RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

POST OFFICE BOX X • OAK RIDGE, TENNESSEE 37830

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Science and art belong to the whole world, and before them vanish the barriers of nationality. ...Goethe

WHAT'S IN A NAME? – "A ROSE BY ANY OTHER NAME..."

The Radiation Shielding Information Center (RSIC) was born and named in 1962, and the name was probably descriptive at that time. Practitioners in those days thought of shielding as including cross sections, radiation sources, radiation physics, measurements (including the various forms of dosimetry), radiation transport analysis, shield design, and radiation effects, especially heating. As the years passed our scope was enlarged and we became more deeply involved in several of these areas, mainly because of user needs. We now claim that our coverage includes radiation protection, radiation transport, and shielding but it is surprising how much information peripheral to those areas is needed by our user communities. Our selection of a name has been questioned by some of our sponsors and users. We received a letter this month urging us to rename the center and a suggested name was given: *Radiation Physics Information Center (RPIC).* This is only one of many possible new names.

How do you feel about it?

The term 'information center' has possibly caused us more problems than has the 'radiation shielding' term, although the latter has also been perceived to be restrictive at times. It is difficult for many persons in research to see information science, which includes dissemination, as a useful partner in their endeavors. When research dollars are tight, there is hesitation in sharing them with the information science functions. There often is an implication that R & D in a project-oriented sense is somehow different and on a higher plane than R&D performed in an information analysis center (IAC).

Since the beginning, we have modeled RSIC after the Weinberg* concept of the IAC as a technical institute manned by experienced scientists and engineers who advance the state of the art by organizing, improving, and distilling research results and technology. We are currently in the process of evaluation by you, our users, who will tell us if we have achieved any degree of success. We feel it would be pretentious to call ourselves a 'technical institute' and we stubbornly cling to the idea that the 'information center' has validity as a respected and respectable technical entity.

We invite you to play the name game. What are your thoughts on any of the above? We'll publish them if we have your permission. We'll accept them as advice to us which is to be held privileged, if that is your wish. Let us hear from you.

*A. M. Weinberg, former ORNL Director

RSIC USER EVALUATION REMINDER

Each mailbag brings a batch of returning evaluation forms, and we thank you for the quick response to our questionnaire. The earliest respondents had not received our letter asking for an estimate of the cost savings from getting code and data packages from RSIC as against designing and developing computing technology or generating cross sections in your own installation. Anyone willing to write giving such estimates to be added to your form will receive our sincere gratitude. Since the testing and packaging of computing technology and generating data represents a large share of the cost of doing business in RSIC, your estimate of savings to your program will be most meaningful.

Did you receive the RSIC Evaluation Questionnaire? A few calls came in from recipients of the followup letter indicating that they had not received the forms. If you need one, call 615-483-8611/3-6944 commercial or 850-6944 FTS.

A quick review of the returning forms indicates that our numeric value system caused some problems. Indeed, we suspect that a respondent reversed the numbering system in his mind when making his judgment. For instance, he praised RSIC in his comments for the general evaluation and gave us a 5 which indicated that he thought RSIC should go out of business! If one remembers that 1 is the highest value, 3 is average, and a 5 suggests that a product or service should be dropped - there should be no real problem. We ask you again to PLEASE COMMENT FREELY. We want your suggestions for improvement of RSIC products and services, your ideas for new investigation, and your calling to our attention your unfilled needs.

Above all, GIVE US YOUR RESPONSE IMMEDIATELY. The return of the forms is also a value judgment! Is RSIC worth your going to the trouble to fill out a form? Let us have 100% participation in the evaluation of your information analysis center.

PROGRAM ANNOUNCED FOR FIFTH INTERNATIONAL CONFERENCE ON REACTOR SHIELDING

The preliminary program for the Fifth International Conference on Reactor Shielding (April 1977) is listed at the back of this newsletter. A Participation Form is also included. For planning purposes, we need to know the prospective attendance; if you think that you may attend, and have not done so, please fill out and return the form. This does not reserve a room for you at the hotel. For this, call the Hyatt Regency at 615-637-1234 or 800-228-9000 (toll free) or write to, Hyatt Regency Knoxville, 500 E. Hill Ave., Knoxville, TN 37915. Please mention the Fifth International Shielding Conference for the special rate.

MORE FY 1976 USER STATISTICS

Last month, the newsletter included some usage statistics for the extended fiscal year 1976. On further analysis, we continue our report to you, the user and contributor. A total of 4,017 separate information queries were processed (∿12.4 each work-day), requiring 9,922 separate activities (∿31.5 each work-day) by RSIC staff members in order to satisfy your requests. As you are aware, your requests can vary from those easy to fill to those that strain all our resources.

Approximately 86% of the requests came from the United States, 14% from other countries. ERDA contractors accounted for the greatest percent of domestic usage (30%), with DoD, the nuclear power industry, NRC, etc., following, in that order. Of the ERDA user community, 62% was thought to be working in the fission R & D area, 35% in fusion, and 3% doing basic research in the physical sciences.

ANS RP&S REPRESENTED ON PANEL ON REFERENCE NUCLEAR DATA

On October 19, 1976 a Panel on Reference Nuclear Data was convened at Brookhaven National Laboratory by the Director of the National Neutron Cross Section Center (NNCSC), Sol Pearlstein. The panel, said to be a permanent committee to continually review the status of data compilations and evaluations and give focus to the needs of the basic and applied communities, is composed of a large variety of societies representing physicists, chemists, engineers, etc., in fields as diverse as medicine, materials testing, electronics, etc. Leona Stewart and C. R. Weisbin were named by the Executive Committee to represent the Radiation Protection and Shielding Division of the American Nuclear Society. Observers from the nuclear structure evaluation field, technical publishers, ERDA Division of Physical Research, Nuclear Regulatory Commission, Bureau of Standards, National Research Council, and National Academy of Science were present. The NNCSC is to serve as the secretariat for the panel and J. Cline was appointed chairman.

The agenda for the October meeting included presentations from most of the nuclear data evaluation and information analysis centers with emphasis on nuclear structure data and, to a lesser degree, charged particle interaction data. Mass chain evaluation responsibilities were reviewed. The principal efforts in this field are: Chart of Nuclides (GE); Energy Levels of Light Nuclei (UP); Gamma-Ray Spectrum Group (INEL); National Neutron Cross Section Center (BNL); Nuclear Data Project (ORNL); Photonuclear Data Center (NBS); and Table of Isotopes (LBL). The BNL NNCSC has assumed a coordination responsibility between these groups, with these groups and users, and for international collaboration in this field.

Since the primary purpose of the panel is to identify user *requirements* and *priorities* for reference nuclear data, Stewart and Weisbin plan to solicit from members of the ANS Radiation Protection and Shielding Division answers to the following questions.

(1) What type of application requires nuclear structure or charged particle data? What are the specific physic quantities required?
(2) Is your need primarily one for new measurements of data, updates of compilations, or evaluations (what time cycle) or transmittal of data in an appropriate format?
(3) What specific computer codes,if any, require this data and what documentation exists on the appropriate format?
(4) Is your preference for desk-top literature, extensive computerized tapes, or retrieval service upon demand? Do you currently retrieve data from the literature or use those associated with computer codes or from information analysis centers?
(5) What type of services would be particularly helpful? (e.g., dial-up access to a master data base, plotting, etc.)

Your comments are solicited on any of the above questions and may be made to either Leona Stewart (LASL; 505-667-7737 or FTS 843-7737) or to Chuck Weisbin (ORNL; 615-483-8611/3-1223 or FTS 850-1223).

CHANGES IN THE DATA COLLECTION

The data collection was changed during the month as follows.

DLC-33/MONTAGE

The 100 Group Neutron Activation Cross-Section Data for Fusion Reactor Structure and Coolant Materials was updated by adding a substantial number of data sets. The revised library contains 406 data sets which include reaction cross section data and half-life information for the radioactive reaction product. The data are available with a retrieval program to extract desired data in the ANISN "activity option" format. The new library is referred to as DLC-33B/MONTAGE-406. Requests should be accompanied by a full reel of magnetic tape.

DLC-39/UKNDL

The UKAEA Nuclear Data Library was contributed by UKAEA through the OECD NEA Data Compilation Centre at Saclay, France and the NEA Computer Programme Library at Ispra, Italy.

CHANGES TO THE COMPUTER CODE COLLECTION

The following changes were made to the computer code collection during the month of November.

CCC-203/MORSE-CG

The CDC version (B) of the general purpose Monte Carlo multigroup neutron and gamma-ray transport code package MORSE-CG was extended to add the BREESE routines contributed by Bechtel Corporation. The BREESE routines implement the MORSE albedo option by providing replacements for the default routines ALBIN and ALBDO in MORSE, an estimating routine ALBDOE compatible with the SAMBO routines in MORSE, and a separate program that writes a tape of albedo data in the proper format for ALBIN. The BREESE routines may be requested separately. An informal report is available. FORTRAN IV; CDC 6600.

CCC-276/DOT 3.5

This two-dimensional discrete radiation transport code package was extended to include DOQDP, a discrete ordinates quadratures double precision routine contributed by the Oak Ridge National Laboratory. FORTRAN IV; IBM 360.

CCC-280/CYLTRAN

This cylindrical geometry multimaterial electron/photon Monte Carlo transport code package was extended to include the IBM 360 version converted from the Sandia Laboratories CDC 6600 version by RSIC. Reference: SAND 74-0030, FORTRAN IV; CDC 6600 (A), IBM 360 (B).

CCC-285/PEPIN

This fission product activity code was contributed by CEA/CEN/Saclay, France. Reference: Informal notes by C. DeVillers. FORTRAN IV; IBM 360.

PSR-98/GALAXY 6

This neutron multigroup cross section data processor was contributed by the UK-AEE Winfrith and UK-AWRE Aldermaston through the OECD NEA Computer Programme Library, Ispra (Varese), Italy. Reference: AWRE 0 13/75 (November 1975). FORTRAN IV and Assembler Language, IBM 370. This package uses data in the UKNDL format (see DLC-39).

PSR-101/HYPERMET

This gamma-ray spectra analyzer germanium detector code package was updated to correct errors called to RSIC attention by the contributor, Gary W. Phillips, Naval Research Laboratory, Washington, D.C. A statement of the correction is available from RSIC.

ERRATA FOR HANDBOOK OF RADIATION SHIELDING DATA

Professor J. C. (Jack) Courtney of Louisiana State University, editor of the *Handbook of Radiation Shielding Data*, ANS/SD-76/14 (July 1976) has requested that the following errata be published. Copies of the handbook are still available for $7.00 (postpaid) from LSU Bookstore, Union Building, Baton Rouge, LA 70893.

Page	Location	Correction
ii	Fifth line.	Replace . . . for at least . . . with . . . for at least . . .
1-27	Sixth line from the bottom.	The BCTIC FTS number should be 850-0293
2-4	Formula for Φ_E at P_1.	Replace $(s + 4a^2d^2)^{.5}$ with $(s^2 + 4a^2d^2)^{.5}$
5-48	Third line from the bottom of the page.	Replace . . . nuclear Date . . . with . . . nuclear data . . .
7-19	second line from the bottom of the page.	Replace . . . semi-infine . . . with . . . semi-infinite . . .
2-24	Second line on the graph title.	replace . . . of cylinder Diameter, c . . . with . . . of cylinder radius, c . . .

OVERVIEW OF INTERNATIONAL SPECIALISTS MEETING

Don Dudziak, LASL, and E. M. Oblow and F. G. Perey, ORNL, attended the specialists meeting on Differential and Integral Nuclear Data Requirements for Shielding Calculations held at IAEA Headquarters in Vienna, Austria on October 12-15, 1976. Ed Oblow offers the following overview of the meeting.

The overall objective of the meeting was to assess, on an international basis, the requirements for both differential and integral nuclear data to meet shield design objectives. A primary tool for this assessment was to be quantitative sensitivity studies of integral experiments and benchmark shield designs. Emphasis was placed on compiling a differential cross-section measurement request list to meet design goals or alternately, to ascertain whether cross-section adjustment could meet the same goals.

Some seventy participants from twenty countries attended the meeting with the U.S., U.K., France, Germany, Italy, Japan, and the USSR playing major roles in the presentations and discussions. The proceedings focussed on four major areas of interest: 1) sensitivity studies of benchmark shield designs and integral experiments for thermal and fast fission reactors, 2) assessments of the status of current differential and integral nuclear data, 3) nuclear data needs for future shield design work, and 4) common ground between data requirements for fission and fusion shield designs. Papers were presented in each of the above categories, with emphasis on areas (1) and (2). A good deal of discussion followed most of the presentations. At the conclusion of the meeting summaries for each area of interest were made by editorial panel members. The papers, summaries, and discussions will be published within the next six months to communicate the results of the meeting to the NEACRP (which was the prime moving force in setting the goals for the four meetings leading up to the present one).

In an overall sense this meeting was beneficial to U.S. interests. It was clear that the European community has made tremendous strides since the Paris meeting in applying sensitivity methods to relate cross-section data and integral measurements to shield design goals. Much of the information derived from these studies is useful in the U.S. fast breeder, thermal, and fusion reactor programs. Of specific interest were the deep penetration iron experiments done at the ASPIS facility in the U.K., the fast breeder reactor (FBR) and light water reactor (LWR) benchmark sensitivity studies reported by several European groups, and the analysis of four fusion reactor shield and blanket benchmark experiments by several European groups. All of these studies tended to highlight high sensitivity to hydrogen and iron cross-section data with sodium, oxygen, lithium, and carbon following close behind in importance.

It is most unfortunate that the extent of the useful information derivable from the meeting went no further than this point. The lack of cross-section covariance files (outside the U.S. and possibly the U.K.) made it difficult to meet the stated objectives of the meeting. Most of the quantitative requests for differential cross-section measurements were based on U.S. studies, with European requests being basically qualitative in nature. It was presumed that the French and U.K. groups would recommend cross-section adjustments to meet design goals, but here again a lack of credible covariance data, both differential and integral, prevented a meaningful contribution to be made even in this area. Clearly much work is needed in both the U.S. and the European communities to evaluate credible covariance files for the next generation of cross-section data files. Uncertainty information for integral measurements will also have to be given more emphasis if the results are to be successfully applied to design studies. Only after these requirements are met will it be possible to assess data needs and decide between adjustment and cross-section measurement as a means of meeting design target accuracies.

E. M. Oblow

INDEX TO STANDARDS PUBLISHED

The 1976 Annual Book of ASTM Standards, Part 48 (292 Pages - 6 x 9 - Hard Cover, Price: $4.00 ea.) became available in November. This book is a key reference volume. It lists by number designation, and cross indexed title every one of over 5,500 ASTM standards.

The index may be ordered by publication code number: 01-048076-42 from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pa. 19103.

A COMMENT ON A QUOTE

The November newsletter quotes Chaim Weizman, "Where there is no vision the people perish." Our longtime RSIC friend, John Hubbell (NBS) writes his personal appreciation of the newsletter and adds:

....."I think you will find " Where there is no vision, the people perish," in Proverbs 29:18, King James Version, probably, in turn, quoting earlier sources."

Our comment: Chaim Weizman, a founder of modern Israel, may have felt especially proprietary in quoting Biblical sources and may or may not have felt the necessity to give the proper reference. The words attributed to him were also lifted out of context.

We're especially glad John noticed and called it to our attention.

PERSONAL ITEMS

D. V. Gopinath, who spent a month in RSIC updating his ASFIT-D (CCC-153) computing technology, has returned to his normal duties as head of the Safety Research Laboratory, Reactor Research Centre, Kalpakkam, Chingleput District, Tamil Nadu, India. Coincident with our writing this month's editorial "What's In A Name...", he writes a suggestion: "In my opinion, RSIC is serving a much wider scientific community than the shielding discipline and I feel it would be appropriate to rename the Centre as Radiation Physics Information Center'. I would request you to give your consideration for the suggestion." (RSIC Note: the editorial was written prior to receipt of this letter!).

FUTURE ANS TOPICAL MEETINGS ON FUSION REACTOR TECHNOLOGY

Two meetings now being planned are as follows:

(1) Third ANS Topical Meeting on the Technology of Controlled Nuclear Fusion - May 7-10, 1978, Santa Fe, New Mexico; General Chairman - Lawrence H. Booth, LASL; Technical Program Chairman - James R. Powell, BNL.

(2) International Conference on Fusion Reactor Materials - January 29-31, 1979, Americana of Bal Harbour, Miami Beach, Florida; General Chairman - Robert J. Teitel, consultant; Technical Program Chairman - James L. Scott, ORNL M&C Division.

CSEWG RESPONDS TO ANS POLICY ON SI UNITS

In response to the June 1976 *Nuclear News* article by Roy G. Post, "Going Metric: Guide for ANS Publications", each Subcommittee of the Cross Section Evaluation Working Group (CSEWG) discussed the topic during the October 26,27, and 28, 1976 meeting at Brookhaven National Laboratory. The consensus of a joint meeting of all subcommittees was that the American Nuclear Society publication policy was too restrictive and went beyond the current system known as SI units, which has been developed by the Congress General des Poids et Mesures (CGPM). It was pointed out that the CGPM was more conservative and had allowed a number of units such as the unified atomic mass unit, the electron volt, and the barn to be used in conjunction with SI units. The CSEWG concurred with the CGPM's opinion that these particular units play such an important role and have been universally used in the field of nuclear data that there was no need to abandon them only for the sake of standardization and uniformity with units in other fields. It was also pointed out that if the ANS banned the use of such

units in its publications, as appears to be their intention, the CSEWG would likely not follow the ANS but would go along with the rest of the nuclear community, for instance the EEC (European Economic Community), the APS (American Physical Society), and the NBS (National Bureau of Standards), in continuing the use of these important units. However, it was realized that the impact of eliminating barn and eV in ANS publications would nonetheless be large upon the CSEWG and create unnecessary confusion. An enormous data base, coordinated worldwide, exists in these units. The CSEWG output, ENDF/B, is one the world standard reference data sets for applications and with other similar reference data sets makes exclusive use of these units. The impact upon users of ENDF/B if it were converted to other units would be enormous and would not serve any useful purpose such as improving communications or eventually facilitating use.

A motion was passed that the CSEWG supports, in general, the conversion to SI units but that important representative groups, such as CSEWG in neutron cross section work, should provide input to the ANS on the implementation of the conversion in order not to defeat the purpose of the change; that is, that communication should be improved and not hindered. Because of the importance of the CSEWG work to the nuclear community it was felt that it could act as a spokesman for the nuclear cross section field and it should take action to inform the ANS of its position. Consequently, a formal resolution was drafted and passed unanimously. Sol Pearlstein, as Chairman of the CSEWG, was instructed to send the resolution to the ANS board of Directors and the members of the Publications Committee. Francis Perey and Sol Pearlstein were asked to follow through on the motion and interact with the ANS Publications Committee of the ANS at the ANS in November in the name of the CSEWG.

The text of the Resolution on ANS Publication Policy adopted by the Cross Section Evaluation Working Group October 28, 1976 is as follows:

WHEREAS, the Congress General des Poids et Mesures (CGPM) has developed a system of units known as SI units which is being adopted by the industrial and scientific communities, and has approved the use of certain units in conjunction with SI units in specialized fields such as nuclear engineering; and

WHEREAS, the Publications Committee of the ANS has gone beyond the guidelines of the CGPM, and adopted very restrictive use of SI units, which in our opinion, will adversely affect the nuclear energy field, such as the abandonment of the barn, electron volt and others,

BE IT RESOLVED that the Cross Section Evaluation Working Group (CSEWG), composed of many contributors to ANS publications, which provides much of the nuclear reference data used in the nuclear community, supports the principle of the conversion to SI units as currently defined by the CGPM and communicates their conviction to the Board of Directors of the ANS and its Publication Committee that the adoption of a restrictive definition of the SI system of units and other units which may be used with it in ANS publications is inappropriate and should be reversed.

(Resolution signed by CSEWG Chairman)

Sol Pearlstein, Chairman
Brookhaven National Laboratory
Upton, N.Y. 11973

DOSIMETRY CONFERENCE PLANNED

The Gesellschaft fur Strahlen- und Umweltforschung mbH, Neuherberg/Munchen, Ingoldstadter Landstrasse 1, Federal Republic of Germany has announced plans for the Third Symposium on Neutron Dosimetry in Biology and Medicine to be held from Monday, 23 May to Friday, 27 May 1977 at their installation. The Symposium will consist of a number of invited lectures by experts, and the presentation of appropriate contributed papers. The following information has been given.

The growing importance of nuclear energy and the applications of neutron sources in research, medicine and industry imply considerable efforts in radiobiological research and increased emphasis on the assessment of radiation hazards to man. Since the Second Symposium on Neutron Dosimetry in Biology and Medicine was held in 1974, interesting results of research related to the physical aspects of neutron dosimetry have been achieved and it appears now worthwhile to stimulate a further exchange of information and to encourage specific research work in the field of neutron dosimetry.

In particular, the discussion of relevant theoretical and experimental aspects of neutron dosimetry in mixed radiation fields is a prerequisite for the worldwide comparison of radiobiological and clinical results. Therefore the program embraces the following topics: Physical basis of neutron interaction and energy deposition; Radiation quality and radiobiological implications; Calculations of radiation transport; Neutron sources, irradiation facilities and collimators; Neutron spectrometry; Neutron and mixed field dosimetry, methods and instrumentation, free-air and phantom measurements; Calibration, standardization, and intercomparison.

A notice of attendance and giving a paper should be sent immediately to the Secretariat of the THIRD SYMPOSIUM ON NEUTRON DOSIMETRY IN BIOLOGY AND MEDICINE, Gesellschaft fur Strahlen- und Umweltforschung mbH., D-8042 Neuherberg/Munchen, Ingolstadter Landstr. 1, Federal Republic of Germany. Papers can be read in English, French or German. Simultaneous interpreting facilities will be provided in these three languages. Abstracts should contain at least 300 words (maximum 600 words) and be as detailed as possible. The abstract should bear the full name and address of the author(s). Authors will be informed whether their papers have been accepted by 28 February 1977.

It is planned that the proceedings of the Symposium will be published. Authors are requested to forward their *original manuscripts* in their *final form* so as to reach the Secretariat not later than *10 May 1977*, and to provide *three copies of the manuscript for the interpreters.*

The conference fee is DM 150,–.

A second announcement will be issued in March 1977 which will include information on hotel bookings.

VISITORS TO RSIC

The following persons visited RSIC facilities during the month of November: Jacob Celnik (Burns & Roe, Inc.); Y. Y. Hsu (NRC); D. J. Varacalle, Keith G. Condie, George L. Schulz, and Lewis J. Bornmann (EG&G (INEL), Idaho); Rodolphe Nicks (ESIS, Euratom); and Pierre LaFore (CEA/CEN/Saclay).

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.

Special bibliographies and selected computer-printed abstracts of the literature in the RSIC system are available upon request. The Selective Dissemination of Information (SDI) Service is available by submitting a list of subject categories defining the recipient's interests.

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/NDM-20
Fast-Neutron Gamma-Ray Production from Elemental Iron: EN Approximately 2 MeV.
Smith, D.L.
May 1976
NTIS

ANL-Trans-1072; CONF-721018-31
Problems Related to the Definition of the Shielding of a Large Fast Power Reactor.
Moreau, J.
1972
Dep., NTIS $3.50

AEC-tr-7138; TT-70-50152
Radiation Technology. Number 3, 1969.
Shtan, A.S. (Ed.)
1971
NTIS

AEC-tr-7138, pp.1-8; TT-70-50152, pp.1-8
Influence of Self-Shielding and Neutron Flux Perturbation Effects on the Activation of Samples by Thermal Neutrons.
Zharkov, V.A.
1971
NTIS

AEC-tr-7138, pp.8-12; TT-70-50152, pp.8-12
Experimental Investigation of the Activation of Spherical and Cylindrical Samples in Thermal-Neutron Fields.
Zharkov, V.A.; Terent'ev, V.P.; Fradkin, G.M.
1971
NTIS

AEC-tr-7138, pp.12-16; TT-70-50152, pp.12-16
Dose Buildup Factor for a Point Isotropic 137-Cs Source in Spherical Geometry.
Rodionov, Yu.A.
1971
NTIS

AEC-tr-7138, pp.16-19; TT-70-50152, pp.16-19
Effect of Constructional Gaskets and Gaps on the Thickness of the Biological Shield in an Isotopic Generator.
Terent'ev, V.P.; Zorina, T.P.
1971
NTIS

AEC-tr-7138, pp.19-26; TT-70-50152, pp.19-26
Calculation of the Parameters of a Radiation Sulfochlorinator RS-2.5.
Osipov, V.B.; Solodikhina, L.D.; Terent'ev, B.M.; Dzhagatspanyan, R.V.
1971
NTIS

AEC-tr-7138, pp.26-32; TT-70-50152, pp.26-32
On the Error and Sensitivity of Density and Thickness Measurements by Radioisotope Absorption-Measurement Techniques.
Kreindlin, I.I.; Matveev, L.V.
1971
NTIS

AEC-tr-7138, pp.32-37; TT-70-50152, pp.32-37
Statistical Error in the Measurement of Binary Mixture Concentrations by Radioisotope Absorption-Measurement Techniques.
Kreindlin, I.I.; Matveev, L.V.
1971
NTIS

AEC-tr-7138, pp.37-40; TT-70-50152, pp.37-40
Errors Due to Nonlinear Absorption in the Measurement of Liquid Densities and Concentrations by a Radioisotope Method.
Kreindlin, I.I.; Matveev, L.V.
1971
NTIS

AEC-tr-7138, pp.40-45; TT-70-50152, pp.40-45
Optimum Selection of Radiation Sources and Probes for Radioisotope Instruments.
Kreindlin, I.I.; Matveev, L.V.
1971
NTIS

AEC-tr-7138, pp.45-50; TT-70-50152, pp.45-50
Measurement of Coating Thickness Over Small Areas by the Method of Back-Scattered Beta Radiation.
Pravikov, A.A.
1971
NTIS

AEC-tr-7138, pp.51-55; TT-70-50152, pp.51-55
On the Transformation of Spectra of Beta Sources Used in Coating Thickness Measurements by the Method of Back-Scattered Radiation.
Pravikov, A.A.; Boyarova, A.K.
1971
NTIS

AEC-tr-7138, pp.55-59; TT-70-50152, pp.55-59
Comparison Between Radiometric Level-Gauging Methods.
Kukharenko, I.V.; Mashinin, V.A.; Shipulina, L.A.
1971
NTIS

AEC-tr-7138, pp.60-64; TT-70-50152, pp.60-64
Optimum Dimensions of the Examined Section in the Radiography of Flat Articles.
Elisyutin, G.P.; Maiorov, A.N.; Tyufyakov, N.D.
1971
NTIS

AEC-tr-7138, pp.64-71; TT-70-50152, pp.64-71
Effect of Scattered Gamma Radiation on the Quality of Radiographic Pictures.
Zhukovskii, E.A.
1971
NTIS

AEC-tr-7138, pp.84-88; TT-70-50152, pp.84-88
Calculation of Optimum Times in Activation Analysis.
Ivanov, I.N.; Filippov, V.V.; Shtan, A.S.
1971
NTIS

AEC-tr-7138, pp.89-93; TT-70-50152, pp.89-93
Measurement of the Activity of an Isotope in Strong Gamma-Radiation Sources.
Kodyukov, V.M.; Terent'ev, V.P.; Ostretsov, L.A.; Forafontov, N.V.; Sokolov, A.I.; Fradkin, G.M.
1971
NTIS

AEC-tr-7138, pp.101-112; TT-70-50152, pp.101-112
Use of Back-Scattered Gamma Radiation for the Measurement of Low Altitudes.
Serebrennikov, I.Ya.; Ostretsov, L.A.; Fradkin, G.M.; Kodyukov, V.M.
1971
NTIS

AEC-tr-7138, pp.112-121; TT-70-50152, pp.112-121
Effect of Density of the Medium on the Accuracy of Height and Level Measurements Made with the Aid of Back-Scattered Gamma Radiation.
Bulatov, B.P.; Serebrennikov, I.Ya.
1971
NTIS

AEC-tr-7138, pp.121-130; TT-70-50152, pp.121-130
Random-Number Generators Based on the Use of Radioactive Isotopes.
Varvaritsa, V.P.; Kozlov, L.F.; Matveev, L.V.
1971
NTIS

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Some Possibilities of Extending the Upper Limit of Thickness Measurements by the Gamma Reflection Method.
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FIFTH INTERNATIONAL CONFERENCE ON REACTOR SHIELDING
April 17-23, 1977, Knoxville, Tennessee, USA
PRELIMINARY TECHNICAL PROGRAM

Monday 9:00 a.m. Opening

Keynote: Where Are We and Where Are We Going in Reactor Shielding – Fred C. Maienschein, Oak Ridge National Laboratory, USA

Monday 9:45 a.m. Session A

OVERVIEW: METHODS AND DESIGN

1. The Evolution of Shielding Methods and Data—A Continuing Process of Adjustment to Changing Project Needs – J. Butler, AEE Winfrith, UK (invited)
2. Shielding Methods Development in the United States – F.R. Mynatt, Oak Ridge National Laboratory, USA (invited)
3. Design of FFTF Shields – W.L. Bunch, Hanford Engineering Development Laboratory, USA
4. A Summary of the ORNL Shield Design Supporting Analysis for the FFTF – W.W. Engle, Jr., F.R. Mynatt, M.B. Emmett, and M.L. Williams, Oak Ridge National Laboratory, USA
5. Shielding Design Features of the Floating Nuclear Plant – M.P. Billings and M.A. Capo, Offshore Power Systems, USA
6. Shield Design for the Joint European TORUS – A.F. Avery et al., AEE Winfrith, UK

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Monday 2:00 p.m. Session B

SENSITIVITY ANALYSIS

1. A Survey of Cross-Section Sensitivity Analysis as Applied to Radiation Shielding – H. Goldstein, Columbia University, USA (invited)
2. A Computational Scheme for Energy Group Boundary Selection Using Sensitivity Theory – V. Herrnberger, Swiss Federal Institute for Reactor Research, Switzerland
3. Sensitivity Profiles for Secondary Energy and Angular Distributions – S.A.W. Gerstl, Los Alamos Scientific Laboratory, USA
4. Three-Dimensional Effects in Sensitivity Studies – H. Rief, EURATOM–Ispra
5. A Review of Progress in the NEA/IAEA Collaborative Program of Sensitivity Studies and Shielding Benchmarks – J. Butler, AEE Winfrith, UK
6. Spatio-Energetic Sensitivity of the Equivalent Thermal Flux on the Intermediate Heat Exchanger of a Typical Fast Breeder Reactor – A. Boioli and L. Fiorini, NIRA (attached to CEN/Cadarache), Italy – J. Moreau and G. Suntinger, CEA CEN/Cadarache, France
7. Fast Reactor Shield Sensitivity Studies for Steel-Sodium-Iron Systems – E.M. Oblow and C.R. Weisbin, Oak Ridge National Laboratory, USA
8. The Effects of Square-Well Cross Section Minima on the Deep Penetration of Neutrons – W. Peng and H. Goldstein, Columbia University, USA

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Monday 3:00 p.m. Poster Session P-1

METHODS I

1. Simultaneous Global Calculation of Flux and Importance with Forward Monte Carlo – O.L. Deutsch and L.L. Carter, Los Alamos Scientific Laboratory, USA
2. Application of the Monte Carlo Track Rotation Estimator – A. Dubi and Y.S. Horowitz, Ben Gurion University of the Negev, Israel
3. Direction Dependent Exponential Biasing in Monte Carlo Simulation of Radiation Transport in Thick Shields – K.P.N. Murthy, Reactor Research Centre, India
4. Methods of Monte Carlo Biasing Using Two-Dimensional Discrete Ordinates Adjoint Flux – J.S Tang and T.J. Hoffman, Union Carbide Corp. Nuclear Division – P.N. Stevens, University of Tennesee, USA
5. A Partial-Range Expansion for Multigroup Monte Carlo Photon Transport – J.T. Ward, Jr. and M.B. Scudiere, Univ. of Virginia, USA
6. Calculation of Toroidal Fusion Reactor Blankets by Monte Carlo – J.L. Macdonald, E.D. Cashwell, and C.J. Everett, Los Alamos Scientific Laboratory, USA
7. A Neutron/Photon/Electron Shielding Study by Monte Carlo – W.L. Thompson, Los Alamos Scientific Laboratory, USA
8. A Study of Applicability of an Albedo Monte Carlo Method for Neutron Streaming Calculation – M. Kawai, and M. Yamauchi, Nippon Atomic Industry Group Co. – H. Kadotani, Century Research Center Corp. – I. Suzuki, Power Reactor and Nuclear Fuel Development Corp., Japan
9. Neutron Streaming Through Conical Ducts – G.P. de Beer, Atomic Energy Board, South Africa
10. Evaluation of Uncertainties in the Gamma-Ray Heating Analysis of a PWR – J.T. West, Union Carbide Corp. Nuclear Division, USA
11. An Examination of Neutron Shielding for Spent Fuel Shipping Casks – K. Ueki and H. Yamakoshi, Ship Research Institute, Japan
12. Gamma-Ray Shield Design Calculations on Multilayered Shields Using Maniscalco Two-Medium Buildup Factors – H.E. Hungerford, Purdue University, USA
13. Development of a Computer Code for Neutron Streaming Calculations in LMFBR – T. Nishimura and H. Kinjo, Mitsubishi Atomic Power Industries, Japan
14. A Simple Albedo Method for Calculating Effects of Single-Legged Ducts – J. Celnik, Burns & Roe, USA

15. The Optimisation of Shielding for Direct-Cycle Steam Turbine Plant – A. Martin, Associated Nuclear Services, UK – J.R.P. Eaton, South of Scotland Electricity Board, UK

16. The Use of Removal Diffusion Theory for Calculating the Effectiveness of Neutron and Gamma-Ray Shields for Nuclear Reactors and Chemical Plants – B.L. Richardson and R.F. Burstall, UK Atomic Energy Authority, Risley, UK

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Tuesday 9:00 a.m. Session C

DESIGN EXPERIENCE

1. Radiation Protection and Shield Design: A Need for a Systems Approach – R.K. Disney, Westinghouse Advanced Reactor Division, USA **(invited)**

2. Radiation Streaming—The Continuing Problem of Shield Design – A.F. Avery, AEE Winfrith, UK **(invited)**

3. Radiation Streaming of N.S. Mutsu and its Repair Plan – M. Osani, J. Miyakoshi, A. Tsubosaka, et al., Nuclear Ship Development Agency, Japan

4. Mockup Experiment and Analysis for the Primary Shield of the Nuclear Ship Mutsu – S. Miyasaka, T. Asaoka, JAERI, – T. Fuse, Ship Research Institute, – J. Miyakoshi, et al., Nuclear Ship Development Agency, Japan

5. Fort St. Vrain Plant Shielding Design and Measurements – S. Su, B.A. Engholm, and R.E. Sund, General Atomic Co., USA

6. Neutrons and Gamma-Ray Streaming in the Annulus Between the Reactor Pressure Vessel and the Sacrificial Shield of the Caorso Nuclear Power Station – P. Barbucci and F. Di Pasquantonio, ENEL-Ente Nazionale per l'Energia Elettrica, Italy

7. Empirical Solution of Radiation Streaming Problems in the Air Gap around the Pressure Vessel of a PWR – C.C. Francis, Tennessee Valley Authority, USA

8. Shielding Against Neutron Streaming in Pressurized Water Reactors - C. Devillers, CEA, Saclay, France – J.P. Payen, EDF, France

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Tuesday 2:00 p.m. Session D

RADIATION DAMAGE AND STREAMING

1. Irradiation Effects and Design of LMFBR Permanent Reactor Structures – L.D. Blackburn and R.L. Knecht, Hanford Engineering Development Laboratory, USA **(invited)**

2. Determination of Radiation Damage to Structural Components Outside the Core of PWRs – J. Koban and G. Leitz, Kraftwerk Union – G. Hehn, IKE, Stuttgart – L. Issler, MPA, Stuttgart, FR Germany

3. Neutron Transport Through Straight and Once Bent Sodium Pipe in Shielding of Fast Reactors – J. Burian, B. Jansky, B. Osmera, P. Otopal, and J. Rataj, Nuclear Research Institute, Rez, Czechoslovakia, – E. Petrov, L. Trykov, A. Nikolajev, and V. Semenov, FEI Obninsk, USSR

4. Calculation of Duct and Gap Problems With ESTOQ-DOT and Analytical Expressions – W. Zumach, IKE, Stuttgart, FR Germany

5. Albedo of Fast Neutrons for Barriers of Various Media – D.B. Pozdneyev and M.A. Faddeyev, Gorky State University, USSR

6. Neutron and Gamma-Ray Transport Studies in the Helium Ducts and Turbogroups of a High Temperature Reactor with Helium Turbine (HHT) Using the Monte Carlo Method – A. Taormina and S. Kypreos, EIR, Switzerland

7. A Study of Fast Neutron Streaming Through the Core Support-Plate Shield of a LMFBR – I. Suzuki and T. Inoue, Power Reactor and Nuclear Fuel Development Corp. – Y. Oka, H. Wakabayashi, N. An, Univ. of Tokyo, – K. Sasaki, Mitsubishi Atomic Power Industries, – S. Miyasaka, JAERI

8. Neutron Dosage at Steel Components in the THTR – H.G. Wahsweiler, Hochtemperatur-Reaktorbau GmbH, Köln – G. Hehn, IKE Stuttgart, FR Germany

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Tuesday 3:00 p.m. Poster Session P2

METHODS II

1. Supplementary Exponential Equations for S_N Methods: The Two-Dimensional Case – P. Barbucci and F. Di Pasquantonio, ENEL-Ente Nazionale per l'Energia Elettrica, Italy

2. The Synthetic Diffusion Acceleration Method in Radiation Transport Calculations Using S_N Codes – R.E. Alcouffe, Los Alamos Scientific Laboratory, USA

3. Toroidal Transport Calculations Using TRIDENT-CTR – T.J. Seed, Los Alamos Scientific Laboratory, USA

4. Application of the ONETRAN and TIMEX Codes to Shielding Problems – T.R. Hill, Los Alamos Scientific Laboratory, USA

5. The DOT IV Variable Mesh Discrete Ordinates Transport Code – W.A. Rhoades, Oak Ridge National Laboratory, USA

6. Optimal Iron-Water Shields for Fusion Reactors – D. Gilai, E. Greenspan, and P. Levine, Nuclear Research Center–Negev, and Ben Gurion University, Israel – W.G. Price, Jr., Princeton University, USA

7. Applications of an Economical Transport Theory Method for Shield Penetration Based on Spherical Harmonics – D.E.J. Thornton and J.K. Fletcher, UK Atomic Energy Authority, Risley, UK

8. A Three-Dimensional Synthesis Approach to Reactor Internal Gamma-Ray Heating – J.T. West III, Union Carbide Corp. Nuclear Division, – C.L. Whitmarsh, Babcock & Wilcox, USA

9. The Direct-Coupled-Ray Method for Three-Dimensional Shielding Analysis – J.A. Bucholz, Union Carbide Corp. Nuclear Division, USA

10. Anisotropic Source-Flux Iteration Technique for Three-Dimensional Systems – D.V. Gopinath and V. Sundararaman, Reactor Research Centre, India

11. A Coarse-Mesh Algorithm to Solve the Neutron Transport Equation in Thick Shields – R. Vaidyanathan, Reactor Research Centre, India

12. The Background Cross Section Approach to Generating Group Constants for Shielding Calculations – R.E. MacFarlane and R.B. Kidman, Los Alamos Scientific Laboratory, – M. Becker, Rensselaer Polytechnic Institute, USA

13. Spatial Channel Theory–A Technique for Determining the Directional Flow of Radiation through Reactor Systems – M.L. Williams and W.W. Engle, Jr., Oak Ridge National Laboratory, USA

14. Sensitivity Analysis for Shielding Data Evaluation by Interactive Graphics Computing – A. Parvez and M. Becker, Rensselaer Polytechnic Institute, USA

15. A Calculation of the Gamma-Ray and Neutron Dose in the Reactor Cavity – J.R. Marshall and W. Zobel, Tennessee Valley Authority, USA

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Wednesday 9:00 a.m. Session E

OCCUPATIONAL EXPOSURE

1. Radiological Exposure Aspects During 25 Reactor-Years of Operation of ENEL LWRs – F. Fiorentino and S. Fiori, ENEL, Italy **(invited)**

2. Radiation Exposure and Protection Problems in Nuclear Power Plants—U.S. Overview – B.J. Verna, Nuclear Power Experience Inc., USA **(invited)**

3. Design Measures to Minimize Radiation Exposure of Staff for a Commercial Nuclear Power Plant – F. Keenan, South of Scotland Electricity Board, – I.G. Pugh, Central Electricity Generating Board, – F.P. Youell, Nuclear Power Company (Risley) Ltd., UK

4. Design Worth of Radiation Exposure Reduction – R. Collins, Atomic Energy of Canada Limited – R.A. James, Ontario Hydro, Canada

5. Radiation Exposure in the Operating PWR Plants and Specific Design Features for Occupational Dose Reduction – V. Mani and K.G. Lingappan, United Engineers & Constructors, USA

6. Experience with Occupational Radiation Exposure in PWRs Built by Kraftwerk Union – G. Hecht, Kraftwerk Union, FR Germany

7. Radiological Experience in Swedish Boiling Water Reactors – J. Elkert, AB Asea-Atom, Sweden

8. Measurement and Prediction of Gamma-Ray Sources and Dose Rates in the Vicinity of the Winfrith SGHWR – P.C. Miller et al., AEE Winfrith, UK

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Thursday 9:00 a.m. Session F

CORROSION AND FISSION PRODUCTS

1. An Overview of the Activated Corrosion Product Reduction Program at U.S. Power Reactors – T.D. Murphy, Nuclear Regulatory Commission, USA **(invited)**

2. Prediction of Primary Circuit Contamination in Power Reactors – P. Beslu, L. Costa, G. Frejaville, and P. Pepin, CEA, France **(invited)**

3. EPRI Programs in Radiation Control in Nuclear Power Plants – R.A. Shaw and D.L. Uhl, Electric Power Research Institute, USA

4. The Contribution of Fission Products to Radiation Fields in a Pressurized Heavy Water Reactor – B.C.J. Neil, Ontario Hydro, Canada

5. Analysis of Dose Rates Near the Circuit of a PWR After Shutdown – P. Beslu, G. Frejaville, and A. Lalet, CEA, France

6. Prediction of Fission Product, Actinide and Canning Activity Levels in Irradiated Reactor Fuel – R.F. Burstall and D.E.J. Thornton, UK Atomic Energy Authority, Risley, UK

7. Criteria for Monitoring Radioactivity Levels in Reactor Power Plants and Performance Specifications for the Monitoring Instrumentation – T.E. Todd, Tennessee Valley Authority, USA

8. Digital Radiation Monitoring System Employing Distributed Microprocessors – E.A. Warman, S.M. Ingeneri, B.M. Newman and T.L. Sowdon, Stone & Webster, USA

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Thursday 2:30 p.m. Session G

INFORMATION RESOURCES AND STANDARDS

1. RSIC After 14 Years–Where Do We Go From Here? – D.K. Trubey, B.F. Maskewitz, and R.W. Roussin, Oak Ridge National Laboratory, USA

2. Radiation Protection and Shielding Standards – E.J. Vallario, Energy Research and Development Adm. – D.K. Trubey, Oak Ridge National Laboratory, USA

3. Shielding Standards–A Case History – M.E. Battat, Los Alamos Scientific Laboratory, USA

4. Activities of the Shielding Subcommittee of the ENDF/B Cross Section Evaluation Working Group – R.W. Roussin, Oak Ridge National Laboratory, USA

5. The Role of "Standard" Fine-Group Cross Section Libraries in Shielding Analysis – C.R. Weisbin, R.W. Roussin, E.M. Oblow, D.E. Cullen, J.E. White, and R.Q. Wright, Oak Ridge National Laboratory, USA

6. Generation and Testing of Shielding Data Libraries for Fission and Fusion Technology – E. Caglioti, M. Mattes, R. Nicks, H. Penkuhn, EURATOM–Ispra – G. Hehn, IKE Stuttgart, FR Germany – V. Herrnberger, Swiss Federal Institute for Reactor Research, Switzerland

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Thursday 3:00 p.m. Poster Session P3

INTEGRAL EXPERIMENTS

1. Results of Neutron Propagation in Steel-Sodium Mixtures, with Various Source Spectra, on HARMONIE and TAPIRO – D. Calamand, A. Desprest, H. Rancurel, and R. Vienot, CEA Cadarache, France – S. Bozzi, M. Martini, and P. Moioli, CNEN/Casaccia, Italy

2. Use of Integral Data for the Prediction of Neutron Propagation in Iron-Sodium Mixtures – J.C. Estiot and J.P Trapp, CEA Cadarache, France – G. Palmiotti and M. Salvatores, CNEN/Casaccia, Italy

3. Measurements and Calculations of Neutron Fluxes Through a Simulation of the CRBR Upper Axial Shielding – R.E. Maerker and F.J. Muckenthaler, Oak Ridge National Laboratory, USA

4. *UK Fast Reactor Shield Design and Performance* – P.C. Miller and R.C. Wheeler, AEE Winfrith, UK

5. Two-Dimensional Shielding Benchmarks for Sodium and Iron at YAYOI – Y. Oka, S. An, S. Miyasaka (JAERI), S. Kasai, R. Yoshii, H. Hashikura, University of Tokyo, – T. Hyodo, Kyoto University, Japan

6. Integral Tests of Iron and Niobium Cross Sections Through Simultaneous Measurements of Neutron and Gamma-Ray Leakage Spectra – D.T. Ingersoll, J.J. Dorning, and B.W. Wehring, University of Illinois, USA

7. Mock-Up Experiment of Radiation Streaming Through Coolant Pipe Penetration – T. Fuse, T. Miura, and A. Yamaji, Ship Research Institute, – T. Asaoka and S. Miyasaka, Atomic Energy Research Institute, – J. Miyakoshi et al., Nuclear Ship Development Agency, Japan

8. Intercomparison of Monte Carlo Calculations and Measurements of the Neutron and Gamma-Ray Streaming in Multibend Ducts – H.G. Vogt, Technische Universitat Hannover, FR Germany

9. Calculations of Neutron Radiation Levels from HTGR Spent Fuel – R.E. Sund, B.A. Engholm, and S. Su, General Atomic Co., USA

10. Analysis of a Fuel-Pin Neutron-Streaming Experiment to Test Methods for Calculating Neutron Damage to the GCFR Grid Plate – C.O. Slater and M.B. Emmett, Oak Ridge National Laboratory, USA

11. Radiation Doses from Iron, Concrete, and Water as a Function of Mean-Free-Path for 14-MeV Neutrons – L.F. Hansen, T. Komoto, and C. Wong, Lawrence Livermore Laboratory, USA

12. Spatial Distribution of Fission Product Energy – W.R. Johnson, R.B. Bass, G.A. Littig, F.L. Robinson, and T.P. Bracke, Univ. of Virginia, USA

13. *In Situ* Measurements with a Mobile Ge(Li) Spectrometer Around a Nuclear Power Plant – R. Finck, K. Liden, and B.R.R. Persson, University of Lund, Sweden

14. TLD Measurement of Radiation Heating in Reactor Shields – W. Yoon, P.N. Stevens, University of Tennesee, USA – C.E. Clifford and F.J. Muckenthaler, Oak Ridge National Laboratory, USA

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Friday 9:00 a.m. Session H

FUSION AND ADVANCED REACTORS

1. Important Aspects of Radiation Shielding for Fusion Reactor Tokamaks – M.A. Abdou, Argonne National Laboratory, USA

2. Shielding Problems in The "FINTOR" Design – R. Nicks, G. Realini, P. Rocco, R. Van Heusden, EURATOM–Ispra

3. Shield Analyses for Intense 14-MeV Neutron Sources – M.E. Battatt and D.J. Dudziak, Los Alamos Scientific Laboratory, USA

4. Monte Carlo Analysis of the Effects of Shield Penetrations on the Performance of a Tokamak Fusion Reactor – R.T. Santoro, J.S. Tang, R.G. Alsmiller, Jr., and J.M. Barnes, Oak Ridge National Laboratory, USA

5. Radiological Safety Design Considerations for a Laser-Fusion Facility – M.S. Singh, Lawrence Livermore Laboratory, USA

6. The Methods of Calculation Used in the Design of Shielding Within the Primary Containment of a Commercial SGHWR – L.M.C. Dutton and P.A. Solari, Nuclear Power Company (Risley) Ltd., UK

7. Shield Design and Streaming Calculations for the Sodium-Cooled PEC Reactor – M. Prosperi, AGIP NUCLEAR – R. Tavoni, N. Travaglini CNEN, Italy

8. Shield Design of a 100 MW(th) Research Reactor – B.F. Chamany, Bhabha Atomic Research Centre, India

9. Application of an Advanced Shielding Analysis System to Gas Cooled Fast Reactor Designs – D.E. Bartine and L.R. Williams, Oak Ridge National Laboratory, USA

FIFTH INTERNATIONAL CONFERENCE ON REACTOR SHIELDING
Knoxville, Tennessee USA
April 18-23, 1977

PARTICIPATION FORM A

(Please return by January 15, 1977)

Name:

Organization:
Institution:

Address:

Citizen of:

Are you author or co-author of a paper?

If yes, title of paper:

List of Authors:

The following questions imply no commitment; they are to assist in planning.

1. Are you interested in the April 22 ORNL tour?

2. Are you interested in the April 23 TVA tour?

3. Do you expect to bring a guest (spouse or family member)?

4. Do you expect to attend the full conference?

5. Are you a university student (as of April 1977)?

Return to:

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Oak Ridge National Laboratory
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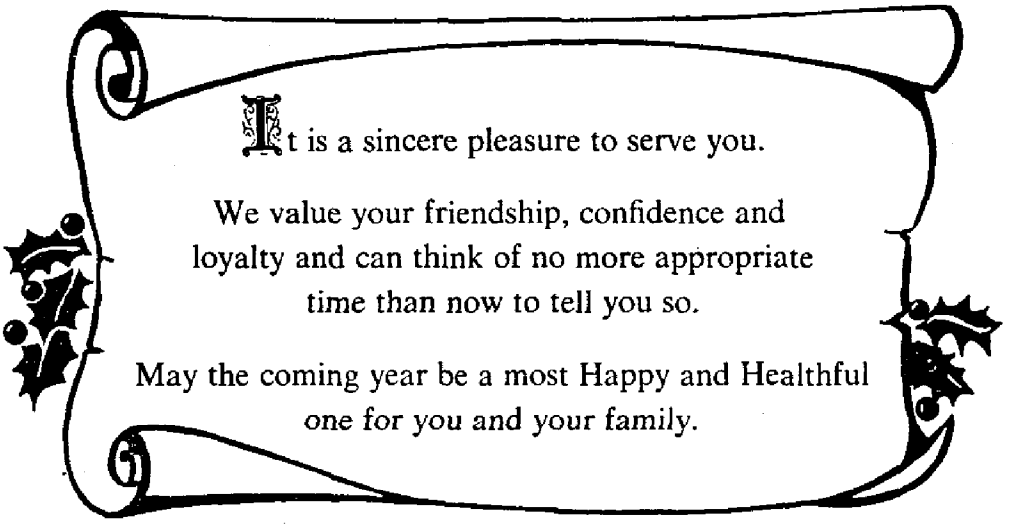

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