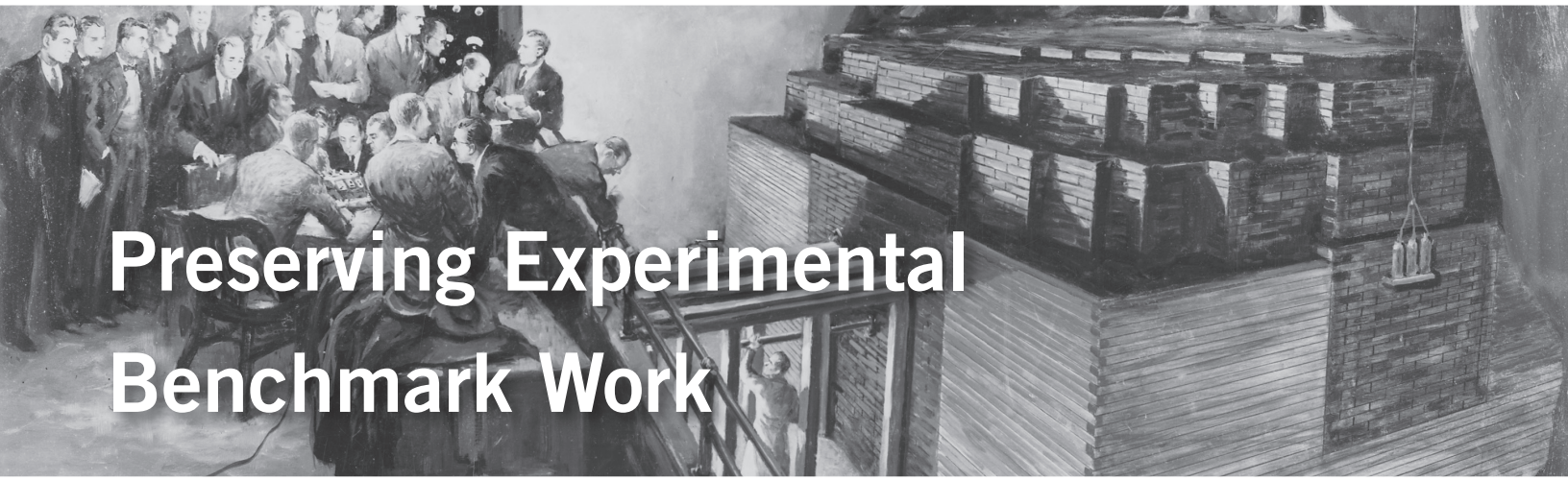
American Nuclear Society

Position Statement #48



Preserving Experimental Benchmark Work

It is the position of the American Nuclear Society that all past experimental documents should be immediately assessed as to their relevance and importance to preserving and advancing the science and technology of the nuclear field. Each experiment chosen as a candidate for preservation should proceed to a collection and review of reference and documents, including, if necessary, logbooks and personal contacts. The experimental information would be stored on a CD-ROM or equivalent media for long-term use.

SUMMARY

An immense amount of money has been expended for experimental work in the nuclear field for the past 50 years. Many of these experiments could never be repeated due to cost and safety constraints. The full experimental information lay within aging paper documents, logbooks, and memories of retiring experimental staff.

Referenced documents are lost yearly due to poor maintenance of records, misplaced due to facility closures, or are discarded due to a lack of understanding as to their value. Rarely does one report or publication contain all the information necessary to 'recreate' or model the experiment with the details allowed in today's sophisticated computer codes.

A comprehensive effort is needed to reclaim the value of this fading storehouse of information. Present day technology exists, in the form of electronic media, i.e., CD-ROM, which would efficiently house the experimental benchmark information. Experts in the fields of interest would be on hand to review the data and information for accuracy and to ensure all relevant and necessary information is included for its future use. The information could then be disseminated as a set of standards used globally for computational work.

JUSTIFICATION

The monies expended by the federal government in the past 50 years of nuclear experimental research are estimated into the tens of billions of dollars.[1] Many experiments could not be duplicated under today's safety standards and highly limited research funds. Documents describing the research, logbooks, and other key records are at high risk to loss by misplacement, accidental or intentional destruction, and decay.[2] Further, the experienced individuals are lost through facility closures and retirement. Hence, more key experimental information needed to fully describe past experimental results is lost each year.

It has been clearly presented in various references the need to collect important experimental information related to nuclear science and engineering.[3-6] By sharing and exchanging data with the international community and openly publishing the results of experimental research, all countries, including the United States, have benefitted. The ability to perform such a task has been demonstrated by the efforts of the International Criticality Safety Benchmark Experiment Project (ICSBEP).[7] Yet there is a lack of funding to complete the work needed elsewhere in nuclear shielding, thermodynamics, reactor physics, and fuel performance. Small programs, i.e., SINBAD,[5] do exist with dedicated professionals who have spent many on- and off-hours in a limited response to this problem.

Saving enough essential experimental data is the most limiting aspect to compiling a benchmark. Examples include large amounts of thermal-hydraulic facility test information from Oak Ridge National Laboratory, which have been lost over the years, due to the failure of the tape media storage system.[8] Also, the LOCA (Loss of Coolant Accident) experiments in the 1960s used for NRC licensing evaluations of complex computer code systems, lacked

much valuable measurement data due to outdated reporting criteria.[9] Further, some criticality experiments which were carried out in the 1960s at Hanford, Washington (Pacific Northwest National Laboratory), and recently valuable to the Fissile Material Disposition Program, could not be assigned a 'benchmark' status due to poor reporting procedures and the loss of the experimental logbooks.[10]

The next important task in providing archived benchmark information is in obtaining and organizing complete experimental information from the storage media and documents. At first glance, such data may be considered to exist in a single reference document, but experts in the nuclear field are finding a lack of complete descriptive information. Usually it is a misprint, lack of tabular results, or a complete omission of vital information. The missing experimental information often exists in various paper and/or electronic forms such as logbooks and experimental notes, and at times through personal contacts with the experimental personnel. The proper collection and evaluation of a single experiment may involve many professionals and span a period of days to a month. The collection and evaluation of experimental data needs a focused effort by educated individuals and access to key personnel and computational experts so that vital information may be recompiled into a document for use by future nuclear analysts.

Finally, the amount of time for computational work is not dominated by computer run times, but instead on the costly gathering and checking of input data. A significant saving of time and money would result from disseminating standard experimental benchmark sets to be used worldwide. The benchmark sets would establish a framework for professionals to validate and verify computer codes and would guarantee comparative analyses between experts. As experimental measurements became available to the benchmark collection, the broader spectra of validation and verification models in computer codes would reduce the uncertainties in computations for predictive use.

Overall, a standard benchmark set of experimental data would benefit the nuclear science and engineering field, preserve an endangered set of invaluable information, and result in a large economic advantage over repeating experiments whose date were lost through neglect.

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Photo credit: Chicago Pile-1 (CP-1), First nuclear chain reaction, Time 3:22 p.m, December 2, 1942. Place, Racquets Court under West Stands of Stagg Field, University of Chicago. Original painting by Gary Sheehan.

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