LONG TERM AND OPERATIONAL SAFETY ISSUES AT THE WIPP

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ABSTRACT

The year 1998 was a significant year for the Waste Isolation Pilot Plant (WIPP), the intended geologic repository in southeastern New Mexico for disposal of U.S. defense transuranic waste. The U.S. Department of Energy (DOE) declared WIPP to be operationally ready to start receiving contact-handled transuranic (CH-TRU) waste after conducting an operational readiness review audit in March 1998. The Environmental Protection Agency (EPA) granted certification to the WIPP in May 1998 (1) for compliance with the EPA's long-term radiation protection standards, 40 CFR 191 Subpart B (2) and 40 CFR 194 (3). The New Mexico Environment Department (NMED) issued a RCRA Part B draft permit in June 1998 (4) and a revised draft permit in November 1998 (5). As the facility prepares for starting waste disposal operations, however, there are a number of issues in both the long-term and operational areas, identified by the Environmental Evaluation Group (EEG), which should be resolved to permit a high level of confidence in the WIPP repository. This paper provides a summary of these issues.

INTRODUCTION AND BACKGROUND

The Environmental Evaluation Group (EEG) has provided independent technical oversight to the WIPP project since 1978, to ensure protection of public health, safety, and the environment. In addition to the reviews of safety assessments for the long-term and the operational period, EEG has conducted environmental monitoring of air, water and soil at the WIPP site and in the surrounding communities since 1984. Thus, a pre-operational environmental baseline has been established against which future suspected contamination episodes might be evaluated. The EEG has offices in Albuquerque and Carlsbad and is funded totally with federal money through the DOE. The EEG has had a major influence in shaping the project to ensure that the public health and safety of the people of New Mexico is not jeopardized and the environment is not adversely affected. The effect of the EEG’s work can be seen, for example, in the following areas:

(a) Vastly improved geological and hydrological data base and modeling;
(b) Relocation of the repository to a more suitable area with respect to long-term integrity;
(c) Safer operational design and procedures;
(d) Abandonment of the plans to conduct “*in situ*” experiments with waste at WIPP;
(e) Continuation of performance assessment work after the disposal standards were vacated by the court in 1987, thus not losing time when the standards were re-promulgated in 1993;

(f) A much safer and more cost-effective redesigned transport container (TRUPACT-II), that has been certified by the Nuclear Regulatory Commission for the contact-handled transuranic (CH-TRU) waste shipments.

In order to appreciate the issues of long-term isolation, and radiological safety during operations at WIPP, it is essential to understand the geologic setting of the site, the design of the repository, the mode of waste emplacement, and the possible mechanisms of release of radionuclides to the environment. This background information is provided below to put the issues discussed in this paper in proper perspective.

<u>Geological Setting of the WIPP Site</u>

The WIPP site is situated in the northern part of the Permian Delaware Basin, 40 km east of the city of Carlsbad, in the State of New Mexico. The repository is located at a depth of 655 m (2150 ft) from the surface, in the Salado Formation of the Permian Ochoan Series. The Salado Formation is about 602 m (1975 ft) thick at the center of the WIPP site and the repository is situated at a depth of 396 m (1300 ft) from the top of the formation (Fig. 1). The Permian Capitan Reef (Fig. 2) bounds the Delaware Basin.

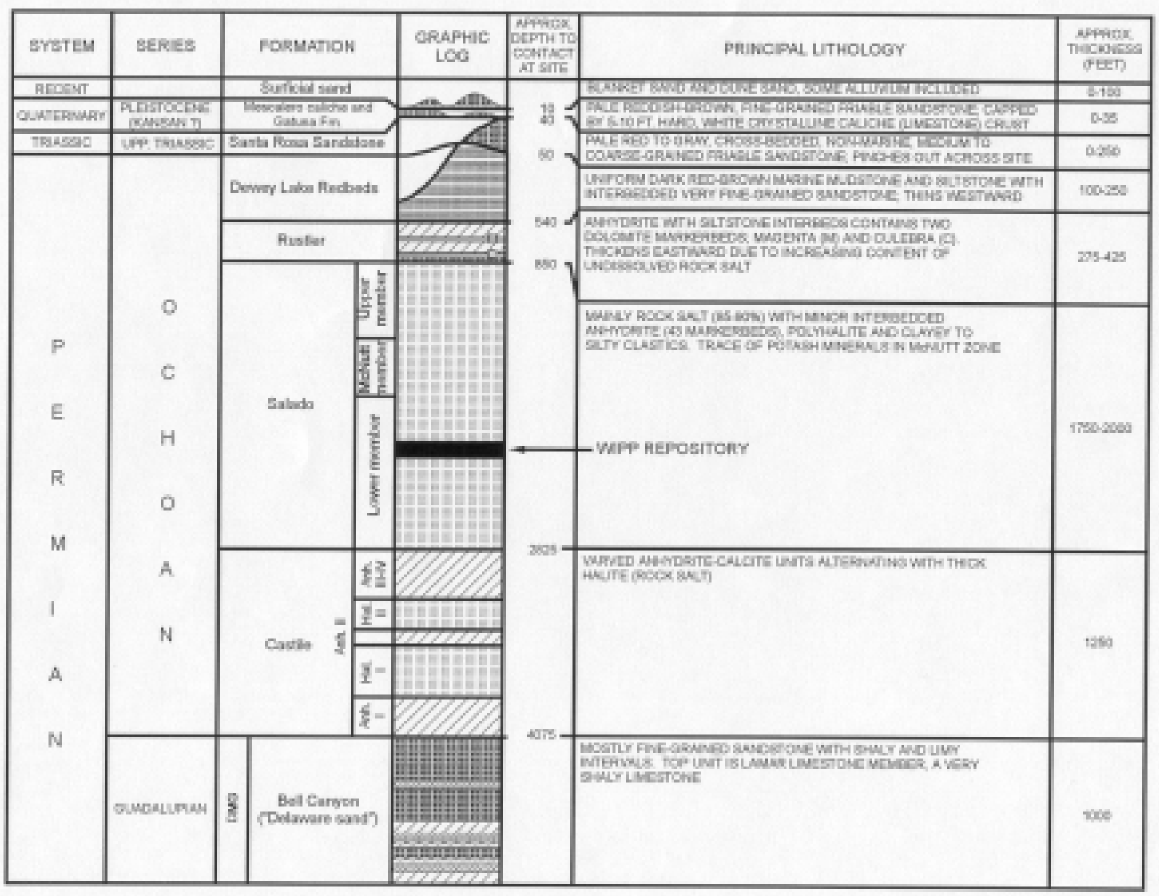

Figure 1. Generalized stratigraphy at the WIPP site

The site lies on a generally flat plain covered with sand, caliche and desert bushes. It is located in a gypsum-karst region. A subsidence landform feature called Nash Draw lies about 5 km (3 mi) west of the WIPP site. It is 10-12 km (6-7 mi) wide in the east-west direction, about 30 km (18 mi) long in the north-south direction, and has resulted from erosion by solution and fill (6) of soluble rocks, a process that has occurred in the past and which is also presently active. The Pecos River flows from northwest to southeast, about 20 km (12 mi) west of the WIPP site. The Malaga Bend of the Pecos river, 22 km southwest of the WIPP repository (Fig. 2), has been identified as an area of discharge of the saline water of the Rustler Formation from the Nash Draw and the WIPP site.

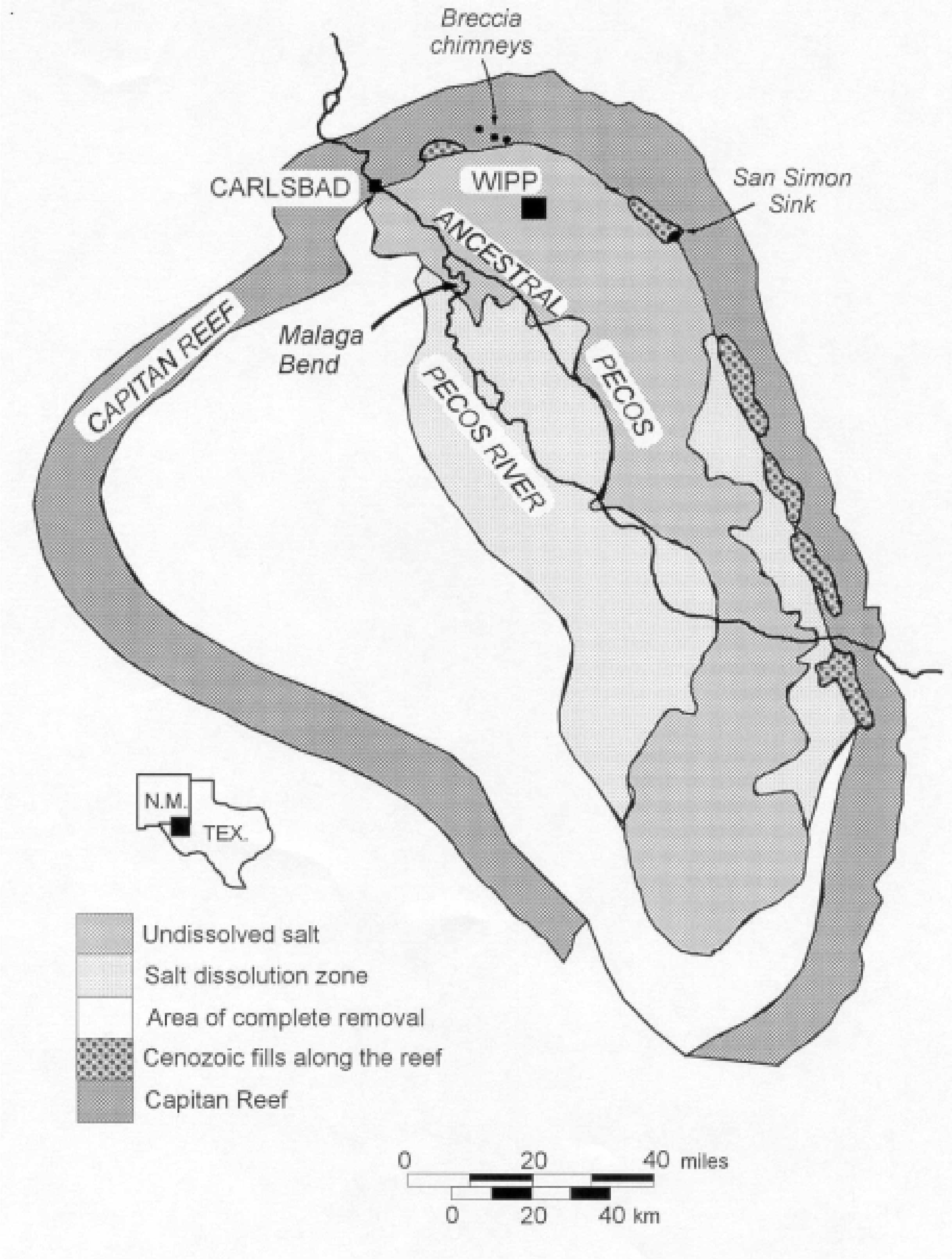

Figure 2. Regional extent of removal of salt from the Salado Formation

All the formations shown on Fig. 1 are geohydrologically significant. Ground water occurs in the upper part of the Bell Canyon Formation in poorly cemented sandstone stringers (7). The Castile Formation is about 470 m (1500 ft) thick at the WIPP site and overlies the Bell Canyon. It consists of alternating layers of anhydrite and halite, with four anhydrite and three halite members. The uppermost anhydrite member contains pressurized brine reservoirs that have been encountered by two of the boreholes drilled for the WIPP project and by several oil and gas exploratory wells (Fig. 3). The Salado Formation overlies the Castile Formation and the repository is located in its lower part (Fig. 1). The Salado Formation consists primarily of halite with a zone of potassium- and magnesium-bearing minerals (sylvite, langbeinite) and thin (<1 m) seams of clay, anhydrite and polyhalite. Before 1986, thick salt beds, as in the Salado Formation, were considered essentially dry and impermeable. Observations from the WIPP excavations, however, indicate that the salt beds may be saturated with brine and the salt exhibits Darcian flow, albeit at very low permeability.

The Rustler Formation overlies the Salado Formation and contains the most important geohydrologic units in the region. The thickness of the Rustler Formation varies between 84 m to 130 m (275 ft to 425 ft) in the northern Delaware Basin and is approximately 95 m (310 ft) at the WIPP site. Lowenstein (8) and Powers and Holt (9) have described the sedimentology of the Rustler Formation. The formation contains three recognized fluid-bearing zones; in ascending order the Rustler-Salado contact residuum, the Culebra dolomite and the Magenta dolomite. The transmissivity of the Culebra aquifer is the highest of the three, followed by the Magenta aquifer and the Rustler-Salado contact zone. The Culebra and the Magenta aquifers are each 8 to 9 meters (25 to 30 feet) thick. The water quality is highly variable within each unit. The total dissolved solids concentration is lowest in the Magenta aquifer and highest in the Rustler-Salado contact zone. Nearly all the water in the Rustler Formation at the WIPP site has total dissolved solid (TDS) concentrations greater than 10,000 mg/l, making it unpotable for humans.

All three Rustler hydrologic units probably discharge into the Pecos River, 22 km (14 mi) to the southwest near the Malaga Bend. The recharge areas are identified rather imprecisely as being upgradient of the measured hydraulic heads, about 16-24 km (10 to 15 mi) north of the WIPP site. At the WIPP site, the three units are separated but are probably interconnected in Nash Draw, west and southwest of the site. Of the three Rustler units, the Magenta and the Culebra dolomites are of prime concern because they extend over the WIPP site, whereas the Rustler-Salado contact zone mainly produces water west of the WIPP site (10). The majority of testing in the Rustler Formation has concentrated on the Culebra aquifer because it is more transmissive than the Magenta and therefore better suited for analyzing bounding breach scenarios.

Results of several single-hole and multihole flow tests (11) at the site indicate that the transmissivities of the Culebra aquifer at and near the WIPP site range from 10^{-3} m^2/s (1000 ft^2/day) in Nash Draw to 10^{-8} m^2/s (10^{-2} ft^2/day) east of the WIPP site. Generally, transmissivity increases from east to west across the WIPP site, but high transmissivity zones occur in the southeastern part of the site in the area of boreholes DOE-1 and H-11, and in the north-central and northwestern parts in the vicinity of boreholes WIPP-13, DOE-2 and H-6 (Fig. 4).

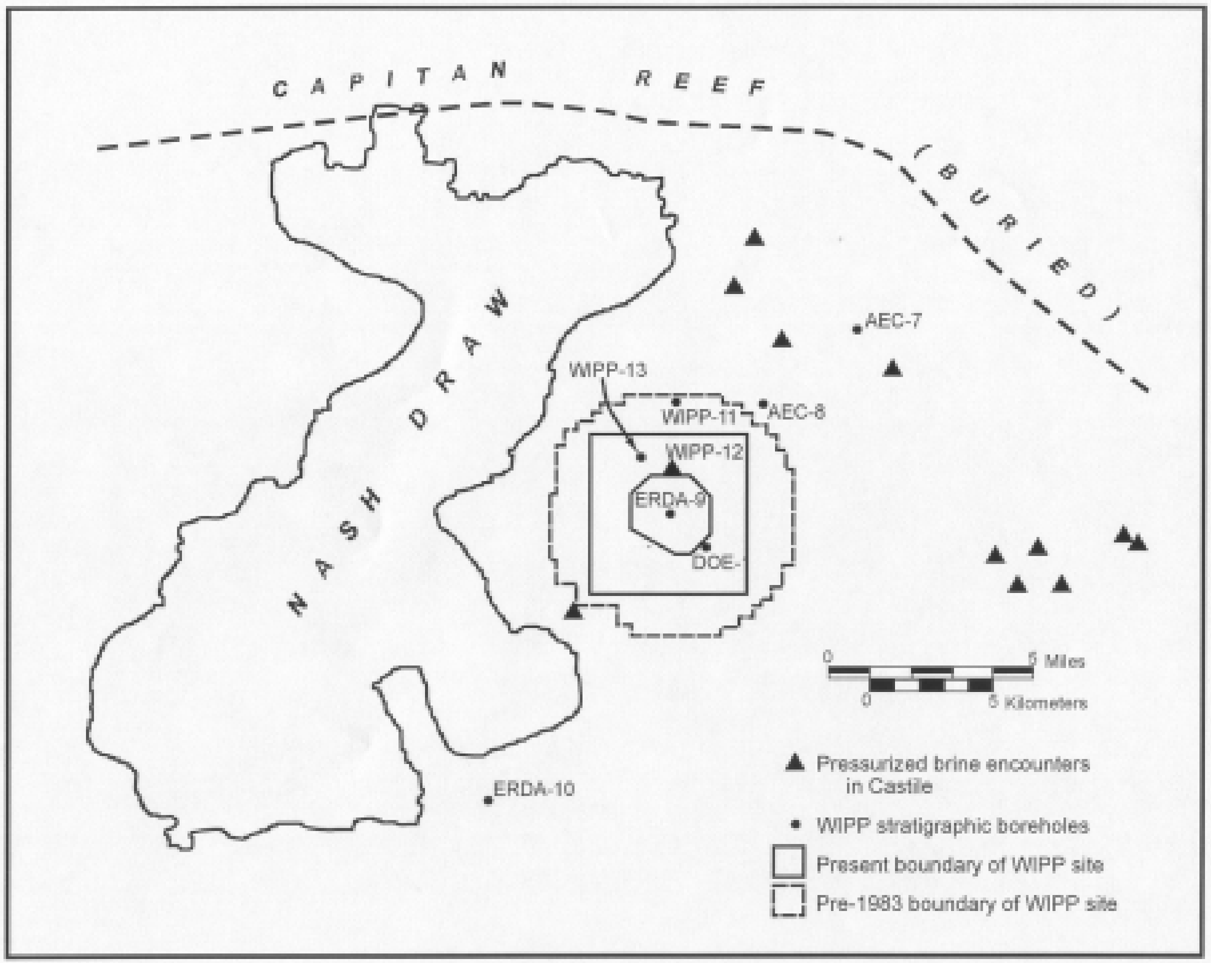

Figure 3. Pressurized brine encounters in the Castile Formation in the vicinity of the WIPP site

Chemical composition of ground water from the Culebra aquifer varies widely within short distances at and near the WIPP site (12). Five kilometers (three miles) south of the WIPP site, the Culebra water typically contains 3000 mg/l of TDS. At the site itself, TDS varies from 12,500 mg/l at H-2 at the center of the site to 139,500 mg/l at H-5 in the northeast corner (Fig. 4). Extreme variation in the chemistry of the Culebra water within short distances is illustrated by the TDS at H-2 (12,500 mg/l), H-3 (153,500 mg/l) and DOE-1 (118,000 mg/l), within a distance of less than 3 km (2 mi).

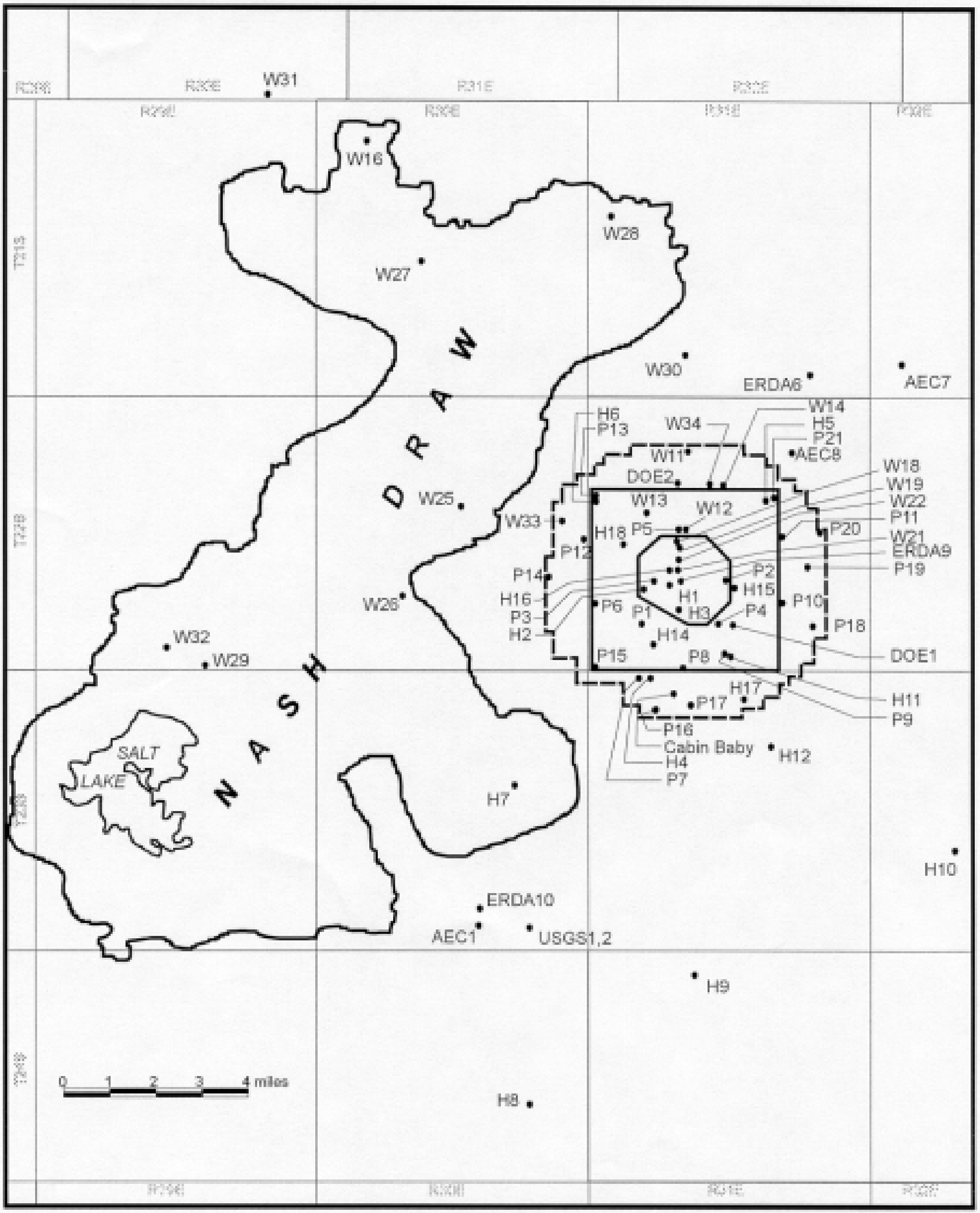

Figure 4. Location of WIPP related boreholes

The WIPP is situated in a mineral-rich area. Potash minerals are mined around the WIPP site from the McNutt potash zone in the upper part of the Salado Formation, approximately 450 m (1500 ft) below the surface. Oil and gas are produced around the WIPP site from the Permian Delaware Mountain Group and the Pennsylvanian Atokan and Morrowan strata, from depths ranging between 1525 m (5,000ft) to 4575 m (15,000 ft).

Repository Design and Waste Emplacement

In addition to support facilities at the surface to provide office space to workers and to receive and handle the waste, there are four shafts (waste handling, construction and salt loading, air intake and air exhaust) that connect the surface to the underground facilities (Fig. 5).

The repository is excavated at a depth of 655 m (2150 ft) below the surface and consists of an experimental area to the north and the main repository to the south of the shafts (Fig. 5). The experiments carried out in the northern part of the facility included mechanics of closure of excavations; effect of heat on closure and brine migration; development of plugs and seals to be used to plug the excavations, shafts and boreholes; and the effect of salt creep on the waste drums. The repository itself consists of 56 “rooms”, each 91.5 m (300 ft) long, 10 m (33 ft) wide and 4 m (13 ft) high, divided in eight panels of seven rooms each. The seven rooms of the first panel were excavated between 1986 and 1988, since the DOE had planned to start shipping radioactive waste to WIPP in 1988 for an “operational demonstration”. Excavation for the other seven panels of the repository has not yet begun.

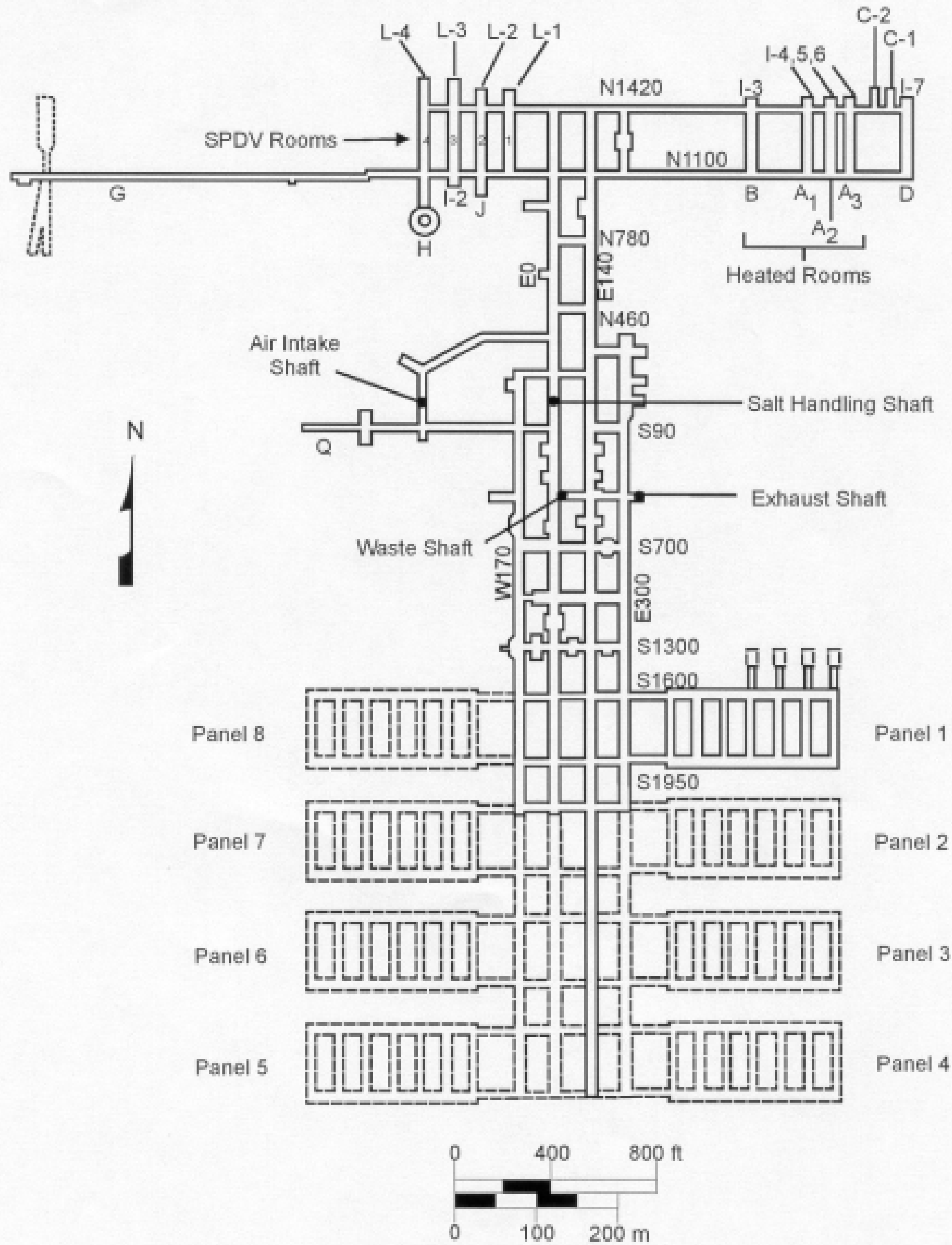

Figure 5. Underground layout of the WIPP repository

Transuranic waste consists of trash contaminated with radionuclides heavier than uranium with half-lives greater than 20 years and a level of contamination exceeding 100 nanocuries per gram of waste. Principal radionuclides of concern are Plutonium (238, 239, and 240), Americium-241, Strontium-90, Cesium-137, and other decay products. Some of the WIPP-bound waste contains high concentration of TRU radionuclides; e.g., residues from the Rocky Flats site may contain up to 10% by weight of Plutonium. The waste is a by-product of nuclear weapons production in the United States during the past 50 years. Only waste retrievably stored since 1970 is presently planned to be shipped to WIPP. Two-thirds of the planned capacity of waste for WIPP is yet to be produced. Two categories of the TRU waste are currently stored at DOE-managed sites and will be disposed at WIPP. The contact-handled (CH-TRU) waste is contained in 0.21 m^3 (55 gallon) mild carbon-steel drums that have a maximum surface-dose rate of 200 millirem per hour. The remote-handled (RH-TRU) waste will be disposed of in 0.89 m^3 capacity cylindrical canisters with unshielded surface dose rate higher than 200 millirem per hour and up to a maximum of 1000 rem per hour. The 50 hectare WIPP repository has been designed to hold 810,000 drums (168,500 m^3) of CH-TRU waste and 7955 canisters (7080 m^3) of RH-TRU waste. The estimated amount of radioactivity at time of emplacement is 6.4 million curies of CH-TRU and 1.0 million curies of RH-TRU. The CH-TRU waste drums will be stacked three high in 56 “rooms” to be excavated in salt. The RH-TRU canisters will be disposed in 0.91 m (36 in.) diameter and 3 m (10 ft) deep horizontal holes.

The TRU waste to be disposed at WIPP consists of both hazardous chemical waste and radionuclides with long half-lives. Its disposal is therefore governed by the requirements of the EPA Standards for the handling and permanent disposal of TRU radioactive materials (2,3), as well as the requirements of the Resource Conservation and Recovery Act (RCRA) (13). The idea of deep geologic disposal of the radioactive waste is to isolate it from the environment for a very long period of time. The EPA Standards for radiation protection specify a time of 10,000 years for containment of the waste and require probabilistic risk analyses to assure that potential releases to the environment will have a low probability and not allow more than a specified amount of various radionuclides. The RCRA regulations require assurance of no releases of hazardous materials beyond a specified “unit boundary”, which in the case of WIPP has been accepted to be the 6.4 km by 6.4 km (4 mi by 4 mi) WIPP site laterally, and up to the top of the disposal unit, the Salado Formation, vertically.

The WIPP repository relies primarily on the geology of the site to provide containment of waste for thousands of years, because there is no commitment to use robust engineered barriers for disposal of the TRU waste. Ninety-seven percent (by volume) of the waste to be disposed at WIPP will be contained in mild-carbon-steel 55-gallon drums (DOT type A) or in standard waste boxes. The containers are expected to be crushed by creeping salt and roof-falls and corrode in a few decades in the corrosive briny environment of the salt beds. Geologic integrity and the absence of geologic and geohydrologic conditions or processes that may breach the integrity of the repository are, therefore, critical issues in assessing the suitability of the WIPP site for use as a geologic repository for long-lived radioactive waste.

Process of Long-Term Performance Assessment

The procedure for assessment of compliance with the EPA disposal Standards (2,3) is called “performance assessment” and is defined in the Standards itself at 40 CFR 191.12, as an analysis that:

1. Identifies the processes and events that might affect the disposal system;
2. Examines the effects of these processes and events on the performance of the disposal system, and
3. Estimates the cumulative releases of radionuclides, considering the associated uncertainties, caused by all significant processes and events.

The EPA disposal standards (2) contain four “requirements”, viz., containment requirements, assurance requirements, individual protection requirements and groundwater protection requirements. The performance assessment technique is used to assess compliance with all of these, except the assurance requirements, which are intended to provide additional assurance of containment of the waste within the repository in view of the inherent uncertainties in calculated projections for the future.

The process of performance assessment consists of : (a) development of potential scenarios for release of radionuclides to the environment, (b) identification and selection of the most appropriate conceptual models, (c) obtaining data for each of the input parameters for the analysis, (d) selection or development of appropriate computer codes, (e) estimating the probabilities of various scenarios, (f) calculating the consequence of the scenarios, and (g) combining the results in the form of complementary cumulative distribution functions (CCDFs).

The DOE has analyzed the probabilities and the effects of radionuclide releases to the environment both with and without inadvertent human-intrusion in the repository. Most of the scenarios are affected by gas pressurization in the repository due to postulated generation of hydrogen by corrosion of metals in the waste and the drums, and carbon dioxide by biodegradation of cellulosic materials, such as paper, clothing, rubber, wood, etc. The scenarios result in both direct releases to the surface as well as injection into the Culebra aquifer overlying the repository. Thus, the assumption of conceptual models and parameters controlling gas pressurization, mechanics of human intrusion, characteristics of the waste including actinide solubility, mechanics of rock fracturing, and physical and chemical retardation processes in postulated containment transport through the Culebra aquifer, affect the outcome of performance assessment.

LONG-TERM ISSUES

The EEG provided detailed comments in March 1998 (14) on the DOE's compliance certification application (CCA) (15). A summary of the EEG's evaluation of the EPA's proposed rule of October 1997, certifying that the WIPP complies with the EPA standards, was published in May 1998 (16). The EPA approved the DOE’s application for WIPP’s certification of compliance with the EPA’s long-term radiation protection Standards in May 1998. After publication of the

EPA's final decision of certification, the EEG started the process of detailed evaluation of the scientific basis of that decision. The EEG is participating in the discussions of the underlying scientific issues with the DOE, and the WIPP committee of the National Academy of Sciences. It is commonly agreed among the organizations involved with WIPP that the basis of acceptance of long-term integrity of the WIPP project can be made more robust by additional analyses and experimental work. The WIPP Land Withdrawal Act (17) requires recertification of compliance with the EPA disposal standards every five years after the initial receipt of waste until decommissioning. The EEG's current work in this area will be useful in the evaluation for recertification. The following is a brief description of the long-term issues that need to be resolved prior to the WIPP recertification in five years.

Solubility

The solubility of actinides is very important to calculating the releases from the repository. The CCA used a model known as FMT to calculate these solubilities. EEG found that the model predicts differences for actinide sulfate solubilities that cannot be explained by chemistry, thus raising questions about the reliability of this model. DOE is considering replacement of FMT with EQ3/6 for the first re-certification (18, 19).

Rather than using an extensive plutonium database, the FMT predictions relied on thermodynamic data for other elements and an oxidation state analog argument. EEG recommends that the calculations be performed using thermodynamic data for plutonium. DOE is pursuing database modifications at this time (19).

The CCA discounts the role of organic ligands on plutonium solubility. It argues that the entire repository waste is a homogeneous blend and that the chelating compound Ethylenediaminetetraacetic acid (EDTA) is the strongest complexing agent and the amount of it present in the inventory is not enough to make a difference. But citrate forms stronger complexes with actinides in the +IV oxidation state than with other cations. EEG recommended that the solubility of a stable plutonium-citrate complex in individual waste containers should be determined. DOE has initiated testing of organic complexation models.

There are serious unanswered questions about the impact of magnesium oxide backfill on the solubility of the actinides. It is proposed that magnesium oxide will reduce the solubility of the actinides by controlling the pH. But, it is not known how long the early reaction product, nesquehonite, will persist. The FMT model calculates that the presence of nesquehonite drives the solubility of the +IV actinides, such as plutonium, higher than in the “no backfill” case. DOE is pursuing an investigation into the mineral phases formed by the presence of MgO under postulated repository conditions (18). The impact of MgO backfill on actinide solubility also requires further investigation.

Spallings

One of the main contributors for the release of radionuclides to the environment is the "spallings" scenario that results from a future driller inadvertently drilling into the repository, blowing out some of the waste to the surface. The DOE’s peer review of conceptual models rejected the CCA spallings model after submission of the CCA, but accepted the argument that the calculation was bounding (20). A new coherent conceptual model and a computer code that would calculate the projected releases have not been developed. The EEG finds the peer review group's and the EPA's basis of accepting the CCA predicted release volumes due to spallings to be both unnecessarily convoluted and faulty. Since this is a mechanism for the largest projected radionuclide releases from the repository, it is essential that it be treated through defensible conceptual and numerical models.

Air Drilling

The EPA rejected the air-drilling scenario (21) because the EPA Standards required consideration of only the drilling practices currently in use in the area at the time of the application. However, the use of underbalanced drilling (drilling with air, foam, aerated mud, and other light fluids) throughout oil fields in North America has dramatically increased as the drilling industry has met each technical challenge posed by various field conditions, including conditions found in the Delaware Basin. Moreover, EEG (14) found fundamental shortcomings in the EPA's air drilling calculations that led EPA to conclude that scenarios involving air drilling would result in low consequence.

Fluid Injection

For fluid injection activities adjacent to the site, the EPA accepted DOE's "low consequence" argument based on a model that has not been verified with oil field water flood data. EPA offered a "low probability" argument based on its expectations of fluid injection practices. The EEG agrees with the DOE about the difficulty of defining the probability of future fluid injection practices. It is difficult to reconcile the low probability argument with the common observation of water flowing through the Salado Formation in water flood operations throughout southeast New Mexico. The anomalous water level rises in the Culebra aquifer at the WIPP site, observed for the last ten years, remain inadequately explained. The water level rises may reflect the effect of water flooding in the area surrounding the WIPP site. There is insufficient basis to dismiss the fluid injection scenario either on the basis of low consequence or low probability.

Anhydrite Fracturing

The EEG has reviewed the basis of the anhydrite fracture model used in the BRAGFLO code and has a number of questions about its validity. The model is unusual in that the effect of fracturing is treated using an equivalent porous medium. All the relevant literature examined by EEG treat fractures as distinct porosity. Use of an equivalent porous medium is not in itself unreasonable. However, the DOE has not referenced, nor has the EEG been able to find, a description of similar treatment of the dependence of porosity and permeability on pressure as a result of fracturing. The lack of a clear development of the BRAGFLO anhydrite-fracturing model from established models makes its review difficult. Until the model and its assumptions are properly justified, the EEG finds it difficult to accept the results derived from this model. An alternative would be to use one of several hydrofacing codes used in the industry.

Solution Mining

The solution mining scenario was eliminated on the basis that it was not a current practice. The EPA Criteria required that near future practices also be considered. While the solution mining is not currently a widespread mining practice in the Delaware Basin, there is evidence to suggest that it will be used in the near future. Given these observations, the scenario will need to be revisited. Potash is used by the fertilizer industry and is ultimately used for the production of food. The demand for food is expected to continue to increase and low-grade potash ores will eventually be mined to meet this demand. DOE and EPA maintain that excavation mining captures the effects of solution mining on the hydraulic conductivity of the overlying aquifers. However, based on the scientific literature, the prediction of subsidence above solution mines can be much more complex than above excavation mining.

Groundwater Flow and Radionuclide Transport

A number of questions related to the flow and transport through the Culebra aquifer have been identified by the EEG (14) and the National Academy of Sciences Committee on WIPP that have not been addressed by the EPA. These questions relate to the conceptual models of the origin and flow of water in the Culebra aquifer, modeling of transport through the Culebra, and the justification of the assumed values of the chemical retardation parameter (K_d) in the CCA calculations. Test plans are in preparation to develop and incorporate a realistic model of transport through the Culebra (22) and to obtain chemical retardation data and determine the effects of organic ligands on Kd. (23).

Brine Reservoirs

The EEG raised a number of issues related to the Castile Formation brine reservoirs in commenting on the CCA. The EPA has accepted all of the EEG suggestions except the one related to the assumption of the probability of encounter of brine reservoirs. The CCA assumed 8% probability on the basis of faulty assumptions, as noted by EPA. The EEG recommended 100% probability on the basis that the WIPP-12 brine reservoir (Fig. 3) was large enough to most likely extend under the repository. The EPA has sampled on a range of 1 to 60%. The time-domain electro-magnetic (TDEM) survey data may be interpreted to indicate that the brine exists only under 60% of the repository. Also, some boreholes adjacent to the brine producing boreholes are known to be dry. For these reasons, it appears more reasonable to assume a fixed 60% probability of encounter of pressurized brine in the Castile Formation.

Waste Issues

DOE calculations showed that non-random emplacement of radionuclides in the repository led to significantly higher releases from cuttings and cavings and spallings. EEG believes that releases from direct brine releases will also increase. Revised calculations should be incorporated into the CCDF even though partial sensitivity analyses indicate that non-random emplacement would not, by itself, result in non-compliance.

The expected quantity of cellulosics, rubber, and plastics (CRP) in the repository is slightly greater than the waste repository limit. The ability to characterize CRP waste with sufficient accuracy has not been shown. Also, EEG believes the limit should be controlled on a per panel basis rather than for the entire repository.

Assurance Requirements

There are six assurance requirements in the EPA standards (40 CFR 191.14) which were incorporated to provide additional confidence in the repository, because of the inherent uncertainty in projecting the future behavior of natural systems and inadvertent human action. The EEG agrees with the EPA determination of two of these six requirements, the active and the passive institutional controls, but has questions about the other four. The fact that the WIPP is situated in a mineral resource rich area is an additional reason for incorporating additional engineered barriers in the WIPP design. For example, the waste could be made less respirable and soluble through treatment and repackaging. Since the DOE has plans to treat or repackage 85% of the existing contact handled TRU waste anyway, this recommendation should be easy to implement.

Ground-Water Protection
EEG believes there is a very low probability of significant contamination of an underground source of drinking water (USDW) by an undisturbed release. However, 40 CFR 191.24 specifies that no contamination is permitted if the USDW is initially at or above the radionuclide limits of 40 CFR 141. No documentation of current radionuclide concentrations in the USDWs has been provided. EPA needs to require submission of data showing the USDWs are below allowed limits or that there is a zero probability of any contamination reaching the USDW.

OPERATIONAL ISSUES

The EEG observed the March 1998 DOE audit of the WIPP's operational readiness. The audit team did not review some important operational safety issues, i.e., mine safety and operations, TRUPACT-II design and maintenance, transportation, radiation dosimetry, and facility design changes prior to September 1993. The EEG published an evaluation of the operational safety issues of WIPP in May 1998 (24), which included the issues that were not addressed by the audit team, as well as some that were. After abolition of the U.S. Bureau of Mines in 1995, the EEG has provided the only outside evaluation (25, 26) of the safety of the underground panel 1 rooms, which were excavated in 1986-88 and have outlived their intended life. The EEG recommended to the DOE to accept the EEG's analysis and suggestions to assure safety, or to have independent annual evaluations of mine safety conducted, as required by the Land Withdrawal Act. The other concerns for which resolution is recommended to the DOE fall in the areas of radiation air effluent monitoring, facility operations, and inspections, as listed below:

- Proper siting and testing of the underground radiation air monitors.
- Establishment of salt aerosol particulate concentrations at underground radiation air monitoring locations.
- Minimize the water leakage in the exhaust shaft.
- Improved procedures and worker training for diverting the mine exhaust air to filtration mode in the event of an underground radioactive release.
- Waste handling procedures should be modified so that the radiation waste containers do not remain unnecessarily suspended above the TRUPACT-II and the waste handling dock.
- Radiation waste shipments should not be received at the access gate for the public and the non-radiation workers.
- Plan to systematically increase waste shipments from low to higher rates with appropriate operational, management, and ALARA reviews.
- Routine radiological health and safety inspections to be conducted by DOE organizations other than the Carlsbad Area Office (CAO) or organizations reporting directly to CAO.

The EEG looks forward to resolving these issues through consultations with the DOE.

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