The pursuit of truth shall set you free – even if you never catch up with it. — Clarence Darrow

6th ICRS Overview

What follows is a brief summary of the 6th Conference on Radiation Shielding as given by T. Asaoku (JAERI), T. Hyodo (Kyoto University), T. Suzuki (JAERI), and S. Kikuchi (Kyoto University).

INTRODUCTION

The Sixth International Conference on Radiation Shielding (ICRS) was held in Tokyo, Japan, May 16-20, 1983, under the sponsorship of Japan Atomic Energy Research Institute (JAERI), in cooperation with IAEA, OECD-NEACRP and American Nuclear Society (ANS) in addition to various Japanese supporting organizations, namely the Science and Technology Agency (STA), the Power Reactor and Nuclear Fuel Development Corporation (PNC), the Japan Nuclear Ship Research and Development Agency, the Federation of Electric Power Companies, Atomic Industry Groups, Construction Companies, Engineering Companies, Data Services Companies and the Atomic Energy Society of Japan.

As compared with the previous conferences in this series held about every 5 years, the conference name was changed from “Reactor Shielding” to “Radiation Shielding” because the activity area has become very wide to cover all radiation shielding. Accordingly, the scope of the conference was extended to comprise advances in shielding and radiation protection for fission, fusion, fuel handling, rad-waste and other related facilities. In addition, emphasis was put on practical aspects of shielding design, requirements for nuclear data, and occupational exposure problems in operating power reactors.

The conference was held in two meeting rooms with about 230 participants from 22 countries and 2 international organizations, namely Australia, Canada, China (RO), Denmark, Finland, France, Germany (FR), Hungary, India, Iran, Israel, Italy, Japan, Korea (RO), Libya, Poland, Sweden, Switzerland, Turkey, United Kingdom, United States, USSR, EC and OECD-NEA.

In the opening session of May 16, Y. Takaoka, Director General for Atomic Energy Bureau, STA, gave a talk under the title of “Current Status of the Development of Nuclear Energy in Japan,” following the opening address of H. Ishikawa, General Chairman of the Japanese Organizing Committee for the Sixth ICRS. At the luncheon of May 19, Betty F. Maskewitz, Director of the Radiation Shielding Information Center, ORNL, gave a speech titled “RSIC After 20 Years – A Look Back and a Look Ahead,” and in the closing session of May 20, J. Butler, Head of Radiation Physics and Shielding Group, AEE Winfrith, summarized the Sixth ICRS by utilizing notes written by session chairman (co-chairman) and proposed the next ICRS be held in Italy or the Federal Republic of Germany.

On May 23, technical visits were performed to the Mihama nuclear power plant of Kansai Electric Power Company, as well as to the Tokai Research Establishment of JAERI and the Oarai Engineering Center of PNC.

NUCLEAR DATA AND ANALYSIS METHODS

The need for transport-method development for 3-dimensional analyses urged in the Fifth International Conference on Reactor Shielding (ICRS) held in Knoxville, Tennessee, USA, in 1977, are going to be met with the development of discrete-ordinates codes and finite-element codes, while Monte Carlo codes are continuously updated to improve calculation effi-
ciency and to make better use of available nuclear data.

Concerning the nuclear data which have become necessary to seek improvements as the analysis methods have advanced, the result of the Specialists' Meeting on shielding benchmark calculations to compare the various in-house data sets was presented to emphasize the necessity for the use of coherent data. The use of sensitivity analysis has advanced from a theoretical status to an operational one.

As for cross-section data, major developments could be observed in the introduction of large fine-group libraries, the utilization of covariance information and the introduction of an adjusted multigroup library for LWR shielding.

Well-defined integral benchmark experiments have now become available for data and methods testing. In the analysis of these experiments, Monte Carlo methods with pointwise cross-section representation is going to be utilized in order to avoid an ambiguous interpretation of the results, especially for the improvements of nuclear data sets by using adjustment techniques.

**SHIELD DESIGNS**

The combined use of the discrete-ordinates method and the Monte Carlo method has given successful results for most of the shield designs for fission reactors (FFTF, PHENIX, French PWR and HEU). The AGR's design in the UK was performed with a combination of the removal-diffusion method and the Monte Carlo method, while for MONJU and MUTSU the discrete-ordinates method was mainly utilized. In addition, a practical example of the use of generalized perturbation methods was illustrated to optimize the material distribution in an LMFBR lateral shield.

For shield designs of fusion facilities, the 3-dimensional Monte Carlo method is necessary due to the complicated geometry and the requirement of a comparison of calculated results with experimental data. For US INTOR, French TORE SUPRA, and Japanese FER, the discrete-ordinates codes are utilized in combination with Monte Carlo codes, while in the UK only the Monte Carlo method is used for JET and for the neutral beam line of Culham Conceptual Tokamak Reactor MK-II. However, data and methods of nuclear design calculations for fusion reactors need to be verified by utilizing various integral experiments.

Radiation streaming, which was one of the major problems for LWRs in the last ICRS, has now come to be treated using discrete-ordinates codes and/or Monte Carlo codes for fission reactors. Contrary to the tendency to transfer from simple methods to 3-dimensional, sophisticated methods in the last conference, new simple and efficient methods are being developed to replace the direct use of discrete-ordinates or Monte Carlo codes. On the other hand, for the analysis of radiation streaming for fusion reactors, which significantly affects the reactor cost, personnel access and reactor operation, it has been pointed out that the utilization of transport codes using continuous-energy cross-section data may represent the only feasible approach.

It has been shown furthermore that radiation skyshine from fission reactors, accelerators and reprocessing installations can now also be analyzed successfully with discrete-ordinates methods or Monte Carlo methods. In addition, there were some presentations related to the optimization of shield designs under ALARA criteria.

**SHIELDING EXPERIENCE**

For the topic of radiation protection experience, the presentation was made on FFTF shielding measurements carried out prior to routine operation, shielding analyses of JOYO compared with the measured data, and radiation distributions in BWR drywells of CAORSO power station at the Hamaoka site. In addition, there were various presentations related to the optimization of shield designs under ALARA criteria.

Concerning the radiation exposure with operating reactors, most of the presentations dealt with the transport and deposition of fission, corrosion and activation products in the primary coolant systems of water- or gas-cooled reactors. However, no presentation was made on the contamination of the primary sodium system, which is of concern in fast breeder reactors.

As for the energy deposition for radiation damage, the presentation was related to an accurate prediction of the fracture toughness and embrittlement of irradiated pressure vessels, as well as the application of newly developed microcalorimeters for measuring energy-deposition rates in the mixed radiation fields.

Concerning radiation shielding for post-accident and decommissioning, there were presentations on shielding measures during the de-
commissioning of Otto Hahn and during the dismantling of the Niederaichbach nuclear power plant, and shielding requirements for the decommissioning of Windscale AGR. In addition, presentations were made on dose rate evaluations after accident in PWRs, safety analyses of spent fuel shipping casks and radioactive waste repository plants in mines.

**CONCLUSIONS**
The Sixth ICRS has shown that data and methods for radiation shielding have so advanced that it will now be possible to identify target accuracies in shielding. Accordingly, a recipe will be given to fill the gap between the present accuracy of nuclear data and the required value for achieving the target accuracies. On the other hand, accumulated information from operating facilities will now be used to reduce occupational exposure.

It is expected furthermore that radiation protection and shielding standards will be established as a result of these, with the help of the systematic development of shield optimization techniques. It may be worthwhile to note that for fusion reactor systems it is necessary first to validate a consistent set of shield design tools.

**RSIC ORIENTATION VISIT TO CHINA (PRC)**

Betty F. Maskewitz made an RSIC orientation visit May 23–June 3, 1983, to the People's Republic of China (ROC) hosted by the Institute of Atomic Energy (IAE), Academia Sinica. The invitation to visit ROC was extended as a result of RSIC's reputation and the presumed expertise of the RSIC director in radiation protection, transport, and shielding technical areas.

Betty was requested to lecture on the historical development and current methodology of shielding technology, the status of multigroup data generation and availability, and the concept, organization, and operation of information analysis centers. She also gave selected summaries of the state of the art as indicated by the coverage of the 6th ICRS. The host personnel (IAE, Beijing and visiting shielders) made technical presentations of their work and gave a tour of the IAE facilities.

During the visit, the agenda for IAE was condensed to allow for a day of CO₂ discussions in Beijing, a visit to the Beijing Institute of Nuclear Engineering (BINE), and a day at the 728 Research & Design Institute in Shanghai.

**ANS APPOINTS NEW STANDARDS STEERING COMMITTEE CHAIRMAN**

C. K. Soppet, Project Manager for Limerick Generating Station for Bechtel Power Corporation, San Francisco, has been appointed the 1983–84 American Nuclear Society (ANS) Standards Steering Committee Chairman.

A graduate of Michigan State University, Soppet began his nuclear career at Argonne National Laboratory in 1950. During the years since, he has been involved in a number of reactor projects, including the Materials Testing Reactor (MTR), the Submarine Test Reactor (STR), the Argonne Research Reactor, CP-5, at Argonne National Laboratory, and the Georgia Tech Research Reactor for General Nuclear Engineering. He became manager of Nuclear Operations for Aerojet General in 1963. His affiliation with Bechtel began in 1970 as project manager for both Peach Bottom Atomic Power Station and Limerick Generating Station, Philadelphia Electric Company projects.

Soppet is a past member of the ANS National Program Committee, and is a member of the Executive Committee of the Power Division as well as the Program and Public Information Committees of that division.

**DOT USERS ALERT (R-Θ CALCULATION OPTION)**

We have been informed of a bug in subroutine PCON of the DOT two-dimensional discrete ordinates transport code system. The problem, not thought to be serious for most practical problems, will cause erroneous results for the most backward-directed angular fluxes computed in runs using R-Θ geometry. The problem affects all versions of CCC-276/DOT 3.5, CCC-320/DOT 4.2, and CCC-429/DOT 4.3, and we are in the process of making appropriate updates. The coding change is minor and details will be provided upon request from RSIC to DOT users wishing to update their own source code.

**CHANGES TO THE COMPUTER CODES COLLECTION**

During the month a new code package was added to the RSIC Computer Codes Collection, an existing code package was replaced with a new version, and an existing package was updated to add new options.

**CCC-200/MCNP**

This general purpose, continuous-energy, gener-
alized geometry, time-dependent, coupled neutron-photon Monte Carlo transport code was contributed by Los Alamos National Laboratory, Los Alamos, New Mexico. This version replaces the previously existing CCC-200/MCP.

The code system treats an arbitrary three-dimensional configuration of materials in geometric cells bounded by first- and second-degree surfaces and some special fourth-degree surfaces. Pointwise cross-section data are used. For neutrons, all reactions in a particular cross-section evaluation are accounted for. For photons, the code takes account of incoherent and coherent scattering, fluorescent emission following photoelectric absorption, and absorption in pair production with local emission of annihilation radiation.

This package is based on MCNP version 3 which is now under trial usage in-house at LANL. Potential users are encouraged to acquire the package now to gain experience in its use. It allows the user to derive a given hardware version from a master source using a special conversion routine, PRPR. It is expected that this initial release will provide feedback which will allow the contributors and RSIC to collect indicated revisions over the next few months. This feedback from the user community in general and from in-house use at LANL is expected to result in an update on a 6- to 12-month time frame. Reference: “MCNP - A General Monte Carlo Code for Neutron and Photon Transport,” informal report (April 1981). FORTRAN 77; IBM 3033 (A), CRAY 1 (B), VAX 11 (C), CDC 7600 (D).

CCC-203/MORSE-CG

All versions of this Monte Carlo multigroup neutron and gamma-ray transport code package were updated to add new options to the package. The new options include a Klein-Nishina estimation capability and are explained in detail in the new MORSE report, ORNL-4972-R1 which was added to the CCC-203 package documentation. FORTRAN IV; UNIVAC 1108 (A), CDC 6600 (B), and IBM 360 (C).

CCC-446M/TWOGE

This two-group, one-dimensional neutron diffusion code system was contributed by Pennsylvania State University, University Park, Pennsylvania. Written for use on an APPLE computer to perform various reactor calculations, TWOGE is based upon the solution of the one-dimensional neutron diffusion equation. The input data can be either typed in through the keyboard or read in from the data file which has previously been generated and saved on the diskette by the program. The system can handle 1 or 2 groups, up to 200 mesh points and up to 5 regions. The main features of the program are:

a) choice of three geometries;
b) calculation of the fluxes and multiplication factor;
c) plotting of the flux shapes on the TV screen;
d) one-iteration problems; and
e) choice of one of nine possible sets of boundary conditions.

Reference: Thesis from Pennsylvania State University (January 1983). BASIC; APPLE II.

PERSONAL ITEMS

In serving a specialized area of scientific endeavor, it seems important that we take note of the movement of people concerned with radiation protection, transport, and shielding in the nuclear industry. We, therefore, continue to carry personal items as they are brought to our attention. During the past month we have been informed of the following changes: Fred Welfare, and Harry W. Webb, from Babcock and Wilcox, to General Electric Co., Wilmington, North Carolina; William A. Reiners, from Dartmouth College, Hanover, New Hampshire, to the University of Wyoming, Laramie, Wyoming; M. A. Babroo, from the University of Dundee, United Kingdom, to Alwas, Iran; and Frank Dombek, from Cygna Corporation, Solana Beach, California, to Cygna Energy Service, San Diego, California. Henry C. Honeck, a principal in the initial establishment of the ENDF/B Nuclear Data System at Brookhaven National Laboratory and the development of the modular code system JOSHUA at Savannah River Laboratory, is now head of Computer Application Technology, Inc., Aiken, South Carolina.

Nicholas Tsoulfanidis has been appointed chairman of the Nuclear Engineering Department of the University of Missouri-Rolla.

Renken Named Manager of SNL Radiation Effects

The newly created Radiation Effects Department of Sandia National Laboratories will be managed by James H. Renken.

The mission of the department is to provide information about radiation environments and their effects on Sandia-designed nuclear weapons hardware. This will
be done by using a combination of radiation transport
analysis and other computational modeling, and
radiation effects experimentation.

Since first joining a nuclear weapons effects group at
Sandia in 1964, Renken has worked as supervisor of the
Calculational Physics Division, the Hostile Environ-
ments Division, and most recently in the Radiation Ap-
plication Division.

Renken holds BS and MS degrees in physics from
Ohio State University and a PhD in physics from the Cal-
fornia Institute of Technology, and is a member of the
American Physical Society and the American Nuclear
Society.

VISITORS TO RSIC

During the month of July the following eight persons
came to visit/use EPIC facilities: Huan-Tong Chen,
Univ. of Tennessee, Knoxville, Tennessee; Takashi
Maruyama, National Institute of Radiological Sciences,
Japan; Dennis Keefer and Monty Smith, Univ. of Ten-
sessee Space Institute, Tullahoma, Tennessee; John C.
Garth, Hanscom Air Force Base, Massachusetts;
Hsing-chow Huang, Raytheon, Sudbury, Massachu-
setts; John Holleib, Sandia National Laboratories, Al-
buquerque, New Mexico; and Horst P. Bruemmer,
Ingenieuresellschaft fur Nuklearschutz, Munchen,
Federal Republic of Germany.

UPCOMING CONFERENCES, COURSES, AND
SEMINARS

Note the following events of interest to the radiation
shielding community.

Annual Waste Management Meet Set

A call for papers has been issued for Waste Manage-
ment (WM) '84, a symposium to be held March 11-15,
1984, in Tucson, Arizona. The conference is sponsored
by the University of Arizona, U.S. Department of Ener-
gy (DOE), the American Nuclear Society (ANS), and
the American Society of Mechanical Engineers Radwaste
Systems Committee.

The topics selected for WM '84 will have both invited
and contributed papers on State, DOE/Contractor, Regu-
lar and Congressional Perspectives on Progress in
Screening and Site Characterization for HLW Reposi-
tories; HLW/Spent Fuel — Storage vs. Disposal Under the
NWPA of 1982, Economics of Fuel Cycle and Waste
Management Systems; "Demonstrated" Disposal — What Is It?; Status of Defense Waste Disposal Plan and
Related Projects (TMI and West Valley); Repository
Construction — Standards and Criteria, Equipment and
Operating Systems; Socio-Economic Impacts of HLW
Repositories; Regional Plans for the Storage and Dis-
posal of LLW; Economic Impact of 10CFR81; Corrosion
of Waste Packages; Operating Experience with Ad-
vanced Volume Reduction Techniques; Radwaste Sys-
tem Modifications at Nuclear Power Plants; and Inter-
national Programs, an Update.

Titles and abstracts (about 500 words) of contributed
papers should be submitted, with three copies, by
September 20, 1983, to the Technical Program
Chairman, M. E. Wacks, or to the Publications Chair-
man, J. G. McCay, Department of Nuclear and Energy
Engineering, University of Arizona, Tucson, Arizona,
85721. Authors will be notified of paper acceptance by
November 1, 1983. Completed papers are required by

5th ASTM-EURATOM Dosimetry Conference
Planned

A call for papers has been issued for the 5th ASTM-
EURATOM Symposium on Reactor Dosimetry to be
held at GKSS Research Centre in Geesthacht (near
Hamburg), Federal Republic of Germany, on September
24-28, 1984. This 5th ASTM-EURATOM meeting is
sponsored by: Commission of the European Communi-
ties, ASTM Committee E-10 on Nuclear Technology
and Applications, U.S. DOE, U.S. Nuclear Regulatory
Commission (NRC), and the U.S. Electric Power Re-
search Institute (EPRI), all in cooperation with the In-
ternational Atomic Energy Agency (IAEA). The sympo-
sium is organized into oral presentations, poster
sessions, and workshops.

The theme of the symposium is radiation metrology
techniques, data bases, and standardization. Emphasis
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 Uncertainty Analysis, Reactor
Fields and Calibration Procedures, Nuclear Data Needs
and Problems, Metrology Techniques (new develop-
ments and improvements), Radiation Damage Correla-
tions and Analysis, Techniques, Nuclear Heating and
Gamma-Ray Dosimetry, Neutron and Gamma-Ray
Transport Calculations, and LWR Surveillance.

Simultaneous interpretation of the oral presentations
will be provided in English, French, and German.

Prospective authors should send four copies of a
150-250-word abstract to the applicable program com-
mittee secretary by December 1, 1983. The program
committee secretary for authors from Japan and the
United States is F. F. Norris, Southwest Research Insti-
tute, P.O. Drawer 26510, San Antonio, Texas 78264
USA. All other authors should send their abstracts to H.
Kotter, Joint Research Centre, Petten Establishment,
HFR Division, Postbus 2, 1755 ZG Petten (N. H.), The
Netherlands.
Notification of acceptance or rejection will be made by March 8, 1984. Authors of those papers accepted will be asked to provide 125 copies of their papers, in final form, for distribution at the opening of the symposium.

Calendar

Your attention is called to the following additional events.

September 1983

International Conference on Numerical Methods in Nuclear Engineering, September 6–9, 1983, Montreal, Quebec, Canada, sponsored by the Nuclear Science and Engineering Division, Canadian Nuclear Society. Contact: Ricardo A. Bonalumi, Nuclear Studies & Safety Dept., H16 H17, Ontario Hydro, 700 University Ave., Toronto, Ontario, Canada MSG 1X6 (phone 416-592-7026).

Environmental, Safety and Health Considerations Associated with Fusion Energy Systems Seminar, September 14, 1983, Germantown, Maryland. Contact: Boyd Shultz, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN 37830 (phone 615-576-3406).


11th Regional Congress of the International Radiation Protection Association: Recent Developments and Trends in Radiation Protection, September 20–24, 1983, Vienna, Austria, co-sponsored by the Austrian Association for Radiation Protection. Contact: A. Hefner, Congress Secretary, c/o Österreichischer Verband für Strahlenschutz, Lenaugasse 10, A-1082 Vienna, Austria.


October 1983

23rd National Congress of the Italian Radiation Protection Association, October 5–8, 1983, Capri, Italy. Contact: A. Moccaldi, CNR, Via Serchio 8, I-00198 Rome, Italy.

Environmental Transfer to Man of Radionuclides Released from Nuclear Installations, a seminar, October 17–21, 1983, Brussels, Belgium, sponsored by the International Atomic Energy Agency. Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

Neutron Exposure and Radiological Protection – Some Limitations, October 18, 1983, London, United Kingdom, sponsored by the Society for Radiological Protection. Contact: J. H. Martin, Dept. of Medical Biophysics, Blackness Laboratory, University of Dundee, Dundee DD1 4HN, Scotland, United Kingdom.


Transport of Radioactive Materials by Post, a seminar, October 24–27, 1983, in Vienna, Austria, sponsored by the International Atomic Energy Agency. Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.


Atmospheric Radiation, October 31–November 3, 1983, Baltimore, Maryland, sponsored by the American Meteorological Society. Contact: American Meteorological Society, 45 Beacon Street, Boston, MA 02108, USA.

November 1983

Radiation Protection in Exploration, Mining and Milling of Radioactive Ores for Developing Countries in Africa, a seminar, November 14-25, 1983, in Libreville, Gabon, sponsored by the International Atomic Energy Agency. Contact: Conference Service Section, IAEA, P.O. Box 100, A-1400 Vienna, Austria.

December 1983


January 1984

Workshop on Nuclear Model Computer Codes, January 16-February 3, 1984, Trieste, Italy, sponsored by IAEA. Contact: International Centre for Theoretical Physics, Workshop of Nuclear Model Computer Codes, P.O. Box 586, I-34100 Trieste, Italy (phone 224281-6).

April 1984


May 1984

6th Congress of the International Radiation Protection Association, and Exhibition, May 7-12, 1984, Berlin, West Germany. Contact: R. Neider, Bundesanstalt für Materialprüfung (BAM), Under den Eichen 87, D-1000 Berlin 45.

June 1984


July 1984


October 1984

Clinical Radiophysics, a symposium sponsored by the Clinical Radiophysics Section of the Society for Medical Radiology of the German Democratic Republic, October 28-November 1, 1984, Binz (island Rügen, German Democratic Republic). Contact: Dr. sc. techn. Manfred Tautz, 1115 Berlin-Buch, Wiltenbergstrasse 50, Staatliches Klinikum Buch, Spezialabteilung Strahlenphysik, German Democratic Republic.

November 1984


JULY 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 22161.

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.

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