RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE U.S. DEPARTMENT OF ENERGY

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You only live once. But if you work it right, once is enough. . . . Fred Allen

SEMINAR-WORKSHOP ON MONTE CARLO METHODS IN PLANNING STAGE

Plans are being formulated for a seminar-workshop on Monte Carlo Methods to be held in Oak Ridge, Tennessee the latter part of April, 1980. The seminar, including both invited and contributed papers, will be followed by a workshop featuring TRIPOLJ-II, a code system developed by SERMA, the CEA/CEN/Saclay Shielding Laboratory, Gif-sur-Yvette, France.

The RSIC seminar-workshop, the first to be held with international sponsorship and collaboration, is expected to constitute an assessment of the state of the art in Monte Carlo methodology in reactor physics in general, and in radiation transport and shielding in particular. The proceedings will be published. Readers are invited to send comments and suggestions for the technical content of the seminar and/or for procedural development of the workshop.

Further details, including the exact dates and program information, will be published in future issues of the Newsletter as they develop.

BOOK REVIEW APPENDED

Technical review of current literature in RSIC's subject coverage is a routine activity of the Center. Occasionally, a publication is seen which, we believe, should be specifically called to the attention of the shielding community. David K. Trubey has, therefore, reviewed the newly published first volume of a series of publications entitled *Handbook of Radiation Measurement and Protection*. The review is appended to the end of this issue of the Newsletter.

CURRENT PUBLICATIONS AVAILABLE

We call attention to the availability of the following new books and publications.

New Books on Nuclear Applications From ASTM

STP 520, Effects of Radiation on Substructure and Mechanical Properties of Metals and Alloys, $49.50.

STP 551, Zirconium in Nuclear Applications, $44.50.

D S52, Nuclear Reactor Neutron Energy Spectra, $26.00.

D S54, Radiation Effects Information Generated on the ASTM Reference Correlation-Monitor Steels, $9.75.

For information on ordering these books, contact American Society for Testing and Materials, 1916 Race St., Philadelphia, PA 19103.

NRC Regulatory Guide Recently Issued

Guide 8.19—Occupational Radiation Dose Assessment in Light-Water Reactor Power Plants (revision 1).

Publications From NCRP and ICRU

Report No. 59, "Operational Radiation Safety Program;" Report No. 60, "Physical, Chemical, and Biological Properties of Radiocerium Relevant to Radiation Protection Guidelines;" and Report No. 61,

"Radiation Safety Training Criteria for Industrial Radiography." (Order from NCRP Publications, P. O. Box 30175, Washington, D.C. 20014.)

Report No. 28, "Basic Aspects of High Energy Particle Interactions and Radiation Dosimetry;" and Report No. 29, "Dose Specification for Reporting External Beam Therapy with Photons and Electrons." (Order from ICRU Publications, P. O. Box 30165, Washington, D.C. 20014.)

CALL FOR PAPERS

The Second International Conference on "Emerging Nuclear Energy Systems" will be held April 8–11, 1980 in Lausanne, Switzerland. Contributed papers are invited in all areas of advanced nuclear energy systems beyond current fission and fusion reactor designs, such as: nuclear energy synergetics (hydrid and symbiotic fission – fusion reactors, accelerator breeding, etc.), micro-explosions (inertial confinement approach to fusion, fissionable pellets, etc.), advanced fuel cycles for both fusion and fission energy, plasma focus and more exotic systems.

For additional information contact Jacques Ligou, Ecolé Polytechnique Fédérale de Lausanne, Laboratoire de Génie Atomique, 33 Av. de Cour, CH—1007 Lausanne, Switzerland; or A. A. Harms, Mc-Master University, Dept. Eng. Physics, Hamilton, Canada L8S LM1. Deadline for 1000-word summaries including the main results (one original for offset reproduction and three copies): December 31, 1979. Send summaries and three self-addressed gummed labels to the Sümer Sahin, Ecolé Polytechnique Fédérale de Lausanne, Laboratoire de Génie Atomique, 33 Av. de Cour, CH—1007 Lausanne, Switzerland.

NOMINATIONS FOR ICRU GRAY MEDAL INVITED

The International Commission on Radiation Units and Measurements (ICRU) announced today that it is seeking nominations for the fourth award of the ICRU Gray Medal. The Gray Medal, established by the ICRU in 1967, is awarded every four years for outstanding contributions in the scientific fields of interest to the ICRU and honors the late Louis Harold Gray, former member and Vice-Chairman of the Commission.

The first award of the medal was to Dr. Lewis V. Spencer (1969) for his work on the theory of charged particle penetration; the second to Dr. John W. Boag (1973) for a number of outstanding scientific contributions, including work on the theory of recombination taking place in ionization chambers; the third to Dr. Mortimer M. Elkind (1977) based on his work leading to the identification of repair in cells. It is expected that the fourth award will be made at the time of the XVth International Congress of Radiology in 1981.

Nominations for the medal may be made by any person or organization. They must include a complete biographical sketch (curriculum vitae) of the nominee, reprints or any other scientific data which show the significant contributions made by the nominee, and the proponent's personal evaluation of the importance of the contributions. Nominations should be directed to the Chairman of the International Commission on Radiation Units and Measurements, Suite 1016, 7910 Woodmont Avenue, Washington, D.C. 20014, and must be received by the ICRU no later than June 1, 1980.

PERSONAL MENTION

Although somewhat belatedly, we would like to note that Ed Brunenkant returned to the United States after serving 6 years as Director, Division of Scientific and Technical Information of the International Atomic Energy Agency. Under his leadership the International Nuclear Information System (INIS) grew into a full-scale abstracting service. Ed was Director of the AEC Division of Technical Information when RSIC was formed, and he provided much encouragement and assistance to the fledgling information analysis centers such as ours through the 1960s.

CURRENT WORK AND PROBLEMS

We continue to report current work and problems as a means of promoting intercommunication between members of the RSIC user community. We encourage our readers to keep us informed and to feel free to communicate, directly or through RSIC, with their peers in areas of interest.

Y. Sato, Core and Safety Engineering Section, Advanced Reactor Engineering Department, Nuclear Energy Group, Toshiba Corp. sends the following information on the shielding activities in the Toshiba Corporation, performed under contact with **Power Reactor and Nuclear Fuel Development Corporation** in Japan. Their program includes:

1. Experimental Fast Reactor "JOYO": shielding experimental analysis of in-vessel and enclosure shield system, spent fuel cask car shielding experimental analysis, coolant pipe streaming calculation, and estimation of fission products and corrosion products radioactivity;
2. Prototype Fast Reactor "MONJU": shield plug design, control rod drive mechanism shielding design, and maintenance cask shielding design;
3. Advanced Thermal Reactor: turbine building shielding design;
4. Plutonium Fuel Production Facility: quality control process shielding design; and
5. General: estimation of albedo Monte Carlo code MORSE-ALB, development of a sensitivity code, and development of a fission products and corrosion products behavior code in primary loop.

They are interested in information concerning the validity of group constants, especially the resonance region in 27 keV of iron, and streaming calculational methods of a large annulus duct such as the gap between reactor vessel and vessel head. Contributions to the *RSIC Newsletter* on these subjects are welcome.

ORAU STUDENTS COMPLETE WORK IN RSIC

Two student employees, **Ken Clement** from the University of Southwestern Louisiana and **Tom Williams** from Nicholls State University, Louisiana, have completed their work as participants in an Oak Ridge Associated Universities summer program. Ken worked to further develop the SARS IBM 360 computer code, originally obtained from the NEA Data Bank, which maintains a master file of code packages and provides facilities for retrieval and distribution from the file. Tom accomplished most of the task of revising and implementing the ADES code on EPIC's new minicomputer, a Data General Eclipse machine. The ADES code is used to maintain information on and the status of all the RSIC transactions, requests, and other information processing.

VISITORS TO EPIC

The following persons came for an orientation visit and/or to use EPIC facilities during the month of August: Dennis Bell and F. J. Slagle, TEC, Knoxville, TN; Herbert Goldstein, Columbia University, New York, NY; William Harless, General Electric, Sunnyvale, CA; Arnost Hönig, Brno Technical University, Czechoslovakia; Charlotte Hollister, General Electric, Schenectady, NY; Bob Howell, Science Applications, Inc., Oak Ridge, TN; and Hafez M. A. Radi, Kuwait University, Kuwait.

CHANGES OF ADDRESS

The following address changes have been noted: **A. R. Hawkins** *from* Science Applications, Inc., *to* TRW Energy Systems, Richland, Washington; **Walter Ross Burrus** *from* Tennecomp, *to* Science Applications, Inc., Oak Ridge, TN; **Henrietta Hendrickson** *from* RSIC-ORNL *to* IAEA Nuclear Data Section, Vienna, Austria; **Yoshiaki Sato** *from* Tokyo Shibaura Electric Co. Ltd. *to* Toshiba Corporation, Tokyo, Japan; **A. Dubi** *from* Los Alamos Scientific Laboratory, NM *to* EURATOM, Ispra (Varese), Italy; **Robert S. Shane** *from* National Research Council, Washington, D.C. *to* Shane Associates, Inc., Springfield, VA; and **E. L. Draper, Jr.** *from* University of Texas at Austin *to* Gulf States Utilities, Beaumont, TX.

CHANGES IN THE COMPUTER CODE COLLECTION

The following changes were made in August.

CCC-254/ANISN

The multigroup one-dimensional discrete ordinates transport (with anisotropic scattering) code package was extended to include a Telefunken-TR 440-Computer version contributed by the Wehrwissenschaftliche Dienststelle Der Bundeswehr Fur ABC-Schutz, Munster, Germany. This hardware version has been designated CCC-254D. FORTRAN IV; IBM 360(A), UNIVAC 1108(B), CDC 6600/7600(C), Telefunken-TR 440(D).

CCC-351/FALSTF

FALSTF, a multigroup transport code which uses response functions to calculate activities for detectors located at points external to a shielding configuration, was contributed by UCC-ND Computer Sciences Division, Oak Ridge National Laboratory. Calculations are made using as input either an emergent particle density or fluxes calculated by the discrete ordinates transport code (CCC-209/DOT III, CCC-276/DOT 3.5, or CCC-320/DOT 4.2) for two-dimensional cylindrical geometry. Doses can be calculated for one or more detectors. Response contributions are calculated from (user-determined) regions within the configuration and sums over the regions to obtain the total response. Both the last flight contribution by region and total response are output by the code. Reference: Informal Notes for user. FORTRAN IV; IBM 360.

PSR-115/SUPERTOG JR

The code package for generating transport group constants, energy deposition coefficients and atomic displacement constants from ENDF/B-IV was extended to include an IBM-360 version (designated Version B) which was contributed by the OECD NEA Data Bank, Gif-sur-Yvette, France. SUPERTOG-JR generates (a) the neutron cross sections for neutron transport calculations and (b) the energy deposition coefficients and the atomic displacement cross sections. The function (a) is the same as in SUPERTOG-3 (PSR-13) except that elastic scattering transfer matrices can be calculated from either tabular or Legendre representation. In addition, an optional routine generating the inelastic scattering matrix in the level density model is provided. The newly developed function (b) treats both in nearly the same mathematical formulae except for the conversion scheme of kinetic energy of neutrons onto the material atoms. The displacement cross section is calculated with the Lindhard model. To perform these additional calculations several new subroutines were developed. SUPERTOG-JR (Version A) for the FACOM-75 computer was contributed by Japan Atomic Energy Research Institute (JAERI), Tokai, Japan. Reference: JAERI-M 6935. FORTRAN IV; FACOM 230-75 and IBM 360.

ENDF/B-V DOSIMETRY DATA NOW AVAILABLE FROM NNDC

ENDF/B-V Tape 531, the Special Purpose Dosimetry File, is available for general release from the National Nuclear Data Center (NNDC) at Brookhaven National Laboratory. The tape contains neutron reaction data for a range of isotopes and includes uncertainty files for the given cross sections. The contents of the tape are listed below.

CONTENTS OF THE ENDF/B-V SPECIAL PURPOSE DOSIMETRY FILE

Tape	Material	MAT	Reaction
531	Na-23	6311	(n,γ)
	Al-27	6313	(n,p),(n,α)
	Mn-55	6325	(n,2n)
	Co-59	6327	(n,2n),(n,γ),(n,α)
	Np-237	6337	(n,f)
	Au-179	6379	(n,γ)
	Th-232	6390	(n,f),(n,γ)
	U-235	6395	(n,f)
	U-238	6398	(n,f),(n,γ)
	Pu-239	6399	(n,f)
	Li-6	6424	Helium Production
	B-10	6425	Helium Production
	Sc-45	6426	(n,γ)
	Ti-46	6427	(n,p)
	Ti-47	6428	(n,p),[(n,d) + (n,n′p)]
	Ti-48	6429	(n,p),[(n,d) + (n,n′p)]
	Fe-54	6430	(n,p)
	Fe-56	6431	(n,p)
	Fe-58	6432	(n,γ)
	Ni-58	6433	(n,2n),(n,p)
	Ni-60	6434	(n,p)
	Cu-63	6435	(n,γ),(n,α)
	Cu-65	6436	(n,2n)
	In-115	6437	(n,n′)m,(n,γ)
	I-127	6438	(n,2n)

AUGUST 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 of out-of-print reports may be available on request. Naturally, we cannot fill requests for literature which is copyrighted (such as books or journal articles) or whose distribution is restricted.

THIS LITERATURE IS ON ORDER. IT IS NOT IN OUR SYSTEM. PLEASE ORDER FROM NTIS OR OTHER AVAILABLE SOURCE AS INDICATED.

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BOOK REVIEW: Handbook of Radiation Measurement and Protection, Section A, Volume I: Physical Science and Engineering Data

The *Handbook of Radiation Measurement and Protection,* the first volume in a series published by CRC Press, has recently become available. The purpose of the series is to provide data and methods for the design and evaluation of radiation measurement instruments, monitoring and survey methods, selection of protective facilities, equipment and procedures for handling radioactive materials, effluent control and monitoring, radioactive waste disposal, transportation of radioactive materials, and many other related subjects. Aspects of these subjects involve not only all of the sciences but also management, legal, insurance, and public information considerations. Included is the entire range of basic scientific and engineering methods, as broad a range as in the entire field of public health itself. This series of volumes will be divided as far as possible into logical groupings that hopefully will tend to maximize the usefulness of each volume, as well as the series of volumes, to its users.

The primary aim of the handbook series is to include as much useful data as possible for the specialist needing ready access for the solution of problems most likely to arise in the radiation protection professions. However, some selected review of fundamental concepts is also included to enable persons with a basic science or engineering background to acquire the necessary knowledge to solve a majority of problems in especially important aspects of radiation protection. Also, since the profession is broad in discipline, an attempt has been made to fulfill the frequent need of professionals for a refresher course in some of the more important fundamentals needed to utilize data included in the handbook. Principles of management, organization, and procedures related to radiation safety will also be summarized in later volumes, with attention to presentation of methods for establishing new radiation safety programs based on the accumulated experience of others.

This series of volumes should, therefore, be useful in industrial, academic, medical, and governmental institutions and to scientists carrying out both applied and basic research in subjects related to radiation protection, to engineers designing protective facilities and equipment, to applied health physicists establishing radiation safety programs, to physicians involved with caring for patients exposed to radiation or radioactive materials, to public health and other governmnt officials concerned with regulating radiation safety and developing national standards, to professors and students studying and synthesizing a broad base of knowledge in radiation protection, and to practically every other type of professional involved in radiation protection problems.

The first volume of the *Handbook of Radiation Measurement and Protection* contains data, references, and some review material to provide much of the basic scientific and engineering information utilized in everyday work in professions related to radiation protection. Some reference is also made to related sections in future volumes where applications requiring the data in this volume are presented.

The introduction by the editor, Allen B. Brodsky, presently with the Nuclear Regulatory Commission, contains an interesting discussion of the rate of growth of radiation standards. He compares two exponential projections, and finds that there may be "only 2470 standards to read in the year 2001 A.D.—very comforting, indeed, compared to (Herbert) Parker's (1971 estimate of) 9662."

The major body of the book consists of graphs and tables as follows: Fundamental Constants, Chart of Nuclides and Elements, Nuclear Cross Sections, Stopping Powers and Ranges for Charged Particles, X- and Gamma-Ray Absorption and Scattering Coefficients, Decay Scheme Data and Dose Constants for Radionuclides of Importance in Radiological Science, Selected Particle and Photon Spectral Data, and Dosimetry of Internal Emitters—A Guide to the MIRD Technique. There also is a section titled "Chemical Data" with chapters on radiation chemistry, preparation of radionuclide sources, and production of radiopharmaceuticals. Appendices give tables of supplementary decay scheme data (fuel cycle nuclides and their radiations), natural radiation, and supplementary information on internal exposure hazards.

The text for the section titled "Chart of the Nuclides" is the booklet which accompanies General Electric's popular wall chart. The chart (1977 version) comes conveniently folded in a pocket inside the back cover. The nuclear cross section data include a table of thermal and 14-MeV neutron cross sections and resonance integrals, thick-target yields from charged particle reactions, various neutron cross-section graphs taken from BNL-17100, neutron reaction graphs, and other data. The stopping power and charged-particle range section is a concise review of the data for water, air, and lead.

The section on x- and gamma-ray energy absorption coefficients includes energy transfer coefficients for the most important elements and compounds. A detailed table of total cross sections is given for many elements for energies less than 25 keV. A number of graphs display the functional dependence of the various cross sections on energy and atomic number. An interesting point is that some of these graphs are taken from a 1948 ORNL report with the explanation that they are still sufficiently "accurate for the most part and provide a good visual comparison of relative absorption coefficients as a function of energy."

A particularly useful section on decay schemes for many of the important nuclides is included as a compilation of data from MIRD pamphlet Number 10 and from the work of Martin of the ORNL Nuclear Data Project. Included is a quantity called "equilibrium dose constant" in units of g·rad/μCi·h. This is the energy per disintegration and is equal to the dose in an infinite, homogeneous medium in which the source is uniformly dispersed. This constant is useful in the MIRD internal dose technique discussed below. In addition, I would have liked to have seen the specific dose constant, i.e., the dose at unit distance from an unshielded source. Additional similar, but older, data are given in the section which follows these tables. Unfortunately, some of these data are much too old. For example, the reference to the Maienschein prompt gamma-ray data is the 1958 Geneva Conference rather than their final report in 1970 (ORNL-4457). Their final results were 8.13 $\pm$ 0.35 photons per fission (rather than 7.2) and 7.25 $\pm$ 0.26 MeV per fission (rather than 7.4). The decay gamma-ray spectra is also very old (reprinted from a 1953 publication). Hopefully, the next edition will incorporate more recent work as that of LaBauve (*Trans. Am. Nucl. Soc.* 28,749(1978)).

A section is devoted to the so-called MIRD technique for computing dose from internal emitters. This technique involves the multiplication of such factors as the equilibrium dose constant (defined above) and the absorbed fraction in an organ due to radiation originating in another organ. Voluminous tables are available in NM/MIRD Pamphlet No. 11.

The main impression that I have after examining this book is that the editor, contributors, and publisher have worked very hard to achieve a comprehensive, useful and accurate reference work. They have largely succeeded, and the cost is not prohibitive. But another impression is that there is a communication gap between "health physics" radiation protection and "shielding." I regard shielding as an important component of radiation protection, yet a book such as this, in its list of periodicals, can leave out journals as important as *Nuclear Science and Engineering*, *Nuclear Technology*, and even the IAEA abstract journal *Atomindex*. Furthermore, the Oak Ridge Nuclear Safety Information Center is referred to as "a nuclear information center," the editor apparently not realizing that there are many information centers at Oak Ridge. In particular, (I am showing my bias now) a book such as this should at least mention the Radiation Shielding Information Center. Also, if there had been at least a small section on shielding data, appropriate references could be made to the shielding literature such as the IAEA *Engineering Compendium on Radiation Shielding* and Schaeffer's *Reactor Shielding for Nuclear Engineers*. I am not making an issue of this to criticize the editor, but to point out a communication gap that health physicists and shielding specialists should work to bridge. One constructive step in this direction is the effort being made by Bill Kreger (chairman of the Radiation Protection and Shielding Division of the American Nuclear Society) to strengthen cooperation of the ANS with the Health Physics Society.

In conclusion, I would like to state again that this is a fine book, and I look forward to seeing the others in the series.

D. K. Trubey

Handbook of Radiation Measurement and Protection, Section A, Volume I: Physical Science and Engineering Data, edited by Allen Brodsky, The Chemical Rubber Company, 18901 Cranwood Parkway, Cleveland, Ohio 44128 ($74.95 US, $86.95 foreign).