

55th Annual Meeting of the Institute of Nuclear Materials Management

(INMM 2014)

**Atlanta, Georgia, USA
20-24 July 2014**

Volume 1 of 4

ISBN: 978-1-63439-621-9

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2014) by the Institute of Nuclear Materials Management
All rights reserved.

Printed by Curran Associates, Inc. (2015)

For permission requests, please contact the Institute of Nuclear Materials Management
at the address below.

Institute of Nuclear Materials Management
111 Deer Lake Road, Suite 100
Deerfield, IL 60015

Phone: (847) 480-9573
Fax: (847) 480-9282

www.inmm.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

CONCURRENT TECHNICAL SESSIONS I

SESSION A - FACILITY OPERATIONS: SAFEGUARDS BY DESIGN

Safeguards by Design of a New Nuclear Material Storage Facility — An Operator's Perspective	1
Alan Homer, Virginia S. Ferguson, Daniel Brannon, Ian Wheeler, Stephen Armstrong, Jonathan Buckley, Frank Gladman, John Gibbons	
Safeguards Coverage of Nuclear Materials? Policy Issues for the Starting Point and Termination of Safeguards	11
Stephen Francis	
NNSA's Next Generation Safeguards Initiative Safeguards By Design Project.....	21
Karyn R. Durbin, Dunbar Lockwood, Melissa Scholz	
Status of the Implementation of Safeguards by Design in the International Safeguards Regime.....	26
Luis A. Ocampo Giraldo	
Japan's Nuclear Safety and Security Policies Before and After the Fukushima Nuclear Incident	36
Aoi Sato	

SESSION B – INTERNATIONAL SAFEGUARDS: INTERFACE AMONG SAFETY, SECURITY AND SAFEGUARDS

3S Culture, Its Meaning and Future Direction	50
Na Young Lee, Ho Sik Yoo, Yon Hong Jeong	
Results of IAEA Workshop on Effective Management of Safety, Security and Nonproliferation Issues at Operating Nuclear Facilities	55
Donald Kovacic, Elina Martikka, Miroslav Gregoric, Saif Al Kaabi	
Analysis of the 3S Concept: Safety-Security-Safeguards	65
Stephen V. Mladineo, Sarah Frazar, Travis Gitau	
Comparative Analysis of 3S Curriculum	73
Nicholas Quintero, Reem Khraisat, Royal Elmore, Jennifer Erchinger, Manit Shah, Steve Gerlt, Robert Zedric, Mohammad Ahmad, Zaid Al-Taher	

SESSION C – MATERIALS CONTROL AND ACCOUNTABILITY: HYBRID K-EDGE MEASUREMENTS

Evaluation of Hybrid K-Edge Densitometry for Pyroprocessing Material Assay	82
Matthew T. Cook, Steven E. Skutnik	
Validation of the KORINZU Four-Delta-Mu Method for KED Analysis of U-Pu MOX	N/A
Michael L. Collins	
Representing the Plutonium K-Absorption Edge in Transmission Measurements	92
Stephen Croft, Robert McElroy, Tyler Guzzardo	
Evaluation of Hybrid K-Edge Densitometer for Safeguarding Pyroprocessing Activities	102
G. Spencer Mickum, Shaheen A. Devji, Nolan E. Hertel, Robert D. McElroy	
How Variations in X-ray Beam Intensity Affect the Analytical Performance of a Hybrid K-Edge Densitometer	N/A
Michael L. Collins	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY: NEUTRON MEASUREMENTS I

Novel He-3 Alternative Designs for Safeguards Neutron Well Counters.....	N/A
Melissa Schear, David Ramsden, Mark Foster, Geraint Dermody, Matthew Dallimore	
Performance Characterization of a Water-based Multiplicity Counter	112
Steven A. Dazeley, A. Asghari, A. Bernstein, N. S. Bowden, V. Mozin	
Total Plutonium Content Determination with the Differential Die-Away Self-Interrogation Instrument	121
Alexis C. Kaplan, Vladimir Henzl, Anthony P. Belian, Martyn T. Swinhoe, Howard O. Menlove, Marek Flaska, Sara A. Pozzi	
Pulse Height Models for Deuterated Scintillation Detectors	131
Haitang Wang, Andreas Engqvist, Thomas N. Massey	

SESSION E – MATERIALS CONTROL AND ACCOUNTABILITY: POLICY AND BEST PRACTICES

Implementation of Limited Notice Performance Testing for Material Control and Accountability	141
Gary P. Kodman, D. L. Whaley, Thomas Messer, Brenda Douglass, Frank Lamb	
Amendments to Material Control and Accounting Regulations	147
Thomas N. Pham	
Revisions of NRC Regulatory Guides in Material Control and Accounting (MC&A) Program	152
Suzanne M. Ani, Thomas N. Pham	

Strategic Roll-up Areas at the NNSS.....	N/A
<i>Mary Alice Price</i>	

SESSION F – NUCLEAR SECURITY AND PHYSICAL PROTECTION: CRITICAL INFRASTRUCTURE SECURITY

International Physical Protection Advisory Service (IPPAS) Mission to the U.S. Nuclear Regulatory Commission.....	158
<i>Joseph Rivers, Nancy Fragoyannis, John Adams</i>	
Risks-Informed Security Workshop Summary.....	162
<i>Joseph Rivers, Nathan Siu, Mark Snell, Samuel Callahan, Perry Pederson, Felicia Duran</i>	
Nuclear Security for the 2010 FIFA World Cup in South Africa: Summary of Logistics and Results.....	165
<i>Charles Kros, Reuben Mogafe</i>	

SESSION G – EDUCATION AND TRAINING: PROFESSIONAL DEVELOPMENT INITIATIVES

Strengthening Indonesian Nuclear Safeguard by Increasing Quality of BATAN's Employees.....	172
<i>Dedy Prasetyo Hermawan, Ganjar Putro Indratoro, Muhammad Rizki Oktavian, Fatikh Fikri Muhammad, Siti Qulsyum Shofiyani, Nur Arifah</i>	
Prospective of INSA's HRD Activities in Area of Nuclear Nonproliferation and Security.....	178
<i>Kwan-Kyoo Choe, Jin Young Lee</i>	
The WINS Academy Nuclear Security Certification Programme	188
<i>Daniel Johnson, Roger Howsley, Raquel Delgado, Brunelle Battistella</i>	
A New Nuclear Security Centre for Education and Training in Nigeria	196
<i>Sunday Jonah, Lawrence Dim, Erepamo Osaisai, Simon Mallam, Ayo Kuye</i>	
Improving Public Acceptance of the Nuclear Industry: An Example of Using the Past to Help the Future	N/A
<i>Vivek J. Maradia, Dana Alabdulmalik, Svitlana Alyokhina, Maryam Al Homaid, Jin Joo Kim</i>	

CONCURRENT TECHNICAL SESSIONS II

SESSION A – FACILITY OPERATIONS: NUCLEAR POWER SYSTEMS FOR REMOTE OR HOSTILE ENVIRONMENTS I

Space and Defense Power Systems: Innovative Power Solutions for Yesterday, Today and Tomorrow.....	202
<i>Alice K. Caponiti, Wade P. Carroll, Rebecca R. Onuschak</i>	
Heat Source Component Production for Radioisotope Power Systems	212
<i>George B. Ulrich, Evan K. Ohriner, Glenn R. Romanoski, K. Rex Veach Jr., Brian R. Friske, Easo P. George, Roger M. Miller</i>	
Capabilities at the Idaho National Laboratory (INL)	222
<i>Kelly Lively, Stephen G. Johnson, Eric S. Clarke</i>	
Launch Safety Analysis for Radioisotope Power Systems	233
<i>Ronald J. Lipinski, Timothy J. Bartel, John Bignell, Nathan E. Bixler, Daniel J. Clayton, Donald L. Potter, Ryan D. Bechtel, G. J. Flores, F. Gelbard, C. A. Jones, S. Le, C. W. Morrow, D. P. Rohe, L. W. Young</i>	
Radioisotope Power System Delivery, Ground Support and Nuclear Safety Implementation: Use of the Multi-mission Radioisotope Thermoelectric Generator for the NASA's Mars Science Laboratory	243
<i>Stephen G. Johnson, Kelly L. Lively, Carla C. Dwight, Eric Clarke</i>	
Plutonium-238 Production Chemical Processing Evaluations	253
<i>Robert Wham, L. Kevin Felker, Dennis E. Benker, Emory D. Collins</i>	
Assessment of Space Nuclear Thermal Propulsion Facility and Capability Needs	261
<i>James E. Werner</i>	
Extrusion Development of Graphite-based Composite Fuel for Nuclear Thermal Propulsion.....	N/A
<i>Michael Trammell, Brian Jolly, Jim Miller, Lou Quals</i>	

SESSION B1 – INTERNATIONAL SAFEGUARDS: ADVANCES IN SAFEGUARDS TECHNOLOGY AND INSTRUMENTATION FOR CONTAINMENT AND SURVEILLANCE

Status of Non-contact Handheld Imager for Reflective Particle Tags.....	270
<i>Heidi A. Smartt, Michael B. Sinclair, William C. Sweatt, Juan A. Romero, Michael McDaniel</i>	
Standoff Video Surveillance for High Radiation Applications.....	278
<i>George T. Baldwin, William C. Sweatt, Maikael A. Thomas</i>	
NGSI's UF6 Cylinder Monitoring Project Update	285
<i>Karyn R. Durbin, Michael Whitaker</i>	

SESSION B2 – INTERNATIONAL SAFEGUARDS: ADVANCES IN SAFEGUARDS TECHNOLOGY AND INSTRUMENTATION FOR URANIUM ENRICHMENT

A Monte Carlo Analysis of Gas Centrifuge Enrichment Plant Product and Tails Withdrawal Station Load Cell Data	292
<i>James Garner</i>	
Platform-Scale Testing to Substantiate Load Cell Monitoring for Nuclear Safeguards	303
<i>James Garner, Michael Whitaker, B. T. Dabbs</i>	
Laboratory Demonstration of a Multisensor Unattended Cylinder Verification Station for Uranium Enrichment Plant Safeguards	314
<i>David Goodman, Kelly Rowland, Sheriden Smith, Karen A. Miller, Eric Flynn</i>	
The UF6 Coincidence Counter (UFCC) for Nondestructive Assay of 5A/5B Uranium Cylinders: Design and Benchmark Measurements	326
<i>Karen A. Miller, Howard O. Menlove, Johnna B. Marlow</i>	
Analytical Study on Uranium Measurement in Uranium Waste Drums by the Fast Neutron Direct Interrogation Method	336
<i>Masao Komeda, Akira Ohzu, Mitsu Haruyama, Misao Takase, Masatoshi Kureta, Yoshiaki Nakatsuka, Naoki Zaima, Shin'ichi Nakashima, Hideaki Yoshida</i>	

SESSION C – INTERNATIONAL SAFEGUARDS: EVOLUTION OF INTERNATIONAL SAFEGUARDS (ISO)

The Evolution of International Safeguards — A Legal and Personal Perspective	345
<i>Laura Rockwood</i>	
Five Challenging Decades of IAEA Safeguards	353
<i>Olli Heinonen</i>	
EURATOM: A Regional Safeguards System Within the International Regime of Nuclear Nonproliferation	359
<i>Christos Koutsoyannopoulos, Piotr Szymanski, Wolfgang Kilb, Wolfgang Kahnmeier</i>	
The Experience of the Establishment and Consolidation of ABACC: Perspectives and Views on Its Foundation and a Look into the Future	367
<i>Sonia Fernández Moreno</i>	
The Evolution of the Safeguards Implementation in Japan Up to RRP/J-MOX	373
<i>Tomonori Iwamoto</i>	
The Evolution of International Safeguards — A View from Germany	380
<i>Arnold Reznicek, Gotthard Stein, Irmgard Niemeyer, Clemens Listner, Wolfgang Trautwein</i>	
Evolution of International Safeguards: An Australian Perspective	N/A
<i>Robert B. Floyd, Michael C. East, John Carlson, Stephan Bayer, Craig W. Everton</i>	
The Evolution of Safeguards Technology for Bulk Handling Facilities for Nuclear Fuel Cycle in Japan— From Ningyo-toge and Tokai to Rokkasho	387
<i>Hirofumi Tomikawa, Masaru Watahiki, Yusuke Kuno</i>	
The Development and Evolution of Nondestructive Assay (NDA) for International Safeguards	396
<i>Howard O. Menlove</i>	
The Evolution of Reprocessing Safeguards	406
<i>Shirley J. Johnson</i>	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY: NEUTRON MEASUREMENTS II

LIST-Mode Applications for Neutron Multiplicity Counting	416
<i>Tal Ridnik, Chen Dubi, Itamar Israelshvili, Janos Bagi, Jozsef Huszti</i>	
Improvement of INVS Measurement Uncertainty for Pu and U-Pu Nitrate Solution	426
<i>Risa Makino, Martyn T. Swinhoe, Yoshimasa Suzuki, Yasunobu Mukai, Howard O. Menlove, Johnna B. Marlow, Hironobu Nakamura</i>	
Corrections on Point Model Equations in Spherical and Hemispherical Shell Weapons-grade Plutonium Mass Assay with Neutron Multiplicity Counting	435
<i>Ligao Chen, Jian Gong, Kan Wang, Qilin Xie, Xiaobo Liu, Xiaoquang Fan, Yanpeng Yin, Zhongxiong Bai</i>	
Performance Test Results for the Advanced Fuel Assembly Assay System (AFAS) on the Active Length Verification of the LWR MOX Fuel Assembly by Neutron Detectors	442
<i>Shinji Nakajima, Taketeru Nagatani, Shiromo Hideo, Takashi Asano, Johnna Marlow, Martyn Swinhoe, Howard Menlove, Carlos Rael, Akane Kawasue, Shoko Iso, Takehito Watanabe</i>	
Sensitivity Analysis and Uncertainty Quantification of Neutron Multiplicity Statistics Using Perturbation Theory	452
<i>Sean E. O'Brien, John Mattingly, Dmitry Anistratov</i>	
The Cf-252 Based Differential Die-away Analysis (CDDA) Method	460
<i>Imre Pazsit, Dina Chernikova, Karel Axell, Marek Flaska</i>	
A Method for Detection of SNM by Pulsed Neutron Interrogation	468
<i>Aharon Ocherashvili, Valeriy Mayorov, Marita Mosconi, Arie Beck, Eric Roesgen, Hanania Ettedgui, Jean-Michel Crochemore, Bent Pedersen</i>	
Integrating and Live-time Radiation Dosimetry by Optical Crystal Damage, Initial Results with Neutrons	475
<i>Adam Hecht, Jean-Claude Diels, Ladan Arissian, Erin Vaughan</i>	

Measurement of Plutonium Content in Scrap Using Neutron Coincidence Counters	N/A
<i>Maksim Semenov, Sergei Levunin, Aleksandr Antushevskii, Anastasia Efremova, Sergei Shlygin, Andrew Sviridov, Veronica Sviridova, Katharine Losenko, Bruce Jensen, Lev Neymotin, Jeff Sanders, Robert Larsen</i>	

SESSION E – NONPROLIFERATION AND ARMS CONTROL: TRANSPARENCY AND VERIFICATION TECHNOLOGIES

All at Sea? A Safeguards Approach for the Military Naval Nuclear Fuel Cycle	482
<i>Sebastien Philippe</i>	
Exploring Quantitative Framework to Evaluate Statelevel Nuclear Transparency	492
<i>Jeeimin Ha, Man-Sung Yim, Hyeyon Seok Park, Sung Yoon Park</i>	
Secure Image Hash Comparison for Warhead Verification.....	500
<i>Paul Bruillard, Kenneth Jarman, Sean Robinson</i>	
Template Approach with Low-resolution Detectors for Nuclear Material Identification	N/A
<i>Changfan Zhang, Gen Hu, Chensheng Chu, Huailong Wu, Guangchun Hu, Suping Liu, Yongchun Xiang, Zonghua Xiong</i>	
Open Source Meets Nuclear Arms Control.....	510
<i>Moritz Kütt, Matthias Englert, Alexander Glaser</i>	
Secure Private Cloud Design for Arms Control and Safeguards Applications: The Use of Virtualization and Mobility in Green Sensor Networks	520
<i>Don Mendonsa, Faranak Nekoogar, Farid Dowla</i>	
Modeling Nuclear Proliferation — Characterization Based on the History.....	527
<i>Man-Sung Yim, Chul Min Kim, Hyeonseok Park, So Young Kim</i>	
Novel Authentication of Monitoring Data Through the Use of Secret and Public Cryptographic Keys	537
<i>Jacob Benz, Keith Tolk, Jennifer Tanner</i>	

SESSION F – NUCLEAR SECURITY AND PHYSICAL PROTECTION: SECURITY INTEGRATION WITH FACILITY DESIGN

Nuclear Security Assessment Methodology (NUSAM)	544
<i>Joseph Rivers, Abdul Shakoor, Mark Snell</i>	
Methodology for the Evaluation of the NPP Physical Protection System Quality Assurance	N/A
<i>Yury Volodin, Sergey Golovchenko, Andrey Zhukov</i>	
Integrated Response at U.S. Nuclear Power Plants	547
<i>Joseph Rivers, Lou Cubellis, Rupert Rockhill, Doug Huyck</i>	
Research and Development on Physical Protection of Nuclear and Other Radioactive Materials.....	N/A
<i>Angelaki N. Gotsev, Boris P. Stanchev</i>	
Incorporating Security-by-Design in Both Planned and Operational Nuclear Facilities	552
<i>Mark K. Snell, Calvin D. Jaeger</i>	
Interactive Radiation Detection Systems	N/A
<i>Divya Pandey</i>	

SESSION G – PACKAGING, TRANSPORTATION AND DISPOSITION: PACKAGING AND TRANSPORTATION OPERATIONS/MONITORING AND TRACKING

Packaging and Repatriation of U.S.-Origin Sources from India	560
<i>Charles Streeper, John Zarling, Cristy Abeyta</i>	
The Challenges in the Transport of Very Short-lived Radionuclide Used in the Nuclear Medical Industry	N/A
<i>Gaurav Kumar Singh, Vipin Shukla, Swapnil Shivaji Patil, Drumil Modhiya</i>	
The IAEA Assistance Programme for Transport Security.....	567
<i>Kimberly K. Anderson, Paul T. Singley, David A. Duhamel, Richard R. Rawl, Stig Isaksson</i>	
The Shipment Experience of the Spent Nuclear Fuel at FSUE “RISI”	N/A
<i>Alexander Chlenov, Dmitry Markitan, Boris Gridin, Taisia Piskureva</i>	
Transport Security for Nuclear And Other Radioactive Materials — A DOE Training Course	575
<i>Ronald B. Pope, Yung Y. Liu, James M. Shuler</i>	
Used Nuclear Fuel Storage, Transportation and Disposal Analysis Resource and Data System	585
<i>John Scaglione, K. Banerjee, K. R. Robb, R. A. LeFebvre</i>	
Monitoring Alpha Gamma Hot Cell Facility with Dosimeter-Enabled ARG-US RFID System.....	594
<i>Hok Lee, Brian Craig, John Hlotke, Hanchung Tsai, Yung Liu, James Shuler</i>	
Detection of Shielded Special Nuclear Material Using High-energy Gamma Ray Transmission Imaging and Cherenkov Detectors	601
<i>Paul B. Rose Jr, Anna Erickson, Igor Jovanovic, Richard Lanza, Buckley O'Day</i>	
Passive and Active Ways of Unique Tagging/Labeling of Long-term Stored Nuclear Waste Copper Canisters.....	611
<i>Dina Chernikova, Karen Axell</i>	

SESSION H – EDUCATION AND TRAINING: BEYOND GUARDS, GUNS AND GATES – CULTURE AS THE MISSING PIECE

Life Cycle of the Curriculum Development Process: A Concept of Enhanced Nuclear Engineering Curriculum with Nuclear Security Related Aspects	617
<i>Sihana Sihana, Susetyo Hario Putero, Ferdiansjah Ferdiansjah, Ester Wijayanti, Haryono Budi Santoso, Sunarno Sunarno</i>	
Lessons Learned from a Nuclear Security Insider Threat Exercise	624
<i>Oum Keltoum Hakam, Patrick Lynch</i>	
Nuclear Security and Workforce Information Retention	N/A
<i>Lüka Potgieter Potgieter</i>	
Professional Development Course in Nuclear Security Education: Objectives, Challenges, Opportunities and Assessing Impact.....	631
<i>Hassan El-Bahtimy, Christopher Hobbs, Matthew Moran</i>	
Current Nuclear Security Education Initiatives in South Africa.....	635
<i>James F. Larkin, Mathew Moran, Christopher Hobbs</i>	
Issues on Security Clearance for Nuclear Security in Japan	640
<i>Tomoaki Inamura, Tomoyuki Tanabe</i>	
Security Policies, Procedures and Implementation: An International Academic Perspective	649
<i>Alex Okowita, Danah Azizi</i>	
INMM Student Chapters and Getting the Message Out	656
<i>John C. Stooksbury, Reem Khrais, Blake Palles, Laith Zaidan, Saed Momani</i>	

CONCURRENT TECHNICAL SESSIONS III

SESSION A – FACILITY OPERATIONS: NUCLEAR MATERIALS MANAGEMENT AND CONSOLIDATION I

U.S. Department of Energy’s Tritium and Enriched Uranium Management Plan Through 2060 — A 2014 Update	N/A
<i>Morris E. Hassler, Richard W. Meehan, Becky G. Eddy</i>	
Mark-18A Target Materials Recovery Study.....	661
<i>Sharon Robinson, Jeffery Allender, Bradley Loftin, Bradley Patton</i>	
Nuclear Materials Measurement Impacts on Plutonium Storage and Disposition	671
<i>Jeffrey S. Allender, Christine M. Hadden, R. Stephen Lee, Brian A. Eberhard, Thomas J. Grim</i>	
International Safeguards Experience at Savannah River Site	678
<i>Richard E. Koenig</i>	
Direct Canning EU Materials Supporting the 9212 Transition and Uranium Processing (UPF) Facility at the Y-12 National Security Complex	684
<i>Jeniece V. May</i>	

SESSION B – INTERNATIONAL SAFEGUARDS: STRENGTHENING STATE SYSTEMS OF ACCOUNTING AND CONTROL AND MEMBER STATE SUPPORT OF IAEA SAFEGUARDS

The Status of the Implementation of International Atomic Energy Agency (IAEA) Safeguards in the United States	694
<i>J. Stephen Adams</i>	
INSEP Approach to Bilateral Cooperation in SSAC Information Management.....	704
<i>Ron Cain, Nguyen Nu Hoai Vi, John Oakberg, Ike U. Therios, Joseph Scott Purvis</i>	
A Review of IAEA Safeguards Agreements within the United States	711
<i>Eric Freeman, Gisele Irola</i>	
Improvement of National Inspection Regime for Enhanced Cooperation Between the ROK and the IAEA	721
<i>Seong Youn Jo, Seung Ho Ahn, Byung Marn Koh, Ki Hyun Kim</i>	

SESSION C – MATERIALS CONTROL AND ACCOUNTABILITY: NEUTRON MEASUREMENTS III

Li-6 Glass Scintillator for Detecting and Discriminating Fission Neutrons in a Mixed Radiation Field Using Time-of-Flight Technique	730
<i>Syed F. Naeem, Brian Wieger, Shaun D. Clarke, Sara A. Pozzi</i>	
A Method for Discrimination of Neutron and Gamma Pile-up Events in Scintillation Detectors with a Simultaneous Identification of Malfunctioning Ones	739
<i>Dina Chernikova, Zsolt Elter, Kare Axell, Anders Nordlund</i>	
Design of Handheld Stilbene System for Neutron Detection in a High-Gamma Field	745
<i>Mark Bourne, Shaun Clarke, Andreas Enqvist, Sara Pozzi, Natalia Zaitseva, Steve Payne</i>	

SESSION D – NONPROLIFERATION AND ARMS CONTROL: PANEL DISCUSSION – USING MATERIAL ATTRACTIVENESS IN THE DEVELOPMENT OF GRADED SECURITY APPROACH

Panel Discussion: Using Material Attractiveness in the Development of a Graded Security Regime	752
<i>Joseph Rivers</i>	

SESSION E – NONPROLIFERATION AND ARMS CONTROL: STRATEGIC TRADE CONTROL

Addressing Proliferation Concerns Within the Existing NRC Regulatory Framework	757
<i>Thomas A. Grice, Brian Smith, Brooke Smith</i>	
I'm Gunna Pop Some Tags - Implications of Secondhand Dual-use and Sensitive Technologies for the Nonproliferation Regime	765
<i>Amanda Sayre</i>	
Nuclear Export Controls Updates	775
<i>Filippo Sevini</i>	
Examining Impacts, Challenges and Next Steps for Nuclear Nonproliferation and the Cyber Environment	786
<i>Kevin M. Whattam, Zoe N. Gastelum, Nick O. Cramer, K. Conklin</i>	

VOLUME 2

The Evolution of Dual-Use Export Controls: From Control List to End-user Controls?	802
<i>Andrea M. Viski</i>	

SESSION F – NUCLEAR SECURITY AND PHYSICAL PROTECTION: NUCLEAR SECURITY CULTURE

Security Culture for Radioactive Sources: Assessment, Enhancement and Sustainability	809
<i>Igor Khripunov, Sara Z. Kuchesfahani, Paul Ebel, Heru Umbara, Khairul Khairul</i>	
A Study on the Development of National Guide for Implementing Nuclear Security Culture in ROK	819
<i>Moonsung Koh, Youngwook Lee, Hosik Yoo</i>	
Japan's Effort on Promoting Nuclear Security Culture	824
<i>Naoko Noro</i>	

SESSION G – PACKAGING, TRANSPORTATION AND DISPOSITION: SPENT AND WASTE PACKAGING AND TRANSPORTATION

Advance High-Level Radioactive Waste Disposal Method	834
<i>Montu P. Bhuvu, Parthkumar R. Patel, Darpan K. Shukla</i>	
Remote Waste Management Systems Support Fukushima Decommissioning Efforts	841
<i>Sheldon Lefkowitz</i>	
Dose Rate Analysis Capability for Actual Spent Fuel Transportation Cask Contents	845
<i>Georgeta Radulescu, Robert A. Lefebvre, Douglas E. Peplow, John M. Scaglione, Mark L. Williams</i>	

SESSION H – EDUCATION AND TRAINING: UNIVERSITY ENGAGEMENT AND PUBLIC OUTREACH

Sharing the U.S. Perspective of Academic Collaboration in Nuclear Nonproliferation, Security and Safeguards: Texas A&M University and Tomsk Polytechnic University	855
<i>Claudio A. Gariazzo, Kate P. Spence</i>	
Unleash the Atom: A Step-By-Step Approach to Build Confidence Among General Public About Nuclear Energy	865
<i>Vipin Shukla, Harsh Agarwal</i>	
The Role of Teachers on Forming Perception on Nuclear Safety in Indonesia	871
<i>Sheila Amalia, Adhiyta Hidayat</i>	
The Role of Students to Increase the Knowledge and Understanding of Society about Nuclear Technology in Indonesia	875
<i>Ganjar Putro Indratoro, Dedy Prasetyo Hermawan, Muhammad Rizki Oktavian, Fatikh Fikri Muhammad, Siti Qulsyuni Shofiyani, Nur Arifah</i>	

POSTER SESSION

Time Correlation Measurements Using Neutron Scintillation Detectors with Digital Pulse Shape Analysis	N/A
<i>Alexander Barzilov, Norman Richardson</i>	
Digital Neutron Spectrum Unfolding Using Wavelets	N/A
<i>Alexander Barzilov, Jessica Hartman</i>	
Potential Trends on Nuclear Safety and Nuclear Security Interaction	N/A
<i>Andrei Bezsonnyi, Timofey Tsvetkov, Evgenie Kushnir</i>	
Risk-Informed Approach to Upgrading Nuclear Security Systems at Nuclear Sites	N/A
<i>Igor Markov, Andrew Bezsonnyi</i>	
Thermal Conductivity Studies on $\text{NpO}_2\text{-Al}$ Cermet Pellets	884
<i>Vickram J. Singh, R. Steve Owens</i>	
ARG-US Remote Area Modular Monitoring for Dry Casks and Critical Facilities	889
<i>Hanchung Tsai, Brian Craig, Hok Lee, Ketan Mittal, Yung Liu, James Shuler</i>	
Shielding Analysis of Dual-Purpose Cask for Spent Nuclear Fuel under Normal Storage Condition	899
<i>Tae-Man Kim, Myung-Hwan Seo, Chang-Yeol Baeg, Si-Tae Yun, Jae-Hun Ko</i>	

ARG-US CommBox: A Standalone Item-Based Tracking and Monitoring System.....	909
<i>Brian Craig, Hok Lee, Kevin Byrne, Ketan Mittal, Justin Scherer, Han-Chung Tsai, Yung Liu, Jim Shuler</i>	
The Development of the Nuclear Material Accounting System for PIEF at KAERI	916
<i>Hyun Jo Kim, In Chul Kim, Byung Doo Lee</i>	
Thermal Analysis of Canned Motor: A Special Type of Squirrel Cage Induction Motor by Lumped Heat Analysis	921
<i>Pankaj K. Pandey, Vijay Vinod Mehta, A. Raviprasad</i>	
Conceptual Design of Hybrid Nuclear Material Accounting Instrument for U/TRU Ingot of Pyroprocessing	930
<i>Hee Seo, Byung-Hee Won, Seong-Kyu Ahn, Se-Hwan Park, Seung Kyu Lee, Ho-Dong Kim, Spencer Menlove</i>	
Effective Thermal Conductivity Based on Methods for Calculating Peak Cladding Temperatures of Spent Fuel Assembly in Transportation/Storage Casks	939
<i>Hyungjin Kim, Gyeong-Uk Kang, Chang-yeal Baeg</i>	
Establishment of a Nuclear Forensics Support System in the Republic of Korea	948
<i>Seungmin Lee, Ho-Bin Yim, Kyungmin Kim, Yunjeong Hong, Jae-Kwang Kim</i>	
Feasibility of a Compton Suppression System for the X-ray Fluorescence (XRF)	953
<i>Seung Kyu Lee, Hee Seo, Byung Hee Won, Se-Hwan Park, Ho-Dong Kim, Yong Kyun Kim</i>	
The Role of Nigeria Research Reactor-1 in Nigeria's Nuclear Power Programme	962
<i>Mbet A. Akpanowo</i>	
Argentinean Safeguards Accountancy System — Requirements and Conceptual Design	N/A
<i>Sebastián Vigile, Beatriz Olano, Gustavo Diaz, Leonardo Pardo, Patricia Arrigoni, Stella Bonet Duran, Carlos Llacer</i>	
Highly Portable Augmented Reality for Safeguards	N/A
<i>Jason Bolles, Karl Horak</i>	
Large Nuclear Calorimeter for Non Destructive Assay on 55-Gallon Waste Drums	971
<i>Bachelet Franck, Luc Dujardin, Sébastien Clouard, Armelle Collardey, Marc Theobald, Guillaume Jossens, Christophe Mathonat, Gary Etherington</i>	
University Nevada Las Vegas Graduate Certificate in Nuclear Safeguards	N/A
<i>Alexander Barzilov, William Culbreth</i>	
Gamma Spectroscopy Systems for Versatile In Situ Counting at the Penn State Radiation Science and Engineering Center.....	981
<i>Sarah E. Sarnoski</i>	
Load Measurements Programming in Belt-conveyor Using Radiation and the Principle of Displacement Based on Nuclear Security Culture	N/A
<i>Mas Ipin, Humam Fauzi, Helmi Tanthawi</i>	
Enrichment Meter Measurements with Falcon 5000	991
<i>Andrey Bosko, Sean Stanfield, Bill Mussman</i>	
Legal Framework on Nuclear Safety, Security and Safeguards	N/A
<i>Manjul Indauliya, Nilima Panda, Gunjan Indauliya</i>	
The Top Ten Things You Need to Know about Non-Destructive Assay	997
<i>Scott L. Stewart, Nicholas Quintero, Jennifer Erchinger, Manit Shah, Steve Gerlt, Rob Zedric, Royal Elmore, Thomas C. Pope, Ryan Coogan</i>	
A Novel Approach of Wavelet-based Edge Detection Technique for Nuclear Facility Surveillance Camera	N/A
<i>Vivek J. Maradia, Gunjan Indauliya</i>	
Triples Production by Cosmic Ray Interactions	1004
<i>John C. Stooksbury, Stephen Croft</i>	
Modeling Gas Phase of Enthalpy and Entropy of Adsorption and Desorption of Ln[Hfac]_x Compounds	1011
<i>Jerrad P. Auxier, John D. Auxier, Daniel Hansen, Howard L. Hall</i>	
Republic of Moldova Efforts in Improving Regional Cooperation on Nuclear Security After the Nuclear Security Summit in Seoul	1018
<i>Artur Buzdugan, Angela Sidorenco, Natalia Vasilieva</i>	
Nuclear Security and Physical Protection	N/A
<i>Ranjeet Kumar Verma</i>	
Radiation Measurement Using a Wireless Robot	1024
<i>Ankanksha Singh, Abhijit Verma, Shikha Prasad</i>	
Development of a MCNP Library in Support of a Broad-Area Search Detection System	1033
<i>Hannah Hale, Samuel Willmon, Howard L. Hall, Matthew Thornbury</i>	
Development of a Semi-Autonomous Aerial Radiation Detection System	1039
<i>Matthew L. Thornbury, Howard L. Hall, Samuel J. Willmon, Hannah Hale</i>	
Korea Safeguards Information System	N/A
<i>Hye-Won Shim</i>	
Analysis of High-Energy Neutron Source Nuclear Reactions Produced by LASER for Nuclear Material Detection	N/A
<i>Sandra K</i>	
Application of GRAS Tool to Study Performance Degradation of HPGe Detector Due to Radiation Damage	1049
<i>Mudit Mishra, Shikha Prasad</i>	
World Nuclear University Alumni Assembly	1054
<i>Jessica L. White-Horton, Patrick D. Lynch, K. Gilligan, J. Garner, T. Guzzardo, M. Kuhn, N. Rowe</i>	
Startup of an Academic Radiochemistry Laboratory: The Groundwork for Nuclear and Radiochemistry Expertise	N/A
<i>Joshua R. Chandler, John Auxier II, Howard Hall</i>	
Feasibility Study of Cosmic-ray Induced Spallation Neutron Background Corrections for Passive Neutron Coincidence Counting at High Altitudes	N/A
<i>Marcel F. Villani, Sean Stanfield, P. Timothy Barton</i>	

Platform-Scale Testing to Substantiate Load Cell Monitoring for Nuclear Safeguards	N/A
<i>Ross Snow, James Garner, Michael Whitaker</i>	
Application of LG-SIMS to Uranium Particle Analysis for IAEA Safeguards	1062
<i>Laure Sangely, Jane Poths, Axel Schwanhaeusser, Olivier Bildstein, Thippatai Tanpraphan, Herbert Siegmund, Steve Balsley</i>	
Extension of the Incident Flux Response Expansion Method for Radiation Detection Modeling	1072
<i>Dingkang Zhang, Farzad Rahnema</i>	
New Dimensions of Center of Excellence	N/A
<i>Syed Tahir Raza Nagvi</i>	

CONCURRENT TECHNICAL SESSIONS IV

FACILITY OPERATIONS: NUCLEAR POWER SYSTEMS FOR REMOTE OR HOSTILE ENVIRONMENTS II

Formation of Surface Oxides on the Superalloy MAR-M-247 as a Function of Heat Treatment Parameters	1081
<i>Daniel P. Kramer, Thomas N. Wittberg, Chadwick D. Barklay, Christofer E. Whiting, Steven M. Goodrich</i>	
Thermomechanical Characterization and Analysis of Insulation Materials for Nuclear-Based Space Power Systems	1091
<i>James G. Hemrick, Zachary Burns, George Ulrich</i>	
Plutonium-238 Production Target Design Studies	1101
<i>Christopher J. Hurt, Robert M. Wham, Randy W. Hobbs, R. Steve Owens, Robert N. Morris, David Chandler, James D. Freels, G. I. Maldonado</i>	
Helium Transport in PuO₂ as a Function of Temperature and Heating Rate	1111
<i>Roberta Mulford</i>	
Iridium Welding Process Improvement	1121
<i>Stanley Pierce, Paul Moniz</i>	
Pu-238 Oxide Fuel Fracture Behavior as a Function of Age	1132
<i>Roberta Mulford</i>	
Studying the Effect of Oxygen Stoichiometry on the Ceramic Integrity of Cerium Dioxide, a Surrogate Material for Plutonium Dioxide	1142
<i>Christofer E. Whiting, Emily A. Kaufman, Daniel P. Kramer, Chadwick D. Barklay, Steven M. Goodrich</i>	
Plutonium Oxide Fuel Particle Size as a Function of Aqueous Processing	1152
<i>Roberta Mulford, Diane Spengler, Rene Chavarria, Michael Stoll</i>	

SESSION B – INTERNATIONAL SAFEGUARDS: FIELD TESTING NEW METHODS, CONCEPTS AND TECHNOLOGIES

Laboratory and Field Testing of Commercially Available Detectors for the Identification of Chemicals of Interest in Nuclear Fuel Cycle for the Detection of Undeclared Activities	1161
<i>Carla Miller, Mary Adamic, Barry Siskind, Joe Brady, Heidi Smartt, Mike McDaniel, Rollin Lakis</i>	
H Canyon Safeguards Test Bed Activities	1171
<i>Lindsay Sexton, Kenneth Fuller, Michael Holland</i>	
Results of the Field Trial of the TRI-ACE and ACE Units in 2013	1180
<i>Jessica L. White-Horton, Paula Cable-Dunlap, Debra Bostick, Lindsay Sexton, Cole Hexel, Timothy Riley, Daniel Radford, Matthew Wellons, James Sumner</i>	
Field Testing with Unattended Environmental Sampling Devices	1187
<i>Lindsay Sexton, Jessica White-Horton, Timothy Riley, Daniel Radford, Matthew Wellons, Paula Cable-Dunlap, James Sumner</i>	
Arranging Spent Fuel Verification Campaign in NPPs — Experiences in Finland	1196
<i>Tapani P. Honkamaa</i>	
Joint Field Trial Considerations for UF6 Cylinder Assay Technologies at an Enrichment Facility	1204
<i>Karen A. Miller, L. Eric Smith, Carlos D. Rael, Emily K. Mace, Christopher R. Orton, Peter Schwalbach, James Morrissey, Paul De Baere, Timco Visser, Roy Veldhof</i>	

SESSION C – INTERNATIONAL SAFEGUARDS: ADVANCES IN SAFEGUARDS TECHNOLOGY AND INSTRUMENTATION FOR PYROPROCESSING

Safeguards Motivations and Limitations on Pyroprocessing Activities	1214
<i>G. Spencer Mickum, Robert D. McElroy, Nolan E. Hertel</i>	
Determination of Pyroprocessing Cathode Processor Failure Modes and Integration Into a Signature-Based Safeguards (SBS) Framework	1224
<i>Philip Lafreniere, Robert Hoover, Edward Blandford</i>	
Simulated Response of Electrochemical Sensors for Monitoring Molten-Salt Fueled Reactors	1234
<i>Devin Rappleye, Michael Simpson, Milan Stika</i>	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY: ACCOUNTING AND CONTROL

Developing a Unique Identification Method for Used Fuel Storage Casks	1244
<i>Eric Rauch, Scott Demuth</i>	

Advantages of Having a Facility Version of a Country's Automated State Nuclear Accounting System	1254
<i>Samuel L. Brown</i>	
Use of Tamper-Indicating Devices (TID) in Hot Cells	1259
<i>Bradley McGill, Pamela Rohde</i>	
Establishing and Advancing Electronic Nuclear Material Accounting Capabilities — A Canadian Perspective	1263
<i>Jennifer Sample</i>	
Improving Process Controls at In Situ Leaching Uranium Mines	1274
<i>Natalya Bokovaya, Biays Bowerman, Michael Browne, Colin Carroll, Sean Dunlop, Karen Miller, Scott Purvis, Gulnara Yeligbayeva, A. Kasabekov</i>	
Using Process Models to Reduce Uncertainties in Nuclear Material Balances	N/A
<i>Jennifer L. Ladd-Lively, Chris Pickett</i>	
Special Nuclear Material Inventory Processes at U.S. Domestic Nuclear Power Plants	1283
<i>Stephen Croft, William Marshall, Ian Gauld, Jianwei Hu, Cathy Romano, Andy Worrall</i>	

SESSION E – MATERIALS CONTROL AND ACCOUNTABILITY: GAMMA RAY MEASUREMENTS I

Temporal Gamma-Ray Spectrometry to Quantify Relative Fissile Material Content	1290
<i>Russell Williford, Alan Hunt, Edward Reedy, Vladimir Mozin, Heather Seipel, Bernhard Ludewigt</i>	
MGAU Enrichment Measurements of U/Th Compounds: Challenges and Results	1300
<i>A. Bosko, M. B. Nangu, E. T. Mbedzi, T. B. Marumo, M. A. Rasweswe, S. Croft, J. A. Chapman, R. D. McElroy Jr.</i>	
Response-Function Fitting of the Compton Continuum: Applications for X-Ray Fluorescence Densitometry	N/A
<i>Michael L. Collins</i>	
Uranium-233 Signatures	1309
<i>Louise G. Worrall, Robert D. McElroy, Alan M. Krichinsky, Steve L. Cleveland, Stephen Croft</i>	
Improvements to the Current NRF Datafile for Use in MCNPX/6	1320
<i>Thomas C. Pope, Stephen Croft, Brian Quiter</i>	
Characterization of Cerium(III) Bromide Compared to Sodium Iodide	1328
<i>Kelsey A. Reamer, Kalene M. Hanson, John K. Mattingly, Noah Bullock</i>	
²³²Th Mass Determination in a Uranium/Thorium Mixture for Safeguards Purposes	1334
<i>Mongezi B. Nangu, Benedict T. Marumo, Eva T. Mbedzi, Mosa A. Rasweswe, Stephen Croft, Robert D. McElroy, Jeffrey A. Chapman, Andrey Bosko</i>	

SESSION F – MATERIALS CONTROL AND ACCOUNTABILITY: DESTRUCTIVE ANALYSIS ANALYTICAL PROCESSES

Uranium Laser-Induced Breakdown Spectroscopy (LIBS) Plasma Lifetime and Pressure Effects	1344
<i>Kyle C. Hartig, Annie Hopkins, Igor Jovanovic, Phyllis Ko</i>	
Trace Fission Product Ratios for Nuclear Forensics Attribution of Weapons-Grade Plutonium Separated from Fuel Irradiated in Thermal and Fast Reactor Types	1352
<i>Jeremy M. Osborn, Taylor M. Coles, Sunil S. Chirayath, William S. Charlton</i>	
Investigation of Trace U-236 Content Variation in Geologic Uranium Deposits	1362
<i>Corey C. Keith, William S. Charlton</i>	
Statistical Analysis for Nuclear Forensics Experiments	1371
<i>C. M. Anderson-Cook, T. Burr, D. Crooks, M. S. Hamada, E. Thomas</i>	
Pu Standard Material Preparation in Japan	1381
<i>Mika Sumi, Katsuo Abe, Tomio Kageyama, Peter Mason</i>	
Use of Prompt Diagnostics to Shorten the Post-Detonation Radiochemistry Timeline	N/A
<i>Nicholas Quintero, David R. Boyle, Craig Marianno</i>	

SESSION G – NONPROLIFERATION AND ARMS CONTROL: NUCLEAR WEAPONS DISMANTLEMENT

Exploring the Role of Trust in Verifying Nuclear Warhead Dismantlement	1390
<i>Keir Allen, Wyn Bowen, Hassan Elbahiti, Christopher Hobbs, Matthew Moran, Ole Reistad</i>	
MCNPX-PoliMi Simulation Capacity Using Thermal Neutron Cross-sections to Assess the Reliability of the Neutron Multiplicity Mass Analysis Where Shielding is Unknown	1395
<i>Malte Götsche, Gerald Kirchner</i>	
Zero Knowledge Warhead Verification: System Requirements and Detector Technologies	1405
<i>Robert J. Goldston, Francesco D'Errico, Angela Di Fulvio, Sébastien Philippe, Alexander Glaser, Mark E. Walker</i>	
Authenticating Nuclear Warheads With High Confidence	1415
<i>Moritz Kutt, Sébastien Philippe, Boaz Barak, Alexander Glaser, Robert J. Goldston</i>	
Exploring the Conditions for Global Nuclear Disarmament	1425
<i>Alicia L. Swift, Bryan Fearey</i>	
Safety First — Not One Accident Can Occur: Nuclear Safety and North Korea's Quest to Build a Light Water Reactor	N/A
<i>Niko Milonopoulos, Edward Blandford</i>	

SESSION H – NUCLEAR SECURITY AND PHYSICAL PROTECTION: AREA/MOBILE RADIATION DETECTION

Revisiting the Broad-area Search for Radioactive Materials	N/A
<i>Sam Willmon, Howard L. Hall</i>	
Development of a Bayesian Approach to the Broad-area Search for Nuclear or Radioactive Materials	N/A
<i>Sam Willmon, Howard L. Hall</i>	
Radiation Detection through Smartphones and Cameras	1434
<i>Gorle Venkata Ramana</i>	
Comparison of NORM Surrogate with Bulk NORM for Detector Characterization	1440
<i>Sean Branney, Peter J. Chiaro, Jason Wilson, Carl Jacobs, David Premo</i>	
Evaluation of Radioactive Hazards from Scrap Metal Dump Site in Kuje Area Council, Abuja, Nigeria.....	1450
<i>Stephen O. Dahunsi, Jafaru M. Egieya</i>	

SESSION I – PACKAGING, TRANSPORTATION AND DISPOSITION: PACKAGING CONDITIONS AND TESTING

Comparison of Piezoelectric Transformer Neutron Generators and Existing Technologies	1459
<i>Emily A. Baxter, Scott D. Kovaleski, Brady B. Gall, James A. Vangordon, Peter Norgard</i>	
Impact on DOT Hours of Service on Transportation Industry	1468
<i>Warren Baugh</i>	
Additional Ballistic Testing of Radioactive Material Shipping Packages	1474
<i>Bradley M. Loftin, Richard Koenig, Glenn Abramczyk</i>	
Characterization and Effects of Hydrides in High-Burnup PWR Cladding Alloys	N/A
<i>Michael C. Billone, Tatiana A. Burtseva, Yung Y. Liu</i>	
Contamination of Zirconium Metal by Cadmium Dissolved in Molten LiCl-KCl Salt.....	1480
<i>Nick Earle</i>	
Work on the Utilization of Biological Protection of RTGs from Depleted Uranium in the Framework of the Global Partnership.....	N/A
<i>Eugeniy Kroshkin</i>	
Results of 10 Years of Successful Russian-American Cooperation in the Decommissioning Russian Radioisotope Thermoelectric Generators (RTGs)	1490
<i>Alexander S. Grigoriev, Olga Firsova, Alexey Khudykin, Tiffany A. Blanchard-Case, William J. Abramson, Stephen J. Porter</i>	

SESSION J – EDUCATION AND TRAINING: UNIVERSITY EDUCATION AND CURRICULUM DEVELOPMENT

A University Semester Course Design in Human Reliability in Nuclear Systems	1500
<i>Joseph R. Stainback IV</i>	
SRAC Extension: A Graphical User Interface to JAERI SRAC	1509
<i>Leben Asa, Debi Kurniawan</i>	
Anticipating New Issues in Nuclear Engineering Curriculum in Indonesia: Classical vs Policy Approach	N/A
<i>Ferdiansjah, Widya Rosita, Susetyo Hario Putero, Sihana, Anung Muharini</i>	
International Trends in Nuclear Security Education	1513
<i>Jason T. Harris</i>	
Introducing Nuclear Security Topics Through Synergizing Several Existing Courses in Nuclear Engineering Curriculum of Universitas Gadjah Mada	1520
<i>Susetyo Hario Putero, Sihana Sihana, Haryono Budi Santosa</i>	
Knowledge Dimensions and Cognitive Processes of a Proposed Nuclear Security Lesson for Undergraduate Student	1528
<i>Haryono Budisantosa, Susetyo Haryo Putro, Sihana Sihana</i>	

CONCURRENT TECHNICAL SESSIONS V

SESSION A – FACILITY OPERATIONS: NUCLEAR MATERIALS MANAGEMENT AND CONSOLIDATION II

Legacy Uranium Material Disposition Methods and Challenges at Y-12	1537
<i>Gerald L. Bland</i>	
Heavy Isotopes Lead Materials Management Organization Update.....	1544
<i>Bradley Patton, Sharon Robinson, Sheri Bone, Steven Sherman</i>	
The Need for U.S. Actinide Enrichment Capability	1553
<i>Bradley Patton, Sharon Robinson</i>	
Consequences of Nuclear Material Container Spills — Worker Risk	1559
<i>Jonathan Teague</i>	
UF₆ Cylinder Cleaning, Inspection and Testing.....	1568
<i>Dale Rogers</i>	

²³⁸PuO₂ Particle Size Determination Supporting Facility Safety Basis.....	1573
<i>Roberta Mulford, Rene Chavarria, Peter Ebey</i>	
Safety Class Containers for Plutonium-238 Oxide Handling and Reduction of Material at Risk	1583
<i>Diane Spengler, Jonathan Teague</i>	

SESSION B – INTERNATIONAL SAFEGUARDS: ADVANCING SAFEGUARDS WITH THE STATE-LEVEL CONCEPT

Assessment of IAEA Safeguards Implementation at the State Level! Troubles Ahead?	1593
<i>Michael Rosenthal</i>	
Safeguardability, the State-level Concept and Advanced Safeguards.....	1605
<i>Joseph F. Pilat, Kory W. Budlong Sylvester, Chantell L. Murphy</i>	
Expectations for Safeguards Effectiveness and Efficiency Under the IAEA State-Level Concept	1611
<i>J. Stephen Adams, Mark W. Goodman, Dunbar Lockwood</i>	
A Canadian Perspective on the IAEA’s State-level Concept.....	1618
<i>Patrick Burton</i>	
Evolution of Safeguards — An Expert-driven Approach to Acquisition Path Analysis	1626
<i>Chantell Murphy, Clemens Listner, Brian Boyer, Kory Budlong Sylvester, Joseph F. Pilat</i>	

VOLUME 3

Evolution of Safeguards - What Can Formal Acquisition Path Analysis Contribute?	1635
<i>Clemens Listner, Chantell L. Murphy, Morton J. Canty, Gotthard Stein, Arnold Reznicek, Irmgard Niemeyer</i>	
ESARDA Contributions to IAEA State-level Concept.....	1645
<i>Filippo Sevini, Irmgard Niemeyer, Arpad Vincze, Klaas Van Der Meer</i>	
The Use of Performance Targets in the State-level Concept	1655
<i>Kory Budlong Sylvester, Joseph F. Pilat, George Anzelon, Chantell L. Murphy, Celia Reynolds, Brian D. Boyer</i>	
Prioritizing Acquisition Paths Under the State-level Concept	1665
<i>George A. Anzelon, Kory J. Budlong-Sylvester, Celia Reynolds</i>	
Developing a State-level Approach for a Hypothetical State with Advanced Fuel Cycle Capabilities.....	1675
<i>Brian D. Boyer, Kory Budlong Sylvester, Chantell L. Murphy, James E. Doyle</i>	

SESSION C – INTERNATIONAL SAFEGUARDS: EDUCATION AND TRAINING FOR ADVANCING INTERNATIONAL SAFEGUARDS

Japan Atomic Energy Agency's (JAEA) International Capacity Building Regarding Safeguards and SSAC — 20 Years of Achievement and Future Challenges	1685
<i>Masao Senzaki, Yosuke Naoi, Toshihiro Kurabayashi, Kazuko Hamada, Yukiko Okumura</i>	
Activities at the Integrated Support Center for Nuclear Nonproliferation and Nuclear Security, and Trilateral Harmonization Among Japan, ROK and China.....	1695
<i>Yosuke Naoi, Naoki Kobayashi, Masao Senzaki</i>	
Competencies, Education, Training and Assessment for SSACs: Developing a Comprehensive National Framework	1704
<i>Susan E. Pickett, Jean-Maurice Crete, Sabina Ticevic, Anna Weichselbaum</i>	
International Safeguards Pre-inspector Course.....	1714
<i>Amanda Rynes, Sean Morrell, Jeff Sanders, Jay Disser, James West, Mark Schanfein, Shirley Johnson</i>	
Nuclear Security Science and Society: Connecting Students to Scientists	1719
<i>Bethany L. Goldblum, Erika Suzuki, Robert L. Brown, Michael Nacht, Stanley G. Prussin, Jasmina Vujić</i>	
Nuclear Science and Security Consortium: Training the Next Generation.....	1729
<i>Bethany L. Goldblum, Jasmina Vujić</i>	
Idaho National Laboratory University Engagement	1736
<i>Amanda Rynes, Sean Morrell, Melissa Scholz, Sarah Poe</i>	
Secret Objective Standoff: International Safeguards Educational Exercise	1741
<i>Samantha L. Okowita</i>	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY/INTERNATIONAL SAFEGUARDS: DEVELOPMENT OF ADVANCED SAFEGUARDS AND SECURITY NDA TECHNOLOGIES BY JAEA-ISCN

Introduction to Development of Advanced Safeguards and Security NDA Technologies by JAEA-ISCN	1749
<i>Michio Seya, Masatoshi Kureta, Kazuhiko Soyama, Hironobu Nakamura, Hideo Harada, Ryoichi Hajima</i>	
Development and Demonstration of a Pu NDA System using ZnS/¹⁰B₂O₃ Ceramic Scintillator Detectors	1759
<i>Hironobu Nakamura, Akira Ohzu, Nozomi Kobayashi, Yasunobu Mukai, Kaoru Sakasai, Tatsuya Nakamura, Kazuhiko Soyama, Masatoshi Kureta, Tsutomu Kurita, Michio Seya</i>	
Development of Neutron Resonance Densitometry	1768
<i>Hideo Harada, Peter Schillebeeckx, Harufumi Tsuchiya, Fumito Kitatani, Mitsuo Koizumi, Jun Takamine, Masatoshi Kureta, Hideki Ilmura, Atsushi Kimura, Michio Seya, Bjorn Becker, Stefan Kopecky, Kim J. Kauwenberghs, Andre Moens, W. Mondelaers</i>	

Developments of a LaBr₃ Scintillation Detector System for Neutron Resonance Densitometry (NRD).....	1776
<i>Mitsuo Koizumi, Harufumi Tsuchiya, Fumito Kitatani, Hideo Harada, Jun Takamine, Masatoshi Kureta, Michio Seya, Atsushi Kimura, Hideki Ilmura, Bjorn Becker, Stefan Kopecky, Willy Mondelaers, Peter Schillebeeckx</i>	
Mixed Sample Effect on Areal Density Measurement with NRTA for Particle Like Debris of Melted Fuel	1783
<i>Harufumi Tsuchiya, Hideo Harada, Fumito Kitatani, Mitsuo Koizumi, Masatoshi Kureta, Jun Takamine, Hideki Ilmura, Bjorn Becker, Stefan Kopecky, Kim-Josepha Kauwenberghs, Andre Moens, Willy Mondelaers, Peter Schillebeeckx</i>	
Development Status of Nondestructive Assay Systems Based on Nuclear Resonance Fluorescence	1789
<i>Ryoichi Hajima, Takehito Hayakawa, Toshiyuki Shizuma, Christopher T. Angell, Michio Seya</i>	
Background Contributions of NRF-based Nondestructive Assay for Spent Nuclear Fuel	1795
<i>Toshiyuki Shizuma, Takehito Hayakawa, Christopher Angell, Ryoichi Hajima, Futoshi Minato, Kenya Suyama, Michio Seya, Micah S. Johnson, Dennis P. McNabb</i>	
Modeling and Benchmarking Nuclear Resonance Fluorescence Experiments using Laser-Compton Scatter Sources	N/A
<i>Brian Quiter, Thibault Laplace, Bernhard Ludewigt</i>	
Report of International Symposium of Nuclear Physics and Gamma-ray Sources for Nuclear Security and Nonproliferation	1804
<i>Takehito Hayakawa, R. Hajima, T. Shizuma, P. Bolton, M. Seya, Y. Naoi, N. Kobayashi, M. Senzaki</i>	

SESSION E – MATERIALS CONTROL AND ACCOUNTABILITY: SCIENTIFIC METHODOLOGIES IN NDA I

Multi-Region Multi-Energy Formulas for Neutron Multiplicity Counting	1809
<i>Tal Malinovitch, Chen Dubi</i>	
Monte Carlo Simulation of Neutron/Gamma-Ray Time-Dependent Cross-Correlation Functions in Source-Driven Noise Analysis Measurements for Uranium Mass Evaluation	N/A
<i>Po Huang, Cengmin Ye, Qilin Xie</i>	
Passive Neutron Interrogation for Fissile Mass Estimation in Systems with Unknown Detection Efficiency	1819
<i>Chen Dubi, Elad Oster, Itamar Israelsky, Janos Bagi, Jozsef Huszti</i>	
Exploring the Impact of Nuclear Data Uncertainties in Ultra-high Resolution Gamma Spectroscopy for Isotopic Analysis Using Approximate Bayesian Computation	1829
<i>Tom Burr, Andrew Hoover, Stephen Croft, Michael Rabin</i>	
On the Possibility of Correlation Measurements with Fission Chambers and Campbell Techniques	1838
<i>Lenard Pal, Imre Pázsit</i>	
Gamma Spectroscopy-based Inverse Radiation Transport Problem Stability Analysis	1848
<i>David R. Anderson, John Mattingly</i>	
Advances in the MCNPX-PoliMi Code for Nuclear Safeguards Applications	1857
<i>Shaun D. Clarke, Matthew J. Marcah, Marc L. Ruch, Jennifer L. Dolan, Marek Flaska, Ed W. Larsen, Enrico Padovani, Paolo Peerani, Sara A. Pozzi, T. H. Shin</i>	
Weighted Least Squares Fitting of Gamma Spectroscopy Efficiency Functions with Correlated Data Sets	1866
<i>John M. Kirkpatrick, William Russ, Kara E. Morris, Brian M. Young</i>	
Experiments and Simulations of Correlated, Prompt Emissions in Cf-252.....	1874
<i>Sara Pozzi, Brian Wieger, Steven Ward, Shaun Clarke, Marek Flaska, Matthew Marcah, Edward Larsen, Andreas Enqvist, Ramona Vogt, Jorgen Randrup, Patrick Talou, Toshihiko Kawano, Ionel Stetcu, Enrico Padovani</i>	
Utilizing Delayed Gamma-Rays to Establish Fission Yields of Short-Lived Isotopes	1882
<i>D. C. Rodriguez, S. Reese, R. Williford, E. T. E. Reedy, H. A. Seipel, M. Smith, V. V. Mozin, A. Favalli, M. Iliev, A. W. Hunt, L. W. Campbell, B. Ludewigt</i>	

SESSION F – NONPROLIFERATION AND ARMS CONTROL: DETECTION TECHNOLOGIES I

A Pragmatic Approach to Improving Spectral Resolution for Laser-induced Breakdown Spectroscopy of Nuclear Materials.....	1891
<i>Phyllis Ko, Igor Jovanovic, Jill Scott</i>	
Automated Multigroup Cross Sections Minimized for Spectral Response.....	N/A
<i>Christopher A. Edgar, Ce Yi, Glenn E. Sjoden</i>	
Low Cost Scintillation Radiation Detector and Its Application	N/A
<i>Ziyad Devshibhai Sagrampai</i>	
The University of New Mexico Fission Spectrometer for High-resolution Fission Fragment Yield Data, With Initial Results	1897
<i>Adam Hecht, Rick Blakeley, Lena Heffern, Drew Mader, James Cole, Paul Gilbreath, Corey Vowell</i>	
Estimation of the Elemental Composition of Low-Z Neutron-attenuating Materials Using Scintillator Pulse-height Data	1903
<i>Christopher Lawrence, Michael Febbraro, Marek Flaska, Sara A. Pozzi, F D. Becchetti</i>	
Simulation Analysis of Scintillation in Sodium Iodide Detector	1914
<i>Manit D. Shah, Craig Marianno, Sunil P. Khatri, David R. Boyle</i>	
A Survey of Nuclear Data Deficiencies Affecting Nuclear Nonproliferation	1923
<i>Rian Bahran, Jesson Hutchinson, Morag Smith, Avneet Sood, Stephen Croft</i>	
Simulation of Neutron Multiplicity Measurements Using Geant4	1934
<i>Moritz Kütt</i>	

SESSION G – NONPROLIFERATION AND ARMS CONTROL: VERIFICATION CHALLENGES AND OPPORTUNITIES

Verification Lessons Learned from the INF, START I and New START Treaties	1944
<i>Edward M. Iffi</i>	
The Trilateral Initiative: IAEA Verification of Weapon-origin Plutonium in Russia and the USA	1953
<i>Thomas E. Shea, Laura Rockwood</i>	
Applying State-level Approaches to Arms Control Verification	1963
<i>Mona Dreicer, Gotthard Stein, Clemens Listner, Irmgard Niemeyer, Cliff Chen</i>	
Information Sensitivities/Classification Issues in a Warhead Verification Regime and What Approaches Might Make Sense	1969
<i>Leesa L. Duckworth</i>	
Societal Verification 2.0: Online Technologies and Inspection by the People	1973
<i>Bryan Lee</i>	
A Review of Emerging Legal and Ethical Issues in Societal Verification	1983
<i>Maynard Holliday, Kelsey Hartigan</i>	
The Role of Non-nuclear Weapon States in International Verification and Disarmament	1991
<i>Al-Sharif Nasser Bin Nasser</i>	
The Challenges and Opportunities of Making Nuclear Material Declarations	1996
<i>Jonas Siegel</i>	

SESSION H – NUCLEAR SECURITY AND PHYSICAL PROTECTION: NUCLEAR SECURITY POLICY

Efforts in Strengthening Nuclear Security Regime in Japan	N/A
<i>Kaoru Naito</i>	
Spent Fuel Pool Sabotage: An Unnecessary Risk	2003
<i>Edwin Lyman</i>	
Moving Toward an International Notification System for Radioactive Sources and Material out of Regulatory Control	2011
<i>George M. Moore</i>	
Final Staff Assessment of Chemical Security at Facilities Regulated by the Nuclear Regulatory Commission	2020
<i>Joseph Rivers, Rebecca Stone, Larry C. Harris</i>	
Rulemaking Activities for the Security of Fuel Cycle Facilities by the Nuclear Regulatory Commission	2024
<i>Joseph Rivers, Tim Harris, Alexander Sapountzis, William Gott</i>	
Integrated Nuclear Security Model for Nuclear Facilities in South Africa	2029
<i>Iyabo T. Usman, James Larkin, John Carter, Howard Hall</i>	
Deviations from Department of Energy Directives to Accommodate Unique Circumstances	2039
<i>Richard L. Donovan</i>	
Experiences in the New Nuclear Security Regulatory Framework in Hungary	2044
<i>Zsolt Stefanka, Arpad Vincze, Jozsef Safar, Kristof Horvath</i>	
Nuclear Security	N/A
<i>Bashar Aljaafreh</i>	
Sabotage Consequence Evaluation per INFCIRC 225, Revision 5	2053
<i>Dennis Stanford</i>	

SESSION I – PACKAGING, TRANSPORTATION AND DISPOSITION: IAEA SPECIAL TOPIC ON SOURCES

Improving the Cradle-to-Grave Control of Sealed Radioactive Sources: An Interregional Approach	2063
<i>Juan Carlos Benitez-Navarro, Manuel Recio, Monika Kinker, Eric Reber, Jose Miguel Roncero Martin, Vilmos Friedrich, Eric Howell, Robin Heard, Nicola Schloegl</i>	
Improving the Cradle-to-Grave Control of Sealed Radioactive Sources (SRS): An Interregional Approach/Case of Morocco	2073
<i>Mohamed Maital</i>	
Egyptian Experience in the Conditioning of Radium Sources	N/A
<i>Yasser T. Selim</i>	
Improving the Cradle-To-Grave Control of Sealed Radioactive Sources — Interregional Projects that Contribute to Achieving the Desired Outcomes	2081
<i>Gerhardus R. Liebenberg</i>	
Development and Implementation of Policies and Strategies for Radioactive Waste & DSRS Management. National Experience — Implementation	2091
<i>Rustem Paci</i>	
Experience of Bosnia and Herzegovina with an Interregional Approach of Improving the Cradle-to-Grave Control of Sealed Radioactive Sources	2097
<i>Armin Lagumdzija, Monika Kinker</i>	
IAEA Assistance in Reinforcing Capacities of National Regulatory Authorities in the Mediterranean Region to License and Exercise Regulatory Control of DSRS	2106
<i>Phil E. Metcalf, Monika Kinker</i>	

Panel Discussion — Paving the Way to Establish Cradle-to-Grave Control of Radioactive Sources in the Mediterranean Region	2115
<i>Phil Metcalf, Manuel Recio, Juan Carlos Benitez Navarro, Rosario Velasco Garcia, Willem Janssens</i>	

CONCURRENT TECHNICAL SESSION VI

SESSION A – FACILITY OPERATIONS: FACILITY SYSTEMS AND CONTROLS

Radiation Shield Design Verification and Optimisation for Two Radionuclide Production Beam Target Stations, Using the Monte Carlo Radiation Transport Code, MCNPX	N/A
<i>Tebogo G. Kupi, Johann T. Van Rooyen</i>	
Monte Carlo Analysis of the Temperature Effect on the Infinite Multiplication Factor for UO₂ and UO₂-PuO₂ Lattices of the Kritz Reactor Benchmarks	N/A
<i>S. El Ouahdani, H. Boukhal, M. Chakir, T. El Bardouni, T. Elkhoukhi, Y. Boulaïch, M. Kaddour, O. Allaoui, J. El Bakkali, K. Benabdilou, E. Chham</i>	
Thermal Analysis of TEFC (Totally Enclosed Fan Cooled) Induction Motor Using ANSYS-FLUENT and Implement this Result to Canned Motor	N/A
<i>Pankaj K. Pandey, Prasant Mishra, Vijay Vinod Mehta, A. Raviprasad</i>	
Application of Automation Tools (PLC & SCADA) in Emergency Shut Down System in Nuclear Power Plant	2119
<i>Bhumi K. Chaudhari, Swapnil Patil, Jay Joshi, Dipesh Mistry</i>	

SESSION B – INTERNATIONAL SAFEGUARDS: ADVANCES IN SAFEGUARDS TECHNOLOGIES AND INSTRUMENTATION FOR SPENT FUEL

Long-Term R&D for Safeguards	2124
<i>Allen J. Bakel, Arden Dougan</i>	
Isotopic Analysis of Spent Nuclear Fuel with an Ultra-High Rate HPGe Spectrometer	2128
<i>James Fast, Brian Glasgow, Douglas Rodriguez, Brent VanDevender, Lynn Wood</i>	
Design of a New Passive Neutron Multiplication Counter to Improve Safeguards Verification of VVER-440 Fuel Assemblies	2138
<i>Adrienne M. Lafleur, Howard O. Menlove, Colin Carroll, Daniela Henzlova, Michael C. Browne</i>	
Gamma Transport Calculations for Gamma Emission Tomography on Nuclear Fuel within the UGET Project	N/A
<i>Peter Jansson, Vladimir Mozin</i>	
Gamma-Ray Emission Tomography for Spent Fuel Assay: Modeling and Performance Evaluation Methods	2147
<i>Timothy White, L. Eric Smith, Vladimir Mozin, Nikhil Deshmukh, Richard Wittman</i>	
Passive Neutron Albedo Reactivity Measurements of Fugen Fuel	2157
<i>Julia Eigenbrodt, Stephen J. Tobin, William S. Charlton, Alan M. Bolind, Howard O. Menlove, Michio Seya, Holly R. Trellue</i>	
Preliminary Performance Results for a Direct Multiplication Measurement (DMM) for Use in Neutron Multiplicity Analysis	2167
<i>Robert D. McElroy, Stephen Croft, Tyler L. Guzzardo</i>	
Nonproliferation Application of Off-the-shelf Detectors for Research Reactors	2176
<i>Thomas Holschuh, Wade Marcum, Sean Morrell</i>	
Improved DCVD Assessments of Irradiated Nuclear Fuel Using Image Analysis Techniques	2186
<i>Erik Branger, Sophie Grape, Staffan Jacobsson Svard, Erik Wernersson</i>	

SESSION C – INTERNATIONAL SAFEGUARDS: CONCEPTS FOR IMPROVING EFFECTIVENESS OF SAFEGUARDS IMPLEMENTATION

Enhancing the Effectiveness of the International Atomic Energy Agency's Safeguards System	2196
<i>J. S. Adams, Adam Scheinman, Dunbar Lockwood, Mark Goodman</i>	
Status of NDA Techniques in Use for IAEA Verification of Light Water Reactor Spent Fuel	2206
<i>Sergey Zykov, Alain Lebrun</i>	
Performance Targets for IAEA Detection of Undeclared Activities	2213
<i>Jonathan B. Sanborn, George A. Anzelon, Mark W. Goodman, Dunbar Lockwood</i>	
Providing Effective International Safeguards for Light-water Small Modular Reactors	2222
<i>Joseph A. Cuadrado-Medina, Mark Pierson</i>	
Toward Safeguarding the Fast Breeder Reactor Fuel Cycle	2231
<i>Stephen B. Gerlt</i>	
A Realistic and Flexible Safeguards Approach for the Finnish Encapsulation Plant	2241
<i>Christos Koutsoyannopoulos, Herbert Dratschmidt, Wolfgang Kahnmeier, Mentor Murtezi, Peter Schwalbach, Andreas Smejkal, Maria Thomas, Ali Zein</i>	
Conducting Acquisition Path Analysis for Developing a State-level Safeguards Approach	2249
<i>Therese Renis, Masato Hori, Yury Yudin</i>	
Lessons Learned from the Application of Proliferation Resistance Methodologies	2255
<i>Klaas Van Der Meer, Riccardo Rossa, Alessandro Borella</i>	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY: SCIENTIFIC METHODOLOGIES IN NDA II

Preliminary Progress of Developing the Plutonium Mass Attribute Assay Equipment	2264
<i>Xiaobo Liu, Yi Lu, Yangpeng Yin, Zhongxiong Bai, Ligao Chen</i>	
Feasibility Study on the Use of Online Multivariate Statistical Process Control for Safeguards Applications in Natural Uranium Conversion Plants	2271
<i>Jennifer L. Ladd-Lively</i>	
Design, Development and Testing of an Automated Measurement System for the Assay of Plutonium in 3013 Containers	2281
<i>John A. Mason, Kevin J. Burke, Tom M. B. Jennings, Marc R. Looman, David J. Maina, Lawrence V. Odell, Adam J. Poundall, Antony C. N. Towner, Graeme H. Wood, Erik Lindburg, E. Ray Martin, Katherine B. Mejias, Curtis C. Keener</i>	
Fundamental Considerations in Uncertainty Analysis for NDA Measurements	2291
<i>John M. Kirkpatrick, Stephen Croft, Ram Venkataraman, Michael Soriano, T. Burr</i>	
Exact Propagation of Variance and Confidence Interval Calculations	2296
<i>John M. Kirkpatrick, Ram Venkataraman, Stephen Croft, Tom Burr, Ken Jarman</i>	
Comprehensive Performance Analysis of Large Volume Twin Cell Heat-Flow Calorimeters for Tritium Assay	2304
<i>Aaron Roffey, Christopher Knott, Antonio Provenzano</i>	
A Group-based Uncertainty Model for the Analysis of Non-destructive Assay Data	2314
<i>Alan Simpson, Martin Clapham</i>	

SESSION E – MATERIALS CONTROL AND ACCOUNTABILITY: NUCLEAR MATERIAL ACCOUNTANCY AND CONTROL FOR FUEL DEBRIS AT FUKUSHIMA DAIICHI NUCLEAR POWER STATION

Current Status of Fukushima Daiichi Nuclear Power Station, Progress Towards Decommissioning	2324
<i>Naoya Hirabayashi, Kogo Kimura, Akira Takagi, Katsuyoshi Oyama</i>	
The Status of the Japanese Project on Material Accountancy of Fuel Debris and U.S.-Japan Cooperation on Survey of Technologies for Nuclear Material Accountancy at Fukushima Daiichi Nuclear Power Plant	2332
<i>Cynthia Heinberg, Keiichiro Hori, James Conner, Michael Browne, Colin Carroll</i>	
Nuclear Material Accountancy Lessons Learned from the Three Mile Island (TMI) and Chernobyl Nuclear Power Plant (ChNPP) Accidents with Potential Application for Nuclear Material Accountancy at Fukushima Daiichi Nuclear Power Station	2340
<i>Douglas Akers, Brian Boyer, Michael Browne, Colin Carroll</i>	
Recommendations for Measurement Systems for Nuclear Material Accountancy of Fukushima Daiichi Fuel Debris: Neutron Technologies	2350
<i>Taketeru Nagatani, Masatoshi Kureta, Masao Komeda, Cynthia Heinberg, Adrienne Lafleur, Martyn Swinhoe, Howard Menlove, Jeff Chapman, Colin Carroll</i>	
Recommendations for Measurement Systems for Nuclear Material Accountancy of Fukushima Daiichi Fuel Debris: Gamma Technologies	2360
<i>Hirofumi Tomikawa, Akihiro Ishimi, Yasushi Nauchi, Young Ham, Duc Vo, Cynthia Heinberg, Colin Carroll</i>	
Monte Carlo N-Particle eXtended (MCNPX) Simulation for Passive Neutron Measurement of Fuel Debris at Fukushima Daiichi Nuclear Power Plants	2370
<i>Taketeru Nagatani, Shinji Nakajima, Hideo Shiromo, Takashi Asano, Yoshihiro Kosuge</i>	
Passive Gamma Spectrometry of Low-volatile FPs for Accountancy of Special Nuclear Material in Molten Core Material of Fukushima Daiichi Nuclear Power Plant — Detectability of Leakage Gamma-Ray and Fundamental Characteristics of U-Ce/Eu Compound	2380
<i>Hirofumi Tomikawa, Hiroshi Sagara, Tomooki Shiba, Akihiro Ishimi, Masahiko Osaka, Masaru Watahiki, Yusuke Kuno</i>	

SESSION F – NONPROLIFERATION AND ARMS CONTROL: DETECTION TECHNOLOGIES II

Development of a Whole Container Seal	2389
<i>Michael Kuhn, Nathan Rowe, Chris Pickett, Brad Stinson</i>	
Development of a Ceramic Seal Handheld Reader and Fluorescent Seal Coatings	2399
<i>Daniel Krementz</i>	
Final Design of a Mobile Pit Verification System	2409
<i>Michael R. Chin, Jessica N. Paul, Glenn E. Sjoden, Ce Yi</i>	
Revisiting the Conversion of U.S. Naval Reactors to Low-Enriched Uranium	2419
<i>Thomas Gray</i>	
A Novel Design Approach for Chirayu (Long living) Radioactive Identification Device (RID)	N/A
<i>Gunjan Indauliya, Vivek Maradia</i>	
Minimum Detection Criteria from Roadside Synthetic Aperture Neutron Detectors	2429
<i>Christopher A. Edgar, Glenn E. Sjoden, Matthew Molinar, Ce Yi, Kevin Manalo</i>	
Mobile Radiation Detection System	N/A
<i>Raja Kama</i>	
Proliferation Aspects of Future Commercial Fusion Power Plants	2439
<i>Matthias Englert, Giorgio Franceschini, Moritz Kutt, Friederike Fries</i>	

SESSION G – NONPROLIFERATION AND ARMS CONTROL: PROLIFERATION RESISTANCE

Quantitative Comparison Study on Nuclear Nonproliferation for Plutonium in Spent Fuel Direct Disposal and Recycle Use	2448
<i>Yusuke Kuno, Daisuke Hara</i>	
Proliferation Issues Related to Fast SMRs	2457
<i>Friederike Friess, Moritz Kutt, Matthias Englert</i>	
Nonproliferation Characteristics of Composite Nuclear Fuels	2467
<i>Abdalla Abou Jaoude, Anna Erickson</i>	
Conversion Options for Iran's IR-40 Reactor with Reduced Plutonium Production	2477
<i>Ali Ahmad, Frank Von Hippel, Alexander Glaser</i>	

VOLUME 4

Assessment of Actinides Buildup Rate of Medical Isotope Production Reactor with Uranyl Nitrate Solution Fuel	2487
<i>Sihana Sihana, Susetyo Harjo Putero, Ester Wijayanti, Widya Rosita, Mondjo Mondjo</i>	
Grand Design of Nuclear Energy System in Indonesia Based on Preliminary Nuclear Fuel Cycles Proliferation Resistance Assessment	N/A
<i>Helmi Tanthawi, Ilham Variansyah, Nur Setyo Wahyuni</i>	

SESSION H – NONPROLIFERATION AND ARMS CONTROL: NUCLEAR NONPROLIFERATION AND SECURITY CULTURE

Nuclear Materials Security Index: Building a Framework for Assurance, Accountability and Action	2493
<i>Samantha Pitts-Kiefer, Page Stoutland</i>	
A Systematic Assessment of Technical Nuclear Threat Reduction Options to Mitigate the Risk of Nuclear Proliferation	N/A
<i>Ivanka Barzashka</i>	
Quantifying the Cultural Dimension of State-level Nuclear Security	2503
<i>Chan Kim, Man-Sung Yim, So Young Kim</i>	
Stakeholders Partnership for Nuclear Security: A Success Story	2512
<i>William W. Keller, Igor Khripunov, Heru Umbara, Khairul Khairul</i>	
Hacking the Nuclear Security Culture: Communicating, Collaborating and Conspiring in a Networked World	2517
<i>Kristan J. Wheaton, Melonie K. Richey</i>	
A Model for a Distributed Security Framework	2527
<i>Carolynn P. Scherer, Galya I. Balatsky</i>	
Chinese Reprocessing and Nuclear Security Issues	2537
<i>Hui Zhang</i>	
Determining the Benefits of Nuclear Material and Arms Control on Nuclear Security	2547
<i>Claudio A. Gariazzo</i>	
The Monitoring and Verification Continuum: Developing the Technological Toolbox, and Challenges for Technology Developers	2557
<i>Leesa L. Duckworth, Jacob Benz</i>	

SESSION I – NUCLEAR SECURITY AND PHYSICAL PROTECTION: THREAT IDENTIFICATION AND PROTECTION ASSESSMENT

Balancing Science and Technology to Advance Nuclear Security	2563
<i>Wendin D. Smith</i>	
Multiple Biometric System for Security in Nuclear Facility	2571
<i>Nur S. Wahyuni, Samsiatiun Mudzkiyah</i>	
Reducing the Danger of Nuclear Terrorism in China	2579
<i>Hui Zhang</i>	
Developing the State's Capacity to Perform Evaluations of Physical Security Systems	2589
<i>Mark K. Snell, Gregory A. Baum, Dean Dominguez</i>	
A Bayesian Game Analysis of Insider Threats to Nuclear Security	2597
<i>Heonjun Park, Kyo-Nam Kim, So Young Kim, Man-Sung Yim</i>	
A Game Theoretic Approach to Nuclear Security Analysis Against Insider Threat	2604
<i>Kyo-Nam Kim, Man-Sung Yim, So Young Kim, Erich Schneider</i>	
Research and Development in Nuclear Security Studies	N/A
<i>Lawrence Anikwe Dim</i>	
Nigeria's Nuclear Security Efforts: Achievements and Prospects	N/A
<i>Mbet A. Akpanowo</i>	
Methodology for the Evaluation of the NPP Physical Protection System Quality Assurance	N/A
<i>Yury Volodin, Sergey Golovchenko, Andrey Zhukov</i>	

SESSION J – PACKAGING, TRANSPORTATION AND DISPOSITION: PACKAGING DESIGN AND MATERIALS

Insulation Substitution in a Licensed Type B Shipping Container	2612
<i>Jeffrey G. Arbital, Gerald A. Byington, W Scott Hood</i>	
The SAVY-4000 Storage Container Design: Meeting the Challenge for Worker Safety	2621
<i>Timothy A. Stone</i>	
Thermal Performance of a Vertical Dry Cask for Storage of High Burnup Used Fuel	2631
<i>Jie Li, Yung Y. Liu</i>	
Temperatures of Interest for the TN-32 Cask During Storage of High Burnup Fuel	2643
<i>Ketan Mittal, Zenghu Han, Jie Li, Hanchung Tsai, Yung Y. Liu</i>	
The Use of Aluminum as a Structural Component in a Radioactive Material Package	2653
<i>Glenn Abramczyk, Charles McKeel, Bradley Loftin, J. Steven Bellamy</i>	
Application of Austempered Ductile Iron (ADI) in Casks/Containers for Spent Nuclear Fuel	2663
<i>Arunsinh B. Zala, Gopalji, Parth R. Patel, Jay K. Joshi, Minal S. Dani</i>	

CONCURRENT TECHNICAL SESSIONS VII

SESSION A – FACILITY OPERATIONS: FACILITY AND POLICY CONSIDERATIONS

Implementation of Nuclear-Desalination in Coastal Region of India for Industrial Development	2669
<i>Swapnil S. Patil, Vipin Shukla, Gaurav K. Singh</i>	
Siting Considerations for Consolidated Storage of Used Fuel - Assessing the Impact of Key Developments Since Release of the Blue Ribbon Commission Report	2679
<i>Chuck Bernhard</i>	
The Influence of the Fukushima Accident on Japan's Reprocessing Policy and the Challenges Ahead	2687
<i>Tadahiro Katsuta</i>	
Evaluating the BN-800 as a Reactor-based Option for Plutonium Disposition	2697
<i>Friederike Friess, Moritz Kutt, Matthias Englert</i>	
Challenges of Nuclear Energy Law (Indian Perspective)	N/A
<i>Shruti Mishra, Siddhant Sao, Manjul Indauliya, Nilima Panda, Gunjan Indauliya</i>	
Implementation and Need of NU-HYDRO Power Plants in Developing Countries Like India	2707
<i>Jay K. Joshi, Parthkumar R. Patel, Arunsinh B. Zala, Gopalji</i>	

SESSION B – INTERNATIONAL SAFEGUARDS: ADVANCES IN SAFEGUARDS IN TECHNOLOGY AND INSTRUMENTATION FOR MONITORING

The Internet of Things: Ubiquitous Sensing and the Next Generation of Safeguards	2714
<i>Kit Conklin</i>	
Using Antineutrinos to Detect Single-assembly Diversion from a Long-life Fast Reactor with a Once-through Fuel Cycle	2724
<i>Christopher L. Stewart, Anna Erickson</i>	
Model Selection and Change Detection for a Time-varying Mean in Process Monitoring	2735
<i>Tom Burr, Michael S. Hamada, Brian Weaver, Larry Ticknor</i>	
An Embedded Data Logging and Analysis Solution for Process Monitoring	N/A
<i>James Garner, Michael Whitaker, John Howell, John Murphy</i>	
Integrated Analysis of Satellite Imagery for Nuclear Monitoring — Results from G-SEXTANT	2745
<i>Irmgard Niemeyer, Clemens Listner, Morton Canty, Erik Wolfart, Jean-Michel Lagrange</i>	
Preliminary Performance Characterization of a hIRX Prototype Instrument for Detection of Plutonium for Safeguards Applications	2755
<i>George J. Havrilla, Kathryn McIntosh, Zewu Chen, Jon Dunphy, Danhong Li</i>	
Prototype Hardware and Software for the Secure Branching of Facility Instrumentation	2761
<i>Maikael Thomas, George Baldwin, Ross Hymel, Jay Brotz</i>	
UHEXRF Applications to the Nuclear Fuel Cycle	2769
<i>George J. Havrilla, Kathryn McIntosh, Velma Lopez, Timothy Elam, Douglas Robinson</i>	

SESSION C – INTERNATIONAL SAFEGUARDS: IMPROVING THE EFFICIENCY OF IMPLEMENTING SAFEGUARDS AT NUCLEAR FUEL CYCLE FACILITIES

IAEA Safeguards Implementation Practices Guides	2776
<i>Carrie Mathews, Vlado Cisar, Sahar Shawky</i>	
IAEA Safeguards in New Nuclear Facilities	2784
<i>James Sprinkle, Andrew Hamilton, Karyn Durbin, Elina Martikka, Mark Schanfein, Marko Hamalainen, Melissa Scholz, Rebecca Stevens</i>	
Impact of Selection of a Nuclear Facility in the United States for Implementation of International Atomic Energy Agency Safeguards / U.S. Nuclear Regulatory Commission	2792
<i>David H. Hanks</i>	

Design and Use of an Unattended Measurement and Surveillance Station in the Product Store of a Large Reprocessing Plant	2801
Sotiris Synetos, A. Ozols, L. Persson, J. Pekkarinen, P. Richir, L. Dechamp, P. Buchet, P. Dransart, P. Peerani, N. Edmonds, A. Homer, K. Benn, A. Polkey	
Signature-based Safeguards Alternative to Material Accountability	2811
Michael Simpson, Ed Blandford, Humberto Garcia, Devin Rappleye	

SESSION D – MATERIALS CONTROL AND ACCOUNTABILITY: PROGRAM DEVELOPMENT DATA COMPARISON/CERTIFICATION

Results of the REIMEP-17 and NUSIMEP-8 Inter-laboratory Comparisons.....	2821
Rozle Jakopic, Renata Bujak, Yetunde Aregbe, Stephan Richter, Razvan Buda, Evelyn Zuleger	
Toward Production of Monodisperse Reference Particles for Nuclear Safeguards Applications.....	2828
Alexander Knott, Martin Duerr, Irmgard Niemeyer, Dirk Bosbach	
Structural Experience Gained and Lessons Learned During the Construction of the Nuclear Forensics Laboratory at NECSA, in South Africa	2836
Daniel Booyse, P. R. Mogafe	
Data Mining Uranium Mining Data	N/A
Martin Robel, Naomi Marks, Lars Borg, Ian Hutcheon, Michael Kristo	
Progress and Future Prospects of Nuclear Forensics Technology Development Project at JAEA.....	2844
Yoshiki Kimura, Nobuo Shinohara, Kaneaki Sato, Nobufumi Toda, Yoshiharu Shinoda, Yoshio Funatake, Masaru Watahiki, Yusuke Kuno	
A Measurement Evaluation Program to Support Nuclear Material Control and Accountability Measurements in Brazil	2851
Fabio C. Dias, Peter Mason	
Enabling Greater Reliability in Database Information Through Utilization of a Spent Reactor Fuel Nuclear Forensic Inverse Analysis	2857
Matthew R. Sternat	
IAEA Nuclear Material Round Robin: Summary of Results and Recommendations for Safeguards Laboratories.....	2865
Steven Balsley, David Amaraggi, Josef Berger, Stefan Burger, Markus Kohl, Urska Repinc, Andreas Schachinger, Gabriele Voigt, Steven Walsh, Dariusz Wegrzynek	

SESSION E – MATERIALS CONTROL AND ACCOUNTABILITY: GAMMA RAY MEASUREMENTS II

Nuclear Materials Quantification without Operator Adjustments Applied on Waste Packages.....	2875
Nicolas Guillot, Nicolas Saurel	
RadSearch Measurements for Quantification of Cesium and Cobalt in Legacy Sodium Loop Section Waste	2881
John A. Mason, Richard Creed, Marc Looman, Gary L. Lusk, Mark Sherick	
Performance of an In Situ Waste Assay System Adapted for Measuring 1 Liter Samples in Close Geometry	2891
Timothy Twomey, Ronald Keyser, John Long	
Passive Imaging of Nuclear Material in Waste Containers Using a Pixelated High-purity Germanium Detector	N/A
Alexander H. Couture , Ethan Hull	
Improved Detection Approach for Quantification of Fissile Material Deposits.....	2898
Stephen Croft, Graham V. Walford, Richard L. Mayer, Franklin Dubose, Laurence F. Miller, Jeffry A. Chapman, Tyler Guzzardo, Gregory R. Peacock	
Hybrid Enrichment Verification Array: Investigations of the High-energy Gamma-ray Signature Origin and Use for Partial Defect Detection	2909
Jonathan A. Kulisek, David Jordan, Emily Mace, Benjamin McDonald, L. Eric Smith	
Universal Approach to Developing Methodologies for Measuring Plutonium (Pu) Content in Holdup, Scrap and Waste Materials Using Gamma Spectrometry	N/A
Maksim Semenov , Anastasia Efremova , Sergei Levunin , Aleksandr Antushevskii , Sergei Shlygin , Andrew Sviridov , Veronica Sviridova , Katharine Losenko , Bruce Jensen , Lev Neymotin , Jeff Sanders , Robert Larsen	
Comparison of Analysis Results of SNM Measurements by Means of Device Implemented Automatic Analysis Routines, FRAM and MGA/MGAU.....	2918
Monika Risse, Wolfram Berky, Hermann Friedrich, Theo Koeble, Wolfgang Rosenstock, Olaf Schumann	
Correlation Technique for High-sensitivity Detection of ^{239}Pu	2928
Rollin Evans	

SESSION F – MATERIALS CONTROL AND ACCOUNTABILITY: SPENT FUEL NDA

Patching Holes in the Explanation of Lead Slowing-down Spectroscopy (LSDS) as Applied to the Nondestructive Assay (NDA) of Used Nuclear-Fuel Assemblies	2936
Alan Michael Bolind	
Nonlinear Optimization and the Inverse Analysis of Irradiated Nuclear Material Gamma Spectra.....	2946
Garrett J. Dean, John Mattingly	
Sensitivity Studies on the Neutron Emission of Spent Nuclear Fuel by Means of the Origen-Arp Code.....	2955
Alessandro Borella, Rossa Riccardo, Mahmoud Shehata, Klaas Van Der Meer	
Optimization of the Filter Thickness for the SINRD Technique Applied to Spent Fuel Verification	2963
Riccardo Rossa , Alessandro Borella , Klaas Van Der Meer , Pierre-Etienne Labeau , Nicholas Pauly	

A Study on Optimun Design of Active Type Fuel Rod Scanner Using Neutron Generator	2973
<i>Byung Hee Won, Hee Seo, Ho Dong Kim, Se Hwan Park, Mun Seog Baik, Jong Youl Park</i>	
A Low-cost Qualitative/Quantitative System for Wet Stored Nuclear Fuel	2982
<i>Jessica N. Paul, Glenn E. Sjoden, Franklin Dubose, Ce Yi</i>	
Monte Carlo Modeling of the Californium-Interrogation with Prompt Neutron (CIPN) Device for Spent Nuclear Fuel Measurements	2992
<i>Robert M. Zedric, Daniela Henzlova, William Charlton, Steve Tobin, John Hendricks, Holly Trellue, Thomas L. Burr</i>	
Delayed Gamma-ray Spectroscopy with Lanthanum Bromide Detector for Non-Destructive Assay of Nuclear Material	3002
<i>Andrea Favalli, Iliev Metodi, Kiril Ianakiev, Edward Reedy, Alan Hunt, Valdimir Mozin, Bernhard Ludewigt, Jonathan L. Thron</i>	

SESSION G – NONPROLIFERATION AND ARMS CONTROL: PROLIFERATION RESISTANCE AND SAFEGUARDABILITY FOR NUCLEAR SUSTAINABILITY

Outcome of the INPRO Collaborative Project “Proliferation Resistance and Safeguards Assessment Tools (PROSA)”	3011
<i>Eckhard Haas, Hong-Lae Chang, James K. Sprinkle, Jon R. Phillips, Yusuke Kuno</i>	
A Case Study for the INPRO Collaborative Project “Proliferation Resistance and Safeguardability Assessment Tools (PROSA)”	3021
<i>Hong-Lae Chang, Eckhard Haas, Eun-Ha Kwon, Won-Il Ko, Se-Hwan Park, Ho-Dong Kim</i>	
Proliferation Resistance and Material Type Considerations within the Collaborative Project or a European Sodium Fast Reactor	N/A
<i>Guido Renda, Fatih Alim, Giacomo G. M. Cojazzi</i>	
A Proliferation Resistance Evaluation for a Pyroprocessing Facility Design	N/A
<i>Seong-Kyu Ahn, Eun-Ha Kwon, Hong-Lae Chang, Ho-Dong Kim</i>	
Proliferation Resistance and Future Reprocessing Activities: Lessons Learned from the Rokkasho Reprocessing Plant	3031
<i>Thomas E. Shea, Melissa S. Hersh</i>	
Development of Safeguards Technologies for Pyroprocessing in KAERI	3039
<i>Se-Hwan Park, Bo-Young Han, Hee Seo, Seong-Kyu Ahn, Dae-Yong Song, Byung-Hee Won, Ho-dong Kim</i>	
Integration of 3S (Safeguards, Security, and Safety) Systems for Pyroprocessing: Issues and Challenges	N/A
<i>Eun-Ha Kwon, Seong-Kyu Ahn, Se-Hwan Park, Jeong-Hoe Ku, Ho-Dong Kim</i>	
Consideration on the Regulation of PR/PP	3046
<i>Hosik Yoo, Jaejin Lee, Moonsung Koh, Hyoungmin Seo, Jeonghoon Lee, Nayoung Lee</i>	

SESSION H – NONPROLIFERATION AND ARMS CONTROL: REGIMES AND TREATIES

United Nations Security Council Resolution 1540: A Universal Model?	N/A
<i>Andrea M. Viski</i>	
From Agreement to Compliance: Building Confidence in the Nuclear Security Regime	3053
<i>Jonathan D. Herbach</i>	
The European Atomic Energy Community — A Supranational Regional Power	3063
<i>Wolfgang Kilb</i>	
Looking Back at Twenty Years of Implementation and Transparency Monitoring Under the 1993 United States-Russian Federation Highly Enriched Uranium Purchase Agreement	3073
<i>Greg Dwyer, William Wanderer</i>	
Fissile Material Controls in the Middle East: Steps Toward a Middle East Nuclear-Weapon-Free Zone	3083
<i>Frank Von Hippel, Seyed Mousavian, Emad Kiyaei, Harold Feiveson, Zia Mian, Alexander Glaser</i>	
Middle East and South Asia Regional Group: Dismantling Political "Cartels" within International Organizations – The Case of the CTBTO	3093
<i>Anne-Marie Riitsaari</i>	
The Road to 2015: Prospects for the Article VI Debate	3102
<i>Joseph F. Pilat, Kory W. Budlong Sylvester</i>	
Advancing and Enhancing National Technical Measures for Handling and Dealing with Illicit Trafficking of Nuclear Material in South Africa	3109
<i>Reuben Mogafe, Jacobus J. Hancke</i>	
Developing National Regulations to Support Nuclear Security: Lessons Learned from the U.S. Support to Russia, Ukraine and Belarus	N/A
<i>Dmitry Kovchegin</i>	

SESSION I – NUCLEAR SECURITY AND PHYSICAL PROTECTION: INTRUSION DETECTION AND ASSESSMENT

Gas-phase Thermochromatographic Separations of Fission and Activation Products	3116
<i>John D. Auxier II, Daniel E. Hanson, Matthew L. Marsh, Steven Jones, Deborah A. Penchoff, Derek L. Mull, David M. Jenkins, Howard L. Hall</i>	

Design and Installation of Integrated Security Equipment Control System (ISECS) at International Nuclear Nonproliferation and Security Academy	3125
<i>Woojin Kim</i>	
Physical Protection of Nuclear Facility Through Automatic Video Surveillance System.....	3130
<i>Vipin Shukla, Gaurav Kumar Singh, Pratik Shah</i>	
Automatic Detection of Abnormal Event Using Smart Video Surveillance System in a Nuclear Power Plant.....	3139
<i>Gaurav K. Singh, Vipin Shukla, Swapnil S. Patil, Pratik Shah</i>	

SESSION J – PACKAGING, TRANSPORTATION AND DISPOSITION: AGING MANAGEMENT AND STORAGE

Measurement Methods for Effective Diffusion Coefficient of Tritiated Water	N/A
<i>Vipin Shukla, Gaurav Kumar Singh, Bhumi Chaudhari, Swapnil Patil</i>	
A Low-tech, Low-budget Storage Solution for High-Level Radioactive Sources	3147
<i>Brett W. Carlsen, Ted R. Reed, Todd L. Johnson, Weathersby John, Joseph E. Alexander, David J. Griffith</i>	
Degradation of Concrete Structures in Used Nuclear Fuel Dry Cask Storage Systems.....	3157
<i>Dwight R. Diercks, David Ma, Omesh K. Chopra, Yung Y. Liu</i>	
Role of Time-limited Aging Analysis in Managing Aging Effects on Used Fuel Dry Storage Systems	3168
<i>Dwight R. Diercks, Omesh K. Chopra, David Ma, Zenghu Han, Yung Y. Liu</i>	
Overview of the Department of Energy's Nuclear Fuels Storage and Transportation Planning Project	3178
<i>John C. Wagner, Joe Carter, Matt Feldman, Rob Howard, Mark Nutt, Jeff Williams</i>	
Holistic Aging Management for Extended Storage and Transportation of Used Nuclear Fuel	3188
<i>Dwight R. Diercks, David Ma, Omesh K. Chopra, Yung Y. Liu</i>	
Process Flow Diagrams and Node Descriptions for the UNF Waste Management System	3198
<i>Robert A. Joseph III, Gordon M. Petersen, Rob L. Howard, Mark Nutt, Richard E. Hale</i>	
Feasibility of Direct Disposal of Dual Purpose Canisters from Criticality Perspective	3208
<i>Kaushik Banerjee, John M. Scaglione, Justin B. Clarity</i>	

CONCURRENT TECHNICAL SESSIONS VIII

SESSION A – INTERNATIONAL SAFEGUARDS: PANEL DISCUSSION – CONTINUITY OF KNOWLEDGE

Panel Discussion: A Global Perspective on Continuity of Knowledge: Concepts and Challenges.....	3218
<i>Dianna S. Blair, Nathan C. Rowe</i>	

SESSION B – MATERIALS CONTROL AND ACCOUNTABILITY: HE-3 ALTERNATIVES

Design and Implementation of $^{10}\text{B}+^3\text{He}$ Integrated Continuous Monitor (BHCM) to Holdup Monitoring in Glove Boxes	3222
<i>Yasunobu Mukai, Adrienne M. Lafleur, Hironobu Nakamura, Howard O. Menlove, Martyn T. Swinhoe, Johnna B. Marlow, Tsutomu Kurita</i>	
Alternative Technologies for ^3He Detectors.....	3230
<i>John Blackadar, Greg Slovik, Shauna Haynes, David Chu</i>	
Characterization of Commercial Lithium Zinc Sulfide and Boron Coated Straw Detectors as Helium-3 Alternatives for Nuclear Safeguards and Security	3236
<i>Alex Okowita, Stephen Croft, Alex Enders, Jason Hayward</i>	
A Straw-based HLNCC Multiplicity Counter with Improved FOM in Same Form Factor	3245
<i>Jeffrey L. Lacy, Athanasios Athanasiades, Liang Sun, Christopher S. Martin, Gerson Vazquez-Flores</i>	

SESSION C – NONPROLIFERATION AND ARMS CONTROL: PANEL DISCUSSION SITUATING THE U.S./ROK RELATIONSHIP IN BROADER PERSPECTIVE

Panel Discussion: Safeguards Implementation at KAERI.....	3251
<i>Inchul Kim, Byung-Doo Lee, S. H. Lee, H. J. Kim</i>	

SESSION D – NUCLEAR SECURITY AND PHYSICAL PROTECTION: PORTAL RADIATION DETECTION

Performance of a EJ309 Organic Liquid Scintillation Detector Pedestrian Radiation Portal Monitor Prototype at the 2nd SCINTILLA Benchmark Campaign.....	3256
<i>Marc G. Paff, Marc L. Ruch, Shaun D. Clarke, Sara Pozzi, A. Sagadevan, P. Peerani</i>	
Analysis of Capabilities of Radiation Portal Monitors to Characterize the Detected Radioactive Sources	3264
<i>Leonid Kagan, Eugene Yamamoto</i>	
Radionuclide Identification by an EJ309 Organic Scintillator-based Pedestrian Radiation Portal Monitor Using a Least Squares Algorithm	3269
<i>Marc L. Ruch, Marc Paff, Athena Sagadevan, Alexis Poitras-Riviere, Shaun D. Clarke, Sara A. Pozzi</i>	

Muon Tomography for Detection of SNMs: A Reconstruction Algorithm Using MATLAB	3279
<i>Saurabh Kanth, Shikha Prasad</i>	
Nuclear Resonance Fluorescence (NRF) Imaging	3285
<i>Mayank Kumar</i>	

SESSION E – NUCLEAR SECURITY AND PHYSICAL PROTECTION: CYBER SECURITY

Cyber Security Program for Facilities Regulated by the U. S. Nuclear Regulatory Commission	3290
<i>Joseph Rivers, Eric Lee, Brad Bergemann, Russell Feltz, Barry Westreich, Stella Opara</i>	
A Study on Additional Requirements of IEEE 7-4.3.2 for Cyber Security in Safety Systems of Nuclear Power Plants	N/A
<i>Kook Heui Kwon</i>	
Cyber-Attack Analysis of a School Computer Network	3296
<i>Akinjide Akinola, Ayoade Kuye, Abiodun Ayodeji</i>	
Identification and Application of Security Measures for Petrochemical Industrial Control Systems	N/A
<i>John W. Piper, H. M. Leith</i>	

ADDITIONAL PAPERS

Adsorptive Films in Support of In-field UF₆ Destructive Assay Sample Collection and Analysis	3303
<i>Christopher A. Barrett, Alonso Martinez, Bruce K. McNamara, Bret D. Cannon, Norm C. Anheier</i>	
Export Control and the Nuclear Business World	3313
<i>Sandro Zero</i>	
Simulation of an EJ-309 Based Pedestrian Radiation Portal Monitor Using MCNPX-PoliMi	3317
<i>A. A. Sagadevan, M. L. Ruch, M. Paff, S. D. Clarke, S. A. Pozzi</i>	
Balancing Nuclear Energy Cooperation With Nuclear Nonproliferation: Situating the US-ROK Relationship in a Broader Perspective	3327
<i>N/A</i>	
Author Index	