RSIC Newsletter

RADIATION SHIELDING INFORMATION CENTER

OAK RIDGE NATIONAL LABORATORY

OPERATED BY UNION CARBIDE CORPORATION • FOR THE U.S. ATOMIC ENERGY COMMISSION

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How many things
that were articles of faith
yesterday
are fables today

....Michel de Montaigne
(1533-1592)

PROGRAMS FOR FOURTH INTERNATIONAL SHIELDING CONFERENCE - AND ISPRA SHIELDING SEMINAR-WORKSHOP

We are grateful to M. Christian Devillers, Conference Scientific Secretary for making available the program for the Paris Shielding Conference, October 9-13. The program is printed in this issue starting on page 24.

The program for the Ispra Seminar-Workshop starts on page 5.

NEW RSIC REPORT ON SPACE SHIELDING TO BE ISSUED

The report ORNL-RSIC-35, "Shielding of Manned Space Vehicles Against Protons and Alpha Particles," by R. G. Alsmiller, Jr., R. T. Santoro, J. Barish, and H. C. Claiborne, Oak Ridge National Laboratory, will be available soon. Please return the form on the last page of this issue to reserve your copy. Please do so promptly to help determine the number of copies to print.

In this report the available information on the shielding of manned space vehicles against protons and alpha particles is summarized. The emphasis in the report is on shielding against Van Allen belt protons and against solar-flare protons and alpha particles, but information on shielding against galactic cosmic rays is also presented.

The report is primarily intended as a handbook for nonexperts in space shielding. For the most part, the approximation methods discussed are those that are standard in the space-shielding literature. However, a large amount of numerical data, not previously published, on the validity of the various approximation methods is presented, and these data may be of interest to those who are familiar with space shielding.

ORNL-RSIC-13, Vol. III
ABSTRACTS OF RSIC DIGITAL COMPUTER CODE PACKAGES
NOW AVAILABLE

The third volume of ORNL-RSIC-13, "Abstracts of Digital Computer Code Packages Assembled by the Radiation Shielding Information Center," by Betty F. Maskewitz, has been issued in a loose-leaf binder. This volume provides abstracts for the code packages CCC-116 to -168. This volume, as well as copies of the previous volumes, is available from RSIC upon request.

Please return the form on the last page of this issue to receive your copy.

NEW EURATOM INTEGRAL NUCLEAR DATA CENTRE (INDAC)
AT C. C. R. ISPRA, ITALY

It has been announced that INDAC's activities will evolve along the following lines:

- Implementation of codes for preparing few-group cross-sections from nuclear data files (ENDF/B, UKNDL, KEDAK). This work has been in progress at Ispra C.C.R. since 1969, and was begun due to the need for few-group cross-sections regularly updated taking into account improvements made to data files directly.

- Critical analysis of the confidence limits of various sets of few-group cross-sections and their methods of production, as well as their adjustment by comparison between calculated values and the results of "clean" integral measurements.

- Collect documentation on integral measurements made throughout the world, and in particular, in the Community, as well as filing of such measurements. The purpose of this work is to determine the integral experiments which could be used to test nuclear data as opposed to those which have been elaborated directly to test mock-up experiments. This work is to be done in liaison with EACRP (European-American Committee on Reactor Physics).

- Systematic dissemination of the work undertaken in Community Member countries and throughout the world concerning codes for elaborating cross sections, series of nuclear data adjusted to critical measurements and current integral experiments.

The Ispra CETIS Programme Library will disseminate the codes and multigroup libraries.

ADDITIONS TO THE COMPUTER CODE COLLECTION

Operable, tested with a sample problem, and available for distribution are the following new code packages:

CCC-181/DEMON — Demonstration Neutron Monte Carlo Code contributed by Radiation Research Associates, Fort Worth, Texas. The code is designed to demonstrate Monte Carlo and neutron transport fundamentals to students. The problem treated is neutron transport and energy deposition in a slab. Reference: RRA-N7122A (Rev.,June 1972). FORTRAN IV, IBM 360.

CCC-185/INREM, EXREM II — Beta and Gamma Radiation Environmental Dose Codes contributed by Computing Technology Center, Union Carbide Corporation, and Health Physics Division, Oak Ridge National Laboratory. These codes were designed to estimate external doses to populations from construction of a sea level canal with nuclear explosives. Reference: CTC-8; K-1752; FORTRAN IV, IBM 360.

UPDATES TO EXISTING CODE PACKAGES

The following code packages have recently been updated:

CCC-161B/NMTC
CCC-178B/HETC — NMTA-1972 is a new set of analysis subroutines for the nucleon-meson Monte Carlo transport codes NMTC and HETC. They were contributed by the Neutron Physics Division, Oak Ridge National Laboratory. The subroutines are used to analyze transport data to compute: flux and current from boundary crossings, flux from collision densities, residual nucleic distributions, and star densities in emulsions. Reference: ORNL-4736 (Nov.1971). Those who have the previous versions should request the new routines by asking for CCC-178/HETC (NMTA-1972 only).

CCC-170C/DISDOS — Calculation of Dose Distribution in Human Phantoms by External Photon Sources. The original version (Ref.: KFKI-71-12) contributed by Central Research Institute for Physics, Budapest, Hungary, has been made operable on the IBM 360/50 by the HEW Bureau of Radiological Health, Rockville, Md.

PSR-13F/SUPERTOG-III — The code, contributed by the Mathematics Division, Oak Ridge National Laboratory, processes ENDF/B format Version II and III data to produce neutron multigroup cross sections. The principal revisions include: improved resonance treatment, now processes (n,2nα) data, improved scattering matrices and n,2n treatment, and printing and punching all one-dimensional cross sections. The code is also much less machine-dependent.

PSR-22B/RICE — The new version of RICE, which calculates primary recoil atom spectra, now can process ENDF/B-III format. A FORTRAN version of the subroutine CRT has been added to the package to make plotting easier to implement. Previously, only an assembler language version was available.

CODE REVISIONS

CCC-112B/SAND — The IBM 360 version of SAND has been revised. We are indebted to F. B. K. Kam of ORNL for suggesting the following corrections: In the MAIN program, following statement 50, the last element of certain arrays is zeroed; to this list should be added EAV(MPL1)=0.0. In subroutine ITER the variable LIM1 is undefined prior to its use in certain cases; immediately following statement 40, insert

```
J1 = JJ - 1
LIM1 = JJ
```

Copies of CCC-112/SAND distributed after September 1 contain these corrections.

CCC-17E/05R — In implementing 05R, IBM 360 version, a defect in Code 6 was introduced. We are indebted to Dr. László Koblinger for locating this problem. Between statements 170 and 175:

```
IF (NFISH(MED-1).LE.1) GO TO 175
```

should be

```
IF (NFISH(MED-1).LT.1) GO TO 175.
```

NTIS DOCUMENT PRICES

The National Technical Information Service (NTIS), Springfield, Va., will reorganize its pricing schedule for all documents, in an effort to "break even" and recover operating, input processing, and marketing costs. The policy change, to take effect as new documents are released, will mean higher prices for those government research studies and other documents which are expected to be "best sellers." At the present time, NTIS sells 10 copies or less of almost half of its offerings.

Documents available on microfiche will cost 95 cents for up to five sheets of fiche, and 95 cents for each additional five sheets. A minimum order, however, must total $2.85. An additional charge of $1.50 is added to each report ordered by foreign users. All other price changes refer to hard-copy documents.

Low-volume documents, those which sell less than 50 copies during the estimated two-year life span of the report, will cost $3 for the first 20

pages, plus 5 cents for every additional five pages. A $2.50 surcharge is added per copy to foreign users.

NTIS officials estimate NTIS loses $300,000 per year on documents in this category. The new rate is expected to recover a pro rata share of input processing costs.

Documents which sell between 50 and 100 copies will follow the current pricing schedule: $3 for 300 pages.

Reports which would be expected to sell several hundred copies will be screened and selected by NTIS officials for a new "wide-interest" category. Special attention will be given to the production and marketing of these publications, and prices will be determined by length of the document. Prices in this category range from a minimum of $3 for up to 30 pages and a maximum of $37.75 for up to 2,750 pages. A $2.50 surcharge is added to all documents ordered by foreign users.

The higher prices for wide-interest documents are expected to help NTIS recover all development and marketing costs expended in this category.

If the new pricing schedule recovers all costs, as anticipated, NTIS will use appropriated funds solely to develop new projects.

Approximately 700,000 document copies are sold by NTIS per year. In 1972, NTIS officials expect hard copy report sales to reach $3.7 million.

PRELIMINARY AGENDA FOR THE SEMINAR WORKSHOP ON SHIELDING PROGRAMS

NEA Computer Programme Library
CCR-EURATOM, Ispra, Italy
October 16-18, 1972

Chairman: Professor R. A. Bonalumi,
Centro Informazioni Studi Esperienza, Italy

1. PIPE: A programme integrating the photon equation, designed for gamma shielding calculations. (Mr. H. Penkuhn, CCR EURATOM, Ispra).

2. LAPHANO: A Po multigroup photon-production matrix and source code for ENDF. (Dr. D. J. Dudziak, Los Alamos Scientific Laboratory, USA).

3. AMPX: A modular code system for the generation of multigroup cross section data sets. (Mrs. B. F. Maskewitz, Radiation Shielding Information Center, ORNL, USA).

4. SCORE: A multigroup removal diffusion theory shielding code in x-y and r-z geometries with insert boundaries optional. (Mr. R. Ackroyd, UKAEA Risley, United Kingdom).

5. SHREDI: A removal diffusion shielding code for x-y and r-z geometries. (Dottssa. A. Daneri, CNEN Bologna, Italy).

6. DOT-3: A multigroup two-dimensional discrete ordinates code with anisotropic scattering. (Dr. R. W. Roussin, Radiation Shielding Information Center, ORNL, USA).

7. MERCURE-4: Calculations of fast fluxes, gamma dose and heating in three dimensions by point kernel integration and Monte Carlo methods. (Dr. C. Devillers, CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, France).

VISITORS TO RSIC

Visitors to RSIC during the month of August were: W. D. Adams, USAEC, Oak Ridge, Tenn.; A. K. Addae, Howard University, Washington, D. C.; R. G. Dalton, University of Florida, Gainesville; L. T. Dillman, Ohio Wesleyan University, Delaware, O.; R. E. Denfeld and D. C. Kaul, Defense Nuclear Agency, Washington, D. C.; H. Feshbach, MIT, Cambridge, Mass.; H. Goldstein, Columbia University, New York; R. C. Haight, Lawrence Livermore Laboratory, California; C. R. Mehl, Sandia Laboratories, Albuquerque, N. M.; H. T. Motz, Los Alamos Scientific Laboratory, N. M.; R. J. Neuhold, USAEC, Washington, D. C.; I.Preda, Institute for Atomic Physics, Bucharest, Roumania; R. Protsik, General Electric, Sunnyvale, Calif.; G. Rausa, EPA/ORP/CSD, Rockville, Md.; A. H. Snell, ORNL; L. Stewart, Los Alamos Scientific Laboratory, N.M.; J. N. Wilson, Tacoma, Wash.

AUGUST ACCESSION OF LITERATURE

The following literature cited has been ordered for review, and that selected as suitable will be placed in the RSIC Information Storage and Retrieval Information System (SARIS). This early announcement is made as a service to the shielding community. Copies of the literature are not distributed by RSIC. They may generally be obtained from the author or from a documentation center such as the National Technical Information Service (NTIS), Department of Commerce, Springfield, Virginia 22151.

RSIC maintains a microfiche file of the literature entered into SARIS, and duplicate copies are 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.

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FOURTH INTERNATIONAL CONFERENCE ON REACTOR SHIELDING

PRELIMINARY TECHNICAL PROGRAM

Session A1: Practical Problems Encountered on Reactors
Chairman: M. P. Lafore

Investigation of the BN.600 Reactor Intravessel Shielding on the BFS.2 Rig. - M. Ya. Kulakovskii, V. I. Savitskii (USSR)

Shielding Concepts for the PHENIX Reactor - J. Culambourg, C. Devillers, A. Le Dieu de Ville, J. C. Nimal, J. Rastoin (France)

Shielding of Commercial Fast Reactors - K. W. Brindley (U.K.)

Shielding Problems in the PEC Reactor - G. Cicognani, R. Tavoni, N. Travaglini, M. Corbo, U. Farinelli, L. Tondinelli (Italy); U. Canali, R. Nicks, H. Penkuhn, C. Ponti (EURATOM)

Problems Posed by Shielding Specifications of a Large Fast Power Reactor - J. Moreau (France)

Gas-Cooled Fast Reactor Shield Design - D. Haschke, B. Ganapol, R. Henninger, C. Maeder (Switzerland)

Sessions A2 - A3: Design Criteria and Philosophy - Means for Dissemination of Information
Chairman: Pr G. Ghilardotti

The Effect of Primary Loops Activities on Reactor Shield Design - A. C. Whittier (Canada)

An Architect Engineer's Approach to BWR-Shield Design - H. Van Halem, R. Kuiken (Netherlands)

The Influence of Radiation Shielding Design and Construction on the Costs of Nuclear Power Stations - C. A. Benz (USA)

Radiation Shielding and Nuclear Engineering - C. Prouillac, J. Jegu, D. Maire, M. Poitou (France)

Monte Carlo Development and Applications in the Los Alamos Nuclear Rocket Program - C. W. Watson, E. D. Cashwell (USA)

Intermission

Shielding Characteristics of a Nuclear Powered Manned Space Station - V. Keshishian (USA)

Shielding Problems in Fusion Reactors - S. Blow, G. M. McCracken (U.K.)

The Radiation Shielding Information Center. A Unifying Force in the International Shielding Community - B. F. Maskewitz, R. W. Roussin, D. K. Trubey (USA)

The European Shielding Information Service (ESIS) - R. Nicks, C. Ponti (EURATOM)

Session B1: Recent Improvements in Methods for Solving Boltzmann Equation
Chairman: Dr. A. A. Abagyan

"Anatomy" of Radiation Transmission, Developed by a Semi-Analytical Simulation of Radiation Transport - G. G. Biro (USA)

Applications of the Transmission Matrix Methods in Gamma Ray Shielding Analysis - A. F. Rohach (USA)

Moments Method Calculations of Neutron and Gamma Ray Penetration in Bulk Media - G. L. Simmons, C. Eisenhauer, L. V. Spencer (USA)

Some Recent Advances in ASFIT - D. V. Gopinath, K. Santhanam, D. P. Burte (India)

Intermission

The Three-Dimensional, Multi-energy Monte Carlo Program TRIPOLI - S. Katz, J. C. Nimal, T. Vergnaud (France)

A Solution of the Coupled Integral and Differential Form of the Transport Equation Using a Legendre Polynomials Source Density Approximation in Angle and Space for Slab Geometry - J. Stepanek (Switzerland)

Discrete Ordinates Numerical Integration Method for Neutron Transport Equation in One and Two-Dimensional Geometries - K. Takeuchi, A Yamaji (Japan)

On the Use of New Modifications of Monte Carlo Methods for the Calculation of Differential Characteristics of Gamma Radiation Fields after the Reactor Shield - A. A. Victorov, V. G. Zolotukhin, V. A. Klimanov, V. A. Kochanov, A. I. Ksenofontov, V. P. Mashcovich, A. M. Panchenko, V. N. Sinyov (USSR)

Session B2: Computer Codes for Bulk Penetration, Shield Irregularities, Shield Optimization
Chairman: Dr. J. Butler

Development of Calculation Methods and Codes and Their Application to Space Reactor Shielding - E. Amin, G. Hehn, W. Klumpp, P. Rühle (Germany)

The Use of Modular Codes in a Unified Scheme of Shield Design Procedures for Commercial, Fast, and Thermal Reactor Plant - M. J. Grimstone, F. P. Youell, J. B. Spooner, I. Pugh (U.K.)

SHIELD: A Monte Carlo Program Designed to Study Neutron Transport in Slab Geometries on the PDP/9 (9/L) Computer - R. J. Adams, L. C. Henry, K. H. Lokan, R. W. Gellie, N. K. Sherman (Canada)

Interactive Computer Graphics Applied to Shield Design - A. J. H. Goddard, M. F. Wrigley (U.K.)

Shielding Optimization by Differential Dynamic Programming Method and Experiment - Y. Kanai, A. Yamaji, K. Takeuchi (Japan)

Intermission

Investigation of Spatial, Energy, and Angular Distributions of Radiation in Reactor Shields - A. A. Abagyan, L. P. Bass, T. A. Germogenova, S. F. Degtyarev, A. A. Dubinin, V. I. Zhuravlev, M. G. Kobozev, E. I. Kostin, V. V. Orlov, V. Ya. Pupko, A. P. Suvorov, V. V. Tarasov, V. A. Utkin, A. N. Khmylev, S. G. Tsypin, I. G. Yarmakhov (USSR)

A Modified Form of Diffusion Theory for Use in Calculating Neutron and Gamma-Ray Penetration in Practical Shields - D. E. Bendall, S. J. Cripps (U.K.)

Characteristics of Secondary Gamma Radiation from Heavy Component of Nuclear Reactor Shielding - A. A. Abagyan, Yu N. Vrazhnov, T. A. Germogenova, S. F. Degtyarev, A. A. Dubinin, V. I. Zhuravlev, Yu. A. Kazanskii (USSR)

Application of the Invariant Imbedding Method to the Penetration Problems of Neutrons - M. Nakai, I. Komatsu, Y. Sato, F. Noguchi, A. Shimizu, M. Hada (Japan)

Ray-Tracing Particle Attenuation by the Monte Carlo Method: The Three-Dimensional Program MERCURE 4 - C. Devillers, C. Dupont (France)

The Development of the Two-Dimensional Shielding Code "RASC-2D" and Its Application - Y. Tanaka, I. Suzuki, N. Otani (Japan)

Session C1: Shield Design
Chairman: Dr. G. Hehn

Practical Analysis of Primary Concrete Shield for a PWR - Shiaw-Der Su (USA)

Radiation Flux and Heating Levels in the HTGR - B. A. Engholm (USA)

Behavior of Reactor Shielding Materials Under Neutron Irradiation - M. Yvars, P. Degas, M. Quetier, G. Rousseau (France)

Special Properties of Shielding Concretes Which Affect Radiation Attenuation Processes - F. Dubois (France)

Choice of Characteristic Element Components in Concrete for Shielding Calculations on Biological Shields for Power Reactors - H. Schultz, H. G. Vogt (Germany)

Intermission

Streaming of Neutrons and Gamma Rays Along Reactor Coolant Pipes - E. Amin, G. Hehn, W. Zumach (Germany)

Heat Generation in Shield Layers of a High-Temperature Reactor - K. Hofmann, H. G. Wahsweiler, U. Weicht (Germany)

Reactor Shielding as a Source of Radiation - A. V. Bolshakov, V. G. Madeev, A. N. Rudakov, E. I. Uksusov (USSR)

Some Problems Associated with Calculating the On-Load Dose Rates on the Pile Cap of an Advanced Gas Cooled Reactor - L. M. C. Dutton (U.K.)

LMFBR Radiation Transport Analysis Using Coupled Discrete Ordinates Calculations - F. R. Mynatt, M. L. Gritzner, L. R. Williams, C. E. Clifford (USA)

Session C2: Problems Related to Reactor Plant Operation
Chairman: Dr. T. Fuse

In Situ Analysis of Shielded, Gamma Active Material Using a Ge (Li) Spectrometer - E. W. Spiers, J. R. A. Lakey (U.K.)

Calculation of the Radioactivity of the Loops in a High-Temperature Reactor - J. Brisbois, P. Beslu, A. L'Homme (France)

Access to the Pressure Vessel of a Direct Cycle BWR for Inspection and Maintenance - R. Hock, L. Seifferth (Germany)

Radioactivity and Shielding of the Argon Loop in a Fast Power Reactor - L. Costa (France)

Radioactivity of the Corrosion Products in the Primary (Loop) Water of the CHOOZ Reactor - G. Frejaville, M. Lott, A. Marchal (France)

Intermission

Continuous Monitoring of Damage Rates on the Tank of a Pressurized Water Reactor - C. Devillers, C. Dupont (France)

Shielding of the Manipulators and Auxiliary Loops of the PHENIX Reactor - J. Culambourg, B. Godot, J. Jegu (France)

Investigations Into the Gamma-Ray Attenuation in Concrete Shielding with Pipes (W. Futtermenger (Germany)

Present Design Methods of Gamma-Ray Shielding - N. Fourcade-Cancelle, L. Papot (France)

Investigations of Shielding Problems Arising from Modifications to Refuelling Machinery at Trawsfynydd Power Station - I. G. Pugh, R. S. Hoverd, A. F. Avery (U.K.)

Session C3: Test of Design Methods
Chairman: Dr. C. Clifford

Comparison of DINE Neutron Attenuation Calculations with Experimental Results for a Wide Variety of Simulated Concrete Configurations for a Fast and Thermal Reactor Spectrum - K. A. Verschuur (Netherlands)

Application of Diffusion and Transport Methods to Some Specific Problems of Reactor Shielding - V. Herrnberger, A. S. Tai, J. F. Zuber (Switzerland)

Control of Shield Design Calculations by Test Measurements in the Biological Concrete Shields of Three German Power Reactors - W. Futtermenger, G. Hecht, R. Hock, H. Schultz, H. G. Vogt, H. Weber (Germany)

A Neutron Shielding Study for a Heavy Water Pressure Tube Reactor - P. Boldori, M. Giorcelli (Italy); H. Lauer, R. Nicks, H. Penkuhn, G. Perlini, C. Ponti (EURATOM)

The Methods of Calculation of the Shielding of Graphite Gas Reactors. Comparison with Shielding Measurements During Physics Experiments of Start-up - J. Duco, J. Brisbois, F. Bourdeau, J. Chapus (France)

Intermission

The Exploitation of a Simplified Albedo Theory for Neutron and Gamma Ray Streaming in Practical Design Situations - P. C. Miller, A. Packwood (U.K.)

Three-Dimensional Analysis of the FTR Shield-Mockup Experiment - E. T. Boulette (USA)

Neutron Streaming Along the Penetration of Twice Bent Primary Sodium Pipe - O. Diettrich, A. Marchal, R. Nicks, G. Perlini (EURATOM); H. Vossebrecker (Germany)

Investigation of Neutron Spectra in Some Shielding Media - Yu. A. Egorov (USSR)

A Study on Shielding Effect of Gamma Rays by Ship Structure - K. Ueki, H. Yamakoshi (Japan)

Session D: Nuclear Data for Shielding
Chairman: Dr. R. Nicks

Data Activities of the Radiation Shielding Information Center - R. W. Roussin, D. K. Trubey, B. F. Maskewitz (USA)

Theoretical Studies of the Sensitivity of Neutron Transport in Iron to Cross Section Properties - H. Goldstein, L. J. Lidofsky, W. Preeg, E. Troubetzkoy, E. Oblow, J. Ching (USA)

The Probability Table Method for Handling Unresolved Resonances in Monte Carlo Calculations - L. B. Levitt (USA)

Anisotropy of Photon Emission in Transport Calculations - D. J. Dudziak, G. E. Bosler (USA)

On Shielding Calculations with Computer Files of Neutron Data - F. H. Fröhner, S. Valente (NEA/CCDN Saclay)

A Status Report on the Available Libraries of Nuclear Data for Shielding Calculations - J. J. Schmidt (IAEA/NDS Vienna)

Intermission

Panel Discussion
Chairman: Pr. H. Goldstein

Session E: Test of Exact Computational Methods and Data
Chairman: Dr. D. V. Gopinath

Experimental Verification of Neutron Transport Calculations in Sodium and Iron - C. E. Clifford, F. J. Muckenthaler, R. E. Maerker, M. L. Gritzner (USA)

Fast Neutron Spectra Measurements in Spherical Iron Assemblies - J. G. Williams, A. J. N. Goddard (U.K.)

Evaluation of Nuclear Data and Computational Methods for Iron as a Shield Material - B. K. Malaviya, N. N. Kaushal, M. Becker, A. Ginsberg, E. Burns, E. Gaerttner (USA)

Investigation of Intermediate Neutron and Capture Gamma-Radiation Propagation in Fast Reactor Shielding - V. V. Bolyatko, M. Ya. Kulakovskii, V. P. Maskovitch, B. I. Sinitsin, A. P. Suvorov, V. S. Troshin, S. G. Tsypin (USSR)

Intercomparison of Different Methods to Calculate Neutron Transport Along Sodium Ducts - E. Amin, O. Diettrich, W. Futtermenger, G. Hehn, F. Schmidt, H. Vogt, H. Vossebrecker (Germany)

Intermission

Comparison of New Transport Calculational Methods for Reactor Shield Design - B. Ganapol, V. Herrnberger, J. M. Paratte (Switzerland)

Comparison of One and Two-Dimensional Discrete Ordinates Calculations with Experimental Results (T. Fuse, A. Yamaji, T. Miura (Japan)

Benchmark Data for High Energy Gamma-Ray Penetration - G. B. Bishop, C. Smitton (U.K.)

Gamma-Ray Transport at 6 and 8 MeV - W. L. Thompson, L. A. Hassler, D. H. Risher, J. E. Rogers (USA)

General Conclusions of the Conference - Dr. J. Butler

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