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. 67 June 1970

The supreme misfortune is
when theory outstrips performance

- Leonardo da Vinci
(1451 - 1519)

RSIC MONTE CARLO SEMINAR-WORKSHOP AT OAK RIDGE, October 5-7, 1970

Plans are being made by RSIC for a seminar-workshop on "Monte Carlo Methods and Computer Codes for Radiation Transport in Shielding Applications" to be held October 5-7, 1970, in Oak Ridge. Approximately 1½ days will be devoted to contributed papers on recent Monte Carlo developments, especially in the areas of adjoint calculations, energy-group treatment, coupled neutron-gamma-ray calculations, time dependence, and 3-D geometry. If you wish to contribute a paper, please submit the title and abstract to RSIC by August 15. Contributors will be expected to provide a photo-ready manuscript summary on October 15 which should be about 300-500 words in length (not counting graphs, tables, or references). The papers will be published in the proceedings to be printed as soon as possible following the conference.

The remaining time will be devoted to a workshop featuring the ANTE 2 code, developed by Mathematical Applications Group, Inc. (MAGI), and the MORSE code, developed by Oak Ridge National Laboratory, Neutron Physics Division.

The MORSE code, developed by V. R. Cain, E. A. Straker, D. C. Irving, and P. N. Stevens, is a multipurpose neutron and gamma-ray transport Monte Carlo code. Through the use of multigroup cross sections, the solution of neutron, gamma-ray, or coupled neutron-gamma-ray problems may be obtained in either the forward or adjoint mode. Time dependence for both shielding and criticality problems is provided. General three-dimensional geometry similar to that of O5R and O6R, as well as specialized one-dimensional geometry descriptions, may be used with an albedo option available at any material surface.

Standard multigroup cross sections such as those used in discrete ordinates codes may be used as input; either ANISN or DTF-IV cross-section formats are acceptable. Anisotropic scattering is treated for each group-to-group transfer by utilizing a generalized Gaussian quadrature technique. The modular form of the code with built-in analysis capability for all types of estimators makes it possible to solve a complete neutron-gamma-ray problem as one job and without the use of tapes. The MORSE code, described in ORNL-CF-70-2-31 (Feb. 1970), is written in FORTRAN IV for the IBM 360.

The ANTE code, developed by M. O. Cohen et al., is also designed to treat the time-dependent neutron transport equation in a 3-dimensional geometry by the adjoint Monte Carlo technique which is especially effective for point-detectors and distributed sources. An important feature of ANTE is the powerful geometric capabilities of the Combinatorial Geometry system. Additional code improvements implemented in the ANTE 2 version include a treatment of the fission process, the n,3n and $n,n'3\alpha$ reactions, detector regions distributed in space, and increased geometrical scoring capabilities. The cross section routines read ENDF/B data and provide adjoint cross sections for the Monte Carlo routines. ANTE, written in FORTRAN IV for the CDC 6600, is described in DASA 2396 (Jan. 1970).

Those planning to attend the conference should notify RSIC by September 1, 1970. Further information will be sent to those planning to attend.

CHAPTER 2 of DASA SHIELDING HANDBOOK Issued

Chapter 2 of the Defense Atomic Support Agency *Weapons Radiation Shielding Handbook*, DASA-1892-5, has been issued and is being distributed by RSIC to those on the reactor-weapons shielding distribution list. Others may obtain copies upon request. This chapter, written by Paul N. Stevens and H. Clyde Claiborne, is titled *Basic Concepts of Radiation Shield Analysis*. The Handbook is edited by Lorraine S. Abbott, H. C. Claiborne, and C. E. Clifford, all of ORNL.

Chapter 2 presents the basic concepts underlying the methods used for weapons or reactor radiation shield analysis. They include the quantities used to describe particle populations and the quantities used to describe radiation interactions with materials. The characteristics of the particular radiations produced by weapons, neutrons and gamma rays, are discussed in detail, including their physical properties and their important interactions. The production processes whereby neutrons and gamma rays are produced are also described. In addition, the chapter discusses the various response functions that are used to convert a radiation field to a biological effect.

The following unclassified chapters have now been issued:

(1) Chap. 2, *Basic Concepts of Radiation Shield Analysis*, DASA-1892-5 (June, 1970).

(2) Chap. 3, *Methods for Calculating Neutron and Gamma-Ray Shields*, DASA-1892-3 (Mar. 1968), now being revised for publication about Sept. 1970.

(3) Chap. 4, *Neutron and Gamma-Ray Albedos*, DASA-1892-2 (June 1967), reprinted as ORNL-RSIC-21.

(4) Chap. 5, *Methods for Calculating Effects of Ducts, Access Ways, and Holes in Shields*, DASA-1892-1 (1967), reprinted as ORNL-RSIC-20.

It appears that all other chapters, except for the introductory chapter 1 still to be written, will be classified and those with proper clearances can request them through the Defense Atomic Support Agency, Washington, D. C. 20305, Attn: RARP. Thus far, Chap. 6, entitled *Methods for Predicting Radiation Fields Produced by Nuclear Weapons*, DASA-1892-4, is the only classified chapter available. Those interested in the classified chapter schedule should write for information to Mrs. Lorraine S. Abbott, Oak Ridge National Laboratory, P.O. Box X, Oak Ridge, Tennessee 37830.

RSIC PSR CODES LISTED

In addition to the radiation transport and closely related codes identified by CCC numbers, RSIC packages other codes of interest to those doing shielding calculations. These codes, identified by Peripheral Shielding Routine (PSR) numbers, perform cross section calculation and processing, general-purpose optimization, energy-spectra unfolding, or other operations. The current list is given in Table 1.

NEW DIRECTORY OF INFORMATION CENTERS AVAILABLE

A revised *Directory of Federally Supported Information Analysis Centers*, compiled by the Committee on Scientific and Technical Information, Federal Council for Science and Technology, is now available. The document, giving data on 119 centers, is available from CFSTI as COSATI-70-1 (PB 189 300) (Jan. 1970) for $3.00.

IEEE TO HOLD NUCLEAR INSTRUMENTATION CONFERENCE

A call for papers has been issued by the Institute of Electrical and Electronics Engineers for the 1970 Nuclear Science Symposium on Nuclear Instrumentation for Research and Development. The conference will be held November 4-6, 1970, in New York City.

Original papers on the impact of nuclear energy on the environment, biomedical applications, data acquisition and processing, hardware and software systems, radiation detectors and circuits and reactor control and operation may be submitted.

TABLE 1

CODE PACKAGE	CONTRIBUTOR	COMPUTER & LANGUAGE	METHOD/TYPE OF CALCULATION/COMMENT
PSR-1/MAX-XTREME	ORNL-N	CDC-1604 FORTRAN 63	One-constraint LaGrange multiplier optimization technique. Can be used for optimizing shield weight, dose, cost, or other variable.
PSR-2/CHAD	AI	FORTRAN IV & MAP	Analyzes and transforms differential neutron scattering data. Computes Legendre expansion coefficients, frame-of-reference transformation matrices.
PSR-3/ELIESE	JAERI	FORTRAN	Calculates elastic and inelastic scattering cross sections for neutrons, protons, and alpha particles. Uses optical model and Hauser-Feshbach formulation.
PSR-4/HEITLER	UKAEA-AEEW	IBM 7030 FORTRAN	Computes Compton, photoelectric, pair-production and total microscopic gamma-ray cross sections. Interpolates in table of photoelectric and pair-production cross sections for 25 elements, computes Compton analytically.
PSR-5/AGN-SIGMA	AGN	FORTRAN	Calculates Legendre components of the multigroup transfer matrices and the group cross sections. Treats elastic-scattering, inelastic-scattering, and n,2n reactions.
PSR-6/EDISN	BE	FORTRAN	Calculates energy distribution of inelastically scattered neutrons. Treats compound nucleus mechanism for n,n' and n,2n reactions.
PSR-7/MUG	CTC, ORNL-N	IBM 360, CDC 6400 FORTRAN IV	Generates multigroup photon cross sections from energy point data. OGRE or ENDF/B input format, ANISN-DOT output format. Interpolates in table of photoelectric and pair-production, computes Compton analytically.
PSR-8/AUTOJOM-JOMREAD	AFWL	CDC 6600 FORTRAN IV	Generates or checks coefficients for quadratic equations describing 3D geometries. AUTOJOM produces coefficients from minimum input, JOMREAD checks 3D geometry input by plotting cross sections defined by intersecting planes.

TABLE 1 (cont.)

CODE PACKAGE	CONTRIBUTOR	COMPUTER LANGUAGE	METHODS/TYPE OF CALCULATION/COMMENT
PSR-9/CSP	ORNL-N	IBM 360 FORTRAN IV	Neutron cross section group-averaging. Uses 05R data tape input, allows up to P_{10} elastic scattering distributions.
PSR-10/EVAP	ORNL-N	IBM 360 FORTRAN IV	Calculates particle evaporation parameters from excited compound nuclei. Calculates types, multiplicities and energy distributions.
PSR-11/POPOP4	CTC	IBM 360 FORTRAN IV	Converts neutron-induced gamma-ray spectral yields to secondary gamma-ray production group cross sections. Data library available as DLC-12.
PSR-12/GGC	GGA, LASL-T	IBM 360 FORTRAN IV	Neutron multigroup cross section calculation, GAM-GATHER combined fine-group system, extensive data library. Performs resonance and spectrum-averaging calculations.
PSR-13/SUPERTOG	CTC	IBM 360 FORTRAN IV	Generation of neutron fine-group parameters and group-to-group scattering matrices from ENDF/B data.
PSR-14/05S	CTC, ORNL-N	CDC 1604 FORTRAN 63 & CODAP IBM 360 FORTRAN IV	Monte Carlo calculation of pulse height distributions due to monoenergetic neutrons incident on organic scintillators.
PSR-15/UKE	CTC	IBM 360 FORTRAN IV	UKAEA to ENDF/B format translator of neutron cross sections; translates smooth data, secondary angular distributions, and secondary energy distributions.
PSR-16/RANGE	UCRL, Berkeley	FORTRAN	Direct integration of Bethe-Bloch equation to calculate differential energy loss and range of charged particles (except for electrons and positrons) of energies between 1 MeV and 500 GeV for any element.
PSR-17/COOLC	ORNL-N	IBM 360 FORTRAN IV	Energy spectra unfolding.
PSR-18/FERDOR	ORNL-N	IBM 7090 FORTRAN II	Energy spectra unfolding.
PSR-19/AGN-GAM	AGN	IBM 7090	Neutron spectra and multigroup cross section generator solves P_1 and B_1 equations for 75 groups from 0.07 ev to 10 MeV.

TABLE 1 (cont.)

CODE PACKAGE	CONTRIBUTOR	COMPUTER LANGUAGE	METHODS/TYPE OF CALCULATION/COMMENT
PSR-20/LAPH	LASL-K	CDC 6600 IBM 360 FORTRAN IV	Constructs multigroup photon-production matrix from cross sections in ENDF/B format.
PSR-21/PHOX	LASL-K	CDC 6600 IBM 360,B5500 FORTRAN IV	Performs physics checks on photon-production cross sections in ENDF/B format.
PSR-22/RICE	ORNL-R	IBM 360 FORTRAN IV	Two-body neutron reaction kinematic equations solved for the energy transfer matrix, also calculates damage cross sections, primary recoil atom spectra and optimum cutoff energies.

TABLE 1 (cont.)

REFERENCES

PSR	
1	ORNL-3742 (1965)
2	NAA-SR-11231 (1965)
3	JAERI-1096 (1965)
4	AERE-M 1956 (1967)
5	AN-1447 (1965)
6	RL-SSL-200 (1968)
7	CTC-17 (1970)
8	AFWL-TR-67-60 (1967) AFWL-TR-67-36 (1967)
9	ORNL-4130 (1967)
10	ORNL-4379 (1969)
11	CTC-12 (1969)
12	GA-7156 (1967 GA-7157 Parts 1 & 2 (1967) GA-9021 (1968)
13	ORNL-TM-2679 (1969)
14	ORNL-4160 (1968) ORNL-TM-2597 (1969)
15	ORNL-TM-2880 (ENDF-134) (1970)
16	UCRL-11647, Rev. (1966)
17	Informal notes, report to be published
18	Informal notes, report to be published
19	AGN-TM-407
20	LA-4337 (ENDF-132) (1970)
21	DASA-2379 (AD 702 128) (1969)
22	ORNL-TM-2706 (1970)

CODE CONTRIBUTORS

AFWL	U. S. Air Force Weapons Lab., Research and Technology Div., Kirtland AFB, N.M.
AGN	Aerojet General Nucleonics, San Ramon, Calif.
AI	Atomics International, Canoga Park, Calif.
BE	Brown Engineering Co., Huntsville, Ala.
CTC	Computing Technology Center, Union Carbide Corp., Oak Ridge, Tenn.
GGA	Gulf General Atomic, San Diego, Calif.
JAERI	Japan Atomic Energy Research Institute, Tokai Research Establishment, Tokai-Mura, Ibaraki-ken, Japan.
LASL-K	Los Alamos Scientific Lab., K Div., Los Alamos, N.M.
LASL-T	Los Alamos Scientific Lab., T Div., Los Alamos, N.M.
ORNL-N	Oak Ridge National Laboratory, Neutron Physics Div., Oak Ridge, Tenn.
ORNL-R	Oak Ridge National Laboratory, Reactor Division. Oak Ridge. Tenn.
UCRL	University of California Radiation Lab., Berkeley, Calif.
UI	University of Illinois, Dept. of Civil Engineering and the Nuclear Engineering Program, Urbana, Ill.
UKAEA-AEEW	United Kingdom Atomic Energy Authority, Atomic Energy Establishment, Winfrith, AERE, Harwell, England

A 50-word abstract and a 500-word summary of papers to be considered for this conference should be submitted by June 15 to W. W. Managan, Program Chairman, Argonne National Laboratory (D818), 9700 S. Cass Ave., Argonne, Ill. 60439.

PERSONAL ITEMS

Yaakov Shima has returned to the Soreq Nuclear Research Center, Yavne Israel, after spending two years at ORNL in the Neutron Physics Division.

* * * * *

John Moteff, formerly with the General Electric Co., Cincinnati, O., is now a professor in the University of Cincinnati Materials Science and Metallurgical Engineering Department.

* * * * *

Jerry McKenzie of Wright-Patterson Air Force Base has recently been promoted to the rank of Major and is chief of the Operations and Maintenance Division of the Air Force Nuclear Engineering Center.

* * * * *

Harry Krug, Jr. is now vice-president of Nuclear Computations, Inc. in Pittsburgh, Pa.

VISITORS TO RSIC

Visitors to RSIC during the month of May were: Norman Allan Harris and Austin A. O'Dell, EG&G, Inc., Goleta, Calif.; Herbert Pomerance, Director's Division, ORNL; John Knight, Computing Technology Center, Union Carbide Nuclear Corp., Oak Ridge, Tenn.; John Moteff, University of Cincinnati, Cincinnati, O.; Brian Nicholls, AECL, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, Canada; Edith Tingle, AECL, Chalk River, Ontario, Canada.

MAY 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 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 the 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 available for the codes literature.

REACTOR AND WEAPONS SHIELDING

AECL-3037 (Pt. 1) *December 1969*

Fission Product Data for Thermal Reactors. Part 1. Cross Sections
W. H. Walker
Available: AEC Dep. Lib.; CFSTI (U.S. Sales only). AECL $2.00

AEC-tr-6944 (rev) *1966*

Distribution and Biological Effects of Radioactive Isotopes
Yu. I. Moskalev
Available: AEC Dep. Lib.; CFSTI

AEEW-R-675 *October 1969*

The Importance of Bremsstrahlung in the Shielding of Gamma Rays Having Energies Less than 10 MeV
L. M. C. Dutton
Available: HMSO; CFSTI

BNL-50145 *April 1969*

Tabulated Dose Uniformity Ratio and Minimum Dose Data for Gamma Irradiator Design
F. X. Rizzo, L. Galanter, K. Krishnamurthy
Available: AEC Dept. Lib.; CFSTI

BNL-50147 *April 1969*

Tabulated Dose Distribution Data for Gamma Irradiator Design
F. X. Rizzo, L. Galanter, K. Krishnamurthy
Available: AEC Dep. Lib.; CFSTI

BNWL-1262 *February 1970*

Neutron Spectra of Plutonium Compounds. Part 1. He-3 and Li-6 Spectrometer Measurements
L. W. Brackenbusy, L. G. Faust
Available: AEC Dep. Lib.; CFSTI

BNWL-1333 *April 1970*

FFTF Shielding Program
W. L. Bunch
Available: CFSTI

CEA-N-1244 (In French) *January 1970*

ORPHEE VI Program: Attenuation of Fast Neutrons in a Lamellar Structure of Water and Dense Material
M. Simon
Available: AEC Dep. Lib.; CFSTI (U.S. Sales only)

CEA-N-1253 (In French) *February 1970*

Calculation of Flux in Sodium Reservoir
S. Katz, J. C. Nimal, T. Vergnaud
Available: AEC Dep. Lib.; CFSTI (U.S. Sales only)

CTO-678 *September 1969*
(Translated from CEA News Bull., 1-2, Sep 1969)

Laser Produced Neutrons
Available: AEC Dep. Lib.; CFSTI (U.S. Sales only)

CONF-690802

Proceedings of the International Symposium on Neutron Capture Gamma-Ray Spectroscopy, Studsvik - August 11 - 15, 1969

EUR-4465 *April 18, 1969*

Measurements of Absorbed Doses Due to Exposure of Organs of Different Composition to Fast Neutrons of Different Energies
J. J. Broerse, G. W. Barendsen
Available: AEC Dep. Lib.; CFSTI (U.S. Sales only) EUR FF 5.60

JAERI-1181 *September 1969*

Evaluation of Thermal Neutron Scattering Cross Sections for Reactors
(Japan Atomic Energy Research Inst.)
Available: CFSTI as N70-17370

NASA-TN-D-5737 *April 1970*

Estimation of Spatial Capture Distributions in Resonance Absorbers
D. Bogart

NCRP-34 *March 2, 1970*

Medical X-Ray and Gamma-Ray Protections for Energies up to 10 MeV.
Structural Shielding Design and Evaluation
NCRP Publication, Washington, D. C. $1.50

ORNL-TM-2879 *May 18, 1970*

The Adjoint Boltzmann Equation and its Simulation by Monte Carlo
D. C. Irving

ORNL-TR-2304 (UJV-2125-R - In Czech)

S_N Approximation of the Transport Equation for Shielding a Nuclear Reactor
J. Burian

WAPD-TM-932 *March 1970*

A Comparison of Thermal Neutron Activation Measurements and Monte Carlo Calculations in Light-Water-Moderated Uranium Cells
J. J. Volpe, J. Hardy, Jr., D. Klein
Available: AEC Dep. Lib.; CFSTI

Health Phys., 18(4), 339- (1970)

An Experimental Measurement of High Energy Gamma Rays Produced by Slowing Down of 14 MeV Neutrons in Air
H. Thorngate

J. Nucl. Sci. Technol. (Tokyo), 6(12), 711-714 (Dec. 1969)

An Approximate Transmission Dose Buildup Factor for Stratified Slabs
Y. Harima, Y. Nishiwaki

Kernenergie 13(2), 47-54 (1970) (In German)

Calculation of Radiation Field of a Collimated Gamma-Ray Point Source by Moments Method
F. W. Kruger

Nucl. Sci. Eng., 40(2), 239-245 (May 1970)
(NucE-34, University of Pennsylvania)

Point Source Green's Functions for Neutral Particle Transport
J. F. Meyer, A. M. Jacobs

Nucl. Sci. Eng., 40(2), 224-238 (May 1970)

The Integral Transform Method for Neutron Transport Problems
H. Hembd

Nucl. Sci. Eng., 40(2), 262-282 (May 1970)

Predictions for Neutron Transport in Air, Based on Integral Measurements in Nitrogen and Oxygen at 14 MeV
L. F. Hansen, J. D. Anderson, E. Goldberg, J. Kammerdiener, E. Plechaty, C. Wong

Phys. Letters A, 31A(7), 392- (1970)

Incoherent Scattering of Low Energy Photons by Low Z-Elements
M. Singh

Siam Rev., 12(1), 1- (1970)

A Retrospective and Prospective Survey of Monte Carlo Method
J. H. Halton

Strahlentherapie, 139(1), 109-112 (1970) (In German)

Energy Fluence/Ion Dose Quotient as a Characteristic Variable in X-Irradiation
G. Drexler, M. Gossrau, U. Nahrstedt

SPACE AND ACCELERATOR SHIELDING

CEA-CONF-1405 (CONF-690814-2) *1969*

Simultaneous Satellite and Rocket Observations of the 25th February 1969 Solar Proton Event
(Presented at the 11th Intern. Conf. on Cosmic Rays, Budapest, 25 Aug.-Sept. 4, 1969)
E. Barouch, J. Engelmann, M. Gros, L. Koch, P. Masse
Available: CFSTI as N70-20793

CONF-671217, p. 639-641 (N70-17855) *April 6, 1968*

Characteristics of Particle Production in the Interaction of 22.8 GeV/c Protons with Light Nuclei in Emulsion
(In Dept. of At. Energy Proc. of the 10th Symposium on Cosmic Rays, Elementary Particle Phys. and Astrophys.)
B. Bhowmik, R. K. Shivpuri
Available: AEC Dep. Lib.

Conf-671217, p. 649-651 (N70-17857) *April 6, 1968*

On the Energy Spectrum of Pions and Protons in Pion-Nucleon (17 GeV/c) and Proton-Proton (24 GeV/c) Collisions
(In Dept. of At. Energy Proc. of the 10th Symposium on Cosmic Rays, Elementary Particle Phys. and Astrophys.)
D. P. Dubey, U. S. Kushwaha, M. S. Swami
Available: AEC Dep. Lib.

CU-276 (R-669; NEVIS-172) *April 1969*

Neutron Emission from Muon Capture
M. H. Krieger
(Thesis - Columbia Univ., Irvington, N. Y., Nevis Labs.)
Available: CFSTI as N70-19538

IHEP-69-76 (In Russian)

Induced Radioactivity at the IHEP Proton Synchrotron
V. T. Golovachik, G. E. Britvich, V. N. Lebedev
(Serpukhov, 1969 - Institute of High Energy Physics)

ISS 69/27 *July 1, 1969*

Value and Limitations of Quasi-Free Electron Scattering Experiments on Atoms
U. Amaldi, Jr., C. Ciofi degli Atti
(Istituto Superiore di Sanita, Rome)

NASA-CR-108118 (N70-20031) (RR-68-2) *August 1968*

Penetration and Interaction of Protons with Matter. Part 1.
Theoretical Studies Using Monte Carlo Techniques
Research Report, 1 June 1964-31 August 1968
M. Leimdorfer, G. W. Crawford, eds.
Available: CFSTI

NASA-CR-109174
(Translated from Ziv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), 33(9), 1408-1416 (1969))

Characteristics of Inelastic Nuclear Interactions of Cosmic Ray Particles at Energies 10 to 11th Power - 10 to 12th Power ev.
V. V. Guseva, et al.
Available: CFSTI as N70-21218

NASA-SP-3051, pp. 37-62 (AMFL-TR-68-205, pp. 37-62; N70-21230)

Penetrating Radiations (article)
E. E. Gaines, W. L. Imhof
In: *Space Materials Handbook*
J. B. Rittenhouse, J. B. Singletary
Washington, NASA, 1969
Available: CFSTI HC/$10.00 MF/$0.75

NASA-TM-X-53957 (N70-22208) *October 17, 1969*

Space Environment Criteria Guidelines for Use in Space Vehicle Development (1969 Revision)
D. K. Weidner, ed.
Available: CFSTI

UCRL-19368 *December 18, 1969*

Concrete Activation Experiment at the Bevatron
W. S. Gilbert, K. Goebel, H. W. Patterson, A. R. Smith
Available: AEC Dep. Lib.; CFSTI

Environmental Space Sciences, 3(4), 267-71 (July-Aug. 1969)
(Translated Kosm. Biol. Med., 3(4), 24-9, July-Aug. 1969)

Problems of Protection Against Radiation Hazards on Flights of Manned "Soyuz" Spaceships
E. I. Vorob'ev, Yu. Grigor'ev, V. I. Efimov, E. E. Kovalev, M. D. Nikitin, V. N. Obridko, V. M. Petrov, N. F. Pisarenko, A. V. Sedov, I. N. Senchuro, M. V. Tel'tsov, P. I. Shavrin

Nucl. Instr. Methods, 81(1), 29-35 (May 1, 1970)

Monte Carlo Calculation of Energy Deposition by the Nucleon-Meson Cascade and Total-Absorption-Nuclear-Cascade (TANC) Counters
J. Ranft

COMPUTER CODES LITERATURE

ORNL-CF-70-3-6 *March 1970* *JRMACRO*

JRMACRO - A Program for Converting Microscopic, Multigroup, P_n Expansion Cross Section Data into Corresponding Macroscopic Data for Mixtures or Compounds
by J. J. Ritts, R. W. Roussin, and I. J. Brown

ORNL-TM-2879 *May 1970* *MORSE*

The Adjoint Boltzmann Equation and its Simulation by Monte Carlo
by D. C. Irving

LA-4337 (ENDF-132) *May 1970* *LAPH*

LAPH - A Multigroup Photon Production Matrix and Source Vector Code for ENDF/B
by Donald J. Dudziak, Alan H. Marshall, and Robert E. Seamon
FORTRAN IV for CDC 6600