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. 48 November, 1968

The best part of our knowledge is that which teaches us where knowledge leaves off and ignorance begins --- O. W. Holmes

GROUP NEUTRON CROSS-SECTION LIBRARY AVAILABLE FROM RSIC

A new 99-group neutron cross-section library is now available from RSIC. The set was derived from the current ENDF/B library by C. W. Craven, ORNL Reactor Division, and R. Q. Wright, Union Carbide Computing Technology Center, in cooperation with RSIC.

The energy range is from 0.414 eV to 14.9 MeV with a scattering angle expansion available up to P_8. The cross-sections are available on tape in the BCD ANISN-DOT format. A program is also supplied which can punch input cards for the ANISN or DOT discrete ordinates codes.

About half the nuclides in the current ENDF/B library are regarded as "shielding nuclides" by RSIC. These are: H, D, 6-Li, 7-Li, Be, 10-B, 12-C, 14-N, 16-O, 23-Na, Mg, 27-Al, Ti, V, Cr, Mn, Fe, Ni, 182-W, 183-W, 186-W, 235-U, 238-U.

The above nuclides currently will be provided on one tape when the "shielding" library is requested. Others are available upon request. These are: Nb, Mo, 135-Xe, 149-Sm, 151-Eu, 153-Eu, Gd, 164-Dy, 175-Lu, 176-Lu, Hf, 181-Ta, 197-Au, 232-Th, 233-Pa, 233-U, 234-U 236-U, 237-Np, 238-Pu, 240-Pu, 241-Pu, 242-Pu, 241-Am, 243-Am, 244-Cm, 174-Hf, 176-Hf, 177-Hf, 178-Hf, 179-Hf, 180-Hf.

The integral testing of the total cross sections for several of these nuclides has been reported by E. A. Straker, *Experimental Evaulation of Minima in the Total Neutron Cross Sections of Several Shielding Materials*, Nucl. Sci. Eng. 34(2), 114-121 (Nov. 1968); E. A. Straker, *Sensitivity of Neutron Transport in Oxygen to Various Cross Section Sets*, Nucl, Sci. Eng. 34(3) 332 (Dec. 1968), and A. E. Profio, *Fast Neutron Spectrum from a Point Fission Source in Infinite Graphite*, to be published as Shielding Benchmark Problem No. 1.

It is anticipated that alternate and additional evaluations including gamma-ray interaction and production cross sections, will be made available later from various sources including the ENDF/A files which now can utilize the ENDF/B format.

One reel of magnetic tape should accompany a request for the "shielding-nuclides" data, and two reels are required for the entire library. Information should be supplied to RSIC which indicates how each tape should be written, e.g., the density and track-channel.

BUILDUP FACTORS IN CONCRETE

We have received a letter from F. Wolfgang Krüger, VEB Kernkraftwerksbaw, 110 Berlin, which discusses the results of his work published in *Kernergie*, 11(7), 197-203 (1968). He has used the Goldstein-Wilkins Z_{eff} interpolation scheme to produce gamma-ray buildup factors for many types of concrete. He finds a much smaller discrepancy between the interpolation results and direct Moments Method results than reported by A. B. Chilton, *Nucl. Eng. and Design*, 6(3), 205-212 (1967) or F. H. Clark and D. K. Trubey, *Nucl. Applications*, 4(1), 37-41, (1968). Dr. Krüger finds a maximum deviation of about 20% out to 10 mfp.

RSIC RECOMMENDATIONS CONCERNING ICRU-DEFINED QUANTITIES PUBLISHED

The report, *Use of ICRU-Defined Quantities and Units in Shielding*, ORNL-RSIC-16, by D. K. Trubey has recently been issued. Discussions and recommendations are given concerning special problems which arise in shielding technology in application of the quantities defined by the International Commission on Radiation Units and Measurements. Report 10a, *Radiation Quantities and Units*, was reprinted in ORNL-RSIC-16 but is now superceded by Report 11. The latter report is now available from ICRU Publications, P. O. Box 4869, Washington, D. C., 20008 for $1.00. Although Report 10a has been superceded, we feel no substantial changes have been made in the definitions which would affect the discussion in ORNL-RSIC-16.

ORNL NEUTRON PHYSICS DIVISION ANNUAL REPORT PUBLISHED

The ORNL *Neutron Physics Division Annual Progress Report for Period Ending May 31, 1968*, ORNL-4280 (Oct. 1968) is now available from ORNL or CFSTI. Summaries and abstracts are given under the following headings:

Nuclear and Reactor Physics, Critical Experiments, Reactor and Weapons Radiation Shielding, RSIC, Radiation Detection and Data-Handling Techniques, Theoretical Studies for Medium- and High-Energy Radiation Shielding, and Experimental Studies for Medium-Energy Radiation Shielding.

PERSONAL ITEMS

Arnost Hönig, Director of the Defectoscopic Center for Building Industry and Materials, Technical University, Brno, Czechoslovakia is now a visiting scholar in the Department of Nuclear Engineering, Purdue University. Before Dr. Hönig, an editor of the IAEA *Engineering Compendium on Radiation Shielding*, returns to Czecholovakia in March, he plans to visit a number of United States' laboratories.

F. O. Leopard is a new staff member at Radiation Research Associates (RRA) at Fort Worth, Texas. He was with General Dynamics, Fort Worth, for about 10 years working in shielding, reactor design, and reactor safety.

Stanton T. Friedman has left Westinghouse Astronuclear Laboratory and is now at 702 Summerlea St., Pittsburgh, Pa., doing some shielding work, writing and presenting lectures on Unidentified Flying Objects.

VISITORS TO RSIC

Visitors to RSIC during the month of October were: James Hurley, Bechtel Corporation, San Francisco, California; M. B. Wells, R. L. French, Norman Schaeffer, Radiation Research Associates, Fort Worth, Texas; Melvin Scott, Sandia Corporation, Albuquerque, New Mexico; John R. Lilley, McDonnell Douglas Astronautics, Santa Monica, Calif.; Maj. George H. Connor, Jr., Nuclear Defense Lab., Edgewood Arsenal, Maryland; James W. Haffner, North American Rockwell-Space Division, Downey, California; Hans Ludewig, Odelli Ozer, Brookhaven National Laboratory, Upton, New York; G. P. Lahti, NASA-Lewis Research Center, Cleveland, Ohio; Tom Wilcox, Lawrence Radiation Laboratory, Livermore California; Lt. Robert F. Barry, USAF, Albuquerque, New Mexico; P. B. Hemmig, U. S. Atomic Energy Commission, Washington, D. C.; A. B. Chilton, University of Illinois, Urbana, Illinois; P. Gollon, Miguel Awschalom, National Accelerator Laboratory, Batavia, Illinois, Martin O. Burrell, NASA, Huntsville, Ala.; Arthur Reetz, Jr., Effects and Shielding, NASA Headquarters, Washington, D. C.; Lambros Lois, Bettis Atomic Power Laboratory, West Mifflin, Pa.; James C. Eamon, Richard K. Disney, Martin J. Schneider, Westinghouse Astronuclear Lab., Pittsburgh, Pa.; Mal Kalos, N. Y. Univ. Courant Inst. of Math., New York, New York; N. Mathur, University of Georgia, Athens, Georgia; Wolfram Uhlmann, Research Inst. of the Swedish National Defense, Stockholm 80, Sweden; K. Mori, Japan Atomic Energy Research Institute, Tokdi-Murd, Ibdraki-ken, Japan; Henry Stern, NASA, Huntsville, Ala.

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 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.

AAEC/TM-462

The High Resolution Study of Gamma Rays from keV Neutron Capture
B. J. Allen
July 1968

AD-670479

Gamma-Ray Pulse-Height Spectra: Formation of a Response Matrix for Iterative Unfolding
Daniel Sam, L. R. Bunney, D. C. Heater
Nov. 20, 1967

AD-670480

Angular Radiation Characteristics of Rough Surfaces Contaminated with Fallout Simulant
B. W. Shumway, A. L. Frank
Feb. 29, 1968

AD-671617

Measurements of the Neutron Angular Flux Spectrum in Water
A. E. Profio, R. J. Cerbone, G. W. Carriveau, T. Guzani
Nov. 20, 1967

AD-671622

Neutron Capture Gamma Ray Spectroscopy
M. Wiest
January 1968

AD-671888

Radiation Distribution within a Multistory Structure
C. McDonnell, J. Velletri
Feb. 1967

AD-671897

Problems of Radiation Safety in the Storage and Transport of Radioactive Isotopes
A. V. Terman
October 13, 1967

AERE-M-2038

The Energy Spectrum of the Gamma Radiation in the Daphne Core
M. G. Silk
June, 1968

AERE-M-2058

A List of Radioactive Isotopes in Ascending Order of Half-Life
R. J. Bullock, N. R. Large
June, 1968

ANL-7373

Determination of Gamma-Ray Heating in a Critical Facility by Thermoluminescent Dosimetry
G. S. Stanford, T. W. Johnson
February 1968

APDA-216(Vol. 1)

Analysis of Sodium Reactivity Measurements. Volume I, Cross Section Evaluation and Data Testing
T. A. Pitterle, E. M. Page, M. Yamamoto
June 1968

APDA-217 (ENDF-121)

Evaluated Neutron Cross Sections of ^{23}Na for the ENDF/B File
T. A. Pitterle
June 1968

APDA-218 (ENDF-122)

Evaluated Neutron Cross Sections of Pu-240 for the ENDF/B File
T. A. Pitterle, M. Yamamoto
June 1968

BMWF-FBK-68-11 (In German)

The Analytic Treatment of Arbitrary Anisotropic Scattering in the Energy Dependent Transport Theory
S. A. W. Gerstl
April 1968

EUR-3913 (In German)

Shielding Experiments at the Reactor Station Geesthacht, Annual Report, 1966
E. Bagge, E. Fischer
1968

EURFNR-486 (Translation)

P.E.C. - Preliminary Design Calculation of Gamma Shields
Installation: Bologna
January 1968

EURFNR-493 (Translation)

Effective Cross-Section for Neutron Capture in 10-150 keV Energy Range
Installation: Karlsruhe
August 1968

FTD-MT-24-253-67

Angular Energy Spectra of Fast Neutrons Behind Iron Shields
T. A. Germogenov, A. P. Suvorov, V. A. Utkin
November 2, 1967

IA-1102

Neutron Capture Gamma Rays from Natural Titanium
J. Tenenbaum, B. Arad, G. Ben-David, R. Moreh
January 1967

ICRU Report 11

Radiation Quantities and Units
International Commission on Radiation Units and Measurements
September 1, 1968

KFK-750 (EURFNR-537, EUR-3715, EANDC(E)-88-U)

Tables of Evaluated Neutron Cross Sections for Fast Reactor Materials
I. Langner, J. J. Schmidt, D. Woll
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KY-D-2554 (CONF-681001-6)

Advantages and Economic Aspects of Laminated Uranium Shipping Casks
C. W. Loveland

KY-F-96 (CONF-681001-7)

Demonstration Fuel Element Shipping Cask from Laminated Uranium Metal: Design and Fabrication
D. H. Stitt, V. A. Smith

LA-3746

Integral Gamma and Neutron Measurements on the Phoebus 1B Reactor
A. J. Ahlquist
September 6, 1968

LA-tr-68-18

Radiative Capture of Fast Neutrons
A. I. Abramov, A. A. Van'kov, V. N. Kononov, A. V. Malyshev, Yu. Ya. Stavisskii

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The Mean Number of Prompt Neutrons in the Fission of U-235 and Th-232 Induced by Neutrons with Energy up to 3.3 MeV
L. I. Prokhorova, G. N. Smirenkin

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Experimental Electron Shielding Studies
C. Jpiter, G. Merkel
November 26, 1965

NASA-TM-X-52358 (N68-11068, CONF-671102-40)

Comparison of Measured and Monte Carlo Calculated Gamma Dose in the Tungsten Water-Moderated Critical Assembly
P. Klann, W. Paulson
1967

NASA-TM-X-1497 (N68-15643)

Experimental Determination of Neutron Fluxes in Plum Brook Reactor HB-6 Facility with Use of Sulfur Pellets and Gold Foil
J. M. Bozek, M. P. Godlewski
February 1968

NAA-SR-Memo-10549

HNPF Spent Fuel Shipping Cask
S. Berger, F. J. Halfen, R. A. Hewson, J. Nishizaka, T. Ricci, A. T. Stelle
October 9, 1964

NASA-TN-D-4783

Measurement of the $^{10}B(n,\alpha)^{7}Li$, ^{7}Li Relative Cross Sections in the keV Region
D. Bogart, L. L. Nichols
September 1968

NASA-TN-D-4827

Comparison of Small Water-Graphite Nuclear Rocket States with Chemical Upper Stages for Unmanned Missions
M. R. Clark, G. D. Sagerman, G. P. Lahti
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Neutron Cross Sections and Teachnology - Proceedings of a Conference Washington, D. C. ; March 4-7, 1968
Edited by D. T. Goldman
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NDL-TM-44 (AD-675410)

Calculations with UNC-SAM-2 of Exposure Rates Measured in an Open Basement
A. R. Buhl, J. E. Lacetera
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NDL-SP-30 (AD-674419, Nucl. Sci. Eng., 32, 195-200

Some Neutron Reaction Cross Sections for $^{111,112}Cd$, ^{87}Sr, and ^{58}Ni.
J. K. Temperlely
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NSJ-tr-105 (FAPIG, Tokyo, 39, 248-53)

Study on the Integration of a Marine Reactor Plant: The Problem of Shielding Design
Y. Tanaka
January 1966

NYO-3829-17 (CONF-671102-44)

Theory of Gamma-Ray Cross Sections
R. H. Pratt
November 1967

ORNL-4289, Vol. II

Time-Dependent Neutron and Secondary Gamma-Ray Transport in an Air-Over-Ground Geometry. Volume II - Tabulated Data
E. A. Straker
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ORNL-RSIC-16

Use of ICRU-Defined Quantities and Units in Shielding
D. K. Trubey
October 1968

ORNL-RSIC-23

A survey of Recent Soviet Radiation Shielding Work
J. Lewin, J. Gurney, D. K. Trubey
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ORNL-TM-2285

A Comparison of the Building Protection Factor Codes CAPS-2 and PF-COMP
M. L. Gritzner, P. N. Stevens
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ORNL-TM-2273

Gamma-Ray Response of the NE-213 Liquid Scintillation Detector
C. Y. Fu, V. R. Cain, E. A. Straker, P. N. Stevens, F. J. Muckenthaler
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ORNL-TM-2299

Fast Neutron Collimator Studies and the Design of the TSF-SNAP Core Mapping Collimator
E. A. Straker
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Angular Distribution Spectra of Gamma Radiation from Behind a Graphite Barrier with a Primary Energy of 4.45 MeV
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Ground Roughness Effects on Fallout Shielding
R. L. French, J. H. Price, K. W. Tompkins
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TRG-1720 (D)

Movable Personnel Shield for Access to Hot Cells
E. Edmonds, I. H. Thomas
June 21, 1968

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Synthesis of Calculational Methods for the Design and Analysis of Radiation Shields for Nuclear Rocket Systems. Volume 1, Radiation Measurements in a Nuclear Rocket Propellant Tank Mockup Using Simulated Liquid Hydrogen
H. C. Woodsum, J. Rowland
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Synthesis of Calculational Methods for the Design and Analysis of Radiation Shields for Nuclear Rocket Systems. Vol. 2, Analysis of Radiation Measurements in a Nuclear Rocket Propellant Tank Mockup Using Simulated Liquid Hydrogen
L. D. Stephenson, R. G. Soltesz, R. K. Disney, S. L. Zeigler
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Hydrogenous-Material-Dependent Removal Cross Section of Lead for Fast Neutron Biological Dose
D. J. Dudziak, J. E. Schmucker
June 1968

Y-DR-1

Thermal Neutron Flux Distribution from a Spontaneous-Fission Neutron Source
D. W. Magnuson
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A Significant Correction Factor in Gamma Ray Dosimetry
A. Brnjolfs

Canad. J. Phys. 46(15), 1657-60 (August 1968)

Gamma Rays from the Interaction of 14.1 MeV Neutrons
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Health Phys., 15, 87-91 (July 1968)

Effective and Average Neutron Energies of (α,n) Sources Behind Hydrogen Containing Shielding
M. Heinzelmann, D. Nachtigall

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The Attenuation Factors for Broad Beam Gamma Radiation in Lead, Steel, Concrete and Water
Arnost Hönig

Izv. Vyssh. Ucheb. Zaveb., Fiz., No. 3, 77-82 (1968) (In Russian)

Application of the Perturbation Theory to Calculation of Gamma Radiation's Penetration Through Two-layer Barrier
A. M. Kolchuzhuzhkin, V. V. Uchaikin

J. Appl. Phys., 39 (6), 2881-2889, (May, 1968)

Bremsstrahlung Produced in Thick Aluminum and Iron Targets by 0.5 to 2.8 MeV Electrons
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J. Phys. A., 1(4), 493-495, (1968)

Total Gamma-Ray Cross Sections in C, Sn, W and Pt in Energy Region 84-662 keV
V. V. Rao, K. Parthosaradhi

Kerntechnik, 10(8/9), 462-471 (1968)

Design of Shielding in Nuclear Power Plants
H. Schultz

Nuovo Cimento B, 56(2), 279-282, (1968)

Photoelectric Cross-Sections of Gamma Rays in Sn, W, Au, Pb and U: A Comparison of McCrary et al.'s Results with Calculated and Compiled Values
K. Parthasaradhi

Radiation Res., 35, 1-25 (1968)

Energy Transfer to Matter by Neutrons
R. L. Bach, and R. S. Caswell

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Describing Irradiation Fields by Separating Primary and Scatter Irradiation, 3. Tissue-Air Ratio and Depth Dose Course with Gamma- and X-Rays in Range from 0.6 to 42 MeV
G. Schoknecht

Yadern. Fiz. (J. Nucl. Phys.) 7, 984-91 (May 1968) (In Russian)

Multiple Scattering of Limited Beam on Plane Layer
Yu. N. Gnedin, A. Z. Doiginov, N. A. Silantev

THESIS

Spectral Distribution of Fission Neutrons in Ordinary Concrete
Myong-jai Gene, Lim, University of Virginia (1966)

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Radiation Penetration Through Matter
A. I. Alekseev
Atomizdat, Moscow (1968)

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An Introduction to Radioactivity for Engineers
R. A. Coombe
London, Macmillan, New York, St. Martin's Press
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Problems in Dosimetry and Radiation Protection, No. 6, 7
L. R. Kimel, Editor
1967

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Handbook on Radiation Safety
V. F. Kozlov
1967

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Nuclear Radiation and Atomic Reactors
Kh. Shirinov
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Problems of Space Biology, Vol. 6
Edited by N. M. Sisakian
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Composition and Properties of Concrete
G. E. Troxell, H. E. Davis, J. W. Kelley
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AVCO-Everett Research Lab. Final Report for Contract NAS 8-20310

Study of Plasma Radiation Shielding
Prepared by AVCO Everett Reserach Lab.
May 1968

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Calculation of Thick Target Electron Bremmsstrahlung with Collimation at High Energies
N. R. S. Tait
July 1968

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Transverse Shielding Calculations for the Components of A 1/2 TeV Proton Synchrotron
Keran O'Brien
August 1968

ORNL-4322

High-Energy Muon Transport and the Muon Backstop for a 200-GeV Proton Accelerator
R. G. Alsmiller, M. Leimdorfer, J. Barish

ORNL-TM2277

Analytic Representation of Nucleon-and Pion-Emission Spectra from Nucleon-Nucleus Collisions in the Energy Range 750-2000 MeV
R. G. Alsmiller, Jr., J. Barish
July 1, 1968

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C. Tschalar and H. Bichsel
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UCRL-17663, Rev. 1

A Range Energy Table for Heavy Particles in Silicon
H. Bichsel, C. Tschalaer
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K. B. Shaw and R. H. Thomas

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Energy Spectra of Cascade Electrons in Lead
I. P. Ivanenko, B. E. Samosudov

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Showers Produced in Lead by 0.1 to 1 BeV Photons
O. A. Zaimidoroga, Yu. D. Prokoshkin, V. M. Tsupko-Sitnikov

COMPUTER CODES LITERATURE

UCRL-17538 (mf) — *May 1967* — *ENLO*

A Fortran Program for the Calculation of the Energy Loss of Heavy Charged Particles
by Hans Bichsel
FORTRAN IV for CDC 6600

KAPL-M-6923 — *May 1968* — *CLEM*

CLEM - A Legendre Polynomial Fitting Program with a Non-Nagativity Constraint
by C. J. Slavik, C. R. Lubitz and J. T. Reynolds

TRG-211-3FR — *December 1959* — *ABCD*

Monte Carlo Code for Penetration of Crew Compartment II
by Herbert Steinberg
IBM 704

WANL-TME-1813 — *June 1968* — *FLUXPLT*

FLUXPLT - A Fortran IV Program to Plot Isoflux Lines Based on the Scalar Flux Calculated by the DOT Program
by Larry L. Moran and Richard G. Soltesz
FORTRAN IV for CDC 6600

NBS 9868 — *July 1968* — *POISOM*

Neutron Flux from a Point Isotropic Source in Carbon Calculated by the Moments Method
by C. Eisenhauer and L. V. Spencer
FORTRAN IV