

RSIC Newsletter



RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

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

POST OFFICE BOX X •
OAK RIDGE, TENNESSEE 37831

No. 50

January, 1969

Every man of sound brain whom you meet knows something worth knowing better than yourself. A man, on the whole, is a better preceptor than a book. But what scholar does not allow that the dullest book can suggest to him a new and a sound idea? --- Bulwer

RSIC TO DISTRIBUTE DATA LIBRARIES

The performance of machine calculations, in general, may be thought of as a three-part process which can be associated with three components. The first phase is the acquisition and preparation of a data base to be processed. The second is the development and use of a computer program to operate on the input data, perform certain logical operations, and finally produce output data. The output data, the third component, is then analyzed, often with the aid of machine manipulation. The data, after reduction, finally appears in reports and journal articles.

In shielding calculations, the three components normally take the form of (1) cross-section libraries, (2) shielding computer codes, and (3) shielding (output) data.

Since inception, RSIC has actively acquired, packaged and distributed computer codes. We have also acquired and indexed published literature which contains shielding data. The available input cross-section data has never been entirely satisfactory because each code requires its own format and so adequate libraries have depended on users developing their own libraries to satisfy their own requirements.

With the development of the Evaluated Nuclear Data File (ENDF) by the Cross-Section Evaluation Working Group (CSEWG) and the National Neutron Cross Section Center (NNCSC) at Brookhaven National Laboratory, we now have the opportunity to proceed in an orderly fashion to develop a reliable, well-documented set of data available to all. With the development of suitable processing routines, each radiation transport code will be able to utilize data in the standard formats.

Since we feel these developments are so important, RSIC is working closely with NNCSC to assist in getting data of interest to shielders into the ENDF system. In addition, we are also making other data libraries available.

Output shielding data will also be made available. RSIC is co-operating with the American Nuclear Society in the development and publishing of Benchmark Problems. Milestones, or state-of-the-art data, for many more problems will also be compiled and published. Some of these may become benchmarks as data accumulates.

In some cases, the volume of data from a problem may be so great that it is not feasible to publish it all. One can then publish samples of the results but place the entire output on magnetic tape for distribution, as needed, by RSIC. Processing codes for performing editing, plotting, interpolation, and certain integrations would accompany the data. An example is the Hallmark data listed below.

Data libraries are now being packaged and organized by RSIC in a manner analogous to the RSIC code collection. Each data set will carry a Data Library Collection (DLC) number and be packaged as a unit. As with the code packages, a particular data package will not remain static, but will be subject to revision, updating, and expansion as required. Such changes will be announced in the RSIC newsletter.

The initial set is as follows:

DATA LIBRARY COLLECTION

- DLC-1/ Bertini Low-Energy Intranuclear Cascade Code Package - Output from ANALYSIS Codes I and II and from EVAP; available on 16-mm microfilm, on reels of magnetic tape (10); or as machine listings.
- DLC-2/ 99-Group Neutron Data Library in ANISN-DOT BCD format - taken from ENDF/B Data Files. Handling routine. (a) 9-track: complete library 1 reel; (b) 7-track: complete library on 3 reels of tape (shielding nuclides, Hydrogen-plus, and non-shielding).
- DLC-3/ Howerton Photon Interaction Cross-Section Library - Elements 1-83, 86, 90, 92, and 94. Ref: UCRL-50174, Section II (1967) and NBS-8681, Second Edition (1966).
- DLC-4/ OGRE Photon Interaction Library No. 2; the DLC-3 Library in OGRE, BCD format - Handling routine. Ref: DLC-3 and ORNL-3805 (1966).
- DLC-5/ HALLMARK - Air-over Ground Data Computed by E. A. Straker, Ref: ORNL-4289, Vol. II. Handling routines and user's manual.

NEW CLASS OF CODES TO BE DISTRIBUTED BY RSIC

A new class of codes has been designated to permit packaging useful routines that are not shielding codes, but may be of interest to those doing shielding research. In order to distinguish between complex shielding programs designated as CCC's (Computer Code Collection) these peripheral codes will be packaged and designated as such. In our abstracts, when such a code is useful to a given Code Package, we have used the name "Auxiliary Routine". Where we cannot tie the routine to a specific package we will package alone and carry it under a PSR (Peripheral Shielding Routine) number.

- PSR-1/MAX-XTREME :A Generalized Several-Constraints Lagrange Multiplier Numerical Formulation, by F. H.S. Clark and F. B. K. Kam, ORNL-3742 and ORNL-3846 (1965).
- PSR-2/CHAD :A Differential Angular Data Transformation Routine, by R. F. Berland (AI), NAA-SR-11231 (1965).
- PSR-3/ELJESE 1 :Analyses of Elastic and Inelastic Scattering Cross Sections, by the Japanese Nuclear Data Committee, Japan Atomic Energy Research Institute, contributed through the ENEA Computer Programme Library, Italy, JAERI-1096 (1965).
- PSR-4/HEITLER :Compton, Photoelectric, Pair-production, and Total Microscopic Cross-Sections Calculations, by A. Foderaro, Ref: AERE-M-1956 (1967). Contributed through the ENEA Computer Programme Library, Ispra, Italy.
- PSR-5/AGN-SIGMA :A Legendre Components of the Multigroup Transfer Matrices and the Group Cross Sections Calculation Code, by S. T. Perkins, D. W. Thompson, and P. J. DuBois, (AGC-San Ramon), AN-1447 (1965).
- PSR-6/EDISN :Energy Distribution of Inelastically Scattered Neutrons Calculations, by R. Snow and M. C. George, Brown Reserach Labs, Huntsville, RL-SSL-200 (1968).

SHORT COURSE AT UCLA ON SPACE SHIELDING

A short course, Radiation Shielding in Space, will be given by J. W. Haffner at UCLA, May 19-23. Further information on this course

(No. 21) can be obtained by writing Program Promotion, P. O. Box 24902, University Extension, UCLA, Los Angeles, California 90024.

BRITISH REPORTS AVAILABLE FROM CFSTI

It has been announced that numbered reports of the United Kingdom Atomic Energy Authority issued since January 1, 1968 can be ordered from the Federal Clearinghouse for Scientific and Technical Information, Springfield, Virginia 22151.

Standing orders for the complete series of UKAEA reports may be placed with National Agency for International Publications, Inc., 317 East 34th Street, New York, New York 10016.

CORRECTION TO THE GAMLEG COMPUTER CODE

R. S. Hubner, of Atomics International, and K. D. Lathrop of Los Alamos Scientific Laboratory, have called to our attention an error in GAMLEG which should be corrected:

The error occurs at statement 102 in the main program when the coherent scattering option is used. At this point the array TRANS contains the PO matrix which is calculated only once; however, the coherent scattering cross section divided by the atomic number, SIGC(K)/ZA, is added to the ingroup values of the matrix for each element processed. This results in an accumulation of SIGC(K)/ZA for all elements processed. Thus TRANS(K,K) for an element contains SIGC(K)/ZA for all elements preceding it. In order to correct this error, TRANS(K,K) must be saved in a new array before statement 102, and then it must be restored after statement 39.

An update is being made to the RSIC code package, and the new version is available to anyone requesting it.

LIBRARY EXPANSION IN QAD P5A

Gerald P. Lahti, of NASA Lewis Research Center, Cleveland, Ohio, has sent to the Radiation Shielding Information Center revised sub-routines and library data for QAD P5A. The new modification expands the buildup factor libraries to include tin (dose and energy absorption), tungsten (dose), and uranium (dose).

The RSIC code package for QAD P5A is being updated to reflect these modifications, and they are available to requesters.

PERSONAL ITEMS

Robert W. Roussin has recently joined the RSIC staff. He completed work for his degree in nuclear engineering at the University of Illinois with a thesis in the area of neutron transport.

Charles M. Huddleston is now a visiting professor at the University of Illinois. Chuck is continuing his duties as technical manager of civil defense.

VISITORS TO RSIC

Our apologies to J. Rastoin, Commissariat a L'Energie Atomique, Centre D'Etudes Nucleaires, de Fontenay-aux-Roses, France. We omitted his name on the last newsletter although we enjoyed his visit in November.

Visitors to RSIC during the month of December are: Dwaine Linstrom, Aerojet-General Corp., Sacramento, California; Archie Wilcox, Aerojet-General Corp., Sacramento, California; Lois F. Lunin, Information Center for Hearing, Speech and Disorder of Human Communication, Baltimore, Maryland; Lawrence B. Miller, Argonne National Laboratory, Argonne, Illinois; Anthony R. Buhl, Capt. U. S. Army, U. S. Army Nuclear Defense Laboratory, Edgewood Arsenal, Maryland.

JANUARY ACCESSION LIST OF LITERATURE

The RSIC is now aware of the literature cited in the following list. This literature has either been obtained by RSIC or has been placed on order. When received, this material will be examined and assigned to various files if suitable for our information system. The accession list is divided into three fields of (1) reactor and weapons shielding, (2) space and accelerator shielding, and (3) shielding computer codes. These titles are announced before processing and indexing so that there will be no delay and can serve as a prompt announcement of current literature.

RSIC is not a documentation center. Copies of the literature cited must generally be obtained from the author or from a documentation center such as the Clearinghouse for Federal Scientific and Technical Information, Springfield, Virginia 22151.

RSIC maintains a microfiche file of literature entered into its information system. Computer searches of this system (which produces a special bibliography) and duplicate microfiche copies of literature in our file are available upon request. Naturally we cannot supply copies of literature which is copyrighted (such as books or journal articles) or whose distribution is restricted. Neither service is yet available for the codes literature.

REACTOR AND WEAPONS SHIELDING

AEEW-R 621

Recommended Formulae and Formats for a Resonance Parameter Library
M. F. James
August, 1968

AERE-R-5871

A New Standard Series of Packaging for Load Up to 40,000 Curies of
⁶⁰Co or Equivalent
F. E. Dixon, L. R. Cohen
August 1968
Availability: CFSTI

BMwF-FBK-68-12 (In German)

Analytical Treatment of Arbitrary Anisotropic Scattering in the
Energy-Dependent Transport Theory
S. A. W. Gerst
April 1968

BNWL-871

Plutonium Dioxide Gamma Attenuation Measurements Through Steel
L. W. Brackenbush
July 1968
Availability: CFSTI

BNWL-898

Total Energy Deposition Rates in Graphite Moderator With Two
Different Fuels
G. E. Hanson
August 30, 1968

BNWL-SA-2164

Strategy and Techniques for Solving the Two-Dimensional Multigroup
Diffusion Equation
R. W. Hardie, W. W. Little, Jr.
October 1, 1968

GAMD-7901

Peach Bottom Shielding Surveys, Results of Post-Construction R
and D Test Procedures DO-1, DO-3, and G03
B. A. Engholm
November 14, 1967
Availability: CFSTI

KFK-791(CONF-680636-1)

Organizational and Technical Aspects in the Field of Neutron Nuclear
Data Evaluation
J. J. Schmidt
July 1968

KURRI-TR-20 (In Japanese)

Neutron Spectra in the Intermediate Energy Region
K. Inoue, T. Nanjo; et al.
July 25, 1966

LA-3954

Fission Product Energy Release and Inventory from ^{239}Pu Fast
Fission
M. E. Battat, D. J. Dudziak, H. R. Hicks
Nov. 1967

LA-4016

Transport Theory: Formulations and Solutions by Finite Difference
Methods
B. G. Carlson
September 14, 1968

LA-DC-7852

Fast Neutron Elastic and Inelastic Scattering from Silicon
D. M. Drake, J. C. Hopkins
1968

NASA-TM-X-1680

Gamma Heating in Thin Heavy-Element Absorbers
J. H. Lynch, R. J. Crum
October 1968

NRL-6783

Empirical Approach to Thermal Neutron Absorption Cross Sections
S. Podgor
September 26, 1968

ORNL-TM-2334

Radiation Survey and Dosimeter Intercomparison Study at The Health
Physics Research Reactor
G. D. Kerr, D. R. Johnson
November 1968

ORNL-TR-2021 (*Vopresy Fiziki Zashchity Reaktorov Sbornik Statei, Vypusk 2, p22-39, Atomizdat, Moscow, 1966 in Russian*)

Transmission of Neutrons Through Plane Parallel, Multilayer Slabs
T. A. Germogonova, A. P. Suvorov, V. A. Utkin

ORNL-TR-2033 (*Translated from Inzenyrske Stavby, 3, 117-130 (1968) in Czech.*)

Attenuation Factors for Broad Beam Gamma-Radiation in Lead, Steel,
Concrete and Water
A. Hönig

ORNL-RSIC-24

Compilation of Data on Experimental Shielding Facilities and Tests
of Shields of Operating Reactors
Radiation Shielding Information Center
November 1968

RF/FI-(68)30

Heterogeneous Methods in Neutron Transport Theory
V. C. Boffi, V. G. Molinari
1968

SC-RR-68-619

Analytical Approximations for Total Pair-Production Cross Sections
F. Biggs, R. Lighthill
September 1968

Energ. Nucl. Milan, 15(10), 648-654 (1968)

Gamma Ray Penetration Through and Back Scattering from Concrete
Slabs
Y. S. Su, K. C. Wu

J. Nucl. Sci. Technol. (Tokyo), 5(9), 458- (September 1968)

Backscattering of Gamma-Rays from Semi-Infinite Stratified Slabs
of Alternating Tin and Aluminum Layers
T. Nakamura, T. Hyodo

J. Nucl. Sci. Technol. (Tokyo), 5(9), 464-471 (September 1968)

A Simple Calculation for Air-Scattered Gamma-Rays
M. Kitazume

J. Nucl. Sci. Technol. (Tokyo) 5(9), 472- (September 1968)

Invariant Imbedding and Absorption Probability in Slabs
T. Nakayama, T. Nishida

Nucl. Appl., 5(6), 456-463 (December 1968)

Gamma Heating in Thin Heavy-Element Absorbers
J. H. Lynch, R. J. Crum, H. J. Reilly

Nucl. Eng. Design, 7(1), 13- (January 1968)

Experimental and Theoretical Studies on the Gamma-Ray Scattering
Technique for Measuring Atmospheric Density
R. P. Gardner, D. R. Whitaker

Nucl. Sci. Eng. 34(3), 328-329 (December 1968)

Linear Energy Transformation for Gamma-Ray Monte Carlo Calculations
A. B. Chilton

Nucl. Sci. Eng. 34(3), 332-336 (December 1968) (ORNL-TM-2252)

Sensitivity of Neutron Transport in Oxygen to Various Cross-
Section Sets
E. A. Straker

Nucl. Sci. Eng. 34(3), 336-339 (December 1968)

Applications of Macroscopic Formulation of Transport Theory
W. Pfeiffer, J. L. Shapiro

Soviet J. At. Energy, English Transl. 23(1), 759 (July 1968)

Neutron Doses from Point Sources in Air
P. A. Yampol'skii, A. I. Khovanovich, V. F. Kokovikhin, A. I.
Kukarin, N. A. Kondurushkin

Soviet J. At. Energy, English Transl. 23(1), 739 (July 1967)

Gamma Flux Near the Air-Water Boundary from an Isotropic 60-Co
Source Immersed in Water
N. F. Andryushin, V. V. Astakhov, B. P. Bulatov, A. V. Kuznetsov

Soviet J. At. Energy, English Transl. 23 (1), 716- (July 1967)

Slant Penetration of Gamma-Radiation Through a Shield
L. N. Veselovskii, E. K. Guzovskaya, V. G. Kuznetsov, V. A.
Sakovich

Soviet J. At. Energy, English Transl. 23(1), 718- (July 1967)

Shielding Properties of Borated Concretes
V. B. Dubrovskii, M. Ya. Kulakovskii, P. A. Lavdanskii, V. I. Savitskii, V. N. Solov'ev, A. F. Mirenkov

Soviet J. At. Energy, English Transl. 23(2), 802- (August 1967)

Scattering of Collimated Gamma-Ray Beams from 60-Co, 137-Cs, and 198-Au at the Boundary of Two Media
N. F. Andryushin, V. V. Astakhov, B. P. Bulatov, G. M. Fradkin

Soviet J. At. Energy, English Transl. 23(2), 813- (August 1967)

Calculation of Dose Rates from the Absorption of Gamma Radiation from Spent Reactor Fuel Elements
V. E. Drozdov

Soviet J. At. Energy, English Transl. 23(2), 858- (August 1967)

Spectral Angular Distribution of 137-Cs Gamma-Rays Scattered in Spherical and Plane Shielding Walls
A. V. Larichev, O. F. Partolin, E. D. Chistov

Soviet J. At. Energy, English Transl. 23(3), 907- (September 1967)

Differential Albedo for Gamma Rays from a Point Unidirectional Source
A. A. Viktorov, B. A. Efimenko, V. G. Zolotukhin, V. A. Klimanov, V. P. Mashkovich

Soviet J. At. Energy, English Transl. 23(3), 912- (September 1967)

Measurement of the Neutron Spectra from a Reactor up to an Energy of ~ 20 MeV
V. I. Kukhtevich, L. A. Trykov, O. A. Trykov

Soviet J. At. Energy, English Transl. 23(3), 965- (September 1967)

Back Scattering of Gamma-Radiation From Isotropic Sources by Cylindrical Sources (Abstract)
B. P. Bulatov, E. Yu. Vasil'eva, N. T. Andryushin, A. V. Kuznetsov, V. L. Chulkin

SPACE AND ACCELERATOR SHIELDING

ANL-TRANS-608

Transmission of Fast Electrons Through Thick Layers of Matter
D. Harder, Thesis
January 1965

HASL-203

Tables for the Determination of the Lateral Shielding Requirements
of High Energy Accelerators
K. O'Brien
November 1968

JINR-P1-3976 (*In Russian*)

Investigation of the Electron-Photon Showers with the Scintillation
Counters
O. A. Zaimidoroga, V. M. Kut'in, Yu. D. Prokoshkin, V. M. Tsupko-
Sitnikov

JINR-P2-4068 (*In Russian*)

Cross Sections for Fast Particles and the Atomic Nuclei
V. S. Barashenkov, K. K. Guidima, V. D. Toneev

LNF-68/55 (*In Italian*)

Problems of Shielding Connected with Increasing the Intensity of the
Frascati Electron Synchrotron
M. Pelliccioni, P. Picchi, G. Verri
September 19, 1968

N68-26119

Lateral and Angular Structure of Electromagnetic Cascades
W. V. Jones (Ph. D. Thesis 67-8785)
January 1967

NASA-CR-1194

Investigation of Electron Interaction in Matter
W. E. Dance, W. J. Rainwater, D. H. Rester
October 1968

NASA-CR-61573 (N68-17666) (UCC/DSSD-270)

Cross Section Calculations and the Study of Space Vehicle Radiation
Shielding
Clayton D. Zerby, Henry Brysk
May 15, 1967

NASA-TN-D-4755 (N68-35535)

Tables of Energy and Angular Distributions of Thick Target
Bremsstrahlung in Metals.
C. A. Powell, Jr.
October 1968

ORNL-4192 (NASA-CR-92578, N68-15367)

The Electron-Photon Cascade Induced in Lead by Photons in the Energy
Range 15 to 100 MeV
R. G. Alsmiller, Jr., H. S. Moran
January 1968

ORNL-4336

Shielding Calculations for a 200-MeV Proton Accelerator
R. G. Alsmiller, Jr.; J. Barish, R. T. Boughner, W. W. Engle
December 1968

ORNL-TR-2017 (LNF-65/30 in Italian)

Calculation of a Nucleon Cascade in Aluminum with the Monte Carlo
Method for Energies Between 400 and 30 MeV
M. A. Locci, P. Picchi, G. Verri
September 6, 1965

ORNL-TR-2022 (JINR-P16-3936 in Russian)

Effectiveness of Boron in Accelerator Shields on Shields on
Scattered Radiation
L. N. Zaitsev, L. R. Kimel, M. M. Komochkov, V. P. Siodorin,
B. S. Sychev, O. A. Ulitin,
June 1968

PPAD-650 E

A Study of the Neutron Cascade in Iron
F. Hajnal, M. Awschalom, B. G. Bennett, J. McLaughlin, K. O'Brien,
P. D. Raft, W. Schimmerling
October 29, 1968

Bull. Am. Phys. Soc., 13(11), 1445- (1968)

Low-Energy Neutron Production in Aluminum at Intermediate Proton
Energies
J. J. Singh, J. G. Griffin

Can. J. Phys. 46(pt.2) S204-5 (May 15, 1968) (A68-41349)

The Angular Distribution Functions of Cascade Electrons in Iron
and Lead in the Shower Maximum
I. P. Ivanenko, B. E. Samosudov

Can. J. Phys. 46(pt.2) S283-86 (May 15, 1968) (A68-41370)

Energy Determination of Electromagnetic Cascades Recorded in
Nuclear Emulsions
W. Enge

Health Phys. 11, 1101-1105, (October 1965) (CERN /DI/HP-45, Rev.)

Time Variation of the Dose-Rate from Radioactivity Induced in High-
Energy Particle Accelerators
A. H. Sullivan, T. R. Overton

Nucl. Instr. Methods, 64, 167-170 (1968)

The Distribution in Energy and Angle of High-Energy Neutrons from
a Gun Source
K. O'Brien, J. E. McLaughlin

Radiation Res., 35(2), 596-611 (1968)

Radiation Dose from High-Energy Nucleons in Targets Containing Soft
Tissue and Bone
J. E. Turner, V. E. Anderson, H. A. Wright, W. S. Snyder, J. Neufeld

Soviet J. At. Energy, English Transl. 22, 6, 607-608, June 1967

Secondary Nucleons Emitted from Thick Aluminum Targets Bombarded
by 340 MeV Protons
V. E. Dudkin, E. E. Kovalev, V. F. Kosmach, V. A. Kuz'min, V. I.
Ostroumov, Yu. I. Serebrennikov, L. N. Smirenniy

BOOK

NAS-NRC Publication 1487

Radiobiological Factors in Manned Space Flight
Editor - Wright Langham

COMPUTER CODES LITERATURE

BNWL-811

September 1968

EXDOSE

EXDOSE - A Computer Program for Calculating the External Gamma Dose
from Airborne Fission Products
by M. M. Hendrickson
FORTRAN II for IBM 7090

Arkiv Fysik 34 (5), pp 481-493 1967

NAMS

A Monte Carlo Program for Calculation of Neutron Attenuation and
Multiple Scattering Corrections
by B. Holmqvist, B. Gustavsson and T. Wiedling
FORTRAN for IBM 7090 and 7044

AE-AEC-MEMO 12693

June 1968

SOSUM

SOSUM - A Program to Compute Multigroup Beta and Gamma Energy
Sources from Radioisotope Activities
by B. J. Dray and R. J. Thomson
FORTRAN for IBM 360

NSSDC 68-02

January 1968

TRECO

TRECO - An Orbital Integration Computer Program for Trapped
Radiation
by A. B. Lucero
FORTRAN IV for CDC 6600

MLM-1460

May 1968

DORAP

Calculated Dose Rates for Plutonium-238 Dioxide
by C. T. Meyer, H. F. Anderson, and J. B. Kahle

WAPD-TM-661

March 1968

LETO
MO648

A Solution of the Slab Transport Problem
by Lambros Lois
FORTRAN IV for CDC 6600