LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-CONF-652026

The Official Website of the U. S. Department of Energy's Nuclear Criticality Safety Program

B. L. Koponen, D. P. Heinrichs, C. K. Lee, L. Scott

March 20, 2014

19th Pacific Basin Nuclear Conference
Vancouver, Canada
August 24, 2014 through August 28, 2014

Disclaimer

The 19th Pacific Basin Nuclear Conference (PBNC 2014)
Hyatt Regency Hotel, Vancouver, British Columbia, Canada, August 24-28, 2014.

PBNC2014-065

THE OFFICIAL WEBSITE OF THE U. S. DEPARTMENT OF ENERGY'S NUCLEAR CRITICALITY SAFETY PROGRAM

B. Koponen,[1] D. Heinrichs,[1] C. Lee[1] and L. Scott[2]
[1] Lawrence Livermore National Laboratory, California, U.S.A.
[2] SAIC, Solana Beach, California, U.S.A.

Abstract

The U.S. Department of Energy (DOE) Nuclear Criticality Safety Program (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 to support safe, efficient fissionable material operations within the DOE. The NCSP Website site makes a variety of information available to the criticality safety practitioner, including reference materials, training modules and links to related sites. It assists criticality safety personnel to keep abreast of NCSP activities or current developments in criticality safety via a "What's New" section within the Website. Convenient access to the many useful features of the Website is available via drop-down menus. The Website is also available to non-DOE and international professionals tasked with ensuring safe operations involving fissionable nuclear materials.

Introduction

The U.S. Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP) is funded and managed by the National Nuclear Security Administration (NNSA), and is essential in ensuring effectiveness of DOE criticality safety programs, including those of small sites that may not have adequate resources to build and maintain a robust criticality safety program. The five key NCSP (interdependent) programmatic elements are: Analytical Methods, Information Preservation and Dissemination, Integral Experiments (critical and sub-critical benchmark experiments performed at the National Critical Experiments Research Center at the Nevada National Security Site), Nuclear Data, and Training and Education. Figure 1 schematically displays the U.S. Department of Energy's Criticality Safety Program.

The NCSP Website provides an online means to disseminate criticality safety information rapidly and facilitates communication among criticality safety practitioners worldwide. The Website also contains a gateway of hyperlinks to other sites containing criticality safety information resources. From its inception, the Website has provided relevant information in a user-friendly environment for the criticality safety community."

This paper describes the development history of the NCSP Website, its mission and key functions, its role in effecting communication among many stakeholders of the criticality safety community, major accomplishments and lessons learned, and its continuing development.

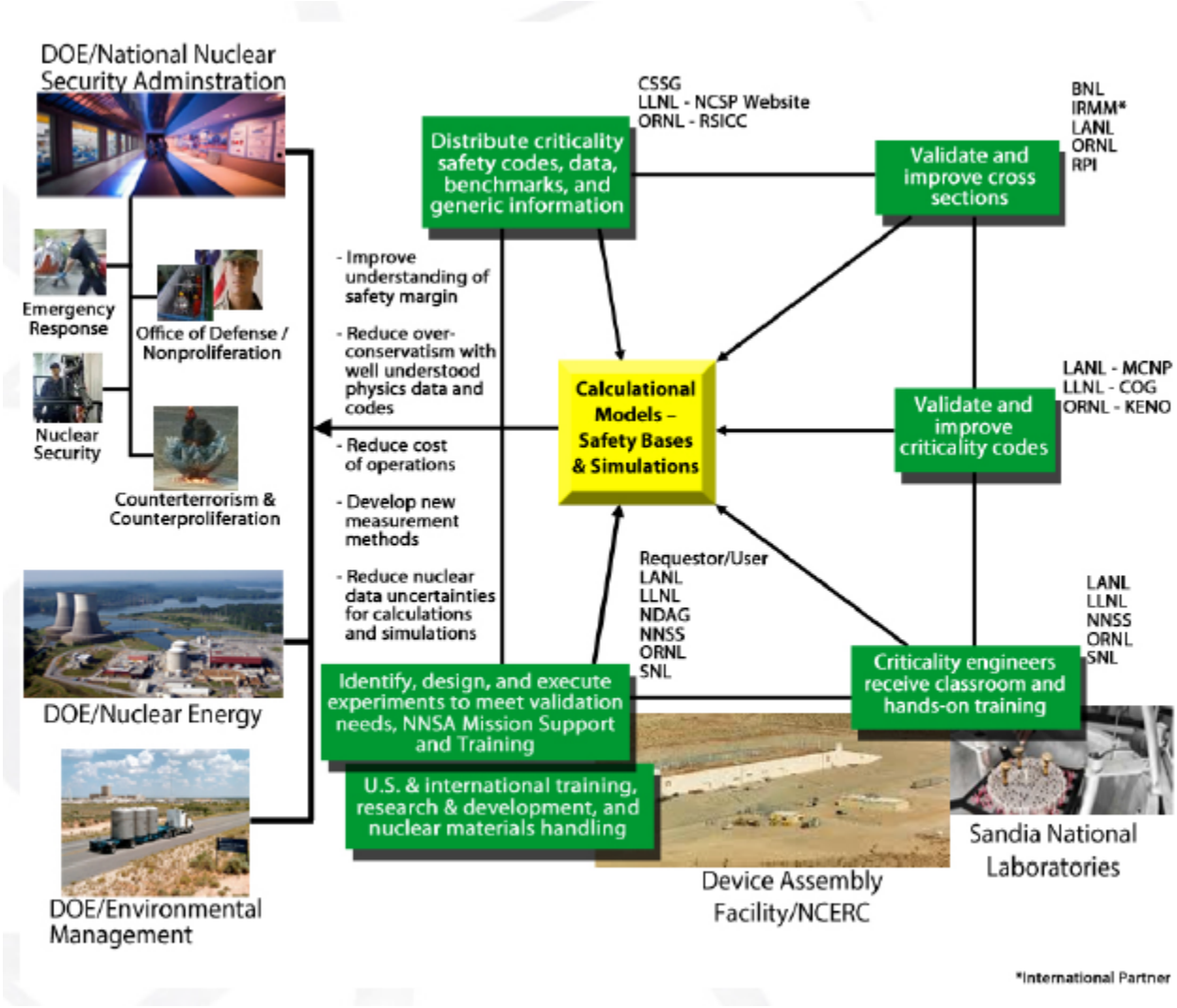

Figure 1 The U.S. Department of Energy's Integrated Nuclear Criticality Safety Program

1. Overview and History of the Website

In 1988 the U.S. Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 97-2, *Continuation of Criticality Safety*, spurred the establishment of the DOE NCSP Website.

The Website assists in the DOE's goal to provide easy access to a wide variety of criticality safety information. The content and format of the Website are the results of cooperative effort among many stakeholders in the nuclear criticality safety community. The Website is maintained by Lawrence Livermore National Laboratory (LLNL). The NCSP Website can be accessed online at http://ncsp.llnl.gov. The Website is accessible and free to the worldwide criticality safety community. The Website is maintained by computer specialists who can provide assistance for any access issues.

The original design of the NCSP Website consisted of web pages with hyperlinks to direct users to the original source of the reference material. The Website continues to evolve and expand. Some of the improvements resulted from a survey to obtain users' feedback on their needs and their assessment of the Website. A navigational buttons menu was set up to facilitate information location and retrieval. This new design change was based on an on-demand, pop-up menu, which was a JavaScript-activated navigational menu. It provides users with flexibility to access the information directly within the Website by simply clicking on a selected item. Other changes included the following:

- A separate column for the navigation menus for user-friendliness.
- New sections and topics can be easily added and partitioned within the Website
- An email directory for nuclear criticality safety professionals.
- An on-line class registration application for the NCSP Hands-on Training and Education Course.
- News alerts and announcements of criticality safety information.
- General help for new criticality safety practitioners, including basic technical references and training modules.
- A new web page on computational methods.
- Search engines for the LLNL bibliographic database and the Hanford databases with links to the selected documents.

2. Some Key Components of the Website

In this section we discuss some of the key Website resources.

2.1 Self-help teaching resources

Currently, no comprehensive specific academic training in criticality safety is offered by accredited colleges/universities in the U.S.A.. In most instances, criticality safety training is offered by these education institutes as a small part of nuclear engineering curriculum. Thus, criticality safety expertise is learned mostly through on-the-job training. The NCSP Website provides valuable general help for newcomers to this field. General help includes a list of basic key references in the field, relevant DOE orders and standards, a list of national criticality safety consensus standards, and key handbook references such as the online ARH-600 data and the news on key analytical methods. The Website includes an online-viewable set of Critical Experiment Heritage Videos that is of interest to both newcomers and experienced criticality engineers.

2.2 A repository of nuclear criticality safety engineer training (NCSET) modules

There are sixteen NCSET modules currently available to the users. These NCSET modules range from training on introductory nuclear criticality physics, neutron interactions, to practical training on subcritical safety limits and how to prepare a criticality safety evaluation. These modules are meant to be used in conjunction with other resources such as the NCSP hands-on training courses and university courses. The material in these NCSET modules is suitable for introductory level training of criticality safety personnel who either do not have a nuclear engineering background or who need a basic level refresher course. With the advance of multi-media technology, conversion of the text-based NCSET modules to a multi-media presentation format greatly enhances the effectiveness of such online training.

2.3 Bibliographic databases

2.3.1 Hanford database

This database contains 4853 references to publications on nuclear criticality safety. Information includes the title of the publication, author, document in which the publication can be located, date of publication, and a value index based on the type of document and peer review to which the publication was subjected. Each publication is also categorized by one or more major topic and sub-topic.

2.3.2 LLNL database

A large number of criticality safety documents have been collected at the Lawrence Livermore National Laboratory. Documents in this collection are dated as early as 1943. Authorship includes such notables as Fermi, Bethe, Feynman, and Kahn. This collection was begun at the Lawrence Radiation Laboratory (as it was known at the time) and eventually provided data for a bibliographic database located on mainframe computers (so long ago input was prepared on punched cards). The bibliography was originally intended for use by Livermore staff members but criticality safety "pioneers" encouraged us to make the database available to the broader criticality safety community and even contributed copies of their bibliographies and reports. The bibliography now contains approximately 21,000 records. About 1,700 publically-available full-text documents have been downloaded and are connected through links within the bibliographic database. Historic documents are being scanned into

digital format and are being included as full-text online-viewable documents. Journal articles and recent conference proceedings are not usually available for online viewing, although abstracts are included for most documents. Proceedings of some "vintage" conferences are also being scanned.

2.4 International criticality safety benchmark evaluation project (ICSBEP)

The International Criticality Safety Benchmark Evaluation Project (ICSBEP) maintains a continually improving, globally-interactive program that provides identification and acquisition of needed experimentally criticality safety-related benchmark data, rigorous evaluation of those data, and formalized documentation of the data for preservation and dissemination in support of safe, efficient fissionable material operations worldwide.

International experts help to identify and evaluate criticality-safety-related experimental benchmark data, verify the integral data, evaluate the data and to quantify overall uncertainties through various types of sensitivity analyses, compile the data into a standard format, perform sample calculations using standard criticality safety codes and data, and formally document the work into a single source of verified, extensively peer-reviewed benchmark data

LLNL is responsible for supervising developing, maintaining, and preserving NCSP benchmark data and liaising with the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) for publication. ICSBEP benchmarks can be viewed online via the NCSP Website or can be obtained in DVD format.

2.5 Integral experiment request process

The Integral Experiment Request Process provides 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. In order to facilitate this task, a Critical Subcritical Experiment Design Team (CE_dT) process was formed. The goal of the CE_dT process is to provide a systematic and efficient means to identify, design, and approve all new integral experiments. This process will ensure that the Requestor's nuclear data validation needs are well-understood and met by integrating all capabilities of the NCSP to design and approve the experiment, consistent with the Guiding Principles of Integrated Safety Management. In order to submit integral experiment requests to the NCSP, an *Integral Experiment Request Form* is provided on the Website for the Requestor to complete and submit.

Hands-on training and education program

The DOE NCSP Training and Education Program (T&EP) element continues to offer hands-on training courses and identifies and develops training needs and resources in areas where no suitable materials exist. The primary purpose of the T&EP element is to maintain the technical capabilities of criticality safety professionals and provide for the training and education of people entering the criticality safety discipline from related scientific fields. The T&EP element identifies, develops, provides, and promotes practical and excellent technical training and educational resources that foster competency in the art, science, and implementation of nuclear criticality safety and is adaptable and responsive to the needs of those responsible for developing, implementing, and maintaining criticality safety.

The purpose of the courses is to provide an experimental hands-on training experience addressing important characteristics of neutron-multiplying systems, which include parameters important to criticality safety and providing awareness and understanding of DOE mandates developed specifically for criticality safety professionals, regarding application of DOE Orders, Guides, Rules, and American Nuclear Society standards in performance of criticality safety evaluations that meet DOE standards and hazards analysis methods and implementation/maintenance of nuclear criticality safety controls.

The courses have been prepared and are taught by experts from Los Alamos National Laboratory, Sandia National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory (ORNL), and the DOE NNSA. ORNL coordinates the courses for the DOE NNSA NCSP. The Website provides information regarding the courses and a page for course registration. Figure 2 displays a hands-on training session in progress.

Figure 2 Hands-on training in progress

3. Goals and Direction of the NCSP IP&D Program Element

The DOE's Information Preservation and Dissemination (IP&D) program element preserves primary documentation supporting criticality safety and makes this information available for the benefit of the technical community, including international partners (e.g., AWE, CEA and OECD). The NCSP internet Website (http://ncsp.llnl.gov) is the central focal point for access to criticality safety information collected under the NCSP and the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information/resources.

The IP&D element will:

- Identify, preserve, and disseminate selected technical, programmatic, and operational information that enables those responsible for criticality safety to sustain, enhance, and continually improve performance in support of safe, efficient fissionable material operations
- Establish a structured approach using expert groups and individuals who will assist in identifying and selecting existing sources of organized information and other types of technical, programmatic, and operational information for preservation.
- Establish easily accessible repositories (unclassified and classified) that can be sustained to provide for preservation and digital dissemination of the selected information.
- Provide processes for evaluating available material for IP&D value; archive and disseminate training and operational videos (historical and current).
- Preserve unclassified topical references (waste drums, vault storage, onsite and offsite transport, criticality alarm placement, D&D, etc.).
- Continue to maintain and improve the NCSP Website to support the IP&D mission.
- Encourage awareness and wider use of the Website (such as this conference paper).

Conclusion

Criticality safety is of fundamental importance to operations with fissionable materials. Ensuring that a criticality accident never happens again in a DOE facility is one key facet of the DOE mission supporting the national security and energy needs of the United States. The NCSP Website is an important tool to share information within the DOE community and with other criticality personnel in the United States as well as internationally. The NCSP Website is a key component of the NNSA NCSP's information dissemination function and works closely with other programmatic elements as an online vehicle to facilitate timely communication and dissemination of information for all NCSP stakeholders. The information summarized in this paper provides only a glimpse at the content of the NCSP Website. The extensive content and the communication resources will be of value to both newcomers and more-seasoned nuclear criticality personnel, and others in the nuclear community. We encourage nuclear personnel to explore this resource. Helpful contributions and suggestions will be appreciated. The address of the Website is http://ncsp.llnl.gov.

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344.