

OFFICE OF TECHNOLOGY INNOVATION & DEVELOPMENT

International Program Strategic Plan 2010 – 2015

JULY 2010



U.S. DEPARTMENT OF
ENERGY

Office of
Environmental Management

Office of Technology Innovation and Development

The U.S. Department of Energy's (DOE) Office of Environmental Management (EM) was established in 1989 to achieve the safe and compliant disposition of legacy wastes and facilities from U.S. defense nuclear sites that performed nuclear energy research, uranium enrichment, isotope production, weapons production, and nuclear fuel processing. The sheer volumes and types of wastes, as well as affected groundwater, soil, and facilities, make this one of the world's most complex environmental challenges. Over the last 20 years, new technologies and approaches have been developed and successfully applied to meet EM's needs.

To address this continuing need, EM established the Office of Engineering and Technology (OET), now the Office of Technology Innovation and Development, to reduce technical risks and uncertainties for EM projects. Our mission is to improve performance of environmental cleanup projects over the entire lifecycle, through investments that develop and implement the best engineering technologies and practices by:

- Transitioning from state-of-the-art fundamental research to technology development to full-scale deployment
- Promoting lessons learned across DOE sites
- Reducing project life-cycle costs, and
- Improving safety while enhancing operational efficiencies





Message from the Director

Our International Program links the DOE Office of Environmental Management (EM) to the world's evolving environmental remediation and radioactive waste management practices. The EM International Program develops formal relationships with multilateral international organizations as well as organizations within individual nations that enable exchange of scientific and technical information and collaborative activities. Further, the International Program fosters communication and discovery globally of emergent technologies.

Participation in these activities benefits EM through the acquisition and pooling of information, particularly related to complex issues, which have the potential of leading to transformational solutions to EM's greatest challenges. These international relationships serve the goals of EM and the U.S. Department of Energy in advancing scientific and technological innovation to ensure national energy security and environmental clean-up of the national nuclear weapons complex.

Working with other nations to identify transformational technologies to address the challenge of completing the safe and timely clean-up of the environmental legacy is key to EM's future success.

Yvette T. Collazo

Office of Technology Innovation & Development
Office of Environmental Management
U.S. Department of Energy





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Introduction: The EM International Program

The International Program assists the DOE Office of Environmental Management (EM) in identifying technologies and strategies for waste processing, groundwater and soil remediation, spent nuclear fuel and surplus nuclear material disposition, and facility deactivation and decommissioning. As part of the Office of Technology Innovation and Development (EM-30), the International Program seeks to transform advances in science and engineering into practical solutions for environmental remediation. Collaboration with governmental, academic, and industrial organizations in other countries expands the technical depth of the EM program. This International Program Strategic Plan outlines our strategy to work with multilateral international organizations as well as organizations within individual nations to improve the way we identify transformational technologies and strategies.



Mission

The mission of the EM International Program is to foster international cooperation in addressing environmental and waste management issues leading to the reduction of technical, financial, and programmatic risks for the EM Program.

Vision

The vision of the EM International Program is to be effective at an international level in connecting government, university, and industry technology development efforts resulting in transformational solutions to EM's technical and strategic challenges.



Foundation of Strategy: Values

The core values that guide our conduct in international exchanges reflect the priorities of EM-30:

Integration

By integrating our technology development activities with those of international partners, we can leverage technological breakthroughs to expeditiously solve complex technical problems.

Collaboration

Working with the international community offers the opportunity to develop consensus on approaches to science, technology and policy for environmental and nuclear material management. Dialogue addressing common technical issues helps develop an internationally recognized foundation of sound science to support our environmental clean-up mission.

Communication

Successful international cooperation depends on open, responsible and timely communication. The International Program promotes effective communication by active participation in international conferences, committees, site visits, and other activities in the United States and abroad.



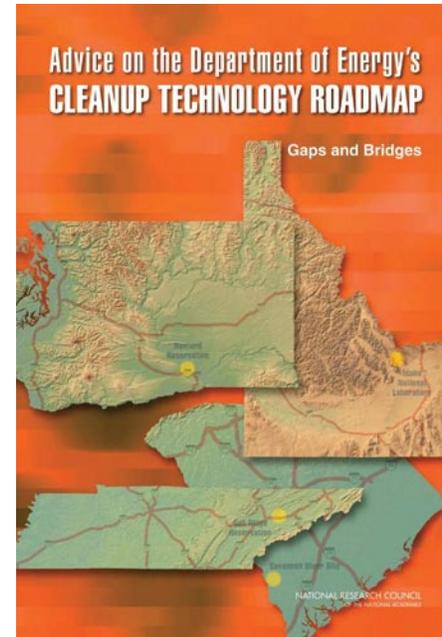


Strategic Approach

The strategic approach of the International Program is to leverage world-wide expertise to aid EM in addressing the 2009 National Academy of Science (NAS) study “Advice on the Department of Energy’s Clean-up Technology Roadmap, Gaps and Bridges,” particularly the EM focus areas recommended in waste processing, groundwater and soil remediation, spent nuclear fuel and surplus nuclear material disposition, and facility deactivation and decommissioning. EM will promote the international program by also assisting countries in developing effective international waste management strategies, including identifying appropriate technologies that protect the environment. This dual process will result in U.S competitiveness in international markets and enhanced domestic technology development and application.

Objective

The objective of the International Program is to contribute to the advancement and deployment of technologies to meet identified environmental remediation and waste management needs through continued communication, collaboration, and integration with international entities.



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Technical Scope by Program Office

EM-30 has identified technical needs in the EM focus areas and has initiated targeted research and development efforts to address those needs.

The organization of EM-30 is structured around the EM focus areas. EM-30 comprises three program offices: Waste Processing (EM-31), Groundwater and Soil Remediation (EM-32), Nuclear Materials Disposition (EM-33). Additionally, EM -30 supports the technology development needs for Deactivation and Decommissioning (D&D) (EM-44). Identified technical needs in those programmatic areas include:

Waste Processing (EM-31)

- Next generation melter development
- Advanced waste form development
- Waste form chemistry and behavior (crystallization, melting rate)
- Long-term performance of waste forms
- Tank retrieval
- Waste pretreatment
- Waste tank integrity
- Repository issues



▲ *Glass pour from the cold crucible induction melter at SIA Radon Institute (Moscow, Russia)*



Soil & Groundwater Remediation (EM-32)

- Radionuclide distribution and migration
- Biogeochemical gradients and permeable reactive barriers
- Site characterization
- Performance assessments and modeling
- Predicting, contaminant fate and transport in the vadose zone
- Monitoring, access, control and delivery of remedial action in the deep vadose zone
- Transformational remediation technologies
- Natural attenuation and enhanced remediation technology development
- Green and sustainable remediation
- Long-term monitoring and data management
- Advanced modeling and simulation



▲ *Chernobyl No. 4 reactor with partially built sarcophagus*

Nuclear Materials Disposition (EM-33)

- Spent nuclear fuel receipts, storage transportation, and disposition
- Plutonium storage and disposition
- Corrosion and materials integrity (storage containers, spent fuel, etc.)
- Materials characterization



▲ *Spent Nuclear Fuel Bundled Storage in SRS L-Basin.*

Deactivation & Decommissioning (EM-44)

- Decontamination technologies
- Remote inspection
- Characterization technologies
- In-situ immobilization and closure.



◀ *Position and Orientation Determination System (PODS™) for RadBall™*



Collaboration with International Partners

The figure below shows the countries of organizations in which the EM International Program is already engaged in collaborative relationships or in which the International Program has identified collaborative opportunities to help address EM's technical needs.



Collaborative opportunities identified by the International Program include (alphabetically by nation):

Australia

- Waste processing technologies (i.e. Hot Isostatic Pressing (HIP))
- Long-term performance of waste forms
- Nuclear material management
- Deactivation and decommissioning technologies

China

- Repository programs-- Developing a detailed knowledge of long-term corrosion behavior in a deep repository
- Spent fuel and fissile-materials management
- Peaceful Uses of Nuclear Technology (PUNT) --to share interest, experiences and potential topics for cooperation in the areas of environment and radioactive waste management



France

- Waste processing technologies-- melter technology, waste form chemistry
- Long-term performance of waste forms
- Deactivation & decommissioning technologies

Germany

- Safety case of a salt-based repository — This cooperation may include exchange of experiences and results of theoretical, experimental and development projects

Hungary

- Operation of modular vault systems for storage of spent nuclear fuel

India

- Performance Assessment
- Waste form development and qualification
- Vitrification and glass technologies

Japan

- Waste processing technologies-- melter technology, waste form chemistry
- Waste retrieval technologies
- Long-term performance of waste forms
- Deactivation and decommissioning technologies

Korea

- Waste processing technologies-- melter technology, waste form chemistry
- Molten salt extraction (electrochemical) processing of used nuclear fuel
- Long-term performance of waste forms



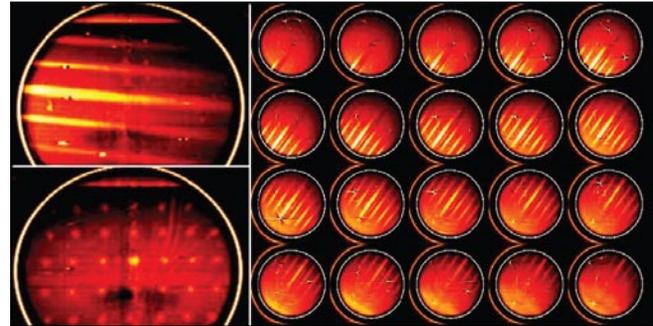
Collaboration with International Partners (Cont.)

Russia

- Fundamental studies of contaminant transport processes to support modeling and simulation
- Advanced Simulation Capability for Environmental Management (ASCEM)
- Waste processing technologies-- melter technology, waste form chemistry

United Kingdom (U.K.)

- Plutonium storage
- Spent fuel storage
- Nuclear facility life management and materials degradation
- Waste form chemistry-- crystallization and melting rate
- Tank retrieval technologies
- Deactivation & decommissioning technologies



▲ Optical scan images of RadBall™ polymer

Ukraine (Chernobyl)

- Performance Assessment
- Radionuclide distribution and migration in soils and groundwater
- Migration and fate of radionuclides in urban ecosystems

In addition to the benefits from the technical knowledge of these international partners, EM has also realized significant benefit through use of existing infrastructure at various research institutions, national laboratories, and universities located in these countries. These capabilities will provide cost-effective methods to conduct key experimental work and testing.



▲ Monument to those lost at Chernobyl



Moving Forward: The EM International Program Strategy 2010-2015

The EM international Program seeks to leverage the following existing mechanisms to increase EM engagement in international technology development activities:

- Multinational forums and agencies
- Collaborative international agreements
- International visitors at EM and foreign sites
- International conferences
- Other US agencies and programs
- Other DOE program offices



EM will seek to expand its role with multilateral international organizations in order to tap into best science being used in the field. The EM International Program will use existing international agreements in order not to duplicate efforts and, where none exist, establish new agreements, that assist in developing effective international waste management strategies and formalize undertakings with international partner countries.

EM will also strive to work with other U.S. agencies involved in energy, waste management, and other nuclear-related programs. By working closely with other government agencies, the International Program can be up to date on the latest policy and technological developments that have the potential to be leveraged to address the time and high-cost of the clean-up mission. To avoid duplication of effort and enhance return on investment, EM will strive to increase coordination with Departmental offices engaged in missions that interface with EM's remediation activities in order to leverage existing international programs and avoid duplication of efforts, and enhance return on investment.



Engage with Multinational Forums/Agencies

The EM International Program will benefit EM's environmental remediation mission by contributing its significant expertise and promoting U.S. leadership world-wide through participation in international organization forums, such as the International Atomic Energy Agency (IAEA) and the Nuclear Energy Agency (NEA).

International Atomic Energy Agency (IAEA)

Background

Established in 1957 within the United Nations, the IAEA is the world's center of cooperation in the nuclear field. Headquartered in Vienna, Austria, the IAEA works with its 151 Member States, including the United States, to promote safe, secure, and peaceful nuclear technologies.



EM's mission comprises of radioactive waste and management of nuclear materials. The United States along with 41 other nations are signatories pledged to support the objectives of the IAEA's Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention). Opened for signature in September 1997 and entered into force in June 2001, the Joint Convention is the first legal instrument to directly address those issues on a global scale.

In May 2006, the second Review Meeting of Contracting Parties to the Joint Convention identified a number of issues that EM may both aid in addressing and benefit from solving: (1) processing of legacy waste, (2) safety implications of longer storage of radioactive waste at the site of origin before disposition in a final repository, (3) the need for improved characterization and quality assurance of waste, and (4) assessment and demonstration of the safety of waste management activities and facilities. In addition, the need to establish a coherent policy for the disposal of all types of radioactive waste was identified.



Opportunities

An avenue for EM influence and benefit is participation in the IAEA “Network of Networks” established in September 2007 by the General Conference, the highest policy-making body of the IAEA composed of representatives of all Member States. Two established networks of interest to EM are the International Decommissioning Network (IDN) and the ENVIRONET for remediation of radiologically contaminated sites and remediation of soil and groundwater.

Among the activities of the networks, several offer clear opportunities for participation by EM as a “Member” organization (providing expertise and training capabilities) and for discovery by EM of innovative approaches to solving challenging remediation problems. These include, but are not limited to:

- Hosting training courses, fellowships or scientific visits by Members
- Providing suitably qualified and experienced individuals to support Participants (receive support from Members)
- Providing qualified peers for the Agency’s peer reviews and technical assistance
- Providing expertise in the Agency’s program areas; and
- Supporting fellowships, exchanges, coaching and mentoring

Nuclear Energy Agency (NEA)

Background

The NEA is a specialized agency within the Organization for Economic Co-operation and Development (OECD), an intergovernmental organization of industrialized countries based in Paris, France. The mission of the NEA is to assist its member countries in maintaining and developing, through international cooperation, the scientific, technological, and legal bases required for the safe, environmentally friendly, and economical use of nuclear energy for peaceful purposes, through the entire fuel cycle, including D&D.





Background (Cont.)

NEA consists of 28 countries, in Europe, North America, and the Asia-Pacific regions, including the United States. Together those countries account for approximately 85 percent of the world's installed nuclear capacity. The NEA works closely with the IAEA and with the European Commission, the European Union's executive body in Brussels, Belgium. Within the OECD, the NEA coordinates with other directorates, such as the Environment Directorate.

While EM's mission is to remediate the legacy waste from nuclear weapons production rather than to develop nuclear energy for peaceful purposes, the interests of EM and of the NEA intersect in several areas, such as D&D, radiological protection and public health, nuclear science, and radioactive waste management. The NEA seeks to assist its member countries in developing safe, sustainable, and societally acceptable strategies for the management of radioactive materials, with particular emphasis on the management of long-lived waste and spent fuel and on decommissioning of retired nuclear facilities.

Opportunities

The NEA's Radioactive Waste Management Committee and the Working Party on Decommissioning and Dismantling (WPDD) can benefit the EM mission through:

- Fostering a shared and broad-based understanding of the state of the art and emerging issues
- Facilitating the elaboration of waste management and D&D strategies that respect societal requirements
- Helping to provide common bases to the national regulatory frameworks;
- Enabling the management of radioactive waste, materials and D&D to benefit from advances in scientific and technical knowledge, e.g., through joint projects and specialist meetings
- Contributing to knowledge consolidation and transfer, e.g., through the publication of technical reports, consensus statements and short flyers
- Helping to advance best practice, e.g., by supporting international peer reviews



Establish Collaborative International Agreements

The EM International Program will expand existing partnerships and establish new ones with countries that embrace a mission-completion philosophy based on remediation and reducing risk. For example, the U.K. is already one of EM's primary international partners. Current collaboration takes place under the DOE-EM and U.K. Nuclear Decommissioning Authority (NDA) Statement of Intent for Information Exchange of Information Concerning Management of Radioactive Waste. With the formation of the U.K. Department of Energy and Climate Change, EM has the opportunity to solidify this bilateral relationship at a government level and establish a mechanism in which to establish future work and an ability to grow the areas of cooperation under one overarching agreement. Recently, EM signed an agreement with the Public Agency for Radioactive Waste Management (PURAM) of the Republic of Hungary for Information Exchange Relating to Operation of Modular Vault Systems for Storage of Spent Nuclear Fuel. The first meeting under this agreement was held May 18, 2010 at Fort St. Vrain, Colorado. Plans are to conduct the next meeting between PURAM and EM at the Paks Modular Vault Dry Store (MVDS) facility in Hungary in 2012. Future agreements will enhance international cooperation in order to strategically promote research and development in EM.





Engage with International Visitors at EM and Foreign Sites

Visits by our international colleagues to DOE sites and facilities offer a unique opportunity to facilitate information exchange and collaboration. These visits can be formal (e.g., in conjunction with workshops or meetings) involving numerous participants or relatively informal visits by one or two individuals. Irrespective of potential language barriers, concepts and issues can be readily communicated through visual observations of sites, facilities and systems. For example, during visits of colleagues (one for an extended duration) from the U.K. involved in waste glass formulation and testing hosted by the Savannah River National Laboratory (SRNL), access was provided to the SRNL shielded cells facility where actual high-level radioactive waste glasses are fabricated and tested on a laboratory-scale. The visit provided the U.K. researcher direct observation of equipment and methods used to remotely melt, characterize, and perform leach tests on the glasses. This information was deemed valuable to the U.K. expert as similar capabilities are currently being established at the U.K. National Nuclear Laboratory facilities.



▲ *Meeting between U.S. and South Korean vitrification experts at the Savannah River National Laboratory*

In the Environmental Management arena, the DOE sites that may have significant interest to international colleagues include-- the Waste Isolation Pilot Plant (WIPP), Idaho National Laboratory (INL), West Valley Demonstration Project (WVDP), Savannah River Site (SRS), and the Hanford Site. Recent examples include the March 2010 site visit from senior representatives of the Australian Nuclear Science and Technology Organization (ANSTO) at SRS. The specific areas of technical exchange revolved around DOE's In-Situ Decommissioning (entombment) Project at the P-, and R-Reactors. Another example of the type of engagement the EM International Program will promote is the November 2010 11th Annual Meeting of the Working Party on Decommissioning and Dismantling (WPDD), sponsored by the Nuclear Energy Agency/Organization for Economic Cooperation and Development (NEA/OECD).

At the WIPP facility, insight into methods used for disposal of transuranic (TRU) wastes can be gained. Waste storage information for solids, liquids and spent fuel can be obtained at



INL. Waste treatment and deactivation and decommissioning (D&D) information are also available at INL. WVDP offers D&D lessons and insight into groundwater remediation. SRS offers a variety of facilities supporting DOE's EM mission. In addition to facilities in SRNL providing EM research, the F Area, waste tank farms, salt waste processing operations, Defense Waste Processing Facility, and saltstone facilities offer opportunities to facilitate discussions through tours. The Hanford Site has tank farm operations similar to SRS as well as extensive vadose zone and groundwater remediation projects. The Hanford Site also offers the opportunity to tour the Waste Treatment Plant that is currently under construction for treatment and vitrification of high-activity radioactivity waste and low-activity waste. Plans are underway to organize a site visit by Rosatom representatives, the Russian equivalent to DOE.

Such visits to DOE facilities are conducted in accordance with all foreign national access requirements. This requires extensive planning and rigor to ensure that visits and tours are conducted properly.

Alternatively, visits by U.S. personnel to foreign facilities are equally important in providing insight into waste management practices employed outside the United States. For example, prior to the visit by the U.K. researchers to SRNL noted above, the U.K. colleagues hosted personnel from DOE-EM and SRNL. During this visit, a tour of the U.K. Sellafield Site was provided including the Waste Vitrification Plant (WVP). The tour also included a tour of the Vitrification Test Rig (VTR) which is a scaled pilot-plant for the WVP. These tours provided the U.S. personnel perspectives on plant operations, technology development, and trouble-shooting philosophies employed in the U.K. In another example, DOE-EM and SRNL personnel visited facilities in South Korea. This interaction involved tours of KAERI, NETEC and Doosan Industry facilities as well as a tour of the Ulchin nuclear power plant. EM has also participated in tours at AREVA facilities in Paris and Marcoule, France that helped to promote transformational technologies in international melter programs. An important future visit to a facility could be the Australian Nuclear Science and Technology Organization (ANSTO) where the Hot Isostatic Pressing (HIP) as a waste management tool was developed. HIP has the potential to be a transformational waste processing technology.





Participate in International Conferences

International conferences provide the opportunity for EM to promote the EM program to an international audience, including at a programmatic and technology level. Most importantly it allows for the EM office to stay abreast of science and technology developments of other countries that may be leveraged to meet the overall EM mission. International conferences allow the opportunity to obtain current technical information related



▲ **IAEA Technical Meeting on Guideline of Good Practice for the Management and Storage of Research Reactor Spent Fuel at the Dounreay Training Facility in Thurso, Scotland, from 19 to 23 October 2009. EM-sponsored team from SRNL organized the meeting with IAEA and is developing the IAEA guide for publication in the IAEA Nuclear Energy Series.**

to treatment of radioactive waste in other countries, and to facilitate contact with potential subject matter experts that could assist DOE-EM in future technical reviews of environmental treatment technologies. EM has been a supporter of various conferences at which EM management has been able to engage with international counterparts that have allowed the pursuit of research and development collaboration. Important conferences that EM supports are the Waste Management Conference held annually in Phoenix, Arizona, the

annual International Conference on Environmental Management and Radioactive Waste Management in Liverpool, U.K.; and various topical meetings organized by the American Nuclear Society. The EM International Program will continue to identify key conferences focused on environmental remediation and radioactive waste management that allow EM to leverage the technical skills and knowledge of foreign governments, industries, and universities to help identify transformational solutions.



Coordinate with Other U.S. Agencies and Programs

In recent years, the U.S. State Department has increased its activities in technical cooperation under the Joint Standing Committee on Nuclear Energy Cooperation (JSCNEC) and Joint Coordinating Meetings (JCM) on Science and Technology. The JSCNEC meeting includes a review of several joint projects between the United States and foreign nuclear research institutions. The JCM's focus more on basic and applied scientific research. At these annual meetings the Department of Energy has been responsible for coordination among the Department of State (DOS), U.S. national laboratories, program offices, and other DOE participants and private entities, collecting updates on ongoing projects and identifying any new areas of collaboration. DOE's Offices of Nuclear Energy and Defense Nuclear Non-Proliferation also participate in DOS's JSCNEC and JCM meetings held annually.

Both the JSCNEC and JCM provide an important opportunity for the EM International Program to continue to broaden its understanding of environmental remediation and energy efforts in the international context. The meetings also enable senior EM personnel to share information and to gain lessons learned from environmental programs that are highly developed and assist in expanding the EM International Program. A number of countries with developed energy and environmental programs use the JSCNEC and JCM as the formal bilateral cooperation channel between them and the United States through which nuclear and science policy consultations, exchange of technical information, joint R&D activities, etc., transpire.

The EM International Program may also engage and coordinate with other U.S. agencies through U.S. Department of Commerce (DOC) trade delegations and the Nuclear Regulatory Commission (NRC) Committee Sessions on Environmental Management. Both of these agencies can help to meet EM and the Department of Energy's goals in advancing scientific and technological innovation, energy security, and environmental remediation of the national nuclear weapons complex.



Engage with Other DOE Program Offices

The EM International Program will engage with the Office of Science (SC), National Nuclear Security Administration (NNSA), Office of Policy and International (PI) Affairs, and the Office of Nuclear Energy (NE) on international programs that support and enhance the EM International Program goals and objectives.

Office of Science (SC)

SC is the single largest supporter of basic research in the physical sciences in the United States, providing more than 40 percent of total funding for this vital area of national importance. It oversees – and is the principal federal funding agency of – the Nation’s research programs in high-energy physics, nuclear physics, and fusion energy sciences. It also manages 10 world-class laboratories, which often are called the “crown jewels” of our national research infrastructure.

The national laboratory system, created over a half-century ago, is the most comprehensive research system of its kind in the world.

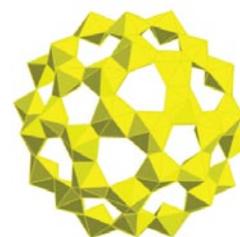
The Office of Science oversees the construction and operation of some of the Nation’s most advanced R&D user facilities, located at national laboratories and universities. These include particle and nuclear physics accelerators, synchrotron light sources, neutron scattering facilities, supercomputers and high-speed computer networks.

By tapping into these resources EM can leverage the ongoing work and the results to its technology innovation program. A good example for leveraging is working with Science to develop EM’s Advanced Simulation Capability for Environmental Management (ASCEM). ASCEM is an integrated, modular, open-source toolset for advanced modeling and simulation that reduces uncertainties and risks associated with environmental remediation and closure programs. Another example would be coordinating with SC on transformational waste processing technologies.



U.S. DEPARTMENT OF
ENERGY

Office of
Science



▲ *Schematic diagrams of U60 fullerene structure*



***Office of Policy and
International Affairs (PI)***



U.S. DEPARTMENT OF
ENERGY

Office of Policy and
International Affairs

PI has primary responsibility

for the Department of Energy's international energy activities including international emergency management, national security, and international cooperation in science and technology. PI's role is to deliver unbiased advice to the Department of Energy's leadership on existing and prospective energy-related policies, based on integrated and well-founded data and analysis.

Through its Energy Policy Dialogue discussions, PI works closely with DOE program Assistant Secretaries and other DOE Secretarial officers to maintain a knowledge of the activities, issues, and policies of the Department, other Federal departments and agencies (including the National Security Council, Office of Management and Budget, and other White House offices), members of Congress and Congressional Committees, and energy producers and consumers. By engaging in the Energy Policy Dialogue discussions and being an active participant. EM can contribute to the optimization of the national environmental management system. Additionally, in its leadership role the U.S. will continue to assist other countries to adopt high-level waste management and disposal practices that enhance international security, safety, and environmental management.

The EM International Program will work closely with PI as it establishes international agreements to ensure that environmental management so that a mechanism is in place to pursue international collaborative undertakings. In addition, the International Program will keep abreast of the latest policy issues affecting bilateral consultations in environmental management and radioactive waste management.



Office of Nuclear Energy (NE)

The Office of Nuclear Energy (NE)

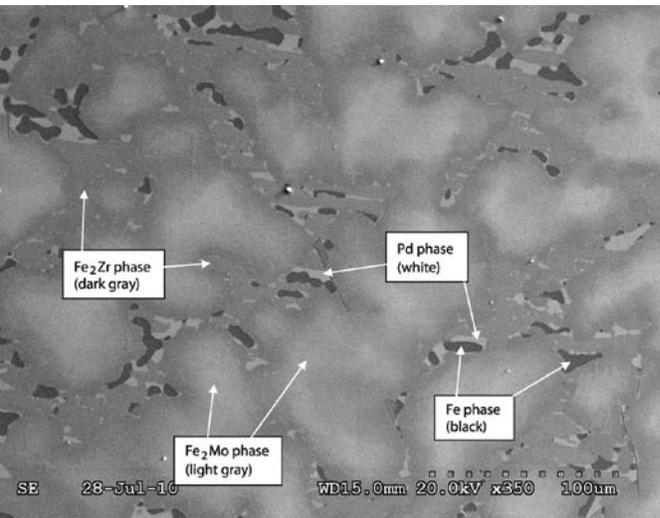
mission is to promote nuclear

power as a resource capable of meeting the Nation's energy, environmental and national security needs. There are two programs relevant to EM's mission, currently the International Framework for Nuclear Energy Cooperation (IFNEC) and the Generation IV International



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▲ *Microstructure of an Iron-Based Alloy Waste Form for Metallic Waste Species from Full Fuel Recycle*

Forum (GIF). IFNEC was established to promote cooperation among States that share the common vision of the need to expand nuclear energy production worldwide in a safe and secure manner. It aims to accelerate development and deployment of advanced fuel cycle technologies to encourage clean development and prosperity worldwide, improve the environment, and reduce the risk of nuclear proliferation. To date the partnership consists of twenty-five partners, three permanent international nongovernmental observers and a number of observer countries. The partners are: Armenia, Australia, Bulgaria, Canada, China, Estonia, France, Ghana, Hungary, Italy, Japan, Jordan Kazakhstan, Republic of Korea, Lithuania, Morocco, Oman, Poland, Romania, the Russian Federation, Senegal, Slovenia, Ukraine, United Kingdom and the United States. The three permanent international nongovernmental observers are: the International Atomic Energy Agency, the Generation IV International Forum and EURATOM.

IFNEC has two working groups—the Infrastructure Development Working Group (IDWG) and the Reliable Nuclear Fuel Services Working Group (RNFSWG). Of special interest to EM is the IDWG. One of the subgroups of the IDWG is the Waste Management Group whose goal is to address radioactive waste management issues. EM has



▲ *Long-term Glass Corrosion Workshop held in Seattle, WA*

the unique opportunity to identify specific activities in the area of radioactive waste management. Some proposed activities are human capital development, exchanging information on calculations and costing methodology, identifying and addressing research and development gaps and providing lessons learned. The partners have suggested that each country identify an expert to participate in the subgroup. Through the International Program, EM can have an important role in the establishment of a IFNEC sub-Working Group to explore

possible strategies for the long term management of radioactive wastes arising at nuclear power stations and from associated fuel cycle activities.

The mission of GIF is to develop the next generation nuclear energy systems to meet the world's future energy needs. This unique international effort allows unprecedented coordination among the national research organizations of the various partners in the GIF, which include Canada, China, Euratom, France, Japan, Republic of Korea, Republic of South Africa, Russia, Switzerland, the United Kingdom, and the United States [Argentina and Brazil are inactive]. Senior representatives from GIF member countries participate in committees that coordinate the research activities required to develop up to six next generation nuclear energy systems. The U.S. is actively participating in joint R&D with various GIF members; EM can leverage these research and development activities to assist in identifying environmental technologies.

EM is currently working with NE in a joint international Study of Glass Behavior over Geologic Time Scales. Recently, twenty-two representatives from five nations (Belgium, France, Japan, United Kingdom, and the United States, including three DOE offices and four national labs) simultaneously connected to a webinar/teleconference meeting to discuss recent progress and opportunities for collaboration in the field of Long-term Glass Corrosion. This webinar was a follow-up to a three-day workshop in Seattle in



October 2009 at which a similar group of scientists and administrators met to establish the current state of understanding, to discuss and develop a comprehensive research plan, and to come to a consensus on required future research.

Glass is the waste form of choice for immobilizing HLW in the U.S. and internationally; however, there is uncertainty due to different repository environments and a lack of consensus on glass corrosion behavior between nations vitrifying HLW. This activity aims to develop the data and understanding necessary for an international consensus on the behavior of glass waste form corrosion over geologic time scales in a variety of disposal environments. This long-term research program was initiated in 2009 with participation from the U.S. (Joint EM-NE-RW), France (CEA, Nantes, AREVA), Belgium (SCK-CEN), UK (NNL, Sheffield), and Japan (Kyushu and JAEA) [Note: additional members will be added on an as needed basis]. This international collaboration will not only help these scientific advances be realized more quickly, but an international consensus on corrosion rate will lessen the complications inherent in the qualification of waste forms and will open the possibility of disposing of HLW glasses in a variety of potential environments.

National Nuclear Security Administration (NNSA)

The National Nuclear Security Administration (NNSA) holds high-level meetings and discussions on non-proliferation issues that have the potential to influence the overall EM mission. NNSA holds meetings with



countries with whom EM may be interested in working or expanding collaborations. Just recently, NNSA held discussions with Russia, India, and China in support of the Peaceful Uses of Nuclear Technology Agreement (PUNT). Even if some of these countries are not actively engaged with EM, there are collaborative opportunities that can be attained with research centers and institutions. As part of the NNSA Global Threat Reduction Initiative, EM can develop close relations with foreign countries possessing U.S.-origin foreign research reactor (FRR) spent fuel (i.e. Japan, Turkey, Israel, and Chile) that can lead to technology development and increased scientific interactions.



Conclusion

EM's International Program will continue to focus on identifying and leveraging international expertise, infrastructure, and collaboration opportunities that can assist in reducing the cost and schedule of the environmental remediation mission; enhancing understanding of the processes related to environmental management; accelerating and increasing innovative technology applications; and helping to ensure that science-based approaches and solutions are implemented on an international level that provide safe, effective, and responsible environmental management approaches. This will be accomplished by enlisting international support and cooperation through participation in international organizations and developing and maintaining appropriate frameworks for bilateral and multilateral cooperation. Most importantly, EM's International Program will direct the implementation of international agreements which involve all of EM. The International Program will also be able to monitor and support international advances in technology that reduce cost and optimize the efficiency of site remediation and will be responsible for obtaining and exchanging information on the global status of technical progress and relevant policies in waste management. Additionally, in its leadership role, the EM program will seize the opportunity to assist other countries to adopt safe waste management and disposal practices that enhance international security, safety, and environmental integrity. 🌐



“Scientific progress is seldom made by a lone explorer working in seclusion.”

— Secretary Chu



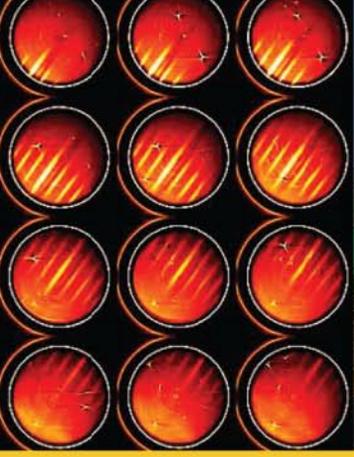
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