

*Used Fuel Disposition
Campaign International
Activities
Implementation Plan*

Fuel Cycle Research & Development

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Used Fuel Disposition Campaign
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FCT Document Cover Sheet

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Technical Review (TR)

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- Signed TR Report or,
- Signed TR Concurrence Sheet or,
- Signature of TR Reviewer(s) below

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(A) ALTHOUGH THIS REPORT HAS BEEN DESIGNATED WITH A QRL OF NA, IT HAS BEEN REVIEWED BY UFD CAMPAIGN MANAGEMENT AND DOE-NE STAFF.

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USED FUEL DISPOSITION CAMPAIGN INTERNATIONAL ACTIVITIES IMPLEMENTATION PLAN

1. INTRODUCTION

The management of used nuclear fuel and nuclear waste is required for any country using nuclear energy. This includes the storage, transportation, and disposal of low and intermediate level waste (LILW), used nuclear fuel (UNF), and high level waste (HLW). The Used Fuel Disposition Campaign (UFDC), within the U.S. Department of Energy (DOE), Office of Nuclear Energy (NE), Office of Fuel Cycle Technology (FCT), is responsible for conducting research and development pertaining to the management of these materials in the U.S. Cooperation and collaboration with other countries would be beneficial to both the U.S. and other countries through information exchange and a broader participation of experts in the field.

U.S. participation in international UNF and HLW exchanges leads to safe management of nuclear materials, increased security through global oversight, and protection of the environment worldwide. Such interactions offer the opportunity to develop consensus on policy, scientific, and technical approaches. Dialogue to address common technical issues helps develop an internationally recognized foundation of sound science, benefiting the U.S. and participating countries.

The UNF and HLW management programs in nuclear countries are at different levels of maturity. All countries utilizing nuclear power must store UNF, mostly in wet storage, and HLW for those countries that reprocess UNF. Several countries either utilize or plan to utilize dry storage systems for UNF, perhaps for long periods of time (several decades). Geologic disposal programs are at various different states, ranging from essentially “no progress” to selected sites and pending license applications to regulators. The table below summarizes the status of UNF and HLW management programs in several countries^a. Thus, the opportunity exists to collaborate at different levels ranging from providing expertise to those countries “behind” the U.S. to obtaining access to information and expertise from those countries with more mature programs.

The U.S. fuel cycle is a once through fuel cycle involving the direct disposal of UNF, as spent nuclear fuel, in a geologic repository (previously identified at Yucca Mountain, Nevada), following at most a few decades of storage (wet and dry). The geology at Yucca Mountain, unsaturated tuff, is unique among all countries investigating the disposal of UNF and HLW. The decision by the U.S. Department of Energy to no longer pursue the disposal of UNF at Yucca Mountain and possibly utilize very long term storage (approaching 100 years or more) while evaluating future fuel cycle alternatives for managing UNF, presents a different UNF and HLW management R&D portfolio that has been pursued in the U.S. In addition, the research and development activities managed by OCRWM have been transferred to DOE-NE. This requires a reconsideration of how the UFDC will engage in cooperative and collaborative activities with other countries. This report presents the UFDC implementation plan for international activities.

The DOE Office of Civilian Radioactive Waste Management (OCRWM) has cooperated and collaborated with other countries in many different “arenas” including the Nuclear Energy Agency (NEA) within the

^a Nuclear Waste Technical Review Board, 2009. Survey of National Programs for Managing High-Level Radioactive Waste and Spent Nuclear Fuel.

Organization for Economic Co-operation and Development (OECD), the International Atomic Energy Agency (IAEA), and through bilateral agreements with other countries. These international activities benefited OCRWM through the acquisition and exchange of information, database development, and peer reviews by experts from other countries. DOE-NE cooperates and collaborates with other countries in similar “arenas” with similar objectives and realizing similar benefits. However the DOE-NE focus has not typically been in the area of UNF and HLW management. This report will first summarize these recent cooperative and collaborative activities.

The manner that the UFDC will cooperate and collaborate in the future is expected to change as R&D is conducted regarding long-term storage and the potential disposal of UNF and HLW in different geologic environments. While some continuation of on-going or recent cooperative and collaborative activities are expected to continue, the approach taken in these activities may be different than past activities given the changes in the U.S. waste management program. In addition, new cooperative and collaborative activities with different scope than in the past may be undertaken. Such potential future cooperative and collaborative activities will be discussed.

The last part of the plan includes the implementation of the UFDC international activities.

Summary of UNF and HLW Management Programs in Other Countries.

Country	Material to be Disposed	Centralized Storage	Geologic Environments	URL	Site-Selection	Anticipated Start of Repository Operations
Finland	SNF		Granite, Gneiss, Grandiorite, Migmatite	ONKALO (Granite)	Site at Olkiluoto Selected	2020
Sweden	SNF	CLAB - Oskarshamn	Granite	Aspo (Granite)	Site at Osthhammar Selected	2023
France	HLW and ILW		Argillite and Granite	Bure (Argillite)	Site near Bure Selected	2025
Belgium	HLW		Clay/Shale	Mol (clay)	Not Initiated	~2040
China	HLW		Granite		Preliminary Investigations Underway - Beishan in Gobi Desert	~2050
Switzerland	HLW	Wulenlingen (ZWILAG)	Clay and Granite	Mont Terri (Clay) Grimsel (Clay)	Initiated	No sooner than 2040
Japan	HLW		Granite and Sedimentary	Mizunami (Granite) Hornonobe (Sedimentary)	Initiated	No Decision Made
Canada	SNF		Granite and Sedimentary	Pinawa (Granite) - being decommissioned	Initiated	No Decision Made
United Kingdom	HLW and ILW		Undecided		Initiated	No Decision Made
Germany	HLW, SNF, heat generating ILW	Gorleben and Ahaus	Salt	Gorleben (Salt)	On Hold	No Decision Made
Republic of Korea	SNF	Envisioned	Granite	Korea Underground Research Tunnel (Granite, Shallow)	Not Initiated	No Decision Made
Spain	No Decision Made	Siting Process Initiated	Granite, Clay, Salt		Not Initiated	No Decision Made

Source: Nuclear Waste Technical Review Board, 2009. Survey of National Programs for Managing High-Level Radioactive Waste and Spent Nuclear Fuel

2. RECENT INTERNATIONAL ACTIVITIES

This section summarizes recently completed and current cooperative and collaborative activities that DOE OCRWM and DOE-NE participated on in the area of radioactive waste management. This establishes a “baseline” for considering future international activities that will be conducted by the UFDC.

IAEA

The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management was opened for signature on September 29th 1997, the first day of the 41st regular session of the IAEA’s General Conference. A U.S. delegation comprised of DOE OCRWM, the DOE Office of Environmental Management (DOE-EM), the Environmental Protection Agency (EPA), and the Nuclear Regulatory Commission (NRC) participates in the Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management. RW staff served on the Executive Steering Committee. The U.S. delegation prepares a national report every three years and attends the tri-annual meetings. As part of the proceedings, U.S. representatives review the reports from other countries, provide responses to comments on the U.S. report, and provide an update on the national program at the international meetings.

OECD/NEA

DOE OCRWM was responsible for leading the U.S. delegation for the OECD/NEA Radioactive Waste Management Committee (RWMC). The delegation participated in annual meetings, provided status reports on U.S. radioactive waste and decommissioning programs, and reviewed/updated international reports. Within the RWMC are the Integration Group for the Safety Case (IGSC) and the Forum on Stakeholder Confidence (FSC). OCRMW staff participated on both the IGSC and FSC (including participating on the IGSC steering committee).

The IGSC’s work centers on methodologies and strategies for characterizing and evaluating disposal sites as well as on repository safety assessment aspects for various waste types. IGSC projects address issues related to fundamental aspects of safety cases, technical issues in the design, study, and evaluation of disposal systems and practical challenges in implementing waste repositories. The FSC facilitates the sharing of experience in addressing the societal dimension of radioactive waste management and explores means of ensuring an effective dialogue with the public with a view to strengthening confidence in the decision-making processes.

The U.S. participated in the NEA Thermochemical Data Base (TDB) with support provided by Lawrence Livermore National Laboratory. The TDB involved a U.S. commitment under contractual arrangement to participate in the development of a comprehensive, internationally recognized and quality assured chemical thermodynamic database of selected chemical elements to meet the specialized modeling requirements for safety assessments of radioactive waste disposal systems and radionuclide migration. The U.S. has agreed to participate through 2011, and has paid its annual dues through this date.

EDRAM

The U.S. is a member of the International Association for Environmentally Safe Disposal of Radioactive Materials (EDRAM), an association of executives and chairmen of worldwide radioactive waste management organizations. There are eleven member countries, including Canada, Germany, France, Switzerland, Belgium, United Kingdom, Finland, United States, Sweden, Spain and, Japan. The Director of the OCRWM program (or his designee) has historically participated in the bi-annual meetings.

International Conference on Geologic Repositories

Since the inception of the International Conference on Geologic Repositories (ICGR), OCRWM has participated in the quadrennial meetings in Denver (1999), Stockholm (2003) and Berne (2007). The conference provides an opportunity to take stock of international political and strategic developments that have taken place in recent years in the field of geological disposal of radioactive waste. The scope of the conference consists of looking at the different political and societal approaches that are being explored or implemented worldwide.

International Framework on Nuclear Energy Cooperation

OCRWM has participated in the DOE Office of Nuclear Energy's International Framework on Nuclear Energy Cooperation (IFNEC) program. In particular, OCRWM participated on the Infrastructure Development Working Group, which includes a Radioactive Waste subgroup that has been formed to address related issues in waste management.

International Training Center

OCRWM staff has served on the Executive Board of the International Training Center (ITC) for the School of Underground Waste Storage and Disposal. Previous funding supported the training course sponsored by ITC on geologic disposal of high-level waste. DOE OCRWM, as a member of ITC, has participated in providing professional training in different aspects of science, engineering, and communication related to underground waste management and environmental issues. OCRWM participation allowed for transfer of knowledge on geologic disposal among countries, and to educate domestic and international students on the importance of radioactive waste management. OCRWM has used Sandia National Laboratories staff, as the OCRWM's Lead Laboratory, and staff from Lawrence Berkley National Laboratory to provide organizational assistance and conduct an IAEA training course under the ITC banner.

Bilateral Agreements

OCRWM staff served as the co-chair the Working Group on Waste Management under the U.S. - China Peaceful Uses of Nuclear Technology (PUNT) and has participated in Joint Coordinating Committee meetings, held every year alternately in China and the United States. Support has been provided by Lawrence Livermore National Laboratory and Sandia National Laboratories.

DOE-NE participates on the U.S. – Japan Joint Nuclear Energy Action Plan (JNEAP), in particular the Waste Management Working Group. Support has been provided by all laboratories involved on the FCT program. Activities in this working group involved first sharing information regarding each program and establishing plans for future collaboration. Work scope was expanded in 2009 and 2010 as a result of the changed direction in the U.S. FCT program.

A bilateral agreement exists between OCRWM and the Japan Atomic Energy Agency, with ongoing collaborative activities with the Japanese Nuclear Waste Management Organization (NUMO), supported by staff from Lawrence Berkley National Laboratory (LBNL). This agreement allows both parties to maintain an international exchange of information and sharing of ideas for modeling of solute transport in complex fractured rock and other modeling methodologies. Several other bilateral agreements have been signed over the years with other countries, but most have either lapsed or been terminated, and technical cooperative activities are no longer being conducted.

Other Cooperative Interactions

OCRWM has supported other international cooperative interactions and State Department initiatives in the area of waste management, including:

- a. American Institute in Taiwan/Taipei Economic and Cultural Representative Office (AIT/TECRO) Joint Standing Committee for Civil Nuclear Cooperation as the Co-Chair of the AIT-TECRO Working Group on Radioactive Waste Management
- b. Joint Standing Committee on Nuclear Energy Cooperation with Argentina
- c. Joint Standing Committee on Nuclear Energy Cooperation with Brazil
- d. Joint Standing Committee on Nuclear Energy Cooperation with Korea.

3. FUTURE INTERNATIONAL ACTIVITIES

The UFDC should continue participation on many of the international cooperative and collaborative activities presented above. The U.S. is a leader in the area of radioactive waste management and has much to offer both to mature and developing programs. Continued, and expanded, participation benefits the U.S. program by gaining access to expertise, information, and data both related to long term storage and UNF/HLW disposal in geologic environments that are being studied in other countries. Thus, broader international collaboration would be beneficial to the U.S. waste management program. This participation will involve both DOE-NE participants and national laboratory participants.

This section presents areas for continued and expanded UFDC international activities. While specific activities are identified, the UFDC will remain flexible with its international program. Additional opportunities may arise, for example as agreements are established, and the UFDC will consider further involvement with other countries.

OECD/NEA

Involvement with the OECD/NEA Radioactive Waste Management Committee (RWMC) should continue with participation at the annual meeting, as well as the Integration Group for the Safety Case (IGSC) and the Forum on Stakeholder Confidence (FSC). Involvement on the IGSC and FSC will be used to identify future projects that UFDC may want to engage on. Specific near-term NEA projects for consideration of UFDC participation are listed below.

- Thermochemical Database Project (continue)
- Retrievability and Reversibility Project - International Conference in Reims, France December 2010 (with IAEA)
- Sorption Project (Phase III began in 2007, currently not member)
- Organizing International Conference on Geological Repositories, Japan 2011
- Dialogue with ICRP intended to lead to revision of ICRP guidance in field of disposal
- Long term information and memory preservation

The UFDC should pursue involvement with the OECD/NEA Working Party on Nuclear Criticality Safety (WPNCS), in particular Expert Group on Burn-up Credit and the Expert Group on Assay Data of Spent Nuclear Fuel. Participation on these expert groups would support storage, transportation, and disposal activities within the UFDC.

The UFDC should also remain involved with the NEA organized International Exchange Meetings on Partitioning and Transmutation. These meetings occur biannually with the 11th meeting held in San Francisco in November 2010. Historically these meetings have primarily focused on transmutation systems and separations technologies. However, the meeting organizers have encouraged broader representation in the area of waste management when considering partitioning and transmutation.

IAEA

The UFDC should continue involvement with the IAEA Joint Convention on the Safety of Spent Fuel and on the Safety of Radioactive Waste Management, and NE staff will continue to serve on the Executive Steering Committee. The UFDC should increase involvement with the IAEA Waste Technologies Section in the near surface and geologic disposal areas. Involvement would provide a mechanism to interact with countries having mature programs and would also provide a mechanism to provide U.S. expertise to less mature programs. The IAEA Waste Technology Section also hosts two waste management networks that the UFDC should join. These networks were established to facilitate information sharing in thematic areas, in particular the Underground Research Facilities Network (URF) and the Low-Level Radioactive Waste Disposal Network (DISPONET). It should be noted that DOE-EM is a participant in the URF network (WIPP through Sandia National Laboratory). The IAEA Waste Technology Section is also initiating a project to better connect their networks, called the CONNECT network. The UFDC should join this project.

The UFDC should also increase involvement with the IAEA Nuclear Fuel Cycle and Materials Section in the area of spent fuel management. Topical areas being pursued by the section include developing technologies and strategies for spent fuel management and technical guidance on good practices for long term storage of spent fuel. Near term projects that should be joined include:

- Coordinated Research Project (CRP) on Spent Fuel Performance Assessment and Research (SPAR-III)
- Technical Meeting On MOX Fuel and MOX Spent Fuel Management, February 2011

The UFDC could also become involved with the IAEA Nuclear Fuel Cycle Information System, an online database of international civilian nuclear fuel cycle facilities that provides basic information on existing and planned civilian nuclear fuel cycle facilities throughout the world. The database provides reliable and accurate statistics on nuclear fuel cycle activities worldwide that are needed by the nuclear community for national policy making, international cooperation, and studies pertaining to the growth of global nuclear energy. Technical meetings provide a forum for Member states to exchange information on latest developments, share national visions and experiences of fuel cycle strategies, discuss synergies between various fuel cycle stages, and discuss long term sustainability and security.

ITC

The UFDC should participate in the International Training Center (ITC) School of Underground Waste Storage and Disposal, both by providing experts for training and utilizing courses offered by the school to educate and inform UFDC researchers. Specific courses in the near-term shown below show the types of courses offered by the ITC.

- Transport and Retention of Radionuclides in Argillaceous and Fractured Media (11/30-12/7, 2010)
- Cement and Cementitious Materials in Geological Disposal of Radioactive Wastes (11/13-17, 2010)

International Repository Program

NE staff will serve as a member of the International Repository Program (IRP) Advisory Board. The charter for this interagency group is to provide and share information between federal agencies to increase the effectiveness of the U.S. government international initiatives related to topics of interest to the planning and implementation of radioactive waste disposal systems. The advisory board consists of a Director and senior personnel from DOE offices (NE, Environmental Management, and Policy and International Affairs) and Federal agencies (Nuclear Regulatory Commission, Environmental Protection Agency, and State Department). The IRP will coordinate international cooperation within DOE and with other Federal agencies.

Agreements

In addition to the multi-country international cooperative and collaborative activities discussed above, the UFD should continue (perhaps broaden), renew, and initiate bilateral agreements with countries actively investigating UNF and HLW management issues. Agreements with countries having both mature and developing programs should be pursued. Cooperation and collaboration with countries having mature programs would benefit the UFDC by gaining access to expertise, information, and data in the areas of long-term storage and disposal in a range of geologic disposal environments. Cooperation and collaboration with less mature programs would allow for efficient resource application to address issues of comment interest. The agreements that would be established and the scope of work under any established agreements will reflect the research and development priorities established in the storage, transportation, and disposal areas within the UFDC.

Existing bilateral agreements present a mechanism for international collaboration in the near-term. These include the existing U.S. – Japan Joint Nuclear Energy Action Plan (JNEAP), the U.S. China Peaceful Uses of Nuclear Technology (PUNT) agreement, and bilateral agreements between DOE-NE and France, and DOE-NE and Russia.

The Japanese UNF and HLW management is quite similar to the current U.S. program. UNF is currently being stored pending its being reprocessed at the Rokkasho reprocessing plant. HLW that was generated from the reprocessing of UNF abroad and that which will be generated at Rokkasho will be stored pending the development of a geologic repository. The Japan Atomic Energy Agency (JAEA) is conducting research and development activities in generic crystalline (granite) and sedimentary (clay/shale) environments that will ultimately need to be translated to site-specific activities (once a site or multiple sites are identified through a voluntary process). Thus, while the Japanese program is somewhat mature, JAEA is still conducting generic R&D.

The Waste Management Working Group under the JNEAP is well established. Slow, but good progress has been made in establishing a collaborative plan under Phase II of the action plan. The expanded scope that occurred with changes in the FCT program, the decision to no longer pursue the Yucca Mountain repository, and the establishment of the UFDC were reflected in changes to the Phase II work scope of the working group. Current activities include the determination of waste forms inventory for advanced fuel cycles, the development of tools for optimizing repository design and operation for advanced fuel cycles, and knowledge management systems for geologic disposal.

However, there are opportunities to further expand the activities within the working group in the area of repository science, including possible collaborative experiments in the JAEA underground research laboratories (URLs). Other Japanese organizations are also conducting other research and development activities in the area of UNF and HLW management. These include CRIEPI (storage), RWMC (engineered component demonstrations), and NUMO (implementation). Expanding the JNEAP to include these aspects should be evaluated and considered.

Other existing DOE-NE bilateral agreements should be considered for expansion to include UNF and HLW management aspects. These cover a range of program maturity, especially with respect to repository development and include the PUNT, the agreement with France (expand to include ANDRA), and Russia.

Bilateral agreements between OCRWM and other countries that have either terminated or lapsed should be reactivated or renewed. In addition, new bilateral agreements should be established. Again, the bilateral agreements could span a range of program maturity. Some countries may limit their desire to collaborate as they proceed to site-specific activities and/or enter the licensing stage (as was the case with the Yucca Mountain repository program). Potential countries include Switzerland, Belgium, Germany, United Kingdom, Canada, South Korea, Sweden, Finland, and Taiwan.

Bilateral agreements would provide an opportunity to access underground research laboratories (URLs) in other countries. Organizations in other countries have expressed interest in having U.S. participation in URL research including JAEA (Japan) and Nagra (Switzerland). Again, such participation would depend on UFDC research and development priorities.

International Meetings/Conferences

International meetings and conferences present a good opportunity for UFDC researchers to interact with researchers from other countries. Contacts can be made and interfaces can be established, leading to information exchange and possibly the identification of additional collaborative projects. The UFDC will identify appropriate meetings to attend each fiscal year and determine the UFDC researchers that should attend. Preference will be given to invited participation because it is those organizations/countries that would be actively interested in collaboration through the invitation. NE participation should continue at the biannual EDRAM meetings.

4. IMPLEMENTATION

The previous section presents the potential areas for UFDC cooperation and collaboration internationally. This section discusses the implementation of international activities within the UFDC. As discussed above, the UFDC will remain flexible with its international program. Additional opportunities may arise, for example as agreements are established, and the UFDC will consider involvement using the broad implementation plan presented below.

Responsibility

All international activities will be coordinated and managed by DOE-NE. However, further review will be required for the international activities that will be conducted by DOE-NE staff alone, those that will require support by national laboratory staff, and those that will be conducted primarily by national laboratory staff. This will be done during FY2011 as the areas are determined where the UFDC will collaborate with its international partners.

Integration with Separations/Waste Form Campaign

The FCT Separations/Waste Form Campaign is responsible for developing, characterizing, and evaluating the long-term performance of advanced high level waste forms. There is strong integration between the UFDC and the Separations/Waste Form Campaign. This integration will continue in the area of international cooperation and collaboration.

Funding

Funding in the UFDC External and International Control Account is \$480K for FY2011 and includes both external interactions and international activities. This Control Account is also intended to support broad

international activities such as attending meetings (e.g. IAEA and NEA), participating on bilateral working groups, and limited attendance at conferences and meetings identified by DOE-NE and UFDC management as important for broadening the UFDC international reach, and preparation activities for such activities.

The mechanism for funding specific cooperative and collaborative activities will be the work packages from the UFDC Disposal Research and Transportation/Storage Control Accounts. These activities include direct cooperative and collaborative activities and attendance at and presentation of UFDC work at international conferences. UFDC researchers, DOE-NE, and UFDC management will determine those activities to fund and include them in the annual planning process.

It is unclear how much funding should be allocated to international activities within the Control Account for Fiscal Year 2011. External interactions are typically attendance at pre-determined meetings, plus level of effort in response to specific requests and needs for external interaction support. Based on FY2010 spending, half of the total FY2011 Control Account budget will be allocated to international activities for planning purposes. The Control Account budget will be evaluated at mid-year to determine if additional funding should be allocated to international activities. It is expected that the UFDC international program will be better defined for FY2012 and beyond, allowing for a more definitive allocation of funding within the Control Account.

Broad Collaboration

The broad cooperative and collaborative groups, such as the IAEA and the OECD/NEA, will be evaluated by DOE-NE and UFDC management to determine which ones should be maintained and which ones would require initiation of a new activity. Another important consideration is determining the appropriate level of participation on specific projects.

Bilateral Agreements

Except for the U.S. – Japan JNEAP, waste management activities under existing bilateral agreements are limited. The UFDC and DOE-NE will pursue expanding the scope of work under the U.S. – China PUNT and under the U.S. – French agreement already in existence within DOE-NE. Additional organizations may have to be included under this expanded scope (i.e., ANDRA in France).

Activities under the U.S. – Japan JNEAP are established and are being executed. Opportunities for increased collaboration are under consideration, in particular in the areas of repository sciences, off-gas capture and immobilization (Separations/Waste Form Campaign), and engineering demonstrations. These opportunities will be further explored at the next Waste Management Working Group meeting tentatively planned for spring 2010 in Japan. Arrangements will be made with Japan Atomic Energy Agency to hold technical tours of their underground research laboratories at Mizunami and Horonobe (visits have already been made to the JAEA research laboratories at their Tokai R&D center).

The UFDC will evaluate the bilateral agreements managed by OCRWM to determine those countries for which future collaboration would be useful. The benefits of collaboration, to both the U.S. and the other country, as well as specific areas of collaboration, will be identified. This may involve visits to countries of interest to determine potential areas of collaboration (funded under the External Interaction and International Control Account). Once the countries and areas of collaboration are identified, the UFDC will then work with the DOE-NE International office to execute the process of establishing bilateral agreements.

Coordination with UFDC R&D Priorities

Priorities for UFDC R&D are still being established in both the storage and disposal areas and are planned to be completed by mid FY2011. DOE-NE, UFDC management, and UFDC researchers will

determine how best to proceed with direct international collaboration once these priorities are established. For a given R&D priority, the applicability of international collaboration and the benefit that would be gained will be evaluated. Specific countries will be identified for potential collaboration, in conjunction with the broad collaboration evaluation discussed immediately above. Detailed work scope will be developed and negotiated with those countries with either an established agreement or one that will be established.