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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Information is the difference between our levels of ignorance before and after receiving a message.

.....Witold Brostow
SCIENCE, 178, 123 (Oct. 1972)

REVISION TO DATA LIBRARY IN CCC-123/XSDRN

A revision has been made to the CCC-123/XSDRN G123 library data for slowly saturating fission products (I.D. No. 4000000) to correct an error in the thermal energy range. Tables 1 and 4 of the report, ORNL-TM-1658, have also been corrected to conform with the revision. The RSIC package has been updated to reflect the revision. Users of the XSDRN library who are interested in this particular data should call or write to RSIC requesting a complete description of the changes; or should send a reel of magnetic tape for the revised library.

RSIC REPORT FROM EUROPE

Staff members Betty F. Maskewitz and Robert W. Roussin recently participated in conferences in Paris, France, Ispra, Italy, and in Monte Carlo, Monaco.

In Paris the FOURTH INTERNATIONAL CONFERENCE ON REACTOR SHIELDING was held October 9-13. The meeting was organized jointly by the OECD Nuclear Energy Agency (NEA) and the French Atomic Energy Commission (CEA) in collaboration with the International Atomic Energy Agency. A program of the papers presented was published in the September RSIC Newsletter No. 94. The meeting was attended by more than 200 participants representing twenty-one countries and seven scientific agencies. The activities of RSIC were described in two of the papers presented during the meeting. The proceedings of the meeting, including summaries of discussions for each paper, will be published by the CEA.

The NEA Computer Program Library (CPL) conducted a seminar on shielding programs at Ispra, Italy, October 16-18. A total of 48 persons from 16 different countries attended. Three removal-diffusion codes (SCORE, SHREDI, and

ATTOW) were discussed and compared. The PIPE code for integrating the photon transport equation, the LAPHANO code for generating multigroup photon production matrices from ENDF, and the MERCURE-4 kernel integration code were also discussed. The RSIC participants described the AMPX system for generating coupled multigroup cross sections from ENDF and the DOT-III two-dimensional discrete ordinates code. Proceedings of the seminar will be published in the NEA CPL Newsletter.

At the request of the Computer Committee of the American Society of Nuclear Medicine, Mrs. Maskewitz attended three days of the Symposium on Medical Radioisotope Scintigraphy held in Monte Carlo, October 23-28, under the sponsorship of the International Atomic Energy Agency (IAEA). She attended sessions and participated in discussions on data processing and the intercomparison of computer-assisted scintigraphic techniques. The proceedings will be published by the IAEA.

STAFF CHANGES AT OECD NEA

An announcement has been made that Luis Garcia de Viedma has been confirmed as head of the OECD Nuclear Energy Agency's Computer Programme Library (NEA CPL) located at Ispra (Varese) Italy. As the result of organization changes within NEA, the overall management of the CPL is now the responsibility of Johnny A. Rosen, currently head of the NEA's Division of Nuclear Information. Mr. Rosen is also responsible for the overall management of the nuclear data center, CCDN, located at Saclay, France, and for the NEA Secretariat for the European-American Committee on Reactor Physics (EACRP) and the European-American Nuclear Data Committee (EANDC).

TRANSLATION OF RUSSIAN BOOK ON INHOMOGENEOUS SHIELDS NOW AVAILABLE

The 368-page book *RADIATION TRANSMISSION THROUGH INHOMOGENEITIES IN SHIELDS*, by V. G. Zolotukhin, V. A. Klimanov, O. I. Leipunskii, V. P. Mashkovich, V. K. Sakharov, B. I. Sinitsyn, and S. G. Tsypin is now available in English from the National Technical Information Service, Springfield, Va. 22151, for $6.00 (paper copy). It was first published in 1968 in Moscow and has now been translated for the USAEC and the National Science Foundation. The document can be ordered as AEC-tr-7175 (TT-70-50155).

The material includes basic definitions and classifications of the inhomogeneities occurring in shields, basic data on shielding constants for calculations, and details of calculation methods and experimental techniques for investigating radiation fields in shields containing inhomogeneities. Material is included on the passage of radiation

through the main types of commonly occurring inhomogeneities - empty or filled straight ducts, passing completely or partially through the shield; sectionalized bent ducts; and uniaxial and multiaxial, stepped ducts - and through shields containing distributed voids or inclusions. The perturbation introduced by linear inhomogeneities into a distributed radiation field in a medium is estimated. The general approach to the solution of problems is to divide the overall characteristic of a radiation field (flux density, intensity, dose rate, etc.) into separate components.

THE NERVA RADIATION ANALYSIS COMPUTER CODES COLLECTION

Operable, tested with a sample problem, and available for distribution are the following code packages contributed by the Radiation Analysis Group, Aerojet Nuclear Systems Company, Sacramento, California. Developed in support of the NERVA program for the analysis of radiation transport and shielding, the code systems are sufficiently general to be applicable to a wide variety of problems.

The collection, packaged as CCC-189, -190, and -191 described below, includes programs written in FORTRAN IV for the IBM 360 series and the UNIVAC 1108 computers. Documentation was prepared especially for the collection and is available from RSIC.

The collection is characterized by a common geometry routine for a series of point kernel and Monte Carlo codes, which permits the user to prepare the geometrical model once and have the opportunity of running either simple or sophisticated analyses for the entire problem confronting him or any part thereof. This collection also features the capability to perform coupled discrete ordinates/Monte Carlo analyses, thus allowing the user flexibility of employing each of these methods for those portions of any given problem where one technique has advantages over the other.

Due to the modular programming involved in the coupling, the common geometry routine, and the flexibility afforded by the COHORT Monte Carlo package, a typical reactor problem can be started as a discrete ordinates analysis, carried through complicated three dimensional configurations with the exactness afforded by the Monte Carlo technique and involve any combination of these two or point kernel analyses at any point in the progression of the solution. They are available as:

CCC-189/ADO — Aerojet Discrete Ordinates Calculational System - One- and Two-Dimensional Codes: ANISN, DOT II, FAMORSE; with auxiliary routines DASH, MONDRIAN, and TAPEMAKER. Included in this package are codes currently operable on the UNIVAC 1108 (DOT II, DASH, ANISN, and MONDRIAN), and those operable on the IBM 360/75/91 (DOT II, DASH, SNOOPY, TAPEMAKER, and FAMORSE). Input and output from the running of sample problems are included for each of the codes in the package.

ANISN (CCC-82) and DOT II (CCC-89) are well known. DASH is included as a discrete ordinates/Monte Carlo coupling code, with allowance for coupling to COHORT (CCC-191), FAMORSE, or FMC (CCC-15) Monte Carlo codes, or to subsequent DOT calculations. MONDRIAN is included for angular flux data manipulation, providing data suited for coupling to DASH. FAMORSE is the MORSE (CCC-127) Monte Carlo code in FASTER (CCC-98) geometry. References: Available only from RSIC - documentation especially prepared by Aerojet for this packaging. Requests for this package should be accompanied by one full reel (2400 ft) of tape if written 9-track, 800 bpi, or by two reels if they must be written 7-track, 556- or 800 bpi.

CCC-190/AKERN Aerojet Point Kernel Integration Calculational Systems - Codes: QAD-P5F and GGGF with auxiliary routines SCATBLOCK, DIRECT, WANG, POINT KERNEL, DATAFILE, FPIC, S-4, GAMSCAT, ACT II and NAP. QAD-P5F is basically the LASL-developed QAD-P5 (CCC-48) for the point kernel integration of neutron or photon fluxes, dose rates and heating rates with ANSC changes to include the FASTER (CCC-98) geometry routine which allows interchangeability with 3-dimensional COHORT (CCC-191) Monte Carlo analyses and a number of other changes, particularly with relation to neutron moments fits and point source option. GGGF is a single scatter point kernel with FASTER geometry. The auxiliary routines: SCATBLOCK analyzes the effect of disk shields of arbitrary radius and location placed between the source point and scatter points in GGGF; DIRECT operates on GGG output for shielding parametric studies; WANG combines information obtained from QAD, GGG, SCATBLOCK, and DIRECT to perform shield optimization studies; using differential dose albedos, GAMSCAT computes gamma-ray scattering with point isotropic sources; ACT-II (CCC-27) is a neutron activation code; NAP (CCC-101) is a neutron activation prediction code; S-4 computes fission product energy release rates; and FPIC (CCC-28) is a fission product inventory code. With a request for CCC-190/AKERN, one full reel of magnetic tape is required. The package includes versions operable on the UNIVAC 1108 of QAD-P5F, GGGF, SCATBLOCK, DIRECT, WANG, and GAMSCAT. Those operable on the IBM 360 are QAD-P5F, GGGF, SCATBLOCK, ACT II, WANG, NAP, S-4, and FPIC.

CCC-191/ACOH Aerojet COHORT Monte Carlo Code System. Included are routines for history generation within a model described in FASTER (CCC-98) geometry; several analysis codes; source generation; several data processing codes; cross section preparation codes (from ENDF/B) and general purpose routines serving the COHORT system. Included in the package are versions for both the UNIVAC 1108 and the IBM 360. The entire package may be written on one 9-track tape, or on two tapes written 7-track.

OTHER ADDITIONS TO THE CODE COLLECTION

Also packaged during the month and now available for distribution are the following code packages.

CCC-192A/SAM-CEP — A Monte Carlo Code System Correlated to the Simultaneous Solution of Multiple, Perturbed, Time-Dependent Neutron Transport Problems in Complex Three-Dimensional Geometry contributed by the U.S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland, and the Mathematical Applications Group, Inc., White Plains, New York. Reference: BRL CR 62 (MR-7020) January 1972. Currently available is a version operable on the CDC 6600. Conversion to the IBM 360 is underway and completion will be announced in the Newsletter. CCC-192A may be written on one reel of magnetic tape.

CCC-193/ESP — A General Monte Carlo Neutron Transport Code System contributed by the Mathematics and Reactor Divisions, Oak Ridge National Laboratory. FORTRAN IV; IBM 360/75/91. Reference: ORNL-TM-3164.

PSR-42/USRHYD — Electron and X-Ray Energy Deposition Code System. The system includes the electron code ZEBRA (See abstract CCC-173) and the X-ray code BIGGS. Contributors are Braddock, Dunn, and McDonald, Inc., and the U.S. Army Harry Diamond Laboratories, both of Washington, D.C. FORTRAN IV; IBM 360. Reference: HDL-044-1.

SAND II DATA LIBRARY EXPANDED

The activation cross section library used with the SAND-II IBM 360 code package (CCC-112B) has been expanded to now include 40 isotopes, courtesy of Hanford Engineering Development Laboratory (W. N. McElroy, R. Simons, G. E. Shook) via F. B. K. Kam of Oak Ridge National Laboratory. He has also provided the necessary changes in CSTAPE to make use of this new library. Users interested in updating their program should furnish one reel of magnetic tape with their request, specifying desired density, whether 7- or 9-track, EBCDIC or BCD, and whether or not their tape is labelled. Requests for the CCC-112B/SAND-II code package filled by RSIC after 9-28-72 will include the new library.

PERSONEL ITEMS

Ralph Fullwood has left the Los Alamos Scientific Laboratory for employment with Science Applications, Inc. (SAI) in Arlington, Va.

David E. Groce, formerly with SAI, reports a change of address to JRB Associates, Inc., La Jolla, Calif.

Jacob Weitman, former head of the shielding group at AB Atomenergi at Studsvik, Nykoping, Sweden, is now with SCANDITRONIX, Täby, Sweden.

A. J. Armini has left McDonnell Douglas Astronautics Company and has joined SPI Company, Inc. of Bedford, Mass., as manager of their newly formed western division in Irvine, Calif. Current plans include conducting research in radioisotope thickness gauges and nuclear effects simulation.

Conrad Lennon, formerly with Computer Sciences Corporation, is now employed by Holmes and Narver, Los Angeles, in their Advanced Technology Division, currently directed by Stan Kaplan.

Hubert C. Woodsum, formerly with the Astronuclear Laboratory, is now associated with the Environmental Systems Division of Westinghouse at Monroeville, Pa.

John Herbst has sent a change of address from Computer Sciences Corporation, Elmsford, N. Y., to the New York State Atomic and Space Development Authority in New York City.

DATA PACKAGE ABSTRACTS DISTRIBUTED WITH NEWSLETTER

Appended to this copy of the RSIC Newsletter are several abstracts of data library packages assembled by RSIC. They are appropriately punched for inclusion in the ORNL-RSIC-30 Vol. 1 book of abstracts. The binders and a collection of abstracts DLC-1 through DLC-16 are available from RSIC upon request. The following packages are now available. Their contents are discussed in detail in the accompanying abstracts.

DLC-17/NOX	119-Group, P_5, Coupled Neutron and Secondary Gamma-Ray Cross Section Data for Nitrogen and Oxygen contributed by the ORNL Mathematics and Neutron Physics Divisions.
DLC-18/NAB	100-Group, P_3, Neutron Cross Section Data for Sodium and Aluminum contributed by the ORNL Mathematics and Neutron Physics Divisions.
DLC-19/DECAYGAM	Radioactive Decay Gamma-Ray Spectra Compilation contributed by the Analytical Chemistry Division, Oak Ridge National Laboratory.
DLC-20/TRANSMIT	Experimental Neutron Transmission Data Used to Test Total Cross Sections contributed by Neutron Physics Division, Oak Ridge National Laboratory.

VISITORS TO RSIC

Visitors to RSIC during the month of October were: Richard B. Martin, USAEC, Oak Ridge, Tenn.; Marion Scatcherd, National Engineering Laboratory, E. Kilbride, Scotland; J. A. Sholtis, Jr., Wright-Patterson AFB, Ohio; Kazuo Yasuda, Tokyo office, USAEC, Japan.

OCTOBER 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.

RSIC maintains a microfiche file of the literature entered into SARIS, and duplicate copies are available on request. Naturally, we cannot fill requests for literature which is copyrighted (such as books or journal articles) or whose distribution is restricted.

Special bibliographies and selected computer-printed abstracts of the literature in the RSIC system are available upon request. The Selective Dissemination of Information (SDI) Service is available by submitting a list of subject categories defining the recipient's interests.

REACTOR AND WEAPONS SHIELDING

AAEC TM 603

Radiation Shielding of an 8 in. x 6 NaI(Tl) Crystal for Use In KeV Neutron Capture Experiments
C. J. Broomhall
1971
AAECRE, Lucas Heights

AECL-3962

Flux Distribution Measurements in the Gintilly Reactor
A. Okazaki, D. H. Walker, M. H. M. Roshd
July 1971
NTIS $3.00

ANCR-1069

Gamma Rays Emitted by the Fissionable Nuclides and Associated Isotopes
J. E. Cline, R. J. Gehrke, L. D. McIsaac
July 1972
Dep. NTIS

ANL-7763

Techniques and Analyses of Fast-Reactor Neutron Spectroscopy with Proton-Recoil Proportional Counters
E. F. Bennett, T. J. Yule
August 1971

ANL-7853

Energy-Dependent Transport Theory with a Separable Kernel
H. A. Larson
October 1971

ANS-SD-12

Proceedings of Invited Papers, Spectroscopy and Unfolding Techniques
Murray A. Schmoke, Ed.
1971 Annual Meeting, ANS, Boston, Mass. June 14-18, 1971
Available: ANS Headquarters

BMBW-FBK-71-2 (In German)

Tabulated Values of Spatial, Directional, and Energy Distributions of Multiple Scattered Gamma Radiation
H. Stehfest
Dep., NTIS

BNL-17188 (ENDF-179)

ENDF/B-III Cross Section Measurement Standards
M. K. Drake
July, 1972
BNL

CEA-R-4289 (In French)

Method of Measuring the Directional and Energy Distribution of a Particle Flux
Claude Hyver
January 1972

CONF 700505

Space Dose Distribution of Monoenergetic Neutrons in Human Body for Different Neutron Incidence Angles
Report at the IRPA Congress, Brighton
V. G. Zolotukhin, I. B. Keyrim-Markus, O. A. Kochetkov, G. M. Obaturov, Z. A. Prokofieva, V. I. Tsvetkov
May 1970

CONF 720823-4
(DP-MS-72-15)

Effects of Radiation on Reactor Confinement System Materials
L. R. Jones
August 1972

DP-MS-71-28

Finite Discrete Fourier Transform Solution to the Neutron Diffusion Equation
J. L. Hightower
May 1971
Vanderbilt Univ., Nashville, Tenn. PC $3.00/MF $0.95

EGG-1183-1519

Monte Carlo Calculation of Electron Production by a Gamma Beam Incident on a Thick Foil
G. W. Wecksun, R. T. Brown
May 1971

EUR-4742e

Neutron Propagation in Water-Lead-Iron Lamination
B. Chinaglia, G. Boxio, F. Vallana, D. Monti
March 1972

EUR 4744e

Albedo Techniques for Calculating the Radiation Transport Through Voids
B. Chinaglia
March 1972
SORIN

GULF-RT-A10848

Energy Deposition Studies (Annual Report for period Sept. 1, 1970 through August 31, 1971)
David A. Vroom
September 1971

HASL-265

Investigation of Thermoluminescent Dosimeters for Environmental Monitoring
G. de P. Burke, A. Shambon
October 1972
Dep, NTIS

IAE-2155

Calculation of Prompt Neutron Lifetime in a Reactor by the Monte Carlo Method
A. D. Frank-Kamenetskii
1971
(Risley-Trans-2354)
Photocopies available from National Lending Library, Boston Spa, Yorkshire, England, LS23 7 BQ

IF VE ORE 71 (In Russian)

Passing of High Energy Muons Through the Steel Shielding
S. A. Drugachenok, L. R. Kimel, G. I. Kripnyi, V. N. Lebedev, V. P. Sidorin
1971
Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii

IS-2687

Fundamentals of Radiation Damage and Applications to Materials Problems in Nuclear Reactors
M. S. Wechsler
September 1971

JAERI-1218

Evaluation of the Total Neutron Cross Section of Carbon Up to 2 MeV
K. Nishimura, Sin-iti Igarasi, T. Fuketa, S. Tanaka
October 1971
Tokai Research Establishment
JAERI

J.E.N. 219-D.Q./1 78

Elementary Computation of Radiation Doses and Shieldings for Radiochemical Laboratories
F. Jimeno De Osso
1971

KFK-1572 (Karlsruhe)

The KFINR-Set of Group Constants; Nuclear Data Basis and First Results of Its Application to the Recalculation of Fast Zero-Power Reactors
E. Ed. Kiefhaber, H. Bachmann, J. Braun, B. Hinkelmann, B. Krieg, D. Thiem
March 1972

LA-4780 (ENDF-174)

A Preliminary Evaluation of the Neutron and Photon-Production Cross Sections of Oxygen
D. G. Foster, Jr., P. G. Young,
August 1972
Los Alamos Scientific Laboratory

LA-4878

Measurements of Filtered X-Ray Spectra
D. W. Lier, H. I. Israel, E. Storm
March 1972

LA-4901

Evaluated Neutron-Induced Gamma-Ray Production Cross Sections for ^{239}Pu and ^{240}Pu
R. E. Hunter, L. Stewart
July 1972
NNCSC

LA-4918

Evaluated Neutron-Induced Gamma-Ray Production Cross Sections for ^{235}U and ^{238}U
L. Stewart, R. E. Hunter
July 1972
NNCSC

LA-4928

Evaluation of the Total Cross Section for Tungsten
J. J. Devaney, D. G. Foster
July 1972
NNCSC

LA-5025-PR

Annual Progress Report July 1, 1971 - June 30, 1972. Defense Nuclear Agency Sponsored Cross-Section Evaluation Group, LASL
P. G. Young, D. R. Harris
August 1972

MR-7022
(Project 6923)
(DNA 2809F)

Analysis of Neutron and Secondary Gamma Ray Transport in Concrete Using the SAM-CE Monte Carlo Code
Martin O. Cohen
November 1971
MAGI

NBS-10,848

Comparison of Photon Interaction Cross Section Data Sets. Vol. V Photran and ENDF/B
G. L. Simmons, J. H. Hubbell
August 21, 1972

NEDO-12154

Compilation of Fission Product Yields
M. E. Meek, B. F. Rider
Vallecitos Nuclear Center,1972

Negev Institute Report 120

Note on the Behaviour of Backscattered Gamma Ray Photons in the Scattered Medium
K. Priess, R. Livnat
March 1972

ORNL-TM-3859

Review of the Cross Sections of the Isotopes ^{6}Li and ^{7}Li as Tabulated on the ENDF/B III Files
M. Tobias
July 1972

ORNL-TM-3910
(ENDF-172)

Comparison of (n_{th},γ)Yields from the Current ENDF/B-III Data With Published Data
W. E. Ford, III
August 1972

ORNL-TM-3957
(ENDF-176)

SDT6. Experiment on Secondary Gamma-Ray Production Cross Sections Arising from Therma-Neutron Capture in Iron, Stainless Steel, Nitrogen, and Sodium
R. E. Maerker
October 1972

ORNL-TM-3974
(ENDF-177)

SDT7. Experiment on Secondary Gamma-Ray Production Cross Sections Averaged Over a Fast-Neutron Spectrum for Iron, Stainless Steel, Oxygen, and Sodium
R. E. Maerker
October 1972

RD/B/M-2356

An Ordered Table of Gamma Radiation Emitted by Fission Products
A. Tobias
June 1972
Dep., NTIS

S-559-R

Calibration of HDL 5-Element Absorption Gamma-Ray Spectrometer (Final Report)
J. L. Pigg, A. A. O'Dell, H. S. Janee, L. P. Hocker
EG&G Santa Barbara Div., Goleta, Calif.
July 1972

SLAC-153

Concepts of Radiation Dosimetry
K. R. Kase, W. R. Nelson
June 1972
Dep., NTIS

TRG Report 2189 (R)

Spectra of Energy Released by Thermal Neutron Capture
E. W. Sidebotham
1972

Ustav Jad. Vyzk No. 2537-R, T (Czech)

Shielding Design for the Experimental Fast Reactor ZRR
J. Burian, J. Rataj, B. Stoces
1970

ZJE 105

Transport Correction of Higher Order and Removal Systems
V. Valenta, O. Veverka, V. Krysl
1971

ZJE-124

Approximation of Resonance Self-Shielding Coefficients
K. Vlachovsky
1972
Skoda Works (Nuclear Power Construction Dept., Info. Ctr.)
Plzen, Czechoslovakia

Atomkernenergie, 19(1) 14 (1972)

Two-Dimensional Shielding Calculations Using a Combination of Diffusion Theory and Line-of-Sight Method
Von H. Vossebrecker
Interatom, Bensberg/Germany

Brit. J. Radiol. 44(518), 116-19 (1971) (Eng.)

Attenuation of 14-MeV Neutrons in Calcium-Based Concrete and the Resultant Production of Radioactivity
D. Greene, D. Major, J. R. Croft, G. C. Roberts

Energia Nucl. Milan, 19(4), 251 (Apr. 1972)

A Variational Acceleration Technique for the Iterative Solution of the Two-Group Neutron Diffusion Equations
L. Brusa, Giorcelli
CISE - Segrate (Milano)

Eur. J. Cancer 7, 105 (1971)

Production and Shielding of 15 MeV Neutrons
J. J. Broerse, A. C. Engels, J. S. Groen

Health Phys., 23, 116-117 (July 1972)

Hazards of Irradiated Liquid Nitrogen (Bibl.)
P. T. Perdue

Kernenergie, 14, 102 (1971) (In German)

Problems of Radiation Shielding Design in Pressurized-Water Reactor Nuclear-Power Plants
F. W. Kruger

Minerva Fisiconucl. G. Fis. Sanit. Prot. Radiaz., 15, 1 (1971) (In Italian)

Approximation of Singular Scattering in Calculation of Intensity of Exposure Due to Gamma-Ray Back Scattering
A. Bottino, F. Zampini

Nucl. Eng. Des., 22 (1), 138-160 (Aug. 1972)

Eine Methode Zur Bestimmung der Differentiellen Albedo fur Photenen im Energiebereich Von 2 Bis 17 MeV
H. G. Vogt

Nucl. Eng. Des., 22(1), 161-166 (Aug. 1972)

Weight Optimization of Reactor Shielding Using Transmission Matrix Methods
W. D. Leech, A. F. Rohach

Nucl. Instr. Methods, 98(3), 393-412 (Feb. 1972)

Response Functions for Proton-Recoil Proportional Counter Spectrometer
E. F. Bennerr. T. J. Yule

Nucl. Instr. Methods, 98(3), 525-533 (Feb. 1972)

Pulse Shape Discrimination in Inorganic and Organic Scintillators II
R. A. Winyard, G. W. McBeth

Nucl. Instr. Methods, 99(2), 295-300 (Mar. 1972)

Neutron Spectrometry with Proton-Recoil Proportional Counters in the Energy Region up to 10 MeV
H. Werle

Nucl. Instr. Methods, 100(1), 77-82 (Apr. 1972)

Measurement of MeV-Range Total Cross-Sections Using Reactor Neutrons
G. R. Norman, W. V. Prestwich, T. J. Kennett

Nucl. Instr. Methods, 100(1), 83-91 (Apr. 1972)

Erzegung Monoenergetischer Neutronenstrahlen im eV Bis keV Bereich Mit Hilfe Von Resonanzstreuern im Tangentialstrahirohr Des Frm
W. Dilg, H. Vonach

Nucl. Instr. Methods, 100, 445 (1972)

Attenuation of Fast-Neutrons in Shielding Materials
S. C. Gujrathi, J. M. Dauria

Nucl. Sci. Eng., 49(2), 117 (Oct. 1972)

Inverse Compton Scattering as an Energy Loss Mechanism in a Controlled Thermonuclear Reactor
P. A. Robinson, Jr., G. D. Sauter

Nucl. Sci. Eng., 49(2), 130-144 (Oct. 1972)

Neutron Displacement Cross Sections for Stainless Steel and Tantalum Based on a Lindhard Model
D. G. Doran

Nucl. Sci. Eng., 49(2), 162-171 (Oct. 1972)

Neutron Angular Distribution Analysis Using Cylindrical Bessel Functions
S. Pearlstein

Nucl. Sci. Eng., 49(2), 232-236 (Oct. 1972)

The Neutron Spectrum from a Fission Source in Water
A. E. Profio, R. J. Cerbone, D. L. Huffman

Nucl. Tech., 12, 375 (Dec. 1971)

Semiempirical Formulas for Gamma-Ray Dose Rates Through Two-Layer Slab Shields
David A. Sharp, A. Carnesale

Nucl. Tech., 16(1),45 (October 1972)

Effect of Neutron Irradiation on the Ductility of Austenitic Stainless Steel
E. E. Bloom, J. R. Weir, Jr.

Nucl. Tech., 16(1), 14 (Oct. 1972)

Damage Function Analysis of Austenitic-Steel, Neutron-Induced Mechanical Property Change Data
R. L. Simons, W. N. McElroy, L. D. Blackburn

Reactor Tech., 15(3), 210-238 (Fall, 1972)

Flux Synthesis Methods in Reactor Physics
Weston M. Stacey, Jr.

Spacecraft Rockets, 9, 597 (1972)

Crew Radiation-Dose from a High-Impulse Gas-Core Nuclear Rocket Plume
C. C. Masser

Transp. Theory & Stat. Phys., 2, 55 (1972)

Nonhomogeneous Boundary-Conditions in Neutron-Transport
J. Mika, R. Stankiew

THESIS

Neutron Transport in Two-Dimensional Slabs by Invariant Imbedding
J. C. Zink
August 1970
Univ. of Oklahoma

BOOK

HANDBOOK OF NUCLEAR DATA FOR NEUTRON ACTIVATION ANALYSIS
(Translated from Russian by Baruch Benny)
A. I. Aliev
Program for Scientific Translations, Jerusalem, Israel
1970

BOOK

RADIATION PROTECTION MEASUREMENT
R. Ehret, et al
(Translated from the German by Ralf Friese)
Pergamon, Oxford, New York
1972

BOOK

RADIOMETRIC METHODS AND INSTRUMENTS FOR MATERIALS DENSITY MEASUREMENT
(Bibl.)
Jiri Holena, Arnost Hönig, Eds.
1968
Brno Techn. Univ., Czechoslovakia

BOOK

DETERMINATION OF ABSORBED DOSE IN REACTORS
International Atomic Energy Agency. Technical Reports Series No. 127
1971

BOOK

RADIOACTIVITY AND RADIATION DETECTION
D. G. Miller
Gordon and Breach Science Publ.
1972

BOOK

RADIATION PROTECTION STANDARDS
L. Taylor
Chemical Rubber Co., Cleveland, Ohio
1971

SPACE AND ACCELERATOR SHIELDING

DESY D3/10

Berechnung der Abschirmung fur Den Speicherring Doris
H. Dinter and K. Tesch
June 1972

FTD-HC-23-719-71

Active Shielding of Spacecraft
K. A. Trukhanov, T. Ya. Ryabove, D. Kh. Morozov

IFVE-ORE-71-84

On Radiation Passing Through the Labyrinth of the IHEP 70 GeV Synchrotron
V. E. Borodin, L. P. Obryashikova, M. N. Chimankov
1971

LA-DC-72-611
CONF-720607-18

Spectrum of Neutrons Produced by 800-MeV Protons on Uranium
L. R. Veeser, R. R. Fullwood, E. R. Shunk, A. A. Robba
1971
Dep., NTIS

ORNL-TR-2536 (Translated from the German - Z. Physik 243, 464-79, 1971)

Electron-Photon Cascades in Lead at Primary Energies of 100, 200 and 400 MeV
R. Brockmann, P. Keil, G. Knop and P. Wucherer
1971

N72-25770

Spacecraft Radiation Analysis
Dale W. Harris
Ref. SIGNIFICANT ACCOMPLISHMENTS IN TECHNOL. GSFC 1970 1972 67-70
NTIS HC $3.00

R2-6225 1-14 (1972)
(ORNL-TR-2620)

Buildup of Cosmic Isotopes in Iron Meteorites
V. S. Barashenkov, N. M. Sobolevskii, V. D. Toneev
(Translated from Russian)

PROCEEDINGS OF THE NATIONAL SYMPOSIUM ON RADIATION PHYSICS, BOMBAY
(CONF-701138)

(1) Mathematical Methods for Energy-Dependent Radiation Transport
D. V. Gopinath
1971

(2) Shielding of High-Energy Accelerators: A Review
G. Srikantiah
1971

Acta Physica Acad. Sci. Hung. 29: Suppl. 3, 377-82 (1970)

Energy Spectrum of Cosmic Radiation from 10^{10} to 2×10^{20} eV
R. G. Brownlee, G. J. Chapman, S. A. David et al

Acta Physica Acad. Sci. Hung. 29: Suppl. 3, 383-8 (1970)

Arrival Directions of High-Energy Cosmic-Ray Primaries
R. G. Brownlee, S. A. David, A. J. Fisher, et al

Health Phys. 23, 159 (1972)

Calculation of Dose, Radionuclide Production and Delayed Photon Leakage Due to Solar-Proton Bombardment of Tissue with Potential Application to Astronaut Dosimetry
T. W. Armstrong, K. C. Chandler

Health Phys. 23, 663 (1972)

Study of Dose Composition in Tissue-Equivalent Phantoms for High-Energy Protons
V. E. Dudkin, E. E. Kovalev, L. N. Smirenny, R. M. Yakovlev

Kokl. Akad. Nauk SSSR 201(1), 75-7 (Nov. 1971)

Effectiveness of Solar Flares
M. I. Pudovkin, A. D. Chertkov

Nucl. Phys. A187(3), 531-44 (1972)

Medium Energy Intranuclear Cascade Calculations: A Comparative Study
V. S. Barashenkov (Joint Inst. for Nucl. Res., Dubna, USSR)
H. W. Bertini, K. Chen, et al

Nucl. Phys. B42, 77-84 (June 1972)

Experimental Study of the Reaction $\pi^- p \rightarrow \pi^0 \pi^0 n$ at 447 MeV Incident Pion Energy
V. Bunyatov, E. Zavattini, et al

Nucl. Sci. Eng. 48(2), 179-88 (June 1972)

Adjoint Difference Method and Its Application to Deep-Penetration Radiation Transport
T. J. Hoffman, J. C. Robinson, P. N. Stevens

Particle Accel. 3(3), 129-61 (June 1972)

Estimation of Radiation Problems Around High Energy Accelerators Using Calculations of the Hadronic Cascade in Matter
J. Ranft

BOOK MSF-2297

FUNDAMENTALS OF SHIELDING FOR ACCELERATORS
L. N. Zaitsev
Atomizdat, Moscow (1971)

BOOK

AN INTRODUCTION TO THE THEORY OF THE BOLTZMANN EQUATION
S. Harris
Holt, Rinehart and Winston, New York (1971)

COMPUTER CODE LITERATURE

AERE-R-7072 March 1972 ELCP
Fortran Program to Calculate Energy Loss of Charged Particles
by McNaughton, M.W.
Atomic Energy Research Establishment, Harwell, England
FORTRAN IV
AVAIL: NTIS (U.S. Sales Only)

CONF-701138 November 1970 COGASP
Computer Analysis of Complex Gamma Spectra
by Rangarajan, C.
Bhabha Atomic Research Centre, Trombay, India
AVAIL: NTIS

CONF-710346 March 1971 PLK,ANISN,DOT
Convergence of Difference Methods in One-Dimensional And Two-Dimensional Transport Codes
by Hehn, G.; Havranek, M.
University of Stuttgart, Germany
AVAIL: NTIS

CONF-710346 March 1971 GODIVA
Solution of the Stationary Neutron Transport Equation In Spherical Symmetry
by Hanke, W.
Kernforschungsanlage, Juelich, Germany
FORTRAN

DP-1304 September 1972 EGAD
EGAD: A Computer Program to Compute Dose Integrals From External Gamma Emitters
by Cooper, R. E.
Savannah River Lab., Aiken, South Carolina
FORTRAN IV; IBM 360/65
AVAIL: NTIS

EUR-4678e 1971 ATEMC
Monte Carlo Simulation of the Adjoint Transport Equation
by Matthes, W.
European Atomic Energy Community, Ispra, Italy

KFKI-71-12 1971 DISDOS
Two Codes for Calculation of Dose Distribution in Human Phantoms Irradiated by External Photon Sources
by Koblinger, L.
Hungarian Academy of Sciences, Budapest, Hungary
IBM 360
AVAIL: RSIC

KFKI-71-22 (In Russian) n.d. RFSP
Program for the Determination of Neutron Spectra From Activation Data
by Fisher, A.; Turi, L.
Magyar Tudomanyos Akademia Kozponti Fizikai Kutato Intezete, Budapest, Hungary

LA-4775-MS January 1972 SLAHM
Space and Time Dependent Slowing Down in Heavy Media
by Weisbin, C.R.; Forster, R. A.; Smith, D. B.; Corngold, N.
Los Alamos Scientific Lab., Los Alamos, N. Mex.
FORTRAN IV; CDC 6600
AVAIL: NTIS

NMCSSC-SPM-OCD-66A-70 November 1971 SATAN 2
Simulation for the Assessment of Tactical Nuclear Weapons (SATAN 2): Operational Capability Description
by Lautzenheiser, M.; Bales, W. B.; Fletcher, N. H.; Eoff, D. A.
Anagram Corp., Springfield, Va.
AVAIL: NTIS

Nucl. Sci. Eng.; 48(3),266-80 July 1972 MSC
Monte Carlo Evaluation of Multiple Scattering and Resolution Effects in Double-Differential Neutron Scattering Cross-Section Measurements
by Bischoff,F. G.
Rensselaer Polytechnic Inst., Troy, N.Y.

NUS-692; NASA-CR-126150 July 1970 CUGEL
Code CUGEL: A Code to Unfold Ge(Li) Spectrometer Polyenergetic Gamma Photon Experimental Distributions
by Steyn, J. J.; Born, U.
NUS Corp., Rockville, Md.
FORTRAN IV; UNIVAC 1108
AVAIL: NTIS

ORNL-TM-3613 October 1972 ARSLRN
A Computer Code for Analyzing Routine Atmospheric Releases of Short-Lived Radioactive Nuclides
by Reeves, M.; Fowler, P. G.; Cowser, K. E.
Oak Ridge National Lab., Oak Ridge, Tenn.
FORTRAN IV; IBM 360
AVAIL: NTIS

Trans. Amer. Nucl. Soc.; 15(1),550-551 June 1972 EMERALD
EMERALD: A Program for Calculating Radiation Doses From Pressurized Water Plant
by Brunot, W. K.
Pacific Gas And Electric Co., San Francisco, Calif.

UCID-30023(Rev. 1) May 1972 BUCKLE
User's Manual for the BUCKLE X-Ray Deposition Program
by Edwards, A. L.
Lawrence Livermore Lab., Livermore, Calif.
CDC 6600; CDC 7600
AVAIL: NTIS

UCRL-17391 Rev. February 1968 BRAGG
Program BRAGG: A FORTRAN IV Program for Calculating Bragg Curves, Flux and Current Distributions, and Energy Spectra
by Litton, G. M.
Lawrence Berkeley Lab., Berkeley, Calif.
FORTRAN IV; CDC 6600
AVAIL: NTIS

UCRL-51061,Vol. 1 March 1972 GAMANAL
Computerized Quantitative Analysis by Gamma-Ray Spectrometry. Vol. 1- Description of the GAMANAL Program
by Gunnink, R.; Niday, J. B.
Lawrence Berkeley Lab., Berkeley, Calif.
AVAIL: NTIS