about TA-55/PF-4 plutonium processing operations**

First week classroom education, exercises and facility tours and training at LANL and TA-55/PF-4 include (cont.)

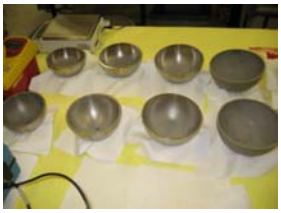
- **NCS history, fundamentals, and data**
- **Process accidents and lessons learned**
- **Human factors and equipment reliability**
- **Hazards analysis techniques**
- **ANSI/ANS-8.XX standards review**
- **US DOE Rules, Orders, Standards, & Guides reviews and expectations**
- **Review of hand calculation methods and point reactor kinetics approximations**
- **Non-destructive analysis methods, results, interpretations and applications to NCS evaluations**
- **Training on and completion of US DOE STD 3007 compliant NCS evaluations**

Second week experiments training at either the NNSS DAF NCERC or SPRF/CX to include:

- **Tour of experiments facilities**
- **Classroom refresher training and education in**
  - **Reactor theory, subcritical multiplication, inverse multiplication applications, and nuclear instrumentation**
  - **Critical experimentation**
    - **Historical perspective**
    - **Experimental accidents & lessons learned**
  - **Development of experimental plans**
  - **Hands-on sub-critical experiments**
  - **Remote assembly critical experiments**
- **Performance and analysis of supervised experiments**

Second week experiments training at the NNSS DAF NCERC to include:

- **Hands-on Subcritical Training Assembly for Criticality Safety (TACS)**

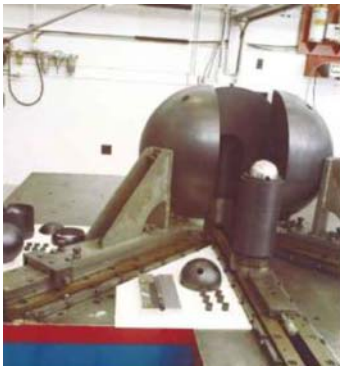


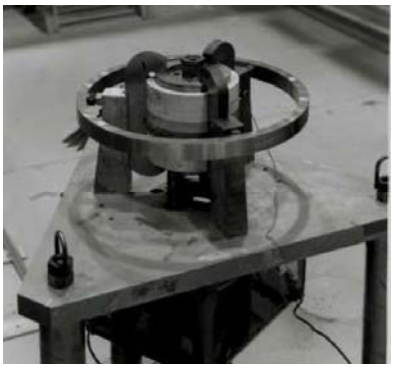
Second week experiments training at NNSS DAF NCERC to include (cont.)

- **Subcritical hands-on stacking of U(93) foils on Planet and subsequent remote critical assembly**

Second week experiments training at NNSS DAF NCERC to include (cont.)

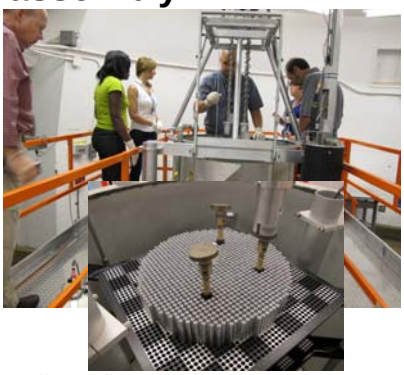
- **Remote critical assembly of Flattop**
- **Remote critical assembly and pulsing of Godiva**

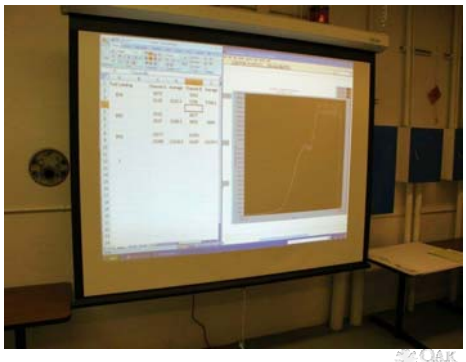




Second week experiments training at SPRF/CX to include

- **Subcritical hands-on loading and approach to critical on fuel rod number, water hole or separation, and/or water height for the CX assembly**





Recap of T&EC Course Description

Overview	The DOE NCSP NCSE T&EC is specifically developed to establish, train and support consistent hands-on training and regulatory expectations, interpretations, and applications within the DOE contractor community.
Purpose	This Course will supplement NCSE training and education that is not available from the employer (e.g., hands-on critical and sub-critical experiment training in experiments facilities, education in DOE Headquarters regulatory interpretations and expectations for site nuclear criticality safety programs).
Audience	U. S. Department of Energy and contractor personnel, consulting personnel in commercial enterprises preparing and reviewing criticality safety operations, evaluations, and/or performing program reviews for DOE contractors.
Prerequisites	Background in sciences and engineering and completion of identified prerequisites.

Recap of T&EC Course Description (cont.)

Content

- **Education about DOE nuclear criticality safety (NCS) program regulatory**
  - **Interpretations**
  - **Expectations**
- **Review of ANSI/ANS-8.XX standards and their relevance to DOE NCS programs**
- **Introduction to:**
  - **Hazards analysis**
  - **Application of NDA measurements and results to criticality safety evaluations**
  - **Human factors and equipment reliability**
- **Field observations and class exercise in performing DOE-STD-3007-compliant criticality safety evaluations**
- **Confirmation of student comprehension through monitored and documented classroom and laboratory exercises, observations, and tests**
- **Instruction on**
  - **performing critical and/or sub-critical measurements**
    - **theory and characteristics of neutron multiplying systems**
    - **implications for the safety of fissionable material operations**
- **Guidance in the performance and analysis of hands-on critical and/or sub-critical measurements**

Recap of T&EC Course Description (cont.)

Duration	80 hours over two contiguous weeks
Method of Instruction	This is an in-experimental facility, hands-on training and classroom education Course consisting of instruction, presentations, experimental exercises, small group problem solving, and knowledge assessment/evaluation of crucial concepts supporting criticality safety evaluations and programs.
Course Materials	Students receive a copy of all Course viewgraphs and selected reference documents. An evaluation form and a Certificate of Training are distributed upon completion of the Course. Mandatory comprehension evaluations are performed to evaluate the student's grasp of the training and education material presented in the Course.

Current schedule* of Hands-on T&ECs

- **23 January – 3 February 2012**
- **19 – 30 March 2012**
- **14 – 25 May 2012**
- **20 – 31 August 2012**
- **15 – 26 October 2012 ****
- **3 – 14 December 2012**
- **7 – 18 January 2013**
- **25 February – 8 March 2013**
- **13 – 24 May 2013**
- **15 – 26 July 2013**
- **16 – 27 September 2013**

*** See http://ncsp.llnl.gov/classMain.html for schedule and registration request information for all course dates.**

**** This course may be cancelled or rescheduled.**

Hands-on T&EC registration request

See US DOE NCSP website @

http://ncsp.llnl.gov/classMain.html