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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MEETING OF A CROSS SECTION EVALUATION WORKING GROUP

On June 9 and 10, 1966, a meeting sponsored by the USAEC Division of Reactor Development was held at Brookhaven National Laboratory. The meeting was concerned with organizing a set of tasks leading to "development of a set of basic nuclear data which can be used to accurately predict the behavior of neutrons in a nuclear reactor."

Work in this area has been going forward for some time, sparked by Henry Honeck of the USAEC. Two computing machine formats have been developed: ENDF-A, a format appropriate to the storage of raw data and described in BNL 8381; ENDF-B, a format appropriate to the storage of processed basic information, immediately available for use in calculations.* The principal result of the Brookhaven meeting was the mutual agreement among the cooperating organizations to share responsibilities for evaluating and placing in the ENDF system various groups of nuclear data and for producing various subroutines necessary or useful for processing data in the ENDF format. It is planned that sufficiently many of these tasks will be completed by the year's end to insure by that time an operable system with a substantial file of centrally available evaluated data. This cooperative effort is voluntary and it is expected that the participating organizations will continue to evaluate and improve data for the file.

Below is a list of the attendees at the meeting.

Laboratory	Representatives
Advisory Committee on Reactor Physics (ACRP)	D. T. Goldman
Argonne National Laboratory (ANL)	E. M. Pennington
	B. Toppel
Atomic Energy Commission (AEC)	H. Honeck
Atomic Power Development Associates (APDA)	T. A. Pitterle
Atomics International (AI)	H. Alter
	C. L. Dunford
	R. S. Berland
Babcock & Wilcox Company (BW)	W. A. Wittkopf
	D. Roy
Bettis Atomic Power Laboratory (BAPL)	D. Harris
Brookhaven National Laboratory (BNL)	J. Chernick
	S. Pearlstein
	T. E. Stephenson

*There is as yet no formal report describing the ENDF-B format, although Dr. Honeck has described it rather completely in some preliminary notes, copies of which were distributed at the meeting.

Laboratory	Representatives
Combustion Engineering (CE)	L. C. Noderer
General Atomic (GA)	M. K. Drake
General Electric (GE)	I. Wall
Knolls Atomic Power Laboratory (KAPL)	C. Lubitz
Los Alamos Scientific Laboratory (LASL)	R. J. LaBauve
Oak Ridge National Laboratory (ORNL)	C. W. Craven
Pacific-Northwest (PNW)	B. R. Leonard
	K. B. Stewart
Phillips Petroleum Company (PP)	J. R. Smith
	R. Grimesey
Savannah River Laboratory (SRL)	J. E. Suich
	D. R. Finch
Westinghouse Atomic Power Division (WAPD)	R. A. Dannels
	N. Azziz

A POSTSCRIPT

We take this occasion to urge all members of the shielding community, who have occasional or frequent need of cross section data in conjunction with computing machine programs, to become familiar with the ENDF-B format and to have it available at their computing facilities. Some may wish to retain whatever locally operating format is now in use; some may wish to adapt local data handling routines to the ENDF-B format and embrace it completely. Even the former group should have the ENDF-B format available and should produce the service routines necessary to translate the common data fields back and forth between the local and ENDF-B formats. We would then have in ENDF-B what has long been lacking and greatly needed: a uniform machine format to permit data transmission between installations without the necessity for hand processing of any kind. Note that this is a benefit almost immediately available from this effort, is independent of the existence of any particular set of data, and has obvious and permanent value.

CURRENT WORK AND PROBLEMS

We are grateful to you who have responded to our questionnaire on current work. We are hopeful that some of you who have not yet responded, including project officers, will send us a note shortly. In the interest of uniform month to month coverage we have withheld some of the information now in our files--it will eventually appear. Please note that no information is conveyed when you say "We are working on shielding problems of a water moderated reactor," especially if it is widely known that you work on water moderated reactors. Without too many words, tell us which problems.

We hope that some of you will read this section not only to find what others are doing which may help you, but also to find where you might be able to give a little helpful advice. If you have any suggestions, especially concerning areas where a need for work is felt, send a note to the person who has expressed the need. It will be appreciated.

National Bureau of Standards (John Hubbell) is assembling and evaluating theoretical and experimental photon cross sections (other than photonuclear). This work covers all elements and the energy range is 1 kev to 100 Gev (with ultimate extension down to 10 ev planned). Need has been found for work in both theoretical and experimental areas. The theoretical needs are: (1) screened photoeffect calculations for light elements (Z = 2 - 10), 1 kev-10 Mev; (2) screened triplet, without Thomas-Fermi (Wheeler-Lamb) approximation (Z = 2-18), threshold (2.044 MeV) to 100 Gev; (3) energy dependence of Coulomb correction to nuclear field pair production, threshold (1.022 MeV) - 100 MeV, (Z = 13 - 92); (4) coherent (Rayleigh) and incoherent (Compton) scattering total σ's, including all electron binding effects, 1 kev - 10 Mev. Needs in the experimental area are low energy gamma-ray attenuation coefficient measurements for Pb, 1 - 40 kev (and especially 15 - 40 kev) and also for U(1 - 200 kev) - perhaps using variable concentration solutions of Pb and U compounds.

Also at the Bureau (Charles Eisenhauer) reports that calculations are being made of dose rates in air near a point source (neutrons or gamma-rays) on an interface, energy spectra of neutrons reflected from a plane surface as a function of the order of reflection, and neutron angle-energy spectra at many distances from a point source in infinite air.

Ship Research Institute of Japan (Iwao Kataoka). Theoretical work being carried on involves direct integration of the Boltzmann equation for both neutrons and gamma-rays (NIOBE, EOS, SELENE). Gamma-rays are being investigated also by Monte Carlo and by use of transmission-reflection matrices. Computer codes are being developed and used for calculating photon and neutron dose rates in and around nuclear powered ships (MARINE-1, MARINE-2), and dose rate distributions from the radioactive cloud in the event of an accident on such a ship. Other studies are being made to determine how photon emission or reflection from a concrete wall is modified by coating the wall with another material. Included in the experimental program are the following: measurement of the effects which surface coatings have on photon reflection; neutron distributions in position and energy around a pool type reactor with a water laminated shield; mockup tests of the nuclear ship shield; measurement of space-angle-energy distributions of photons from a ^{60}Co beam transmitted through barriers; monitoring of gamma-ray dose rates from a ^{60}Co source in the training ship Shintoku Maru. Design studies include preliminary design of a secondary shield for the nuclear ship and calculation of expected dose rate distributions in the nuclear ship.

Lockheed Georgia (A. O. Burford) is concerned with studies of shield design and development applicable to isotopic, reactor, and space radiation. Problems being worked on include weight optimization of space nuclear auxiliary power (SNAP) shields, design of source and shield assemblies for radioisotope irradiation facilities, and development of computational methods for estimating space radiation sources and transport.

At Atomics International (A. Thiele) the SNAP reactor experimental shielding effort includes study of composite lithium hydride-heavy metal shields. Gamma-ray and neutron dose rates, spectra, angular distributions, and secondary gamma-ray production are being studied in slab geometries. Areas in which a need for further work is felt include analytic techniques for dealing with secondary gamma-rays, more detailed determinations of inelastic scattering cross sections, further instrumental development in neutron spectroscopy.

From the Commissariat a l'Energie Atomique (Philippe Tardy-Joubert) we learn that shielding efforts are concerned with high energy (accelerator) beam dosimetry, fast neutron dosimetry, propagation of nuclear cascades, and shielding of μ-mesons around high energy machines. Areas where further work is felt to be needed include propagation of high energy radiation and fast neutrons in ducts and problems of access to very high energy accelerators.

Around the universities -- we hear that the University of Illinois (A. B. Chilton) is studying gamma-ray shielding by ribbed slabs, gamma-ray albedos, exponential transform techniques in Monte Carlo, neutron penetration into military structures, and fallout shielding technology. Pennsylvania State Univ. (A. Foderaro) is working on general methods of calculation of point source-point detector-slab shielding configurations, analysis of experimentally determined gamma-ray spectra from source distributions on nonsmooth air-ground interfaces, and the buildup of low energy neutrons within enclosures.

CCC-17/05R MODIFICATIONS

Subroutine GEOM, the geometry routine in computer code package CCC-17/05R may be easily modified to perform calculations for an infinite array of parallelepiped cells. Instructions for making such a modification are available and may be secured from the RSIC Codes Coordinator.

05R-Memo 3, "Various Auxiliary Routines for use with 05R," is now available. LEGENDRE, a calculation of Legendre coefficients from angular distributions; PUNCHSIG, which provides tape-to-card capability for cross section handling; and PICTURE, a geometry diagnostic program are described. Certain other items of information helpful in modifying 05R are given and attention is called to a bug in the IBM 7090 version of the code. The memo may be secured from the Codes Coordinator.

ORNL-RSIC-13 PUBLISHED

A new report in loose-leaf form, ORNL-RSIC-13, containing abstracts of 39 codes in the RSIC collection has been issued and copies have been sent to persons on our codes distribution list. Others who wish copies may request them. As new abstracts are made available, they will be sent to holders of ORNL-RSIC-13.

Abstracts for the following codes are now being prepared and will be ready for publication soon:

Code Name	Contributed to RSIC by
NIOBE	United Nuclear Corporation, Development Division - NDA, White Plains, New York
RENUPAK	United Nuclear Corporation, Development Division - NDA, White Plains, New York
DTF-IV	Los Alamos Scientific Laboratory, T Division, Los Alamos, New Mexico

Code Name	Contributed to RSIC by
PROTOS	Research Institute of National Defense, Stockholm, Sweden
TORN I & II	Technical Operations Research, Burlington, Massachusetts
TORG	Technical Operations Research, Burlington, Massachusetts
OGRE	Oak Ridge National Laboratory, Neutron Physics Division, Oak Ridge, Tennessee
LEP	Oak Ridge National Laboratory, Neutron Physics Division, Oak Ridge, Tennessee
QAD	Los Alamos Scientific Laboratory, N Division, Los Alamos, New Mexico
TAPER II	Atomics International, Power Systems Division, Canoga Park, California
LRSPC	Lockheed-Georgia Company, Nuclear Analysis Department, Marietta, Georgia
LPPC	Lockheed-Georgia Company, Nuclear Analysis Department, Marietta, Georgia
LEBC	Lockheed-Georgia Company, Nuclear Analysis Department, Marietta, Georgia
LSVDC	Lockheed-Georgia Company, Nuclear Analysis Department, Marietta, Georgia
ISOGEN	Battelle Northwest Laboratories, Chemical Laboratory, Richland, Washington
MYRA	Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tennessee
STERNO	Pratt and Whitney Aircraft, CANEL, Hartford, Connecticut
SPARC (P09,E59)	USAF Nuclear Aerospace Research Facility, General Dynamics, Fort Worth, Texas
COMBINE (E91,E20) F29	USAF Nuclear Aerospace Research Facility, General Dynamics, Fort Worth, Texas
SDC	Oak Ridge National Laboratory, Chemical Technology Division, Oak Ridge, Tennessee

The following codes are nearing the end of the RSIC check-out process. When packaged and ready for distribution, they will be announced in the Newsletter:

The Lewis Proton Shielding Code (LPSC) contributed by National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

GAMLEG - A Fortran Code to Produce Multigroup Cross Sections for Photon Transport Calculations, contributed by Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico

TYCHE III - A General Code for Display of Digital Data, contributed by Atomics International, Canoga Park, California

CEP - A Monte Carlo Program for the Calculation of First-Flight Escape Probabilities for Finite Cylinders, contributed by Phillips Petroleum Company, Atomic Energy Division, Idaho Falls, Idaho

K009 - MSC Solid Angle Radiation Dose Program, contributed by National Aeronautics and Space Administration, Manned Spacecraft Center, Houston, Texas.

RECENT VISITORS TO RSIC

The following people visited RSIC during the month of June: Earl W. Allen, TRW Systems, Redondo Beach, California; Tom Lence, TVA, Knoxville; and Henry L. Bermanis, General Electric, King of Prussia, Pennsylvania.

SUMMER PARTICIPANTS

Assisting in the RSIC program for the summer are the following people: William Wayne Scott, faculty member from Chattanooga Technical College; Dennis M. Stricklan, student, Ohio State University; and Linda G. Keylon, student, Tennessee Wesleyan College.

JUNE ACCESSION LIST OF LITERATURE

The following accession list consists of literature which the RSIC obtained through its usual scanning procedures. This literature will be examined for assignment to various files or for possible rejection. The accession list is divided into three fields of (1) reactor and weapons shielding, (2) space and accelerator shielding, and (3) shielding computer codes.

RSIC is not a documentation center. Hard copies of the literature cited below must generally be obtained elsewhere. In most cases, however, we will be able to supply microfiche copies upon request. There may be a delay if a microfiche original is not available and we must produce one. This will be the case with ordered and newly obtained literature only. Naturally, we cannot supply copies of literature which is copyrighted or whose distribution is restricted.

Reactor and Weapons Shielding

USNRDL-TR-992

Calculations of the Energy and Mass Yields from the Thermal-Neutron Fission of U^{235}
J. M. Ferguson and P. A. Read - March 15, 1966

AFWL-TR-66-43 (S)

Two Radiation Transport Calculations of Nuclear Weapon Output (HB1 and HB2)
George R. Spillman, George E. DeBorde, et al. - May 1966

NAA-SR-11821

Space-Time Flux Synthesis Methods for the Approximate Solution of Time-Dependent Boltzmann Neutron Transport Equation
V. Luco - May 25, 1966

AD-624874

Radiation Absorbing Glass
John H. Fishwick - October 27, 1965

AD-725406

The Physics and Shielding Aspects of Heterogeneous Isotopic Neutron Sources
Donald F. Knuth - July 1965

AD-625463

Neutron Spectra from Monoenergetic Photons on Bismuth
Franca Tagliabue Kuchnir - December 1965

DC-59-3-90

Milestone 12--Data Report on Neutron Induced Activation of X-211 Turbomachinery Materials
E. R. Beever, J. Moteff, M. J. Schumacher, H. J. Tushar - Feb. 27, 1959

LA-3448-MS

Gamma Dose Rate Measurements on the Phoebus 1A-321 Reactor
A. J. Ahlquist and F. W. Sanders - December 1965

LNF-66/7

Passage of Neutrons with Energy E_o less than or equal to 30 MeV in Ordinary Cement and in its Components.
M. A. Locci, P. Picchi, G. Verri - Feb. 16, 1966

J. Nucl. Energy, Pts. A/B, Vol. 20(4), 318 (April 1966)

Use of the Method of Moments for Solving Neutron Thermalization Equations for an Infinite Medium
M. V. Fedulov

J. Nucl. Energy, Pts. A/B, Vol. 20(5), 404 (May 1966)

An exact general solution of Boltzmann's equation in spherical harmonics
G. Ya. Rumyantsev

J. Nucl. Energy, Pts. A/B, 20(5), 390 (May 1966)

Attenuation of Reactor Radiations by Serpentine Concrete
G. A. Vasil'ev, A. P. Veselkin, et al.

J. Nucl. Energy, Pts. A/B, 20(5), 381 (May 1966)

Angular and Energy Characteristics of the Emission of ^{235}U fission Neutrons
M. V. Blinov, N. M. Kazarinov and A. N. Protopopov

NYO-2380-1, Vol. 1, Book 1

PM-3A Nuclear Power Plant Design Analysis Report
A. Andonedis - Dec. 1965

CEA-R-2971

On the Solution of a Few Problems of Multiple Scattering by Monte Carlo Method
Jean-Claude Bluet - Feb. 1966

LA-DC-7623

Capture and Fission Cross Sections of Pu-240
D. H. Byers, B. C. Diven, M. G. Silbert - 1965

TID-22418

Snap 10A Flight Vehicle Nuclear Environment and Radiation Effects
C. M. Bennett, J. J. Kraker and W. G. Kruse - Oct. 15, 1965

RT-PROt-(65)32

Flux of Slow Neutrons and Gamma Rays in the Interior of A Paraffin Moderator
T. Trochev - October 1965

LA-DC-7603

Elastic and Inelastic Scattering of Fast Neutrons from Li-6 and Li-7
John C. Hopkins - 1966

LA-DC-7622

The Fission Cross Section of U-233, 20 ev to 2 Mev.
D. W. Bergen, M. G. Silvert, and R. C. Perisho - 1966

BNL-10085

The Neutron Cross Section of Sodium Below 40 kev
Thomas E. Stephenson - 1964

GEMP-411

Neutron Cross Sections for Cm^{244} and Pu^{238}
A. Prince - February 22, 1966

Shielding Computer Codes

TIM-880 (microfiche) January 1965 MORTIMER

Mortimer - A Neutron Shielding Code for Snap Systems Utilizing the Two-Component Method
by A. J. Friedman

NP-15155 (microfiche) November 1964 SALOMON

A User's Manual for Salomon, An IBM-7090 Code for Gamma Transport Calculations
by G. Engstroem

AD 616106 (microfiche) May 1965 SRESC

A Computer Program Incorporating the Whitaker Threat Model into the Space Radiation Environment and Shielding Computer Program
by J. A. Barton, et al.

RT FIMA-65-5 (microfiche) November 1965 RAM

RAM - An IBM-7094 Monte Carlo Code for Criticality Calculations
by E. Cupini and A. DeMatteis

USNRDL-TR-921 October 1965 FPA

A Computer Program for Calculating Fission Product Abundances
by M. A. Hogan, J. K. Crawford, and V. Goddard
Fortran for IBM 7090

AN-1447 October 1965 AGN-SIGMA

Users Manual for AGN-Sigma: A Code To Calculate the Legendre Components of the Multigroup Transfer Matrices and the Group Cross Sections
by S. T. Perkins, D. W. Thompson, and P. J. DuBois
Fortran II for IBM 7090/7094

OCD-JD1 January 1966 CAPS-2

CAPS-2 - A Computerized Method of Analyzing Structures for Radiation Shielding
by John L. Dirst
Fortran for IBM 7090

RM-205-1 July 1965 PF-COMP

Computer Program for Analysis of Building Protection Factors
by E. L. Hill, T. Johnson, and R. O. Lyday, Jr.
Fortran 64 for CDC 3600

RM-205-6 January 1966 PF-COMP

PF-Comp Computer Program Test Building
by M. D. Wright and R. O. Lyday, Jr.
Fortran 64 for CDC 3600

AEEW-M 648 March 1966 COMPRASH

A Preliminary User's Guide Prepared for the E.N.E.A. Seminar-Workshop on Shielding Programmes Held at Ispra, April 1966
by A. F. Avery, J. Clarke, and Mrs. A. Hartley
Fortran II for IBM 7090

FZK-156 October 1962 COHORT I

A Monte Carlo Procedure for Radiation Transport and Heating Studies
by M. B. Wells and C. F. Malone
IBM 7090

AE-6 July 1959 NTHS

Monte Carlo Calculations of Neutron Thermalization in a Heterogeneous System
by T. Högberg

TO-B 61-39 May 1962 RTSGR (orig. TORG)

Monte Carlo Calculations on the Reflection and Transmission of Scattered Gamma Radiations
by Dominic J. Raso
Fortran for IBM 704, 709, and 7090