SCIENTIFIC, INSTITUTIONAL, REGULATORY, POLITICAL, AND PUBLIC ACCEPTANCE OF THE WASTE ISOLATION PILOT PLANT TRANSURANIC WASTE REPOSITORY

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Abstract

The recent successful certification and opening of a first-of-a-kind, deep geological repository for safe disposal of long-lived, transuranic radioactive waste (TRUW) at the Waste Isolation Pilot Plant (WIPP) site, New Mexico, United States of America (USA), embody both long-standing local and wide-spread, gradually achieved, scientific, institutional, regulatory, political, and public acceptance. The related historical background and development are outlined and the main contributors to the successful siting, certification, and acceptance of the WIPP TRUW repository, which may also serve as a model to success for other radioactive waste disposal programs, are described.

1. INTRODUCTION

The successful 1998 certification and 1999 opening of a first-of-a-kind, deep geological repository for safe disposal of long-lived, transuranic radioactive waste (TRUW) at the Waste Isolation Pilot Plant (WIPP) site, New Mexico, United States of America (USA) (Fig. 1), embody both long-standing local and wide-spread, gradually achieved, scientific, institutional, regulatory, political, and public acceptance. Five main contributors to the successful siting, certification, and acceptance of the WIPP TRUW repository, which may also serve as a model to success for other radioactive waste disposal programs, were and are:

- The existence of a strong, *independent* regulator;
- The existence of a regulatory framework that was largely perceived to provide *adequate* protection of public health and the environment;
- A *willing* host community;
- A simple, stable, robust, and generically highly regarded host rock, i.e., bedded salt,; and
- An open siting, site characterization, repository development, certification/recertification process with *periodically scheduled opportunities for information exchanges with affected and interested parties,* including (a) prompt responses to non-DOE concerns and (b) transparency/traceability of external input into and the logic behind the DOE's decision-making process.

On 13 May 1998, the United States (U.S.) Environmental Protection Agency (EPA) certified [1] that the specially sited, designed, and constructed deep geological repository for safe disposal of long-lived TRUW proposed by the U.S. Department of Energy (DOE) at a depth of 600 meters (m) in a regionally extensive, 600-m thick, 225-million year old, virtually impermeable, bed of rock salt the WIPP site in New Mexico, USA (Fig. 1), complied with all applicable radioactive waste disposal regulations [2,3]. After overcoming a legal challenge, the DOE commenced disposal operations at the WIPP TRUW repository on 26 March 1999. The opening of the WIPP TRUW repository was preceded by a 24-year-long process, of which the *convergence* of scientific, institutional, regulatory, political, and public issues achieved by the DOE Carlsbad Area Office (CAO) between 1993 and 1998, was instrumental to both enhanced acceptance and an almost three-year advancement of the certification of the WIPP TRUW repository.

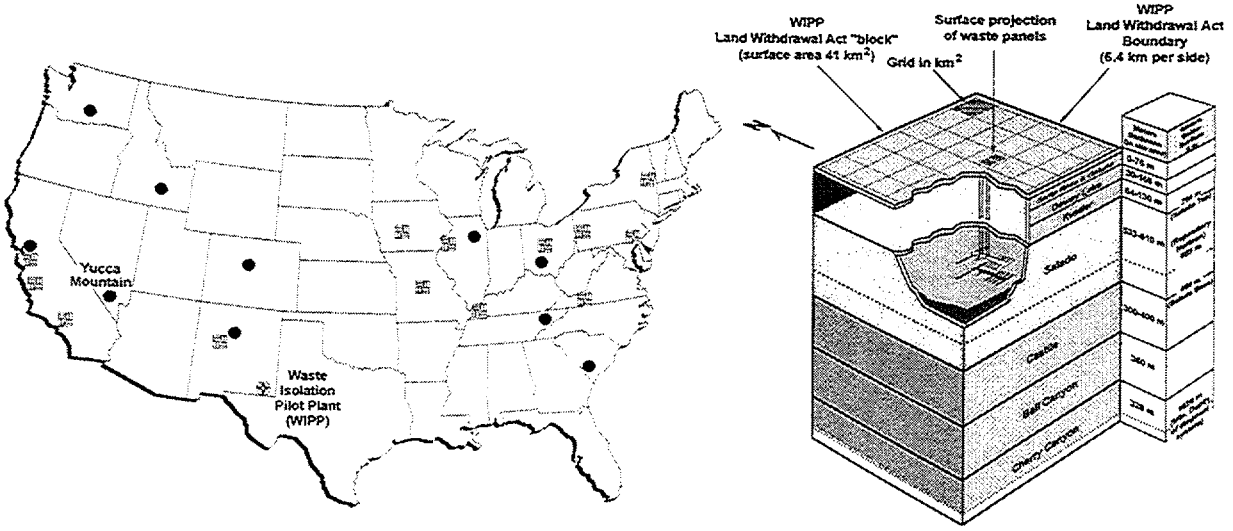

Fig. 1. Locations of 23 TRUW generator/storage, the WIPP, and the Yucca Mountain sites (to the left) and schematic illustrations of the "controlled area", repository layout/foot print, and stratigraphy at the WIPP site (to the right)

Consistent with the guidelines defined by the International Atomic Energy Agency's "Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management" [4], concisely summarized below are the main perceived contributors to maintained and enhanced acceptance of the WIPP TRUW repository. The main objective for sharing these, possibly unique site- and country-specific, chain of events with the international radioactive waste management community is to promote an effective nuclear safety culture worldwide by providing other radioactive waste management organizations the opportunity to assess and use past WIPP policies and results and to participate in ongoing WIPP activities that may be useful in advancing their respective waste disposal program. . Additional pertinent information is available in e.g. [5-7].

2. BACKGROUND

In the USA, the birth of the deep geological disposal concept for long-lived radioactive waste occurred in September 1957 when a Committee of the National Academy of Sciences-National Research Council, at the request of the Atomic Energy Commission and after 2 years of deliberation, published a report on land-disposal of long-lived radioactive waste [8]. This report includes the following statement: *"Disposal in cavities mined in salt beds and salt domes is suggested as the possibility promising the most practical immediate solution of the problem."*

In response to a 1973 invitation by local communities in New Mexico and following a regional screening of potential rock salt sites conducted by the Oak Ridge National Laboratory, in 1975, under the advisement of Sandia National Laboratories (SNL), the DOE began surface-based site characterization activities in the region of the current WIPP site. At that time, the mission was to establish a repository for defense-generated spent nuclear fuel and other high-level radioactive waste, hereinafter jointly referred to as HLW, and TRUW. In 1979, the U.S. Congress (a) officially named the candidate repository site "the WIPP site" and (b) redefined the mission of WIPP to only serve as a research facility for safe disposal of TRUW. An underground research laboratory was excavated and characterized in the candidate, bedded rock salt, host formation, the 225-million year old, 600-m thick Salado Formation, between 1981 and 1988. Concurrently, all surface facilities, four shafts, and a portion of the potential repository were also constructed, tested, and deemed adequate by the DOE for safe disposal of TRUW, including a hot cell for safe handling of HLW and remote-handled TRUW.

However, the DOE had entered a Consultation and Cooperation Agreement with the State of New Mexico in 1981. This agreement was subsequently amended to include a commitment by the DOE, which was self-regulating at that time, to comply with the EPA's environmental radiation protection standards, also commonly referred to as the standards, final disposal regulations, and 40 CFR 191. These standards had been partially remanded and vacated by the court in 1987. Several attempts made by the EPA to repromulgate 40 CFR 191 failed until the U.S. Congress directed the EPA in the WIPP Land Withdrawal Act of 1982 [9] to only repromulgate the three portions of the standards that had been remanded and vacated by the court. The LWA also withdrew the 16-square-kilometer WIPP land parcel (Fig. 1) from public use and directed the DOE to develop a TRUW repository at the WIPP site in compliance with all applicable regulations, including the EPA's pending final disposal regulations for the WIPP site. The new standards [2] were promulgated in December 1993, the DOE submitted a draft compliance certification application (CCA) to the EPA on 30 May 1995, the EPA promulgated criteria for compliance with these standards in February 1996 [3], which involved and were followed by an iterative information exchange process culminating in the DOE's submittal of the final CCA in October 1996 and the EPA's certification of the WIPP TRUW repository on 13 May 1998 [1]. In other words, the certification of WIPP involved an almost 4-year long iterative information exchange process between the applicant and the regulator, which included more than 50 public meetings and reams of documentation. It should be noted that the final disposal regulations for the WIPP site apply to both HLW and TRUW, and that several of the tests that were conducted at the WIPP site involved simulated HLW disposal conditions and model developments.

Another specific condition affecting the opening, operation, and acceptance of the WIPP repository was the large percentage of the existing TRUW that also contained regulated hazardous constituents, hereinafter referred to as mixed TRUW. Although the EPA had promulgated the applicable hazardous waste disposal regulations, the authority to permit hazardous waste disposal at the WIPP site had been transferred to an independent state agency, the New Mexico Environment Department (NMED). The NMED received the DOE's permit application in May 1995, issued draft permits in May and October 1998, and issued the final hazardous waste disposal permit on 27 October 1999. The NMED's permitting process included extensive public hearings. In the mean time, the DOE, with the concurrence of the NMED, had commenced disposal operations for of non-mixed TRUW at the WIPP site on 26 March 1999.

Before describing the main contributors to the wide-spread acceptance of the currently operating WIPP TRUW repository, it should be acknowledged that, although the DOE is responsible for the development of repositories for both spent nuclear fuel and high-level radioactive waste (HLW) and TRUW in the USA, it has established two essentially autonomous offices to accomplish these missions. In short, the CAO is responsible for the integration of the safe management of the nations TRUW, including the continued safe operation and decommissioning of WIPP, whereas the Office of Civilian Radioactive Waste Management (OCRWM) is responsible for the development and operation of a repository for HLW. One candidate site, the Yucca Mountain site, is currently being evaluated. Significant differences between the two repository programs are:

- They're distinctly different legal/statutory and regulatory frameworks, of which, the regulatory framework for the Yucca Mountain HLW repository site is currently being modified.
- The U.S. Nuclear Regulatory Commission (NRC) is he main regulator for a HLW repository whereas the EPA is the main regulator for a TRUW repository.
- The WIPP repository concept is based on direct disposal, a 100-year post-closure, active institutional controls period, and almost sole reliance on the natural barriers for long-term radionuclide containment and isolation, whereas the current Yucca Mountain HLW repository concept is based on high-thermal loading of the natural setting, significant reliance on engineered barriers, and a 300-year pre-closure active institutional controls/monitoring/recoverability period.

- The WIPP TRUW repository has been in operation for almost a year, whereas the candidate HLW repository at the Yucca Mountain site in Nevada, contingent upon the NRC's timely promulgation of the final disposal regulations for the Yucca Mountain site, is scheduled to be subjected to a suitability assessment/recommendation in July 2001, followed by a license application in 2002, and the potential opening of a HLW repository in 2010.

3. MAIN CONTRIBUTORS TO THE ACCEPTANCE OF THE WIPP TRUW REPOSITORY

One of the cornerstones to the existence of the WIPP TRUW repository is the long-standing willingness among local politicians and residents to host a deep geologic repository for long-lived radioactive waste in their backyard. This, possibly unique, local support and participation in the WIPP project has remained strong throughout the years and has resulted in DOE-sponsored socio-economic developments both in the WIPP region and elsewhere in New Mexico.

One particularly successful DOE action was the December 1993 establishment of the CAO in the WIPP-site region, augmented by the good fortune of finding a very, if not uniquely, resourceful and motivated CAO manager [6,7]. Two measures implemented by the CAO manager that contributed to both enhanced acceptance and a 3-year advancement of the certification of the WIPP TRUW repository were: (1) The April 1994 development and subsequent vigorous implementation of the WIPP Disposal Decision Plan (DDP); and (2) The August 1995 implementation of the Systems Prioritization Method (SPM), which essentially tempered an ambitious but unwieldy scientific program.

The two key elements of the DDP contributing to its wide-spread acceptance were that it (a) integrated the entire TRUW disposal program from cradle to grave and (b) institutionalized about 50 public meetings during a 5-year period. The SPM involved a thorough assessment of 116 proposed scientific activities based on their individual and combined contributions to achieving compliance with the EPA's final disposal regulations. The 116 scientific activities were evaluated in more than 46,000 combinations by some 1,300,000 stochastic assessments and eight activity sets were identified that would provide a 0.96 probability/confidence level that the WIPP TRUW repository would comply with the final disposal regulations if the projected outcomes of these activity sets were within the expected ranges. As evidenced by the 1998 certification of the WIPP TRUW repository, the SPM successfully focused the scientific program. The related time and cost savings were substantial, which highlight the value of a well-defined, non-conjectural, regulatory framework. In terms of contributing to the acceptance of WIPP, the SPM process also included the formulation of proposed DOE-approaches in 11 white papers that were presented and discussed at eight public meetings between April 1994 and April 1995. In addition to establishing a strong local ownership of and support for the subsequent decision by the CAO manager to implement a program policy based the SPM results, the aforementioned white papers and public meetings provided transparency and credibility to both the SPM and the subsequent CAO decision-making process.

Two concepts introduced by the CAO that also enhanced the acceptance of the WIPP TRUW repository were (1) its inherent safety and (2) the national risk reduction provided by WIPP. Suffice it to summarize that the calculated radiation risks from WIPP in terms of (a) radionuclide releases caused mainly by inadvertent human intrusions conditions is at least 10 times lower and (b) the maximum individual committed effective annual dose is at least 32 times lower than the related, very stringent, regulatory criteria. The national risk reduction offered by WIPP was exemplified by the fact that the removal of all existing TRUW currently stored in temporary surface and near-surface facilities, including tents, at 23 sites scattered around the nation to WIPP would reduce the risks to the 53 million residents living within an 80-kilometer radius of these sites.

Another successful strategy employed by the CAO to maintain and enhance broad-based acceptance of the WIPP TRUW repository was the use of independent domestic and international peer reviews, and expert elicitation, which ensured visible, constructive feed back from the scientific community. For example, during 1995 and 1997, the CAO commissioned seven domestic and one international peer reviews, and one expert elicitation. Several additional peer reviews of data and information supporting of the WIPP compliance certification application were commissioned by SNL.

Lastly, compared to the challenges and delays currently facing many other radioactive waste management organizations and programs, two conditions that contributed to the broad-based acceptance and advancement of WIPP appear to be the CAO's ability to (a) recognize and accept external concerns, including residual concerns and that perceptions need to be dealt with as realities, and (b) convey its message in terms that were clearly understood by all affected and interested parties, including avoiding falling into a number of potential semantic traps. Such traps are commonly used by opponents to misconstrue and compromise the safety of a given repository or repository concept by emphasizing any inadvertent or potential negative implication of a term used by the applicant or the regulator. For example, terms like "the best site" and "consensus", which depict unattainable conditions, and "retrievability" and "extended pre-closure safeguards/active institutional controls period/monitoring", which convey both a positive or a negative message depending upon the mind set of the recipient/audience, were not allowed to became issues at WIPP. Favored and recommended alternatives to the first three terms are "safe site", "convergence/majority support", and "recoverability". The fourth term/concept never surfaced at WIPP. However, a more neutral replacement term could be "extended public-protection assurance".

In summation, the initial acceptance of the WIPP TRUW repository was largely attained by the generic radionuclide containment and isolation merits vested in rock salt and the willingness of the local communities to host a repository for HLW and TRUW. Final scientific, institutional, regulatory, political, and public acceptance was attained gradually over a period of 24 years, and culminated with the EPA's May 1998 certification of the WIPP TRUW repository and the EPA's March 1999 defeat of a lawsuit challenging the certification of WIPP. The five main contributors to the broad-based acceptance of the WIPP TRUW repository and its successful certification are:

- The existence of a strong, *independent* regulator;
- The existence of a regulatory framework that was largely perceived to provide *adequate* protection of public health and the environment;
- A *willing* host community;
- A simple, stable, robust, and generically highly regarded host rock, i.e., bedded salt,; and
- An open siting, site characterization, repository development, certification/recertification process with *periodically scheduled opportunities for information exchanges with affected and interested parties,* including (a) prompt responses to non-DOE concerns and (b) transparency/traceability of external input into and the logic behind the DOE's decision-making process.

In closing, it is emphasized that the acceptance of the WIPP TRUW repository (a) is broad but not total and (b) was not achieved by a single event or action. However, without one or more of the following three attributes (1) good science, (2) strong leadership, and (3) local acceptance, the current status of WIPP would likely be different and less advanced than it is today. Since the WIPP TRUW repository needs to be recertified by the EPA at least every fifth year, the CAO intends to maintain established and promote new partnerships to enhance the credibility and acceptance of the CAO and the WIPP TRUW repository. As follows, local, domestic, and foreign partnerships are integral components of WIPP future that also promote an effective nuclear safety culture worldwide.

References

[1] U.S. ENVIRONMENTAL PROTECTION AGENCY, Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision; Final Rule, Federal Register, Volume 63, pp. 27354-27406, May 18, 1998, Radiation Protection Division, Washington, D.C. U.S.

[2] U.S. ENVIRONMENTAL PROTECTION AGENCY, Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes; Final Rule, Code of Federal Regulations, Title 40, Part 191 (40 CFR 191), December 30, 1993.

[3] U.S. ENVIRONMENTAL PROTECTION AGENCY, Criteria for the Certification of the Waste Isolation Pilot Plant's Compliance With the 40 CFR Part 191 Disposal Regulations; Final Rule," Code of Federal Regulations, Title 40, Part 194 (40 CFR 194), February 7, 1996.

[4] INTERNATIONAL ATOMIC ENERGY AGENCY, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, signed by the United States of America on 30 September 1997.

[5] HURTT, D.S., et al., Waste Management Symposia '99, Developing Broad Based Stakeholder Acceptance for the Waste Isolation Pilot Plant, these Proceedings.

[6] McFADDEN, M.H., et al., Waste Management Symposia '99, The Successful 1998 Certification of the Waste isolation Pilot Plant Transuranic Waste Repository - Ten Important Lessons Learned, these Proceedings.

[7] ERIKSSON, L.G., ENS Topseal '99, The 1999 Opening of the Waste Isolation Pilot Plant Transuranic Waste Repository: A Glance in the Rearview Mirrors on Successful and Unsuccessful Strategies, Volume II of these Proceedings.

[8] NATIONAL ACADEMY OF SCIENCES - NATIONAL RESEARCH, Report on Disposal of Radioactive Waste on Land, by the Division of Earth Sciences, Committee on Waste Disposal, Publication 519, September 1957, Library of Congress Catalog Card No.57-60047.

[9] U.S. CONGRESS, Public Law 102-579, The WIPP Land Withdrawal Act of 1992, as amended 1996.