RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

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

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The wisest man hath something yet to learn. . . .George Santayana

RSIC FY 1980 USER STATISTICS

RSIC user statistics show an increasing number of activities for the period October 1, 1979 – September 30, 1980 over the prior year. Information dissemination activities were as follows.

A total of 3505 separate letters/telephone calls (about 14.0 each working day) requesting a variety of products and services (9362 total) were processed during FY 1980. In addition to advisory, trouble-shooting, and other problem-solving communications with the user community, RSIC shipped 1246 code and data packages.

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

5.0 codc/data packages were shipped to requesters.

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

24.4 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.

37.3 separate activities required daily to satisfy the 3505 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 1663 people. Maintenance of the RSIC user directory resulted in 1817 changes during the year. A total of 1176 separate literature citations were entered into the Storage and Retrieval Information System (SARIS) during FY 1980.

A total of 96 people (37 foreigners) came for an orientation visit and/or to use the Center's facilities during the year.

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

	FY 78	FY 79	FY 80
Total Requests Received	2911	3452	3505
Average/Working Day	11.6	13.8	14.0
Activities Performed to Satisfy Requests	7604	8623	9362
Average Activities/Working Day	30.4	34.5	37.3
Increase/Decrease Over Prior Year's Activities	−12%	+13.0%	+9.0%

IF YOU CHANGE YOUR ADDRESS, please notify us (including Building and Room No. where needed). *Third Class Mail* is returned to us at our expense if the addressee has moved. If your mail is returned, your name will be deleted from our distributions until we hear from you.

CHANGES IN THE COMPUTER CODE COLLECTION

The following change was made in December.

CCC-384/ICRP

The ICRP code/data system for performing dosimetric calculations was updated to replace decay data in machine-dependent binary format with the same data in EBCDIC in order to facilitate transportability. FORTRAN IV; IBM 360.

STAFF CHANGES CONTINUE

In addition to the retirement of three senior staff members announced last month, RSIC loses **Eddie W. Bryant**, computer-based publication expert, on December 29th. Eddie has for more than three years carried the lead in producing the monthly *RSIC Newsletter* and other center publications. She has transferred to a similar position in the Users Services Group of Union Carbide Nuclear Division (UCND) Computer Sciences Division (CSD) at the Oak Ridge National Laboratory (ORNL).

Three UCND employees at ORNL have accepted assignments in RSIC. **Elaine Plemons**, formerly with the Engineering Physics Division's (EPD) Nuclear Experiment and Data Evaluation Group, will serve RSIC as Secretary. She is a graduate of Knoxville Business College and studied accounting at the University of Tennessee.

Pamella S. Young, a graduate of Roane State Community College of Harriman, Tennessee, has transferred from the UCND/CSD Nuclear Engineering Applications Group to work in the Information Processing Section.

John E. White, a former member of the UCND/CSD Nuclear Engineering Applications Group at ORNL, will carry responsibility in codes and data evaluation and packaging and related computer activities. John's academic background includes a degree in physics from Norfolk State University and work in the graduate programs in Nuclear Engineering at Ohio State University and the University of Tennessee. Prior to employment at Oak Ridge, he worked for the Defense Nuclear Agency in the Pentagon, Washington, D.C. His applications work at ORNL has varied, including gamma-ray cascade modeling and methods development associated with the AMPX II modular code system for generating coupled multigroup neutron-gamma-ray cross-section libraries from data in ENDF format and with MINX for the calculation of fine-group averaged infinitely dilute cross sections, self-shielding factors, and group-to-group transfer matrices from ENDF/B format producing data libraries in the standard CCCC-III interface formats. John has also served as a member of the team for the development and testing of the VITAMIN-C and VITAMIN-E data libraries.

PERSONAL ITEMS

The following changes of address have been noted: **M. G. Zimmerman** *from* Battelle Northwest, Richland, WA *to* Westinghouse Hanford, Richland, WA; **L. I. Mayweather** *from* Norman Engineering Co., Los Angeles, CA *to* Nuclear Systems Associates, Inc., LaBrae, CA; and **R. D. Mosteller** *from* Science Applications, Inc., McLean, VA *to* S. Levy, Inc., San Jose, CA.

STAFF MEMBER COVERS SPECIALISTS' MEETING & VISITS EUROPEAN INSTALLATIONS

Robert W. Roussin, EPIC's Data Coordinator and RSIC Deputy Director, recently completed a trip to France and England. He attended the OECD NEA Specialists' Meeting on Nuclear Data and Benchmarks for Reactor Shielding in Paris, France, visited the OECD NEA Data Bank and the CEA/CEN/Saclay SERMA Shielding Laboratory in France, visited the AEE Winfrith Laboratory and attended a meeting of British Shielding Specialists at Imperial College, and visited the University of London Reactor Center in England.

The OECD NEACRP Specialists' Meeting on Nuclear Data and Benchmarks for Reactor Shielding met at OECD Headquarters, Paris, France, October 27–29, 1980, to review the status of multigroup cross

sections and covariance data, shielding integral experiment programs, analysis of generic problems for assessing shielding data requirements, and sensitivity and uncertainty analysis methods and applications. The difficult task of analyzing benchmark experiments performed at other laboratories was addressed, implications of the results of the current studies on the design of future benchmark experiments were reviewed, and a future collaborative program was outlined.

The content of the presentations indicated much progress made in the NEA community since the last meeting. Work on developing multigroup data libraries, analyzing benchmark experiment results, and utilizing and formulating techniques for performing sensitivity and uncertainty analyses were reported by several installations. Much of the one-dimensional analyses are done with the ANISN/SWANLAKE approach developed at ORNL and the users have been able to learn and exploit that technique successfully. The development of three-dimensional perturbation techniques was reported at Winfrith in England (DUCKPOND, based on McBEND), at Ispra in Italy (based on TIMOC), and at Saclay in France (based on TRIPOLI). The traveler reported on the latest ORNL sensitivity and uncertainty analysis system (FORSS), the French at Cadarache reported on their one-dimensional system with high order capability (SAMPO, a system like FORSS), and the other U.S. representative, S.A.W. Gerstl of LASL, described the SENSIT system based on the LASL 1-D transport code system.

Multigroup cross-section data most widely used are based on the U.S. ENDF/B-IV library. A careful program to develop and improve the standard multigroup library for European work, EURLIB-IV, continues by collaboration between IKE Stuttgart, ESIS Euratom, and EIR Switzerland. Detailed comparisons between EURLIB-IV and VITAMIN-C, the library developed at ORNL and widely used as a standard, were reported at the meeting. Multigroup covariance information used in the NEA community is drawn on a compilation developed at ORNL (COVERX) based on ENDF/B-IV and informal evaluations. Participants were eager to discover the effect that ENDF/B-V cross sections and covariances would have on their analyses.

Integral benchmark measurements and analyses were reported by the British (ASPIS), French (JASON), Italians (TAPIRO, EURACOS) and Japanese (YAYOI).

Open questions appear to deal with "where are we headed in data adjustment?" Should we be headed toward the "consistent" method – adjustment of point data? It was noted that groups in Italy and the U.S. are studying changes in group constants due to adjustment of nuclear parameters and the associated problem of assessing the uncertainty in the nuclear parameter. There was likewise a feeling we should concentrate on first understanding where we are now. The group agreed to recalculate the PWR and FBR national benchmarks and to calculate the ASPIS Iron Benchmark.

Installation Visits

A brief visit was made to the NEA Data Bank for discussions of mutual exchange problems and to the CEA/CEN/Saclay SERMA Shielding Laboratory (LEP) to discuss common work and problems.

The Shielding Laboratory (LEP) is part of the Division of Reactor Studies and Applied Mathematics (SERMA) which is in the Department of Water Reactors in the French CEA. The 20 staff members in the LEP work in methods development and applications and are also now involved in some reliability work. Presentations were made of work done at LEP during the previous year on computer code improvements for gamma-ray or neutron transport calculations and on shield design studies in which they are involved, cross-section processing for ANISN, DOT, and TRIPOLI, and the reliability work in which they are involved.

For 1-D and 2-D studies, LEP primarily uses ANISN and DOT, respectively. For 3-D work TRIPOLI is used as a reference method, MERCURE-IV (Kernel Integration) for design studies for gamma rays or fast neutrons, and TRINISHI (first collision source-line of sight kernel attenuation) for heterogeneous media and streaming through voids. Criticality calculations are done with DOT or TRIMARAN (Monte Carlo), using cross sections developed through the APOLLO system. Much effort goes into developing a fission product library and associated codes PEPIN and PICFEE for calculating sources of beta and gamma rays for heating calculations. They also can generate neutron sources by using APOLLO to compute concentrations of Pu, Am, Cm, etc.

Codes are being developed for analyzing gamma-ray streaming through pipes or gaps by two methods, albedo Monte Carlo and matrix probability method. A means of coupling DOT to TRIPOLI (DOTTRI) has been devised. A code called AGATHE has been developed to analyze time-dependent heating of a gamma-ray thermometer in a PWR fuel element during any power transient.

Design studies are done for PWR shielding, heating after shutdown, shipping casks, fusion TOKOMAK shield evaluation, shield design for reprocessing plants, and other classified applications.

J. Gonnord reported on processing ENDF/B-IV data into multigroup and point form to provide the basis for a consistent set of data for their discrete ordinates and Monte Carlo codes. This work, which was begun during his one-year assignment at ORNL, is a major effort and the progress made to date will allow the interfacing of the U.S. ENDF/B library to the TRIPOLI Monte Carlo system. A library with data for 31 elements has been completed and will be given to RSIC for general distribution here in the U.S.

The Atomic Energy Establishment Winfrith Laboratory in Dorchester, England was visited. It is said to be the leading shielding research facility in England. The head of the Shielding Group, J. Butler, host during the visit, outlined calculational and experimental work to support various nuclear projects in Britain. Much of the technology developed there is classified as "commercial" and is quite often not available for distribution.

The shielding group has adopted the ANISN and DOT discrete ordinates methodology and uses SWANLAKE for sensitivity studies. They have developed the DUCKPOND Monte Carlo approach for 3-D sensitivity work based on their McBEND Monte Carlo system. The combinatorial geometry (CG) package from either MORSE-CG or the SAM-CE code systems is used for representing geometry in their code series. They have also taken the COVERX data and extrapolated it to the group structure of the EURLIB-IV cross-section library.

The RANKERN system for radiation transport via the kernel integration technique is used for 3-D gamma-ray transport and in some cases for neutron transport. It has two particularly nice features. First, it uses the combinatorial geometry technique for representing 3-D sources and geometry. Second, it uses stochastic rather than analytic techniques in solving the integrals. It is expected that this code will be made available to RSIC.

A meeting of British Shielding Specialists was held at Imperial College, London, on November 4 with J. Mason of the University of London Reactor Center and P. Grant, Chairman of the Nuclear Power Section, Mechanical Engineering Department, Imperial College of Science and Technology, as hosts. A total of 22 persons attended, representing 10 installations. Several presentations of work were made: G. Damalas presented an analysis of sphere transmission results to test ENDF/B-IV cross sections; K. Ziver presented results of finite element code development for shielding applications; N. Taylor, University of Birmingham, reviewed the neutronic/photonic calculational system used at his university, including a code called ENBAL2 for generating kerma factors from multigroup libraries; P. Heffer, Berkeley Labs, discussed in-core dosimetry in CAGRs and problems they have in trying to understand graphite weight loss in the reactors (will attempt sensitivity analysis, probably with the Monte Carlo perturbation approach); M. Thurlow, British Aerospace, described their approach to design of mobile systems, taking advantage of mass of non-essential components to provide shielding for essential sensitive components; and M. Dean, UKAEA-Risley, illustrated the use of RADKERN to predict dose rates on ships used to transport fuel elements from Japan to England.

VISITORS TO EPIC

The following persons came for an orientation visit and/or to use EPIC facilities during the month of December.

David R. Boyle, U.S. Air Force, Patrick AFB, FL; **Bob Hamm**, Health & Safety Division, ORNL, Oak Ridge, TN; and **Krzysztof Wincel**, University of Missouri, Rolla.

BOOK REVIEW: STRUCTURE SHIELDING AGAINST FALLOUT GAMMA RAYS FROM NUCLEAR DETONATIONS

It is only occasionally that an exhaustive treatise on a shielding subject is published. We have one now in the nearly 1000-page book *Structure Shielding Against Fallout Gamma Rays From Nuclear Detonations* by L. V. Spencer, A. B. Chilton, and C. M. Eisenhauer.

All of the authors have been leading researchers in shielding, especially fallout shielding, for many years. Spencer and Eisenhauer, especially, are well-known for their development and application of the moment method for gamma-ray penetration and, with N. FitzSimons, of the so called "Standard Method" for fall-out shielding analysis.

In the preface the authors give the background and purpose:

> Attempts to develop satisfactory methods for estimating the shielding properties of ordinary buildings against gamma rays from radioactive fallout began in the early 1950s. Intensive research of many kinds was carried out during the decade from about 1956 to 1966; but in the past decade, there has been a steady decline of new research on these problems. There are many reasons for this, one of which is **not**, however, the achievement of a fully satisfactory state of the technology. An updating and improvement of the material presented here is overdue, but is not easily effected.
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> We intend this publication to serve 1) as a reference for engineering students, 2) as a reference and source of ideas for engineers engaged in research and development on radiation shielding problems, 3) as a basic reference architects and engineers concerned with the design of buildings with protective features, and 4) a reference for officials responsible for civil protection in nuclear emergencies. These multiple uses are expected partly because this is the first attempt to bring together and summarize much of the material presented.

The book summarizes the extensive effort, much of it by the authors, during the twenty years following 1956 to understand the protective capability of structures against fallout gamma radiation from nuclear weapons. It describes both experimental and theoretical efforts that were sponsored for the most part by the U.S. Defense Civil Preparedness Agency, now part of the Federal Emergency Management Agency.

The first two chapters of the book give a historical review of methods and programs associated with fallout radiation shielding, and a description of the physical and biological aspects of fallout radiation. The production, transport and deposition of fallout are described and biological hazards are reviewed.

The next three chapters describe a series of calculations which formed the data base for a set of procedures to evaluate shielding from fallout radiation. Basic concepts such as cross sections, flux density, and energy deposition are discussed. Examples of photon transport in simple configurations are given. A detailed discussion is given on the moment method of photon transport. Curves are given for calculating photon transport in configurations applicable to structures.

The next six chapters describe the procedures for calculating protection from fallout radiation and the extensive series of experiments which were carried out to test these procedures. Discussion begins with the simple configuration of a point detector located above a plane isotropic source and proceeds to increasingly complex structural configurations. Comparisons of experimental and calculated results are given for many of these configurations.

The final chapter discusses sources of error and sensitivity studies. The problem of accuracy, in general, and sensitivity of protection factors to uncertainties in the calculations are discussed.

This massive work is far more than a state-of-the-art report; it is a textbook on gamma-ray transport, the moments method of solving the Boltzmann transport equation, fallout gamma-ray sources, fallout phenomena, shielding concepts, penetration data, field experiments, and shielding analysis (especially the "Standard Method"). Each section has a long list of references, mostly from the 1950–1978 period.

This book is a must for any engineer interested in fallout shielding and would be a valuable reference to anyone interested in gamma-ray shielding applications.

D. K. Trubey

Structure Shielding Against Fallout Gamma Rays From Nuclear Detonations, L. V. Spencer, A. B. Chilton, and C. M. Eisenhauer, NBS Special Publication 570, Sept. 1980, for sale by Supt. of Documents, U. S. Government Printing Office, Washington, D.C. 20402, $20.

CALL FOR PAPERS

A call for papers has been issued for the **Fourth ASTM-EURATOM Symposium on Reactor Dosimetry** to be held at the National Bureau of Standards, Washington, D.C., March 22–26, 1982. The Symposium is sponsored by the Joint Research Centre (EURATOM) of the Commission of the European Communities, ASTM E10 Committee on Nuclear Technology and Applications, U.S. Nuclear Regulatory Commission (NRC), and U.S. Electric Power Research Institute (EPRI), all in cooperation with the International Atomic Energy Agency (IAEA). The theme of the symposium is techniques, data bases, and standardization. The focus will be on the application and requirements for radiation metrology of irradiated fuels and materials in fission and fusion technology. Papers are solicited for the following topics (involving light water reactors, fast breeder reactors, and fusion systems) as well as related subjects: Characterization of Environments, Irradiation Monitoring of Experiments, Adjustment Codes and Uncertainties, Benchmark Fields and Calibration Procedures, Nuclear Data Needs and Problems, Metrology Techniques (new developments and improvements), Fuel Cycle Dosimetry, Radiation Damage Correlations of Structural Materials and Damage Analysis Techniques, Nuclear Heating and Gamma-Ray Dosimetry, and Neutron and Gamma-Ray Transport Calculations.

Through the courtesy of the Nuclear Regulatory Commission, simultaneous interpretations will be provided between French and English and between German and English.

The symposium will be organized into formal presentations, a poster session, and workshops. Authors who wish to submit summaries for publication in the proceedings without presentation, or those who wish to present their material in the poster session, should announce this. Prospective authors should send 4 copies of a 150–250 word abstract to the applicable program committee secretary by April 1, 1981. For U.S. authors this is: J. K. Schmotzer, Babcock & Wilcox, Lynchburg Research Center, P. O. Box 1260, Lynchburg, VA 24505, USA. For all other authors this is: H. Röttger, Joint Research Centre, Petten Establishment, HFR Division, Postbus 2, 1755 ZG PETTEN (N.H.), The Netherlands.

Authors will be notified by July 31, 1981, of the acceptance (or rejection) of their papers. Simultaneously the authors will be informed of the Session within the symposium in which their papers will be presented and, if it is a workshop session, of the workshop chairman's name. The authors in the workshop sessions will be asked to prepare their papers or the highlights of their papers and send them to the indicated workshop chairmen not later than December 31, 1981. All authors will be asked to supply 125 copies of their final papers for distribution in Washington at the opening of the symposium. The original of the paper (on special forms to be provided) should be sent to: F. B. K. Kam, Oak Ridge National Laboratory, P. O. Box X, Oak Ridge, TN 37830, USA.

ASTM Symposium Committee members are: W. N. McElroy (Chairman) and F. B. K. Kam (Vice-Chairman). ASTM Program Committee members are: F. B. K. Kam (Chairman), E. B. Norris (Co-Chairman), Jack Schmotzer (Secretary), and C. M. Eisenhauer (Local Arrangements Chairman).

A call for papers has been made for the **Ninth Symposium on Engineering Problems of Fusion Research,** Chicago, Illinois, October 26–29, 1981. The conference is sponsored by the University of Illinois Fusion Studies Laboratory, the U.S. Department of Energy, the American Nuclear Society, Argonne National Laboratory, and the Electric Power Research Institute.

A one-page abstract, approximately 400 words in length, is now solicited. The subject categories for abstracts are: Magnets and Coil Engineering; Superconductor Development; Energy Storage, Switching, and Supply; Vacuum and First-Wall Technology; Controls, Instrumentation, and Data Handling; Engineering Problems of Future Fusion Reactors; Experimental Systems Design; Energetic Plasma and Particle Sources; Plasma Heating Systems; Remote Maintenance and Handling; Tritium and Chemical Systems; Driver Technology for ICF; Photon and Charged Particle Beam Transport Systems; and Plasma Engineering.

Contributions will be judged on the basis of recency, significance, and usefulness of the results as described in the abstract. The abstract should make clear the purpose and scope of the work and the new results obtained. The program will be selected by the local program committee and the Standing Committee members.

Inquiries of a general nature should be directed to the conference office, Mary Bussert, telephone (217) 333-2880, or the general chairman, George Miley, telephone (217) 333-3772. Inquiries concerning papers or the technical program can be directed to the above or to Bob Turnbull, telephone (217) 333-0890. Correspondence should be addressed to: Dr. George H. Miley, University of Illinois Fusion Studies Laboratory, C/O Conferences & Institutes Office, 116 Illini Hall, University of Illinois, 725 South Wright Street, Champaign, IL 61820 USA.

RADIOLOGICAL HEALTH COURSES OFFERED

The following 5-day courses are being offered by the University of Texas Health Science Center: (1) Basic Radiological Health, February 15–20, 1981 and August 9–14, 1981; (2) Advanced Radiological Health, June 1–5, 1981; and (3) Radiation Safety Officer, June 8–12, 1981. Tuition costs are $350, $450, and $500, respectively. Further information can be obtained from the Medical School, Continuing Education Services, University of Texas Health Science Center, 7703 Floyd Curl Drive, San Antonio, TX 78284, Phone 512-691-7291.

DECEMBER 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

LA-UR-80-2922
The Elmo Bumpy Torus Reactor., Bathke, C.G.; Dudziak, D.J.; Krakowski, R.A.; Ard, W.B.; DeFreece, D.A.; Driemeyer, D.E.; Juhala, R.E.; Kashuba, R.J.; Stones, P.B.; Waganer, L.M.; Zuckerman, D.S.; Lieurance, D.W., Fourth ANS Topical Meeting on the Technology of Controlled Nuclear Fusion, King of Prussia, PA - October 14-17, 1980, October 1980, Los Alamos Scientific Lab., P.O. Box 1663, Los Alamos, New Mexico 87545

LA-UR-80-2926
Nucleonic Analysis of a Preliminary Design for the ETF Neutral-Beam-Injector Duct Shielding., Urban, W.T.; Seed, T.J.; Dudziak, D.J., Fourth Topical Meeting on the Technology of Controlled Nuclear Fusion, King of Prussia, PA - October 14-17, 1980, October 1980, Los Alamos Scientific Lab., P.O. Box 1663, Los Alamos, New Mexico 87545

LA-UR-80-2927
Review of New Developments in Fusion Reactor Nucleonics., Dudziak, D.J.; Young, P.G., Fourth ANS Topical Meeting on the Techology of Controlled Nuclear Fusion, King of Prussia, PA - October 14-17, 1980, October 1980, Los Alamos Scientific Lab., P.O. Box 1663, Los Alamos, New Mexico 87545

LA-UR-80-2928
A Comparison of Calculational Methods for EBT Reactor Nucleonics., Henninger, R.J.; Seed, T.J.; Soran, P.D.; Dudziak, D.J., October 1980, Los Alamos Scientific Lab., P.O. Box 1663, Los Alamos, New Mexico 87545

NBS Spec. Pub. 594; CONF-791058
Nuclear Cross Sections for Technology., Proceedings of the International Conference on Nuclear Cross Sections for Technology, Held at the University of Tennessee, Knoxville, TN, October 22-26, 1979., Fowler, J.L.; Johnson, C.H.; Bowman, C.D. (Eds.), September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.1-5; CONF-791058, pp.1-5
Nuclear Data Needs for LWR Applications., Ozer, O., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.6-17; CONF-791058, pp.6-17
Nuclear Data Needs for Plutonium Breeders., Hammer, P., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.18-24; CONF-791058, pp.18-24
Nuclear Data Needs for the Analysis of Generation and Burn-Up of Actinide Isotopes in Nuclear Reactors., Kusters, H., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.58-62; CONF-791058, pp.58-62
Evaluation of ^{23}Na for ENDF/B-V., Larson, D.C., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.68-72; CONF-791058, pp.68-72
Evaluations of the $^{58}Fe(n,gamma)$, ^{59}Fe and $^{54}Fe(n,p)^{54}Mn$ Reactions for the ENDF/B-V Dosimetry File., Schenter, R.E.; Schmittroth, F.; Mann, F.M., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.119-121; CONF-791058, pp.119-121
The Use of Thorium in Fast Breeder Reactors., Bartine, D.E., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.122-125; CONF-791058, pp.122-125
Deep Penetration Integral Experiment for a Thorium Blanket Mockup., Ingersoll, D.T.; Muckenthaler, F.J., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Analysis of a Swiss Thorium Blanket Integral Experiment., White, J.R.; Ingersoll, D.T.; Schmocker, U.; Gmur, K., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.131-134; CONF-791058, pp.131-134
Data Needs for Fuel Handling and Waste Management Aspects of Thorium Fuel Cycles., Nair, S.; Macdonald, H.F., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Relative Consistency of ENDF/B-IV with Fast-Reactor Benchmarks., Yeivin, Y.; Wagschal, J.J.; Marable, J.H.; Weisbin, C.R., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.187-189; CONF-791058, pp.187-189
A Test of ENDF/B Library in the Criticality Predictions of Fast Assemblies., Shukle, V.K.; Garg, S.B., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.239-245; CONF-791058, pp.239-245
Shielding of Fusion Reactors., Alsmiller, R.G., Jr., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Tritium Breeding in Fusion., Swinhoe, M.T., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Charged Particle Cross Section Requirements for Advanced Fusion Fuel Cycles., Shuy, G.W.; Conn, R.W., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Measurement and Analysis of Neutron Spectra in Some Assemblies of Reactor Materials., Kimura, I., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

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Nuclear Development Needs for Fusion-Fission Hybrid Reactors., Jassby, D.L., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.360-363; CONF-791058, pp.360-363
Burning Nuclear Wastes in Fusion Reactors., Meldner, H.W.; Howard, W.M., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.364-367; CONF-791058, pp.364-367
Safeguards., Higinbotham, W.A., September 1980, Supt. of Documents, U.S. Government Printing Office, Washington, D.C. 20402

NBS Spec. Pub. 594, pp.397-407; CONF-791058, pp.397-407
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