SINBAD 98
RSICC DATA LIBRARY DLC-191

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ABSTRACT

1.   **Name and Title of Data Library:**
      SINBAD 98:Shielding Integral Benchmark Archive and Database.

2.   **Computer for Which Program is Designed and Other Machine Versions Available:**
      PC 486, Pentium, UNIX Workstations

3.   **Problem Solved:**
      SINBAD began in 1992, prompted by the continued closure of experimental facilities world wide. The loss of benchmark experimental facilities jeopardizes the future of new shielding data. Further, the loss of lab notes and/or logbook records from poor document storage and/or aging, together with the loss of guidance from retirements of key experimental staff, complete benchmark data becomes a premium under today's strict quality assurance needs. The decision was made to collect, recompile, and distribute benchmark information in formats acceptable to the international community in an attempt to preserve and disseminate the information. The data integrity was checked and reference sources examined for self-consistency. At times, full benchmark information was gathered from multiple sources including personal contacts and laboratory logbooks.

      The ORNL Nuclear Analysis and Shielding Section effort was joined by the ORNL Radiation Safety Information Computational Center and the NEA Data Bank. The benchmarks chosen have international acclaim and broad usage in the nuclear shielding community. These benchmarks are a part of a recommended set from the Cross Section Evaluation Working Group (CSEWG), Nuclear Energy Agency Nuclear Science Committee (NEANSC), and the International Atomic Energy Agency Nuclear Data Section (IAEA NDS) and sanctioned for use as quality assurance in computational shielding verification and cross-section library production.

      The high accuracy of benchmark experimental data allows checks for quality assurance in user's computations or with new experimental results. The user may find a lack of experimental data in some energy regions which could become a focus for future computations and experiments. New data libraries containing revised cross sections may be verified and validated, drawing comparisons to previous cross-section data releases. New information on benchmark results, i.e.

new computations, revised data results, errors in data generation, will be provided as updates to this library, so users will find up to date applications in computational ready formats.

4.   **Method of Solution:**

SINBAD benchmarks include a large set of 25 fission shielding benchmarks. Six fusion shielding benchmarks were recently added, as well as two intermediate energy accelerator benchmarks. Work on follow-up versions of SINBAD will provide more benchmarks in fission, fusion, and accelerator shielding with new additions in radioactive waste and medical applications.

The benchmark information provides information to fully describe the experimental parameters in a modern-day computational model. All relevant engineering details of the experimental configuration are included with the physics equations and theory to provide the user with an understanding of the principles of the benchmark and the manner data was collected. The full benchmark information includes the source of radiation, its energy, angle, and strength; the materials tested, their compositions, tolerances, temperatures, and physical arrangement; and the detectors, their locations, data results, resolution limits, response curves and unfolding code references. Included are statistical error analyses of the measurements.

To access the benchmark data on the PC, running Windows 95/98, a SINBAD program setup is performed. The abstracts are retrieved through a browse window and displayed using the user's Internet browser. A second search window allows the user to set desired benchmark details to match the abstracts retrieved and displayed by the above method. After the benchmark abstract has been selected, the experimental information may then be displayed within the browser. Associated computations are not fully separated from the experimental data in this version, but will be added to the calculations browse and display area of SINBAD.

The UNIX version of the SINBAD retrieval system is a keyword search engine, loaded with the subdirectories of SINBAD 98 data. An abstract and a experimental html document within each of the subdirectories of data have a hyperlink to the abstracts and experiments specified by names and listed alphabetically.

5.   **Restrictions on the Complexity of the Problem:**

No restrictions apply.

6.   **Typical Running Time:**

Varies according to library size and user application. No standard running times can be applied to the use of the data library.

7.   **Unusual Features of the Program:**

None.

8.   **Related and Auxiliary Programs:**

Hypertext Markup Language has been used to store the experimental data in readable formats. Access to this type of language is through the use of standard market browsers, such as Microsoft® Internet Explorer or Netscape® Navigator freely available via the Internet or by mail. The GIF or TIF style graphics are interpreted and displayed through the user browser. The text

portions of the data tables are in ASCII format, and are viewed and edited for user computational purposes via standard market desktop publisher text editors, such as Microsoft® Wordpad.

9.   **Status:**
The SINBAD data is a living database, constantly changing, expanding, and improving. The first market version was delivered in 1997, SINBAD 97. Later that year and through the summer of 1998, the next version SINBAD 98 was finished and delivered in December, 1998. The work continued through summer 1999 and SINBAD 2000 will be delivered spring 2000, as quality assurance testing is finished.

10.   **References:**
H. T. Hunter, J. L. Parsons, W. J. Marshall, E. Sartori, I. Kodeli "Shielding Experimental Benchmark Storage, Retrieval, and Display System," to be published as part of a special edition for ICRS-9 in the Nuclear Science and Engineering 2000.

H. T. Hunter, "SINBAD Users' Manual," unpublished document (November 1998).

H. T. Hunter, R. W. Roussin, C.O. Slater, D. T. Ingersoll, E. Sartori, I. Kodeli, "SINBAD - Shielding Integral Benchmark Archive and Database," Proceedings of the 1996 Topical Meeting of Radiation Protection and Shielding No. Falmouth, Massachusetts (April 21, 1996).

11.   **Hardware Requirements:**
A Pentium II 266 Mhz CPU processor in a personal computer with 100 MB hard drive and CD ROM access is suggested, though slower CPU processors, would suffice. A terminal with 1000x800 pixel screen resolution is also suggested. For UNIX workstations, a SUN UltraSpark or HP B1000 or equivalent is sufficient.

12.   **Programming Languages:**
The data are provided in HTML 3.1 format compatible with most UNIX and Microsoft® Windows™ platforms. This change from the previous 1997 release of DLC-191, that included word processor formats as well as PDF formats, was prompted by the widely accepted HTML formats and the HTML browsers available free to anyone with access to the World Wide Web. The highly graphical and tabular nature of the benchmark data makes the hypertext links within the main HTML document user friendly. The data files may be used in PC compatible systems that run Windows 3.1™ or higher, and UNIX systems. The HTML browsers that are compatible with these platforms would be able to open the data files with no format problems. The size of each benchmark may range from a few hundred kilobytes to over a Megabyte depending on the number of associated graphical and tabular files. There are 33 benchmarks in this release and have a total disk space requirement of approximately 14 MB.
A SINBAD search engine has been developed for both environments. The Windows 95/98 SINBAD search engine displays abstracts, experiments, and computational HTML information via the user's browser. A simple or complex search involving many aspects of the experiments of interest are ways SINBAD assists the users to access pertinent information. A simple UNIX keyword search engine has been included with the HTML files for workstation users. The PC version of the SINBAD search engine has been developed using the Microsoft® Visual FoxPro™ 32 bit platform. The setup takes approximately 90 MB of disk space.

13. **Operating System:**
The PC versions operate under Microsoft® Windows 95™ or Microsoft® Windows 98™. Earlier versions of Microsoft® Windows™ (i.e. 3.1) are compatible with the older 16 bit browsers that read the HTML 3.1 formats. The UNIX version of SINBAD will operate under SUN Solaris 2.6 and the HP HP-UX 10.20 or equivalent platforms.

14. **Other Programming or Operating Information or Restrictions:**
None apply.

15. **Name and Affiliation of Authors or Contributors:**
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16. **Materials Available:**
Available Benchmark Experiments in SINBAD 98
Nuclear Fission Shielding:
Euracos - Iron Benchmark
Euracos - Sodium Benchmark
Karlsruhe KFK - Iron Benchmark
Proteus - Wuerenlingen Iron Benchmark
Harmonie - Cadarache Sodium
JANUS - Phase 1
JANUS - Phase VIII
NESDIP-2
NESDIP-3
PCA - PV
SB2 - Gamma -ray
SB3 - Gamma-ray
SDT1 - ORNL Iron
SDT2 - ORNL Oxygen
SDT3 - ORNL Nitrogen
SDT4 - ORNL Sodium
SDT5 - ORNL SS
SDT11 ORNL Thick Iron/SS
SDT12 ORNL Thick Sodium
Winfrith ASPIS - Iron Benchmark
Winfrith ASPIS - Iron 88 Benchmark
Winfrith ASPIS - Graphite Benchmark
Winfrith ASPIS - Water Benchmark
Winfrith NESDIP-2 Benchmark
Winfrith PCA - Replica Benchmark
U of Illinois Iron Sphere

Fusion:
FNG - SS Bulk Shield

FNG - ITER Blanket
Osaka Iron Sphere
SB5 - ORNL SS/BP
TUD - Dresden Iron
U of Illinois Iron Sphere

Accelerator:
INS Tokyo - Shielding Mats. I
AVF Cycl U of Osaka - Shielding Mats II

The 1-2-page abstracts, which completely specify the major components of each benchmark, are available on the Radiation Safety Information Computational Center WEB site at **http://www-rsic.ornl.gov/BENCHMARKS.html** and at the OECD/NEA WEB site at **http://www.nea.fr/html/dbprog**. A user may check the updates to SINBAD and benchmarks being prepared for release at the above WEB sites.

Included are a user's manual for the PC search engine and an abstract describing the general characteristics of the package.

17. **Category:**
Z, O, L, M, K

Keywords:
BENCHMARK PROBLEM CROSS SECTIONS; BENCHMARK NEUTRON FIELDS; DATABASE; DETECTOR RESPONSE

18. **Sponsors:**
Office of Fusion Energy, Department of Energy, Washington D.C.
The Organization for Economic Cooperation and Development (OECD) Nuclear Energy Agency Data Bank (NEADB)