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

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ABSTRACT

This paper discusses the official Website of the U. S. Department of Energy's (DOE) Nuclear Criticality Safety Program (NCSP). This site makes a variety of information available to the criticality safety practitioner, including reference materials, training modules and links to related sites. The drop-down menus provide convenient access to the many useful features of the Website, including recent news and additions. 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 to support safe, efficient fissionable material operations within the DOE. The NCSP Website assists in the DOE's goal to provide easy access to this wide variety of 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 being maintained by Lawrence Livermore National Laboratory for the DOE NCSP. Some recent additions to the Website include: (a) A means to submit an integral experiment request form for nuclear data validation needs. This process provides a sustainable infrastructure and a systematic, interactive process to assess, design, perform, and document integral criticality safety-related benchmark-quality experiments. (b) Online access for users of the International Criticality Safety Benchmark Evaluation Project (ICSBEP) to the ICSBEP's benchmark evaluations and other resources. (c) Online information and registration to the NCSP Hands-on Training and Education Course. (d) An expanded LLNL Bibliographic Database which now contains information on about 16,000 nuclear criticality documents, plus over 1,700 that are available in full-text pdf-format, that can be viewed via links within the Database.

Key Words: Criticality, Safety, NCSP, ICSBEP, Website

1 INTRODUCTION

1.1 The Value of the Website

The US Department of Energy (DOE) Nuclear Criticality Safety Program (NCSP) is one of the key DOE initiatives to sponsor an effective infrastructure to support criticality safety needs across the DOE complex. The NCSP, funded and managed by the National Nuclear Security Administration (NNSA), is essential in ensuring effectiveness of DOE site criticality safety programs: individual sites may not have the resources to build and maintain the required

infrastructure for a healthy criticality safety program. The seven key NCSP programmatic elements are international criticality safety benchmark evaluation, analytical methods and code development, nuclear data, differential measurements, integral experiments (critical and sub-critical benchmark experiments performed at the National Critical Experiments Research Center at the Nevada National Security Site, and at Sandia National Laboratories), information preservation and dissemination, and training and education. These areas are interdependent and form a complete set of infrastructure elements for a strong national criticality safety program. The NCSP Website is a key component of the information dissemination segment and works closely with other programmatic elements as an online electronic vehicle to facilitate timely communication and dissemination of information for all NCSP stakeholders.

1.2 Overview of the Website

The DOE NCSP Website can be accessed online at <http://ncsp.llnl.gov>. The drop-down menus provide convenient access to the many useful features of the Website, including recent news and additions. The Website assists in the DOE's goal to provide easy access to this wide variety of 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). 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.

2 HISTORY OF THE WEBSITE

2.1 The Beginnings

The NCSP Website began in 1988 as part of the DOE implementation plan in response to the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 97-2, Continuation of Criticality Safety, which reflected the need to make criticality safety information available to a wide audience. Since its inception, the Website has been used by criticality safety practitioners worldwide to access criticality safety information. The Website also contains a gateway of hyperlinks to other sites containing criticality safety information resources. The NCSP Website provides an online means to disseminate criticality safety information rapidly and facilitates communication among criticality safety practitioners. The original design of the Website consisted of web pages with hyperlinks to direct users to the original source of the reference material. The use of hyperlinks helps to ensure that the most current data is retrieved and avoids duplication of effort. From its inception, the Website has provided relevant information in a user-friendly environment for the criticality safety community.

2.2 Continued Improvements

The NCSP Website has continued 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 new design was then implemented in 2001. At that time, a navigational buttons menu was set up to facilitate information location and retrieval. The NCSP constantly strives to ensure that the Website better serves the DOE and worldwide community by soliciting users' input. Through

additional users' feedback, another Website design change was made in June of 2003. 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. Another design change was implemented in June of 2005 and included the following:

- A separate column for the navigation menus for user-friendliness.
- New sections and topics can be easily added on 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 data base and the Hanford databases with links to the selected documents.

3 MISSION AND KEY FUNCTIONS OF THE WEBSITE

3.1 A Central Focal Point

The NCSP Website (<http://ncsp.llnl.gov>) is the central focal point for access to criticality safety information collected under the NCSP, and serves as the gateway to a comprehensive set of hyperlinks to other sites containing criticality safety information resources. The NCSP Website serves as an efficient means for the DOE NCSP to disseminate information electronically to the entire criticality safety community. Only information authorized by the NNSA NCSP Manager is available on the Website. Several important functions provided by the Website are summarized below:

3.2 Information Rapidly Available

The NCSP Website provides for on-line rapid dissemination of relevant criticality safety information to the user community. The Website is accessible and free to the criticality safety community worldwide. The Website is maintained by computer specialists to provide assistance for any access issues.

3.3 Self-Help Teaching Resources

Currently, no comprehensive specific academic training in criticality safety is offered by accredited colleges/universities. 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.

3.4 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.

3.5 Searchable Bibliographic Databases

A criticality safety professional can access the site to search relevant technical references in criticality safety. Search engines are provided to facilitate electronic searching of thousands of technical references. A list of key criticality safety groups with expert resources is provided to help newcomers. The Website strives to provide a professional and user-friendly environment to newcomers. A newcomer to this field can obtain personal help from many criticality safety professionals. In addition, a message board provides a forum for asking questions and soliciting help from individuals or organizations in the community.

3.6 Timely Communication

A nuclear criticality accident anywhere in the world will attract instant world-wide media attention, thus timely communication of accurate information is essential to avoid confusion, rumors, and unwarranted fears. The NCSP Website serves as an effective vehicle to facilitate communication among the programmatic elements and by doing so also provides valuable technical resources and a communication forum to benefit the entire criticality safety community. Effective communication tools also assist in the professional development of members of the criticality safety community.

3.7 Website Examples

The NCSP sponsors an infrastructure which encompasses many technical resources including neutron cross section work, critical/subcritical measurements, benchmarks, analytical methods, hands-on training, etc. The Website provides a valuable means for the NCSP to communicate to its stakeholders. For example, the current five-year plan is listed in the Website along with the past NCSP activities/accomplishments.

The Website lists the key NCSP organizational elements and supplies a forum to enhance communication among various key stakeholders, including an oversight group and the contractor's end-user group. Separate web pages are available to enhance communication needs of separate groups or to report the progress of a new project. For example, a web page follows the progress of the National Criticality Experiments Research Center (NCERC)). Similarly, separate web pages are posted for the DOE Criticality Safety Coordinator Team (i.e., federal

criticality safety staff) and for the end-users group (i.e., the contractors' criticality safety professionals).

The contractors' end-users workshop assembles to discuss issues associated with operations support at various nuclear facilities. The presentation viewgraphs are posted to assist the criticality professionals who are not able to attend. The value of an online setting to supplement professional conferences or workshops cannot be overestimated. The NCSP Website is used to quickly inform the criticality safety community of criticality code errors as soon as possible after they are discovered and assessed for impact by the NCSP Manager.

4 ACCOMPLISHMENTS

4.1 Website Usage

The NCSP Website has served the nuclear criticality safety community for the last thirteen years. It provides prompt and up-to-date criticality safety information to the entire DOE complex and the worldwide criticality safety community. The content and format of the Website are continuously improved in response to users' feedback. The accomplishments to-date include 257 registered users worldwide, over 89,000 total visitors, over 20,000 aggregate downloads of the training modules, and a substantial bibliographic databases. More importantly, however, is the role that the Website plays in enhancing communication among criticality safety professionals for their professional growth and in providing resources to help newcomers to this important field.

4.2 Lessons Learned

To be successful as a nuclear criticality safety community website, the participation of criticality safety professionals is essential to provide feedback on the effectiveness of the Website in order to meet their needs. Since its inception, the NCSP Website has been a joint community effort to improve its format and content. Frequent surveys and conference presentations are used as important means to receive input from the community.

5 RECENT DEVELOPMENTS

5.1 Expansion of the LLNL Bibliographic Database

The LLNL bibliographic database—available within the LLNL Database of the NCSP Reference Database section—is continually updated and includes recent publications published in journal articles and proceedings such as those published by the American Nuclear Society and the International Conferences on Nuclear Criticality Safety (ICNC). The LLNL bibliography now contains approximately 16,000 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 (see Figs. 1 & 2). Journal articles and recent conference proceedings are not usually available for online viewing, although abstracts are included for most documents in the bibliographic database. Documents from a large collection preserved by Joseph

Thomas and Howard Dyer at Oak Ridge National Laboratory have been subsumed into the bibliographic database. Incorporation of scanned copies of these documents into the NCSP database is being considered.



Figure 1. The NCSP historic document collection

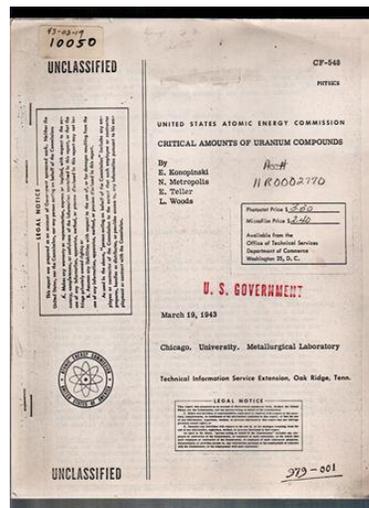


Figure 2. An historic scanned document (sample)

5.2 International Criticality Safety Benchmark Evaluation Project (ICSBEP)

The (DOE) Nuclear Criticality Safety Program (NCSP) is chartered with maintaining the technical infrastructure necessary to ensure safe, efficient operations from a criticality safety perspective. One of the broad technical program sub-elements that support the NCSP and its identified goals is the International Criticality Safety Benchmark Evaluation Project (ICSBEP). “The ICSBEP will maintain a sustainable and 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 those data for preservation and dissemination in support of safe, efficient fissionable material operations worldwide.”

LLNL is responsible for supervising development, maintaining, and preserving NCSP benchmark data and liaising with the Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency (NEA) for publication through the ICSBEP. 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. Questions regarding this process should be directed to the LLNL Task Manager, David Heinrichs at heinrichs1@llnl.gov or 925-422-2009.

Currently, the Website is managed and maintained by LLNL. Questions regarding issues with the Website, inoperable links, etc., should be directed to the NCSP webmaster, Chuck Lee at ncsp@llnl.gov or 925-422-2009. ICSBEP benchmarks can be viewed online via the NCSP Website or a file can be downloaded for burning into DVD format. A DVD can also be ordered for standard delivery (Fig. 3 shows an example copy of the DVD).

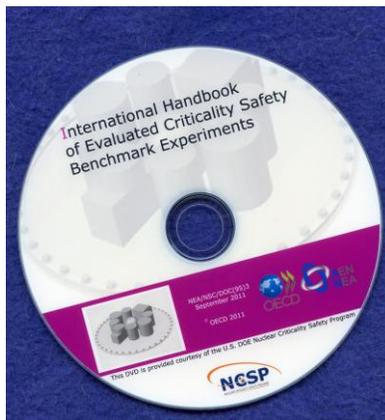


Figure 3. ICSBEP Evaluations are also available in DVD format

5.3 Integral Experiment Request Process

The IE Element 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. This integral experiment request process is for unclassified experiments only. For classified experiment requests, the Requestor should contact the CE_dT Manager to arrange a discussion directly with the NCSP Manager or his Deputy for this type of request. The CE_dT Manager is responsible for maintaining the CE_dT Process including any help needed with the Integral Request Form. Questions regarding this process should be directed to the CE_dT Manager, Nichole Ellis, at ellis_9899@msn.com or 803-381-3710. Questions regarding issues with the Website such as inoperable links, should be directed to the NCSP webmaster, Chuck Lee at ncsp@llnl.gov or 925-422-2009. Note: DOE or DOE contractors with a laboratory email extension (e.g., @lanl.gov, @inl.gov, etc.) generally have automatic access to the IER link of the NCSP Website without requiring a user ID and password. Otherwise, a requestor should contact the CE_dT Manager, Nichole Ellis at ellis_9899@msn.com or 803-381-3710 to request approval for access.

5.4 HANDS-ON TRAINING & EDUCATION

The DOE NCSP Training and Education Program (T&EP) element continues to offer hands-on training courses as needed by the DOE 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.

Two courses are sponsored by the DOE NCSP and are **FREE** to the participants (there is no tuition for these courses). One course is specifically designed for criticality safety professionals, while the other course is specifically designed for managers, fissile material operators, and process supervisors. 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 ANS 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. Questions about the courses should be directed to Becka Hudson at hudson14@llnl.gov, with a courtesy copy to Sedat Goluoglu at goluoglu@ornl.gov.

6 CONCLUSIONS

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. We encourage nuclear criticality safety personnel to explore this resource. Helpful contributions and suggestions will be appreciated. The address of the Website is <http://ncsp.llnl.gov>.

APPENDIX A

Online Section	A Brief Summary of the Website Online Information
NCSP Home Page	NCSP Website makes a variety of information available to the criticality safety practitioner, including reference materials, training modules and links to related sites. The drop-down menus provide convenient access to the many useful features of the Website, including recent news and additions.
What's New	Contains updates or additions to the Website.
NCSP Mission and Vision	The NCSP Mission and Vision will be achieved by identifying and accomplishing a set of five-year programmatic goals in five broad technical program elements that support identified five and ten-year goals. The yearly implementation plans are developed in collaboration with experts appointed by, and working under charters approved by the NCSP manager.

National Criticality Experiments Research Center (NCERC)	NCSERC is located at the Nevada National Security Site and operated by Los Alamos National Laboratory. NCERC maintains a substantial special nuclear material inventory and expertise to support a variety of nuclear security missions, including nuclear criticality safety research and training, nuclear emergency response, nuclear nonproliferation, and support for other Government Agencies that require hand-on access to significant quantities of nuclear material. Operations conducted at NCERC include both subcritical and critical experiments.
Integral Experiments Request	A Critical Subcritical Experiment Design Team (CE _d T) process is in place to provide a systematic and efficient means to identify, design, and approve all new integral experiments. This process ensures 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.
Nuclear Data Request	This program element includes the measurement, evaluation, testing, and publication of neutron cross-section data for nuclides of high importance to nuclear criticality safety applications. Criticality safety end-users are encouraged to identify their nuclear data needs by submitting a Nuclear Data Request to the NCSP Nuclear Data Advisory Group which provides recommendations to the NCSP Program Manager on prioritization of the technical resources of the Nuclear Data program element. Submission of a Nuclear Data Request initiates the process between the data requestor and NCSP Nuclear Data program element to meet those needs.
Hands-on Training and Education Course	This course is sponsored by the DOE's NCSP and is FREE to the participants (there is no tuition for this course). The course is designed to satisfy the DOE-STD-1135-99 requirement for hands-on experimental training for Nuclear Criticality Safety Engineers.
DOE NCSP Plan	This page provides access to the NSCP Five-Year Plan, the NCSP Task Managers, the NCSP Planning Calendar, and the NCSP Succession Planning.
DOE NCSP Accomplishments	The NCSP Accomplishments for recent years are listed here.
DOE Criticality Safety (CS) Groups	The CSSG was formed in response to Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 97-2, Criticality Safety. The CSSG functions as the technical support group to the Nuclear Criticality Safety Program (NCSP) manager, providing operational and technical expertise pertinent to the criticality safety needs of DOE missions. This expertise is relevant to experiments, nuclear data, methods, training, organizational structures and criticality safety evaluations.
Registration	Website users will find a form to enroll in the registry and

	can view the list of others who have registered.
Website Archives	Information posted in past years in online and downloadable pdf format are provided on this page.
Nuclear Criticality Safety (NCS) Information	This page provides a basic Reference Set of Rules, Standards, and Guides for newcomers.
CSE Database	The CSE database maintenance is part of NCSP Information Preservation and Dissemination element's subtask. This subtask is to collect publicly-available CSEs from DOE complex, to maintain and preserve CSEs in an electronic format, and to make it available in a searchable database
LLNL Database	The LLNL database is a searchable nuclear criticality bibliographic database which contains information on approximately 16,000 documents. Many of the document listings contain abstracts, and some have links to full-text files in pdf format.
Hanford Database	This database contains more than 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.
International Criticality Safety Benchmark Evaluation Project (ICSBEP) Handbook	This page includes a brief history of the CSBEP, ICSBEP and NCSP and details on how to peruse the ICSBEP Handbook online or obtain copies of a DVD version. A user's manual is provided for the DICE system which is a relational database containing information extracted from the ICSBEP Handbook.
Computer Codes	Links are provided to computer codes and data centers that are used as tools for NCS engineers to direct the performance of criticality safety across the DOE complex can be found on this page.
External NCS Links	Web links are provided to a variety of DOE sites and other sites with information of value to NCS professionals.
Training	This page provides links to a series of training modules that can assist training organizations in developing a criticality safety training program. These modules are meant to be used in conjunction with other resources such as the NCSP Hands-on 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.