OCRWM INTERNATIONAL COOPERATION IN NUCLEAR WASTE MANAGEMENT

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ABSTRACT

With the implementation of nuclear power as a major energy source, the United States is increasingly faced with the challenges of safely managing its inventory of spent nuclear materials. In 2002, with 438 nuclear power facilities generating electrical energy in 31 nations around the world, the management of radioactive material including spent nuclear fuel and high-level radioactive waste, is an international concern.

Most of the world's nuclear nations maintain radioactive waste management programs and have generally accepted deep geologic repositories as the long-term solution for disposal of spent nuclear fuel and high-level radioactive waste. Similarly, the United States is evaluating the feasibility of deep geologic disposal at Yucca Mountain, Nevada. This project is directed by the U.S. Department of Energy's Office of Civilian Radioactive Waste Management (OCRWM), which has responsibility for managing the disposition of spent nuclear fuel produced by commercial nuclear power facilities along with U.S. government-owned spent nuclear fuel and high-level radioactive waste. Much of the world class science conducted through the OCRWM program was enhanced through collaboration with other nations and international organizations focused on resolving issues associated with the disposition of spent nuclear fuel and high-level radioactive waste.

INTRODUCTION

In l982, a major milestone was achieved when the Nuclear Waste Policy Act (NWPA), enacted by the U.S. Congress, established geologic disposal as the Government's policy for managing spent nuclear fuel and high-level radioactive waste. The NWPA gave the newly created Office of Civilian Radioactive Waste Management (OCRWM), along with several other federal agencies, various responsibilities for implementing waste policy. OCRWM's implementation of its responsibilities under the NWPA, as originally enacted, resulted in the identification of three potential sites for the first repository and a multi-year evaluation of each of the sites.

In 1987, the NWPA was amended to narrow the evaluation to just one potential site – Yucca Mountain, Nevada. After many years of investigation, and much world class science conducted at the Yucca Mountain site, the OCRWM Program is now nearing a major milestone required by the NWPA – site recommendation. That science was enhanced through 20 years of scientific and technical collaboration with the international community through bilateral agreements with various nations and participation in activities of international organizations and multinational projects.

OCRWM PROGRAM INTERNATIONAL OBJECTIVES

The OCRWM Program's objectives for international collaboration are to obtain information that will benefit the development and licensing of a U.S. federal waste management system and to promote international understanding and consensus on radioactive waste management issues. In support of these objectives, the OCRWM Program has focused on those issues which enhance the near-term activities leading to a determination on the suitability of the Yucca Mountain site for a high-level waste repository as well as those that benefit the Waste Acceptance and Transportation Project. It is also important to the Program to contribute to the development of geologic disposal of spent nuclear fuel and high-level radioactive waste worldwide by sharing science and technology gained from the many years of U.S. high-level radioactive waste management experience. The OCRWM Program accomplishes

these objectives through information exchange and consensus development as well as through technology development and technology transfer activities.

INFORMATION EXCHANGE AND CONSENSUS DEVELOPMENT ACTIVITIES

The OCRWM Program assures the exchange of information and consensus development through cooperative bilateral agreements with other nations and participation in the activities of international organizations and multinational projects.

Bilateral Agreements

Over the past 20 years, the OCRWM Program has developed and implemented many cooperative agreements with various nations in an effort to share information on radioactive waste management topics. The degree of cooperation with the various nations has ranged from the exchange of technical documents and personnel to full collaboration in cost sharing for underground research laboratories. Presently, the Program maintains waste management agreements with Canada, France, Japan (JNC), Spain, Sweden, and Switzerland.

Participation in International Organizations and Multinational Projects

To promote international understanding and to develop consensus on radioactive waste management issues, the OCRWM Program became participants in programs and related activities sponsored by the Organization for Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA), the International Atomic Energy Agency (IAEA), the International Association for the Environmental Safe Disposal of Radioactive Materials (EDRAM), the Commission of European Communities (CEC) and several multinational projects.

Nuclear Energy Agency

The OCRWM Program is actively involved in activities of the OECD/NEA's Standing Committee on Radioactive Waste Management (RWMC). For many years, the Program has represented the U.S. on the RWMC through coordination of U.S. positions on waste management issues of the Department of Energy, the Nuclear Regulatory Commission and the Environmental Protection Agency.

The Program's participation in the activities of the RWMC include the Integration Group for the Safety Case, which is responsible for identifying and investigating issues relevant to the field of repository development for long-lived radioactive waste; the Forum on Stakeholders Confidence, which focuses on public perception and confidence issues; and the Thermochemical Data Base, which develops, compiles and reviews thermodynamic data for particular radionuclides. Participation in these types of activities has benefited OCRWM over the years. The acquisition and exchange of technological and scientific information, particularly related to complex issues dealing with performance assessment, database development, and peer review by experts of other participating nations has significantly enhanced OCRWM understanding of those types of issues. This enhanced understanding has further strengthened the understanding and insight of technological and science related issues at Yucca Mountain.

International Atomic Energy Agency

The OCRWM Program's relationship with the IAEA is also both long standing and active. The Program's involvement in activities of the IAEA focuses on spent fuel storage and systems integration and includes participation in the Advisory Group on Spent Fuel Management, the spent nuclear fuel burn-up credit project, spent fuel performance assessment and research activities, underground research laboratory development activities, and biosphere peer reviews. OCRWM has significantly benefited from participation in these activities, especially through the exchange of information on resolving scientific and technological issues associated with storage, monitoring and other topics of concern to Yucca Mountain. The knowledge gained through resolution of these global issues, through direct collaboration with experts from other nations has been of direct benefit to OCRWM.

The OCRWM Program has also undertaken joint endeavors which have included the cooperation of both the NEA and the IAEA including the l999 Department of Energy-sponsored Conference on Geologic Repositories held in

Denver, Colorado and the recently completed international peer review of the Yucca Mountain Site Characterization Project's Total System Performance Assessment.

EDRAM

The Program is also an active participant in the International Association for Environmental Safe Disposal of Radioactive Waste Materials (EDRAM). The purpose of the association is to enhance international cooperation by exchanging views on policy issues and stimulating joint research and development projects. Its 12 members are senior level officials who are responsible for waste management programs in 11 nations. The nations represented include Belgium, Canada, Finland, France, Germany, Japan, Spain, Sweden, Switzerland, the U.K., and the U.S.

CEC

The Program also participated in several activities of the Commission of European Communities, including the Natural Analogue Working Group that dealt with incorporating knowledge gained from natural analogue systems into long-term understanding of repository environments, and the validation of geochemical models in the CHEMVAL project.

Multinational projects

The OCRWM Program currently participates in the multinational DECOVALEX Project, which focuses on coupled thermal, hydrologic, mechanical, and chemical processes of importance to radionuclide release and transport, and provides an opportunity for peer review for code developers along with the exchange of laboratory and field data for validation purposes.

In addition, the Program is an active participant in the International Working Group on Sabotage Studies, an international forum to exchange information on consequences related to sabotage of certain types of transport and storage systems used for radioactive materials.

The Program also participates in the NEA's GEOTRAP Project that is a venue for exchanging information on approaches for acquiring field data, testing, and modeling transport of radionuclides in geologic formations. From the early l980's through l991, the OCRWM Program participated in the NEA's International Stripa Project, which involved joint activities by seven to nine nations in an old abandoned iron mine in Central Sweden to develop prototype methods, instruments and tests for characterizing and evaluating sites for geologic disposal. The Program gained experience in design, testing, and use of equipment and methods for underground testing and modeling of data. The Program also participated in the NEA sponsored Alligator Rivers Analogue Project which developed reliable and realistic radionuclide migration models and methods of model validation using laboratory and field data.

Other international projects in which the OCRWM Program has participated include the INTRACOIN, HYDROCOIN and INTRAVAL Projects, which emphasized the verification and validation of geosphere performance assessment models. OCRWM also participated in the Pocos de Caldas natural analogue project in Brazil, which studied uranium and thorium deposits as analogues for processes related to a mined geologic repository. In addition, the Program worked with the New Zealand Institute for Geologic and Nuclear Studies and used data from New Zealand's geothermal fields to test and validate the geochemical models used at Yucca Mountain and tested its ability to simulate the chemical and mineralogical evolution of a repository in silicic volcanic rocks for regulatory time periods.

COOPERATIVE TECHNOLOGY DEVELOPMENT AND TECHNOLOGY TRANSFER

Prior to the development of Yucca Mountain's underground Exploratory Studies Facility, in which the U.S. able to perform site characterization testing activities, the OCRWM Program formulated three cost-sharing research and development projects under existing bilateral agreements with Canada, Sweden, and Switzerland to gain experience in the development of underground laboratory research. The outcome was a cost-effective transfer of technology developed under the tasks to the work that was on-going in the U.S. domestic program, particularly the site characterization program at the Yucca Mountain site.

Canada

From the mid-l980's to the mid-l990's, the OCRWM Program worked closely with Atomic Energy of Canada Limited (AECL) under two subsidiary agreements. The agreements included work on the shaft extension of AECLS's Underground Research Laboratory located in the Province of Manitoba, planning for in-situ tests, surface-based geologic characterization, and performance assessment code transfer. Collaboration with AECL also involved activities in direct support of Yucca Mountain site evaluation activities, including site characterization and validation, instrumentation and testing development, radionuclide transport, sealing technology and spent fuel dissolution modeling.

Sweden

Collaboration was also conducted with Sweden's Nuclear Fuel and Waste Management Company (SKB) beginning in l992 with the Program participating in technical activities at SKB's Hard Rock Laboratory in southern Sweden. Joint cooperative activities included improving the understanding of specific key processes relevant to repository performance, validation of specific models on data collection procedures, and optimization of site characterization methods related to flow and transport in fractured rock. Field and laboratory data for geochemical modeling was collected by SKB, acquired by OCRWM, and provided a unique source of high quality hydrologic and chemical data for testing techniques and models.

Switzerland

The OCRWM Program also developed three project agreements with Switzerland's National Cooperative for the Disposal of Radioactive Waste (NAGRA) and performed joint technical activities at NAGRA's underground Rock Laboratory located in the Swiss Alps. The joint work included the development of a stochastic model for fracture flow hydrology to be used in the U.S. and Switzerland, and model development and verification of hydrologic flow in fractured rocks. Under this cooperative relationship, new techniques were developed and tested for bore hole fluid logging and seismic tomographic characterization of fracture zones as well as studies to develop a mechanistic approach to sorption.

Japan

More recently, in the late l990's, under the bilateral agreement with the Japan Nuclear Cycle Development Institute, the OCRWM Program developed two project annexes to work cooperatively on near field processes and engineered barrier performance, and hazard analyses of volcanic and seismic activity.

Technical Assistance Activities

The NWPA, in Section 223, directed the OCRWM Program to offer technical assistance for a five-year period to non-nuclear weapons states in the areas of spent fuel storage and disposal. The OCRWM Program also participated in technical assistance agreements with South Korea, Taiwan and the newly Independent States of the Former Soviet Union for the purpose of supporting U.S. policy on non-proliferation and enhancing U.S. competitiveness in nuclear technology in the Pacific Rim area.

NEW INITIATIVES

With the end of the Cold War and the increased concern about non-proliferation and nuclear arms reduction, the Program has developed cooperative relationships with the Ministry of Atomic Energy of the Russian Federation (MINATOM) and the Russian Academy of Science. A bilateral agreement is under development with MINATOM and two implementing arrangements have been signed with the Academy of Science in an effort to strengthen scientific and technical cooperation in addressing waste management issues as well as enhance the capability to develop safe and reliable spent nuclear material isolation technologies. New bilateral agreements to share science and technology in the area of radioactive waste management have also been initiated and are under development with Posiva Oy of Finland, UK Nirex of the United Kingdom and with NUMO, Japan's new implementing organization.

The Program is also involved in the development of an International Center for Geologic Repository Science and Technology (ICGRST), working with organizations located in the Pacific Rim area. The purpose of the ICGRST is to provide a forum to advance geologic repository science, promote cooperative research, exchange views and experiences, enhance public outreach, and address regulatory, safety assessment, and validation issues related to geologic repositories.

The OCRWM Program also monitors developments abroad to gather information and maintain a cognizance of other waste management efforts and developing technologies being pursued by other nations and private enterprises.

COORDINATION OF INTERNATIONAL ACTIVITIES

Implementation of OCRWM international program activities requires coordination and interaction with other Department of Energy components as well as other government agencies to ensure integration of international experience into domestic program activities and decision-making. OCRWM works closely within the Department with the Office of Policy and International Affairs, and the Office of Environmental Management and the Carlsbad Field Office who manage the Waste Isolation Pilot Project. Coordination also occurs with the Office of Nuclear Energy, Science and Technology, Office of General Counsel, Office of Management, Budget and Evaluation, and the National Nuclear Security Administration. In addition, the Program interacts with the Department of State, the Nuclear Regulatory Commission, the Environmental Protection Agency, and the National Academy of Sciences.

SUMMARY

The OCRWM Program has benefited tremendously from 20 years of international collaboration. Through this collaboration, the Program was provided access to unique foreign facilities, data sets, scientists, techniques, experience, and instrumentation not otherwise available in the U.S. There is still much we can gain from the collective knowledge of other nations for the safe disposal of high-level waste and spent nuclear fuel. The Program will continue to pursue opportunities to cooperate with other nations and international organizations to share science and technology, promote international understanding, develop consensus on radioactive waste management issues, and advance U .S. non-proliferation policy. As stated in the recent report of the National Academy of Science's National Research Council, "Global cooperation on high-level waste can bring benefit to all."