Real World Solutions for Integrated Management of Used Fuel and HLW

Preliminary Program

April 12-16, 2015
Charleston Marriott
Charleston, SC
Bronze Sponsorship

DUKE ENERGY

EPRI

Southwest Research Institute
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# Meeting Officials

**Honorary Chair:**
- Tiina Jalonen
  - Posiva Oy

**General Chair:**
- Lake H. Barrett
  - L. Barrett Consulting, LLC

**Program Chair:**
- Andrew G. Sowder
  - Electric Power Research Institute
- Ruth F. Weiner
  - Boston Government Services

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## International High-Level Radioactive Waste Management (IHRLWM) 2015

**Title:**

"Real World Solutions for Integrated Management of Used Fuel and HLW"

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### Technical Program Committee

<table>
<thead>
<tr>
<th>Name</th>
<th>Institution/Position</th>
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<tr>
<td>Joonhong Ahn</td>
<td>University of California - Berkeley</td>
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<tr>
<td>Mick Apted</td>
<td>INTERA Inc.</td>
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<td>Sven Bader</td>
<td>AREVA Federal Services</td>
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<td>Evaristo J. (Tito) Bonano</td>
<td>Sandia National Laboratories (SNL)</td>
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<td>Daniel Bullen</td>
<td>Defense Nuclear Facilities Safety Board (DNFSB)</td>
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<td>Lake Barrett</td>
<td>L. Barrett Consulting</td>
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<td>Pat Brady</td>
<td>Sandia National Laboratories (SNL)</td>
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<td>Amanda Casella</td>
<td>Pacific Northwest National Laboratory (PNNL)</td>
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<td>Asdul Chowdhury</td>
<td>Southwest Research Institute (SWRI)</td>
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<td>Ray Clark</td>
<td>USEPA</td>
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<td>George Danko</td>
<td>University of Nevada - Reno</td>
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<td>Bjorn Overstorp</td>
<td>Swedish Radiation Safety Authority (SSM)</td>
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<tr>
<td>Leif Eriksson</td>
<td>Nuclear Waste Dispositions</td>
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<td>Charles Forsberg</td>
<td>Massachusetts Institute of Technology</td>
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<td>Frank Garisto</td>
<td>Nuclear Waste Management Organization (NWMO)</td>
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<td>Nava Garisto</td>
<td>SENES</td>
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<td>Brady Hanson</td>
<td>Pacific Northwest National Laboratory (PNNL)</td>
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<td>John Kessler</td>
<td>Electric Power Research Institute (EPRI)</td>
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<td>Matt Kozak</td>
<td>INTERA Inc.</td>
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<td>Erik Kremer</td>
<td>Nuclear Waste Management Organization (NWMO)</td>
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<td>Charles McCombie</td>
<td>Arius Association</td>
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<td>Rod McCullum</td>
<td>Nuclear Energy Institute (NEI)</td>
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<td>Sitakanta Mohanty</td>
<td>Southwest Research Institute (SWRI)</td>
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<td>Kaname Miyahara</td>
<td>Japan Atomic Energy Agency (JAEA)</td>
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<td>Steve Nesbit</td>
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<td>Gerald Ouzounian</td>
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<td>Claudio Pescatore</td>
<td>Organization for Economic Cooperation and Development (OECD)</td>
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<td>David Pickett</td>
<td>Southwest Research Institute (SWRI)</td>
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<td>Rob Rechard</td>
<td>Sandia National Laboratories (SNL)</td>
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<td>Vincenzo Rondinella</td>
<td>Joint Research Centre, Institute for Transuranium Elements (JRC-ITU)</td>
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<td>Jim Rubenstone</td>
<td>U.S. Nuclear Regulatory Commission (USNRC)</td>
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<tr>
<td>Budhi Sagar</td>
<td>Consultant</td>
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<td>Graham Smith</td>
<td>GMS Abingdon</td>
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<td>Karen Smith</td>
<td>RadEcol Consulting Ltd</td>
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<td>Andrew Sowder</td>
<td>Electric Power Research Institute (EPRI)</td>
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<td>Eileen Supko</td>
<td>Energy Resources International (ERI)</td>
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<td>Mark Sutton</td>
<td>Lawrence Livermore National Laboratory (LLNL)</td>
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<td>Peter Swift</td>
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<td>Sylvia Saltzstein</td>
<td>Sandia National Laboratories (SNL)</td>
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<td>Stephen L. Turner</td>
<td>Leidos</td>
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<tr>
<td>Abe Van Luik</td>
<td>U.S. Department of Energy (DOE) Carlsbad Field Office</td>
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<td>Stratis Vomvoris</td>
<td>NAGRA</td>
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<td>John Walton</td>
<td>University of Texas at El Paso</td>
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<td>Ruth Weiner</td>
<td>Boston Government Services</td>
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<td><strong>MONDAY SCHEDULE AT A GLANCE</strong></td>
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<td><strong>7:00 a.m. - 7:00 p.m.</strong></td>
<td><strong>Registration</strong></td>
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<td><strong>8:00 a.m. - 12:30 p.m.</strong></td>
<td><strong>Opening Plenary—I</strong></td>
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<th><strong>TUESDAY SCHEDULE AT A GLANCE</strong></th>
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<tr>
<td><strong>7:00 a.m. - 5:00 p.m.</strong></td>
<td><strong>Registration</strong></td>
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<td><strong>8:00-10:10 a.m.</strong></td>
<td><strong>Plenary—II</strong></td>
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<td><strong>10:25 a.m. - 12:30 p.m.</strong></td>
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<td><strong>6:00-7:30 p.m.</strong></td>
<td><strong>Special Evening Session</strong></td>
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<td><strong>Wednesday</strong></td>
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<td>7:00 a.m.-5:00 p.m.</td>
<td>Registration</td>
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| 8:00 a.m.-10:00 a.m. | Plenary—III  
  - Storage and Transportation: Experience, Success and Progress |                     |
| 10:25 a.m.-12:30 p.m. | **Technical Sessions**  
  - Regulatory and Institutional Topics: Challenges and Successes  
  - Regulatory and Institutional Topics—Special Session on the Waste Isolation Pilot Plant  
  - Regulatory and Institutional Topics—Special Session on the Waste Isolation Pilot Plant: It Happened Here It Happened There—Panel  
  - Storage and Transportation—Special Session on Chloride-Induced Stress Corrosion Cracking of Stainless Steel Welded Canisters During Extended Storage—Panel  
  - Nuclear Fuel Cycle Optimization and Integration—Alternative Fuel Cycles and Reactor Technologies  
  - Borehole Disposal—Siting |                     |
| 2:00-3:40 p.m.   | **Technical Sessions**  
  - Repository Performance Assessment: Radionuclide Release and Transport—I  
  - Repository Design: Natural Barrier Systems—I  
  - Storage and Transportation—Inspection and Aging Management of Dry Storage Systems  
  - Nuclear Fuel Cycle Optimization and Integration—Integrating Interim Storage and Disposal  
  - Biosphere—I |                     |
| 3:55-5:10 p.m.   | **Technical Sessions**  
  - Repository Performance Assessment: Radionuclide Release and Transport—II  
  - Repository Design: Natural Barrier Systems—II  
  - Storage and Transportation: Inspection and Aging Management of Dry Storage Systems—II  
  - Security, Safeguards and Non-Proliferation  
  - Biosphere—II |                     |
| **Thursday**     |                                                                               |                     |
| 7:00 a.m.-1:00 p.m. | Registration                                                                 | Crystal Promenade AB |
| 8:00-10:05 a.m.  | **Technical Sessions**  
  - Repository Performance Assessment—Disruptive Scenarios  
  - Regulatory and Institutional Topics—Special Session on Regulatory Updates and Milestones—Panel  
  - Storage and Transportation—Dry Storage System  
  - Storage and Transportation: Transportation Analysis and Testing—II  
  - Regulatory Institutional Topics—Advances in Understanding Consent-Based Siting for UNF Storage—Panel  
  - Regulatory and Institutional Topics—Management, Oversight and Decommissioning of Nuclear Facilities |                     |
| 10:20 a.m.-12:30 p.m. | **Technical Sessions**  
  - Repository Design: Engineered Barrier Systems—III  
  - Nuclear Fuel Cycle Optimization and Integration—Modeling and Simulation |                     |
NOTE:
Additional tickets can be purchased at the ANS Registration Desk for the Opening Reception, and the Conference Luncheon.

NOTICE FOR SPEAKERS:
All Speakers and Session Chairs must sign in at the ANS Registration Desk located in the Crystal Promenade AB, during registration hours.

MEETING REGISTRATION
Meeting and Speaker Registration will be located at the ANS Registration Desk located in the Crystal Promenade AB of the Charleston Marriott, Sunday, April 12, 2015 – Thursday, April 16, 2015. Meeting registration is required for all attendees, and speakers. Badges are required for admission to all plenaries, technical sessions and events.

REGISTRATION HOURS
- Sunday, April 12 • 1 – 4 p.m.
- Monday, April 13 • 7 a.m. – 7 p.m.
- Tuesday, April 14 • 7 a.m. – 5 p.m.
- Wednesday, April 15 • 7 a.m. – 5 p.m.
- Thursday, April 16 • 7 a.m. – 1 p.m.

MEETING AND HOTEL INFORMATION
The Charleston Marriott will be the location for the International High-Level Radioactive Waste Management Conference, where all activities and technical sessions will take place. The Charleston Marriott is located at 170 Lockwood Boulevard, Charleston, SC 29403-5123.

The special room rate for the meeting is $179/per night (single/double rate). The Government room rate is $173/per night (single/double rate). Please note that if booking an available Government rate room, a valid and active Government ID will be required at check-in.

Reservations can be made online at: Charleston Marriott
Book your Government Rate: Marriott Government Rate
To make a phone reservation for a guest room, call 800-228-9290.

Attendees must identify themselves as part of the American Nuclear Society to receive the group rate.

SPECIAL EVENTS
Opening Reception • Monday, April 13, 2015 • 7 - 9 p.m.
Location: Courtyard
One ticket to the Opening Reception is included in the full meeting registration fee. Additional tickets can be purchased in advance or on-site at the ANS Registration Desk for $100.00.

Conference Luncheon • Monday, April 13, 2015 – Thursday, April 16, 2015 • 12:30–2 p.m.
Location: Crystal AB
Each full conference registrant will include a ticket for all (4) luncheons. Single day registrations will include a lunch ticket for that day. Additional tickets, except for Thursday, may be purchase at the ANS Registration Desk for $85.00.
Opening Plenary— I: International Implementation of Used Fuel and HLW Disposal
Welcome and Opening Remarks
Session Organizer: Lake H. Barrett (L. Barrett Consulting, LLC)
8:00 a.m.
Speakers:
• Used Fuel and HLW Management in the U.S.: The View from Congress, Thomas Craig III (U.S. Senate)
• Status of Finland’s Repository Program (Onkalo Project), Tiina Jalonen (Posiva)
• Status of the CIGEO Project in France, Jean-Michel Hoorelbeke (ANDRA)

Opening Plenary— I (cont’d): International Implementation of Used Fuel and HLW Disposal
Session Organizer: Lake H. Barrett (L. Barrett Consulting, LLC)
10:25 a.m.
Speakers:
• Status of Sweden’s Repository Program, Saida Laârouchi Engström (SKB)
• What Next for Geologic Disposal in the United States? U.S. DOE (invited)
• Panel Q&A [Moderated by Michael Apted (INTERA)]

Repository Licensing—I
Session Organizer: Michael John Apted (INTERA Inc.)
2:00 p.m.
Early Involvement of the Canadian Nuclear Regulator in an Initiative for a Deep Geological Repository for the Long-term Management of Canada’s Used Nuclear Fuel, Julie Mecke (Canadian Nuclear Safety Commission)

Regulatory Review and Assessment of SNF Encapsulation and Disposal Facility Construction License Application in Finland, Jussi Santeri Heinonen, Risto Paltemaa, Kai Hämäläinen, Jaakko Leino (STUK)

Regulatory Assessment of a Spent Fuel Repository at the Forsmark Site Sweden; Evolution of Groundwater Site Conditions, Bo Stromberg, Georg A. Lindgren, Bjorn Dverstorp (Swedish Radiation Safety Authority)

Nuclear Fuel Cycle Optimization and Integration: Disposal of Dual Purpose Canister—I
Session Organizer: Matthew W. Kozak (INTERA, Inc.)
A Case for Direct Disposal of SNF in Existing DPCs, Ernest L. Hardin (SNL), Robert Clark (DOE), Robert Howard, John Scaglione (ORNL), Joe Carter (SRNL)

Revisiting Direct Disposal of Dual-Purpose Canister Systems, Andrew G. Sowder (EPRI), Matthew W. Kozak, Michael Apted (INTERA, Inc.)

Evaluation of Filler Materials to Control Post-Closure Criticality of Dual Purpose Canisters, Robert T. Jubin, Kaushik Banerjee (ORNL), Thomas F. Severynse (SRNL)

Criticality Analysis Process for Direct Disposal of Dual Purpose Canisters, John M. Scaglione (UT-Battelle), Abdelhalim A. Alsaed (Enviro Nuclear Services), Ernest L. Hardin (SNL)

Storage and Transportation: Transportation—I
Session Organizer: Ruth F. Weiner (Boston Government Services)
A Proposed Waste Acceptance Queue for Shutdown Nuclear Power Reactors, Steven P. Nesbit, Lara S. Nichols (Duke Energy Corp)

Transportation of Spent Nuclear Fuel from the Reactor Sites in U.S.—What Will It Take, Elena A. Kalinina (SNL), Ingrid Busch (ORNL)

Constraint-Based Routing Models for the Transport of Radioactive Materials, Steven Peterson, Cheng Liu (ORNL)

Systems for the Intermodal Routing of Spent Nuclear Fuel, Steven Peterson, Cheng Liu (ORNL)
Nuclear Fuel Cycle Optimization and Integration—Special Session: Progress in HLW Management at the U.S. DOE Savannah River Site

Session Organizer: Andrew G. Sowder (EPRI)

Integrated High Level Waste System Planning, Lawrence T. Ling (Savannah River Remediation), Sonitza Blanco (DOE), invited

High-Level Liquid Waste Management at the Department of Energy Savannah River Site, Lawrence T. Ling, Stuart MacVean (Savannah River Remediation), Jim Folk (DOE), invited

Robotic Sampling to Support Tank Closure at SRS, Timothy Leon Chandler, George Davis (Savannah River Remediation)

Completion of Operational Closure of Tank 5F and Tank 6F by Grouting (Including the First Time Grouting of Cooling Coils and Associated Annulus), James Rush (Savannah River Remediation, LLC), J. K. Seitz (DOE)

Borehole Disposal: General

Session Organizer: Patrick Vane Brady (SNL)

Why Demonstration of a Deep-Borehole Disposal Concept Matters to the Nuclear Industry, Andrew G. Sowder (EPRI), Rodney J. McCullum (NEI)

Deep Boreholes: A Potential Disposal Route for Hanford Cs/Sr Capsules, Karl P. Travis, Fergus Gibb (Univ of Sheffield)

Research Needs for Deep Borehole Demonstration, Patrick Vane Brady, Robert J. MacKinnon, Bill W. Arnold (SNL)

Repository Licensing—II

Session Organizer: Michael John Apted (INTERA Inc.)

3:55 p.m.

The Role of Key Consultants in the Finnish Radiation and Nuclear Safety Authority’s ‘Construction License Application’ Review and Assessment, Michael John Apted (INTERA Inc.), Neil Chapman (MCM International), Budhi Sagar (Southwest Research Inst)

Maintaining a Safety Case for Licensing—A Swedish Case Study, Kristina Gillin (Candesco), Martina Sturek (SKB)

Nuclear Fuel Cycle Optimization and Integration—Disposal of Dual Purpose Canisters—II

Session Organizer: Matthew W. Kozak (INTERA, Inc.)

Disposability of the Loaded U.S. Dual-Purpose Canisters from a Criticality Standpoint, Kaushik Banerjee (ORNL)

Initial Evaluation of Standardized Canisters in the Waste Management System, Joshua John Jarrell, Robert Anthony Joseph, Robert L. Howard (ORNL), Jeffrey A. Fortner (ANL), Richard Hale (ORNL), Elena Kalinina (SNL), Gordon M. Petersen, Robert B. Wilkerson (Univ of Tennessee)

Storage and Transportation: Transportation—II

Session Organizer: Ruth F. Weiner (Boston Government Services)

Stakeholder Tool for Assessing Radioactive Transportation (START), Mark Abkowitz (Vanderbilt Univ), Erica Bickford (DOE), invited

Laying the Groundwork for a Large-Scale Used Fuel Transportation System, Matthew R. Feldman, John C. Wagner, Kevin Connolly (ORNL), Steven J. Maheras (PNNL), Erica Bickford, Jay Jones (DOE)

Nuclear Fuel Cycle Optimization and Integration—Management of Wastes from Reprocessing

Session Organizer: Andrew G. Sowder (EPRI)

Contamination of Zirconium Metal by Cadmium Dissolved in Molten LiCl-KCl Salt, Nicholas A. Earle, Steve Eugene Skutnik (Univ of Tennessee)


Regulatory and Institutional Topics—Managing Unique Inventories of Used Fuel and HLW

Session Organizer: Graham Smith (GMS Abingdon Ltd.)

Regulatory Supervision of Management of Submarine and Icebreaker Spent Fuel in Russian Federation, Malgorzata Karpow Sneve (Norwegian Radiation Protection Authority)

Issues in Research Reactor Spent Fuel Management, Graham Smith (GMS Abingdon Ltd.)
Plenary—II: What is Consent? What Does Consent-Based Siting Really Look Like?

Session Organizer: Leif G. Eriksson (Univ of Pittsburgh)

8:00 a.m.

Speakers:
- The Public Side of Consent, Hank Jenkins-Smith (Univ of Oklahoma)
- What Did Consent Look Like for WIPP?, George Dials (LANL)
- Moving Beyond the BRC Recommendations in the U.S., Timothy Frazier (Bipartisan Policy Center’s Nuclear Waste Initiative)
- Consent in Canada, Jo-Ann Facella (NWMO)

Repository Safety Assessment I

Session Organizer: Sitakanta Mohanty (Southwest Research Inst)

10:25 a.m.

SKB’s Updates of the Forsmark SNF Repository License Application—Long-Term Safety, Allan B. Hedin (SKB)

Overview of a Postclosure Safety Assessment of a Canadian Used Fuel Repository in Sedimentary Rock, Mark Gobien, Frank Garisto, Neale Hunt, Erik Kremer (NWMO)

Development of the NUMO Safety Case—Safety Assessment, Manabu Inagaki, Susumu Kurosawa, Sanae Shibutani, Keisuke Ishida, Katsuhiro Ishiguro (NUMO)

Generating External Dose Rate Contour Map at Yucca Mountain Project, John H.C. Wang (Enviro Nuclear Services), Jabo S. Tang (Independent Consultant)

Regulatory and Institutional Topics—The U.S. Geologic Repository Program

Session Organizer: Steven P. Nesbit (Duke Energy)

Partisanship, Information, and Public Opinion about Yucca Mountain, Matthew C. Nowlin (College of Charleston)

Redirecting the U.S. Nuclear Waste Program, Bob Halstead (State of Nevada), Alvin Mushkatel, Kathy Thomas (Arizona State Univ)

Regulatory and Institutional Topics—The U.S. Geologic Repository: Getting Off the Dime—Panel

Session Organizer: Steven P. Nesbit (Duke Energy)

There is a national and international consensus that deep geological disposal is the best solution for the disposal of the large and growing quantities of used nuclear fuel and high-level radioactive waste. That consensus is further embodied in United States law (the Nuclear Waste Policy Act, as amended). Nevertheless, while other countries make progress on siting and developing geologic repositories, the future of the U.S. program remains uncertain. Knowledgeable and respected panelists from government and industry will discuss ways of making real progress on the geologic repository part of the United States radioactive waste management program. Included will be consideration of international lessons-learned that may actually be applicable and useful in the United States.

Panelists:
- Rod McCullum (NEI)
- Mick Apted (INTERA)
- Additional panelists to be announced.

Storage and Transportation—Multipurpose System Designs

Session Organizer: Brady D. Hanson (PNNL)

AREVA TN Universal Centralized Storage System, Jane He (AREVA)

MP197HB: First Licensed Transportation Package with Canistered High Burnup Fuel After Dry Storage, Jayant Bondre (AREVA TN)

Recent Issues Found in a Dual Purpose Cask Design, David Garrido (ENSA)

COBRA-SFS Dry-Cask Modeling Uncertainties in High-Capacity Canisters, Remy R. Devoe (Univ of Tennessee, Knoxville), Kevin Robb (ORNL)
Repository Site Selection
Session Organizer: Peter N. Swift (SNL)

Site Selection in Switzerland: The Narrowing-Down Methodology and its Application, Piet Zuidema, Andreas Gautschi (Nagra)

Implementing Geological Disposal in the UK, Andrew Craze (Radioactive Waste Management Limited), invited

Development of the NUMO Safety Case—Geological Characterisation and Synthesis, Kunio Ota, Junichi Goto, Kimitaka Yoshimura, Toshifumi Moriya, Takanori Kunimaru, Seiitsu Takeda (NUMO)

Canada's Deep Geological Repository for Used Nuclear Fuel—Update on the Site Evaluation Process, Mahrez Ben Belfadhel, Jo-Ann Facella, Bob Watts (NWMO)

Repository Safety Assessment— II
Session Organizer: Matthew W. Kozak (INTERA, Inc.)

2:00 p.m.
A Simple Improved Measure of Risk from a Geologic Repository, Allen G. Croff (Vanderbilt Univ)

A Methodology for Representing the Geosphere-Biosphere Interface in Assessment Models, Michael Charles Thorne (Mike Thorne and Associates Ltd), Graham Smith (GMS Abingdon Ltd)

Repository Design: Engineered Barrier Systems— I
Session Organizer: Andrew Sowder (EPRI)

Modeling Thermohydrological-Mechanical Behavior of Granular Bentonite, Chandrika Manepally, Stuart Stothoff, Goodluck I. Ofoegbu, Biswajit Dasgupta (CNWRA-Southwest Research Inst), Randall Fedors (NRC)

Monitoring of the Shaft Seal at Canada’s Underground Research Laboratory, Deni G. Priyanto Putro, Paul Thompson, Sim Stroes-Gascoyne (AECL), David Dixon (Golder Assoc Limited), Petri Korkeakoski (Posiva Op), Radwan Farhoud (ANDRA)

Nuclear Fuel Cycle Optimization and Integration: Integrating Interim Storage and Disposal— II
Session Organizer: Charles W. Forsberg (MIT)

Overview of the DOE Nuclear Fuel Storage and Transportation Planning Project, John Wagner (ORNL), Joe Carter (SRNL), Matt Feldman, Rob Howard (ORNL), William Nutt (ANL), Jeff Williams (DOE)

Update on the United States Department of Energy’s Used Fuel Disposition R&D Campaign, Peter N. Swift (SNL), Jens Birkholzer (LBNL), Shannon M. Bragg-Sitton (INL), Kevin A. McMahon, Ken B. Sorenson, Robert J. MacKinnon, Sylvia J. Saltzstein (SNL)

The Path to an International High-Level Radioactive Waste Repository, Craig L. Porter (Jetseal Engineering and Technical Services, LLC)
Storage and Transportation: Extended Storage—I

Session Organizer: Vincenzo V. Rondinella (EC-JRC-ITU)

ISI of Dry Storage Casks for Spent Nuclear Fuel: Leveraging Knowledge from Reactors, Ryan M. Meyer, Michael T. Anderson, John P. Lareau (PNNL)

The Role of Weld Residual Stresses on Environmental Degradation of Used Fuel Canisters, Ronald George Ballinger (MIT)

Probabilistic Performance Assessment: SCC of SNF Interim Storage Canisters, Charles Raul Bryan, Cedric Sallaberry, Remi P. Dingerville, Christine T. Stockman (SNL), Harold Adkins (PNNL), Mark Sutton (LLNL)

Sealing Deep Borehole Disposals of Radioactive Waste by “Rock Welding”, Fergus George Ferguson Gibb, Karl P. Travis (Univ of Sheffield), invited

High Performance Ceramic Plugs for Borehole Sealing, William E. Lowry (Olympic Research, Inc.), Andrew Duguid (Schlumberger Carbon Services)

Repository Safety Assessment—III

Session Organizer: Matthew W. Kozak (INTERA, Inc.)

3:30 p.m.

Assessment of the Chemical Hazard of a Canadian Used Fuel Repository with Copper Containers, Mark Gobien, Frank Garisto, Neale Hunt, Erik Kremer (NWMO)

Investigating the Implications of Managing DNLEU Through Geological Disposal, Daniel A. Galson (Galson Sciences Limited), Matthew Wallstead (Radioactive Waste Management Ltd.), Liz Harvey (Galson Sciences Ltd.)

Site Specificity in Advanced Dose Assessment Modeling, Richard Andrew Klos (Aleksandria Sciences Ltd.), Anders Wörman (KTH)

Repository Design: Engineered Barrier Systems—II

Session Organizer: Andrew Sowder (EPRI)

Constitutive Model Development for Thermohydrologic Processes in Swelling Porous Media, Stuart Stothoff, Chandrika Manepally (CNWRA-Southwest Research Inst), Randall W. Fedors (NRC), Goodluck Ofoegbu, Biswajit Dasgupta (CNWRA-Southwest Research Inst)

A Consequence Model for Bentonite Buffer Defects in Fractured Rock, Stuart Stothoff (CNWRA)

Borehole Disposal—Sealing and Thermal Modeling

Session Organizer: Patrick Vane Brady (SNL)

Cementitious Grouts for Disposal of Nuclear Wasteforms in Deep Boreholes, Nick C. Collier, Karl P. Travis, Fergus G F. Gibb (The Univ of Sheffield), Neil B. Milestone (Callaghan Innovation)

Sealing Deep Borehole Disposals of Radioactive Waste by “Rock Welding”, Fergus George Ferguson Gibb, Karl P. Travis (Univ of Sheffield), invited
Storage and Transportation: Extended Storage—II

Session Organizer: Vincenzo V. Rondinella (EC-JRC-ITU)

Characterization and Effects of Hydrides in High-Burnup PWR Cladding Alloys, Michael C. Billone, Tatiana A. Burtseva, Yung Y. Liu (ANL)

Spent Nuclear Fuel Characterization in View of Long-Term Storage, Vincenzo V. Rondinella, Thierry Wiss, Dimitrios Papaioannou, Ramil Nasyrow, Detlef Wegen, Fabiola Cappia (EC-JRC-ITU)

Radiolysis Model Analysis for a Used Fuel Storage Canister, Richard S. Wittman, Brady D. Hanson (PNNL)

Borehole Disposal: Challenges and Opportunities—Panel

Session Organizer: Patrick Vane Brady (SNL)

Deep borehole disposal of nuclear wastes is receiving increasing attention as a solution to nuclear waste disposal that is potentially cheaper, faster, and just as safe a solution as traditional mined geologic repositories. The US Department of Energy has recently embarked on a 5-year effort to demonstrate deep borehole technology in the field and to address key technical issues, including site selection and characterization, borehole sealing and feasibility of drilling large diameter boreholes. This panel will present US and international perspectives on the challenges and opportunities associated with deep boreholes as a disposal option.

Panelists:
- Fergus Gibb (Univ of Sheffield)
- Additional panelists to be announced.

Storage and Transportation: Transportation Analysis and Testing—I

Session Organizer: Ruth F. Weiner (Boston Government Services)

Rail Shock and Vibration Testing of Used Nuclear Fuel Assembly, Philip Jensen, Steven Ross (PNNL), Ralph Best (PNNL Independent Consultant), Nicholas Klymyshyn, Steven Maheras (PNNL), Paul McConnell (SNL), John Orchard (DOE)

Lessons Learned from CIRFT Testing on SNF Vibration Integrity Study, Jy-An John Wang, Hong Wang, Hao Jiang, Bruce Bevard, Rob Howard, John Scaglione (ORNL)

Special Fleet Maintenance Functions, Requirements, and Facility Concepts for AAR-2043 Railcars, Robert L. Howard, Paul Singley, Matthew Feldman, Dominic Giuliano, Bruce Bevard (ORNL), Joe Carter (SRNL)

Special Evening Session: Ben Rusche Special Session—Perspectives on Geologic Disposal

6:00 p.m.

Session Organizer: Ruth F. Weiner (Boston Government Services)

This special evening session honors the life and contributions of Ben Rusche, a treasured citizen of South Carolina and true pioneer and leader in nuclear safety, waste management, and clean-up. His numerous contributions and accomplishments include service as the first director of the Office of Civilian and Radioactive Waste Management at DOE, the first Director of the NRC’s Nuclear Reactor Regulation Branch roles, multiple key leadership positions at the Savannah River Plant (now Savannah River Site), and member and chair of the South Carolina Governor’s Nuclear Advisory Council. The session will feature international perspectives and dialog on lessons learned from over six decades of global pursuit for permanent geologic disposal of used fuel and HLW.

Panelists:
- Mick Apted (INTERA)
- Piet Zuidema (NAGRA)
- Michael Voegele (Consultant)
Wednesday, April 15

Plenary—III: Storage and Transportation: Experience, Success and Progress

Session Organizer: Ruth F. Weiner (Boston Government Services)

8:00 a.m.

Speakers:

- Challenges and Progress for U.S. Used Fuel and Management, TBD (DOE)
- Coming Soon: Centralized Interim Storage in Spain, Pablo Zuloaga (ENRESA)
- Transporting Used Nuclear Fuel—Experience and Perspective from a U.S. Utility, Steve Edwards (Duke Energy)
- Is Transportation of Used Nuclear Fuel and HLW a Non-Issue?, Doug Ammerman (SNL)

Regulatory and Institutional Topics: Challenges and Successes

Session Organizer: Rob P. Rechard (SNL)

10:25 a.m.

Development of the NUMO Safety Case—Overview, Hiroshi Fujihara, Akira Deguchi, Hiroyoshi Ueda, Tetsuo Fujiyama, Hiroyuki Umeki (NWMO)

The Review of the Swedish Spent Fuel Repository License Application, Johan Swahn (Swedish NGO Office for Nuclear Waste Review)

Knowledge Preservation for Repository Systems, Kevin A. McMahon, Gordon J. Appel (SNL)

Changes in Two Measures of Dose as Modeling Progressed at the Proposed U.S. Repository in Tuff, Rob P. Rechard (SNL)

Regulatory and Institutional Topics—Special Session on the Waste Isolation Pilot Plant

Session Organizer: Abraham E. Van Luik (DOE, Carlsbad Field Office)

In the nuclear industry, whatever happens in one place, especially if it is a negative thing, will have repercussions throughout the industry. The 15 years of success at the Waste Isolation Pilot Plant in New Mexico had some positive influence on other repository programs, but that quickly faded away as the news of the minor radiation release from that repository became known. Locally, support for the repository remained strong due to the communications effort made on the nature of the event, its negligible public health impacts, and the likelihood of full recovery. Local support was also enhanced by the work of an independent monitoring agency, located in Carlsbad, that corroborated the claim to continued public safety. The panel will include both U.S. and international participants.

Panelists:

- Bob McQuinn (Nuclear Waste Partnership)
- Thilo von Berlepsch (DBE, Germany)
- Alain Harman (ANDRA, France)
- Ann McCall (NDA, United Kingdom)
- Dana Bryson (DOE, Carlsbad Field Office)
- Derek Wilson (NWMO)

Storage and Transportation—Special Session on Chloride-Induced Stress Corrosion Cracking of Stainless Steel Welded Canisters During Extended Storage—Panel

Session Organizer: Steven C. Marshman (INL)

Dry storage of used nuclear fuel will continue for many years. Large numbers of welded stainless steel canister systems are in use internationally and now dominate the U.S. market. As storage times have increased, canister aging phenomena become increasingly important. Chloride-induced stress corrosion cracking (CISCC) of austenitic stainless steel is a concern for susceptible welded stainless steel systems. This panel brings together representatives from government and industry to discuss the current state of CISCSS research, the evolving state of dry storage regulations, and a status of plans and actions being taken to mitigate potential canister degradation.

Panelists:

- Al Csontos (NRC)
- Rod McCullum (NEI)
- John Kessler (EPRI)
- Steve Marshman (INL)
### Nuclear Fuel Cycle Optimization and Integration—Alternative Fuel Cycles and Reactor Technologies

*Session Organizer:* Joonhong Ahn (Univ of California, Berkeley)

Development and Testing of a Decision Framework for Informing Fuel Cycle Preferences, Andrea Resch Gardiner, Steven Krahn, Timothy Ault, Allen Croff, Bethany Smith, James Clarke (Vanderbilt Univ), Albert Machiels, Andrew Sowder (EPRI)

Qualitative and Quantitative Metrics for Evaluating the Nuclear Fuel Cycle, John M. Swanson, Ishoc Salaam, Sama Bilbao y Leon (Virginia Commonwealth Univ)


Hedging Against Uncertainty in the Nuclear Fuel Cycle, Urarisa Birdy Phathanapirom, Erich A. Schneider (Univ of Texas, Austin)

Feasibility of Molten Salt Fast Reactor for Emerging National Tasks, Yasuo Hirose, Koshi Mitachi (Retired), Yoichiro Shimazu (Fukui Univ)

### Borehole Disposal—Siting

*Session Organizer:* Patrick Vane Brady (SNL)

Siting Guidelines for a Deep Borehole Disposal Facility, Geoff Freeze, Bill W. Arnold, Patrick V. Brady, David C. Sassani, Kristopher L. Kuhlman (SNL)

Site Characterization for Deep Borehole Disposal, Kristopher L. Kuhlman, Bill W. Arnold, Patrick V. Brady, David C. Sassani, Geoff A. Freeze, Ernest L. Hardin (SNL)

A GIS Database to Support Siting of a Deep Borehole Demonstration, Frank V. Perry (LANL), Bill Arnold (SNL), Richard Kelley (LANL)

An Analysis on the Borehole Spacing of Deep Borehole Disposal for HLW, Jong-youl Lee, Geonyoung Kim, Daesok Bae, Heuijoo Choi, Kyeongsoo Kim (KAERI)

Modeling Transient Thermal Conditions for Nuclear Waste in Deep Boreholes, Robert J. Geringer, Clifford Singer (Univ of Illinois)

### Repository Performance Assessment: Radionuclide Release and Transport—I

*Session Organizer:* Andrew Sowder (EPRI)

2:00 p.m.

FIRST-Nuclides: Results on Radionuclide Release from Used Fuel, Bernhard Kienzler (KIT), Karel Lemmens (SCK.CEN)

Sensitivity Studies With a Probabilistic Radionuclide Transport Model for Geological Disposal in Meuse/Haute-Marne, France, Richard Codell (Consultant), Sitakanta Mohanty, Stuart Stothoff (Southwest Research Inst), Gregory Mathieu, Amelie de Hoyos, Marc Bourgeois, Delphine Pellegrini (IRSN)

Effects of Dissolved Hydrogen on Dissolution Rates of SIMFUEL in Reducing Repositories, Pavan K. Shukla (Southwest Research Inst)

### Repository Design: Natural Barrier Systems—I

*Session Organizer:* Efstratios (Stratis) Vomvoris (NAGRA)

Modeling THMC Changes in EBS Bentonite and Clay Host Rocks, Liange Zheng, Jonny Rutqvist, Jens Thomas Birkholzer (LBNL)

THMC Behaviour of Clay-Based Barriers under High Temperature—From Laboratory to URL Scale, Efstratios (Stratis) Vomvoris (Nagra), Jens Birkholzer (LBNL), Irina Gaus, Ingo Blechschmidt (Nagra)

Understanding Thermal Constraints for High-Heat-Generating Wastes in the UK, Ann McCall, Martin Cairns (Radioactive Waste Management Limited), invited

Storage and Transportation—Inspection and Aging Management of Dry Storage Systems

Session Organizer: John H. Kessler (EPRI)

Aging Management for High Burnup Used Fuel in Dry Storage—A Holistic Approach, Rodney J. McCullum (NEI)

Gap Analysis to Support Modeling the Long-Term Degradation of UNF Canisters, Philip Jensen, Ram Devanathan, Steven Ross, Dion Sunderland, Robert Montgomery, Brady Hanson, Nicholas Klymyshyn (PNNL)

Aging Management Program for Stainless Steel Dry Storage System Canisters, Darrell S. Dunn (NRC)

EPRI’s CISCC R&D Roadmap and Development of CISCC Aging Management Guidelines, Shannon Chu (EPRI)

Nuclear Fuel Cycle Optimization and Integration—Integrating Interim Storage and Disposal

Session Organizer: Rob P. Rechard (SNL)

Process Flow Diagrams and Node Descriptions for the UNF WMS, Robert Anthony Joseph, Robert L. Howard, Richard E. Hale, Gordon M. Petersen (ORNL), Mark Nutt (ANL)

Waste Management System Architecture Evaluations, William M. Nutt (ANL)

Integrating Management of Spent Nuclear Fuel with Consolidated Storage, Rob P. Rechard, Laura L. Price, Elena Kalinina (SNL)

Evaluation of Options for Disposal of SNF and HLW, Laura Lea Price, David C. Sassani, Peter Swift, Evaristo J. Bonano (SNL)

Internatinal Developments in Addressing Environmental Change in Post-Closure Safety Assessment, Tobias Lindborg (Swedish Nuclear Fuel and Waste Management Co)

Repository Performance Assessment: Radionuclide Release and Transport—II

Session Organizer: Andrew Sowder (EPRI)

3:55 p.m.

Scientific Understanding Aids 129I Disposal at the Savannah River Site, Daniel I. Kaplan, Kimberly Roberts (SRNL), Saijin Zhang, Chen Xu, Kathleen Schwerh (Texas A&M), Chris Yeager (LANL), Peter Santschi (Texas A&M)

Estimating Gas-Borne Dose Consequences from a Used Fuel Repository in Sedimentary Rock, Erik Paul Kreme (NWMO), J. D. Avis (GeoFirma Eng Limited), N.G. Hunt (NWMO)

Relevance of Radionuclide Transport Assisted by Colloids in a KBS-3 Repository, Osvaldo Pensado (Southwest Research Inst)

Repository Design: Natural Barrier Systems—II

Session Organizer: Asadul H. Chowdhury (Southwest Research Inst)

Modeling the Coupled Hydrogeochemical and Mechanical Behavior of a Single Artificial Fracture in Novaculite Rock, Jin-Ping (Jack) Gwo, Tianqing Cao, Randall Fedors, James Rubenstone (NRC)

Coupled Hydro-Mechanical Model for Fracture Propagation in Clay Rock, Kunwhi Kim, James E. Houseworth, Jonny Rutqvist (LBNL), Daisuke Asahina (Advanced Industrial Science and Technology), Jens Thomas Birkholzer (LBNL)

Numerical Characterization of the Excavation Damaged Zone in the HG-A Experiment, John Denys Avis, Robert Walsh, Othman Hasir (GeoFirma Eng Ltd), Helen Leung (NWMO)

Biosphere—I

Session Organizer: Karen Smith (RadEcol Consulting Ltd.)

International Cooperation and Biosphere Assessment: BIOPROTA, K. Smith (RadEcol Consulting Ltd.), G. Smith (GMS Abingdon Ltd.), D. Perez-Sanchez (CIEMAT)

Biosphere Assessment for Safety Case of Final Disposal of Spent Nuclear Fuel, Lauri Parviainen (Posiva Oy)
Storage and Transportation: Inspection and Aging Management of Dry Storage Systems—II

Session Organizer: John H. Kessler (EPRI)

Collaboration on Aging Management for Extended Storage of Used Fuel, Holger Voelzke (BAM Federal Inst for Materials Research and Testing), Yung Y. Liu (ANL)

Dry Storage Canister Inspections to Inform Aging Management Efforts, Keith Waldrop (EPRI), John Massari (Exelon), Glenn Schwartz (PSEG), Larry Pulley (PG&E), William Bracey (AREVA TN), Laszlo Zsidai (Holtec)

Inspection and Monitoring of Dry Canister Storage Systems, Jeremy B. Renshaw, Shannon Chu, John H. Kessler, Keith Waldrop (EPRI)


Security, Safeguards and Non-Proliferation

Session Organizer: Andrew G. Sowder (EPRI)

Uncertainty of the Pu to $^{244}$Cm Ratio in Spent Fuel, Seung Min Woo, Joonhong Ahn (Univ of California, Berkeley)

Numerical Estimation of the Spent Fuel Ratio, Samuel Glen Durbin, Eric Lindgren, Jason Wilke (SNL)

Biosphere—II

Session Organizer: Karen Smith (RadEcol Consulting Ltd)

Results from Post-Closure Dose Assessment Models with “Alternative” Levels of Detail, Ryk A. Klos (Aleksandria Sciences), Danyl Perez-Sanchez (CIEMAT), Shulan Xu (SSM)

Estimation of Dilution, Capture, and Dose for IAEA Reference Biospheres, Paul E. Mariner, W. Payton Gardner (SNL)

Determination of Concentration Ratios of Stable Sr and Cs for Fish, Analysis of Factors Influencing Their Range of Variation, Lena Konovalenko, Clare Bradshaw (Stockholm Univ), Ulrik Kautsky (SKB)

Review of Current Methods in Internal Dosimetry of Non-Human Biota, Nicole Martinez (Clemson Univ)
Repository Performance Assessment—Disruptive Scenarios

Session Organizer: Erik Paul Kremer (NWMO)

8:00 a.m.

Fifth Case Study: Identification and Analysis of Disruptive Scenarios, Frank Garisto (NWMO), John Avis (Geofirma Eng Ltd), Mark Gobien, Chantal Medri, Erik Kremer (NWMO)

Detailed Gas Generation and Transport Modelling at the Room and Repository Scale, John Denys Avis, Nicola Calder (Geofirma Eng Ltd), Erik Kremer (NWMO)

Modeling the Accumulation of Thermally Fissile Materials in HLW Repository, Alex Salazar (MIT), Joonhong Ahn (Univ of California, Berkeley)

A Criticality Safety Study for the Disposal of Damaged Fuel Debris, Xudong Liu, Joonhong Ahn (Univ of California, Berkeley), Fumio Hirano (JAEA)

Storage and Transportation—Dry Storage Systems

Session Organizer: Brady D. Hanson (PNNL)

Behaviour of Spent Fuel During Storage, Paul Nicholas Standring (IAEA)

The Use of Zn–40Cd Alloy Coating as a Neutron Poison in Spent Fuel Pools and Dry Cask Storage, Cody S. Wiggins, Dustin Giltnane, Dane Gotthold, Seth Langford, Michael Ratliff, Jessica Shewmaker, M. L. Grossbeck (Univ of Tennessee, Knoxville)

Experimental Determination and Modeling of Used Fuel Drying for Dry Cask Storage, Travis W. Knight, Jamil A. Khan (Univ of South Carolina), James S. Tulenko (Univ of Florida)

Phenomena Affecting Used Nuclear Fuel Cladding Temperatures during Vacuum Drying Operations, Mustafa Hadj-Nacer, Triton Manzo, Miles Greiner (Univ of Nevada, Reno), Irina Graur, Minh Tuan Ho (Univ of Aix-Marseille)

Regulatory and Institutional Topics—Special Session on Regulatory Updates and Milestones—Panel

Session Organizer: James Rubenstone (NRC)

Independent regulators have an important role in ensuring the safe and secure management of spent fuel and other high-level radioactive waste, and in environmental protection. This session highlights recent regulatory actions in the U.S. and other countries, including decisions and review activities on continued storage of spent fuel and proposed deep geologic repositories for high-level waste.

Panelist:

• Jospehine Piccone (NRC)
• Keith McConnell (NRC)
• Additional panelists to be announced.

Storage and Transportation: Transportation Analysis and Testing—II

Session Organizer: Ruth F. Weiner (Boston Government Services)

A Sufficiency Criterion for Spent Fuel in Dry Storage Subjected to Transportation Accident Conditions, Joseph Y. R. Rashid (ANATECH), Albert Machiels (EPRI)

Impact of Cask Wake on Dispersion of an Accidental Release of Radioactive Material, Ruth Weiner, Christopher Clutz (SNL)

Shielding Evaluation of the ENSA ENUN 32P Cask for Zonal Loading, Dominic Napolitano (NISYS Corp), David Hartmanngruber, Drew Blackwell (Enercon Federal Services), David Garrido (Equipos Nucleares, SA)

Burnup Credit Criticality Evaluation of the ENSA ENUN 32P Cask, Dominic Napolitano (NISYS Corp), Curt Lindner, Alan Wells (Enercon Federal Services), David Garrido (Equipos Nucleares, SA)
Regulatory Institutional Topics—Advances in Understanding Consent-Based Siting for UNF Storage—Panel

Session Organizer: Rob Rechard (SNL)

As the U.S. contemplates directions for and revisions to its radioactive waste policy, the next few years provide an opportunity to explore options for and attributes of a consent-based process for siting radioactive waste management facilities. Panel members will review research on public perceptions of consent-based siting, discuss the implications of these perceptions relative to the U.S. situation, and capture lessons learned from international programs, including those addressed in Tuesday’s Plenary Session on Consent.

- Matt Knowlin (College of Charleston)
- Additional panelists to be announced.

Regulatory and Institutional Topics—Management, Oversight and Decommissioning of Nuclear Facilities

Session Organizer: Kevin A. McMahon (SNL)

Content Analysis of DOE Occurrence Reports at Nuclear Chemical Facilities, Lyndsey Fyffe, Steven L. Krahn (Vanderbilt Univ), James Hutton (DOE), David Kosson, James H. Clarke (Vanderbilt Univ)

Decommissioning and Environmental Remediation Scenario Development for Fukushima Daiichi, Hideki Kawamura (Obayashi Corp.), Katsumi Kishimoto (JAEA), Ian G. McKinley (MCM)

Aging Management Program for Concrete Structures, Ricardo Daniel Torres (NRC)

Fukushima Spent Fuel Defueling Status, Takao Shimura, Masaru Iwanami (Hitachi-GE Nuclear Energy)

Repository Design: Engineered Barrier Systems—III

Session Organizer: David A. Pickett (Southwest Research Inst)

10:20 a.m.

Development of the Canadian Used Fuel Repository Engineered Barrier System, Chris Hatton (NWMO)

Development of the NUMO Safety Case—Repository Design and Engineering, Shigeru Kubota, Kiyoshi Fujisaki, Satoru Suzuki, Akira Deguchi (NWMO)

Alternative Method for the Production of Copper Barriers, Andrew McClusky (BEP Surface Technologies Ltd), Tomas Hernandez-Selva, Dirk Engleberg, Fabio Scenini (Univ of Manchester)

Corrosion of Carbon Steel and Copper Waste Containers in Reducing Environment, Xihua He, Jude McMurry (Southwest Research Inst), Tae Ahn (NRC)

Nuclear Fuel Cycle Optimization and Integration—Modeling and Simulation

Session Organizer: Vincenzo V. Rondinella (EC-JRC-ITU)

Validation of Natural Convection in Vertical Fuel Rod Bundles, Kyle L. Jones, Barton L. Smith (Utah State Univ), Sal B. Rodriguez (SNL)

Validation of Electrolyte Solution Densities Important to Processing Hanford Nuclear Waste, Jacob G. Reynolds (Washington River Protection Solutions, LLC)

ORIGAMI: A New Interface for Fuel Assembly Characterization with ORIGEN, Steve Eugene Skutnik (Univ of Tennessee), Mark L. Williams, Robert A. LeFebvre (ORNL)

Fuel Cycle Applications With the Data Stored Within the Unified Database, Joshua Loren Peterson, Paul Miller, John M. Scaglione (ORNL)
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