RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ATOMIC ENERGY COMMISSION

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OAK RIDGE, TENNESSEE 37831

No. 101 April 1973

It is only about things that do not interest one
that one can give a really unbiased opinion,
which is no doubt the reason why
an unbiased opinion is always valueless.

....Oscar Wilde

SHIELDING AGAINST INITIAL RADIATIONS FROM NUCLEAR WEAPONS: A STATE-OF-THE-ART REPORT ON SHIELD DESIGN TECHNIQUES

At the request of the U.S. Corps of Engineers, Omaha District, Omaha, Nebraska, Lorraine S. Abbott of ORNL has written a report which will serve both as an introduction to the subject of weapons initial radiation shielding and as a state-of-the-art report on shield design techniques. As such, it should be of interest not only to non-nuclear engineers who must consider the effects of nuclear radiation on the integrity and usefulness of various types of structures, but also to participants in the field, especially those planning future work in the various areas. The document begins with an elementary description of the physical characteristics of the radiations from nuclear weapons and discusses their interactions with matter. It continues with a brief summary of the methods most frequently used to calculate the penetration of the radiations through the atmosphere and into shielded structures. Finally, it gives some examples of how these methods have been applied to particular structures and points out areas in which applications should be improved. The publication of this document as an RSIC report is supported by the Defense Nuclear Agency with the permission of the U.S. Corps of Engineers.

A form for requesting a copy of the document, ORNL-RSIC-36, is provided on the last page of this newsletter.

NUCLEAR DATA COMMITTEE ESTABLISHED BY AEC

The AEC's Director of Physical Research has established a U.S. Nuclear Data Committee (USNDC) in cooperation with the National Standard Reference Data System of the National Bureau of Standards. The Committee, which evolved from the AEC's Nuclear Cross Sections Advisory Committee, is concerned with the problems of measurement, compilation, evaluation, and dissemination of nuclear data for basic and applied nuclear sciences and technology. Areas covered include basic nuclear science, fusion reactors, nuclear safeguards, biomedical applications, and environmental sciences.

Members of the USNDC are: Robert E. Chrien, chairman, from Brookhaven National Laboratory; H. E. Jackson, secretary, Argonne National Laboratory; Harry Alter, Atomics International; R. C. Block, Rensselaer Polytechnic Institute; C. D. Bowman, National Bureau of Standards; R. S. Caswell, National Bureau of Standards; Herbert Goldstein, Columbia University; D. J. Horen, Oak Ridge National Laboratory; M. H. Kalos, New York University (alternate: Dean C. Kaul, Defense Nuclear Agency); M. S. Moore, Los Alamos Scientific Laboratory; H. W. Newson, Duke University; F. G. J. Perey, Oak Ridge National Laboratory; G. C. Phillips, Rice University; J. S. Robertson, Brookhaven National Laboratory; G. L. Rogosa, AEC; E. M. Smith, University of Miami; and Donald Steiner, Oak Ridge National Laboratory.

Ex officio members are: W. W. Havens, Jr., Columbia University; P. B. Hemmig, AEC; G. A. Kolstad, AEC; D. R. Lide, Jr., National Bureau of Standards (alternate: Lew Gevantman, NBS); William Bartels, AEC; W. S. Rodney, National Science Foundation; Alan B. Smith, Argonne National Laboratory; R. F. Taschek, Los Alamos Scientific Laboratory; and R. W. Wood, AEC.

The USNDC cooperates with two international groups - the European-American Nuclear Data Committee, which operates under the auspices of the OECD Nuclear Energy Agency, and the International Nuclear Data Committee, which works under the IAEA.

The Committee urges people working in areas where a need exists for the best available nuclear data to contact the Nuclear Data Project, Oak Ridge National Laboratory, for nuclear structure and reaction data, or the National Neutron Cross Section Center, Brookhaven National Laboratory, for neutron data. Requests for other types of data are available through the Office of Standard Reference Data, National Bureau of Standards.

CHANGES TO THE DEFENSE NUCLEAR AGENCY WORKING CROSS SECTION LIBRARY

Two new evaluations have been added to the library and four have been modified. The new evaluations are MAT 4539, plutonium-239,and MAT 4540, plutonium-240, by Stewart and Hunter of Los Alamos Scientific Laboratory.

The most recent versions of the evaluations that were modified are MAT 4152 MOD 3 calcium, MAT 4154 MOD 1 beryllium-9, MAT 4187 MOD 1 uranium-238, and MAT 4188 MOD 1 uranium-235.

The modifications are summarized as follows:

1. Calcium - MAT 4152 - ORNL
   MOD 3 February 1973

   This is essentially a complete reevaluation of MOD 2 (May 1972). Details of MOD 3 will be published in ORNL 4866, "A Reevaluation of Neutron and Secondary Gamma-Ray Production for Calcium," by C. Y. Fu and F. G. Perey.

2. Beryllium - MAT 4154 - LLL
   MOD 1 March 1973

   The energy range was extended down to 10^{-5} eV. Gamma-ray production (n,γ) data and (n,T) data are now represented as MT=102 and MT=105, respectively, in files 12 and 15. The photon spectrum was assumed independent of incident neutron energy with the multiplicity varied (with incident neutron energy) to conserve energy.

3. Uranium-238 - MAT 4187 - LLL
   MOD 1 March 1973

   The energy range was extended down to 10^{-5} eV. The elastic and capture data below 1 keV were obtained by generating point values from ENDF/B-III MAT 1158 resonance parameters, Doppler broadening to 300°K, and thinning with a 0.2 criterion. For consistency, all data in files 3, 4, and 5 are given at 300°K. At neutron energies below 1.09 MeV, data are given for gamma-ray production spectra from fission and capture, and discrete gamma rays from some low-lying levels (0.05, 0.15 MeV). Above 1.09 MeV the gamma-ray production spectrum from all reactions is given in one reaction (MT=3).

4. Uranium-235 - MAT 4188 - LLL
   MOD 1 March 1973

   The energy range was extended down to 10^{-5} eV. The elastic, fission, and capture data below 80 eV were obtained by generating point data from ENDF/B-III MAT 1157 resonance parameters, Doppler broadening to 300° K, and thinning with a 0.1 criterion. For consistency, all data in files 3,4, and 5 are given at 300° K. The shape of the energy distribution of capture gamma rays was assumed independent of incident neutron energy, with an adjustment made in the multiplicity to conserve energy.

ABSTRACTS OF THE PERIPHERAL SHIELDING ROUTINES TO BE ISSUED

The loose-leaf binder, ORNL-RSIC-31, ABSTRACTS OF PERIPHERAL SHIELDING CODE PACKAGES ASSEMBLED BY THE RADIATION SHIELDING INFORMATION CENTER, will be available soon. This book of abstracts describes computer code packages considered to be useful tools in doing shielding research, although not treating radiation transport. Many of the PSR codes process cross sections. The abstract format is similar to that used in ORNL-RSIC-13 which describes the transport codes.

Green cards have been mailed to our codes distribution, announcing the availability of RSIC-31. Those persons wishing to receive a copy should return their cards to RSIC as soon as possible. If you have not received a green card, you can still receive a copy of RSIC-31 by returning the

form at the end of this newsletter or by writing to us.

DLC ABSTRACTS AVAILABLE UPON REQUEST

Those who have obtained ORNL-RSIC-30, ABSTRACTS OF THE DATA LIBRARY PACKAGES ASSEMBLED BY THE RADIATION SHIELDING INFORMATION CENTER, may wish to update their binders with the latest versions of abstracts now available from RSIC. Some data libraries have been revised and new ones have been added since the original version of ORNL-RSIC-30 was issued in March 1972. Abstracts for DLC-17 through DLC-24 were made available along with recent issues of the RSIC Newsletter. Abstracts for DLC-2 (updated in July 1972) and DLC-25 (just added to the collection) are now available upon request.

ADDITION TO THE DATA LIBRARY COLLECTION

DLC-25/MASS — An atomic mass evaluation has been contributed by the Nuclear Data Group at ORNL. A retrieval program is included which reads the data and calculates reaction Q values. FORTRAN IV, IBM 360. Ref.: Nuclear Data Tables A9 (4-5), 265-468 (1971) and Nuclear Data Tables A11 (2-3), 128-280 (1972).

CHANGES TO THE COMPUTER CODE COLLECTION

CCC-66C/BIGGI-4T — A UNIVAC 1108 version has been contributed by EURATOM, Ispra (Varese), Italy, via the NEA Computer Programme Library and is packaged as CCC-66C. BIGGI-4T performs a numerical integration of the Boltzmann equation for gamma rays in plane multilayer geometry. Ref.: EUR 3555e; EUR 2488e; EUR 1643e.

CCC-187B/SAM SYSTEM — Revision A of the SAM-CE code has been received from Mathematical Applications Group, Inc., Elmsford, N. Y. and is packaged as CCC-187B. SAM-CE is a Monte Carlo Time-Dependent Three-Dimensional Complex Geometry Code System (with) ENDF Formatted Cross Sections. Revision A has a routine, SAM-X, which treats gamma-ray production data in addition to the neutron interaction data. Additional options have been made available, including the treatment of the unresolved resonance region. Ref.: MR-7021, Rev. A (DNA 2830F, Rev. A); MR-7030 (DNA 2958F). FORTRAN IV; CDC 6600.

PSR-41B/MAZE2 — A FORTRAN V version, operable on the UNIVAC 1108, has been contributed by Science Applications, Inc., La Jolla, California. The MAZE2 system is a set of FORTRAN

subroutines for unfolding energy spectra. Ref.: DASA 2720-2 (Vol. II) and DNA 2990F.

PERSONAL ITEMS

In serving a specialized area of scientific endeavor, it seems important that we take note of the movement of people concerned with radiation transport in the nuclear industry. We, therefore, continue to carry personal items as they are brought to our attention. During the past month, we have been informed of the following changes.

In recent organizational changes at the Los Alamos Scientific Laboratory a new division was formed (Q) to deal with matters of energy. R. E. Malenfant writes that he is now associated with the Office of Analysis and Planning (Q-DOT) in Q Division. His former division, N, has been eliminated, and his former group, N-2, has been transferred, with some personnel loss, to the Physics Division as a new group designated P-5.

Ralph J. Cerbone recently transferred from Gulf Radiation Technology to Gulf General Atomic where he manages the Nuclear Analysis Branch in the Gas Cooled Fast Reactor Project.

Jorma Routti has informed us that he is now teaching and doing research as Associate Professor in Nuclear Engineering at the Helsinki University of Technology, Otaniemi, Finland. He spent 5 years (1965-70) at Lawrence Berkeley Laboratory in California and 3 years (1970-2) as a Visiting Scientist at CERN, Geneva, Switzerland.

The following changes of address are noted: *Captain John P. Sommar*, USAF, from the Air Force Weapons Laboratory, Kirtland AFB, to the Defense Communications Agency, National Military Command System Support Center, Washington, D.C.; *W. M. Peffley*, from Culver City to Fullerton, California, within the Hughes Aircraft Industry; *Bruce Ernst* from Nuclear Fuels Services, Springfield, New York, to NUMEC, Apollo, Pennsylvania; *William J. Nalesnik* from Memorial Hospital for Cancer and Allied Diseases, New York City, to Department of Radiology, Yale-New Haven Hospital, New Haven, Connecticut.

MARCH ACCESSION OF LITERATURE

The following literature cited has been ordered for review, and that selected as suitable will be placed in the RSIC Information Storage and Retrieval Information System (SARIS). This early announcement is made as a service to the shielding community. Copies of the literature are not distributed by RSIC. They may generally be obtained from the author or from a documentation center such as the National Technical Information Service (NTIS), Department of Commerce, Springfield, Virginia 22151.

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AVAIL: NTIS

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ORNL-RSIC-31
AVAILABILITY ANNOUNCEMENT

ORNL-RSIC-31, ABSTRACTS OF PERIPHERAL SHIELDING CODE PACKAGES ASSEMBLED BY THE RADIATION SHIELDING INFORMATION CENTER, is now available for distribution. Please return this coupon to RSIC if you wish to receive a copy.

Please mail a copy of ORNL-RSIC-31 to:

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ORNL-RSIC-36
AVAILABILITY ANNOUNCEMENT

ORNL-RSIC-36, SHIELDING AGAINST INITIAL RADIATIONS FROM NUCLEAR WEAPONS: A STATE-OF-THE-ART REPORT ON SHIELD DESIGN TECHNIQUES, is now available for distribution. Please return this coupon to RSIC if you wish to receive a copy.

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