RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

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

POST OFFICE BOX X •
OAK RIDGE, TENNESSEE 37830

No. 178 *October 1979*

Kites rise against, not with the wind. No man has ever worked his passage anywhere in a dead calm. *. . . John Neal*

RSIC FY 1979 USER STATISTICS

RSIC user statistics show an increasing number of activities for the period October 1, 1978 – September 30, 1979 over the prior year. Information dissemination activities were as follows.

A total of 3452 separate letters/telephone calls (about 13.8 each working day) requesting a variety of products and services (8623 total) were processed during FY 1979. In addition to advisory, trouble-shooting, and other problem-solving communications with the user community, RSIC shipped 994 code and data packages.

On an average, the following dissemination of activities took place each working day:

4.0 code/data packages were shipped to requesters.

10.1 shielding documents (RSIC reports, handbooks, code and data documentation in addition to those included in above packages) were mailed.

20.2 responses to inquiries for information; citing possible solutions to problems; recommendations of calculational methods, computer codes, nuclear data sets, or literature specimens for study; troubleshooting problems when requester had difficulties using RSIC materials; and miscellaneous consultation and advising services.

0.2 special retrospective searches.

34.5 total of separate activities required daily to satisfy the 3452 letters of request.

In addition to the above daily activities, the following special products or services were given.

The RSIC Newsletter was mailed each month to a peak of 1639 people. Maintenance of the RSIC-user directory resulted in 957 changes during the year.

A total of 96 people (31 foreigners) came for an orientation visit and/or to use the Center's facilities during the year.

The increasing/decreasing workload over the last three years may be seen in the following comparison table.

	FY 77	FY 78	FY 79
Total Requests Received	3305	2911	3452
Average/Working Day	13.2	11.6	13.8
Activities Performed to Satisfy Requests	8671	7604	8623
Average Activities/Working Day	34.5	30.4	34.5
Increase/Decrease Over Prior Year's Activities	+9.0%	−12%	+13.0%

MONTE CARLO SEMINAR WORKSHOP SET FOR WEEK OF APRIL 21–25, 1980.

ANS RP&S DIVISION BEST PAPER AWARD ANNOUNCED

The ANS Radiation Protection and Shielding Division's Honors and Awards Committee has completed its selection process for the winner of the award for the best paper presented at the June 1979 ANS Annual Meeting, held in Atlanta. Candidate papers, selected by the Division's Program Committee for further consideration upon presentation at the meeting, were judged on the basis of technical content, presentation, and relevance. The three papers considered were: *External Gamma Dosimetry in the Light of ICRP-26,* by A. R. Jones (AECL) and R. Marsolais (Univ. of BC); *Shielding Calculations for the TFTR Neutral-Beam Injectors,* by R. T. Santoro, R. A. Lillie, R. G. Alsmiller, Jr., and J. M. Barnes (ORNL); and *Radiation Source Central Programs at EPRI,* by R. A. Shaw (EPRI). A $100 prize and certificates will be presented to the winners, Santoro, Lillie, Alsmiller, and Barnes, for their paper on shielding calculations, at the ANS Winter Meeting in San Francisco this November.

ERROR NOTED IN ADDRESS FOR CHEMICAL RUBBER COMPANY

The September 1979 RSIC Newsletter, in a book review for the *Handbook of Radiation Measurement and Protection,* listed an incorrect address for the publisher. The correct address should be: CRC Press, 2000 Northwest 24th St., Boca Raton, Florida 33431.

REVIEW ON CALCULATIONAL TECHNIQUES IN SHIELDING AND DOSIMETRY COURSE

V. Sundara Raman, Safety Research Laboratory, Reactor Research Centre, Kalpakkam, India, prepared the following review on the Erice course, "Calculational Techniques in Shielding and Dosimetry," held in Erice, Sicily (Italy) October 25–November 3, 1978. His review was published in the April 1979 ESIS Newsletter.

The International School of Radiation Damage and Protection conducted its second course on "The Use of Computers in Health Physics: Calculational Techniques in Shielding and Dosimetry" at the "Ettore Majorana," the International Centre for Scientific Culture, for 10 days. Forty-six persons from different parts of the world participated. Various topics such as radiation transport, cascade phenomena in matter, shielding and activation spectrum analysis were covered in 27 lectures with special emphasis on the use of computer codes for solving the pertinent problems. As it would be difficult to discuss each lecture individually, a general review alone is given, leaving the reader to refer for details to the Proceedings which will be made available. Interested persons may contact W. R. Nelson (SLAC, USA; Director of the course) or A. Rindi (Erice; Director of the School).

A keynote lecture by **G. Stevenson (CERN, Geneva)** stressed the idea that the important person involved with the computer program is the user without whom program writing becomes mere self-gratification. Very often, the user of the program turns out to be a person who knows little about computer techniques or, the user and the author belong to different fields, which introduces a large communication gap. The user should know which code is best suited for his problem, for there is a wide range of codes available. The programs used in the fields of shielding or radiation protection are voluminous, leading to a high probability of error. Many effects cause the output to be in error, for example, false input data, the wrong algorithm giving rise to "round-off" errors, an insufficient number of iterations or convergence criteria or an inadequate number of events in a Monte Carlo code. Among the factors listed above, the errors arising out of the input data cannot be guarded against. It is the responsibility of the user to verify them by checks and cross checks. Finally, the correctness of the solution must be checked by repeated tests of the program against detailed physical measurements. It is in this context that the user and the author have a chance for interaction, and a course like the present one brings both together.

The main topics treated in the course may be classified as follows.

Low Energy Neutron-Photon Transport

W. Engle (ORNL, USA) elaborated the method of discrete ordinates for the low energy (< 20 MeV) neutron-photon transport. **ANISN** and **DOT** are the offsprings of a long generation of S_N codes. ANISN, though one dimensional, has secured a unique place in the shielding domain. The disadvantage that it cannot handle complex geometries is overcome by its capabilities of running in adjoint mode in generating scoring functions for coupled Monte Carlo-S_N calculations and importance functions for Monte Carlo biasing. In addition, the code performs activity calculations, concentration search, zone width, or buckling searches. ANISN has another important feature: it has options which allow collapsing a fine-group to a broad-group set of cross sections. The cross section libraries containing about 100-150 groups are too large to be handled in some cases, e.g., in 2-D or 3-D calculations. With changes in the specified weighting option

parameters, the code reproduces a broad-group set from a fine-group library by averaging the data over the appropriate energy limits and over specific regions. The collapsing can be done by using a spatially dependent flux spectrum or infinite homogeneous medium flux spectrum. ANISN, however, suffers from the inherent defect of giving out negative fluxes. This may be due to the large cross-section value or large spatial mesh width or when sources and cross sections become negative. Different flux models and weighted difference models with or without "fix-ups" have been used so far to eliminate the above defect. DOT is an extended version of ANISN in 2 dimensions. Apart from the fact that it occupies a large computer memory and time, it is amenable to the "Ray effect." Use of the first collision fluxes and large numbers of angular quadrature are the remedies suggested for its removal.

The method of Monte Carlo in the low energy neutron-photon transport was treated by **T. Gabriel (ORNL, USA)** with illustrations from the well known code **MORSE.** The various sampling procedures—basic sampling rejection techniques, importance sampling and sampling from a joint function—and the Monte Carlo estimation of the particle flux were dealt with. MORSE is a powerful tool to handle complex geometries and therefore widely used in shielding problems. Specific fields in which MORSE has been used—fusion reactor shielding, accelerator breeder design, high energy nuclear instrumentation and accelerator beam stop activation—were discussed. It was interesting to note that ANISN, DOT, and MORSE have been effectively combined for the use of fast reactor shielding calculations.

C. Ponte (ESIS, Ispra) gave a descriptive lecture on approximate methods in reactor shielding calculations. They are non-rigorous methods involving simplified assumptions; nevertheless, they yield satisfactory results with less computing time. The gamma flux distribution in any medium can be derived from the knowledge of the buildup factors. This principle is used in the code **MERCURE.** Diffusion and removal diffusion theories have been effectively combined to yield a suitable approximation for the calculation of neutron transport in hydrogeneous shields of one- and two-dimensional geometries. **SABINE** depicts this method.

There was one lecture on the multigroup cross-sections processing at ORNL, featuring the various cross-section libraries and the computer codes required for their processing.

Electro Magnetic Cascade

K. O'Brien (Environmental Measurement Lab., New York) gave detailed lectures on the physics of radiation transport and of electromagnetic cascades. High energy charged particles (of the order of few GeV) are now used for medical treatment and for basic research. The particles while penetrating into the matter radiate photons of comparable energy. These photons create particles of opposite sign (electron positron pair) and finally we end up with photons and electrons in a shower or "cascade." Bremsstrahlung and pair production are the main processes of shower formation. He reviewed the earlier approximate methods by Rossi and Greisen. They are adequate for some purposes in light media, but fail completely in higher atomic number materials, because of the role played by the energy-dependent cross sections and multiple scattering of the electrons. The Monte Carlo method has proved its worth in this field, accounting for all the important processes involved and permitting the solution of multi-media and three-dimensional geometries. He described his code, **ESRO** and its applications in electron dosimetry.

W. R. Nelson (SLAC, USA) illustrated his code **EGS** (Electron-Gamma Shower) and its applications. This is an analog Monte Carlo code, simulating electron-photon shower. In an attempt to design high energy particle detectors, no variance reduction techniques have been used in this code. This results in the increase in the computer time enormously; but fluctuations in the Monte Carlo results truly represent the real-life fluctuations. This is in contrast to radiation shielding type fluctuations where statistical variance is of importance. EGS has the advantage that it has been written in an extended FORTRAN language, known as MORTRAN. This gives a good amount of flexibility for the user to interact with the code. Further, there is freedom for the user to set the code running in FORTRAN language, in case the user desires not to learn a new language.

That EGS is of extensive use to accelerator engineers and radiation protection physicists was amplified by **H. Dinter (DESY, FRG)** in his lectures. It was observed that the results obtained by EGS agree reasonably well with the measured values.

AEGIS, a program to calculate the average behavior of the electromagnetic showers, was treated by **Van Ginniken (Fermilab, USA).** This code also uses the Monte Carlo method but with a biasing technique. It is mainly written for the calculation of the energy deposition by the EM cascade and finds its applications in determining the radiobiological dose, heating effects, and radiation damage.

The phenomenology of hadronic cascades was introduced by **T. W. Armstrong (Science Applications, USA).** The Monte Carlo method is widely used in this area. The FLUKA, KASPRO, CASIM and HETC programs were discussed in the course.

ANISN, DOT, MORSE, MERCURE, SABINE, EGS, FLUKA-TRANKA, CASIM, and HETC code packages **are available from RSIC.** ESRO, AEGIS, and KASPRO are not yet included in the RSIC code collections.

Unfolding Technique

J. T. Routti (Helsinki University of Technology, Finland) gave two lectures on unfolding techniques for activation detector analysis and on activation detectors for neutron spectrum measurements. He critically reviewed the different procedures adopted for the solution of unfolding equations: viz., functional representations, orthonormal expansions and least-squares expansion methods. Unfortunately, these methods are based upon some assumptions about the type of kernel (response functions of the detector device) or on some a-priori knowledge about the spectrum, etc. This has resulted in a number of unfolding codes for different applications. Some codes are written for specific applications, while some are flexible enough to be extended to different problems. This necessitates a general comparison of the suitability of various unfolding codes for different applications. So far, only a few comparisons of the available codes for reactor neutron spectroscopy have been made. Such a study has revealed that computer codes like **SAND II, SPECTRA,** and **CRYSTAL BALL** are suitable for the usual reactor applications. **FERDOR** is a useful tool in cases where the number of measured activities is equal to or greater than the number of energy bins. Real problems may arise when the response functions do not properly cover the whole energy range. Therefore, "an unfolding code should never be used as a black box." Even in this field, the user should carefully select his code to suit the problem at hand.

T. K. Nakamura (University of Tokyo, Japan) gave lectures on Bremsstrahlung spectrum analysis by activation method and application of activation spectrum analysis method to shielding. **LYRA, DIBRE, REFUM, TAURUS,** and **SAND** were the computer codes described in detail.

There were two lectures—one on the Radiation Shielding Information Center (by T. Gabriel, ORNL) and the other on the European Shielding Information Service (by C. Ponti).

SAND II, SPECTRA, and CRYSTAL BALL are packaged in RSIC; LYRA, DIBRE, REFUM, and TAURUS are not.

CERN Workshop

The notable feature of this school was to hold a special workshop at CERN, Geneva (6–8, November 1978), in which many computer codes were presented for demonstration purposes. Participants were able to run the computer codes on specified benchmark problems and then problems of their own choice. All the results thus obtained from different codes for various problems were later discussed in detail, in a joint session, illustrating the various possibilities of the different codes.

The real success of the CERN Workshop was clearly seen: the people were working with the computer till midnight! However, it may be pointed out that the workshop might have been for a longer period, since the participants could not, in the limited time, run more than two or three codes, nor could they efficiently interact with the moderators. Furthermore, computer codes like ANISN and DOT were not available at CERN, nor were there many cross-section libraries available for use.

It was wise on the part of the authorities to arrange for a visit to the CERN 400 GeV accelerator. Participants really wondered which code they could choose for shielding calculations of such a massive accelerator!

NRPB REPORTS ON SAFETY TESTING OF RADIOACTIVE CONSUMER PRODUCTS

In 1976 the National Radiological Protection Board (Harwell, England) established a laboratory for testing consumer products containing radioactive materials. The work of the laboratory is described in a report published recently.

Experimental appraisal and measurement play a substantial role in the development both of a coherent philosophy on the safety of consumer products and rational radiological protection standards. At the NRPB, tests have been designed to simulate credible and extreme abuse and mishandling of products and include burning, freezing, puncturing, immersion in water, vibrating and dropping from a height of 10 meters. Each type of product is assigned an individual test program which may then be modified in the light of experience.

The types of consumer product which have received most attention have been ionisation chamber smoke detectors and liquid crystal digital watches containing gaseous tritium light sources; the results obtained on these two types of devices are the main subject of this report.

Most of the smoke detectors performed entirely satisfactorily in the mechanical tests, although there were some shortcomings in construction and in the cutting and mounting of the radiation sources. The fire tests—carried out at 600°C—produced the most interesting results, and several problems of materials incompatibility leading to leakage of radioactivity in excess of the limit specified in the standard were identified and solved.

Liquid crystal watches also performed creditably under the Board's test programs, although shortcomings in construction were initially relatively common. The main problem concerned the gaseous tritium light sources rather than the watches themselves. The need for stricter quality control during

manufacture, and monitoring with regard to release of activity, were particularly evident.

A feature of this work has been the willingness of manufacturers to undertake the necessary modifications as a result of the Board's findings. Products are submitted for testing at the prototype stage. For further information and/or a copy of the report, NRPB-R85, "The Raiological Testing of Consumer Products: 1976-78," by B. T. Wilkins and D. W. Dixon, contact the Information Officer, National Radiological Protection Board, Harwell, Didcot, Oxon OX11 ORQ, United Kingdom.

NRC STANDARD AND REGULATORY GUIDES RECENTLY ISSUED

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

ANSI/IEEE Std. 680-1978—Techniques for Determination of Germanium Semiconductor Detector Gamma-Ray Efficiency Using a Standard Marinelli (Reentrant) Beaker Geometry (new standard). Order from IEEE, $5.50.

NRC Guide 3.34—*Assumptions Used for Evaluating the Potential Radiological Consequences of Accidental* Nuclear Criticality in a Uranium Fuel Fabrication Plant (Revision 1).

NRC Guide 3.35—Assumptions Used for Evaluating the Potential Radiological Consequences of Accidental Nuclear Criticality in a Plutonium Processing and Fuel Fabrication Plant (Revision 1).

BRITISH STANDARD: ISO4037: 1979—X and y Reference Radiations for Calibrating Dosemeters and Dose Ratemeters and for Determining Their Response as a Function of Photon Energy. For price and availability, contact BSI Sales Dept., Newton House, 101 Pentonville, Rd., London, N1 9ND, England.

New NBS Publications: N542—"Classification of Sealed Radioactive Sources," and **N433.1,** "Safe Design and Use of Self-Contained, Dry Source Storage Gamma Irradiators (Category I)" are standards developed by Committee N43, Chairman, E. H. Eisenhower. They are available from the U.S. Dept. of Commerce, National Bureau of Standards, Washington, D.C. 20243.

ORAU COURSES ANNOUNCED

Oak Ridge Associated Universities will present the following courses in Oak Ridge, Tennessee: *Basic Use of Radionuclides in Research,* December 3–14, 1979, and July 21–August 1, 1980 (fee: $1100); *Internal Dosimetry for Fixed Nuclear Facilities,* November 5–9, 1979 (fee: $550); and *Applied Health Physics,* September 10–October 12, 1979 (fee: $2250), and May 19–June 20, 1980 (fee: $2500). For more information, contact ORAU, Registrar, Professional Training, P. O. Box 117, Oak Ridge, TN 37830; phone 615-576-3434.

NOVEMBER CONFERENCE EXPLORES ENERGY FROM WASTE POTENTIAL

Canada's energy from waste potential – and the extensive EFW development that is likely to take place over the next ten years – are the subjects of a unique conference to be held at the Park Plaza Hotel in Toronto, November 21–22, 1979.

"ENERGY FROM WA$TE: A Decade of Development" will explore all aspects of generating energy from municipal, industrial, biomass and thermal wastes. It will provide both companies and municipal and regional governments with the information they will need to get in on the ground floor of EFW development. Included will be an examination of the five key factors for viability of an energy from waste development: secure waste supplies, technology, ownership/management/operations structure, markets for energy products produced, and overall economics. More than 20 expert speakers from Canada and the United States will provide case histories and other practical information on existing energy from waste installations throughout the world and explore the critical relationship between EFW and spiralling costs for both energy and landfill.

Registration information is available from Mary Schmieder, CanInfo Communications Limited, 1450

Don Mills Road, Don Mills, Ontario M3B 2X7, Canada, (416) 445-7101.

PERSONAL MENTION

Kaye D. Lathrop, Los Alamos Scientific Laboratory staff member since 1962, head of the Computer Sciences and Services (C) Division since 1978, has recently been appointed LASL Associate Director for Engineering Sciences.

Thomas D. Murphy was recently appointed Chief, Radiological Assessment Branch, Division of Site, Safety, and Environmental Analysis, Office of Nuclear Reactor Regulations (NRR), Nuclear Regulatory Commission. He replaces W. E. Kreger who is now Assistant Director, Site Analysis, DSE/NRC.

ESIS-RSIC COLLABORATION

Elena Caglioti, a staff member of the European Shielding Information Service at EURATOM Joint Research Center, Ispra, Italy, is currently on a four-week assignment with RSIC. She is working on cross-section processing of the ENDF/B dosimetry files and examining the concept of including Bremsstrahlung production for high-energy photon interactions.

VISITORS TO EPIC

The following persons came for an orientation visit and/or to use EPIC facilities during the month of September: Donald T. Berry, Sandia Laboratories, Albuquerque, NM; G. Caglioti, Politechnico di Milano, Italy; Huan Tong Chen and Min-Fong Su, INER, Taiwan, Republic of China; Roy R. Culp and T. Michael Flanders, University of Arkansas, Fayetteville; Manfred Heindler, McMaster University, Ontario, Canada; J. David Irish and Augustine C. Mao, Atomic Energy of Canada, LTD, Chalk River, Canada; Subrata Nath, Texas A & M, College Station, TX; Thomas D. Smith, ORNL, Oak Ridge, TN; Mary Audeen Walters, Battelle Columbus Laboratories, Columbus, Ohio; and Michael Weber, NUKEM, Hanau, and Bayer AG, Leverkusen, F. R. Germany.

CHANGES OF ADDRESS

The following address changes have been noted: **Morgan Libby** *from* Combustion Engineering *to* General Electric Co., Sunnyvale, CA; **B. R. Wienke** *from* LASL *to* MRC, Los Alamos, NM; **Eugene Normand** *from* Sargent and Lundy *to* Puget Sound Power & Light, Bellevue, WA; **Doug R. Wenzel** *from* Allied Chemical Corp. *to* EXXON Nuclear Idaho, Idaho Falls, ID; **Yine-Ping Ting** *from* NUS Corp. *to* Oregon State University Radiation Center, Corvallis, OR; and **Mohamed Abdou** *from* Georgia Inst. of Technology *to* Argonne National Laboratory, Argonne, IL. The **Institut fuer Naturwissenschaftlich-Technische Trendanalysen** (INT) has a new mailing address: Appelsgarten 2, 5350 Euskirchen, West Germany.

CHANGES IN THE COMPUTER CODE COLLECTION

The following changes were made in September.

CCC-217/ORIGEN-79

The ORIGEN (isotope generation and depletion; matrix exponential method) code series development within the Chemical Technology Division of the Oak Ridge National Laboratory has resulted in a newly-frozen code package, designated by RSIC as ORIGEN-79 to differentiate from the earlier packaged model. The new version offers several improvements including the capability for variable dimensioning (making use of larger libraries possible), more thorough input instructions and more liberal output possibilities, object time format statement allowing for numbers like millions of years to be used, large numbers are put out in E-format while small numbers are presented with more accuracy, and provision is

made for more general blending options. Requesters of the new package are reminded of the availability of data libraries based on ENDF/B-IV packaged in RSIC as **DLC-38/ORYX-E**, ORIGEN Yields and Cross Sections, Nuclear Transmutation and Decay Data. Reference: ORNL-4628 and ORIGEN-79 Notes. FORTRAN IV; IBM 360.

CCC-254/ANISN-ORNL

The CDC version (C) of the multigroup one-dimensional discrete ordinates transport code package with anisotropic scattering was extended to include a sample problem for AWNL, an auxiliary code to calculate the adjoint weighted neutron lifetime. AWNL and the sample problem were contributed by Ecole Polytechnique Federale, Lausanne, Switzerland. FORTRAN IV; CDC 6600/7600.

CCC-327/PHOEL-2

PHOEL, a Monte Carlo calculation of initial energy of photoelectrons and Compton electrons produced by photons in water, has been replaced by a newly frozen version, which has been designated PHOEL-2 by the ORNL contributors. PHOEL was written specifically to provide a source term for a Monte Carlo electron energy degradation and transport code for liquid water being used to study the relative biological effectiveness (RBE) of low-LET radiation at low doses. The new version (PHOEL-2) differs from the old by (1) employing a more realistic handling of the photoelectric cross section as a function of energy, (2) compiling electron spectra instead of storing the energies of every electron produced, (3) eliminating some former input restrictions and (4) using a different random number generator. PHOEL-2 does not treat pair production, which should be included for water at photon energies above about 2000 keV. Both PHOEL and PHOEL-2 were contributions of the Oak Ridge National Laboratory. Reference: ORNL/TM-6954. FORTRAN IV; IBM 360.

CCC-343/LEOPARD

The spectrum-dependent non-spatial fuel depletion code was contributed by Electric Power Research Inst., Palo Alto, Ca, and Westinghouse Electric Corp., Pittsburgh, PA. The data libraries included in the package were generated from ENDF/B-IV by Battelle Pacific Northwest Laboratories. LEOPARD determines fast and thermal neutron spectra, using only basic geometry and temperature data. The code optionally computes fuel depletion effects for a dimensionless reactor and recomputes the spectra before each discrete burnup step. References: WCAP-3269-26 and EPRI 221. FORTRAN IV; CDC.

CCC-344/LASER

The one-dimensional, multi-energy, lattice-cell program based on MUFT and THERMOS was contributed by Electric Power Research Institute, Palo Alto, CA and Westinghouse Electric Corp., Pittsburgh, PA. Conversion from CDC to IBM was performed by the Tennessee Valley Authority, Chattanooga, TN, and the data libraries were generated from ENDF/B-IV by Battelle Pacific Northwest Laboratories. LASER is based on modified versions of the slowing-down program MUFT and the thermalization transport theory program, THERMOS, and performs a calculation of the neutron spectrum in a uniform lattice made up of cylindrical rods, cladding, and surrounding moderator. A burnup calculation for the lattice is performed, and the spatial distribution of burnup within the fuel rods is explicitly calculated. References: EPRI 221, WCAP-6073, WCAP-6069. FORTRAN IV; IBM 360.

CCC-352/RASPA

RASPA, designed to calculate buildup, decay, and burnup of fissionable isotopes and their fission products, was contributed by INTERATOM, Bensberg, Federal Republic of Germany, through the OECD NEA Data Bank, Gif-sur-Yvette, France. It calculates the concentrations of all isotopes for any desired moment in time, and from this calculates both the activity and the decay heat production rate and the gamma-ray source spectrum. In addition, the total burnup, the production density, and burnup values of the fissionable isotope are calculated. Routines are available for the calculation of the integral relative decay heat production, the proportionate collection of decay heat rate, the performance of error analysis using the

Monte Carlo technique, and the plotting of the results on the Calcomp microfilm plotter. References: ITB-76.08, OLS-79-241. FORTRAN IV; CDC 7600.

CCC-354/ACRO

ACRO, a calculation of internal exposure doses resulting from acute or chronic inhalation and oral ingestion of radionuclides was contributed by Tokai Works, Power Reactor and Nuclear Fuel Development Corporation, Tokai, Ibaraki, Japan. The International Commission on Radiation Protection (ICRP) Task Force Lung Model (TFLM) was used as the inhalation model in ACRO, and a simple one-compartment model was used as the ingestion model. This model is effective for cases involving long-term continuous ingestion. A number of metabolic models have been proposed for the evaluation of internal exposure. Reference: PNCT 841-78-01. FORTRAN IV; IBM 360.

PSR-118/NJOY-79

A new version of this code system for producing pointwise and multigroup neutron and photon cross sections from ENDF/B-IV and ENDF/B-V evaluated nuclear data was contributed by Los Alamos Scientific Laboratory, New Mexico. This new code package, designated by RSIC as NJOY-79 to differentiate from that originally packaged, features an improved thermal treatment and increased accuracy for the discrete scattering matrices and weight function in GROUPR. Several errors have been corrected, and the machine compatibility of the coding has been improved. A few changes to the input instructions were necessary, and the test problem results are different for some calculations. A microfiche showing new input and output is included in each package. The new thermal treatment is based on the use of discrete angles rather than Legendre components. Short-collision-time approximation is used to extend inelastic scattering to high energy and momentum transfers. Reference: LA-7584-M (ENDF-272) and addendum. FORTRAN IV; CDC.

SCALE-04/SUPERDAN

The SUPERDAN code package was extended to include a TOSBAC-5600 (B) version, contributed by Japan Nuclear Fuel Co. Ltd., Kanagawa-ken, Japan. The code system is designed for calculating the Dancoff factor of spheres, cylinders, and slabs for use in the determination of flux reduction in resonance integral calculations. The original code, written for the IBM 360/370 computer, was contributed by the UCND Computer Sciences Division at Oak Ridge National Laboratory. Reference: ORNL/NUREG/CSD/TM-2. FORTRAN IV; IBM 360/370 and TOSBAC-5600.

CHANGES IN THE DATA LIBRARY COLLECTION

The following changes were made in September.

DLC-54/LAFPX-E

The data package of 154-neutron-group cross sections for fission products generated with NJOY from ENDF/B-IV was updated to correct two errors called to RSIC attention by Dan Wessol of EG & G, Idaho and William B. Wilson, LASL. Details of the corrections or the complete data package may be requested from RSIC. FORTRAN IV; CDC.

DLC-67/PUCOR

A data compilation, 84-neutron-group cross sections for uranium-plutonium cycle PWR and BWR models, was contributed by the Chemical Technology Division, Oak Ridge National Laboratory. Data are provided for 24 actinide, structural, moderator, and poison materials as well as 180 fission products. The data are in AMPX master library format and require modules from PSR-63/AMPX-II or PSR-117/MARS for utilization of the cross sections. Reference: ORNL/TM-6051. IBM 360/91.

SEPTEMBER 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.

REACTOR AND WEAPONS RADIATION SHIELDING LITERATURE

ANL-79-5, Monte Carlo-Based Validation of the ENDF/MC^2-II/SDX Cell Homogenization Path., Wade, D.C., April 1979, NTIS $5.25

AERE-R9195, Neutron Yields from (alpha, n) Reactions in the Light Elements., West, D.; Sherwood, A.C., July 1978, HMSO

AEEW-M-1631, The Treatment of Active Waste from a PIE Facility., Turier, C.A.; Kerswell, A.G., September 1978, UKAEA, Winfrith. Atomic Energy Establishment

AEEW-M-1637, The Use of the Aitken Extrapolation Method in Accelerating Two- and Three-Dimensional Neutron Diffusion Flux Calculations., Buckler, A.N., October 1978, HMSO

AEEW-R-834, GRAB - WRS System Module Number 60221 for Calculating Gamma-Ray Penetration in Slab Shields by the Method of Kernel Integration with Build-Up Factors., Grimstone, M.J., June 1978, UKAEA, Winfrith. Atomic Energy Establishment

AEEW-R-849, SREM - WRS System Module Number 3348 for Calculating the Removal Flux Due to Point, Line or Disc Sources., Grimstone, M.J., June 1978, UKAEA, Winfrith. Atomic Energy Establishment

AEEW-R-1157, MIXGAM - WRS System Module Number 1300 for Mixing Gamma-Ray Cross Sections for Removal Diffusion Calculations., Grimstone, M.J., June 1978, UKAEA, Winfrith. Atomic Energy Establishment

AEEW-R-1159, NADCON - WRS System Module Number 23016 for Mixing ADC Method A Data for Neutrons., Grimstone, M.J., June 1978, UKAEA, Winfrith. Atomic Energy Establishment

AEEW-R-1160, REGROUP - WRS System Module Number 13774 for Energy Group Conversion of Flux Spectra., Grimstone, M.J., June 1978, UKAEA, Winfrith. Atomic Energy Establishment

BARC-808, Fission and Activation Product Data Relevant to the Studies on Radioactive Fallout from Atmospheric Nuclear Explosions., Mishra, U.C.; Shukla, V.K.; Ramachandran, T.V., 1975, Division of Radiation Protection, Bhabha Atomic Research Centre, Bombay (India)

BNL-22742; CONF-770321-10, Much Ado about Nothing: Deep Minima in ^{45}Sc and ^{56}Fe Total Neutron Cross Sections., Chrien, R.E.; Liou, H.I.; Block, R.C.; Singh, U.N.; Kobayashi, K., March 1977, NTIS

BNL-24566; CONF-780508,Vol.2,pp.903-909, Effects of Waste Management on the Impact of Fusion Power., Botts, T.; Powell, J., 1978, NTIS

CEA-CONF-4203; CONF-771233-7, Effects of Waste Management on the Impact of Fusion Power., Botts, T.; Powell, J., 1978, NTIS

CEA-CONF-4203; CONF-771233-7, Evaluation of the Capture Cross Section of Natural Ti from 10^{-5}eV to 20.10^{6}eV., Simon, G.; Bersillon, O.; Mosinski, G.; Philis, C.; Trochon, J.; Verges, N., 1977, Dep., NTIS (U.S. Sales Only)

CEA-CONF-4204; CONF-771233-5, Evaluation of the (n,p) Cross Sections of Natural Ti and Its Isotopes from Thresholds to 20 MeV., Bersillon, O.; Philis, C.; Smith, D.; Smith, A., 1977, Dep., NTIS (U.S. Sales Only)

76-CNA-800, pp.1-19, Designing to Minimize Radiation Exposure., Legg, G.G., No Date, Canadian Nuclear Association, Toronto, In: Nuclear Energy and Society. Vol.8: Scientific Session - Control of Reactor Radiation Fields.

76-CNA-800, pp.20-40, Predicting Radiation Fields Around Reactor Components., Lister, D.H., No Date, Canadian Nuclear Association, Toronto, In: Nuclear Energy and Society. Vol.8: Scientific Session - Control of Reactor Radiation Fields.

76-CNA-800, pp.41-58, Techniques to Reduce Radiation Fields., Montford, B., No Date, Canadian Nuclear Association, Toronto, In: Nuclear Energy and Society. Vol.8: Scientific Session - Control of Reactor Radiation Fields.

CNEN-RT/FI-77-8, Functional Investigation and Kernel Expansion Technique for the System of Integral Equations Governing the Stationary Anisotropic Transport of Monoenergetic Neutrons in Three Dimensional Media., Premuda, F.; Bassini, A.; Spiga, G.P., 1977, Comitato Nazionale per l'Energia Nucleare, Rome (Italy)

CONF-770409,Vol.2, pp.377-380, Spectra and Dosimetry of Neutrons Interacting with Concrete Shielding., Cross, W.G.; Ing, H., 1977, M. Gilbert Bresson, General Secretary IRPA, B.P. no.33, 92260 Fontenay-aux-Roses (France), In: Proceedings of the 4th International Congress of the International Radiation Protection Association. Paris, 24-30 April 1977.

CONF-770409,Vol.2, pp.471-474, Monte Carlo Simulated Dose to the Human Body Due to Neutrons Emitted in Laser-Fusion., Gileadi, A.E., 1977, M. Gilbert Bresson, General Secretary IRPA, B.P. no.33, 92260 Fontenay-aux-Roses (France), In: Proceedings of the 4th International Congress of the International Radiation Protection Association. Paris, 24-30 April 1977.

CONF-790125-57, Range Calculations Using Multigroup Transport Methods., Hoffman, T.J.; Robinson, M.T.; Dodds, H.L.,Jr., 1979, Dep., NTIS

CONF-790602-61, Influence of Fission Spectra Uncertainties on Calculated Fast Reactor Parameters., Lucius, J.L.; Marable, J.H., 1979, Dep., NTIS

COO-2280-28, Exact and Approximate Interior Corner Problem in Neutron Diffusion by Integral Transform Methods., Bareiss, E.H.; Chang, K.S.J.; Constatinescu, D.A., September 1976, NTIS

EPRI-NP-332, Evaluation of Operational Techniques that Can Reduce Radiation Fields in LWRs During Maintenance., Keneshea, F.J.; Knecht, P.D.; Doyel, D.; Zahner, R., March 1979, Nuclear Service Corporation, 1700 Dell Avenue, Campbell, California 95008

EUR-5684, The Angular Gamma Flux in an Iron Shield Due to a Thin Slab Source., Penkuhn, H., April 1977, Joint Research Centre, Commission of the European Communities, Ispra (Italy)

EUR-6041en, Lecture Notes on Cross-Section Adjustment Procedures. (Nuclear Science and Technology), Yeivin, Y.; Matthes, W., 1978, Office for Official Publications of the European Communities, Boite postale 1003 - Luxembourg

FOA Rapport C 20236-A2, Time-Dependent Dose Rate and Compton Electron Generation from Mono-Energetic Gamma Sources in Homogeneous Air., Engstrom, G., April 1978, Forsvarets Forskningsanstalt, National Defense Research Institute, S-104 50 Stockholm 80, Sweden

GSI-79-2, Gamma-Ray Catalog., Reis, U.; *et al.*, February 1979, Gesellschaft fuer Schwerionenforschung, Darmstadt (Germany, F.R.)

INIS-mf-4043, pp.29-40 (In Russian), Effects of Neutron Constants on the Neutronic Calculation of a Thermonuclear Reactor Blanket., Markovskij, D.V.; Shatalov, G.E.; Yan'kov, G.B., 1976, INIS, In: Neutron Physics. Part 1.

INIS-mf-4043, pp.83-87 (In Russian), Nuclear Data for the Calculation of Neutron-Induced Secondary Gamma-Ray Spectrum in Soil., Birintsev, A.A.; Medvedev, Yu.A.; Safin, Yu.A.; Stepanov, B.M.; Trukhanov, G.Ya., 1976, INIS, In: Neutron Physics. Part 1.

JAERI-1252; INDC(JAP)-38/G, Table of Nuclear Reactions and Subsequent Radioactive Decays Induced by 14-MeV Neutrons., Tsukada, K., September 1977, Tokai Research Establishment, Japan Atomic Energy Research Inst., Tokai, Ibaraki

JINR-P16-12078, Study of the Fluence and Neutron Dose Energy Distribution at Large Distances from Accelerators., Komochkov, M.M.; *et al.*, 1979, Joint Institute for Nuclear Research, Dubna

KFK-2386/III, KEDAK: Evaluation for the German Nuclear Data Library KEDAK-3. Pt.2. Fissile and Fertile Materials., Goel, B.; Weller, F., March 1977, Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik

LA-7835-M, TRIDENT-CTR User's Manual., Seed, T.J., May 1979, NTIS

LA-7861-MS, SPECTRA-IV, Benchmark Spectra Based on LIB-IV., Kidman, R.B., June 1979, NTIS

NBSIR-78-1534, Monte Carlo Studies of Electron and Photon Transport at Energies up to 1000 MeV., Seltzer, S.M.; Berger, M.J., 1978, National Bureau of Standards, Dept. of Commerce, Washington, D.C. 20234

ORAU-132, Gamma Spectra and Nuclide Identification Catalog. (2nd Edition), Gleason, G.; Reed, B.H. (Comps.), April 1979, Dep., NTIS

ORNL-5551, Analysis of the ORNL/TSF GCFR Grid-Plate Shield Design Confirmation Experiment., Slater, C.O.; Cramer, S.N.; Ingersoll, D.T., August 1979, NTIS $8.00

ORNL/TM-6571, INGDOS - A Conversational Computer Code to Implement U.S. Nuclear Regulatory Commission Regulatory Guide 1.109 Models for Estimation of Annual Doses from Ingestion of Atmospherically Released Radionuclides in Foods., Pleasant, J.C., August 1979, NTIS

ORNL/TM-6663, The Evaluation of Selected Predictive Models and Parameters for the Environmental Transport and Dosimetry of Radionuclides., Miller, C.W.; Dunning, D.E.,Jr.; Etnier, E.L.; Hoffman, F.O.; Little, C.A.; Meyer, H.R.; Shaeffer, D.L.; Till, J.E., July 1979, NTIS

ORNL/TM-6889, Calculated Response of a Total Liquid Argon Calorimeter to Protons and Electrons in the 0.5- to 5.0-GeV Energy Range., Gabriel, T.A.; Bishop, B.L., July 1979, NTIS $4.50

ORNL/TM-6904, Dose Rates from Induced Activity in the TFTR Test Cell., Alsmiller, R.G.,Jr.; Barish, J.; Santoro, R.T.; Lillie, R.A.; Barnes, J.M.; Ragheb, M.M.H., August 1979, NTIS

ORNL/TM-6949, Shielding Calculations for the TFTR Neutral Beam Injectors., Santoro, R.T.; Lillie, R.A.; Alsmiller, R.G.,Jr.; Barnes, J.M., July 1979, NTIS $4.50

ORNL/TM-6996, Preconceptual Study of Proliferation-Resistant Heterogeneous Sphere-Pac-Fueled LMFBR Cores., Selby, D.L., September 1979, Department of Energy, TIC, P.O. Box 62, Oak Ridge, Tenn. 37830 $9.50

PPGM-L99-76 (In Indonesian), Experiment on Radiation Shielding. Part I: Preparation., Soekarno; Mursid, D., 1976, Gama Research Centre, Yogyakarta (Indonesia)

PTB-FMRB-72, Average Cross Sections in the Neutron Benchmark Field of Californium-252: A Status Report., Mannhart, W., April 1978, Institut Berlin der Physikalisch-Technischen Bundesanstalt, Abbestrabe 2-12, 1000 Berlin 10 (Charlottenburg)

PTB-Ra-9, Radionuclide Concentration in Ground Level Air from 1974 to 1977 in North Germany and North Norway., Kolb, W., November 1978, Institut Berlin der Physikalisch-Technischen Bundesanstalt, Abbestrabe 2-12, 1000 Berlin 10 (Charlottenburg)

STI/PUB-463; CONF-770220, Handling of Radiation Accidents - 1977., IAEA, 1977, International Atomic Energy Agency, Vienna $42.00

Tech. Reports Series No.180, Compendium of Neutron Spectra in Criticality Accident Dosimetry., Ing, H.; Makra, S., 1978, International Atomic Energy Agency, Vienna $17.00

TREE-1358; BLG-525, Neutron Spectrum Measurements in CFRMF 6Li Spectrometry., Deleeuw-Gierts, G.; Deleeuw, S.; Rogers, J.W.; Johnson, L.O., May 1979, NTIS $4.50

TREE-1369, Preliminary Studies for the PDX Tokamak Radiation Shield Design., Grimesey, R.A.; Nigg, D.W.; Scott, A.J.; Wheeler, F.J., July 1979, Dep., NTIS $8.00

UCRL-78482-Supplement (Preprint), Atlas of Photoneutron Cross Sections Obtained with Monoenergetic Photons. Supplement., Berman, B.L., June 1979, Lawrence Livermore Laboratory, University of California, Livermore, California 94550

UCRL-79759; CONF-771109-41, Applications of the Probability Table Method to Practical Problems., Plechaty, E.F.; Cullen, D.E.; Levitt, L., July 1977, NTIS

UVVVR-6, Energy and Angular Distribution of Secondary Particles in the Detection Media After the Interaction of Ionizing Radiation. Part One., okta, L.; Petr, I., 1979, Institute for Research, Production and Uses of Radioisotopes, Prague 7, Pristavni 24, Czechoslovakia

UWFDM-270, SOLASE-H - A Laser Fusion Hybrid Study., Conn, R.W.; Abdel-Khalik, S.I.; Moses, G.A.; Cooper, G.W.; Howard, J.E.; Kulcinski, G.L.; Larsen, E.; Maynard, C.W.; Ragheb, M.M.H.; Sviatoslavsky, I.N.; Vogelsang, W.F.; Wolfer, W.G.; Ortman, M.; Smatlak, D.L.; Watson, R.; Youssef, M.Z., May 1979, Fusion Engineering Program, Nuclear Engineering Dept., University of Wisconsin, Madison WI 53706

UWFDM-304, Discrete Transfer Cross Section Expansion for Time Dependent Neutron Transport., Beranek, F.; *et al.*, October 1978 (Rev. January 1979), Nuclear Engineering Department, University of Wisconsin, Madison, WI

WAPD-TM-1449, Integral Testing of Thorium and U233 Data for Thermal Reactors (AWBA Development Program)., Hardy, J.,Jr.; Ullo, J. J.; Steen, N. M., June 1979, Bettis Atomic Power Laboratory, West Mifflin, Pa.

WAPD-TM-1275, AIRWAY - A FORTRAN Computer Program to Estimate Radiation Dose Commitments to Man from the Atmospheric Release of Radionuclides (LWBR Development Program)., Rider, J.L., June 1979, Bettis Atomic Power Laboratory, West Mifflin, Pa.

Atomic Energy Rev., 17(1), 129-179, Physics Problems of Fast Reactor Shielding., Farinelli, U.; Nicks, R., 1979

Environmental Sci. and Tech., 13, 872-874, Reducing Environmental Radiation with Krypton-85 Utilization., Hollis, D.L.; VanArtsdalen, E.R.; Whittle, G.P.; Thomas, E.T., July 1979

ESIS Newsletter, 30, 3-6, Measurements of Neutron Spectra Behind Iron-Water and Iron Shielding Configurations by Means of Proton Recoil Proportional Counter Spectrometry., Albert, D.; Hansen, W.; Vogel, W.; Desi, S.; Elo, S.; Csom, Gy., July 1979

Geophysics, 44(1), 89-98, Technique for Correcting for Overburden Effects in Ground Level Radiometric Surveys of Uranium Ore Bodies., Dickson, B.L.; Clark, G.J.; McGregor, B.J., January 1979

J. Applied Meteorology, 18(1), 17-26, Monte Carlo Simulation of Turbulent Atmospheric Transport and Comparisons with Experimental Data., Alsmiller, F.S.; Alsmiller, R.G.,Jr.; Bertini, H.W.; Begovich, C.L., January 1979, Announced previously as ORNL/TM-6291

J. Nucl. Sci. Technol., 14(4), 308-311, Neutronics Experiments of D-T Fast Neutrons by Application of Associated Particle Method., Takahashi, A.; Iwai, K.; Yamamoto, J.; Ebisuya, M.; Sumita, K., April 1977

J. Nucl. Sci. Technol., 14(7), 467-481, Evaluation of Neutron Cross Sections of Plutonium-241., Kikuchi, Y., July 1977

J. Nucl. Sci. Technol., 15(4), 302-309, Elastic Removal Self-Shielding Factors for Light and Medium Nuclides with Strong-Resonance Scattering., Nakagawa, M.; Ishiguro, Y., 1978

J. Nucl. Sci. Technol., 16(2), 117-131, Variance Reduction Techniques Using Adjoint Monte Carlo Method in Shielding Problem., Ueki, K.; Stevens, P.N., February 1979

Nucl. Safety, 20(4), 458-467, An Analysis of NRC Methods for Estimating the Effects of Dry Deposition in Environmental Radiological Assessments., Miller, C.W.; Hoffman, F.O., July-August 1979

Nucl. Sci. Eng., 71(3), 287-293, Thor, A Thorium-Reflected Plutonium-Metal Critical Assembly., Hansen, G.E.; Paxton, H.C., September 1979

Nucl. Sci. Eng., 71(3), 294-300, Penetration of Secondary Neutrons and Photons from a Graphite Assembly Exposed to 52-MeV Protons., Shin, K.; Uwamino, Y.; Yoshida, M.; Hyodo, T.; Nakamura, T., September 1979

Nucl. Sci. Eng., 71(3), 327-330, Comparison of Calculations and Measurements of Fission Product Decay Heat for Uranium-235 and Plutonium-239 for Cooling Times Greater than 50,000. (Tech. Note), Shure, K.; Wallace, O.J.; Connor, J.C., September 1979

Nucl. Sci. Eng., 71(3), 330-342, An Improvement of the PALLAS Discrete-Ordinates Transport Code. (Tech. Note), Sasamoto, N.; Takeuchi, K., September 1979

Nucl. Technology, 45(2), 177-182, Neutron Gauge for Measurement of High Void Fraction in Water-Steam Mixtures., Frazzoli, F.V.; Magrini, A., September 1979

Nucl. Technology, 45(2), 113-120, Neutronic Performance of Fusion Reactor Blankets with Different Coolants and Structural Arrangements., Chao, J.; Mikic, B.B.; Todreas, N.E., September 1979

Phys. Lett., 60A(3), 219-222, Observation of Photonuclear Processes in the TFR Tokamak., T.F.R. Group, February 21, 1977

Soviet J. At. Energy(English Transl.), 42(3), 225, The Dose Distribution for a Thin Neutron Beam in a Tissue-Equivalent Medium., Budnikov, N.S.; Pozdneev, D.B., March 1977

Thesis, Evaluation of Mass Integral Scaling as Applied to the Atmospheric Radiation Transport Problem., Shulstad, R.A., Air Force Inst. of Tech., Wright-Patterson AFB, Ohio, 1976, University Microfilms Order No.77-9476

Thesis, Radioactivity Calculations in Fusion Reactors., Sung, T.Y., University of Wisconsin, Madison, WI, 1976, University Microfilms Order No.77-8817

COMPUTER CODES LITERATURE

AEEW-R-825 ..... DOCTOR; REDIFFUSION
DOCTOR - WRS System Module Number 1827 for Calculating Reaction Rates from a Set of Fluxes., Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, February 1978

AEEW-R-834 ..... GRAB
GRAB - WRS System Module Number 60221 for Calculating Gamma-Ray Penetration in Slab Shields by Method of Kernel Integration with Build-up Factors., Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, June 1978

AEEW-R-836 ..... REDIFFUSION
User's Manual for the REDIFFUSION Programme., Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, June 1978

AEEW-R-849 ..... SREM
SREM - WRS System Module Number 3348 for Calculating the Removal Flux Due to Point, Line or Disc Sources., Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, June 1978

AEEW-R-1157 ..... MIXGAM; REDIFFUSION
MIXGAM - WRS System Module Number 1300 for Mixing Gamma-Ray Cross Sections for Removal Diffusion Calculations., Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, June 1978

AEEW-R-1158 ..... SCRIM
SCRIM - WRS System Module Number 22947 for Small Core Removal Calculations., Emmett, J.; Grimstone, M.J., UKAEA Winfrith, Atomic Energy Establishment, UK, June 1978

EUR 5794en ..... ESP-TIMOC
ESP-TIMOC Code Manual., Jaarsma, R.; Perlado, J.M.; Rief, H., Joint Research Centre, Ispra Establishment, Italy, FORTRAN IV, 1977

LA-7835-M ..... TRIDENT-CTR
TRIDENT-CTR User's Manual., Seed, T.J., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, May 1979

LA-7524-MS ..... ELLIPTIC EQUATIONS
Certification Report on "Efficient FORTRAN Subprograms for the Solution of Elliptic Partial Differential Equations" by Swarztrauber, P.; Sweet, R.; National Center for Atmospheric Research, Boulder, Colorado., Steuerwalt, M., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, October 1978

LA-7861-MS ..... SPECTRA-IV
SPECTRA-IV, Benchmark Spectra Based on LIB-IV., Kidman, R.B., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, June 1979

LA-7879-MS ..... SNEX
SNEX: Semianalytic Solution of the One-Dimensional Discrete Ordinates (Sn) Transport Equations with Diamond Differenced Angular Fluxes., Wienke, B.R., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, June 1979

ORNL-5561 ..... MAGIK
MAGIK - A Monte Carlo System for Computing Induced Residual Activation Dose Rates., Barish, J.; Gabriel, T.A.; Alsmiller, R.G., Jr., Oak Ridge National Laboratory, Oak Ridge, TN, August 1979

ORNL/RSIC-42, pp. 135-143
..... FERRET; SAND-II
Use of HEDL Codes in the Sensitivity and Uncertainty Analysis of the Pressure Vessel Embrittlement Damage Function Problem., Guthrie, G.L.; Schmittroth, F.; Simons, R.L.; Lippincott, E.P.; Oster, C., Hanford Engineering Development Laboratory, Richland, Washington, February 1979

ORNL/TM-6526 ..... BUSH
Effects of Man's Residence Inside Building Structures on Radiation Doses from Routine Releases of Radionuclides to the Atmosphere., Kocher, D.C., Oak Ridge National Laboratory, Oak Ridge, TN, December 1978

ORNL/TM-6954 ..... PHOEL-2
User's Manual for PHOEL-2, a Monte Carlo Computer Code for Calculating Energies of Photoelectrons and Compton Electrons in Water., Turner, J.E.; Hamm, R.N.; Wright, H.A.; Modolo, J.T.; Sordi, G.M.A.A., Oak Ridge National Laboratory, Oak Ridge, TN, August 1979

RD/B/N4582 ..... HYACINTH; RICE
Amendments to the Data Libraries of the HYACINTH and RICE Reactor Inventory Codes., Harte, G.A.; Mairs, J.; Nair, S., Central Electricity Generating Board, Berkeley Nuclear Laboratories, UK, June 1979

Trans. Am. Nucl. Soc., 32, 646-647
..... KRIS-01
A Monte Carlo Radiation Transport Program for Reactor Bundle Gamma Transport and Energy Deposition Analyses., Kang, C.M.; Hansen, E.C.; Crowder, A.S., General Electric, San Jose, CA, June 1979

UCRL-50400, Vol.17, Part E ..... EVALPLOT
Program EVALPLOT (Version 79-1): Plot Data in the Evaluated-Nuclear-Data File/Version B (ENDF/B) Format., Cullen, D.E., Lawrence Livermore Laboratory, Livermore, CA, February 1979

UCRL-50400, Vol.18 ..... ACTL
ACTL: Evaluated Neutron Activation Cross Section Library-Evaluation Techniques and Reaction Index., Gardner, M.A.; Howerton, R.J., Lawrence Livermore Laboratory, Livermore, CA, October 1978

ZJE-227 ..... BIPAL
BIPAL - A Data Library for Computing the Burnup of Fissionable Isotopes and Products of Their Decay., Královcová, E.; Hep, J.; Valenta, V., Skoda Works, Nuclear Power Construction Division, Information Centre, Plzen, Czechoslovakia, 1978