RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION FOR THE DEPARTMENT OF ENERGY

POST OFFICE BOX X •
OAK RIDGE, TENNESSEE 37830

No. 175 *July 1979*

If things are ever to be moved upward, someone must be ready to take the first step and assume the risk of it. . . . *William James*

ANS/RP&S AWARD TO ENGLE & MYNATT

The American Nuclear Society through the Radiation Protection and Shielding Division presented its award for Technical Achievement to two research staff members of the Oak Ridge National Laboratory (ORNL), ***Ward W. Engle, Jr.*** *and* ***Fred R. Mynatt,*** *for leadership in solving radiation transport problems and for specific contributions. Their work was performed within the ORNL Engineering Physics (formerly Neutron Physics) Division, which was founded by the late Everett Blizard and now led by Fred C. Maienschein. The Division has always been heavily involved in shielding research and development.*

Engle was cited for "his leadership in the development and application of discrete-ordinates methods for solving radiation shielding problems. ANISN, the one-dimensional discrete ordinates code whose development was led by him, remains as surely the most-used shielding code in the world today. He has participated directly in the development of discrete ordinates methods for handling complex problems including two dimensions, time dependence, and other complexities.

"He has been responsible for shielding analysis which has been carried out in support of the design of the FFTF and CRBR. In this analysis he has extended the concept of coupled calculations to the extreme which is required for following the attenuation through the entire shield of a large power reactor. He earlier played a strong role in developing new shielding methods and applying them to solving radiation problems associated with nuclear-powered space vehicles and for the Defense Nuclear Agency. In both cases, the methods have been later widely adapted to other types of shielding situations.

"In addition to his direct contributions, he has made a continued and important impact on the work of others by advising broadly on problems of methods development and application and with regard to the innovative use of modern computing capability."

The ***Mynatt*** *citation reads as follows.*

"He led in the development of the two-dimensional discrete-ordinates method, DOT, which was designed to be a practical tool for the shielding analyst from the beginning. This user-orientation, together with the high level of sophistication in the development of the method, has led to its worldwide use for two-dimensional calculations.

"He was directly involved in the development of the cooperative roles in the design of fast reactors in which the methods developers in the national laboratories have assisted the designer by specifically tailoring methods to the design needs and applying these methods for a few selected problems which require the maximum analytical capability. This cooperative arrangement appears as a desirable model of interaction between national laboratories and industry.

"His applied analysis group has led many of the innovative developments in the use of discrete-ordinates, Monte-Carlo, coupled methods for combining the above, sensitivity analysis and shield optimization techniques. Applications have been made to a wide variety of civilian and military reactor and weapon systems.

"He has led in the development of the specially designed integral experiments which are required for the validation of analysis methods. Careful preanalysis of the experiments was shown to be necessary in order that the experiments provide a meaningful validation.

"He was chairman of the Radiation Protection and Shielding Division, 1976–1977."

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.

Naoki Yamano, Division of Engineering, Sumitomo Atomic Energy Industries (SAEI), Ltd., Tokyo, Japan, writes that SAEI is a management office of the Sumitomo industry group for research and development in nuclear energy. His division is currently involved in a design study for an FBR fuel reprocessing plant in collaboration with the Power Reactor and Nuclear Fuel Development Corporation.

Dr. Yamano, responsible for shielding design, is currently concerned with methods development. In cooperation with S. Miyasaka, K. Koyama, and T. Asaoka of JAERI, he is engaged in evaluation and in making improvements to the shielding analysis code system, RADHEAT-V4. Its predecessor is packaged in RSIC as CCC-300/RADHEAT-V3, A Modular System for the Calculation of Neutron and Gamma-Ray Transport and Energy Deposition in a Nuclear Reactor or Shield, a contribution of the Japan Atomic Energy Research Institue (JAERI).

Dr. Yamano is also involved with T. Miura of the Ship Research Institute in an analysis of circular duct benchmark experiments performed at JRR-4, the JAERI swimming pool type reactor, in which they are using a combination of DOT-DOMINO-MORSE-CG. He is also studying the window and self-shielding effects of neutron cross sections of structural materials (especially iron) for shielding calculations as a part of the work of the Japanese Nuclear Data Committee.

Ulf Tveten, Institutt for Atomenergi, Kjeller, Norway, writes that for some time, he has been diverted from shielding studies for accident analyses performed for the Norwegian Government Committee on Nuclear Power. With the publication of the results of the analyses in a report by that name and summarized in *Nuclear Power Safety,* NOU 1978: 35c, he hopes to return in a more positive way to his original work.

Professor J. Seda and **Dr. Ivo Petr** of the **Technical University of Prague** write that they plan research programs on the interaction of photons and neutrons in several materials. Their immediate interest is the energy deposition of recoil electrons in thin layers from photon interactions.

PERSONAL ITEMS

Bonnie C. Talmi, formerly coordinator of information centers at the Oak Ridge National Laboratory (ORNL), has resigned to manage Oak Ridge Operations of Franklin Research Center, a Division of the Franklin Institute. She will do part-time consulting with the Engineering Physics Information Centers (EPIC), which includes RSIC.

CHANGES OF ADDRESS

We note the following changes of address: **J. R. Liaw** *from* University of Oklahoma *to* Applied Physics Division, Argonne National Laboratory, Argonne, IL; **Roy A. Castelli** *from* Gibbs & Hill, Inc. *to* Knolls Atomic Power Laboratory, Schenectady, NY; **S. L. Bhatia** *from* Allied Chemical Corp., *to* EG&G Idaho, Idaho Falls, ID; **Marco Zaider** *from* Los Alamos Scientific Laboratory *to* Radiological Research Laboratory, Columbia University, New York, NY; **Mercury Vlasov** *from* IAEA Nuclear Data Section, Vienna, Austria, *to* Institute of Nuclear Research, Ukrainian SSR Academy of Sciences, Kiev, USSR; **Thomas M. Jordan** (Consultant), *from* Darnestown, MD, *to* 814 22nd. St., Santa Monica, CA 90403; and **Peter J. Gollon** *from* Fermilab *to* Brookhaven National Laboratory, Upton, NY.

UNIVERSITY OF TENNESSEE TO OFFER APPLIED MONTE CARLO COURSE

The Nuclear Engineering Department of the University of Tennessee will offer a one-week course in Monte Carlo analysis as a part of Tennessee Industries Week (TIW), September 10–14, 1979. The registration fee is $400, and the deadline for registration is August 24, 1979.

The course is designed specifically for the practicing engineer engaged in shield design and does not presume any prior knowledge of Monte Carlo methods. An understanding of the theoretical basis of Monte Carlo methods will be emphasized along with their specialized applications to practical shielding problems. The versatile Monte Carlo code, MORSE, will be described. Special attention will be given to the understanding and use of the ALBEDO option. Application of the appropriate Monte Carlo code and/or the cross-section data for your job will also be discussed.

Additional information on this and other courses offered during TIW can be obtained from F. N. Peebles, Dean of Engineering, or P. N. Stevens, Professor of Nuclear Engineering, UTK College of Engineering, 124 Perkins Hall, Knoxville, TN 37916 (615-974-5321).

RENSSELAER ANNOUNCES COURSES

The Office of Continuing Studies of Rensselaer Polytechnic Institute announces its summer programs in Nuclear Reactor Design and Basic Nuclear Technology as follows: July 9–13 — Basic Nuclear Reactor Technology; July 16–20 — Nuclear Reactor Design; and July 23–27 — Computer Applications and Reactor Design Codes.

The program is intended primarily for nuclear industry and utility power company engineers and managerial and technical staff personnel as well as educators desiring a review of the background material and the methods and procedures involved in the analysis and design of current nuclear power reactor systems. It will also be useful to the practicing engineer interested in improving his background in nuclear technology, reactor design or computer applications. A number of important topics in reactor engineering and design will be covered in depth, starting from the fundamentals of nuclear reactor technology to the state-of-art techniques and methods used in the integrated design analysis and evaluation of nuclear power plants, including computational approaches and methods, safety and fuel management. Computer programs and reactor design code packages typical of those in current use in the nuclear industry will be discussed and their operation demonstrated on the IBM 3033 computer and an up-to-date interactive computer graphics system at RPI.

The overall program will comprise three separate, self-contained one-week course modules, organized and structured in a manner so as to permit adequate flexibility and optimum usefulness. Any one course module can be taken separately and independently—or all three sequentially. No special preparation in nuclear science is required for the course, although it would be helpful for the participants to have adequate background in basic technical areas.

Topics to be covered include the following.

Basic Nuclear Reactor Technology: Reactor Physics & Engineering Fundamentals; Nuclear Power Systems, Reactor Types; Nuclear Energy Conversion and Heat Transport; Systems Analysis of Nuclear Power Plants; Safety and Health Physics, Licensing; and Use and Operation of the Rensselaer Reactor.

Nuclear Reactor Design: Design Considerations: Approaches and Methods; Nuclear Design; Thermal-Hydraulic Design; LWR Safety and Related Design Requirements; Nuclear Power Quality Assurance; Fuel Management; and Nuclear Power & Electric Utility Economics.

Computer Applications and Reactor Design Codes: Fundamentals of Computing and Numerical Methods for Nuclear Engineering Applications; Programming Reactor Problems for Digital Computers; Computer Programs—Reactor Statics, Thermal Hydraulics, Fuel Management, Reactor System Dynamics, Shielding, etc.; Information Flow Among Computer Programs; Operation and Use of Typical Reactor Design Codes—Sample Problems; and Applications of Reactor Calculations to Reload Licensing.

For additional information, contact Office of Continuing Studies, Rensselaer Polytechnic Institute, Troy, New York 12181.

UPCOMING MEETINGS

We call attention to the following upcoming meetings which have not been previously announced in this newsletter.

August 1979

ANS/ENS International Meeting on Fast Reactor Safety Technology, August 19–23, 1979, Olympic Hotel, Seattle, Washington. Contact: J. C. Danley, W/C-78, Westinghouse-Hanford Company, P. O. Box 1970, Richland, WA 99352.

September 1979

Nuclear Energy Women National Meeting, September 14, 1979, Greenwood Inn, Bellevue, Seattle, Washington. Contact: Marie Dunkle, Atomic Industrial Forum, Inc., 7101 Wisconsin Avenue, Washington, D.C. 20014.

The Management of Spent Fuel and Radioactive Wastes Workshop, September 16–19, 1979, Shoreham-Americana Hotel, Washington, D.C. Contact: Atomic Industrial Forum, Inc., 7101 Wisconsin Ave., Washington, D.C. 20014, Att: Conference Registrar.

October 1979

Advanced Course in Radiological Protection, October 1–26, 1979, Harwell Education Centre, A.E.R.E. Harwell, Oxfordshire, England. Contact: The Education & Training Centre, A.E.R.E. Harwell, Oxfordshire, OX110QJ, England.

April 1980

Nuclear Criticality Safety ANS National Topical Meeting, April 8–10, 1980, El Paso, Texas. Contact: Thomas P. McLaughlin, P. O. Box 1663/MS-560, Los Alamos, NM 87545.

1980 Thermal Reactor Safety Conference, April 8–11, 1980, Hyatt Regency Knoxville, Knoxville, Tennessee. Contact: William B. Cottrell, Oak Ridge National Laboratory, P. O. Box Y, Oak Ridge, TN 37830; or Dwight R. Patterson, Tennessee Valley Authority, 400 Commerce Ave., Knoxville, TN 37902.

December 1980

Topical Meeting on Atomic and Nuclear Methods in Fossil Energy Research, December 1–4, 1980, Mayaguez, Puerto Rico. Contact: Dr. Royston Filby, Nuclear Radiation Center, Washington State University, Pullman, WA 99163.

CHANGES IN THE COMPUTER CODE COLLECTION

The following changes were made in June.

CCC-345/SEDONE

SEDONE, a simulator of fast-transient, one-dimensional hydrodynamic and three-layer, variable-size sediment concentration conditions in controlled rivers and tidal estuaries, is particularly designed for application to site-specific problems that require accurate predictions of the sedimentation phenomena under severely reversing flow conditions. It is a contribution of UCC-ND Computer Sciences Division, Oak Ridge National Laboratory. Reference: ORNL/NUREG/TM-256. FORTRAN IV; IBM 360.

CCC-347/REDIFFUSION

REDIFFUSION, a one-dimensional neutron and gamma-ray shield penetration code system was contributed by The Reactor Physics Division Atomic Energy Establishment Winfrith, Dorchester, Dorset, England through the OECD NEA Data Bank, Gif-sur-Yvette, France. For neutrons the removal-diffusion method is used. For gamma-rays there is the option of using either kernel integration with buildup factors or diffusion theory with a first-flight correction. Linked calculations are possible in which the gamma-ray sources are calculated from the neutron fluxes. References: AEEW-R-818, -819, -825, -826, -827, -828, -834, -836, -848, -849, -1157, -1158, -1159, -1160. FORTRAN IV; IBM 370.

PSR-139/SIOB

SIOB, a code for least-squares shape fitting of several neutron transmission measurements using the Breit-Wigner multilevel formula, was contributed by Oak Ridge National Laboratory. Any number of measurements on a common energy scale for different sample thicknesses can be simultaneously fitted. The computed transmission curves can be broadened with either a Gaussian or a rectangular resolution function or both, with the resolution width a function of energy. Reference: ORNL/TM-6286, ENDF-261. *FORTRAN IV; IBM 360.*

CHANGES IN THE DATA LIBRARY COLLECTION

The following changes were made during June.

DLC-2/100G

DLC-2, the 100-neutron group cross-section library has been updated with the addition of a data set for iodine, contributed by Oak Ridge National Laboratory. All other data were unchanged. The new code package is denoted DLC-2G. To obtain the iodine alone, or the total package, one should submit a single reel of magnetic tape.

DLC-41/VITAMIN-C

The 171-neutron, 36-gamma-ray group cross-section library in AMPX master format has been updated by reprocessing some data sets and adding new ones to the current library. The updated library is designated DLC-41C/VITAMIN-C. Material for the update is a contribution of the Engineering Physics and Computer Sciences Divisions, Oak Ridge National Laboratory. Much input for the update came as a result of participation in the CSEWG data testing program by ORNL and other installations. User feedback from Sandia, General Electric–Sunnyvale, Princeton Plasma Physics Laboratory, Westinghouse Fusion Power Systems, Texas A&M, and other installations was helpful in developing this update.

New data include neutron cross sections for Gd, ^{149}Sm, ^{233}Pa, ^{243}Am and ^{243}Cm and new photon interaction cross sections from Gd and Sm. Neutron cross sections for ^{234}U, ^{236}U, and ^{242}Pu were rerun with a revised prescription for coating the unresolved energy mesh ($\Delta u = 0.05$ rather than $\Delta = 0.5$). Neutron cross sections for ^{240}Pu were regenerated with refinement in the quadrature for the fluctuation integrals associated with the unresolved resonance calculation. For ^{11}B, a rerun was made to include secondary neutrons produced by (n,2n) and continuum inelastic scattering. A rerun was made for ^{16}O with an improvement in the linearization process to correct a problem with the capture reaction. The hydrogen data were modified by inserting bound-in-water values for the thermal groups into the infinitely dilute cross sections associated with the Bondarenko part of the file. The previous version had bound-in-water values only for the 1D and 2D AMPX data, and if the hydrogen were run through BONAMI, these data would be replaced by self-shielded but unbound values.

Finally a new version of the entire gamma-ray production library was run with a linearized and correctly normalized pointwise weighting functions.

The two sample problems were rerun to test the effect of the changed data sets, and differences in results are, in general, minor. The form of the library is modified slightly so that neutron cross-section data are divided into 3 files. One file contains 21 materials (includes all materials which were rerun except ^{11}B) including all that are used in the DLC-41 sample problems. Another contains 20 materials (includes 5 new materials plus H and ^{11}B). The third contains 25 materials and is the same as that for DLC-41B.

A total of six full reels (2400 ft.) of magnetic tape are required to transmit the entire library. IBM 360/91.

DLC-44/COVERX

The compilation of multigroup covariance matrices has been updated with the addition of a 26-neutron energy group set for fast reactor benchmarks, contributed by the Oak Ridge National Laboratory. Covariances are included for ^{235}U, ^{238}U, ^{239}Pu, ^{240}Pu, ^{241}Pu, Na, Fe, N, O, and C based on evaluated covariance files from ENDF/B-IV and private communication. The data can be retrieved and utilized by the FORSS (CCC-334) system, in particular the COVERT and CAVALIER modules. The new package is designated DLC-44B/COVERX. A single reel of magnetic tape is needed for transmittal. Reference: ORNL-5318. IBM 360.

DLC-57/SAIL

A 37-neutron, 21-gamma-ray group albedo data library generated using 1-1/2-D DOT with DLC-31/FEWG1 cross sections processed from ENDF/B-IV library, was contributed by Science Applications, Inc., La Jolla, California, and Electric Power Research Institute (EPRI), Palo Alto, California. Data for two types of materials, ordinary concrete and low carbon steel, are included. Also included is a utility code for reducing the number of groups. The albedo data can be utilized in a Monte Carlo procedure such as BREESE in MORSE. Reference: SAI-013-79-525-LJ. FORTRAN IV; IBM 370.

DLC-65/ESG

The 56-group cross-section library based on VITAMIN-C, generated by using SPHINX and XSDRNPM to collapse 171 groups, was contributed by Rockwell International, Canoga Park, California, and *UCC-ND Computer Sciences Division*, Oak Ridge National Laboratory. Reference: Informal Notes. IBM 360.

TAPES REQUIRED FOR DLC-59/CAD REQUESTS

DLC-59/CAD, the 51-neutron, 25-gamma-ray group ALBEDO DATA generated with DOT for various materials, contains 361,000 records for each of 4 materials (total 1,444,000 records). **Two 2400 ft. reels of magnetic tape** should accompany each request for the library **written at 6250 bpi. Four reels** should accompany requests to be **written at 1600 bpi and 8 reels for 800 bpi.** *All of the above are for 9-track tapes.*

JUNE 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

B.A.R.C./I-503, Manual of Dose Evaluation from Atmospheric Releases., Shirvaikar, V.V.; Abrol, V., 1978, Bhabha Atomic Research Centre, Bombay, India

CONF-780921, Proceedings of an International Conference on Neutron Physics and Nuclear Data for Reactors and Other Applied Purposes., OECD/NEA, September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.7-27, Nuclear Data for Reactor Design, Operation and Safety., Rowlands, J.L., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.28-60, Nuclear Data for Reactor Shielding., Butler, J., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.61-75, Non-Proliferation and Nuclear Data., Sowerby, M.G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.104-115, Covariance Matrices of Experimental Data., Perey, F.G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.116-135, Correlated Uncertainties in Integral Data., McCracken, A.K., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.160-180, Photon Production in Neutron Induced Reactions., van Heerden, I.J., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.181-186, Determination of Transactinide Nuclear Data Required Accuracy for Burn-up Calculation in Fast Reactors., Usachev, L.N.; Bobkov, Yu.G.; Kolesov, V.E.; Krivtsov, A.S., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.209-214, The UK Chemical Nuclear Data Files: An Evaluated Set of Radioactive Decay Data for Reactor Applications., Davies, B.S.J.; Crouch, E.A.C.; James, M.F.; Nichols, A.L.; Parkinson, J.R.; Tobias, A.; Vallis, D.G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.215-222, Bibliothèque de Données Nucléaires non Neutroniques des Isotopes Radioactifs, Produits de Fission et Noyaux Lourds., Blachot, J.; Fiche, Ch., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.241-267, Cross-Sections of the Major Transactinium Isotopes in the Resonance Region., Keyworth, G.A.; Moore, M.S., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.268-287, Resonance Cross Sections for Structural Material., Fröhner, F.H., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.288-305, Neutron Radiative Capture Cross-Section Calculations., Benzi, V., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.378-395, Recent Developments in the Theory of the Nuclear Level Density., Jensen, A.S., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.518-550, Fuel Handling, Reprocessing and Waste and Related Nuclear Data Aspects., Küsters, H.; Lalović, M.; Wiese, W.H., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.569-588, Fission Yield Data., Denschlag, H.O., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.610-614, Neutron Yields from (alpha,n) Reactions in the Light Elements., West, D.; Sherwood, A.C., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.615-620, Neutron Production from (alpha,n) Reactions in Actinide Oxides., Lees, E.W., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.621-627, Nuclear Data Requirements for the Calculation of Absorbed Dose and Simulation of Tissue Response in Neutron Therapy., Pfister, G.; Hehn, G.; Mattes, M.; Friedlein, H.P., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.628-635, Basic Nuclear Data for Dosimetry in Radiotherapy and Radiobiology., Ricourt, A.; Chemtob, M.; Nguyen, V.D.; Parmentier, N., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.642-647, Nuclear Data in the Design of Neutron Probes for Borehole Logging., Sanders, L.G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.648-666, Nuclear Data for Radiotherapy with Neutrons., Cross, W.G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.667-687, Recent Trends in Nuclear Reaction Data Needs for Nuclear Medicine., Stöcklin, G.; Qaim, S.M., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.766-771, Neutron Spectra from Materials Used in Fusion and Fusion-Fission Hybrid Reactors., Hansen, L.F.; Wong, C.; Komoto, T.; Pohl, B.A., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.772-777, Neutronic Studies of a ^{233}U Fusion Breeder., Hansen, L.F.; Maniscalco, J.A., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.783-791, Neutron Data for the Hybrid Reactor Calculation., Markovskii, D.V.; Shatalov, G.E., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.792-808, Accelerator Breeding of Fissile Material., Taschek, R.F., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.829-847, The Rutherford Laboratory Spallation Neutron Source., Manning, G., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.922-940, Nuclear Data for Safeguards., Fuketa, T., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.993-998, Conséquences des Incertitudes sur les Données de Base dans les Calculs de Protection., Estiot, J.C.; Rado, V.; Salvatores, M.; Trapp, J.P., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1022-1027, Fast Neutron Dose in High-Temperature Gas-Cooled Reactors - Comparison of Measured and Calculated Fast Fluxes., Neef, R.D.; Drüke, V.; Khamis, H.; Litzow, W., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1028-1032, Reproduction of the Weale Experiment Results with Modified ENDF/B-IV U-238 Data., Segev, M.; Krumbein, A., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1059-1065, Analysis of Neutrons Emitted from 14 MeV Neutron Induced Reactions., Pearlstein, S., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1073-1087, Nuclear Data for Fusion Reactors., Jarvis, O.N., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1088-1107, Recent Advances in the Study of Some Neutron Threshold Reactions., Qaim, S.M., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1146-1150, An Evaluated Fission Product Data Library for Super Phenix Project., Darrouzet, M.; Fabbri, F.; Fort, E.; Krebs, J.; Langlet, J.; Martin-Deidier, L.; Montaguti, A.; Menapace, E.; Motta, M.; Panini, G.C.; Reffo, G.; Ribon, P.; Thuong, T.Q.; Vaccari, M.; Ventura, A., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1167-1171, Adjustment of Evaluated Neutron Capture Cross-Sections of Neodymium Isotopes to Integral STEK and CFRMF Data., Gruppelaar, K.; Dekker, J.W.M.; Janssen, A.J.; Rieffe, H.C., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-780921, pp.1172-1177, The Linearity Assumption in Adjustment Procedures: Is It a Real Problem?, Yeivin, Y., September 1978, OECD, 2, rue André-Pascal, 75775 PARIS CEDEX 16, France

CONF-781174-4, Review of Microscopic Neutron Cross Section Data for the Higher Plutonium Isotopes in the Resonance Region., Weston, L.W., 1978, Dep., NTIS

CONF-790125-12, Radiation Damage in Diagnostic Windows for the TFTR., Primak, W., 1979, Dep., NTIS

CONF-790125-25, Effects of Irradiation on the Normal Metal of a Composite Superconductor: A Comparison of Copper and Aluminum., Klabunde, C.E.; Coltman, R.R.,Jr.; Williams, J.M., 1979, Dep., NTIS

CONF-790602-37, Sensitivity of Decay Power to Uncertainties in Estimated Decay Data., Tasaka, K., 1979, Dep., NTIS

COO-2218-124, Monte Carlo Method for Calculating Fusion Product Behavior in Field-Reversed Mirrors., Driemeyer, D.; Miley, G.; Condit, W., April 23, 1979, Dep., NTIS

DOE/ET-0079, Workshop on 2-D Transport (Workshop was Held at Cornell University, Ithaca, New York, August 2-4, 1978)., Office of Fusion Energy, DOE, Washington, D.C., February 1979

DOE-tr-71; KFK-2501 (In German), Application of Integral Transport Theory with Linearly Anisotropic Scattering to the Calculation of the Neutron Distribution in Finite Plate Arrays of Fast Reactors., Boehme, R., 1979, USDOE Technical Information Center, Oak Ridge, Tenn.

DOE-tr-72; KFK-2444 (In German), Measurement and Calculation of the Gamma-Fields Induced in Iron by 252-Cf Fission Neutrons., Jiang, S.-H., 1979, USDOE Technical Information Center, Oak Ridge, Tenn.

DP-MS-79-9, Evaluation and Testing of Actinide Cross Section Data. Final Report., Benjamin, R.W., January 1979, Dep., NTIS

ECE-79-6, Transport in Toroidal Stellarators and Torsatrons., Shohet, J.L., March 1979, University of Wisconsin, Department of Electrical and Computer Engineering, Madison, Wisconsin

EPRI-NP-997, Fissions Determination in ^{239}Pu Sample. Final Report., Dickens, J.K.; McConnell, J.W., February 1979, Electric Power Research Inst., Palo Alto, CA

EPRI-NP-1017, The SAI/EPRI Albedo Information Library., Simmons, G.L., March 1979, Science Applications, Inc., 1200 Prospect St., La Jolla, California 92038

EPRI-NP-1042, Development of the Criticality Capability for the SAM-CE Monte Carlo System., Lichtenstein, H.; Troubetzkoy, E.; Steinberg, H.; Cohen, M.O., April 1979, Mathematical Applications Group, Inc., 3 Westchester Plaza, Elmsford, New York 10523

GA-A15356, The Application of Martensitic Stainless Steels in Long Lifetime Fusion First Wall/Blankets., Rosenwasser, S.N.; Miller, P.; Dalessandro, J.A.; Rawls, J.M.; Toffolov, W.E.; Chen, W., March 1979, NTIS $4.00

HEDL-SA-1144-A; CONF-770641-9, Damage Correlation in Theory and Practice., Doran, D.G.; Odette, G.R.; Simons, R.L.; Mansur, L.K., June 1977, NTIS

ICRU-28, Basic Aspects of High Energy Particle Interactions and Radiation Dosimetry., ICRU, December 1, 1978, ICRU Publications, P.O. Box 30165, Washington, D.C. 20014

INDC(NDS)-103/M, Proceedings of the Advisory Group Meeting on Nuclear Data for Reactor Dosimetry, Vienna, 13-17 November 1978., IAEA, May 1979, IAEA Nuclear Data Section, Karntner Ring 11, A-1010 Vienna

INIS-mf-4157; CONF-7710161-1, Bases for Protection Against Radiation and Conventional Hazards., Ganguly, A.K., 1977, Dep., NTIS (U.S. Sales Only)

JINR-P16-12069, Unfolding of Neutron Spectra in the Energy Range 10^{-8} - 15 MeV from Activation Detectors Data by the Statistical Regularization Method., Bamblevskij, V.P.; Grechko, V.V., 1978, Joint Institute for Nuclear Research, Dubna, 7675-MS, Jezebel and Godiva., Kidman, R.B., February 1979, NTIS $5.00

LA-7686-MS, A Conceptual Design of the Fast-Linear Reactor (FLR) for Fusion Power., Moses, R.W.; Krakowski, R.A.; Miller, R.L., February 1979, NTIS

LA-UR-79-168, Cross-Section Sensitivity and Uncertainty Analysis for Fusion Reactors (A Review)., Dudziak, D.J., December 1978, Los Alamos Scientific Lab., University of California, Los Alamos, New Mexico 87544

NBS Spec. Pub.493, pp.137-144; CONF-770321, pp.137-144, Standards for Dosimetry Beyond the Core., Rahn, F.J.; Stahlkopf, K.E.; Marston, T.U.; Gold, R.; Roberts, J.H., October 1977, Supt. of Documents

NBS Spec. Pub.493, pp.310-312; CONF-770321, pp.310-312, Impact of ENDF Standards on Fast Reactors., Farinelli, U., October 1977, Supt. of Documents

NRL-Memo Report-3963, A Fast Approximation to the Complementary Error Function for Use in Fitting Gamma-Ray Peaks., Phillips, G.W., April 24, 1979, Naval Research Laboratory, Washington, D.C. 20375

NRPB/RandD-2, A Comparison of Three Neutron Transport Codes., Jones, D.C., March 1978, HMSO - ISBN 0 85951 081 6

ORNL/TM-6728, Oak Ridge TNS Program: Reference Design and Program Plan for a TNS ECH Startup System., Rosenfeld, R., April 1979, NTIS $4.50

ORNL/TM-6828, Concept Evaluation of a Nuclear Design for Electronuclear Fuel Production: Evaluation of ORNL's Proposed TMF-ENFP., Burns, T.J.; Bartine, D.E.; Renier, J.P., May 1979, NTIS $4.50

Physics Data-Nr.13-1, Evaluation of the Cross-Sections for the Reactions ^{24}Mg (n,p) ^{24}Na, ^{64}Zn (n,p) ^{64}Cu, ^{63}Cu (n,2n) ^{62}Cu and ^{90}Zr (n,2n) ^{89}Zr., Tagesen, S.; Vonach, H.; Strohmaier, B., 1979, ISSN 0344-8401

REG/G-1.112(5-77), Calculation of Releases of Radioactive Materials in Gaseous and Liquid Effluents from Light-Water-Cooled Power Reactors., Nuclear Regulatory Commission, April 1976, NUREG, Washington, D.C.

SAI-121-132-1, Neutron and Gamma Ray Response/Fluence Factors for Human Dosimetry Applications., Kaul, D.; Chen, S.; Jarka, R., March 1979, Science Appliations, Inc., 1701 East Woodfield Rd., Suite 819, Schaumburg, Ill. 60195

SAI-121-132-4-79, Predicting Probability of Early Mortality from Acute Exposure to Mixed LET Radiation., Kaul, D., May 1979, Science Applications, Inc., 1701 East Woodfield Rd., Suite 819, Schaumburg, Ill. 60195

UCRL-50400, Vol.18, ACTL: Evaluated Neutron Activation Cross Section Library–Evaluation Techniques and Reaction Index., Gardner, M.A.; Howerton, R.J., October 17, 1978, NTIS

UCRL-50400, Vol.21, Pt.A, Maxwell-Averaged Reaction Rates for Selected Reactions Between Ions with Atomic Mass not Greater than 11., Howerton, R.J., February 14, 1979, NTIS

UCRL-80588; CONF-780508-27, Nuclear Design of the LLL-GA U_3Si Blanket., Lee, J.D., May 26, 1978, Dep., NTIS

UWFDM-288, Tokamak Reactors and Structural Materials., Conn, R.W., January 1979, Nuclear Engineering Department, University of Wisconsin, Madison, WI 53706

ZJE-220, Neutron Spectrometry Using Scintillation Spectrometer and Hydrogen-Filled Proportional Counters., Holman, M., 1979, Skoda Works, Nuclear Power Construction Depart., Information Centre, Plzen - Czechoslovakia

ZJE-230, Gamma-Ray Spectra of Neutron-Irradiated Activation Detectors., Hogel, J., 1978, Skoda Works, Nuclear Power Construction Depart., Information Centre, Plzen - Czechoslovakia

Atomic Data and Nucl. Data Tables, 22(2), 109-123, The Internal Conversion Coefficients of the 2-0, E2 Nuclear Transitions in Even-Even Nuclei., Mladjenovic, M.; Zupancic, M.; Vukanovic, R., August 1978

Bull. Inst. Chem. Research, Kyoto Univ., 57(1), 102-111, Experimental Research on Penetration of Neutrons and Photons Produced in a Graphite Target Bombarded by 52-MeV Protons., Shin, K.; Yoshida, M.; Uwamino, Y.; Hyodo, T.; Nakamura, T., 1979

J. Phys. Chem. Ref. Data, 8(1), 69-105, Relativistic Atomic Form Factors and Photon Coherent Scattering Cross Sections., Hubbell, J.H.; Overbo, I., 1979

Nucl. Sci. Eng., 67(1), 1-7, Deposition of Iron Oxide on Heated Surfaces in Boiling Water., Asakura, Y.; Kikuchi, M.; Uchida, S.; Yusa, H., July 1978

Nucl. Sci. Eng., 70(2), 150-154, The Transmission of Neutrons Through Iron-56 at 24.37 keV., Liou, H.I.; Chrien, R.E.; Block, R.C.; Singh, U.N., May 1979

Nucl. Sci. Eng., 70(2), 177-183, Fission Yields for Thermal-Neutron Fission of Plutonium-241., Dickens, J.K., May 1979

Nucl. Sci. Eng., 70(2), 184-191, Calculated Time-Dependent Delayed Neutron Group Yields for Thermal-Neutron Fission of Uranium-235., Alexander, D.R.; Peng, Y.K., May 1979

Nucl. Sci. Eng., 70(2), 192-200, Electron Transport in One-Dimensional Finite Systems., Gupta, S.K.; Prasad, M.A., May 1979

Nucl. Sci. Eng., 70(2), 207-209, On the Polynomial Form of Gamma-Ray Buildup Factor Functions., Metghalchi, M., May 1979

Nucl. Sci. Eng., 70(2), 210-212, Optimum Biasing of Integral Equations in Monte Carlo Calculations., Hoogenboom, J.E., May 1979

Nucl. Sci. Eng., 70(3), 243-261, Prediction of Statistical Error and Optimization of Biased Monte Carlo Transport Calculations., Sarkar, P.K.; Prasad, M.A., June 1979

Nucl. Sci. Eng., 70(3), 274-280, Tritium Production in a Sphere of 6-LiD Irradiated by 14-MeV Neutrons., Hemmendinger, A.; Ragan, C.E.; Wallace, J.M., June 1979

Nucl. Sci. Eng., 70(3), 309-313, Neutron Multiplication Studies in Beryllium for Fusion Reactor Blankets. (Tech. Note), Basu, T.K.; Nargundkar, V.R.; Cloth, P.; Filges, D.; Taczanowski, S., June 1979

Nucl. Sci. Eng., 70(3), 313-315, Reactor Fuel Burnup Calculations in the LASER Code. (Tech. Note), Chang, Y.Y.; Loyalka, S.K.; Timmons, D.H., June 1979

Nucl. Technology, 43(3), 338-348, Feasibility Study to Produce First Wall Fusion Reactor Spectra Around a 14-MeV Neutron Point Source., Battat, M.E.; Dierckx, L.A.; Emigh, C.R., May 1979

Nucl. Technology, 44(1), 84-90, Occupational Radiation Exposure at French Power Plants: Measurement and Prediction., Beslu, P.; Frejaville, G.; Jeanson, P., June 1979

Nucl. Technology, 44(1), 91-96, Quantifying Plant Availability, ALARA, and Occupational Radiation Exposure Relationships., Garrett, P.M., June 1979

Nucl. Technology, 44(1), 97-103, Getting at the Source: Reducing Radiation Fields., Shaw, R.A., June 1979

BOOK, SAFE HANDLING OF RADIATION SOURCES., Oberhofer, M., 1974, Munchen, Verlag Thiemig

BOOK, THE FINITE ELEMENT METHOD. (3rd Expanded and Rev. Ed.), Zienkiewicz, O.C., 1977, London, New York, McGraw-Hill

COMPUTER CODES LITERATURE

AEEW-M 318 ..... PIXSE
PIXSE., MacDougall, J.D., Atomic Energy Establishment, Winfrith, Dorchester, Dorset, UK, April 1963, FORTRAN II; S1 IBM 7090; STRETCH

AEEW-R-962 ..... MURALB
MURALB: A Programme for Calculating Neutron Fluxes in Many Groups., MacDougall, J.D., Atomic Energy Establishment, Winfrith, Dorchester, Dorset, UK, September 1977, AVAIL: NTIS (U.S. Sales Only)

ANL/FPP/TM-106 ..... MACKLIB-IV
MACKLIB-IV: A Library of Nuclear Response Functions Generated with the MACK-IV Computer Program from ENDF/B-IV., Gohar, Y.; Abdou, M.A., Argonne National Laboratory, Argonne, IL, March 1978

IKE-4-83 (In German) ..... BOIL; RSYST-III
Statistical Analysis of the BOIL Program in RSYST-III., Beck, W.; Haush, H.J., Stuttgart Univ., Inst. fuer Kernenergetik und Energiesysteme, Germany, November 1978

IN-1062 ..... INCITE; LIBMOD
INCITE - A FORTRAN-IV Program to Generate Thermal Neutron Spectra and Multigroup Constants Using Arbitrary Scattering Kernels., Curtis, R.L.; Grimesey, R.A., Idaho Nuclear Corporation, Idaho Falls, ID, November 1967, FORTRAN IV IBM 7040

IRNE-127-1978 ..... PRORA
PRORA: Program for Calculating Neutron Flux in Reactor Shielding., Sindilaru, G.; Cuculeanu, V., Institutul de Reactori Nucleari Energetici, Pitesti, Romania, June 1978

JAERI-M-7119 ..... LOOM-P
LOOM-P: A Finite Element Mesh Generation Program with On-Line Graphic Display., Ise, T.; Yamazaki, T., Japan Atomic Energy Research Institute, Tokai-mura, Naka-gun, Ibaraki-ken, Japan, June 1977, AVAIL: NTIS (U.S. Sales Only)

JAERI-M-7506 (In Japanese)
..... RELAP4J; RELAP4-Mod2
LOCA Analysis Program RELAP4J for Water Cooled Nuclear Reactors., Motizuki, Y.; Sobajima, M.; Suzuki, M.; Soda, K.; Tasaka, K., Japan Atomic Energy Research Institute, Tokyo; Mitsubishi Heavy Industries Ltd., Tokyo, February 1978

J. Nucl. Sci. Technol., (Tokyo), 14(9), 680-681
..... NJOY
Effect of Nonelastic Neutron Anisotropy on Fission Rates Measured in a Graphite-Reflected Lithium Assembly., Seki, Y.; Maekawa, H.; Muir, D.W., Japan Atomic Energy Research Institute, Tokai, Ibaraki, September 1977

LA-7584-M; ENDF-272 ..... NJOY
The NJOY Nuclear Data Processing System: User's Manual., MacFarlane, R.E.; Barrett, R.J.; Muir, D.W.; Boicourt, R.M., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, December 1978

LA-7595-M ..... MOLID
MOLID: A General Purpose Subroutine Package for the Numerical Solution of Partial Differential Equations., Hyman, J.M., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, March 1979, FORTRAN

LA-UR-78-1288; CONF-780508-44
..... TRIDENT-CTR
TRIDENT-CTR: A Two-Dimensional Transport Code for CTR Applications., Seed, T.J., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, 1978

ORNL-5505; ENDF-274 ..... VITAMIN-E
VITAMIN-E: An ENDF/B-V Multigroup Cross-Section Library for LMFBR Core and Shield, LWR Shield, Dosimetry and Fusion Blanket Technology., Weisbin, C.R.; Roussin, R.W.; Wagschal, J.J.; White, J.E.; Wright, R.Q., Oak Ridge National Laboratory, Oak Ridge, Tennessee, Februuary 1979

SRD-R-88 ..... MONK
The Monte Carlo Code MONK - A Guide to its Use for Criticality Calculations., Rushton, K.C., Safety and Reliability Directorate, United Kingdom Atomic Energy Authority, Culcheth, Warrington, UK, August 1978

TID-28577 ..... SDL-4
Design Criteria for the 218-Group Criticality Safety Reference Library., Westfall, R.M.; Ford, W.E. III; Webster, C.C., Union Carbide Corporation, Oak Ridge, TN, Computer Sciences Division, 1976, AVAIL: NTIS

Trans. Am. Nucl. Soc., 28, 90-91
..... REBATE
REBATE: Neutron Activation Code for the Tokamak Fusion Test Reactor (TFTR)., Huang, R.; Ostrow, S.L.; Friedenberg, R.A., Ebasco Services Inc., New York, June 1978

Trans. Am. Nucl. Soc., 28, 776-777
..... THREETRAN
Analysis of Three-Dimensional, Hexagonal-Z Systems Using THREETRAN (hex,z)., O'Dell, R.D.; Walters, W.F., Los Alamos Scientific Laboratory, Los Alamos, New Mexico, June 1978

UWFDM-276 ..... ACTEN; ANISN
ACTEN: A Computer Program to Calculate the Reaction Rate, the Rate of Energy Deposited and the Power Multiplication in a Fusion Blanket Using the Reaction Q Values., Youssef, M.Z., Department of Nuclear Engineering, University of Wisconsin, Madison, WI, December 1978

UWFDM-291 ..... UNCER
UNCER: A University of Wisconsin Version of Uncertainty Files Processor for ENDF/B-V., Wu, T.; Maynard, C.W., Nuclear Engineering Department, University of Wisconsin, Madison, WI, November 1978

WCAP-7363; ENDF-146-Supp. ..... ETOT
ETOT, a FORTRAN IV Program to Process Data from the ENDF/B File to Thermal Library Format., Raymund, M., Westinghouse Nuclear Energy Systems, Pittsburgh, Pennsylvania, November 1973, FORTRAN