Tenth International Symposium on REACTOR DOSIMETRY
September 12-17, 1999 Osaka, JAPAN

Final Program
And
Book of Abstracts
INTRODUCTION

The symposia in this series are organized to provide a forum for the interchange of techniques, data bases, and standardization of nuclear radiation metrology. The symposium will be of value to those involved in nuclear reactor radiation dosimetry, including researchers, manufacturers, and representatives from industry, utilities, and regulatory agencies.

The theme of the symposium is dosimetry for the assessment of irradiated reactor materials and reactor experiments. Papers will be presented in the following areas:

- Characterization of neutron and gamma-ray environments
- Dosimetry techniques, new developments, and optical methods
- Data evaluation procedures and uncertainty analysis
- Radiation monitoring of irradiation experiments
- Damage correlation and exposure parameters
- Nuclear data, benchmarking, calibrations, and standards
- Neutron and gamma-ray transport calculations
- Reactor surveillance and plant-life management
- Dosimetry for core characterization for reactor physics
- Assessment of dose for decommissioning of reactor components
- Dosimetry for assessment of reactor structural materials
- Fusion and high-energy neutrons
- Advanced neutron sources (reactors and accelerators)
- Irradiation processing and testing of electronics

The symposium program includes oral sessions, poster sessions, workshops, and tutorials. Except for the workshops and tutorials, there are no parallel sessions.

The symposium series is organized jointly by Committee E-10 of the American Society for Testing and Materials (ASTM) and the European Working Group on Reactor Dosimetry (EWGRD). The first symposium in this series, formerly called the ASTM-Euratom Symposia on Reactor Dosimetry, was held in 1975 at the Joint Research Centre in Petten, The Netherlands. Subsequent symposia were held in 1977 in Palo Alto (hosted by the Electric Power Research Institute), in 1979 at the Joint Research Centre in Ispra, Italy, in 1982 at the US National Bureau of Standards (now the National Institute for Standards & Technology) in Washington, DC, in 1984 at the GKKS Research Center in Geesthacht, Germany, in 1987 at Jackson Hole, Wyoming, in 1990 in Strasbourg, France, in 1993 at Vail, Colorado, and in 1996 in Prague, Czech Republic. The 1999 Osaka Symposium represents the first time that this meeting has been held outside of Europe or the United States.

The Osaka Symposium is jointly sponsored by the Atomic Energy Society of Japan, ASTM, and EWGRD. The symposium is held in co-operation with the International Atomic Energy Agency, and co-sponsors include the US Department of Energy, US Nuclear Regulatory Commission, the Electric Power Research Institute, the US National Institute of Standards & Technology, the Institute of Electrical and Electronics Engineers, the American Nuclear Society, the American Physical Society, Studiecentrum voor Kernenergie/Centre d’Etude de l’Energie Nucleaire, the Chinese Nuclear Society, and the Korean Nuclear Society. Local sponsorship is provided by the following Japanese organizations: the Ministry of International Trade and Industry, the Science and Technology Agency, Japan Atomic Energy Research Institute, Japan Nuclear Cycle Development Institute, the Japan Society of
Applied Physics Division of Radiation Science, Thermal and Nuclear Power Engineering Society, Nuclear Power Engineering Corporation, Research Association for Nuclear Facility Decommissioning, the Federation of Electric Power Companies, Central Research Institute of the Electric Power Industry, the Japan Atomic Industry Forum, the Japan Electrical Manufacturers Association, the Japan Electric Association, the Japan Welding Engineering Society and Japan Power Engineering and Inspection Corporation.

The officers of the Organizing Committees for the Tenth International Symposium on Reactor Dosimetry are: Dr. Frank H. Ruddy, Symposium Chairman; Professor John G. Williams, Program Committee Chairman; Dr. David W. Vehar, Symposium Secretary; Dr. David M. Gilliam, Program Committee Vice Chairman; Dr. James M. Adams, Poster Sessions Chair; Ms. Mary Helen Sparks, Workshop Sessions Chair; Professor Itsuro Kimura, Local Organizing Committee Chairman; Professor Katsuhei Kobayashi, Local Organizing Committee Secretary; Dr. Pierre D’hondt, EWGRD Programme Chairman; and Dr. Hamid Ait Abderrahim, EWGRD Programme Secretary. The Chairman of ASTM Committee E-10 is Dr. Patrick J. Griffin. We are grateful to the following committee members for their invaluable assistance in all aspects of the organization of the Osaka symposium:

ASTM Symposium Committee - Dr. Dale E. Alexander, Dr. Richard Cacciapouti, Dr. Jonghwa Chang, Dr. Harry Farrar IV, Mr. Arnold H. Fero, Dr. T. Michael Flanders, Dr. Larry R. Greenwood, Professor Alireza Haghighat, Mr. Michal Herman, Dr. Yujiro Ikeda, Dr. E. Parvin Lippincott, Mr. Arthur L. Lowe, Jr., Professor Masaharu Nakazawa, Dr. Bojan Petrovic, Ms. Felicia Quinzi, Dr. Igor Remec, Mr. Doug Selby, Dr. Roger Stoller, Professor James F. Stubbins, Mr. Soju Suzuki, Professor J. J. Wagschal, Dr. Charles A. Wemple, and Dr. Pan Zi Qiang.

EWGRD Programme Committee - Mr. Alain Alberman, Mr. Bertram Boehmer, Dr. Ferenc Hegedus, Dr. Krassimira Ilieva, Mr. Trevor Lewis, Mr. Henk Nolthenius, Dr. Bohumil Osmera, Mr. Tom Serén, Mr. Willem P. Voorbraak, Dr. Sergei Zaritsky, and Mrs. Eva M. Zsolnay.

Local Organizing Committee - Mr. Kazuo Nakatsuka, Mr. Ichiro Kobayashi, Mr. Yoshikazu Tsuchihashi, Dr. Kiyoto Aizawa, Professor Yoshiaki Fujita, Dr. Toru Hiraoka, Mr. Yoshimitsu Kajii, Mr. Mitsuhiro Yokote, Mr. Morio Makiguchi, Dr. Yoshiaki Makihara, Dr. Hiroyuki Matsuura, Mr. Akiyoshi Minematsu, Professor Chizuo Mori, Mr. Nobuo Nagai, Professor Takashi Nakamura, Professor Masaharu Nakazawa, Mr. Nagao Ogawa, Dr. Sinzo Saito, Mr. Suguru Sakamoto, Mr. Tasuku Shimizu, and Professor Akiti Takahashi. The Local Organizing Committee Internet Page was assembled by Dr. Chihiro Ichihara.

We thank all of these members for their contributions to the success of the Tenth International Symposium on Reactor Dosimetry.
**SYMPOSIUM SCHEDULE**

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>Sun. Sept. 12</td>
<td>17:30-21:00</td>
<td>Registration &amp; Welcome drink at Nakanoshima Plaza (room COSMO)</td>
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<tr>
<td>Mon. Sept. 13</td>
<td>08:00-08:30</td>
<td>Registration at RIHGA ROYAL NCB</td>
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<tr>
<td></td>
<td>08:30-08:50</td>
<td>Opening Session</td>
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<td>08:50-10:20</td>
<td>Keynote Session</td>
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<td>10:20-10:40</td>
<td>“Coffee Break”</td>
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<td></td>
<td>10:40-12:40</td>
<td>Oral Session 1</td>
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<td>12:40-14:00</td>
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<td></td>
<td>14:00-16:10</td>
<td>Poster Session A</td>
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<td>15:50-16:10</td>
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<td></td>
<td>16:10-18:10</td>
<td>Tutorial Sessions A &amp; B</td>
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<tr>
<td>Tue. Sept. 14</td>
<td>08:30-10:30</td>
<td>Oral Session 2</td>
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<td>10:30-12:40</td>
<td>Poster Session B</td>
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<td>12:40-14:00</td>
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<td>16:00-18:00</td>
<td>Workshop Session I</td>
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<td>Wed. Sept. 15</td>
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<td>10:30-12:30</td>
<td>Workshop Session II</td>
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<td>Afternoon</td>
<td>Social Event</td>
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<td>Thu. Sept. 16</td>
<td>08:30-10:30</td>
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<td>10:30-12:40</td>
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<td>12:40-14:00</td>
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<td>Fri. Sept. 17</td>
<td>08:30-10:50</td>
<td>Oral Session 7</td>
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<td>11:10-12:40</td>
<td>Closing Session</td>
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**SYMPOSIUM ROOM ASSIGNMENTS:**

1) Registration on Sunday 12 Sept. Room “COSMO” of Nakanoshima Plaza
2) Registration on Monday 13 Sept. Lobby (2nd floor) of RIHGA ROYAL NCB
3) Presentations through Mon. to Fri. Room “MATSU” of RIHGA ROYAL NCB
4) Banquet on Thursday 16 Sept. “HIKARI Hall” of Nakanoshima Plaza
5) Workshops Rooms “MATSU”, “HANA” and “TSUKI”
6) Tutorials Rooms “HANA” and “TSUKI”

All rooms are in the RIHGA ROYAL NCB
6-2-27, Nakanoshima, Kita-ku, Osaka 530-0005, JAPAN
Telephone: +81-6-6443-2251
Fax: +81-6-6445-2755
# SYMPOSIUM SOCIAL/COMPANIONS PROGRAM

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
<th>Location</th>
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<tbody>
<tr>
<td>Sun.</td>
<td>17:30-21:00</td>
<td>Registration</td>
<td>Nakanoshima Plaza (room COSMO)</td>
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<td>Welcome drink</td>
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<tr>
<td>Mon.</td>
<td>08:00-08:30</td>
<td>Registration</td>
<td>RIHGA ROYAL NCB</td>
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<td>16:10-18:30</td>
<td>Tutorial sessions A and B</td>
<td>HANA, TSUKI</td>
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<td>at the RIHGA ROYAL NCB</td>
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<tr>
<td>Tue.</td>
<td>08:30-18:00</td>
<td>Companion program</td>
<td>Ikebana (flower arrangement)</td>
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<td>Ocha-kai (tea ceremony)</td>
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<td>Wed.</td>
<td>12:30-18:30</td>
<td>Symposium tour</td>
<td>Sightseeing in Nara</td>
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<td>Thu.</td>
<td>Afternoon</td>
<td>Companion program</td>
<td>Sightseeing/Short Tours</td>
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<td>18:30-21:00</td>
<td>Banquet</td>
<td>Nakanoshima Plaza (Hikari Hall)</td>
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<tr>
<td>Sat.</td>
<td>08:30-18:00</td>
<td>Optional tour</td>
<td>Sightseeing in Kyoto</td>
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## TECHNICAL SESSION SCHEDULE

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<thead>
<tr>
<th>Time</th>
<th>Mon</th>
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<th>Thu</th>
<th>Fri</th>
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<tr>
<td>8:00am</td>
<td>Registration</td>
<td>Oral Session 2 Test Reactors &amp; Accelerators</td>
<td>Oral Session 4 Cross Sections &amp; Nuclear Data</td>
<td>Oral Session 5 Calculations &amp; Adjustment Methods</td>
<td>Oral Session 7 Experimental Techniques</td>
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<td>5 papers</td>
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<td>7 papers</td>
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<td>10:20am</td>
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<td>11:10am</td>
<td>Power Reactor Surveillance</td>
<td>Poster Session B</td>
<td>Workshop Session II</td>
<td>Poster Session C</td>
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<td>12:30pm</td>
<td>[12:40] Lunch</td>
<td>[12:40] Lunch (Packed Lunch)</td>
<td>[12:40] Bus Departure</td>
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<td>2:00pm</td>
<td>[2:00] Poster Session A</td>
<td>[2:00] Oral Session 3</td>
<td>Afternoon Social Visit to Nara</td>
<td>[2:00] Oral Session 6</td>
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<td></td>
<td>2 hr 10 min</td>
<td>Benchmarks &amp; Intercomparison</td>
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<td>Damage Correlation</td>
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<tr>
<td>4:10pm</td>
<td>Tutorial Session I</td>
<td>Workshop Session I</td>
<td>Workshop Session III</td>
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<td>6:10pm</td>
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TECHNICAL SESSIONS

Sunday, September 12

5:30-9:00pm  REGISTRATION and WELCOME DRINK
Nakanoshima Plaza (room COSMO)

Monday, September 13

8:00am  REGISTRATION
RIHGA ROYAL NCB

8:30am  OPENING SESSION  RIHGA ROYAL NCB (room MATSU)
Chaired by  F. Ruddy, Symposium Chairman, and
I. Kimura, Local Organizing Committee Chairman

8:50am  KEYNOTE SESSION  (room MATSU)
Chaired by  P. D’hondt, EWGRD Program Chairman, and
J. Williams, ASTM Program Chairman

8:50am  paper K.01  What Do We Need Dosimetry For ?
R. Gerard and S. M. Zaritsky

9:20am  paper K.02  ASTM Standards for Reactor Dosimetry and Pressure Vessels Surveillance
P. J. Griffin

9:50am  paper K.03  Developments in Reactor Dosimetry in Japan
I. Kimura

10:20am  BREAK

ORAL SESSION 1  DOSIMETRY FOR POWER REACTOR SURVEILLANCE  (room MATSU)
Chaired by  E. P. Lippincott and B. Ošmera

10:40am  paper 1.01  French PWR Pressure Vessel Surveillance Program Dosimetry: An Experience Concerning More Than
One Hundred Capsules
D. Beretz, C. Brillaud, C. Destouches and S. Saillet

11:00am  paper 1.02  Reactor Pressure Vessel Neutron Dosimetry Assessments for UK PWR Plant
D. A. Thornton, T. A. Lewis, J. R. Mossop and S. A. Haddock

11:20am  paper 1.03  Lessons Learned on Reactor Vessel Dosimetry Issues
L. Lois and J. Carew

11:40am  paper 1.04  Assessment of Neutron Fluence Uncertainty and its Impact on Safety Issues
E. P. Lippincott

12:00pm  paper 1.05  Review of Problems and Requirements in VVER Reactor Type Pressure Vessel Dosimetry
S. Zaritsky, B. Ošmera, P. Platonov, and V. Valenta

12:20pm  paper 1.06  Overview of the Surveillance Dosimetry Activities in Ukraine
V. N. Bukanov, V. L. Dyemokhin, V. I. Gavriljuk, A. V. Gritzenko, O. V. Nedyelin and E. G. Vasylyeva

12:40pm  LUNCH
POSTER SESSION A (room YODO)
Chaired by S. Suzuki

POWER REACTOR SURVEILLANCE
TEST REACTORS AND ACCELERATORS
BENCHMARKS AND INTERCOMPARISONS

POWER REACTOR SURVEILLANCE
PA1.01 Improved Evaluation of the Atucha-I Ex-vessel Dosimetry
   F. Albornoz, H. Blaumann, E. M. Lopasso, A. Blanco, G. Gennuso and O. Serra
PA1.02 Reactor Dosimetry in the Surveillance Program of Kozloduy NPP Reactor Pressure Vessels
   K. Ilieva, T. Apostolov, S. Belousov and M. Monev
PA1.03 Evaluation of the Reactor Dosimetry Results Obtained During the First 10 Years of the RPV Surveillance Programme at the NPP Paks
   E. M. Zsolnay, E. J. Szondi and F. Osvald
PA1.04 Neutron Dosimetry for VVER Reactor Pressure Vessels and Integrity Assessment in Czech Republic
   M. Brumovsky, O. Erben, B. Ošmera and J. Hógel
PA1.05 Analysis of Pressure Vessel Surveillance Dosimetry Inserted into Korean PWR
   C.-S. Gil, J.-D. Kim and J. Chang
PA1.06 Integrity Assessment for Aging Reactor Vessel of Japan's First Generation PWR Plants
   T. Sato, S. Shiota and A. Kusuki
PA1.07 Measurement of Neutron Flux Density of TOKAI Power Station
   M. Nakazawa, T. Yamamoto and M. Shirakawa
PA1.08 The Impact of the ENDF/B-VI Cross Sections on the Flux and dpa Attenuation in RPV Walls and on the RPV Fluence Determination
   I. Remec
PA1.09 Factors Affecting Predicted Neutron Dose Rates to Steel Pressure Vessels of Magnox Plant
   D. A. Thornton
PA1.10 The Attenuation of Neutron Dose Rates through the Steel Pressure Vessels of Magnox Power Plants
   A. L. Fletcher, J. R. Mossop and C. J. Page
PA1.11 Assessment of Activation of Concrete Wall for Decommissioning of Nuclear Power Plants
   T. Matsumura, T. Hattori and T. Kawabe
PA1.12 Use of SSTRs and a Multi-Component Shield Assembly to Measure Radiation Penetrating the Reactor Biological Shield in the Presence of Radiation Streaming from Other Sources
   A. H. Fero

TEST REACTORS AND ACCELERATORS
PA2.01 The Irradiation Characteristics of the KUR Heavy Water Facility -- Neutron Energy Spectra for Several Irradiation Modes
   T. Kobayashi, Y. Sakurai and K. Kobayashi
PA2.02 Radiation Dosimetry at the BNL High Flux Beam Reactor and Medical Research Reactor
PA2.03 Measurement of Neutron Spectra at HANARO
   U. Hong, H. Kang, C. G. Seo and Y. Kang
PA2.04 Detailed Neutron Dosimetry and Damage Analysis in Steel Irradiation Test Experiments - The Powerful Tool of Combining Measurements and 3D Neutron Transport Calculations
   W. P. Voorbraak, W. E. Freudenreich and D. J. Ketema
PA2.05 Characterization of Neutron Field for Stainless Steel Irradiation Experiments in JMTR
S. Shimakawa

PA2.06 Assessment of the Fission Power Level in Fuel Rods Irradiated in the High Flux Materials Testing Reactor BR2 with the Aid of Fluence Dosimetry. Comparison with Other Methods
Ch. De Raedt, E. Malambu and S. Bodart

PA2.07 Local Changes of Neutron Spectrum in the Fast Reactor BOR-60 for Expansion of Research Tasks
A. I. Tellin and I. Yakovleva

PA2.09 Neutron fluxes and Spectra Measurement at TAPIRO Fast Source Reactor Using Unfolding Techniques
M. Angelone, F. Cavallari, A. Festinesi and G. Rosi

PA2.10 Improvement of Reactor Dosimetry for Irradiation Tests in the Experimental Fast Reactor JOYO

PA2.11 Transmutation Process Usage for Thermal and Epithermal Neutron Fluence Estimation in Intensive Neutron Flux
N. V. Markina, D. K. Ryazanov, G. A. Shimansky and H. E. Lebedeva

PA2.12 Database of Russian Research Reactors Neutron Spectra

PA2.13 Estimation of Low Level Neutron Doses Based on Neutron Spectra in the Vicinity of Nuclear Reactor
I. Urabe, H. Sagawa, Y. Ogawa, T. Osawa, K. Kobayashi, T. Yoshimoto and T. Tsujimoto

PA2.14 Future Plan on Neutron Source in Kyoto University Research Reactor Institute (KURRI)
S. Shiroya, H. Unesaki, Y. Kawase and H. Moriyama

BENCHMARKS AND INTERCOMPARISONS

PA3.01 Dosimetry Benchmark Experiment in LR-0 for WWER-1000/320 Reactor Type
B. Ošmera and S. Zaritsky

PA3.02 Benchmark Experiments on the KORPUS Facility
N. Markina, V. Tsikanov, S. Zaritsky and H. Ait Abderrahim

PA3.03 Monte Carlo Calculations of Neutron Fluence Spectra, Activation Measurements, Uncertainty Analysis and Spectrum Adjustment for the KORPUS Dosimetry Benchmark
H. U. Barz, B. Böhmer, J. Konheiser and I. Stephan

PA3.04 Actual and Potential Measurements of Fission-Rate-Ratios in the NIST Iron Sphere
R. L. Perel, J. J. Wagschal and Y. Yeivin

PA3.05 Recommendations for PCA and PSF Benchmark Data in Light Water Reactor Pressure Vessel Surveillance
R. Gold

PA3.06 Adjustment of the $^{235}\text{U}$ Fission Spectrum
P. J. Griffin and J. G. Williams

PA3.07 PCA and HBR-2 Benchmarks for Qualification of Pressure Vessel Fluence Calculational Methodology
I. Remec

PA3.08 Analysis of the ORNL PCA and VENUS Benchmarks Using TORT and BUGLE-96
A. H. Fero, S. L. Anderson and G. K. Roberts

PA3.09 Development of Intermediate Neutron Fluence Standard by Using Several Methods
N. Takeda, K. Kudo, M. Fujihiro, K. Okamoto, K. Kobayashi and S. Yoshimoto
A Study on 14 MeV Neutron Beam Characteristics and its Applications
H. Sakane, Y. Uno, F. Maekawa, Y. Kasugai, C. Konno, J. Kaneko and Y. Ikeda

3:50pm Refreshments

4:10pm-6:10pm OPTIONAL TUTORIALS

1. ADJUSTMENT - THE OPTIMAL ANALYSIS OF SURVEILLANCE DOSIMETRY DATA (room HANA)
   Presented by Y. Yeivin

2. CROSS SECTIONS AND EVALUATION TECHNIQUES (room TSUKI)
   Presented by K. Shibata

Tuesday, September 14

ORAL SESSION 2 DOSIMETRY FOR TEST REACTORS AND ACCELERATOR SOURCES (room Matsu)
Chaired by: H. Aït Abderrahim and K. Kobayashi

8:30am paper 2.01 Spectral Unfolding of Mixed Proton/Neutron Fluences in the LANSCE Irradiation Environment

8:50am paper 2.02 Neutron Beam Characterisation at the Finnish BNCT Facility - Measurements and Calculations
   T. Serén, I. Auterinen, P. Kotiluoto and T. Seppälä

9:10am paper 2.03 Establishment of Fe-Filtered Beam Facility and Measurement of the Filtered Neutrons
   K. Kobayashi, T. Yoshimoto, Y. Fujita, M. Utsuro and H. Utsumi

9:30am paper 2.04 Design and Characterization of a Facility for Fast Neutron Irradiation of Semiconductors at Penn State
   B. Petrovic and A. Haghighat

9:50am paper 2.05 Comprehensive Nuclear Fuel Dosimetry Program in OSIRIS Reactor
   A. Alberman, C. Morin, L. Marchand and A. Marcault

10:10am paper 2.06 Dosimetry of a GeV Proton-Driven Spallation Neutron Field by the Activation Method
   Y. Kasugai, H. Takada and Y. Ikeda

10:30am Coffee will be served in the Poster Session

10:30am POSTER SESSION B (room YODO)
Chaired by A. Takahashi

CROSS SECTIONS AND NUCLEAR DATA
CALCULATIONS AND ADJUSTMENT METHODS
DAMAGE CORRELATIONS AND DAMAGE DOSIMETRY

CROSS SECTIONS AND NUCLEAR DATA

PB4.01 Reference Data Library for Dosimetry Applications
   S. A. Badikov

PB4.02 Neutron and Non-neutron Nuclear Data for Radiation Dosimetry
   N. E. Holden

PB4.03 Re-evaluation of Al-27(n,p)Mg-27 Reaction Cross Sections for Use as a Standard in Dosimetry and Activation Measurements
   A. B. Pashchenko, K. I. Zolotarev and C. J. Csikai
PB4.04  New Measurements of the H(n,n)H Angular Distribution  

PB4.05  Fission Cross Section Measurements of Th-229 and Pa-231 Using LINAC-Driven Lead Slowing-Down Spectrometer  

PB4.06  Measurement of Differential Neutron-Induced Charged-Particle Emission Cross Sections for 5 - 75 MeV Neutrons  
M. Baba, Y. Nauchi, T. Sanami, Y. Hirasawa, N. Nakashima, S. Meigo, S. Tanaka and N. Hirakawa

PB4.07  Measurements of $^9$Be-d Nuclear Reaction Cross Sections at Low Energy  
K. Ochiai, K. Ishii, I. Murata, H. Miyamaru and A. Takahashi

PB4.08  Fast Neutron Yields Generated from Deuteron Break-up in Low Energy Reactions of Light Nuclei  
P. Bém, V. Burian, F. Cvachovec, M. Götz, V. Kroha, E. Yu. Nikolskii, E. Simeêkova and J. Vincour

PB4.09  Gamma-ray Production Cross Sections for 209Bi in the Incident Neutron Energy of 0.5 - 20 MeV  
K. I. Zolotarev and G. Ya. Tertychny

PB4.10  Measurement of Neutron Capture Cross Sections for Dy and Hf between 0.001 eV and 50 keV Using Total Energy Absorption Detector  

PB5.01  Algorithm and Computer Code of Group Neutron Spectra Transformation  
G. A. Shimansky, A. I. Tellin and M. Gurevich

PB5.02  Improved Covariance Analysis and Spectrum Adjustment for VVER-1000 Pressure Vessel Fluences  
B. Böhmer, G. I. Borodkin and G. N. Manturov

PB5.03  Resolving Measurement Spectrum in Reactor With Flexible Tolerance Method  
Y. Wang, K. Kobayashi, Z. Li and I. Kimura

PB5.04  Input Source Generator and Visualisation Tool Software Package for Dort/Tort Application  
I. Popova, S. Belousov, K. Ilieva and S. Antonov

PB5.05  VENUS-3 Modeling with PENTRAN  
A. Haghighat, H. Aït Abderrahim and G. E. Sjoden

PB5.06  Three Dimensional Neutron Analysis in the Baffle-Former Area of PWR Plant  
H. Kitagawa and N. Yamagiwa

PB5.07  Analysis of a 3-D Calculational Benchmark for PWR Pressure Vessel Fluence Calculations  
B. Petrovic and A. Haghighat

PB5.08  MCBEND - A Fluence Modeling Tool from AEA Technology  
P. Cowan, E. Shuttleworth and G. Wright

PB5.09  Two Proposals for Enhancing Monte Carlo Transport Codes for Reactor Dosimetry: Increase of Efficiency and Incorporation of Uncertainty Estimations  
K. Noack

PB5.10  TRIPOLI-4 Monte Carlo Transport Code for Research Reactor In-Core Calculations  
Y. K. Lee, G. Néron, M. Nobile, Y. Péneliau, J. P. Both and C. Diop
PB5.11 Benchmarking of the 3-D Neutron-Gamma Calculations for the BWR Core Shroud Using A3-MCNP
A. Haghighat, H. Hikaru and B. Petrovic

PB5.12 Development of 3D MCNP-Based Fluence Computational Software Package: MF3D
R-T. Chiang and S. Sitaraman

PB5.13 BWR Neutron and Gamma Fluence and Spectral Computations Using MF3D
S. Sitaraman, R.T. Chiang, R. L. Kruger, A. L. Jenkins, K. Asano and K. Koyabu

PB5.14 Detailed Source and Nuclear Data Sensitivity Analysis in PHWR Pressure Vessel Dosimetry
Calculations
E. M. Lopasso, A. Blanco, A. F. Albornoz, H. Blaumann

PB5.15 Development of Induced Activity Estimation Method for PWR Containment
M. Nakata and T. Muramatsu

PB5.16 MCNP-to-TORT Radiation Transport Calculations in Support of Mixed Oxide Fuels Testing for the
Fissile Materials Disposition Program
J. V. Pace III

PB6.01 Primary Recoil Energy Spectra at the RPV of a PHWR
M. Caro and A. Caro

PB6.02 The PKA Energy Spectrum Analysis of Defect Structures in Neutron Irradiated Metals
T. Yoshii, Q. Xu and Y. Satoh

PB6.03 Refinement of Threshold Energy Values and Calculation of Nuclear Displacement for Vanadium
Alloys
V. V. Kirsanov, A. N. Balashov, N. V. Markina and M. U. Tikhonchev

PB6.04 A Comparison of the NRT Displacement Model and Primary Damage Formation Observed in
Molecular Dynamics Cascade Simulations
R. E. Stoller

PB6.05 Fusion Neutron Irradiation Effects on Some Electronic Devices
T. Iida, Y. Tanimura, F. Sato and T. Tanaka

PB6.06 Dosimetry Using Interaction Between Materials and Radiation Field

PB6.07 Nondestructive Analysis of Properties Degradation in NPRV Steels Using Magnetic Properties
J. F. Stubbins and W-J. Shong

PB6.08 Project AMES Dosimetry and MADAM: Results and Future Activities
A. Ballesteros and L. Debarberis

PB6.09 U.S. NRC Embrittlement Data Base (EDB) - The Merging of the Power Reactor Embrittlement Data
Base (PR-EDB), the Test Reactor Embrittlement Data Base (TR-EDB), and the Fracture Toughness
Data Base
J-A. Wang

12:40-2:00pm LUNCH

ORAL SESSION 3  BENCHMARKS AND INTERCOMPARISONS  (room MATSU)
Chairied by F. Ruddy and S. Zaritsky

2:00pm paper 3.01 Results from the NIST Round Robin Test of Fissionable Dosimeters in a Reactor Leakage Spectrum
J. M. Adams
2:20pm paper 3.02 New NEA Benchmarks Reveal Decisive Improvements in Calculating Fast Neutron Fluence for Prediction of Neutron Embrittlement in the Reactor Pressure Vessel
G. Hehn and R. P. Rulko

2:40pm paper 3.03 Database for WWER-1000 Reactor Pressure Vessel. IAEA Regional Project RER 4/017
B. Ošmera, S. Zaritsky, K. Iljeva, Ju. Kovoobenko, V. Lyssakov and A. Uritani

3:00pm paper 3.04 Balakovo-3 Ex-vessel Exercise: Intercomparison of Results

3:20pm paper 3.05 Measurement and Analysis of Pulsed Sphere Experiment of Fusion Related Material with Incident 14 MeV Neutrons
C. Ichihara

3:40 - 4:00pm BREAK

4:00 - 6:00pm WORKSHOP SESSION I

1. RADIATION DAMAGE CORRELATIONS (Room MATSU) Chaired by I. Remec and T. Lewis
2. DOSIMETRY FOR IRRADIATION FACILITIES AT TEST AND RESEARCH REACTORS (Room TSUKI) Chaired by D. Beretz and S. Suzuki
3. THERMAL AND LOW-ENERGY NEUTRONS (Room HANA) Chaired by D. Gilliam and A. Takahashi

Wednesday, September 15

ORAL SESSION 4 CROSS SECTIONS AND NUCLEAR DATA (room MATSU)
Chaired by P. Griffin and E. Zsolnay

8:30am paper 4.01 Integral Assessment of the Revised JENDL Dosimetry File

8:50am paper 4.02 High Energy Neutron Activation Cross Sections
T. Nakamura, E. Kim, Y. Uwamino, N. Nakao and S. Tanaka

9:10am paper 4.03 SPALLDOS, A New Neutron Metrology Cross Section Library for Use at Spallation Neutron Sources
E. J. Szondi, E. M. Zsolnay and F. Hegedüs

9:30am paper 4.04 Integral Testing of Spallation Cross Sections for Neutron Dosimetry at 113 and 256 MeV
L. R. Greenwood

9:50am paper 4.05 Production of a Self-Consistent Dosimetry Cross Section Set Up to 50 MeV
F. Maekawa, U. Von Moelendorff, P. Wilson, M. Wada and Y. Ikeda

10:10 - 10:30am BREAK

10:30am WORKSHOP SESSION II

4. LWR SURVEILLANCE AND RETROSPECTIVE DOSIMETRY (Room MATSU) Chaired by A. Fero and T. Serén
5. FUSION AND HIGH ENERGY NEUTRONS (Room TSUKI) Chaired by F. Hegedüs and Y. Ikeda
6. CROSS-SECTION FILES AND UNCERTAINTIES (Room HANA) Chaired by P. Griffin and E. Zsolnay

12:30pm Depart by Bus for AFTERNOON SOCIAL EVENT TO NARA (Packed lunch en route)
Thursday, September 16

**ORAL SESSION 5  CALCULATIONS AND ADJUSTMENT METHODS** (room MATSU)
Chaired by: B. Böhmer and M. Nakazawa

8:30am paper 5.01 Modeling of BWR for Neutron and Gamma Fields Using PENTRAN
A. Haghighat, V. Kucukboyaci, G. Sjoden and B. Petrovic

8:50am paper 5.02 Activity Determination with High Precision for Components to be Disposed of
E. Polke

9:10am paper 5.03 PV-Surveillance Dosimetry and Adjustment: Review of Several Significant "Oral Laws"
R. L. Perel, J. J. Wagschal and Y. Yeivin

9:30am paper 5.04 Development of an Associated Data Base for a Unfolding Procedure for RPV VVER Reactor Fluence Estimation
S. Belousov, K. Ilieva, S. Antonov and I. Popova

9:50am paper 5.05 Physically Constrained Adjustment of Calculated Neutron Spectra for Dosimetry and Vessel Locations
J. G. Williams and P. J. Griffin

10:10am paper 5.06 Analysis of the In- and Ex-Vessel Dosimetry of SLB-1 Using the LEPRICON system
H. Aït Abderrahim, O. Picavet and P. Barbrault

10:30am End of Oral Session
Coffee will be served in the Poster Session

10:30am **POSTER SESSION C** (room YODO)
Chaired by Y. Ikeda

**EXPERIMENTAL TECHNIQUES**

PC7.01 A Method for the Minimization of the HPGe Detector Efficiency Bias in the Measurement of the Spectral Index
A. I. Hawari and L. Tarko

PC7.02 A Laser Compton-Scattered Photon Source for the Calibration of Gamma-Ray Detectors in the Energy Range from 2 MeV to 22 MeV
K. Kudo, N. Takeda, H. Ohgaki and H. Toyokawa

PC7.03 Stilbene Neutron Spectrometer with Spreading of a One Parameter Pulse Shape Discrimination (PSD) Dynamic Range
F. Cvachovec and B. Ošmera

PC7.04 Using of the Reaction $^{93}$Nb($n$,n$'$)$^{93m}$Nb for Determination of Neutron Spectra at Outer PV Surface of WWER-1000 Reactor
O. O. Gritzay and O. G. Vasiljeva

PC7.05 $^{93}$Nb($n$,n$'$)$^{93m}$Nb: Intercomparison of Foil Activity Measurements in Application to the VVER-1000 Ex-vessel Experiment

PC7.06 Experimental Method of Neutron Spectra Determination with Activation Foils
F. Colomb, H. Carcreff and C. Morin

PC7.07 Qualifying C8/F9 and F8/F9 Spectrum Index Measurements by Using Standard Neutron Fields
K. van der Meer, P. D’hondt and R. Vandebroek
PC7.08 Metal Discs As Very Low Neutron Flux Monitors In Reactor Environment
  M-J. Martinez, M. Hult, M. Köhler, H. Aït Abderrahim and D. Marloye

PC7.09 Development of Neutron and Gamma-Ray Flux Distribution Measurement System with Scintillator and
  Optical Fiber Combination
  C. Mori, A. Uritani, T. Iguchi, S. Hayashi, Y. Takami, I. Kimura and M. Katagiri

PC7.10 A Robot-Mounted System for Neutron and Gamma Ray Dosimetry of Fuel Containing Masses at the
  Chernobyl Unit 4 Shelter
  F. H. Ruddy, A. R. Dulloo and J. G. Seidel

PC7.11 Real-Time Dosimetry Method Using an Imaging Plate
  K. Sakasai, M. Katagiri, M. Kishimoto and Y. Fujii

PC7.12 Dosimetry Techniques Developed for Radiation Monitoring of Irradiation Experiments in the IVV-2M
  Research Reactor
  S. Zlokazov

PC7.13 Application of Accumulative Type ESR-Sensors for Determination of Intensity, Spectral
  Characteristics and Volume Distribution of Intense Gamma and Neutron Fields
  A. F. Usatyi, V. B. Kainov, L. A. Serdiukova and A. Z. Khamidov

PC7.14 The Light Transmission Method of Automated SSTR Scanning
  R. Gold and J. H. Roberts

PC7.15 Neutron Dosimetry Using Diallyl Phthalate Resin
  T. Tsuruta

PC7.16 Development of In-Core Monitoring System for the Advanced Fission Reactor

PC7.17 Measurement of Neutron Flux Tilt at Small Core Using Optical Fiber with Scintillator
  T. Misawa, C. Mori, H. Unesaki and S. Shiroya

PC7.18 Development and Modelisation of Neutron Detectors for In-Core Measurement Requirements in
  Nuclear Reactors
  C. Blandin, G. Bignan, J. C. Guyard and A. Lebrun

PC7.19 On-Line Reactor Dosimetry with Intrinsic Silica Optical Fibre Sensors
  P. Borgermans and B. Benoit

PC7.20 Simultaneous Measurement of Neutron Pulse Series in Time and Space by Using Position Sensitive
  Proportional Counter
  Y. Kitamura, T. Misawa, H. Unesaki, S. Shiroya, K. Ishtani, A. Uritani and Y. Yamane

PC7.21 A System Design for Measuring Boron Concentration in PWR Cooling Water
  K. Oda, T. Kojima, K. Nakagawa, T. Yamauchi and S.Ohashi

PC7.22 14 MeV Neutron Irradiation Tests on Window Materials for Fusion Reactors
  F. Sato, T. Iida, Y. Oyama, F. Maekawa, Y. Ikeda and T. Nishitani

PC7.23 Mixed-Field Electronic Radiation Dosimeter Development for Reactor Buildings

LATE NEWS

LN.01 Neutron Flux Characterisation in The Thermal Column of a Fast Research Reactor
  S. Agosteo, G. Gambarini, P. Marchesi, E. Nava, P. Palazzi, A. Pecci, G. Rosi and R.Tinti
LN.02 Application of Monte Carlo Method for Determination of Radiation Fields of Small Regions in Reactor Cores
Yuji Uenohara

LN.03 Evaluation Method for K-infinitive of MOX Lattice with Conversion Ratio Measurement
S. Miyashita, K. Yoshioka, T. Sasaki, I. Mitsuhashi, and M. Ueda

LN.04 Biodosimetry of Fast Neutrons from a Nuclear Reactor
K. Fujikawa, S. Endo, T. Itoh and M. Hoshi

LN.05 On the Iron Effect on Neutron Transport
A. Jehouani, R. Ichaoi and M. Boulkheir

12:40-2:00pm LUNCH

ORAL SESSION 6 DAMAGE CORRELATIONS AND DAMAGE DOSIMETRY (room MATSU)
Chaired by A. Alberman and T. Yoshiie

2:00pm paper 6.01 Comparative Analysis of DPA Processed from Current Evaluated Nuclear Data Libraries
J. Chang, C-S. Gil, Y. Cho and J-D. Kim

2:20pm paper 6.02 JENDL PKA/KERMA File for IFMIF Project
T. Fukahori, S. Chiba, K. Shibata, Y. Ikeda, T. Aruga, Y. Watanabe, T. Murata, N. Yamano and M. Kawai

2:40pm paper 6.03 A Study of Displacement Cross Section in Medium Energy Region
K. Iga, H. Takada and Y. Ikeda

3:00pm paper 6.04 Role of Radiation in BWR Core Shroud Cracking
J. Kwon and A. T. Motta

3:20pm paper 6.05 Correlating Radiation Exposure with Embrittlement: Comparative Studies of Electron- and Neutron-Irradiated Pressure Vessel Alloys

3:40 - 4:00pm BREAK

4:00 - 6:00pm WORKSHOP SESSION III

7. BENCHMARKS AND INTERCOMPARISONS (Room HANA) Chaired by A. Haghighat and K. Illieva
8. MIXED-FIELD DOSIMETRY (Room TSUKI) Chaired by H. Ait Abderrahim and L. Greenwood
9. ADJUSTMENT METHODS AND UNCERTAINTIES (Room MATSU) Chaired by T. Iguchi and H. Nolthenius

Friday, September 17

ORAL SESSION 7 EXPERIMENTAL TECHNIQUES (room MATSU)
Chaired by F. Hegedüs and D. Vehar

8:30am paper 7.01 Measurement of Eigenvalue Separation in Coupled-Core System Using Optical Fiber with Scintillator

8:50am paper 7.02 Selective and Prompt Self Powered Neutron Detectors for Characterization of Mixed Radiation Fields in Reactors
C. Blandin and S. Breaud
9:10am paper 7.03 Neutron and Gamma Ray Dosimetry in Spent-Fuel Radiation Environments Using Silicon Carbide Semiconductor Radiation Detectors

9:30am paper 7.04 Retrospective Fast Neutron Dosimetry of Nuclear Power Plants by Means of Scraping Samples Using the $^{93}\text{Nb}(n,n')^{93m}\text{Nb}$ Reaction
J. van Aarle and F. Hegedüs

9:50am paper 7.05 A Novel Neutron Spectrometer with Response of Wide Energy Range

10:10am paper 7.06 Characterization and Representation of the HPGe Detector Efficiency
M. H. Sparks, T. M. Flanders, P. J. Griffin and D. W. Vehar

10:30am paper 7.07 Accreditation and Certification in Radioactivity Measurement: Experience of the CEA/Reactor Dosimetry Laboratory
J. C. Royer and D. Beretz

10:50 - 11:10am BREAK

11:10am WORKSHOP SUMMARIES SESSION (room MATSU)
Chaired by M. H. Sparks and W. P. Voorbraak

12:10pm CLOSING SESSION (room MATSU)
Chaired by P. D’hondt, M. Nakazawa and F. Ruddy

Saturday, September 18
08:30am - 6:00pm OPTIONAL TOUR (1-DAY TOUR)

SIGHTSEEING IN KYOTO
WORKSHOPS

Nine workshops will be held during the symposium with the intent of providing an informal exchange of information for a selected variety of topics. The workshops are a very important part of the symposium. They are intended to provide a discussion forum for the workshop topic that was selected by a significant number of attendees. The detailed format of the workshop may vary according to the topic.

TOPICS

1. **RADIATION DAMAGE CORRELATIONS**
   Chaired by I. Remec and T. Lewis
   
   Pressure vessel damage modeling, correlation of material damage data, and quality of data in the embrittlement data base.

2. **DOSIMETRY FOR IRRADIATIONS AT TEST AND RESEARCH REACTORS**
   Chaired by D. Beretz and S. Suzuki
   
   Irradiation conditions, spectral dependence on operating conditions, adjustment codes & calculations in dosimetry.

3. **THERMAL AND LOW-ENERGY NEUTRON DOSIMETRY**
   Chaired by D. Gilliam and A. Takahashi
   
   Measurements of thermal-to-fast neutron ratios and their impact on the relevant metallurgy issues.

4. **LWR SURVEILLANCE & RETROSPECTIVE DOSIMETRY**
   Chaired by A. Fero and T. Serén
   
   Status of accuracy achievable in fluence determinations (capsules, vessels) & a highlight on niobium dosimetry.

5. **DOSIMETRY FOR FUSION AND HIGH ENERGY APPLICATIONS**
   Chaired by F. Hegedüs and Y. Ikeda
   
   Includes 14 MeV, spallation and fast/thermal mixed-spectrum reactor irradiations; cross-section needs; dosimetry reactions.

6. **CROSS-SECTION FILES AND UNCERTAINTIES**
   Chaired by P. Griffin and E. Zsolnay
   
   Emphasis on evaluation & uncertainties of dosimetry cross sections, selection of multi-group cross sections for calculations.

7. **BENCHMARKS AND INTERCOMPARISONS**
   Chaired by A. Haghighat and K. Illieva
   
   Ongoing benchmarks and intercomparisons to validate calculations.

8. **MIXED FIELD DOSIMETRY**
   Chaired by H. Aït Abderrahim and L. Greenwood
   
   Current state of neutron/gamma mixed-field dosimetry and possible avenues of research and development.

9. **ADJUSTMENTS METHODS AND UNCERTAINTIES**
   Chaired by T. Iguchi and H. Nolthenius
   
   Emphasis on calculational aspects and sensitivity analysis of spectrum adjustment methods; code selection.
TUTORIALS

Two optional tutorials are offered as part of the Symposium Program. They will be held concurrently at the end of the technical program on the first day of the Symposium, Monday, 13 September. A separate registration, with a fee of $50, is required from Symposium registrants (see registration form). Places will be limited, so advance registration is recommended. Registration for one of the two tutorials is included in the special one-day registration.

The tutorials will be taught classes presented by a leading expert in each of the two fields. Printed lecture notes will be provided. The purpose of these tutorials is to provide attendees with an authoritative introduction to one of the fundamental technical areas of the International Symposium on Reactor Dosimetry. The topics have been selected on the basis of replies received to a questionnaire that was distributed with the Call for Papers.

TUTORIAL A. ADJUSTMENT - THE OPTIMAL ANALYSIS OF SURVEILLANCE DOSIMETRY DATA  (room HANA)
Presented by Y. Yeivin

General adjustment prescriptions are derived from elementary principles. Given available parameter and measured-response data (nominal values and uncertainties), and the sensitivities of the responses to each parameter, these prescriptions produce objectively adjusted parameters and their associated uncertainties, and thus enable more reliable predictions. It is shown that the adjustment formalism is the natural procedure to extrapolate surveillance measured information to the RPV, and that it is also the proper way to evaluate the uncertainties in the predicted RPV fluences.

Professor Yehuda Yeivin earned advanced degrees from the Hebrew University of Jerusalem, and the Weizmann Institute of Science. He attended the International School of Nuclear Science and Engineering at Argonne National Laboratory and worked at the Centre d'Etudes Nucleaires at Saclay, France and at the Swiss Federal Institute for Reactor Research, E.I.R., at Wuerenlingen. He spent a year with the Israel AEC, before joining the Racah Institute of Physics of the Hebrew University in 1961. He has taught general physics courses at Tel Aviv University, and served as acting head of its physics department, and taught applied mathematics courses at the department of nuclear engineering of Ben Gurion University (Beer Sheva). He has served as president of the Israel Physical Society, vice president of the Israel Nuclear Society and as a member of the council of the European Physical Society. He is a member of the advisory committee for nuclear safety of the Israel AEC. He has been a senior visiting scientist at Goddard Institute for Space Studies, New York, a consultant at ORNL and at the European JRC, Ispra. He also organized and directed the 1986 Ispra school on Data Uncertainties, Sensitivities, Consistency and Adjustment. Professor Yeivin has published over 100 learned articles, including pioneering results on adjustment of cross sections together with I. Reiss and G. Rakavy (1967).

TUTORIAL B. CROSS SECTIONS AND EVALUATION TECHNIQUES  (room TSUKI)
Presented by K Shibata

How to evaluate cross sections and uncertainties. Several nuclear reaction models are presented as useful evaluation tools: resonance theory, optical and statistical models, and direct-interaction models. the data in Japanese Evaluated Nuclear Data Library (JENDL) are shown, with emphasis on dosimetry applications. Activities on high-energy neutron-, photon-, and photon-induced reaction data are also presented, together with the results so far obtained.

Dr. Keichi. Shibata is Principal Scientist in the Nuclear Data Center at the Japan Atomic Energy Research Institute (JAERI). He earned his degrees at Rikkyo University, where he majored in nuclear physics. After joining JAERI in 1982, he has been involved in the evaluation of neutron cross-sections for fission and fusion reactors. A medal was awarded him by JAERI for the development of the Japanese Evaluated Nuclear Data Library Version 3 (JENDL-3), issued in 1990. He is now an editor of J. Nucl. Sci. Technol. published by the Atomic Energy Society of Japan. His recent publications include articles on gamma-ray production data, evaluation of neutron data for mercury and covariance data for the JENDL files for chromium, iron and nickel.
TOURS

SYMPOSIUM TOUR for Nara (Half-day Tour)

Date: Afternoon on Sept. 15 (Wed), 1999
Fare: Attendees : No Fee
Companions : $30 (Includes box lunch)
Transportation: Bus

For a 70-year period or more following the establishment of the Heijokyo capital in Nara in 710, it became Japan's political and cultural hub. Japanese civilization, deeply influenced by Chinese culture, blossomed in Heijokyo. Nara is a place of a long history, whose legacy is still very much alive in the city's many famous buildings and ruins and in its many magnificent works of art.

Todaiji Temple:
Founded in the 8th century as the general headquarters of the provincial temples, it houses the world's largest bronze image of Buddha in the main hall, and a lot of sculptures from the 8th century.

Kasuga Shrine:
Established in the 8th century, the most famous and beautiful Shinto shrine in Nara. It features some 3,000 antique stone and bronze lanterns.

Kofukuji Temple:
Founded in the 8th century, it ruled Nara with more than 50,000 warrior priests in the 13th and 14th century. It has the second highest five-storied pagoda in Japan and many Buddhist sculptures.

COMPANION TOURS -- Short Tours

Some companion programs will be scheduled during the Symposium, such as Ikebana (flower arrangement), Ocha-kai (tea ceremony) and short city-tours.

1) Enjoy Ikebana (flower arrangement) and Ocha-kai (tea ceremony)

Date: Full day on Tuesday, Sept. 14
Fare: $30
Transportation: Bus or Train
Lunch: Included

IKEBANA (Floral Art)

Japanese floral art (Ikebana) was brought to its peak of refinement in the latter half of the 16-th century. Along with the tea ceremony, Ikebana is very popular among young Japanese ladies, and there are schools where they can go to learn it. Ikebana can be divided into two styles, Nageirebana and Moribana, depending on the type of vase used.

OCHA-KAI (Tea Ceremony)

Ocha-kai (Tea ceremony) or Sado (lit. the way of tea) was perfected by Master Senno-Rikyu based on the spirit of “ZEN” in the 16-th century.

For Japanese people, tea ceremony is a mental discipline for pursuing “WABI” (a state of mind in which a person is calm and content, with a profound simplicity), and is at the same time a performance in which form and grace are paramount.
2) **Short city-tour (visit Osaka castle, etc.)**

- **Date:** Afternoon on Thursday, Sept. 16
- **Fare:** $20
- **Transportation:** City-Bus or Train(Subway)

Osaka Castle was built by Hideyoshi Toyotomi, who succeeded in unifying the entire country in the 16-th century. Destroyed in the past by war and fire, the castle has since been rebuilt, and the present-day castle tower was constructed with the aid of financial contributions from the people of Osaka. The castle grounds now form a large, tree-filled park.

**OPTIONAL TOUR**

**Sightseeing in Kyoto (1-day Tour)**

- **Date:** Sep 18 (Sat), 1999
- **Fare:** $50
- **Transportation:** Bus
- **Number of Participants:** min.10 to max. 50 people
- **Lunch:** Included

Kyoto was the capital of Japan for about 1,000 years, from her establishment as Heiankyo in 794 until the transfer of government to Tokyo in 1868 following the Imperial Restoration. Kyoto has provided over the last twelve centuries a natural cradle for the art and culture of Japan, and a noble heritage for her people. For this reason Kyoto is known as the spiritual home of Japanese people.

- **Nijo Castle:**
  The Tokugawa shogunate built this castle in 1603. Nijo Castle is noted for the contrast of its solemn appearance and gorgeous interiors.

- **Golden Pavilion:**
  Built as a villa in 1397 by Ashikaga Yoshimitsu and later converted into a temple. The Golden Pavilion is covered in gold leaf and stands in the middle of a spacious pond garden.

- **Kyoto Imperial Palace:**
  The ancient Imperial Palace clearly shows the Japanese taste for purity, simplicity and calmness.

- **Kiyomizu Temple:**
  Kiyomizu Temple was founded in 780 and has attracted the faith of ordinary people ever since. Many of the present structures were built in the 15th-17th centuries. The temple is especially famous for the wooden balcony extending from the Main Hall.

- **Heian Shrine:**
  Graceful medieval court life is reflected in this brightly colored shrine with its vermilion pillars and green roof and enchanting inner gardens and ponds.