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

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RSIC STAFF CHANGES

After 12 years at Oak Ridge and 4 years as RSIC Director, S. K. Penny has taken a position at Union Carbide Research Institute, Tarrytown, New York. Keith will be sorely missed.

D. K. Trubey has taken his place as manager of the Center. Dave worked closely with Keith in the early planning in 1962 and throughout the operation of the Center since that time.

Mrs. Miriam Guthrie and Mrs. Vivian Jacobs have recently joined the staff on a part-time basis. Miriam works in the area of space shielding and Vivian helps move the mountain of paper connected with the code collection.

A N N O U N C E M E N T

Special Sessions on Protection Against Space Radiation
ANNUAL AMERICAN NUCLEAR SOCIETY MEETING

June 11-15, 1967
San Diego, California

Special sessions on Protection Against Space Radiation will be sponsored by the Shielding Division and the Aerospace Division of the American Nuclear Society at the Annual ANS Meeting in San Diego, California, on June 11-15, 1967.

Invited and contributed papers will be presented to provide a coverage similar to that of the Gatlinburg Symposia in 1962 and 1964. The principal areas of interest to be discussed are:

(1) Basic interactions and transport of space radiation in materials
(2) Methods for space radiation shield penetration calculations
(3) Spacecraft shield design, analysis, and verification
(4) Advanced shielding concepts for spacecraft

Invited papers will also be presented to review the space radiation environment and the effects of space radiation on man, materials and components.

Following the meeting, it is planned that all papers will be published in a special volume by the ANS Shielding Division. Contributed papers for the sessions will be considered if 400 to 600-word summaries are received by February 16, 1967. Summaries or requests for further information should be sent to Dr. J. Ernest Wilkins, Jr., Technical Program Chairman, General Atomic Division, General Dynamics Corporation, P. O. Box 608, San Diego, California 92112.

CURRENT WORK AND PROBLEMS

We knew we would get around to reporting on Oak Ridge in this column sooner or later. This month, we devote this entire space to Oak Ridge activities. Whether that is a reflection of level of effort or convenience of information gathering or just plain chauvinism we will not dispute.

There is a substantial experimental effort aimed at the understanding of interactions involving the radiations of space (Gibson, Wachter, Peelle, Verbinski, Maienschein, Zobel). The program of measurements conducted at the Harvard 160 MeV and Chicago 450 MeV accelerators to determine secondary neutron, gamma ray and proton spectra in selected materials is substantially complete. The data are now in final analysis prior to reporting.

A program is now in an advanced stage of planning to measure secondary neutron spectra from proton interactions at the 600 MeV SREL at Langley Field. A proton recoil spectrometer will be used to determine the high energy part of the spectrum. The low energy part will be measured with the recently developed NE 213 spectrometer.

Programs under way at the Oak Ridge Isochronous Cyclotron include the following.

The spectra of all secondary charged particles resulting from 60 MeV proton primaries in selected materials is being measured. The secondary neutron spectrum up to 20 MeV from 60 MeV proton primaries is being measured in selected materials. The secondary gamma ray spectra are being measured in selected materials for the following primaries: 13 MeV protons, 30 MeV protons, 50 MeV protons, 55 MeV alphas.

A theoretical effort in space radiation (Alsmiller) is also carried on. A principal effort in this is the extension of the NTC (and related routines) to be effective at 3 GeV. Their present upper energy limit is considered to be 400 MeV. These programs compute the transport of high energy radiations, their interactions with matter, including the formation of multiple secondaries, and the transport of secondaries to the point where they are no longer significant contributors to doses. The effective upper energy limit of the system is being increased to 3 GeV by making provision for the creation of single or double pions. The models incorporated for this process are not considered effective above 3 GeV. The modified program will handle pion and muon as well as nucleon transport.

The problem of very high energy (50-100 GeV) muon transport is under study. The existing NTC is being used to compute thermal neutron flux from 540 MeV protons in thick targets of lead and uranium. Preliminary comparisons with Brookhaven measurements indicate good agreement. Neutron current to dose conversion factors are being computed in the range .5-60 MeV. The intranuclear cascade model is being applied to photon-nuclei collisions in an attempt to calculate angle-energy spectra of the photonucleons and photopions.

A variety of work is being carried forward in the weapons and space reactor shielding group (Clifford). The fifth chapter of the DASA Shielding Handbook, Chapter title, Methods for Calculating the Effects of Ducts, Access Ways, and Holes in Shields will be issued as a DASA report.

Development work on the NE 213 neutron spectrometer and on an intermediate energy neutron spectrometer (below 10 keV) continues. By use of the NE 213 spectrometer measurements have been made at the TSF on 17 materials which will permit evaluation of the adequacy of any set of total cross sections for such materials in the 1-14 MeV energy range. Current work at the TSF includes measurement of neutron and gamma ray leakage spectra from lead and polyethylene as a function of leakage angle. These results will be compared with Sn leakage calculations. A SNAP 2 type reactor will be installed at the TSF in February and an extensive program of SNAP shielding measurements will follow.

Also in progress is work on the design of shielded radioisotope containers, a program to check the validity of certain programs used to calculate fallout shelter effectiveness, and a program to make rough assessments of shield weights associated with various space reactor concepts. Additionally, work is in progress on time dependent Monte Carlo neutron transport through air, two dimensional air over ground Sn calculations, use of Sn produced adjoints as importance sampling devices in Monte Carlo and assembly of neutron cross sections for gamma ray production as a function of neutron energy.

The albedo and duct measurement and calculation program has been completed and final report are in preparation.

Other theoretical work in progress includes the following. Concepts of particle importance are being reformulated and analyzed; random number generators are being analyzed further with emphasis on limitations of individual machines, a generating function is being developed for the moments of the space-time dependent particle probability distribution (Coveyou). A neutron moments method calculation is under development (Penny). The ENDF-B cross section storage effort with production of service routines is being carried on cooperatively with other organizations; further work is being done on "impossible" Legendre coefficients (Irving). A note on variance reduction for certain flux estimators and one on neutron and gamma ray penetration of LiH are in preparation; work is proceeding on neutron penetration and gamma ray buildup factors for concrete (Clark).

Extensive calculations are under way to determine a multicollision neutron dose response function in a humanoid phantom (Snyder). Fundamental studies on the stopping of beta rays in tissue are being carried out (Ritchie).

NEW RSIC REPORTS

In October ORNL-RSIC-15, "Bibliography of the Computer Codes Literature Examined by the Radiation Shielding Information Center," by Betty F. Maskewitz, Betty L. McGill, and Jane Gurney was distributed to persons who are on our computer codes list.

The new reactor-weapons bibliography ORNL-RSIC-5 (Rev. 1), "Bibliography, Subject Index, and Author Index of the Literature Examined by the Radiation Shielding Information Center" (May 1966) by S. K. Penny, D. K. Trubey, and J. Gurney was distributed to persons who are on our reactor-weapons shielding list. This volume supercedes ORNL-RSIC-5 (Dec. 1964). Additions to ORNL-RSIC-6, corresponding to the new accessions of ORNL-RSIC-5 (Rev. 1), will be ready for distribution soon.

Anyone who did not receive these reports may obtain a copy of either upon request.

DECEMBER ACCESSION LIST OF LITERATURE

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

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

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

Reactor and Weapons Shielding

AHSB(S) R 109

Photon Interaction Data in the UKAEA Nuclear Data Library
P. J. Hemmings and Susan M. Offord - 1966

Nucl. Appl., 2(5), 430-439 (Oct. 1966)

Neutron-Flux and Gamma-Ray Dose Distributions in the NPR Shield
J. Greenborg

RRA-M67

The Effect of Cutoff Energy on Monte Carlo Calculated Gamma-Ray Dose Rates in Air
J. D. Marshall and M. B. Wells - Oct. 31, 1966

AEEW-M-504

Neutron Cross-Sections for Natural Zirconium in the Energy Range 0.0001 eV to 6 keV
A. L. Pope - 1966

BRL R-1329

Secondary Gamma Ray Transmission through Nevada Test Site Soil
A. J. Budka, W. J. Brand, and T. J. Dolce - July 1966

RRA-M66

Comparisons of Calculated and Measured Neutron Dose Rates Inside Steel Compartments Exposed to the Radiation Field of a Reactor
J. J. Long and M. B. Wells - Oct. 31, 1966

Paper presented at the ANS Winter Meeting, November 1966 in Pittsburgh

Calorimeter Radiation Heating Rate Measurements and Analysis for Nerva Reactors
M. A. Capo and G. A. Gilmour - September 1966

LA-DC-7966

Effective Gamma-Ray Spectra for Thermal Neutron Capture and Prompt Fission
Donald J. Dudziak

BNL 325 Suppl. No. 2

Neutron Cross Sections, Volume IIA, Z = 21 to 40
M. D. Goldberg, S. F. Mughabghab, B. A. Magurno, and V. M. May - Feb. 1966

USNRDL-TR-876

Gamma-Emission Data for the Calculation of Exposure Rates from Nuclear Debris. Vol. I. Fission Products
G. R. Crocker and M. A. Connors

Paper presented at the II Symposium on Health Physics, Pecs, Hungary, Sept. 26-30, 1966. Eotvos Lorand Physical Society, Health Physics Section, Budapest.

Irradiation Facilities for Gamma and Neutron Dose Calibration
S. Makra, E. Bekes, and I. Meszaros

Thesis - Iowa State University of Science and Tech. - Ames, Iowa

Application of Dimensional Analysis to Radiation Shielding
W. C. Assaf - 1965

U. S. Patent 3,247,131

Neutron Shielding Composition Having Good High Temperature Strength
J. F. Bliss, J. P. Gilvary, F. J. Castner - April 19, 1966

J. Physique, 26, 776-84 (1965) Translation requested

Analyse Continue du Spectre Dabsorption de Largon et du Neon Entre 2 Et 8A
F. Wuilleum

Acts Phys. Austriaca, No. 1-2, 198-203 (1966) Translation requested

Study of the Behaviour of γ-Rays in Air
M. Tisljar

Atomkernene, 10, 432-35 (Sept.-Oct. 1965) (German)

Doppel-Pl-Approximation fu Gammastrahlen
S. A. W. Gerstl

NAA-SR-MEMO-11971

Weight Scaling Factors for SNAP Reactor Shields
J. L. Hedgecock, G. E. German - June 8, 1966

Atompraxis, 12(8), 392-398 (1966)

Dose Constants of Gamma-Rays
W. Marth

URS 658-3

Combined Effects of Nuclear Weapons on NFSS Type Structures
Carl K. Wiehle and William L. Durbin - September 1966

KAPL-3099

C-12 Fast Neutron Cross Sections and Legendre Moments Below 15.0 MeV
E. L. Slaggie, J. T. Reynolds - June 30, 1966

USNCEL N-843

A Revised Formula for the Calculation of Gamma-Ray Shielding Properties of Shelter Entranceways
C. M. Huddleston and W. C. Ingold - Oct. 1966

NP-16251 (Vols. 1 and 2)

Browns Ferry Nuclear Power Station, Tennessee Valley Authority Design and Analysis Report
TVA, Knoxville, Tennessee - 1966

NAA-SR-MEMO-11901

Fast Neutron Weighting Factors for Manrated SNAP Reactor Applications
G. W. Spangler - April 20, 1966

USNRDL-TR-1038 (AD-637685)

Monte Carlo Technique Applied to the Calculation of Gamma-Ray Transport in Compartmented Structures
L. G. Haggmark

NAA-SR-11980, Vol. I

Compilation, Evaluation and Production of Nuclear Data for Reactor Calculations
Harry Alter and C. L. Dunford - Aug. 15, 1966

IN-1019

Slow Neutron Scattering Kernels for H_2O at 423 deg K and 550 deg K
H. L. McMurry - Aug. 1966

N66-29367 (NASA-TM-X-56837)

Flight-Test Results of Gamma Ray Scattering as a Technique for Air-Density Measurement
H. G. Reichle, Jr. - 1965

KFKI, 14(1), 49-61 (1966)
Reports of the Central Research Institute for Physics

A Device for the Measurement of Average Neutron Energies
S. Makra

AE-227

Integral Transport Theory in One-Dimensional Geometries
Ingvar Carlvik - June 1966

AERE-R-5238

The Measurement of the Dose-Equivalent from Thermal and Intermediate Energy Neutrons with Personnel Dosimeters
J. A. Dennis, J. W. Smith, et al. - July 1966

J. Nucl. Energy, Parts A/B, 20, 851-861 (1966)

Passage of Reactor Neutron Radiation through Non-Hydrogenous Media
S. G. Tsipin, B. I. Sinitsin and V. K. Daruga

UCRL 14922

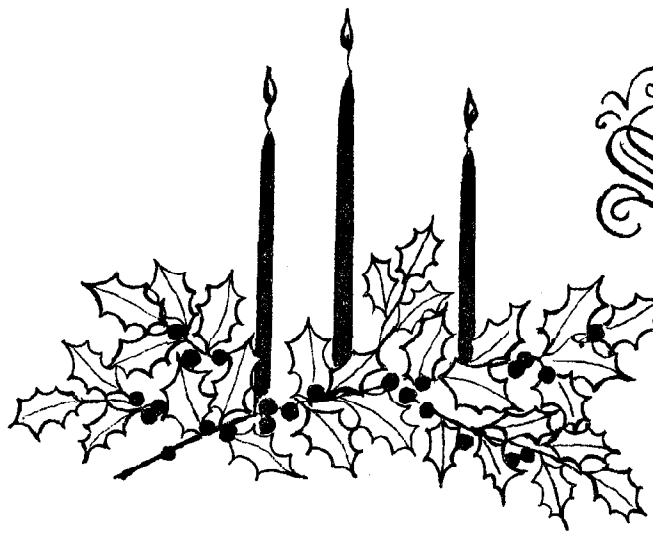
A Graphical Method for Calculating the Dose in Man from Individual Radionuclides in Fallout
C. A. Burton - June 3, 1966

NASA-CR-556

Air Radiation Graphs, Spectrally Integrated Fluxes Including Line Contributions and Self Absorption
R. A. Allen - Aug. 1966

CCDN-NW-3

Newsletter No. 3 - Review of the Present Status of Li-6 (n,α) Data for Neutron Energies up to 500 keV
October 1966



Season's Greetings

And best wishes for the coming year