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. 73 December 1970

Concentrate your energies and work hard.
Launch out in new experiments.
Never be afraid to have the courage of your opinions.
Fix the lines you want to travel along and keep on them.
That's all.
- A. C. W. Harmsworth

SECOND RADIATION SHIELDING ISSUE IN AUGUST

Nuclear Engineering and Design

The second in a series of issues devoted to radiation shielding is now available in the August 1970, Vol. 13, No. 3 publication of the journal *Nuclear Engineering and Design*. The first of the series was announced in the September 1970 RSIC Newsletter, No. 70. Editors Charles F. Bonilla and Thomas A. Jaeger have been assisted in the preparation of the radiation shielding series by Editorial Board members E. Aalto, J. Butler, A. H. Foderaro, and D. K. Trubey.

The following articles appear in the above issue. Requests for reprints of any article should be addressed to the author concerned.

Attenuation of Monoenergetic Source Neutrons in Different Shielding Materials
G. Perlini, R. Nicks, H. Penkuhn, C. Ponti (EURATOM), C. Manduchi, G. Moschini, G. Zago (University of Padova)

The Optimum Arrangement of Laminated Iron-Water Shields
T. Fuse, A. Yamaji, T. Miura (Ship Research Institute, Japan)

Use of the Discrete Ordinates S_n Method in Radiation Shielding Calculations
P. N. Stevens (ORNL)

Practical Aspects of Multi-Dimensional Monte Carlo Shielding Calculations
P. S. Mittelman, M. H. Kalos (MAGI)

Advanced Monte Carlo Concepts in Radiation Shielding Calculations: Methods and Applications
T. M. Jordan (A.R.T.)

Kernel Methods for Radiation Shielding Calculations
D. K. Trubey (RSIC)

Computer Codes for Shielding Calculations - 1970
B. F. Maskewitz, D. K. Trubey (RSIC)

A Time Optimisation for the Gamma Transport Codes BIGGI 3/4
H. Penkuhn (EURATOM)

Gamma-Ray Spectra Arising from Thermal-Neutron Capture in Elements Found in Soils, Concretes, and Structural Materials
R. E. Maerker, F. J. Muckenthaler (ORNL)

ARE YOU INTERESTED IN SHIELDING STANDARDS?

The ANS-6 Subcommittee on Shielding Standards, which is sponsored by the Shielding and Dosimetry Division, has been in existence now for 5 years. In this period some milestone accomplishments include publication of benchmark problems (ORNL-RSIC-25 or ANS-SD-9) and a shield test program which we hope is close to being approved as a standard by the American National Standards Institute (ANSI).

The subcommittee also feels that a shield test program should be written for accelerators for particles with energies less than 100 MeV. Volunteers are needed for this proposed working group, as well as for existing groups. In particular, the working group for shield materials is now an empty set. A working group leader and 3 to 5 group members are needed for this important work. The cross section group, chaired by Don Dudziak, also needs members. Anyone who is willing to help should contact the ANS-6 chairman, Norman M. Schaeffer of Radiation Research Associates at 3550 Hulen St., Fort Worth, Texas 76107, or H. C. Claiborne of ORNL at P.O. Box X, Oak Ridge, Tennessee 37830.

SHALL RSIC PUBLISH ANOTHER GENERAL SHIELDING BIBLIOGRAPHY?

Since the beginning of RSIC we have published bibliographies of shielding literature - in 1963, in 1966, and in 1968. Each publication included only the literature entered into the system since the previous one. The most recent in the area of reactor and weapons shielding, ORNL-RSIC-5 (Vol. II), included the literature entered into the files between May 1966 and September 1968. We are now considering the advisability of publishing Vol. III, including the literature reviewed since September, 1968.

As costs are rather great for such a publication and up-to-date special computer produced bibliographies and abstracts are available from RSIC upon request, we wish to solicit your opinion as to whether such publications are worthwhile. Have you found that the published bibliographies are useful to you? Are the SDI's and the special bibliography-on-request service adequate for your needs? If you feel strongly that the general bibliography publication is worthwhile, please indicate this by reserving your copy of the next one in the form on the following page. We will also appreciate letters of comment from you, so that we may know how best to serve you.

It is our intention to discontinue publishing abstracts in the loose-leaf binders (ORNL-RSIC-6 and ORNL-RSIC-12) since the abstracts are available from a special printout upon request and are usually

available in *Nuclear Science Abstracts*. We would like your opinion on this, too.

PLEASE RETURN THIS FORM WITH YOUR COMMENTS NO LATER THAN FEBRUARY 1, 1971.

TO: RSIC COORDINATOR DATE_____

I do___ do not___ wish you to reserve a copy of ORNL-RSIC-5, Vol. III for me for the following reasons:

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(Name)_____

(Installation)_____

(Address)_____

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ORNL-RSIC-5 Vol. I AVAILABILITY

Until recently each new subscriber on the RSIC Distribution received automatically a copy of the reactor and weapons shielding bibliography, ORNL-RSIC-5 Vol. I and II. Our supply of Vol. I is now exhausted and we do not plan a new printing. All subscribers are now referred to the former Clearinghouse for Federal Scientific and Technical Information, new name and address below:

National Technical Information Service
U.S. Department of Commerce
Springfield, Virginia 22151

RECENTLY PACKAGED CODES

Operable, tested with a sample problem, and available for distribution are the following peripheral shielding code packages:

PSR-24/IER	Integral Evaluation Routines. SIR - a Gauss-based quadrature formula applied to Sievert's Integral was contributed by the University of Tulsa and Warren Research Foundation, Tulsa, Okla. ENOFX - an Exponential Integral Routine was contributed by ORNL. (NOTE: Any integral evaluation routines thought to be useful in programming for shielding calculations may be added to this package. A contributor is asked to send adequate documentation and a sample calculation with his offering to the package).
PSR-25/DUCAL	Neutron-Capture Gamma-Ray Spectra Generator, contributed by ORNL.
PSR-26/NEVEMOR	Multigroup-Multiregion Calculation of Flux Spectra and Energy Deposition for Fast Neutrons, contributed by the AECL Whiteshell Nuclear Research Establishment,

Pinawa, Manitoba, Canada

PSR-27/GIRD Shuffle-Dwell Gamma-Ray Irradiator Design Code, contributed by Brookhaven National Laboratory.

PSR-10 UPDATE

Peripheral shielding code package PSR-10 has been updated by the addition of the fourth version of EVAP. It is a Monte Carlo code designed to calculate the types, multiplicites, and energy distributions of particles evaporated from excited compound nuclei. Based on EVAP-3, the code has been extended to include an "improved termination" feature. Reference: EVAP-4: Another Modification of a Code to Calculate Particle Evaporation from Excited Compound Nuclei," ORNL-TM-3119 (September 1970), by Miriam P. Guthrie.

CHANGES TO PSR-13B/SUPERTOG

A new version of SUPERTOG, denoted as SUPERTOG-II, is now available from RSIC as PSR-13B. This version was prepared by R. Q. Wright of ORNL. The code will generate multigroup cross-section sets from the ENDF/B Version II data. In addition, some modifications were incorporated to allow new output options and improve some calculational techniques. With minor modifications, SUPERTOG-II may also be used to process ENDF/B-Version I data. The RSIC code package has been updated to reflect these changes.

The maximum number of multigroups allowed in the present version of PSR-13B/SUPERTOG-II is 150. Approximately 400K bytes of core storage are required. If additional core storage is available, the maximum number of multigroups can be easily increased to 300. The resulting version of SUPERTOG-II will require approximately 750K bytes of core storage. Information needed to modify the program to increase the number of groups is available from RSIC on request.

MODIFICATION TO SUBROUTINE FORN IN CCC-107/ETRAN

A modification, representing a minor correction to Computer Code Package CCC-107/ETRAN has been called to RSIC's attention by Martin J. Berger, NBS. Only Subroutine FORN is involved in the change. The information needed to effect the change is available from RSIC upon request. The RSIC package has been updated to reflect the modification.

CORRECTION TO CCC-131/ANTE

Martin O. Cohen, MAGI, has called to RSIC's attention a correction to all versions of CCC-131/ANTE: ANTE, ANTE-2, and ANTE-BELLM. All future distribution will reflect this correction. To current ANTE users, the change is as follows:

In REAL FUNCTION LEGP (X,JA)

two lines below Statement Number 101

change the variable NT to the variable N1.

RSIC SUBJECT CATEGORIES EXPANDED

Several new subject categories are now available in the RSIC computerized information retrieval system. The new subject categories in the reactor and weapons shielding area are

111500	Sources - Neutron - Discrete Energies
112B00	Sources - Gamma-Ray - Discrete Energies
122350	Cross-Section Evaluation by Integral Experiment - Gamma-Ray - Secondary
717000	Fusion Reactor Shielding
760000	Medical Facilities
795xxx series	Computer codes in the RSIC collection as cited in the literature. The last 3 digits represent the number of the code package.
870xxx series	Shielding materials where the last 3 digits represent the atomic number of a given element
886000	Fluorides

The following category numbers and titles have been changed.

Was	Now	
122311	122310	Cross-Section Evaluation by Integral Experiment or Sensitivity Study - Neutron
122312	122330	Cross-Section Evaluation by Integral Experiment - Gamma-Ray - Primary
122313	122370	Cross-Section Evaluation by Integral Experiment - X-Ray
711000	same	Hot Cells
810000	same	General Survey of Materials

Please let us know if you wish to add any of these new categories to your SDI profile.

PERSONAL ITEMS

Harold B. Atkinson, Jr. has assumed the duties formerly carried by Walter Kee in the USAEC Division of Technical Information, Washington, D.C. Mr. Kee is now Chief of the Library Division.

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W. J. Dodson is now project manager for Kaiser Engineers at the Idaho Falls Facility.

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Glenn Graves has returned to his post at the Los Alamos Scientific Laboratory after having served a year with the International Atomic Energy Agency (IAEA) in Vienna, Austria.

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We note a letterhead change. RSIC correspondents from the former Grumman Aircraft Engineering Corporation of Bethpage, Long Island, New York, are now communicating under the name Grumman Aerospace Corporation.

VISITORS TO RSIC

Visitors to RSIC during the month of November were: J. DePangher, Health Physics & Occupational Health, Stanford University, Stanford, Calif.; L. A. Matheson, Dow Chemical Co., Rocky Flats Plant, Golden, Colo.; W. Nelson, IBM, Owego, N. Y.; J. J. Schmidt, IAEA, Vienna, Austria.

NOVEMBER 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 (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 National Technical Information Service, 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 the literature in our files 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.

REACTOR AND WEAPONS SHIELDING

AAEC/TM-542 *May 1970*

The Calculation of (n,2n) Cross Sections Using the Hauser-Feshbach Theory
W. K. Bertram
Avail. Dep.; NTIS (U.S. Sales only)

AEEW-R-701 *August 1970*

Thermal Neutron Diffusion Data and the WIMS Scattering Models for Light Water
A.T.D. Butland, C. T. Chudley
Avail.: HMSO Price 6s. 6d. NET

AERE-R-6408 *June 1970*

Selective X-Ray Generation by Heavy Ions. Part I. The Use of Energetic Heavy Ions to Generate Characteristic X-Rays from Elements in a Selective Manner. Part II. Measurement of the Concentration Distribution of Ion-Implanted Antimony in Silicon by the, (etc.)
I. A. Cairns, R. S. Nelson, et al

AFWL-TR-70-29 (Limited Distribution) *August 1970*

An Active Dosimeter System to Measure Energy Deposition and Charged Particle Spectra of High Energy Inner Van Allen Belt, Solar Flare, and Galactic Cosmic Protons on Manned Spacecraft.
M. E. Schneider, G. C. Ainsworth, R. E. Walters

BRH-DEP-70-18 *July 1970*

Bremsstrahlung Production
D. G. Brown

BRL-MR-2045 *July 1970*

DORF-1, Gamma-Ray Spectrograph Shielding Studies
W. R. Van Antwerp, B. L. Cash, W. Hendricks
Avail.: NTIS as AD-711531

CEA-N-1294 (In French) 1969

Irradiation Damage from Pile Neutrons. Detailed Calculations on the Atomic Processes Involved. Program Source.
P. Chabry, J. P. Genthon
Avail.: Dep.; NTIS (U.S. Sales only)

CEA-R-4049 (In French) August 1970

Device for the Ionometric Determination of the Dose Absorbed in Various Materials, Study of the Air and Tissue Equivalence of Various Materials Used in Photon Dosimetry
G. Troesch
Avail.: Dep.; NTIS (U.S. Sales only)

CONF-690548, pp. 552-559

Present Status of Isotope Applications in Japanese Industry
M. Kato, M. Kobayashi, A. Ohno, T. Nagumo; K. Takano, H. Iijima, H. Ohno, M. Goto
(Proc. Jap. Conf. Radioisop., 9th, Tokyo, 1969)

DP-REPORT-296 September 1964

Final Shielding Report for the Dragon Reactor Experiment - Project DRAGON
D. B. Crawley, C. R. Owen
Avail.: Dep.; NTIS

FTE-MT-24-243-69 (AD-703059; N70-35335) December 3, 1969

Modern Trends in the Investigation of Nuclear Reactor Shielding
S. G. Tsypin
Avail.: NTIS

GA-10280 August 24, 1970

Fast Reactor Spectrum Measurements. Quarterly Progress Report for the Period Ending July 31, 1970
J. C. Young, P. d'Oultremont, G. M. Borgonovi, C. Rindfleisch, A. E. Profio
Avail.: Dep., NTIS

IITRI-578-P-33-18 May 1970

Development of Neutron Spectrometry for Critical Facilities. Final Report, Oct. 1, 1968 - March 31, 1970
R. A. Semmier
Avail.: Dep.; NTIS

KAPL-P-3889 1969

Anisotropic Sources in Two-Dimensional Transport Theory
J. P. Friedman, B. W. Crawford
Avail.: Dep.; NTIS

NASA-CR-109876 (HIT-439, N70-34007) March 1970

Radiation Flux Mapping of OPE Spacecraft Models, Phase 1.
Hittman Associates, Inc., Columbia, Md.

NASA-CR-110136 (JPL-TR-32-1481; N70-35897) June 15, 1970

Gamma Radiation Characteristics of Plutonium Dioxide Fuel
P. J. Gingo, M. A. Dore
Avail.: NTIS

NASA-TM-X-65001 (N70-35645) August 19, 1966

Polonium-210 and Plutonium-238 Radioisotope Shielding for Post-Apollo Missions
G. L. Hagey

NRL-MR-2126 (AD-707 336) May 1970

Irradiation Effects on Reactor Structural Materials
L. E. Steele, C. Z. Serpan, Jr., J. R. Hawthorne

ORNL-TM-1274 October 1965

A Model for Fission Product Transport and Deposition Under Isothermal Conditions
T. S. Kress, F. H. Neill

ORNL-TM-3156 October 27, 1970

Calculated Neutron Flux Distribution Resulting from a Fission Source Located at the Center of a 10-Meter-Diameter Sphere of Sodium
C. L. Thompson

RISO-M-1289 August 1970

Integral Transport Theory in Various Geometries
H. Neltrup
(Danish Atomic Energy Commission Research Establishment, RISO)

RRA-M702 June 26, 1970

Gamma-Ray Attenuation in Structures with Basements
D. E. Hinkley, R. L. French

RRA-M703 November 1, 1970

A Study of the Components of the Exposure in Cylindrical Structures
D. E. Hinkley

RT EL-(69)12 (In Italian) November 12, 1969

Control System with Linear Calculator for Experiments in Neutron Spectrometry
L. Babiloni, E. de Agostino, G. Fillarini

RT EL-(70)1 (In Italian) December 22, 1969

Interface for PDP-8L Computer Control of a Triple Axis Neutron Spectrometer
L. Babiloni, E. de Agostino, G. Fillarini

RT/FI/69/46 (N70-33488) October 14,1969

Stationary Neutron Transport in Plane Heterogeneous Assemblies
T. Trombetti
Avail.: NTIS

SGAE-PH-97-1970 1969

Magnetic Shielding System for a Reactor Beam Tube
R. Dobrozemsky

UCRL-19868 August 1970

Observations by Human Subjects of Radiation-Induced Light Flashes in Fast-Neutron, X-Ray, and Positive-Pion Beams
C. A. Tobias, T. F. Budinger, et al

UCRL-50857 April 20, 1970

Collimation of Fast Neutrons
E. M. Lent
Avail.: Dep.; NTIS

Carbon, 8, 297-311 (June 1970) (In French)

Properties of Absorbent Carbons for Fast Reactor Shielding
J. Cledat

J. Nucl. Sci. Technol. (Tokyo), 7, 34-40 (Jan. 1970)

Studies on Gamma-Ray Exposure in Environment Due to ^{41}Ar Cloud from a Nuclear Reactor
M. Kadokawa

Nucl. Eng. Design, 13(3), 377-459 (Aug. 1970)

Radiation Shielding (2)
C. F. Bonilla, T. A. Jaeger (Eds.)

Nucl. Eng. Design (13(3), 377-389 (Aug. 1970)

Attenuation of Monoenergetic Source Neutrons in Different Shielding Materials
G. Perlini, R. Nicks, H. Penkuhn, C. Ponti

Nucl. Eng. Design, 13(3), 390-394 (Aug. 1970)

The Optimum Arrangement of Laminated Iron-Water Shields
T. Fuse, A. Yamaji, T. Miura

Nucl. Eng. Design, 13(3), 395-408 (Aug. 1970)

Use of the Discrete Ordinates S_n Method in Radiation Shielding Calculations
P. N. Stevens

Nucl. Eng. Design, 13(3), 409-414 (Aug. 1970)

Practical Aspects of Multi-Dimensional Monte Carlo Shielding Calculations
P. S. Mittelman, M. H. Kalos

Nucl. Eng. Design, 13(3), 415-422 (Aug. 1970)

Advanced Monte Carlo Concepts in Radiation Shielding Calculations: Methods and Applications
T. M. Jordan

Nucl. Eng. Design, 13(3), 423-447 (Aug. 1970)

Kernel Methods for Radiation Shielding Calculations
D. K. Trubey

Nucl. Eng. Design, 13(3), 448-449 (Aug. 1970)

Computer Codes for Shielding Calculations - 1970
B. F. Maskewitz, D. K. Trubey

Nucl. Eng. Design, 13(3), 455-456 (Aug. 1970)

Gamma-Ray Spectra Arising from Thermal-Neutron Capture in Elements Found in Soils, Concretes, and Structural Materials
R. E. Maerker, F. J. Muckenthaler

Phys. Med. Biol., 15, 121-3 (Jan. 1970)

Fast Neutron Central Axis Depth Dose Equation
P. H. McGinley

Radiochem. Acta, 14(2), 83- (1970)

Recoil Atoms from (N, Gamma) Reactions
C. S. Tumosa, H. J. Ache

Radiol. Health Data Rep.; 11, 135-6 (Mar. 1970)

Lead Content of Glass Used for Shielding Television Receiver Components and Its Relation to Exposure Rate
H. Levine, P. S. Ruggera

Strahlentherapie, 139, 179-85 (Feb. 1970) (In German)

Determination of Quality Factor for 15 MeV Neutrons
H. Krueger, E. H. Graul

Soviet J. At. Energy (English Transl.), 26(6). 642- *(June 1969)*

Scattered γ-Ray Buildup Factors for Oblique Incidence
I. V. Goryachev, V. G. Kuznetsov, V. I. Manchevskii, V. A. Sakovich, V. I. Shcherbakov, M. M. Yakubovich

Soviet J. At. Energy (English Transl.) 28(3), 336-338 (March 1970)

Hematite Concrete for Shielding from High Neutron Fluxes
V. B. Dubrovskii, Sh. Sh. Ibragimov, V. V.Korenevskii, A. Ya. Ladygin, V. K. Pergamenshchik, V. S. Perevalov

BOOK

Precision Measurement and Calibration, N. B. S. Papers on Statistical Concepts and Procedures (pp.92-102)

H. H. Ku (Ed.)

ARTICLE:

Design and Statistical Procedures for the Evaluation of an Automatic Gamma-Ray Point Source Calibrator.
S. B. Garfinkel, W. B. Mann, W. J. Youden
Washington, U.S. Dept. of Commerce (1969)

THESIS *1970*

Theoretical Investigation of Gamma Ray Transport Through Mutually Perpendicular Slabs
David E. Hinkley
Catholic University of America, Washington, D.C.

SPACE AND ACCELERATOR SHIELDING

ORNL-4631 *November 1970*

Energy Deposition by 45-GeV Photons in Be and Al
R. G. Alsmiller, Jr. H. S. Moran
Avail.: NTIS

ORNL-TM-31 9 *September 10, 1970*

EVAP-4: Another Modification of a Code to Calculate Particle Evaporation from Excited Compound Nuclei
M. P. Guthrie
Avail.: Dep.; NTIS

ORNL-TM-3153 *October 1, 1970*

An Approximate High-Energy Alpha-Particle-Nucleus-Collision Model
T. A. Gabriel, R. T. Santoro, R. G. Alsmiller, Jr.

Health Phys., 18, 693-704 (June 1970)

Photon Energy Emission from Spallation Products Produced by 3 to 13 GeV Electrons
J. M. Wyckoff

COMPUTER CODES LITERATURE

AHSB (S) R 184 — *1970* — *POND4, MONK*

Use of the U. K. Nuclear Data Library in the Monte Carlo Program MONK
P. J. Hemmings, Authority Health and Safety Branch, UK, Risley, Warrington, Lancashire
FORTRAN IV, ICL 470

CEA-N-1335 (French) — *November 1970* — *LGR/B*

The Program LGR/B for the Maintenance of the ANISN Data Tapes, with Tracing of Cross Section Curves (Plotting)
Gilles Brandicourt and Jacques de Scheemaecker, Shielding Group, CEN Fontenay-aux-Roses
FORTRAN IV, IBM 360

CEA-N-1361 (French) — *October 1970* — *ELF*

Program ELF - User's Manual
Francois Gervaise, Shielding Group, CEN Fontenay-aux-Roses
FORTRAN IV, IBM 360

IAE-1828 (Russian) — *1969* — *PRACTINEZ*

A Program for Calculating the Neutron Thermal Utilization Coefficient in a Cylindrical Cell
N. I. Leletin, Institute of Atomic Energy, Moscow
ALGOL 60

JUL-603-ST, pp 204-8 (German) — *DRIS*

Activity and Shielding: A Computer Program for the Determination of Radiation Intensity and Shielding Requirements in Reactor Activation
F. Rohloff and G. Crommen, Juelich, West Germany

ORNL-TM-1970 October 1967 PREDEP-II

Numerical Solution of the Isothermal Fission-Product Deposition Equations: The Program PREDEP II
T. S. Kress and Paul Nelson, Jr., ORNL Mathematics Division
FORTRAN IV, IBM 360

ORNL-TM-3119 September 1970 EVAP-4

EVAP-4: Another Modification of a Code to Calculate Particle Evaporation from Excited Compound Nuclei
Miriam P. Guthrie, ORNL Neutron Physics Division
FORTRAN IV, IBM 360

UM-P-70/4 1970 MCNEUT

Monte Carlo Calculation of Pulse Height Spectra from Organic Scintillators
P. J. Saunders and G. G. Shute, University of Melbourne Physics Department, Australia
FORTRAN IV, IBM 7044