

**THE INTERNATIONAL WASTE MANAGEMENT PROGRAM
AT THE U.S. DOE CARLSBAD AREA OFFICE**

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ABSTRACT

The U.S. Department of Energy's (DOE) Carlsbad Area Office (CAO) administers the only currently operating, deep-geological nuclear repository in the world, the Waste Isolation Pilot Plant (WIPP). The WIPP provides for the safe disposal of U.S. defense-related transuranic (TRU) waste and is located 42 kilometers (km) east of Carlsbad, New Mexico. At WIPP are surface and subsurface facilities designed to facilitate the safe handling and disposal of TRU waste. The WIPP began receiving waste in March 1999.

During the 35-year disposal phase, continued investigations into certain scientific issues will allow the CAO to develop more detailed knowledge which could enhance WIPP operations and performance. This is true of activities, which will be conducted over the life of the operation or implemented late in the operational life.

To facilitate gathering of scientific information in a more effective and efficient manner, the CAO has developed a vigorous international cooperative program. The purpose of this program is to bolster CAO as an international radioactive waste management leader by promoting solutions to waste management issues. This consists of three parts:

1. The timely and cost-effective acquisition of data and information enhancing the assurance and confidence in the CAO's safe operation, closure, and decommissioning of the WIPP site;
2. The timely and cost-effective sharing of WIPP data and information with other similar programs; and
3. Vigorous, timely, and cost-effective international outreach promoting (a) the recognition of the CAO as an international leader, peer, broker, source, and resource in radioactive waste management and disposal, and (b) Carlsbad/WIPP-based multi-national collaborations and partnerships.

Cooperative activities will include personnel exchanges, technical exchanges, and international organizations' workshops and meetings.

In some areas of broad international interest, the CAO has developed a leading expertise through its 25-year WIPP repository and TRU waste characterization activities. In addition to participating in relevant and beneficial experiments, the CAO will provide the international community convenient access to this information by sponsoring and hosting symposia and workshops on relevant topics and by participation in international waste management organizations and topical meetings. This paper includes an update on the progress and achievements of CAO in developing international collaborative efforts.

INTRODUCTION

The CAO administers and operates the WIPP site, which hosts a deep geologic repository for safe disposal of U.S. defense-related TRU waste and is located 42 kilometers (km) east of Carlsbad, New Mexico. CAO also manages the National Transuranic Waste Program (NTP), which oversees TRU waste management from generation to disposal. The WIPP began receiving waste in March 1999.

The CAO's main programmatic responsibilities during the disposal phase are to operate a safe and efficient TRU waste repository at the WIPP, to operate an effective system for management of TRU waste from generation to disposal, and to comply with applicable laws, regulations, and permits. This responsibility requires maintenance and upgrades to the current technologies for TRU waste operations, monitoring, and transportation. This responsibility also requires the maintenance of scientific capabilities for evaluating the performance of the WIPP repository. This includes supporting probabilistic performance assessments with credible evidence of the nature and consequences of events and processes that may occur in the repository and the surrounding geological setting during the 10,000-year

regulatory period. The CAO firmly believes that international cooperative efforts will assist in the maintenance and advancement of the technological and scientific basis for the WIPP.

Located within the WIPP site's 42-km² set-aside area are surface and subsurface facilities designed to facilitate the safe handling and disposal of TRU waste. Approximately one-tenth of the underground waste disposal area has already been mined in a bedded salt formation at a depth of 650 meters (m) (Figure 1). Approximately 176,000 m³ of TRU waste containing about 12,000 kilograms of plutonium and other actinides will be emplaced in disposal rooms 4 m high, 10 m wide, and 91 m long. Magnesium oxide (MgO) backfill will be emplaced with the waste to control the actinide solubility and mobility in the disposal areas. Properties of the repository horizon have been investigated in an underground test facility excavated north of the waste disposal area, in which seals, rock mechanics, hydrology, and simulated waste emplacement tests were conducted. Geologic and hydrologic characterizations of strata on the site have been conducted by surface-based boreholes and observations from the existing excavation.

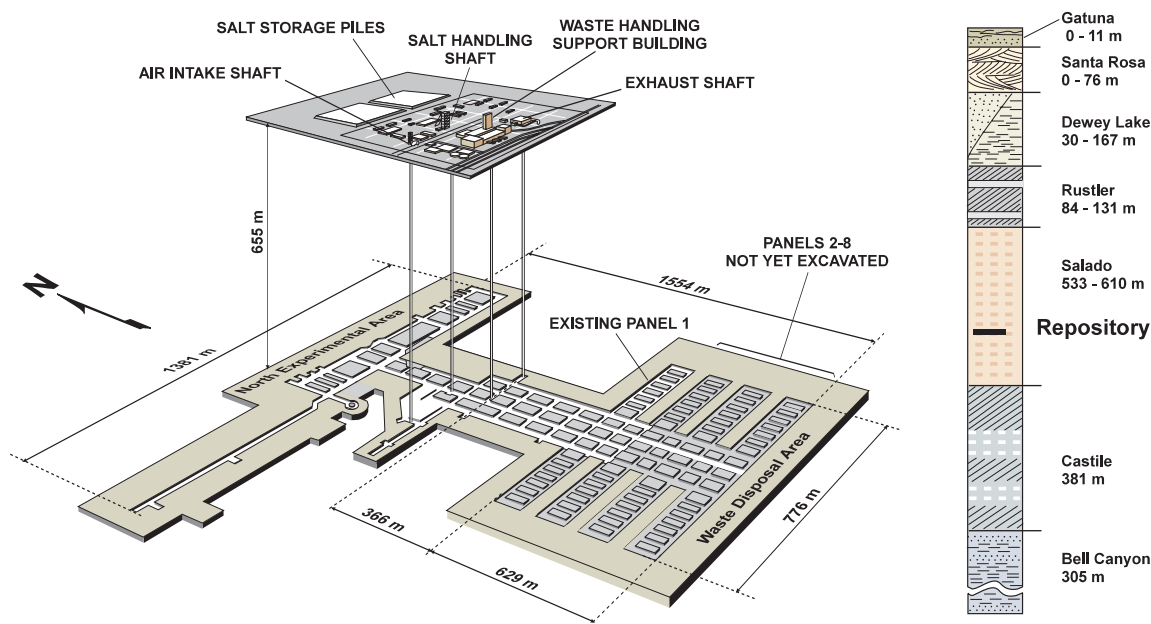


Figure 1. Schematic illustration of the WIPP repository and the geologic stratigraphy at the site.

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The bases for the CAO's interest in and commitment to international collaborations and technical exchanges were initially outlined in the October 1, 1997, "Carlsbad Area Office International Research and Development Plan" (DOE/CAO 97-1266, Rev. 0) and read:

"The DOE will participate in international collaborative studies and experiments where such interactions (1) provide increased assurance of WIPP facility safety and reliability, (2) advance the scientific expertise or data collection in technical disciplines important to WIPP, (3) provide cost savings, or (4) expedite the acquisition of necessary scientific information."

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The CAO, supported by its Science Advisor, Sandia National Laboratories, has agreed to exchange scientific information with seven foreign radioactive waste management organizations, and three more national radioactive waste management and disposal organizations have expressed interest in similar agreements for technical exchanges with the CAO. These activities result in the cost-effective acquisition of scientific information in support of increased WIPP facility operational and post-closure assurance and reliability. It also demonstrates the CAO's intent and resolve to honor international commitments and obligations.

INTERNATIONAL PROGRAM

The three main CAO International Program objectives are:

1. The timely and cost-effective acquisition of data and information enhancing the assurance and confidence in the CAO's safe operation, closure, and decommissioning of the WIPP site;
2. The timely and cost-effective sharing of WIPP data and information with other similar programs; and
3. Vigorous, timely, and cost-effective international outreach promoting (a) the recognition of the CAO as an international leader, peer, broker, source, and resource in radioactive waste management and disposal, and (b) Carlsbad/WIPP-based multi-national collaborations and partnerships.

There are two main strategies designed to achieve the International Program objectives:

1. Identify and pursue *foreign-based collaborations and partnerships* with other radioactive waste management organization that may support (a) the recertifications of WIPP, (b) enhanced operational safety of the National TRU Program and WIPP, and (c) reduction of program costs; and
2. Identify and pursue *USA-based collaborations and partnerships* with other radioactive waste management organization that may support (a) the recertifications of WIPP, (b) enhanced operational safety of the National TRU Program and WIPP, and (c) reduction of program costs.

It is emphasized from the outset that in order to accomplish these objectives, a strong and focused *international outreach* effort is required to facilitate the identification of both foreign and USA-based potential collaborations and partnerships. As discussed further below, this is particularly the case for successfully attracting interest and participation in USA-based collaborations and partnerships because only a few nations currently are seriously considering rock salt for deep geological disposal of long-lived radioactive waste.

Foreign-Based Collaborations And Partnerships

The CAO has engaged in seven foreign-based collaborations and partnerships with mature radioactive waste management organizations in Canada, Germany (2), Japan, Spain, Sweden, and Switzerland. These collaborations and partnerships are based on the CAO's monitoring and evaluation of foreign-based radioactive waste management programs, and they are projected to continue to add value to the International Programs for at least another five years, i.e., through FY04.

Several additional nations have radioactive waste management programs that may contain, provide, or share data and information of potential value to the above-summarized main objectives of the International Programs. Currently, based largely on expressed external interest in the CAO's programs and operations, radioactive waste management organizations in France, Peoples Republic of China, Republic of China (Taiwan), Republic of Korea (South Korea), the United Kingdom, and Argentina are the main potential near-term possibilities for additional collaborations and partnerships. The CAO's current goal is to establish relationships/dialogues with an average of at least one additional new national organization per year through FY04. It should be noted that these collaborations and partnerships include both foreign and USA-based activities.

USA-Based Collaborations and Partnerships

Current USA-based collaborations and partnerships with foreign radioactive waste management organizations include hydrological and chemical laboratory tests, analyses, and modeling, which are principally conducted in Albuquerque, New Mexico, by SNL. A primary goal of future USA-based collaborations and partnerships is,

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whenever possible, to focus new activities in Carlsbad or at the WIPP site. Four main conditions that have encumbered increased Carlsbad/WIPP-based activities in the past are:

1. The limited number of nations currently pursuing rock salt as a primary geologic medium for deep geological disposal of long-lived radioactive waste;
2. The limited global knowledge about the experience/knowledge vested in the WIPP-project participants;
3. The limited global knowledge about the CAO's pending activities; and
4. The limited availability of resources, equipment, and facilities to conduct state-of-the-art earth sciences experiments in Carlsbad and at the WIPP site.

Crystalline rocks are currently the main geological media considered by other national programs for deep geological disposal of long-lived wastes. Another geological medium gaining international interest is clay. However, among the approximately 40 nations with radioactive waste management programs, more than 20 nations may have adequate rock salt formations for a geological repository. Although this is based on preliminary geological information that needs to be supplemented before the full potential of the listed salt deposits may be stated, it clearly illustrates the abundance of rock salt in many of the nations currently considering and/or actively pursuing deep geological repository programs. Consequently, in order to attract interest and participation in Carlsbad/WIPP-based collaborations, it is imperative that:

- The excellent long-term containment and isolation characteristics of rock salt are better understood and appreciated around the world;
- The CAO's scientific and operational programs are better understood and appreciated throughout the world; and
- The resources, equipment, and facilities in Carlsbad and at the WIPP site are expanded.

CAO's first proposed step in addressing these challenges is the development of a concise document outlining the CAO's future plans, including the resources, equipment, and facilities available in Carlsbad and at the WIPP site. This document is called the "Prospectus on Waste Management and Repository Development Collaborations with the U. S. Department of Energy Carlsbad".

INTERNATIONAL OUTREACH

International outreach is the main key to successfully accomplish the CAO mission, objectives, and goals discussed above. Whereas the identification of potential foreign-based collaborations and partnerships are well advanced, Carlsbad/WIPP-based collaborations and partnerships require additional efforts and attention.

One significant challenge to cost-effective international outreach is to select for CAO participation from among the large number of annual conferences, symposia, topical meetings, workshops, etc., involving disciplines and topics of potential value to the CAO mission. Experience gained during the past five years suggests that the most promising regions, both for benefiting from the information and attracting interest in Carlsbad/WIPP-based collaborations and partnerships, are Europe, Asia/Far East, and South America.

One new Carlsbad-based concept to be promoted and pursued in FY00 is the establishment of the "Salt Club". Membership in the "Salt Club" will be open to representatives from any international or national organization interested in staying abreast on the latest R&D and near-term plans for deep geological disposal of long-lived wastes in rock salt.

In addition to attending domestic and international meetings, the CAO believes that it is important to maintain current, and pursue new, opportunities for collaborations with or under the umbrella of international radioactive waste management organizations. International organizations deemed to be of particular interest to the successful accomplishment of the CAO mission are the Commission for European Communities (CEC), the International Atomic Energy Agency (IAEA), United Nations Educational, Scientific, and Cultural Organization (UNESCO), the Organization for Economic Co-operation and Development/Nuclear Energy Agency (OECD/NEA), and the International Commission on Radiological Protection (ICRP). Collaborations with these organizations will provide both access to state-of-the-art information and enhance recognition of the CAO as an international radioactive waste

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management leader, peer, broker, source, and resource. Ongoing collaborations include CAO membership in the OECD/NEA's Radioactive Waste Management Committee (RWMC), the "Performance Assessment Advisory Group" (PAAG), the "Site Evaluation and Design of Experiments" (SEDE) Group, and the Integration Group for the Safety Case (IGSC), which is the successor group to the PAAG and SEDE. The CEC's Cluster Repository Project has been identified as the main new potential international program opportunity during the next three years.

FOCUS AREAS

The three main focus areas for the International Programs are:

1. International Organization Programs (IOP);
2. National Organization Programs (NOP); and
3. International Outreach (IO).

Each of these areas is concisely addressed below under separate headings in terms of their benefits to the CAO and the strategy and tactics to be used by the International Programs management and staff to pursue and achieve them.

International Organization Programs

The main benefits to the CAO of monitoring and being involved, as appropriate, in IOPs such as those managed and/or coordinated by the CEC, IAEA, UNESCO, OECD/NEA, and ICRP are:

1. To facilitate timely and cost-effective access to state-of-the-art research and developments in a broad range of radioactive waste management areas and disciplines; and
2. To be recognized as a global leader, peer, broker, source, and resource in safe radioactive waste management and disposal.

The CAO International Programs strategy for the IOPs focus area is based on the monitoring of the activities and initiatives undertaken, supported and/or promoted by IOPs, as well as becoming involved in activities and initiatives adding value to the CAO's statutory mission, which is to:

- Integrate the characterization, preparation, and shipment of the nation's transuranic radioactive waste (TRUW) to WIPP; and
- Develop, open, and safely operate, decommission and close the WIPP site.

The proposed International Programs baseline activity for IOP is the periodic monitoring of and annual reporting on the activities and initiatives of the CEC, IAEA, OECD/NEA, and, possibly, the ICRP. These annual reports will provide the CAO Manager a transparent basis for decision making on new and/or expanded IOP relationships and involvement.

The CAO's past active IOP involvement is largely associated with the activities and initiatives managed and/or coordinated by the OECD/NEA. These activities include memberships on the OECD/NEA's RWMC, PAAG, SEDE Group, and the "Geosphere Transport of Radionuclides Predictions" (GEOTRAP) series of workshops, including hosting in Carlsbad and co-sponsoring the GEOTRAP IV Workshop dedicated to the "Characterization of Water-Conducting Features and their Representation in Models for Radionuclide Migration". Another important OECD/NEA involvement is CAO representation on the RWMC. This is a representation of global visibility and importance because the annual RWMC meetings address a broad range of international radioactive waste management program issues.

Concerning new IOP relationships and involvement, the International Programs have identified the CEC-sponsored Cluster Repository Project as a very promising opportunity to enhance the visibility and credibility of the DOE, the CAO, and the WIPP project, as well as to identify rock salt as a preferred geological medium for safe disposal of long-lived radioactive waste. The Cluster Repository Project is a three-year CEC-sponsored study designed to collect and assess experience from large-scale underground laboratories in order to provide guidance on the safe disposal of highly radioactive waste. The final report is intended to serve as an international aid in future repository

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development, testing, and construction. As the owner of the world's only operating deep geological nuclear repository for long-lived radioactive waste, the CAO's involvement in the CEC's Cluster Repository Project would provide an excellent opportunity to highlight/showcase and spread information on WIPP and its lessons learned during its 25 years of development. This would be of great interest to a large number of nations with mature or emerging radioactive waste management and disposal programs. The CAO's involvement should also add credibility to the both the Cluster Repository Project and the CAO.

National Organization Programs

The CAO has agreements with seven foreign radioactive waste management organizations. The International Programs is preparing and/or discussing collaborations and partnerships with three additional foreign parties, which have expressed interest in technical information exchanges with the CAO.

The main benefit of the aforementioned agreements is that they allow the DOE to build new, and to strengthen, its relationships with foreign radioactive waste management organizations and to become better acquainted with the strategies, issues, and research and developments faced and pursued by these organizations. It is also deemed beneficial to the CAO to strengthen the relationship and technical exchanges with domestic radioactive waste management programs. Thus, the International Programs will continue to (a) strengthen the relationships with the seven organizations with which CAO is currently collaborating, and (b) build new relationships with radioactive waste management organizations in the USA and abroad that will provide access to data and information of potential value to the CAO mission.

A logical element of the aforementioned agreements is topical meetings and/or workshops. For example, the CAO has held and/or co-sponsored several topical meetings, including two international workshops in Carlsbad on backfill in 1998 and GEOTRAP IV in 1999. Past topical meetings and workshops have been very conducive to focused and in-depth information exchanges and to the fostering of lines of communication for future technical exchanges and cooperation. They have also expanded the CAO's visibility and international network of contacts, and enhanced the CAO's credibility and standing in the international radioactive waste management community.

The CAO will sponsor, either singularly or jointly with other organizations, two topical meetings/workshops per year. Whenever appropriate and concurred by the co-sponsor, organizations from other countries will be invited. This initiative/activity and approach will increase the visibility of the CAO and allow it to share its state-of-the-art knowledge with other organizations as well as obtain current information on issues faced by, and needs of, other radioactive waste management organizations. The logical evolution of such topical meetings/workshops is the development of joint research activities.

As indicated above, to bolster the knowledge about and interest in Carlsbad/WIPP-based R&D, the International Programs will prepare the "Prospectus on Waste Management and Repository Development Collaborations with the U.S. Department of Energy Carlsbad Area Office", which will list select important future CAO activities of potential interest to the international radioactive waste management community. The Prospectus will contain concise information on the type, schedule and expected outcomes of the tests, model developments, and safety/performance assessment activities planned by the CAO to support the recertification of WIPP. It will also contain information on planned experiments designed to reduce (a) the conservatism in the current baseline design and (b) construction and operational complexities. The Prospectus will be distributed to radioactive waste management organizations in all nations with potentially adequate rock salt deposits, ongoing repository siting efforts, and/or ongoing radioactive waste R&D programs. This document will serve to enhance the CAO as a leading global broker of, and source and resource for, radioactive waste management and disposal services.

International Outreach

In IO, a vigorous effort will be conducted to maintain and enhance the CAO's international visibility and recognition as a leading peer, broker, source, and resource in safe radioactive waste management and disposal. Activities to be promoted will include the entire CAO mission. CAO and WIPP presentations at domestic and foreign international conferences, seminar, symposia, and meetings are an integral component of the proposed IO program.

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The strategy for promoting the CAO mission and interest in international collaborations in Carlsbad and at the WIPP site is based on:

1. Presenting CAO and WIPP-related papers and participating on topical waste management and disposal panels;
and
2. Organizing and/or chairing dedicated WIPP/International sessions.

For example, the CAO has organized and co-chaired dedicated WIPP and International sessions at the Waste Management Symposia during the past several years, and the CAO Manager has been one of the invited speakers at the opening Plenary Session twice during the past four years. Furthermore, three dedicated WIPP sessions were organized for the ICEM Conference, held in Nagoya, Japan, in September 1999, which indicates the considerable current global interest in the successful 1998 certification, 1999 opening, and current safe operation of the WIPP site. Indeed, the CAO has a global obligation to organize WIPP-related presentations and sessions at events attended by the international radioactive waste management community.

In addition, as part of IO, the CAO may sponsor scholarships/internships allowing students and scientists to work for a limited time on one or more of the CAO's domestic R&D initiatives/activities. These scholarships/internships will foster greater understanding of the CAO's mission and capabilities and aid in the sharing of relevant data.

SUMMARY AND CONCLUSIONS

The mission, vision, objectives, goals, strategies, approaches, initiatives, and activities described above comprise the framework for how the CAO will pursue international collaborations and partnerships. The vigorous implementation of the initiatives and activities defined in this paper will maintain and enhance the DOE's, the CAO's, and the WIPP project's visibility and credibility in the international radioactive waste management community. It will also provide cost-effective access to state-of-the-art data supporting the recertification of WIPP.

FURTHER READING ON WIPP

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