OVERVIEW OF DOE/OCRWM COOPERATIVE PROGRAMS WITH OTHER COUNTRIES

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ABSTRACT

The Office of Civilian Radioactive Waste Management (OCRWM) has pursued, and will continue to pursue, a program of international activities in support of the OCRWM program mission. The OCRWM international program is designed to support both technical and non-technical areas of the program. Activities in the program address two broad objectives, to acquire information that benefits the U.S. program and, to promote understanding, and where possible consensus, in the international community on waste management issues of common interest.

Information acquisition includes a wide range of activities including, cooperative testing efforts (surface-based field, laboratory and underground), safety assessment (model and code verification and validation) natural analog studies, working groups and peer review groups, topical meetings, personnel exchanges, etc. Efforts at consensus development include participation in peer review and advisory groups on technical as well as non-technical subjects. Many of the OCRWM international activities contribute to both objectives.

Benefits to the OCRWM program from participation in cooperative international activities include sharing of research and development costs among cooperating nations, increasing expertise within the OCRWM staff that is applied to the U.S. program, and developing and implementing policies, approaches and strategies within the U.S. program based on a broader experience base. These benefits increase the cost effectiveness and schedule confidence of the U.S. program.

INTRODUCTION

The Office of Civilian Radioactive Waste Management (OCRWM) conducts a program of international activities to support the overall mission of the OCRWM program, i.e., to dispose of the nation's spent fuel and high-level waste in a manner that protects the health and safety of the public and the quality of the environment. This program of international efforts is particularly relevant to the constraints on the OCRWM mission, that it be carried out in accord with all applicable laws, regulations and DOE directives, and that it be timely and cost effective. Supporting the timeliness of the U.S. program and increasing its cost effectiveness are two major benefits to be gained from participation in international activities. The laws, regulations, and DOE directives, serve as means to evaluate the applicability of approaches used in other countries, thereby helping to focus OCRWM efforts on approaches that can be adapted to the U.S. regulatory environment.

The basic aims of the OCRWM efforts are to acquire information in both technical and non-technical areas that would benefit the U.S. program, and to promote international understanding, and where possible consensus, on common waste management issues. Many of the projects in which the OCRWM program participates contribute to both aims.

The broad aim of acquiring information actually encompasses a wide range of activities, which include cooperative testing and technology development efforts involving laboratory, surface-based field and underground testing, safety assessment model and code development and testing (benchmarking and model validation), personnel exchange, information exchange, as well as participation in working groups focused on specific technical subjects. To promote understanding, and where possible consensus, the OCRWM program participates in peer review and working groups in technical and non-technical areas, and is represented on senior advisory groups of international organizations. OCRWM also monitors developments and trends in the international waste management community, so that the U.S. can learn from the experience in other countries, both in technical and non technical areas.

MECHANISMS FOR PARTICIPATION IN INTERNATIONAL ACTIVITIES

There are several mechanisms for the OCRWM Program to participate in international activities. Bilateral agreements are established between the U.S. and other countries to specify requirements for developing and exchanging waste management technology. Within the context of these bilateral agreements, implementing project

and subsidiary agreements can be developed to define the terms and conditions for specific technical exchanges and projects. These projects are termed either joint projects or joint studies, where the latter does not involve funds transfer. Multi-lateral agreements are also a common vehicle for international efforts. These agreements cover participation with a number of countries, or multi-national organizations, in cooperative projects or studies.

The U.S. is also a member of two important multi-national organizations, the Organization of Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) and the International Atomic Energy Agency (IAEA). As appropriate, the OCRWM program participates in projects, working groups and other activities, sponsored by these organizations. A significant component of the U.S. program's international efforts involve these agencies.

DEVELOPMENT AND INTEGRATION OF OCRWM'S INTERNATIONAL PROGRAM

For the OCRWM program to ultimately be successful, it must integrate and balance technical concerns, such as site characterization and repository design, with non-technical aspects such as public involvement, education, acceptance and risk perception. Like the OCRWM program as a whole, integration of the OCRWM international work into the domestic program is the key to realizing the benefits to be gained.

To promote this integration, the International Program Working Group (IPWG) has recently been established as a permanent working group within the U.S. program. The IPWG is chaired by the Office of Strategic Planning and International Programs (OSP&IP), and contains representatives from all OCRWM program Offices with either direct responsibilities for, or interest in, international activities (most of the offices within the OCRWM program structure). The responsibilities of this working group are to, promote integration with the domestic program, periodically review and evaluate the OCRWM international activities and their contribution to the U.S. program, recommend changes to the existing efforts or new initiatives in the international area, as well as overview the OCRWM international activities.

The nature of extent of OCRWM's involvement in international activities is a function of the evolving needs of the U.S. program, and the relative state of development of specific areas within the programs of other countries relative to that in the U.S. In some areas, the U.S. program is more advanced than other countries, either in schedule or technology (such as site evaluation methodologies), while in other areas there is more experience in the international community (such as in situ underground testing). In carrying out its functions, the OCRWM IPWG will consider the state of development of the U.S. program in evaluating current activities and formulating new initiatives, as well as promoting the integration of international work into the domestic program. The IPWG by its nature will also be involved in strategic planning for the international program so that the program will evolve in response to changing program needs.

OCRWM INTERNATIONAL ACTIVITIES

The OCRWM program has been and is currently involved in a wide range of international activities. These activities vary from cooperative testing (under bilateral or multilateral agreements) which take advantage of unique facilities in other countries, to participation in working and advisory groups focused on developing understanding, and where possible consensus, on waste management issues of common interest. These activities are described below along with their purpose, a brief history, and the benefits expected for the U.S. program.

Cooperative Testing

Cooperative testing in the OCRWM international programs has involved surface-based field, laboratory and underground testing. A major emphasis of these activities has been on underground testing in research and development facilities in other countries. The major benefits to the U.S. program have been cost sharing for technology development, and building expertise in the U.S. program to be applied to the design and execution of similar testing in the U.S. program. Significant testing projects have been done under cooperative agreements with the Canadian and Swiss Programs. These efforts are expected to continue and evolve in the future as described below. Multi-national cooperative testing projects have also been performed under multi-lateral agreements.

Canada

The U.S. had a subsidiary agreement (SA#1-initiated in 1986) covering cooperative testing with Atomic Energy of Canada, Ltd. (AECL), which centered around work in the Underground Research Laboratory (URL), near Pinawa, Manitoba. This agreement was set aside after the Nuclear Waste Policy Act was amended in late 1987. The OCRWM Program is in the process of negotiating a new agreement (SA#2) focused on work to be done which is relevant to characterization of the candidate Yucca Mountain Site. Proposed activities in the scope of work include testing of sealing materials, spent fuel dissolution model development, large block tracer tests, and testing/calibration of in situ stress measurement techniques, and hydrochemical measurement instrumentation, and the use of natural analogs to understand radionuclide migration.

Most of the work involves field and laboratory testing rather than underground testing.

Although much of the previous testing with AECL focused on techniques more applicable to candidate repository sites in the saturated zone, the OCRWM program has benefited in several areas. Techniques were developed for efficient geological mapping along shaft walls, and useful geophysical measurement technology was developed. With a re-focussing on work transferrable to the candidate Yucca Mountain site, the OCRWM program will benefit more directly from the results and experience of future testing.

Cooperative Multi-National Testing

Significant cooperative testing efforts utilizing a unique underground facility in Sweden have been done under the three successive phases of the Stripa Project, a multi-national project under the auspices of the NEA. Testing in the Stripa Project has been extensive, covering such subjects as thermomechanical testing, development of seismic, radar and hydraulic testing instrumentation, grouting and sealing materials testing, radionuclide transport (ground water flow through rock fractures) testing and modeling, and development of remote sensing instrumentation.

Benefits to the OCRWM program have included significant advances in rock mass characterization techniques, hydrologic flow characterization and development of geophysical sensing techniques. Additional benefits include the development of expertise in the U.S. program which has been applied to site characterization efforts and the planning and design of underground testing to be done in the U.S. Exploratory Shaft Facility when it is constructed.

Although the Stripa Project is in its final year, the OCRWM program is working with the Swedish Nuclear Fuel and Waste Management Company to develop cooperative studies to be done in the Swedish Hard Rock Laboratory (HRL). The basic intent of the HRL is to test and verify methods for site characterization, develop methods for repository construction and test disposal concepts. Such testing is a valuable demonstration, and hopefully confirmation, of modeling capabilities which support repository design and safety assessments.

The OCRWM program participated in a recently completed three-year multi-national natural analog study, (with Sweden, Brazil, Switzerland and the United Kingdom), of uranium mobilization in an open-pit uranium mine in Brazil. This study, (the Pocos de Caldas analog study) will also be a test case in Phase II of the INTRAVAL project (see safety assessment below).

Switzerland

Since 1985, the U.S. has had a bilateral agreement with the Swiss National Cooperative for the Disposal Radioactive Waste (NAGRA). Two project agreements under the bilateral agreement have been completed, and a third is being finalized. Much of the testing involved was done in the Swiss Grimsel Pass underground test facility. Project agreement one (PA1) focused on fractured rock hydrologic modeling, and PA2 focused on further model development and verification, and the development of seismic and tomographic instrumentation and data analysis. The current proposed project agreement involves testing particularly relevant to hydrologic processes at the candidate Yucca Mountain site. Testing under PA3 will focus on multi-phase flow in porous and fractured rock hydrologic regimes, diffusion and sorption processes, seismic imaging and borehole logging.

The results from this cooperative program have contributed to the development of fractured rock hydrology models and studies and characterization of fractures from borehole measurements. Both subjects are important for characterizing the candidate Yucca Mountain site, designing underground testing, and modeling the hydrology at the site.

Safety Assessment

In the area of safety assessment, the OCRWM program has participated in a number of cooperative projects, advisory and user groups, and data compilation projects. The U.S. will continue a strong involvement in these activities in the future.

The OCRWM program participated in the INTRACOIN and HYDROCOIN projects which involved comparative exercises using hydrologic flow and radionuclide transport codes. As a further logical development from these programs, the INTRAVAL project was established to attempt validation of safety assessment codes using data from field tests, laboratory experiments, and natural analog studies. The U.S. program has participated in INTRAVAL, using data from field and laboratory tests on unsaturated tuff. Results from the INTRAVAL project will be important to the OCRWM program because the subject of model validation, i.e., comparison of model predictions against real data, is an important issue in the U.S. regulatory arena. It is important for the U.S. program to promote understanding and consensus on what constitutes validation of safety assessments, because this is an important concern

in defending the assessments that will be in the license application for the U.S. geologic repository.

To promote efforts to improve safety assessment technology and understanding, the OCRWM program is represented on the NEA Performance Assessment Advisory Group (PAAG) which oversees the progress, and supplies direction to, NEA projects in this general area. The U.S. also belongs to the NEA Probabilistic Safety Assessment Code Users Group which performs verification studies of probabilistic codes and serves as a forum for technical discussion and exchange.

The U.S. program also participates in the NEA Thermochemical Data Base Project which is producing peer reviewed compilations of thermodynamic data for radionuclides of interest in safety assessments (U, Pu, Np, Am and Tc). These compilations will be incorporated into ongoing work within the U.S. program to upgrade the data base in the EQ3/6 geochemical modeling code, used in the U.S. program to support interpreting laboratory sorption, solubility, and spent fuel dissolution testing.

Working and Advisory Groups

The OCRWM participation in these groups is focused on developing understanding of the issues, both technical and non-technical, involved in executing geologic disposal programs. Such groups provide a forum for discussion and information exchange to promote understanding of the issues, and the approaches being used in other countries to address them. Where possible, consensus on approach to addressing common issues can help significantly in advancing the programs of all participating countries. The OCRWM participation in such groups is described more fully below.

Safety Assessment

The PAAG, under the OECD/NEA, works to develop an understanding of the role of safety assessments in geologic disposal programs, their limitations and uncertainties. The PAAG is preparing a state-of-the art review of safety assessment which addresses the nature, role, and uncertainties of the technology. The PAAG also oversees the work done in other safety assessment efforts mentioned earlier, which also contribute to developing consensus on such areas as the nature of verification and validation, scenario development, use of probabilistic versus deterministic assessments, etc. Understanding developed from these efforts is directly applicable to the U.S. program's work in performance assessment, significantly enhances the expertise within the U.S. program, and will significantly support the assessments required by the U.S. Nuclear Regulatory Commission in the license application for a geologic repository.

Site Characterization

The Site Evaluation and Design of Experiments (SEDE) Coordinating Group, under the NEA, was recently organized to provide mechanisms to exchange information and bring international expertise to bear on common problems involved with site characterization testing and evaluation strategy, experiment design, instrumentation development and data interpretation. This group is a logical balance to the focus of the PAAG. The SEDE efforts are directed at data collection and analysis, while PAAG efforts focus on modeling, which uses these data. The first SEDE technical workshop was held in October 1990, and centered on flow heterogeneity and site evaluation problems. Results from SEDE should be very useful for characterization studies to be done at the candidate Yucca Mountain site.

Natural Analogs

The OCRWM program is represented on the Natural Analog Working Group (NAWG) which is sponsored by the Commission of European Communities. The NAWG works to develop an understanding of the role of these studies in establishing confidence in the performance of the natural barrier, and to facilitate work in this area involving CEC member countries. The Pocos de Caldas analog study is an example of the type of multi-national project the NAWG would encourage in the future.

Waste Management Issues

The OCRWM program is represented on the NEA Radioactive Waste Management Committee (RWMC) by the director of OSP&IP. The RWMC is an advisory group to the NEA Secretariate. This group oversees the progress of NEA projects, serves as a forum for discussion and consensus development on waste management issues, and makes recommendations for future efforts under NEA sponsorship. The OCRWM program also has input to the International Nuclear Waste Advisory Committee of the International Atomic Energy Agency (IAEA), which provides another forum for addressing waste management issues. The OCRWM program also participates in IAEA working groups in which topical activities such as standards and-criteria development are addressed.

Public Involvement

The OCRWM program participates in the NEA Working Group on Public Outreach, which focuses on developing materials for public education in the area of radioactive waste management, and is a forum for discussing issues and

developing approaches for use in the area of public outreach.

International Peer Review

The OCRWM program has had experts from other countries provide peer review of U.S. program planning documents, such as portions of the site characterization plan and study plans for certain scientific investigations. Such reviews can provide useful insight and ideas for the U.S. program. In the future, the OCRWM program intends to continue and expand the opportunities for such reviews, possibly using the expertise in international organizations such as the IAEA.

MONITORING INTERNATIONAL DEVELOPMENTS

To keep abreast of developments in the waste management field internationally, the OCRWM program monitors developments in other countries through reviews of the published open literature and national program overviews prepared by the International Program Support Office in Pacific Northwest Laboratories. Other activities of this type include:

- briefing meetings with visitors from waste management programs in other countries;
- attendance at topical international conferences and symposia (such as the PATRAM symposia on transportation and packaging)
- personnel exchanges of staff between OCRWM and programs in other countries
- briefings on program status presented during topical meetings in working and advisory groups and project meetings.

In these ways, the OCRWM program can stay aware of developments and opportunities for beneficial cooperative activities and information exchange

FUTURE DIRECTION

The aim of the OCRWM international program will remain the same in the future but its content will change as a reflection of the evolving nature of the U.S. program and its needs. The general direction of the OCRWM international program will be:

- to continue to pursue cooperative testing projects focused on technical subjects applicable to the Yucca Mountain characterization efforts;
- to continue to pursue activities related to safety assessment technology development;
- to focus more attention on international experience in spent fuel transportation and handling in support of the Monitored Retrievable Storage Facility;
- to focus more effort in the institutional areas and public education, involvement and outreach;
- to pursue beneficial information in the areas of systems engineering, quality assurance/control and regulatory strategies from experience in other countries; and
- to work toward greater integration of the international efforts into the domestic efforts.

BENEFITS FROM INTERNATIONAL ACTIVITIES

By participating in international activities, maintaining an awareness and understanding of the nature and progress of radioactive waste management programs in other countries, and monitoring developments and trends in the international community, the OCRWM program benefits in a number of important ways. These benefits touch all levels of the U.S. program, from top-level policy to conducting field or laboratory testing. The benefits to the OCRWM are, in summary:

- program policy, regulatory approaches, technical strategies, approaches to institutional concerns and public involvement, can be pursued using a broader experience base than otherwise available.
- technology development (instrumentation, test design, analysis techniques, safety assessment, etc.) from cooperative programs can be used in the design and execution of scientific studies within the U.S. domestic program.
- participation in cooperative efforts serves as a means to build expertise within the U.S. program, which can be applied to address technical and non-technical challenges in the U.S. program.

These benefits can be realized by integrating international efforts into all areas of the OCRWM program, to improve cost effectiveness and build schedule confidence in the domestic efforts. Perhaps more importantly, the benefits for developing and implementing policy and approaches in the non-technical areas can help the U.S. program minimize missteps and their consequent adverse impacts on cost, schedule and perception of the program in the public and institutional areas.

SUMMARY

The OCRWM program pursues an active program of involvement in international projects, working and advisory groups, as well as maintaining an active interest in the status of programs in other countries. The U.S. program intends to continue participation in these activities and expand its activities in areas such as described while working to promote the integration of these activities with the domestic programs.