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APPENDIX E1

RCRA GROUNDWATER PROTECTION INFORMATION
WASTE ISOLATION PILOT PLANT

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1.0 Introduction

The Waste Isolation Pilot Plant (WIPP) Project was authorized by the U.S. Department of Energy (DOE) National Security and Military Applications of the Nuclear Energy Authorization Act of 1980 (Public Law 96-164). Its legislative mandate is to provide a research and development facility to demonstrate the safe disposal of radioactive waste resulting from national defense programs and activities. To fulfill this mandate, the WIPP facility has been designed to perform scientific investigations of the behavior of bedded salt as a repository medium and the interactions between the salt and radioactive wastes.

In 1991, DOE proposed to initiate a multi-year experimental Test Phase designed to demonstrate the performance of the repository (Molecke, 1990; Molecke and Lappin, 1991). The Test Phase activities involve experiments using transuranic (TRU) waste typical of the waste planned for future disposal at the WIPP facility.

Experimental waste will be received from the DOE Rocky Flats Plant and the Idaho National Engineering Laboratory. Although the WIPP facility is designed to receive wastes over a 25-year period, the full design capacity will not be utilized until scientific data and analysis obtained during the Test Phase indicate that disposal of radioactive and radioactive mixed waste at the WIPP facility is protective of human health and the environment. Near the end of the Test Phase, DOE will make a determination as to whether the WIPP facility will ultimately become the nation's first permanent TRU waste repository for DOE facilities.

Substantial quantities of the TRU waste proposed for shipment to the WIPP facility will contain hazardous chemical components that qualify as "hazardous waste" under the Resource Conservation and Recovery Act (RCRA). Therefore, the WIPP facility is a "mixed waste" miscellaneous unit, subject to regulation by the New Mexico Environment Department (NMED) under New Mexico Hazardous Waste Management Regulations (HWMR-6), Part V, Subpart X. The NMED was granted authority by the U.S. Environmental Protection Agency (EPA) to regulate radioactive mixed waste facilities in New Mexico effective July 25, 1990. Part A of a RCRA permit application was submitted by DOE to the NMED's predecessor to meet part of the requirements for interim status under RCRA.

Because geologic repositories, such as the WIPP facility, are defined under RCRA as land disposal facilities, the groundwater monitoring requirements of HWMR-6, Pt. V, Subpart X, must

be addressed. HWMR-6, Pt. V, Subpart F, applies to miscellaneous unit treatment, storage, and disposal facilities (TSDF) only if groundwater monitoring is needed to satisfy HWMR-6, Pt. V, sections 264.601 through 264.603, performance standards. This appendix demonstrates that groundwater monitoring is not needed in order to demonstrate compliance with the performance standards; therefore, HWMR-6, Pt. V, Subpart F, will not apply to the WIPP facility.

DOE is seeking to demonstrate to a reasonable degree of certainty that there will be no migration of hazardous waste or hazardous constituents via groundwater during the Test Phase. In March 1989, DOE submitted a No-Migration Variance Petition (DOE, 1990a) under 40 CFR 268.6 to the EPA demonstrating that there will be no migration of hazardous waste or hazardous constituents from the WIPP facility during the Test Phase. On November 14, 1990, EPA granted the WIPP Project a Conditional No-Migration Variance under 40 CFR 268.6. The EPA concluded that hazardous constituents will not migrate to groundwater from the repository during the Test Phase (EPA, 1990).

To fulfill environmental performance standards for groundwater requirements as described in HWMR-6, Pt. V, secs. 264.601(a) and 264.602, the following points are addressed in this appendix:

1. The potential for migration of hazardous waste or hazardous constituents from the facility to the uppermost aquifer by an evaluation of:

   a. A water balance of precipitation, evapotranspiration, runoff, and infiltration.

   b. Unsaturated zone characteristics (e.g., geologic materials, physical properties, and depth to groundwater).

   c. The existing quality of groundwater, including other sources of contamination and other cumulative impact on the groundwater.

2. The potential for hazardous waste or hazardous constituents that enter the uppermost aquifer to migrate to a water supply well or surface water by evaluation of:

   a. Saturated zone characteristics (i.e., geologic materials, physical properties, and rate and direction of groundwater flow).

   b. The proximity of the facility to water supply wells or surface water.

   c. The proximity to and withdrawal rates of current and potential groundwater users.

This document provides the data necessary to demonstrate that the migration of hazardous waste or hazardous constituents from the WIPP underground facility by way of the most likely water-bearing unit to water supply wells (domestic, industrial, or agricultural) or to surface water is unlikely. To make this demonstration, DOE considered formation permeability and fractures, the location and relationship of water-bearing units to the repository horizon, and the potential for flooding. Also considered were the characteristics of the waste, integrity of the waste containers, and the chemical composition of groundwater in the repository area, as recommended in the EPA's permit guidance for hazardous waste storage and disposal in geologic repositories. The facility design (Section 7.0) and waste containment (Section 8.0) are key factors related to the ability of the WIPP site to isolate waste from groundwater with a high degree of certainty.

The demonstration provided in this appendix is formatted as follows:

- Section 2.0 is a groundwater protection summary.
- Section 3.0 describes the geographical setting and land use at the WIPP site.
- Section 4.0 provides a general summary of the geologic characteristics of the WIPP site that pertain directly to the ability of the WIPP site to contain waste.
- Section 5.0 presents local climatological data and describes the water balance at the WIPP site.
- Section 6.0 describes the hydrologic conditions and groundwater quality at the WIPP site.
- Section 7.0 describes facility design related to waste containment.
- Section 8.0 presents waste containment characteristics that ensure isolation of wastes in the WIPP facility.
- Section 9.0 presents a general summary that demonstrates that the WIPP facility meets groundwater performance standards and the requirements for groundwater protection, as required in HWMR-6, Pt. V, secs. 264.601 and 264.602.

2.0 Groundwater Protection Summary

Since 1975, an extensive program of site characterization and validation has been conducted at the WIPP site. The results of these studies have been summarized in numerous publications, including the following documents: (1) Geological Characterization Report (Powers et al., 1978); (2) the WIPP Design Validation Final Report (DOE, 1986); (3) Summary of Site-Characterization

Studies Conducted from 1983 Through 1987 at the Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico (Lappin, 1988); (4) the WIPP Final Safety Analysis Report (FSAR) (DOE, 1990b); and (5) the WIPP No-Migration Variance Petition (DOE, 1990a). These studies provided information that was used to substantiate the conclusion that there is no possibility of migration of hazardous waste or hazardous constituents from the WIPP facility by groundwater. This section summarizes the factors (discussed in detail in Chapter D, Facility and Process Information, and the appendices to Chapter D) that justify the determination that the groundwater monitoring requirements in HWMR-6, Pt. V, Subpart F, and HWMR-6, Pt. V, sec. 264.602, are not applicable to the WIPP site.

The WIPP site geologic and hydrologic investigations indicate there will be little groundwater available to mobilize and transport waste. The groundwater protection information provided will demonstrate that during the Test Phase: (1) groundwater will not come in contact with the waste, and (2) there is no potential for any possible contaminated groundwater to migrate from the disposal horizon to the accessible environment, due to the existence of natural hydrologic gradients toward the facility level from all surrounding water-bearing zones.

Because the WIPP site is a unique land disposal unit constructed far below the surface, the water-bearing unit most likely to be affected by releases from the repository is the Culebra Dolomite Member of the Rustler Formation which lies 1400 feet above the repository horizon. The Culebra Dolomite is the most likely pathway to transport contaminated groundwater to the accessible environment or to surface water. The possibility of transport of hazardous waste or hazardous constituents to the Culebra Dolomite Member will be discussed later in this section.

The WIPP facility horizon is located 2,150 feet below the land surface in the Salado Formation, a bedded salt formation. The thick sequences of predominantly very low to low permeability sediments and evaporites isolate the waste disposal horizon from any infiltration from the surface as well as from the overlying water-bearing units (Sections 5.0, 6.0, and 7.0). The facility disposal horizon is isolated from the underlying water-bearing formations by about 2,000 feet of very low permeability sediments and evaporites. It is separated from the overlying Culebra Dolomite Member by about 1,400 feet of evaporites and other sedimentary rocks. All shafts extending to the facility horizon have been designed and constructed to minimize the infiltration of water from the overlying water-bearing units into the facility during the operational life of the facility (DOE, 1990b). All groundwater seepage into the shafts is collected and routed for disposal by water collection rings built into the shaft liners.

Very small amounts of brine are trapped in the host rock salt (Deal and Case, 1987; Deal et al., 1987, 1989). The quantity of brine available is insufficient to consider it a potential transport medium during the Test Phase. Additionally, evaporation of the brine due to the normal mine ventilation prevents the accumulation of brine in quantities sufficient to come in contact with the

√ waste itself. Also the natural hydrologic gradient during the Test Phase is from the surrounding
√ rock to the repository horizon, making transport away from the facility unlikely.

√ During the Test Phase, brine compositionally similar to the brine that occurs naturally in the WIPP
√ vicinity will be added to some of the waste containers for experimental purposes. Containers will
√ be inspected and monitored during these tests. In the unlikely event that the test bins should
√ develop leaks, the brine added for experimental purposes will not migrate from the test bins and
will be controlled by the Radiological Control Boundary (RCB), which will serve as a secondary
containment system installed around the bins. The secondary containment around the bins, and
√ the limited amount of added brine will preclude the migration of hazardous waste or hazardous
constituents from the disposal area to any water-bearing unit or to the accessible environment
√ during the Test Phase at the WIPP facility (Section 8.0).

The WIPP site is located in a very sparsely populated region in which the major land uses are
cattle grazing, oil and gas production, and potash mining (DOE, 1990b). The facility is remote
from significant surface water resources, and the poor quality and small quantity of groundwater
in the area limit its possible uses. Water in the water-bearing strata overlying and underlying the
facility horizon is high in dissolved solids and is not potable. The only potable groundwater in the
√ general area is found in isolated and discontinuous perched or semiperched water tables in the
√ Dewey Lake Redbeds or the Santa Rosa Formation. The nearest wells that produce potable
√ water used for domestic and livestock purposes are located 3 miles south of the WIPP facility
(DOE, 1990b). There is no connection between the confined groundwater systems at the WIPP
√ facility and nearby surface water bodies. There is, therefore, no potential for waste placed in the
√ WIPP facility to affect water resources by entering water supply wells or surface water systems.

To summarize, for waste to migrate to groundwater-bearing units, there must first be a transport
medium (in this case, water or brine). There must also be a pathway, such as a shaft, a drill
hole, or fracture, that would connect the contaminated brine with overlying water-bearing units,
that would be the most likely routes to the accessible environment. In addition, there must be a
driving force or gradient to transport contaminants from the waste disposal area. None of these
√ factors is considered to be significant at the WIPP facility during the Test Phase, because of the
√ physical characteristics of the site and test and facility designs. No feasible transport medium or
√ hydraulic gradient will exist during the Test Phase period at the WIPP facility, and no natural
√ pathway exists to allow migration of hazardous waste or hazardous constituents from the waste
√ disposal area to any water-bearing unit. If, after the Test Phase, the WIPP facility is determined
to be an unsuitable repository for permanent disposal of TRU waste, the waste emplaced during
√ the Test Phase will be removed from the underground storage facility. Migration of hazardous
√ waste or hazardous constituents in groundwater during the Test Phase is highly unlikely.

3.0 Geographical Setting and Land Use

3.1 Geographical Setting

The WIPP site is located in the Pecos River Valley section of the Great Plains physiographic province in the north-central part of the Delaware Basin. The land surface in the region surrounding the WIPP site slopes gently to the west and southwest at approximately 45 feet per mile. The surface elevations range from 3,550 feet above mean sea level (MSL) along the eastern border of the site to 3,300 feet MSL in the west. Eolian sand, which occurs as partially stabilized or active sand dunes, covers much of the site. The sand, of Holocene age, is very erratic in distribution and thickness (DOE, 1990b). Appendices D6 and D7 of Chapter D, Facility and Process Information, provide more detail on the geographical setting of the WIPP site.

The WIPP site is located in Eddy County 26 miles east of Carlsbad, New Mexico, in an area known as Los Medanos (The Dunes) (Figure E1-1). This area is relatively flat and sparsely inhabited with little water and limited land uses. Most of the land is federally or state owned and is used principally for grazing. Other uses of land in the area include potash mining and oil and gas exploration and development.

Livingston Ridge, located about 4 miles northwest of the WIPP facility, is the most prominent physiographic feature in the area. This northeast-trending escarpment is about 12 miles long and 75 feet high and marks the eastern edge of Nash Draw. Late Permian Dewey Lake Redbeds and the Pleistocene age Gatuna Formation and Mescalero caliche crop out along the ridge (Figure E1-2).

Nash Draw is northwest of Livingston Ridge and is a shallow northeast-trending depression 3 to 9 miles wide. It is the nearest drainage course to the west of the WIPP facility. Elevations within Nash Draw range from 3,300 feet MSL at its head in the northeast to 2,945 feet MSL at Salt Lake near the Pecos River and are generally 200 to 300 feet lower than the surrounding terrain. Nash Draw is believed to have developed as a result of the subsurface dissolution of salt from the Rustler and upper Salado Formations and gypsum and anhydrite from the Rustler, followed by subsidence of overlying materials (DOE, 1990b).

East of the WIPP facility, the nearest major drainage course is the San Simon Swale (Figure E1-2). The swale is a southeast-trending depression about 25 miles long and from 2 to 6 miles wide that overlies the southern extent of the Capitan Reef. Elevations within the depression range from 3,650 feet MSL in the northwest to 3,270 feet MSL in the collapse feature called San Simon Sink at the southeastern end of the swale, about 18 miles east of the WIPP facility. The sink is filled with fine sand and calcareous silt, and the surface of the swale is covered by eolian sand, which masks the relief (DOE, 1990b).

San Simon Swale probably originated from a combination of surface stream erosion and solution subsidence because the area of collapse seems to be confined to the sink areas and is not pervasive over the entire swale. Rather, collapse in the sink areas steepened the local drainage gradient, resulting in headward cutting and widening of the swale.

Between San Simon Swale and the WIPP facility is a broad, low mesa named "the Divide." About 7 miles east of the WIPP facility, the Divide rises about 100 feet above the surrounding terrain and has an elevation of about 3,800 feet MSL. It marks the local boundary between the southwest drainage toward Nash Draw and the southeast drainage toward San Simon Swale. The Divide is capped by the Ogallala Formation of late Tertiary age and an overlying caliche layer (DOE, 1990b).

3.2 Land Use

The WIPP site consists of 16 sections of federal land located in Township 22 South, Range 31 East (Figure E1-3). Lands were withdrawn from settlement, sale, location, or entry under the general land laws by Public Land Order 6403, which authorized the land to be used for the construction of the WIPP facility. Surface land uses in this area remain largely unchanged with the exception of the one square mile area encompassing the facility. Surface entry for mining, drilling, and resource exploration is restricted in the 16 sections from purposes other than support of the WIPP Project.

The WIPP site is divided into three zones (Figure E1-3). Zone I, covering about 35 acres, encompasses all major surface facilities and is surrounded by a chain-link fence (Figure E1-3). Zone II indicates the maximum extent of present and future underground development (Figure E1-3). The Zone III boundary extends a minimum of 1 mile beyond any underground development and provides a functional barrier between the underground region defined by Zone II and the accessible environment.

The major use of land within 10 miles of the center of the site is cattle ranching. There are about 500 head of cattle within 5 miles of the site and approximately 1,500 head between 5 and 10 miles from the site. At present, none of the ranches within a 3-mile radius of the WIPP facility uses well water for livestock. The Smith Ranch used well water for domestic consumption and grazing until 1978, but the quality was poor and they now use water supplied by pipeline. Drinking water at the Smith Ranch and the WIPP facility is supplied by the International Mineral and Chemical Corporation (IMCC), which has a well system in the Capitan Aquifer. Stock water comes from IMCC and the New Mexico Potash Corporation, whose well systems tap the Ogallala Formation (DOE, 1990b).

The WIPP site lies in a sparsely populated area. Eight people reside at the Mill's Ranch, the residence nearest the WIPP facility, located about 3.5 miles south-southwest of the site. The

nearest town, Loving, New Mexico, has a population of about 1,700. Loving lies about 18 miles southwest of the site. There are several active potash mines within 15 miles of the WIPP site. The closest is the Western Ag-Mineral Company potash mine located approximately 5 miles west-southwest of the WIPP site.

4.0 Site Geology

4.1 Site-Specific Exploration Techniques

Detailed site-specific exploration techniques have been and are being utilized at the WIPP site. Among these are geophysical surveys, including seismic reflection, resistivity, gravity, electromagnetic, and magnetic techniques; borehole exploration, including coring, geophysical logging, and hydrologic testing; and geologic mapping. Many publications describe the geology at the WIPP site, including the Geologic Characterization Report, Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico (Powers et al., 1978); the Final Safety Analysis Report (FSAR) (DOE, 1990b); Regional Geology of Ochoan Evaporites, Northern Part of the Delaware Basin (Bachman, 1984); Summary of Site-Characterization Studies Conducted from 1983 through 1987 at the Waste Isolation Pilot Plant (WIPP) Site, Southeastern New Mexico (Lappin, 1988); and Facies Variability and Post Depositional Alteration Within the Rustler Formation in the Vicinity of the Waste Isolation Pilot Plant, Southeastern New Mexico (Holt and Powers, 1991).

4.2 Site Stratigraphy

The WIPP facility is constructed near the middle of a sequence of evaporite beds about 3,600 feet thick that consist primarily of halite and anhydrite (Figures E1-4, E1-5). This chapter summarizes the stratigraphic units from the surface down to the Castile Formation, including the Salado Formation. Special emphasis is placed on the water-bearing units and the Salado Formation whose properties eliminate the potential for migration of hazardous waste or hazardous constituents from the WIPP site during the Test Phase. Detailed descriptions of local stratigraphy are provided in the reports named above and in Appendices D6 and D7 of Chapter D, Facility and Process Information.

4.2.1 Permian System

The nearly 13,000 feet of Permian strata that were deposited within the Delaware Basin area constitute the most complete Permian sequence in North America (Brokaw et al., 1972). At the WIPP site, the average thickness of the Permian sequence is about 12,800 feet. The upper part of the sequence, in which the facility is located, is composed of approximately 3,600 feet of thick evaporite beds (primarily halite and anhydrite) with only minor amounts of clastic material (DOE, 1990b). The Permian System is divided into four series which are, in ascending order, the

Wolfcampian, Leonardian, Guadalupian, and Ochoan. The Permian-age rocks of interest here are part of the Ochoan Series.

Ochoan Series

The Ochoan sediments are of marine origin and are separable into two distinct sections: (1) a thick lower section of evaporites, and (2) a thinner upper layer of redbeds. The lower section includes, in ascending order, the Castile, Salado, and Rustler Formations. The upper section consists of the Dewey Lake Redbeds. A summary of the Ochoan evaporites in the northern Delaware Basin is provided in Bachman (1984).

Castile Formation

The Castile Formation underlies the Salado Formation. The thickness of the Castile at and near the WIPP site is approximately 1,250 feet. Lithologically, the Castile contains a sequence of three thick anhydrite beds, separated by two thick halite sequences. These low-permeability evaporite units lie between the rocks of the Bell Canyon Formation and the overlying Salado Formation. The evaporites of the Castile Formation were deposited in the Delaware Basin on the basinal side of the Permian Capitan Reef. These evaporite deposits almost completely filled the basin prior to deposition of the Salado Formation.

Salado Formation

The WIPP underground structures are being excavated in the Salado Formation. A core hole, ERDA-9, was drilled at the center of the WIPP site through the Salado and into the Castile Formation. At ERDA-9, the top of the Salado is 848 feet below ground surface (BGS), and the base is at 2,824 feet BGS for a total thickness of 1,976 feet. The waste disposal horizon is located approximately 2,150 feet BGS. Schematic sections and detailed lithologic logs for ERDA-9 and additional core holes surrounding the site, as well as information obtained from shaft mapping, may be found in the WIPP FSAR (DOE, 1990b) and Holt and Powers (1984, 1986, 1990).

The Salado Formation is composed predominantly of halite, which constitutes about 85 to 90 percent of this formation at the WIPP facility. The next most abundant rock type in the formation is anhydrite. The remainder of the formation is polyhalite and other potassium-rich rocks with subordinate amounts of glauberite, magnesite, sandstone, siltstone, and claystone (DOE, 1990b).

The Salado Formation is divided informally into three members: an unnamed lower member, the McNutt potash zone, and an unnamed upper member. The WIPP underground facility is in the lower member, which is 1,094 feet thick and is composed of alternating thick layers of halite and

thinner interbeds of anhydrite and polyhalite. Thin bands of magnesite form a carbonate-rich zone in the lower part of most of the polyhalite and anhydrite seams. Seams of claystone underlie the anhydrite and polyhalite seams. The clay seams, in turn, are underlain by dark to medium-gray argillaceous halite, which grades downwards into polyhalite or clear halite (DOE, 1990b).

The McNutt potash zone is 380 feet thick at the center of the WIPP site and differs from the other members of the Salado in that it is rich in potassium-bearing minerals. In addition to potassic rocks, the McNutt contains thin seams of anhydrite and polyhalite within the dominant halite (DOE, 1990b).

The upper unnamed member is 502 feet thick at the center of the WIPP site and is composed predominately of halite with minor amounts of anhydrite and polyhalite. It also contains two persistent beds of very fine-grained sandstone, the Vaca Triste sandstone and Marker Bed 101. These halite-cemented sandstones are found throughout the Delaware Basin. These relatively thin sandstone beds occur, respectively, 30 to 40 feet and 112 to 120 feet below the top of the member (DOE, 1990b). A detailed discussion of the stratigraphy of the Salado Formation at the underground facility level is given in Appendices D6 and D7 of Chapter D, Facility and Process Information.

Rustler Formation

In the WIPP site area, the Salado Formation is overlain conformably by the Rustler Formation. The Rustler Formation is approximately 310 feet thick at the center of the site. Overall, the lithology of the Rustler is quite variable, containing carbonates, sulfates (gypsum, anhydrite, polyhalite), clastic materials, and halite (Holt and Powers, 1991). The Rustler Formation is the youngest unit in the Ochoan evaporite sequence and is a key marker bed of the upper Permian in Texas and New Mexico. The Rustler Formation is divided into five members in the WIPP site area. The division includes: (1) at the base, an unnamed unit of clayey siltstone and very fine-grained sandstone with thin interbeds of anhydrite and halite; (2) the Culebra Dolomite Member, a unit of thin bedded, finely crystalline dolomite; (3) the Tamarisk Member, mostly anhydrite and some unconsolidated clayey silt; (4) the Magenta Dolomite Member, a cross-laminated, fine-grained dolomite; and (5) the Forty-niner Member, anhydrite with a single interbed of clayey silt. The unnamed lower member is approximately 120 feet thick and is dominated by siltstone and claystone with lesser amounts of anhydrite and halite. The anhydritic upper Forty-Niner Member of the formation is approximately 50 to 60 feet thick (Powers et al., 1978). The Culebra and Magenta Dolomite Members of the Rustler Formation are water-bearing in the vicinity of the WIPP site. These two dolomite members are discussed below. Additional detail on Rustler Formation stratigraphy is given in Appendices D6 and D7 of Chapter D, Facility and Process Information.

Culebra Dolomite Member

The Culebra Dolomite Member occurs in the Rustler Formation between 704 and 727 feet BGS near the center of the WIPP site (Winstanley and Carrasco, 1986). It is a thinly-bedded microcrystalline dolomite that contains many small spherical cavities ranging 2 to 20 millimeters in diameter. These cavities may be partially filled with secondary anhydrite, gypsum, or calcite. Although many cavities are open, they do not appear to be interconnected except along fractures (Mercer, 1983).

The Culebra Dolomite has been examined extensively during mapping of the Waste Handling Shaft (Holt and Powers, 1984), the Exhaust Shaft (Holt and Powers, 1986), and in the Air Intake Shaft (Holt and Powers, 1990). These observations, along with the results of the evaluation of numerous core samples, have indicated that most zones of interconnected porosity and formation permeability is along fractures. Both open-and sulfate-filled vugs and fractures are locally abundant across the site area. The majority of the Culebra sediment is of uniform size, fine-grained carbonate mud, which upon lithification produced finely crystalline dolomite.

Magenta Dolomite Member

The Magenta Dolomite Member occurs in the Rustler Formation between 596 and 620 feet BGS near the center of the WIPP site (Winstanley and Carrasco, 1986). It is characterized by alternating wavy laminae of silty dolomite and anhydrite altered locally to gypsum. The dolomite is bounded above and below by anhydrite (Mercer, 1983) of the Forty-niner and Tamarisk Members of the Rustler Formation, respectively.

Dewey Lake Redbeds

The Dewey Lake Redbeds are the uppermost unit of the Late Permian Ochoan Series at the WIPP site and represents the top of the Paleozoic section in the Delaware Basin. At the center of the WIPP site, the Dewey Lake Redbeds are 474 feet thick. The Dewey Lake Redbeds consist of mudstone, siltstone, and interbedded thin lenticular beds of sandstone.

4.2.2 Triassic System

Late Triassic rocks in the northern part of the Delaware Basin belong to the Dockum Group which unconformably overlies the Dewey Lake Redbeds. The Dockum Group occurs in the vicinity of the WIPP site as an erosional wedge pinching out near the center of the site. It consists of fine-to-coarse-grained sandstone with interbeds of siltstone and mudstone. Throughout most of the area, the Dockum Group sandstone is covered by surficial Cenozoic deposits.

4.2.3 Tertiary and Quaternary Systems

Cenozoic and more recent rocks found at the WIPP site consist of the Pleistocene- and Holocene-age Gatuna Formation, the Mescalero caliche, and recent windblown sand and playa lake deposits. Although not occurring at the site, the late Cenozoic Ogallala Formation occurs in the WIPP site area.

Recent (Holocene age) deposits in the vicinity of the WIPP site include windblown sand, alluvium, and playa lake deposits (Powers et al., 1978). The most prevalent recent deposits consist of the windblown sand that covers most of the WIPP area (Figure E1-6). The sand occurs as either tracts of conspicuous dune fields or as sheet deposits. The dune deposits can be up to 100 feet thick, whereas the sheet deposits are typically no more than 10 to 15 feet thick.

Alluvial deposits occur in ¼- to ¾-mile-wide belts along declivities into Nash Draw, for example, along the base of Livingston Ridge and locally in small depressions (Figure E1-6). These deposits are similar to small alluvial fans or sheet deposits.

Playa deposits consist of eolian sand, alluvium, and gypsum and halite. The nearest playas are about 5 miles west of the WIPP site within Nash Draw (Figure E1-6).

Twenty-seven feet of the Gatuna Formation were encountered at the center of the site. This formation consists of reddish-brown, poorly consolidated sand, gravel, and silty clay. Beneath a cover of windblown sand, much of the site area is covered by a hard, resistant petrocalcic horizon informally known as the Mescalero caliche, which is about 4.3 feet thick in the site area (DOE, 1990b).

The Ogallala Formation, of Miocene age, is a major water-bearing unit supplying groundwater for a large area of the Permian Basin east of the WIPP site. This unit does not occur west of San Simon Swale, except for thin exposures about 7 miles east of the WIPP facility. Therefore, activities at the WIPP facility will not impact the Ogallala aquifer.

5.0 Climatology and Water Balance

5.1 Climatology

The regional and local climate is semiarid. The mean annual rainfall is approximately 12 inches, about half of which is received from thunderstorms during June through September. Daytime summer temperatures consistently exceed 90°F and occasionally rise above 100°F. Winter afternoon temperatures often rise as high as 70°F. Nighttime lows during the winter average near 23°F, occasionally dipping below 14°F. Prevailing winds are from the southeast; however, strong winds are frequent (especially in the spring) and can blow from any direction, creating potentially

violent windstorms which can carry large volumes of dust and sand. Detailed compilations of climatic data for the WIPP site appear in the WIPP Ecological Monitoring Reports (Fischer, 1985, 1987, 1988; DOE, 1990c). Climatic data are currently being collected approximately 2,000 feet northwest of the Zone I boundary of the WIPP site. Additional climatic information appears in the Final Environmental Impact Statement (FEIS) (DOE, 1980) and the WIPP FSAR (DOE, 1990b). Additional discussion of the local climate of the WIPP site is given in Appendices D4, D5, and D6 of Chapter D.

5.2 Local Water Balance

The infiltration and percolation rates of meteoric water into the sediments overlying the facility horizon have been investigated for the U.S. Bureau of Land Management (Geohydrology Associates, Inc., 1978). At least 96 percent of precipitation was lost due to evapotranspiration. On the average, therefore, the annual amount of infiltration would be less than 0.5 inch per year and may, for many years, be essentially nonexistent.

The widespread presence of the Mescalero caliche, which has existed several feet below the surface for approximately 500,000 years, provides an additional barrier to infiltration (Bachman, 1985). Its existence indicates that, on a regional scale, not enough infiltration has taken place to result in its complete dissolution. The upper surface of the hard caliche typically is covered with a mat of plant roots which indicate that most of the moisture that reaches that surface is taken up by plants and transpired. It is difficult to arrive at a precise figure for the amount of water that infiltrates downward into the formations overlying the WIPP site. Infiltration is apparently negligible as evidenced by the absence of a near-surface groundwater body or regional water table above the Rustler Formation at the WIPP site (DOE, 1990b).

A regional water-balance study has been conducted covering approximately 2,000 square miles in Eddy County east of the Pecos River (Figures E1-7 and E1-8) (Hunter, 1985). The study encompassed all local stratigraphic units above the Salado Formation and below the Ogallala Formation. The results of that study showed that recharge to the Rustler Formation water-bearing units was not occurring at or in the vicinity of the WIPP site. Hunter (1985) showed that the uncertainties in local and regional precipitation, infiltration, evapotranspiration, and groundwater discharge from the Rustler Formation are so large that water-budget techniques cannot be used either to determine the amount of recharge or to determine that recharge is actually occurring. As reported in Lappin (1988), the water budget described by Hunter (1985) is, in fact, consistent with the conclusion that no recharge is now occurring at or near the WIPP site. The hydrologic and isotopic studies presented in Sections 4.1, 4.3, and 4.4.2 of Lappin (1988) place tight constraints on the possibility of recharge to the Rustler Formation presently being active at the WIPP site.

A recent, detailed hydrogeologic study (Holt et al., 1989) presents additional evidence that the Rustler Formation and its water-bearing units are not now receiving recharge. The results of this study support the concept that the Rustler Formation in the WIPP site area has not been recharged for at least 10,000 years. This conclusion is supported by the results of isotopic studies presented by Lambert (1983, 1987) and Lambert and Harvey (1987).

Recharge to the waste disposal horizon would require the infiltration and percolation of precipitation from the surface and through the overlying sedimentary sequence. The hydrologic investigations discussed above demonstrate that this is not occurring at the WIPP facility.

It is concluded from these investigations that infiltration of precipitation and recharge to either the facility disposal horizon or the water-bearing units of the overlying Rustler Formation is not sufficient to cause the future migration of hazardous constituents to the accessible environment during the Test Phase. It is also concluded that the waste will not come into contact with infiltrating precipitation and groundwater recharge during the Test Phase.

6.0 Site Hydrology and Water Quality

6.1 Surface Hydrology

Surface water is generally absent at the WIPP site. The nearest large surface water body, Laguna Grande de la Sal, is located about 8 miles west-southwest of the WIPP site in Nash Draw where shallow brine ponds occur. The only other surface water is the Pecos River, which is 14 miles southwest of the WIPP site at its closest point. Small man-made livestock water holes ("tanks") occur several miles from the WIPP site, but are not hydrologically connected to the formations overlying the WIPP facility. The source of water in these tanks is runoff from precipitation (Hunter, 1985). Additional detail on the surface water hydrology of the WIPP site area is presented in Appendices D6 and D7 of Chapter D, Facility and Process Information.

6.2 Subsurface Hydrology

Several water-bearing zones have been identified and extensively studied near the WIPP facility. Limited amounts of potable water are found in the Dewey Lake Redbeds and the overlying Triassic Dockum Group several miles south and east of the WIPP facility. Two water-bearing units, the Culebra and Magenta Dolomites, occur in the Rustler Formation and produce brackish to saline water in the vicinity of the site. Another saline water-bearing zone that occurs west of the site beneath Nash Draw is the so-called "Brine Aquifer" at the Rustler-Salado contact. These water-bearing horizons, which occur above the Salado Formation, are described below, but do not represent useable aquifers at the site due to their very poor water quality and low yields. Brine and gas occurrences in the Salado and Castile Formations are also described.

6.2.1 Hydrology of the Castile Formation

The Castile Formation is composed of a sequence of three thick anhydrites separated by two thick halites. This formation acts as an aquitard, separating the Salado Formation from the underlying water-bearing sandstones of the Bell Canyon Formation (DOE, 1990b). Except for the isolated brine reservoirs locally found in the fractured anhydrites, very little hydrologic data are available from the Castile Formation (Mercer, 1987). In the halite zones, the occurrence of circulating groundwater is restricted because halite at these depths does not readily maintain porosity, open fractures, or solution channels. Drill stem tests conducted in the Castile Formation show the permeability of the anhydrite and salt beds underlying the WIPP facility to be negligible, and in most tests, values for permeabilities were too low to be determined accurately with conventional methods. Based on the limitations of the instrumentation used to measure these very low permeabilities, a conservative estimate for permeability would be less than 0.1 microdarcy (Mercer, 1987).

No regional groundwater flow system is present in the Castile Formation. The only significant water present in the formation occurs in isolated brine reservoirs in fractured anhydrite. The brine occurrences are described in several reports (Popielak et al., 1983; Mercer, 1983; Griswold, 1980; DOE, 1990a, 1990b). Geochemical data (Lappin, 1988) support the hypothesis that the brines represent trapped Permian seawater that is now halite saturated and in equilibrium with the host rock. Therefore, these brine reservoirs are not increasing in volume or pressure, are unconnected with other aquifers or the surface, and have little potential to dissolve the host rocks or move through them. The regional and local hydrogeology of the Castile Formation is presented in Appendix D7. The structural and dissolution characteristic of the Castile are discussed in detail in Appendix D9.

6.2.2 Hydrology of the Salado Formation

The massive halite beds within the Salado Formation host the WIPP facility emplacement horizon at a depth of 2,150 feet BGS. The Salado Formation represents a regional aquiclude due to the hydraulic properties of the bedded halite that forms most of the formation. In the halites, the presence of circulating groundwater is restricted because halite does not readily maintain primary porosity, solution channels, or open fractures. During the mapping that was conducted as part of the construction of the Waste Handling, Exhaust, and Air Intake Shafts, the halites of the Salado Formation did not produce any observable fluid inflow (Holt and Powers, 1984, 1986, 1990). In addition, significant brine flows have not been encountered in hydrologic testing from the surface (Lappin, 1988).

Limited hydrologic testing has been conducted in the past within the Salado Formation, but hydrologic characterization investigations are currently in progress. The results of the permeability testing, within the underground facility, are generally consistent with a permeability

of the undisturbed salt mass that is approximately 0.001 to 0.01 microdarcy, with no distinguishable strata variability (Lappin, 1988). Published results of "successful" hydrologic tests of the Salado from the surface indicate permeabilities from approximately 0.01 microdarcy to a high of 25 microdarcies. Later evaluation of the tests indicated that the data from the Salado in Well DOE-2 are the most reliable, indicating a maximum permeability of 0.3 microdarcy (Mercer, 1987). Field testing of the Salado from the surface has had only limited success. The apparent causes of this are (1) the formation permeability appears to be below the testable minimum for the equipment used (approximately 0.01 to 0.1 microdarcy), and (2) hole aging during the time between hole completion and attempted testing of the Salado caused great difficulty in finding locations in the borehole that allowed successful setting of packers to isolate test intervals. Evaluation of all existing hydrologic test data from the Salado indicate that data from testing of undisturbed halite at the underground facility level is the most representative permeability data available. Hydrologic data from testing in the WIPP underground were used in hydrologic modeling presented in the WIPP No-Migration Variance Petition (DOE, 1990a). Such very low permeability values indicate that any fluid flow within the competent salt is extremely slow and would result in an imperceptible rate of fluid movement in conventional hydrologic considerations. The only significant variation to these extremely low permeabilities stated above occurs in the disturbed rock zone in the immediate vicinity of the underground excavation. Gas-flow permeability tests indicate a marked increase in the permeabilities within approximately 6 to 7 feet of the underground excavation (Stormont et al., 1987). This apparent increase in permeability is restricted to the disturbed zone immediately surrounding the excavation and is believed to be a result of near-field fracturing and possible matrix dilatancy due to stress relief associated with excavation. Stormont et al., (1987) also indicated that interpretation of their gas-flow permeability tests was complicated by uncertainties in the degree of saturation of the Salado, pressure threshold effects inherent in the testing techniques, and local inhomogeneities due to fracturing in the disturbed rock zone near the underground facility openings.

Marker Bed 139, an anhydrite unit which lies approximately 1 meter (approximately 3.28 feet) below the facility floor, exhibits increased permeability due to fracturing in the disturbed rock zone. Separation along these fractures in the floor of WIPP facility rooms and drifts may be quite large (several centimeters). Hydrologic testing in Marker Bed 139 at one location of the facility suggested that separate fracture systems existed and yielded transmissivity values of 10×10^{-6} to 2.2×10^{-6} square meters per second (approximately 6×10^{-4} to 1×10^{-3} square feet per day). Geotechnical evaluations have shown that Marker Bed 139 may be connected to the floors of rooms and areas excavated through fractures. However, pathways for brine and gas migration in the floor and in Marker Bed 139 are limited to zones directly below the excavations. In the pillars and away from the excavation outside of the disturbed rock zone, the anhydrite bed will not exhibit open fractures due to compressive loading and migration of fluid away from the excavation through marker Bed 139 is not expected. Should a spill reach Marker Bed 139, migration to overlying or underlying water-bearing units will not occur.

Salado Formation Brine and Gas Inflow

Minor quantities of gas and brine have been encountered in the salt beds of the WIPP facility excavation, as described in Deal and Case (1987) and Deal et al. (1987, 1989). The inflows of brine occur as "weeps" on the exposed surfaces of the underground workings and as accumulations in some of the boreholes drilled outward from the workings, most noticeably in the downholes. Gas (mostly nitrogen) is usually associated with the brine inflow and can be observed as gas bubbles in the brine occurrences. Moisture content measurements of the Salado host rock salt have been made as part of the Brine Sampling and Analysis Program (BSEP) (Morse and Hassinger, 1985). These measurements are based on the easily moved fluid content in the low range of temperatures (25° to 250°C or 77° to 482°F) as described in Deal et al. (1987, 1989). The BSEP has measured moisture content of more than 500 core samples representing different lithologies and different areas of the underground facility. The results of these measurements indicate that moisture content ranges from 0.01 to 6.67 percent (for one isolated clayey sample), with most samples less than 1 percent. Stratigraphic variations in moisture content were shown by Deal et al. (1987, 1989) to be related to the clay content of the units. Based upon the thickness of the various stratigraphic units, a weighted-average amount of brine that occurs naturally in the rock and is not bound crystallographically or sealed in fluid inclusions, is in the order of 0.1 to 0.6 percent by weight (up to 1.6 percent by volume) of the surrounding rocks (Deal et al., 1989). Most of the measured brine inflows in boreholes have ranged between a few tenths to a few hundredths of a liter per day. The liquid and gas movement observed in the walls, floors, and roofs of the excavated surfaces is believed to be the result of the pressure gradient caused by the excavation. Geochemical studies on the origin of the brines indicate that they originate as intergranular fluids with residence times within the Salado Formation of at least several million years (Stein and Krumhansl, 1986) and may have been resident since Permian time (Abitz et al., 1990; Deal et al., 1989). In addition, the variability found by Stein and Krumhansl (1986) of the compositions of fluid inclusions in salt near the WIPP facility workings is consistent with there being little or no vertical fluid movement. During the five-year Test Phase, the majority of the moisture entering the facility from the host rock will evaporate and be removed in the air circulated by the underground ventilation system (Deal and Case, 1987). Additional detail of the hydrogeology of the Salado Formation is presented in Appendices D7 and D10 of Chapter D, Facility and Process Information.

6.2.3 Hydrology of the Rustler-Salado Contact

The contact zone between the Rustler and Salado Formations at the WIPP site was tested in 20 cased and open drill holes (DOE, 1990b). In Nash Draw and areas immediately west of the site, the contact exists as a dissolution residue capable of transmitting water. Moving eastward from Nash Draw toward the WIPP site, the amount of dissolution decreases and the transmissivity of this interval decreases. All tests within the boundary of the WIPP site showed very low transmissivities, ranging from 3×10^{-5} to 3×10^{-3} square feet per day (Mercer, 1983).

6.2.4 Hydrology of the Culebra Dolomite

The Culebra Dolomite Member of the Rustler Formation has been studied extensively during the site characterization program. Because it is the most transmissive hydrologic unit in the WIPP site area, it is considered the most likely hydrologic pathway to the accessible environment for any potential contamination.

Mercer (1983) and Mercer and Orr (1977) provided detailed test results for a number of wells completed in the Culebra prior to 1983. Results for both single and multiwell hydrologic tests were presented by Beauheim (1986, 1987a, 1987b) and Lambert and Robinson (1983). These tests show that the Culebra Dolomite is a fractured, heterogeneous system with varying local anisotropic characteristics. Calculated transmissivities for the Culebra Dolomite within the WIPP site boundary have a wide range with values between 9×10^{-2} to approximately 69 square feet per day, with the majority of the values being less than 1 square foot per day (Beauheim, 1987b). Transmissivities generally decrease from west to east across the site area. A summary of Culebra hydrologic characteristics is presented in Lappin (1988), and detailed discussions are given in Appendices D6, D7, and D10 of Chapter D, Facility and Process Information.

Potentiometric surface maps have been constructed using water-level data (see Appendices D7 and D10). The Culebra Dolomite Member is heterogeneous and anisotropic, and the flow path of water moving through the Culebra Member is affected by fractures and variable water densities caused by compositional variability. Consequently, the regional direction of flow may have little or no relationship to local flow paths. An interpretation of flow direction in the Culebra Member is depicted in Figure E1-9. This map shows the most likely regional flow direction of groundwater in the Culebra Dolomite Member to be predominately to the south (LaVenue et al., 1988; Crawley, 1988). The flow directions were computed from variable density corrected potentiometric surfaces. The average linear velocity between the WIPP facility and the southern boundary of the WIPP site is 1.77×10^{-3} feet per day. The average linear velocity is based on the 15 wells that are within the WIPP site boundary.

6.2.5 Hydrology of the Magenta Dolomite

Because the Magenta Dolomite is generally much less permeable than the Culebra Dolomite at and near the WIPP site, less testing of the Magenta has been performed at the WIPP site. The hydrologic characteristics of the Magenta Dolomite Member were determined in 15 test holes in the area of the WIPP site. Transmissivities within the WIPP site boundary calculated from the results of these tests range from 1×10^{-2} to 3×10^{-1} square feet per day (Mercer, 1983). The results of recent testing of the Magenta Dolomite in wells H-14, H-16, and DOE-2 (Beauheim 1986, 1987b) indicated that transmissivities were 5.6×10^{-3} square feet per day for well H-14, 2.8×10^{-2} square feet per day for well H-16, and 1.0×10^{-3} square feet per day for well DOE-2 (see Figure E1-10 for well locations).

Water-level data have been collected and potentiometric surface maps constructed. The direction of groundwater flow at the WIPP site, as estimated from the potentiometric surface map, is west-southwest toward Nash Draw (Mercer, 1983). Potentiometric surface maps and additional detail on the hydrogeology of the Magenta Dolomite are provided in Appendices D6 and D7 of Chapter D, Facility and Process Information. The average hydraulic conductivity in the Magenta Dolomite at the WIPP facility was calculated from transmissivity and aquifer thickness values as 1.18×10^{-3} feet per day. The calculated hydraulic conductivity values and potentiometric contours were used to calculate average linear groundwater-flow velocity of the Magenta aquifer at the WIPP facility. The average linear velocity in the Magenta aquifer at the WIPP site is 3.18×10^{-5} feet per day.

6.2.6 Hydrology of the Dewey Lake Redbeds

Hydrologic investigations at and near the WIPP site have not identified a continuous zone of saturation within the Dewey Lake Redbeds. Where water is present in the formation, it is generally in small perched or semiperched water tables, and its occurrence is localized (Mercer, 1983). Several wells believed to be completed in the Dewey Lake Redbeds are located within several miles of the WIPP facility. These wells include Ranch Well, Barn Well, Twin Wells, Fairview Well, and Unger Well. Of these wells, one is used occasionally by a ranch house for drinking water (Barn Well) and the remainder supply water for livestock (Figure E1-10).

Four intervals of the Dewey Lake Redbeds were tested in drill holes at the WIPP site. Although no saturation was encountered during drilling, ten wells were completed as observation wells (Ward and Walter, 1983). The data obtained showed that there was no evidence of a zone of saturation in any of these wells. Additional data concerning the hydrogeologic characteristics of the Dewey Lake Redbeds are given in Lappin (1988) and Appendix D7 of Chapter D, Facility and Process Information.

6.2.7 Hydrology of the Dockum Group

At the WIPP site, exploratory holes were drilled through the Gatuna Formation and the Dockum Group. The Gatuna Formation and Dockum Group occur within 50 feet of the surface and little or no water was encountered in these formations. Only one hole reported a small zone of moisture in the Dockum Group, but observation wells completed in the Dockum Group were dry (Mercer, 1983). Two private wells (Comanche and Clifton Wells) located approximately 10 miles east of the WIPP site produce potable water from the Dockum Group, and they are used for livestock watering.

6.3 Water Quality

In addition to the study of site hydrology, surface and groundwater quality have been characterized for two major reasons: (1) to establish baseline levels of naturally occurring inorganic solutes, radionuclides, and potential organic contaminants in water prior to waste emplacement; and (2) to define the existing use in the area for ground and surface water as a supply for domestic, industrial, and livestock consumption. Evaluation of the WIPP site area hydrology and water quality data indicates that the existing and potential future use of groundwater is extremely limited due to nonsaturated conditions and very poor water quality. Table E1-1 lists the wells that have been sampled as part of the WIPP Water Quality Sampling Program (WQSP) and the formation sampled by each well. The well locations are shown in Figure E1-10. The subsections below describe the general quality of the groundwater that occurs in the WIPP site area. Groundwater quality data from the WQSP have been reported annually in water-quality data reports. These data are now included as part of the Annual Environmental Monitoring Report. The results of the WQSP can be found in Uhland and Randall (1986), Uhland et al. (1987), Randall et al. (1988), and Lyon (1989). Detailed discussions of water chemistry for the water-bearing units at the WIPP are given in Appendix D7 of Chapter D, Facility and Process Information.

Rustler-Salado Contact

Mercer (1983) provided data from 20 wells sampled in the WIPP vicinity from the Rustler-Salado contact. The highest concentrations of total dissolved solids (TDS) in the WIPP water-bearing formations were contained in the Rustler-Salado contact. TDS values ranged from 79,800 milligrams per liter (mg/ℓ) (approximately 2.6 ounces per quart) in well H-07b1 to 480,000 mg/ℓ (approximately 15.9 ounces per quart) in well H-01. Sulfates and chlorides of calcium, magnesium, sodium, and potassium made up the primary dissolved mineral constituents of this brine.

Culebra Dolomite

The water quality of the Culebra varies greatly. The TDS values range from 2,900 mg/ℓ (approximately 9.6×10^{-2} ounces per quart) at well H-08b to about 291,000 mg/ℓ (approximately 9.6 ounces per quart) at well WIPP-29. These two wells are fairly remote from the site, but even closer to the WIPP facility, a marked variation in water quality is observed. Well H-02a is located ½ mile west of the site and has a TDS of 13,500 mg/ℓ (approximately 4.5×10^{-1} ounces per quart), whereas Well H-15, which lies 2 miles east of the site, has a TDS of 231,000 mg/ℓ (approximately 7.6 ounces per quart). The chemical constituents consist predominantly of chlorides and sulfates of sodium, calcium, magnesium, and potassium.

Magenta Dolomite

The water-quality data for the Magenta Dolomite indicate that the water is saline to briney, with TDS values ranging between 5,460 to 270,000 mg/ℓ (approximately 1.8×10^{-1} to 8.9 ounces per quart). The predominant dissolved species are sodium, calcium, magnesium, chloride, and sulfate.

Surface Water

No surface water occurs in the immediate area of the WIPP site. Several surface-water bodies located within an approximate 25-mile radius of the site, such as the Pecos River, the Laguna Grande de la Sal, and livestock tanks which are fed from surface runoff, are sampled and monitored for water quality. Data were collected and reported as part of the WIPP Radiological Baseline Program, the Water Quality Sampling Program, and the Ecological Monitoring Program. Surface-water sampling is now conducted and reported as part of the WIPP Operational Environmental Monitoring Program (Mercer et al., 1989).

Surface-water samples have been collected at four surface-water bodies near the WIPP site. These sampling locations are: Hill Tank, Red Tank, Indian Tank, and Laguna Grande de la Sal-Laguna Tres (Figure E1-11). The water chemistry of the three tanks is similar and is a calcium bicarbonate type, having TDS less than 240 mg/ℓ. Laguna Grande de la Sal, a saline lake, contains water that is a sodium chloride type with a TDS concentration of 320,000 to 350,000 mg/ℓ (approximately 10.6 to 11.6 ounces per quart). Surface water quality data for these sampling locations are presented in Appendix D7 of Chapter D, Facility and Process Information.

7.0 WIPP Facility Design

The WIPP facility consists of surface and subsurface installations designed to receive, handle, and safely dispose of radioactive mixed waste underground. Several design features, particularly in the shafts connecting the surface and subsurface operations, are utilized to assure that groundwater and precipitation do not enter the facility and that no wastes will enter the local groundwater system during the five-year Test Phase. This section summarizes these design features of the WIPP facility.

7.1 Shaft Designs

The WIPP facility design includes four shafts. These are the Waste Shaft, the Salt Handling Shaft, the Exhaust Shaft, and the Air Intake Shaft (AIS). Each shaft includes a shaft collar, a shaft lining, and a shaft key section (DOE, 1990b).

The reinforced concrete shaft collars extend from the surface to the top of the underlying consolidated sediments. Each collar serves both to retain adjacent unconsolidated sands and soils and to prevent surface runoff from entering the shaft. The shaft linings extend from the base of the collar to the top of the salt beds approximately 850 feet below the surface. The shaft lining serves to inhibit water seepage into the shafts from water-bearing formations, such as the Magenta and Culebra Dolomite Members of the Rustler Formation. The liners are also designed to retain loose rock. The shaft liners are concrete except in the Salt Handling Shaft, in which a steel shaft liner has been grouted in place.

The shaft key is a circular reinforced concrete section emplaced in each shaft below the liner in the base of the Rustler Formation and extending about 100 feet below and into the Salado Formation. The key functions to resist lateral pressures and to support the shaft liner. The key ensures the liner will not separate from the host rocks or fail under tension. This prevents the shaft from becoming a conduit for groundwater flow into the underground facility.

Two water-seal rings are incorporated in each key. The rings are separated by an 11-foot interval into which eight 2-inch-diameter pipes are inserted to monitor any water that may penetrate the upper ring. If groundwater is detected flowing past the upper ring, this condition is corrected by injecting chemical sealants or cement grouts to stop the leakage.

On the inside surface of each shaft, excluding the Salt Handling Shaft, there are three water-collection rings. The first is located just below the Magenta Dolomite interval, the second just below the Culebra Dolomite interval, and the last at the lowermost part of the key section. These collection rings function to collect any groundwater that may seep into the shaft through the liner. The groundwater would then be piped to the storage tanks located at the station. The water could either be used underground for dust control or would be transported to the surface in portable tanks for disposal (DOE, 1990b). At the present time, the AIS liner has not been grouted in place. Groundwater seepage from the Rustler Formation is collected by water rings and routed to mobile water holding tanks. These tanks are inspected and emptied periodically to ensure that they do not overflow. Therefore, overfilling and leakage from these tanks is not a source of water underground which could come into contact with the waste. Recent inflow measurements from the AIS indicate that total seepage is approximately 1.24 gallons per minute. On January 17, 1992, the NMED issued an approved Discharge Plan to expand the WIPP sewage facility. The discharge plan allows for the disposal of AIS brine waters in the evaporation lagoon and the expanded sewage facility.

7.2 Repository Seals

Upon closure of the WIPP facility, sections of the shaft liners may be removed and replaced by permanent shaft seals. Seals may also be placed in boreholes at the WIPP site, as well as in tunnels throughout the facility. These seals will function primarily to limit any seepage into the

facility from overlying water-bearing units or from infiltration from the surface. In addition, seals will help prevent any contaminated water in the facility from reaching the accessible environment.

√ The approaches to preliminary seal design and performance goals for the WIPP facility are described in detail by Stormont (1988). The general approach taken in the preliminary design
√ concepts for shaft and borehole seals at the WIPP facility is to limit the inflow of groundwater from formations above the facility level until the host rock and the backfill encapsulate the waste because of salt consolidation. Water from other sources, such as saturated interbeds near the facility horizon or from the host salt itself, may also enter the repository following decommissioning. Although these water sources are volumetrically less significant, the seal system will be designed to limit inflows and to inhibit the expulsion of contaminated brines through the shafts upon pressurization due to host formation consolidation. Seals will be emplaced throughout the facility to separate areas of the facility should human intrusion, (e.g., drilling) occur at some time greater than 100 years following decommissioning. Existing boreholes will be sealed, thus, they are unlikely to become significant flow paths. Therefore, borehole seals provide some additional assurance that dissolution will be minimized.

8.0 Waste Containment

√ The Test Phase of the WIPP Project is scheduled to take several years to complete. During the Test Phase, the sealed bin-scale test waste containers will be emplaced in the storage rooms of Panel 1. Waste containers will be fully retrievable in case it is determined that removal or
√ relocation of the waste is necessary. The WIPP Project bin-scale contact-handled TRU waste tests are to be performed over the duration of the Test Phase to gain a better understanding of waste interactions due to differing degradation modes, waste forms, and repository conditions. The experiments are intended to obtain data under various controlled conditions such as different material classifications and compositions, age, compaction ratios, backfill and gettering materials, added brine type and amount, temperature, and atmospheric conditions. The data to be collected during these tests relate to both single and combined effects of gas generation phenomena with
√ respect to short-term and long-term waste isolation at the WIPP facility. Gas generation is anticipated under differing conditions to be produced by corrosive, bacteriological, and radiolytic reactions with the waste components. The data will be used to better define the nature of long-term and short-term gas composition, production, transport, and consumption in the WIPP facility. Additional tests will be performed to define more precisely the rate of natural brine inflow from the host rock to the underground facility.

The sealed test bins will isolate the waste from contact with any available brine and will preclude the possibility of any hazardous constituent migrating into a water-bearing unit either above or below the repository horizon. Shipment of the test bins to the WIPP facility will be in a Standard Waste Box (SWBs) inside of the U.S. Nuclear Regulatory Commission-certified Transuranic Package Transporter (also called a TRUPACT-II) shipping container. Upon arrival at the WIPP

facility, additional preparation activities for the test bins will be performed. These activities include modification of the SWB to create an RCB, connection of test-bin instrumentation, and modification of the test-bin internal environment (e.g., argon purge, oxygen gettering, etc.). The RCB will act as a secondary containment structure surrounding each test bin. Proper sealing of the bin lid will be assured by reviewing the records associated with bolt tightening to verify that the proper torque was applied.

Verification of proper bin assembly and secondary containment by the RCB will add an extra margin of safety to ensure that migration of hazardous waste or hazardous constituents from the test rooms is unlikely. The brine added to test bins will neither be capable of dissolving the host salt, nor will it be added to any container in sufficiently large quantities to reach and contaminate the Culebra Dolomite Member or other water-bearing units, should it leak from the containers (Molecke, 1990a; Molecke and Lappin, 1991).

The Waste Acceptance Criteria (WAC) for TRU waste (Westinghouse, 1989) destined for disposal at the WIPP site specifically control the inclusion of constituents that are chemically incompatible. Strict control of explosives, pyrophorics, gas generators, heat generators, and corrosives is covered in the WAC and reduces the potential for waste releases due to accidents or container breaches in the facility subsequent to placement. Limits on respirable particulates in the waste (less than 1 percent by weight) reduces the quantities of harmful materials that could be released due to accidents. All materials shipped and emplaced in the WIPP facility must meet these stringent requirements for stability, compatibility, and physical form to ensure the safety of the repository even in the unlikely event that waste comes into contact with the Salado Formation during the Test Phase.

9.0 Summary and Conclusions

Release of hazardous waste or hazardous constituents from the WIPP site to the accessible environment via groundwater during the Test Phase is unlikely. The most transmissive hydrologic unit in the WIPP area, and the most likely groundwater transport pathway, would be the Culebra Dolomite Member, a water-bearing stratum in the Rustler Formation overlying the underground facility. The natural characteristics of the site and the design of the WIPP facility ensure that there is no potential of hazardous waste or hazardous constituents reaching the Culebra Dolomite and subsequently affecting the accessible environment during the Test Phase. These characteristics include site geology, site hydrology, climate, and groundwater utilization in the WIPP area, as well as the WIPP shaft designs and the waste container configuration used during the Test Phase.

The inapplicability of RCRA groundwater monitoring requirements during the Test Phase at the WIPP facility is determined based on the information provided in the previous sections of this document. The major points used in this determination are:

- The facility horizon is located 2,150 feet below the land surface in the Salado Formation which is composed mainly of bedded salt. The salt acts as a very low permeability regional barrier isolating the facility from water-bearing units above and below. The Castile Formation underlying the Salado Formation is also a very thick, low-permeability evaporite unit that further isolates the facility from underlying water-saturated units.

- There appears to be little or no infiltration of precipitation deeper than the most shallow
✓ surface soils at the WIPP site, and no shallow perched saturated zones have been detected at the site.

- The possibility of groundwater reaching the underground facility in quantities capable of transporting waste up the shafts to the Culebra Dolomite or other water-bearing units is unlikely. During the Test Phase, small brine seeps from the Salado Formation will evaporate in circulating air in the facility. The shafts do penetrate water-bearing units
✓ but the shaft design incorporates features designed to minimize and control groundwater inflow to the facility and to divert any inflow for collection and disposal.
✓ Tests with brine added to the waste containers will not contaminate groundwater should
✓ any leaks occur. The volumes of brine to be added to test bins will be too small to flow to the Culebra Dolomite Member, and test designs that include secondary containment features will prevent any leakage of brine from the test bins.

✓ • The waste container design and the open rooms will ensure complete control and containment of the waste throughout the Test Phase.

- No migration pathways or hydraulic gradients exist for the transport of contaminants from the disposal facility level via groundwater to the accessible environment during the
✓ Test Phase. During the Test Phase, the natural hydraulic gradients of all surrounding
✓ water-bearing units are toward the facility, making migration of contaminants from the
✓ facility horizon to the nearest aquifer impossible.

✓ • Groundwater quality in the vicinity of the WIPP facility, particularly in the Rustler and Rustler-Salado Formations contact water-bearing zones, is generally poor. Thus, groundwater from these water-bearing zones is not a resource for domestic, irrigation, or livestock use. The major groundwater resources in the area, the Capitan and Ogallala aquifers and surface water, are not hydrologically connected with the WIPP
✓ underground facility or water-bearing units overlying the WIPP facility.

This document serves as a demonstration that the RCRA groundwater monitoring requirements
✓ are not applicable to the WIPP facility because they are unnecessary to meet or demonstrate
✓ compliance with environmental performance standards, as described in HWMR-6, Pt. V,
✓ sec. 264.601. The groundwater protection information provided demonstrates that, to the best

of DOE's knowledge, migration via groundwater of hazardous waste or hazardous constituents emplaced in the WIPP facility during the Test Phase to pose a threat to the environment is unlikely. The facility provides effective isolation of hazardous waste or hazardous constituents from groundwater sources that would be the most likely pathways to the accessible environment. Because DOE is seeking to demonstrate that migration of hazardous waste or hazardous constituents to any water-bearing formations at the WIPP site is unlikely, there can be little potential for hazardous waste or hazardous constituents to move via these water-bearing formations to water supply wells (domestic, industrial, or agricultural) or to surface water. Groundwater monitoring, as mandated by RCRA, is not required at this time.

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TABLES

TABLE E1-1

WELLS SAMPLED AS PART OF THE WATER QUALITY SAMPLING PROGRAM

WELL NAME	WATER-BEARING UNIT	WELL NAME	WATER-BEARING UNIT
DOE-1	Culebra	H-14	Culebra
DOE-2	Culebra	H-17	Culebra
H-02a	Culebra	H-18	Culebra
H-03b1	Magenta	P-14	Culebra
H-03b3	Culebra	P-17	Culebra
H-04c	Magenta	Barn Well	Dewey Lake
H-04b	Culebra	Clifton Well	Santa Rosa
H-05c	Magenta	Comanche Wells	Santa Rosa
H-05b	Culebra	Engle Well	Culebra
H-06c	Magenta	Fairview Well	Dewey Lake
H-06b	Culebra	Mobley Ranch Well	Culebra
H-07b1	Culebra	Poker Trap	Culebra
H-08b	Culebra	Ranch Well	Dewey Lake
H-09b	Culebra	Unger Well	Dewey Lake
H-11b3	Culebra	USGS-1	Culebra
H-12	Culebra		

FIGURES

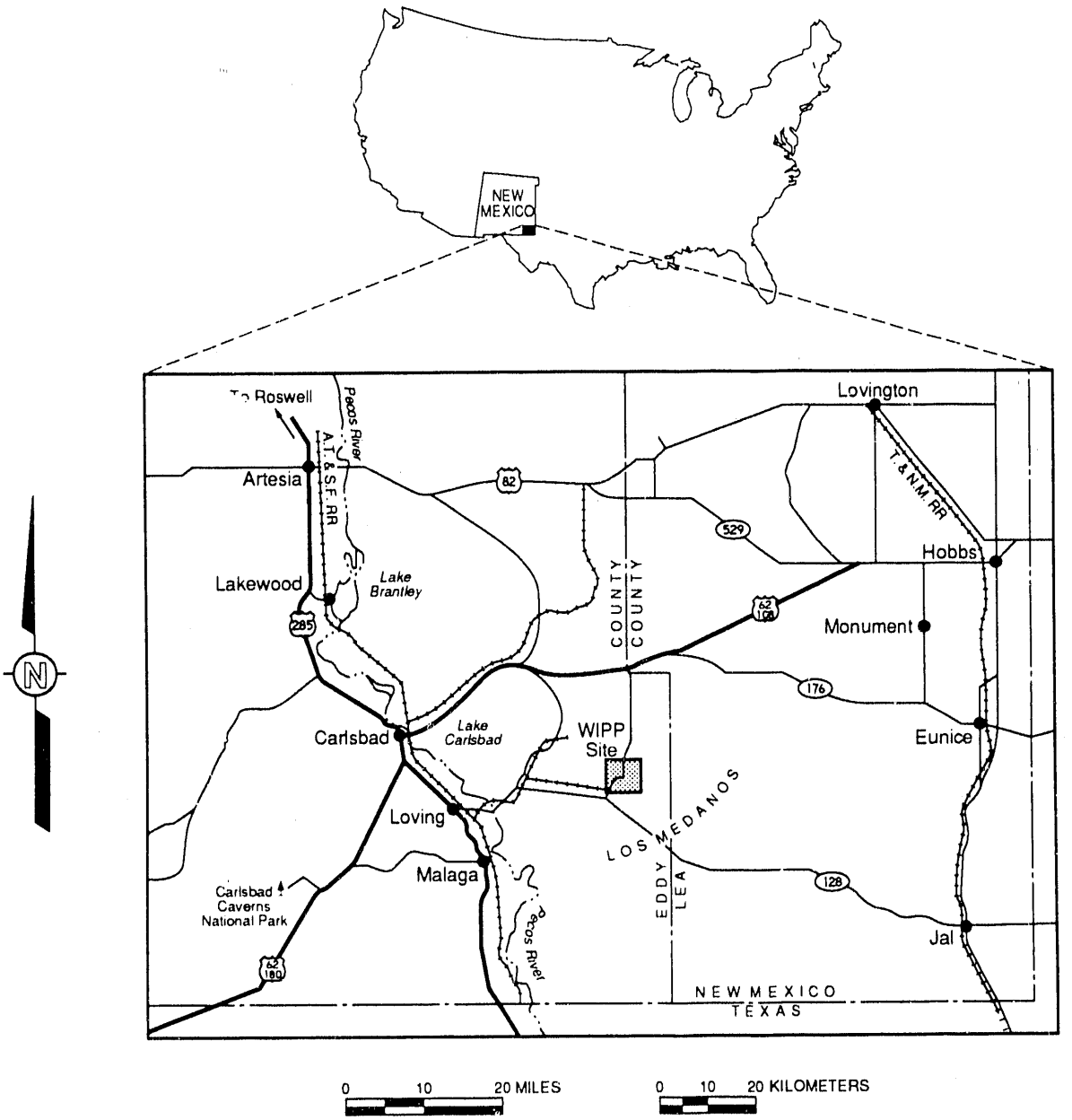
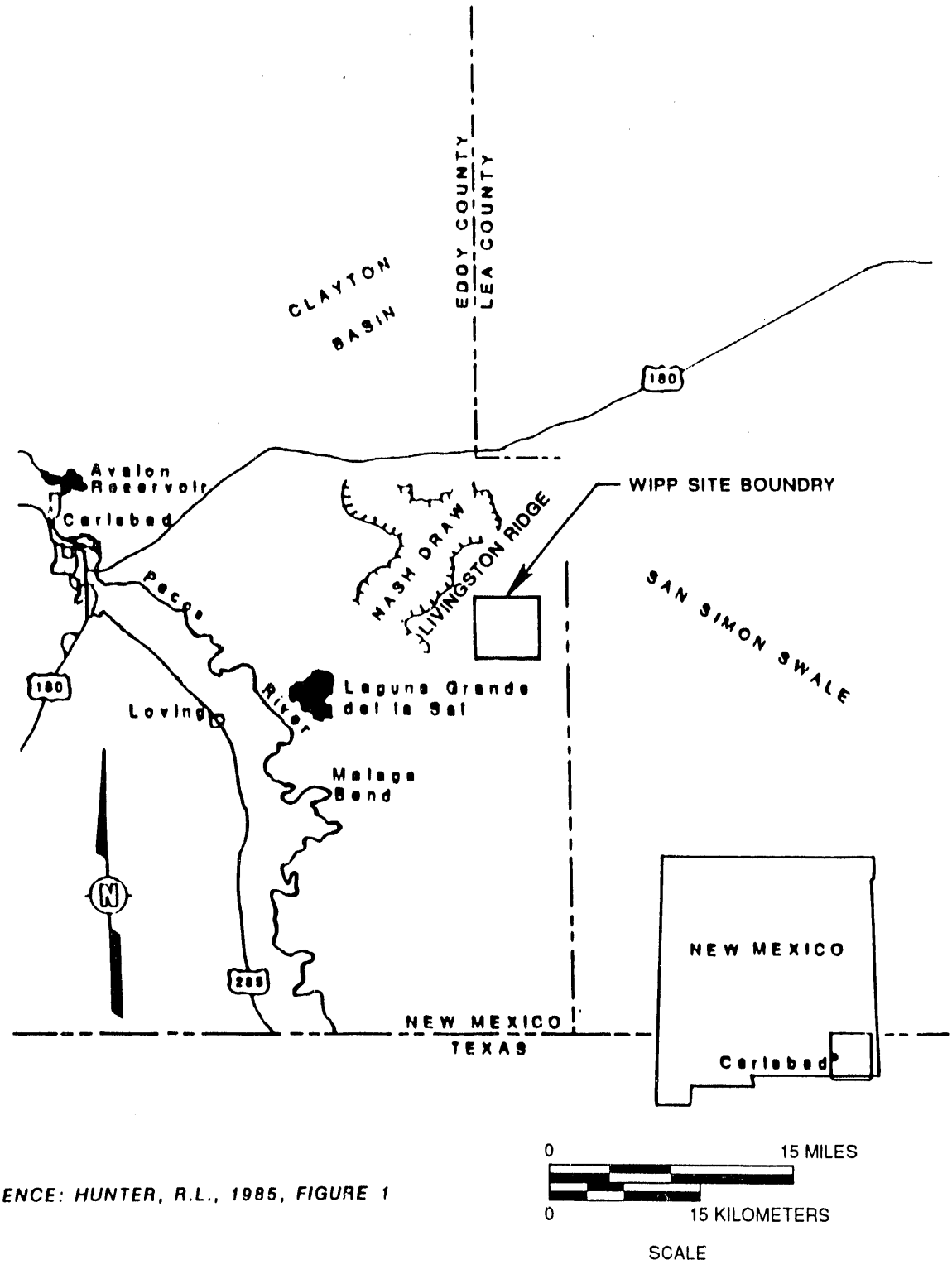


FIGURE E1-1 LOCATION OF THE WIPP SITE



REFERENCE: HUNTER, R.L., 1985, FIGURE 1

FIGURE E1-2 GENERALIZED PHYSIOGRAPHIC SETTING OF THE WIPP FACILITY

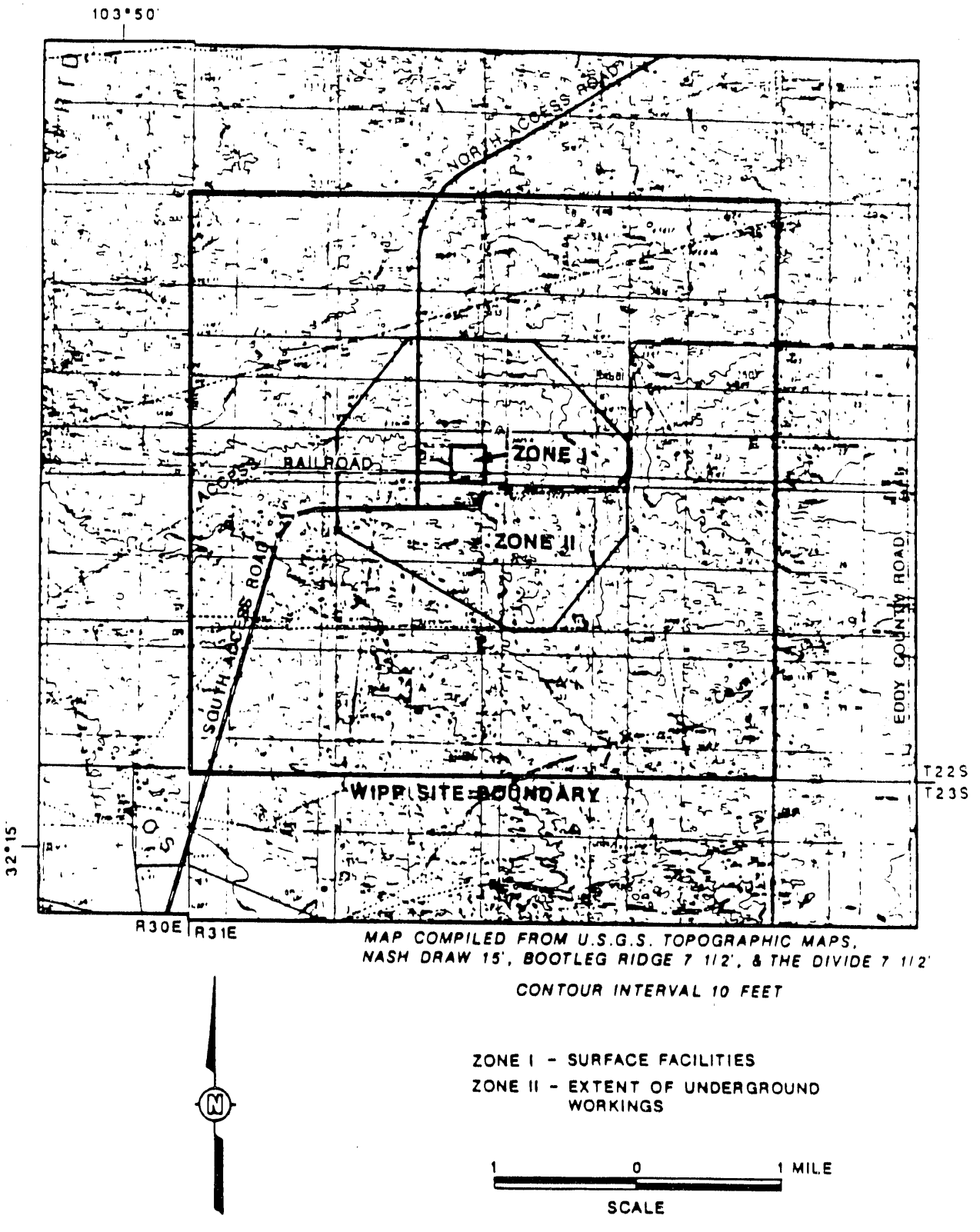


FIGURE E1-3 WIPP LOCATION AND BOUNDARIES

SYSTEM	SERIES	GROUP	FORMATION	MEMBER
RECENT	RECENT		SURFICIAL DEPOSITS	
QUATER-NARY	PLEIST-OCENE		MESCALERO CALICHE	
			GATUNA	
TRIASSIC		DOCKUM	UNDIVIDED	
PERMIAN	OCHOAN		DEWEY LAKE RED BEDS	
			RUSTLER	Forty-Niner
				Magenta
				Tamarisk
				Culebra
				Unnamed
			SALADO	Upper
				McNutt
				Lower
			CASTILE	
	GUADALUPIAN	DELAWARE MOUNTAIN	BELL CANYON	
			CHERRY CANYON	
			BRUSHY CANYON	

Geologic Column Representative of WIPP Facility Area

REFERENCE: POWERS et al., 1978. COOPER AND GLANZMAN, 1971

FIGURE E1-4 STRATIGRAPHIC COLUMN AT THE WIPP SITE

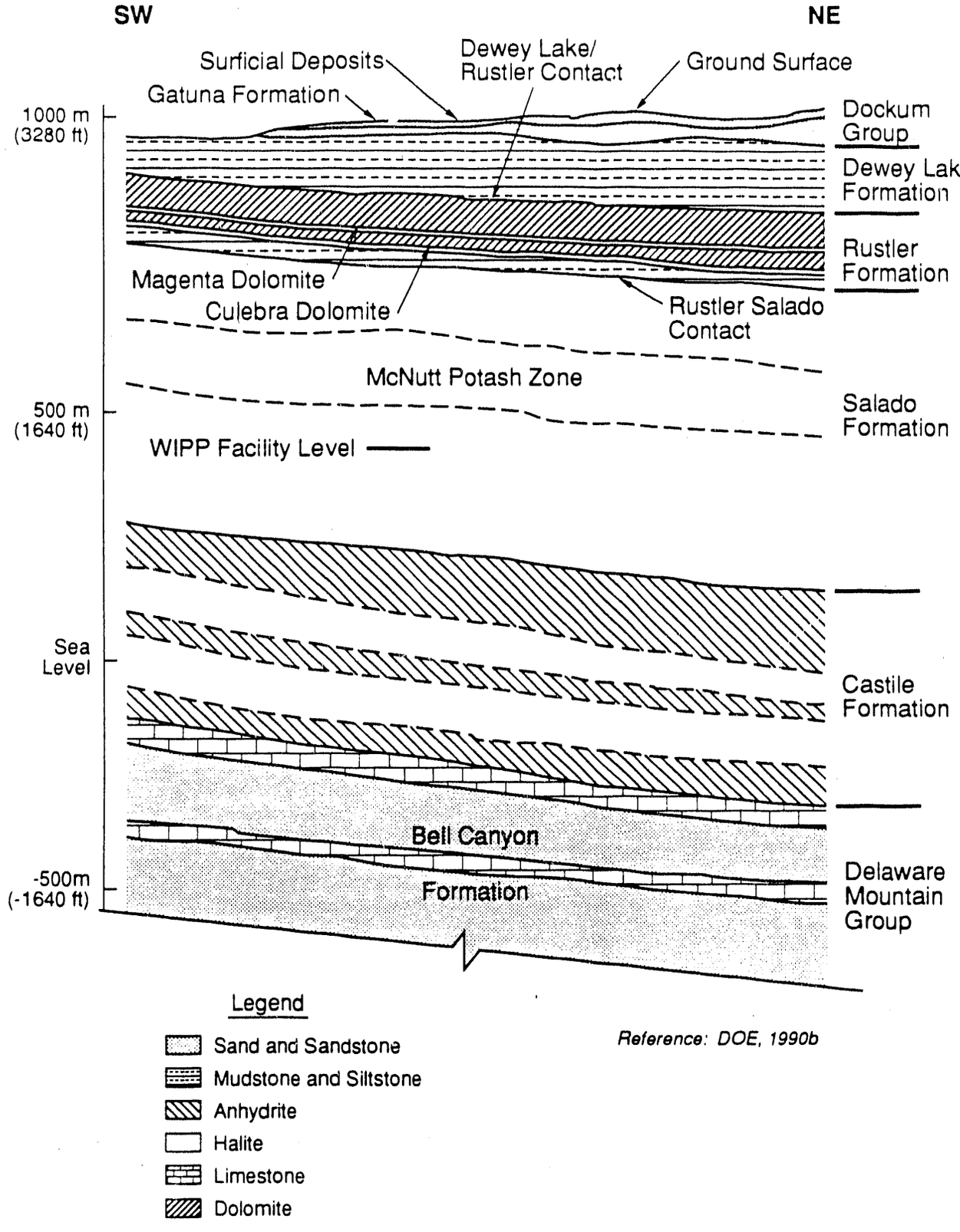


FIGURE E1-5 GENERALIZED STRATIGRAPHIC CROSS SECTION

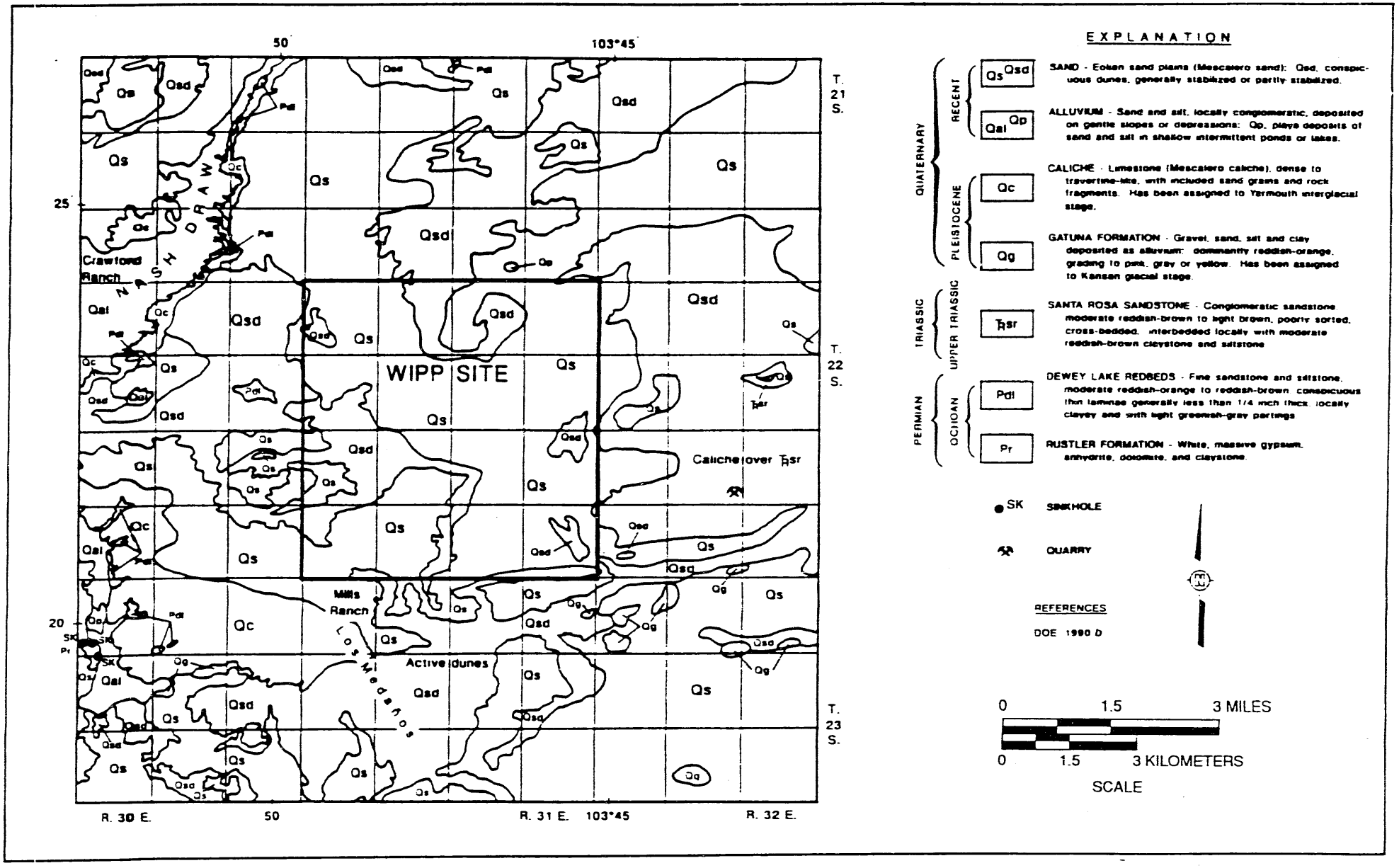
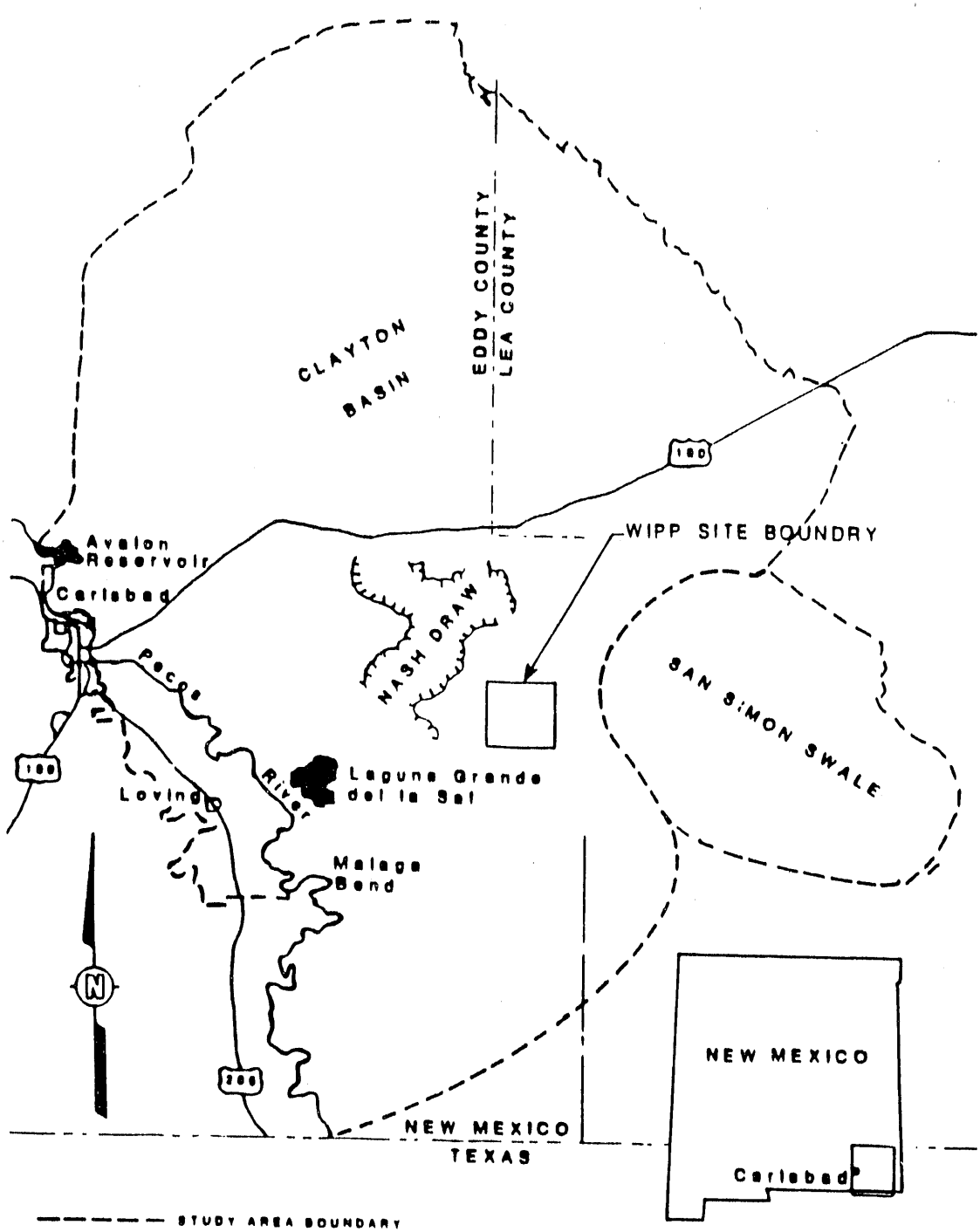


FIGURE E1-6 MAP OF SURFICIAL GEOLOGY



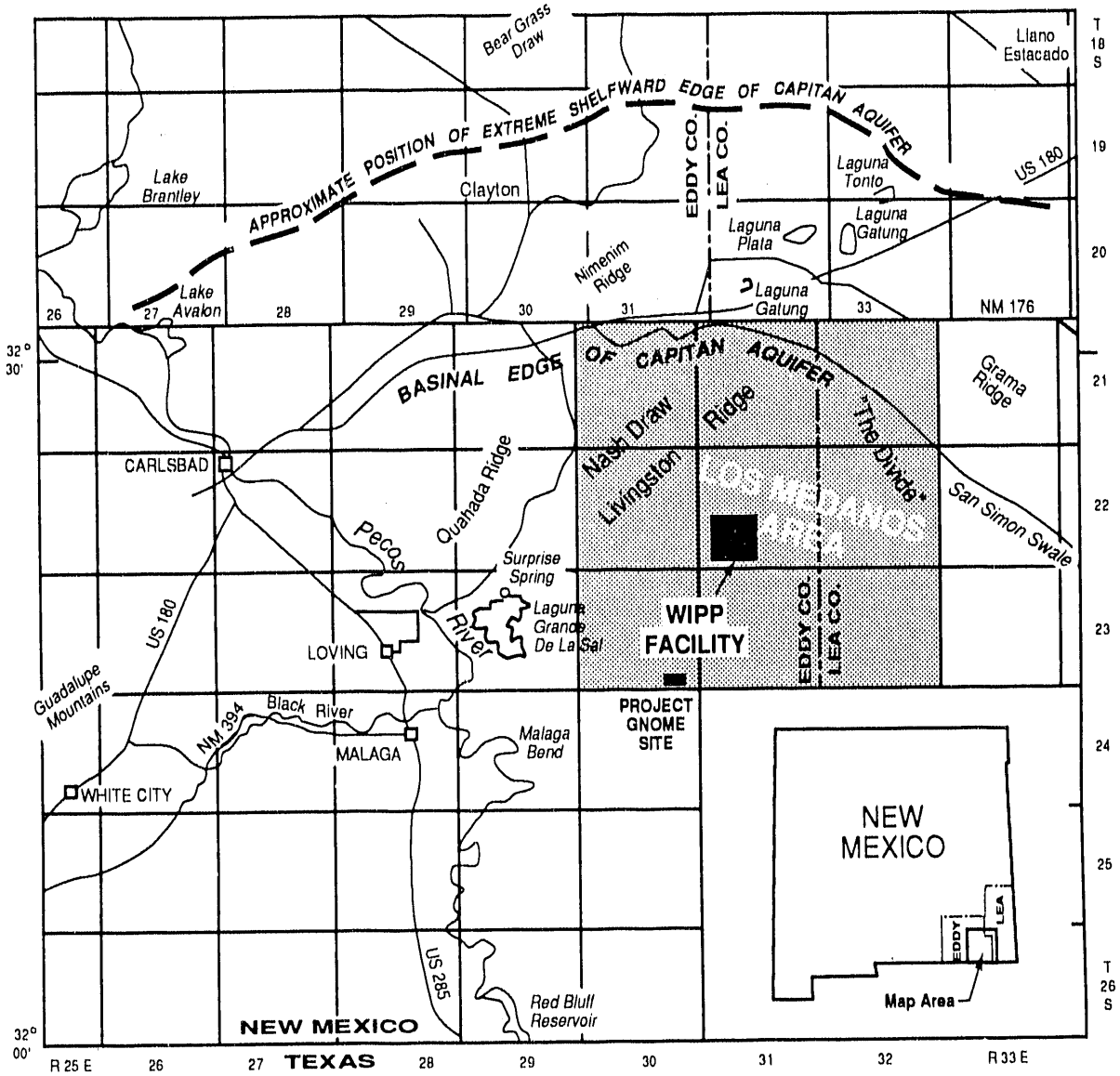
REFERENCE: HUNTER, R.L., 1985, FIGURE 1

0 15 MILES

0 15 KILOMETERS

SCALE

FIGURE E1-7 STUDY AREA FOR THE WIPP WATER-BALANCE STUDY



REFERENCE DOE, 1990 b

FIGURE E1-8 WIPP LOCATION AND SURROUNDING FEATURES CONTRIBUTING TO WIPP WATER BALANCE

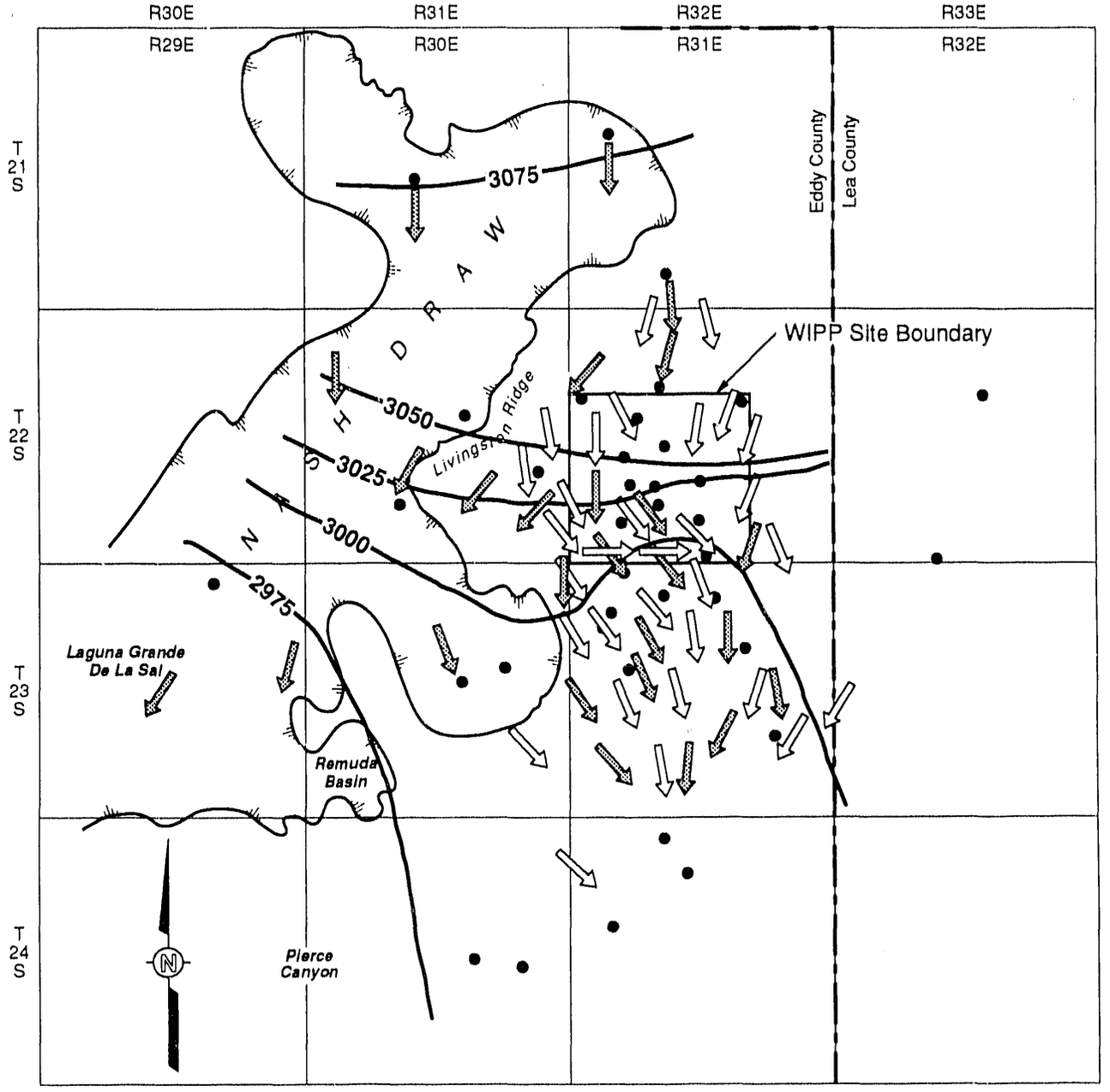
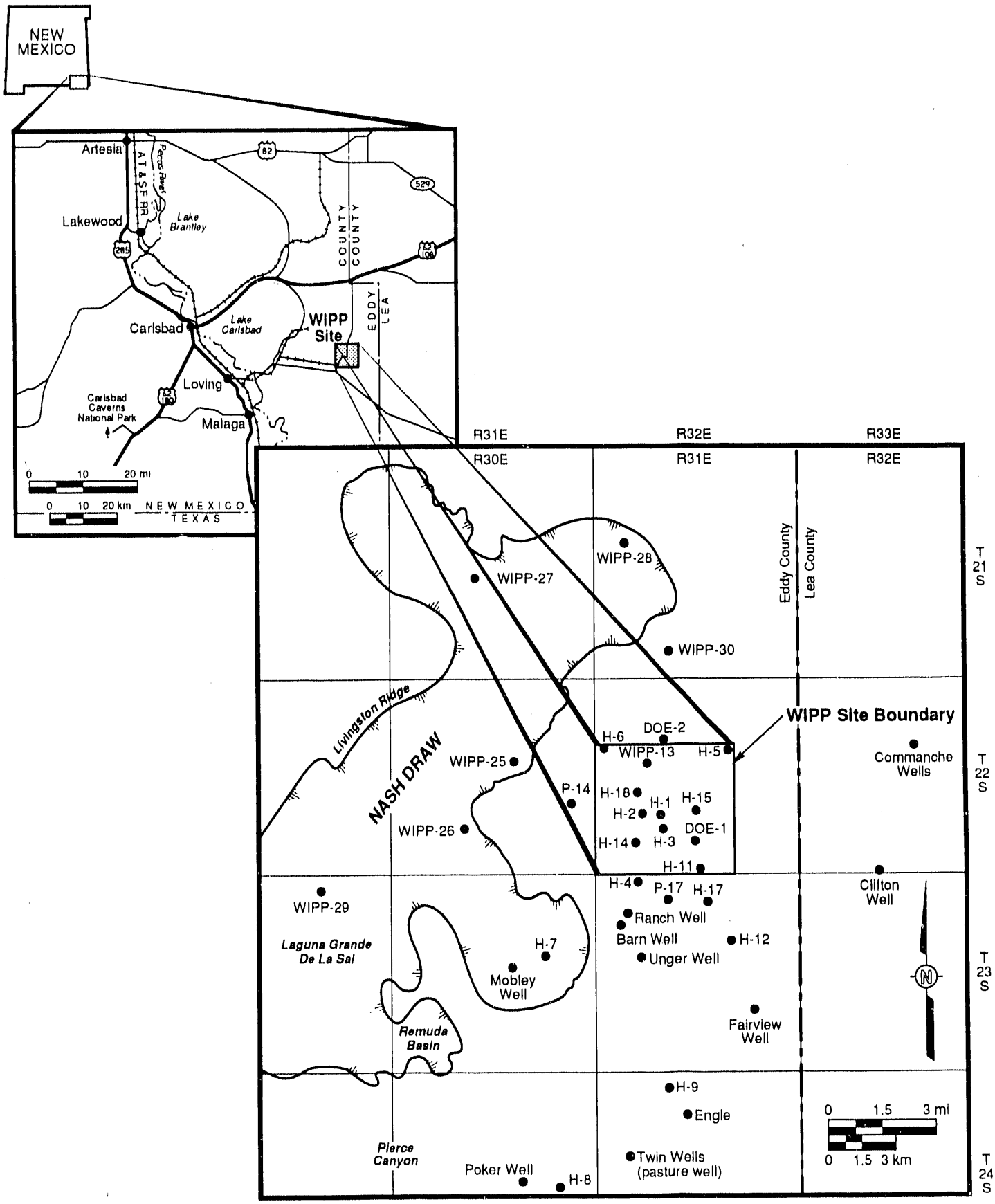
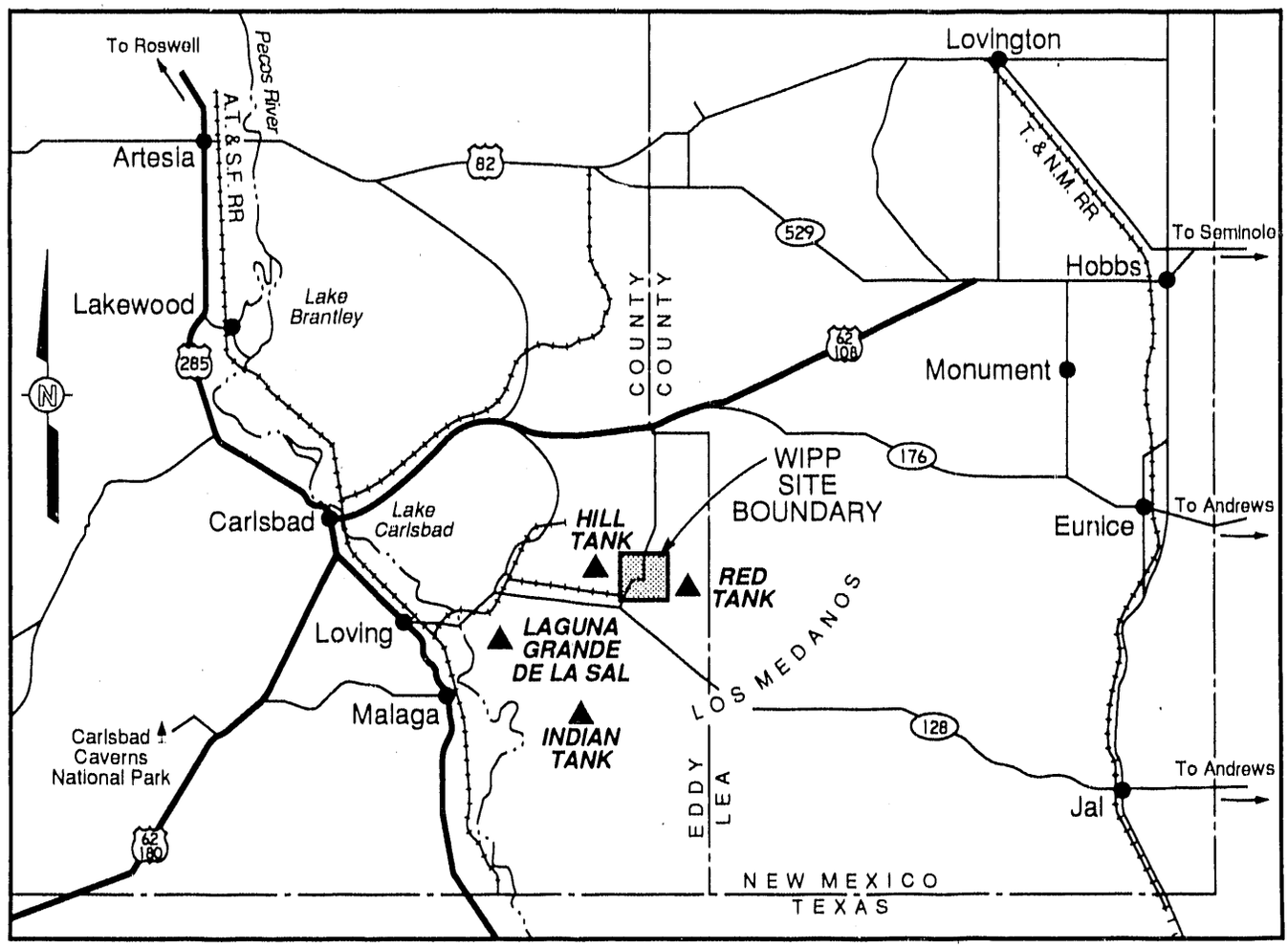


FIGURE E1-9 CALCULATED GROUND WATER FLOW DIRECTIONS
CULEBRA DOLOMITE MEMBER OF THE RUSTLER FORMATION



Reference: Randall et al., 1988

FIGURE E1-10 GROUND WATER SAMPLING AND PRIVATE WELL LOCATIONS



Reference: Fischer, 1988

0 10 20 MILES 0 10 20 KILOMETERS

▲ SURFACE WATER AND SEDIMENT LOCATIONS

FIGURE E1-11 SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

APPENDIX H1

LIST OF JOB TITLES

APPENDIX H1
LIST OF JOB TITLES

RCRA Position Title	WIPP Section
Shaft Tender	Hoisting Operations
Senior Shaft Tender	Hoisting Operations
Hoisting Operation Specialist	Hoisting Operations
Supervisor, Hoisting Operations	Hoisting Operations
Manager, Hoisting Operations	Hoisting Operations
Senior Engineer	Hoisting Operations
Senior Operations Engineer "B"	Facility Operations
Senior Engineer	Facility Operations
Shift Supervisor	Facility Operations
Manager, Facility Operations	Facility Operations
Waste Handling Technician	Waste Handling Operations
Senior Waste Handling Technician	Waste Handling Operations
Waste Handling Specialist	Waste Handling Operations
Senior Waste Handling Specialist	Waste Handling Operations
Senior Operations Engineer "B"	Waste Handling Operations
Associate Operations Engineer	Waste Handling Operations
Manager, Waste Handling	Waste Handling Operations
Health Physics Technician	Operational Health Physics
Senior Health Physics Technician	Operational Health Physics
Health Physics Specialist	Operational Health Physics
Senior Health Physics Specialist	Operational Health Physics
Manager, Operational Health Physics	Operational Health Physics
Quality Assurance Specialist	Inspection Services and QA Records
Senior Quality Assurance Technician	Inspection Services and QA Records
Quality Assurance Technician	Inspection Services and QA Records
Manager, Inspection Services and QA Records	Inspection Services and QA Records
Quality Assurance Analyst	Inspection Services and QA Records
Technical Assistant	Inspection Services and QA Records
Manager, Quality Assurance Engineering	Quality Assurance Engineering
Quality Assurance Engineer	Quality Assurance Engineering
Senior Quality Assurance Engineer	Quality Assurance Engineering
Senior Engineer	Quality Assurance Engineering
Senior Engineer "B"	Quality Assurance Engineering

APPENDIX H1
LIST OF JOB TITLES
(CONTINUED)

	RCRA Position Title	WIPP Section
1	Emergency Services Technician	Safety and Plant Protection
2	Manager, Safety and Plant Protection	Safety and Plant Protection
3	Emergency Services Coordinator	Safety and Plant Protection
4	Scientist, Environmental Permits and Programs	Environmental Permits and Programs
5	Principal Engineer	Environmental Strategic Planning
6	Senior Engineer	Environmental Strategic Planning
7	Technical Assistant	Environmental Analysis and Compliance
8	Engineering Technician	Environmental Analysis and Compliance
9	Experimental Technician	Environmental Analysis & Compliance
10	Senior Engineer	Environmental Analysis & Compliance
11	Senior Engineer "B"	Environmental Analysis & Compliance
12	Associate Scientist	Environmental Analysis & Compliance
13	Senior Scientist "B"	Environmental Analysis & Compliance
14	Utility Technician	Maintenance Operations
15	Maintenance Technician	Maintenance Operations
16	Supervisor, Maintenance Operations	Maintenance Operations
17	Manager, Maintenance Operations	Maintenance Operations
18	Maintenance Specialist	Maintenance Operations
19	Senior Maintenance Specialist	Maintenance Operations
20	Assistant Engineer	Environmental Monitoring
21	Training Coordinator	Technical Training
22	Manager, Technical Training	Technical Training
23	Associate Engineer	Quality Assurance Programs
24	Senior Quality Assurance Engineer	Quality Assurance Programs
25	Quality Assurance Specialist	Quality Assurance Programs
26	Senior Engineer "B"	Radiological Engineering
27	Senior Engineer	Radiological Engineering
28	Health Physics Specialist	Radiological Engineering
29	Associate Operations Engineer	Transportation & Hazardous Materials Handling
30	Senior Engineer "B"	Transportation & Hazardous Materials Handling
31	Senior Operations Engineer	Transportation & Hazardous Materials Handling
32	Utility Technician	Transportation & Hazardous Materials Handling
33	Manager, Transportation and Hazardous	Transportation & Hazardous Materials Handling
34	Maintenance Technician	Transportation & Hazardous Materials Handling

APPENDIX I1

MEMORANDUM OF UNDERSTANDING BETWEEN THE UNITED STATES DEPARTMENT OF ENERGY, WIPP PROJECT OFFICE, AND THE UNITED STATES DEPARTMENT OF THE INTERIOR, NEW MEXICO STATE OFFICE, BUREAU OF LAND MANAGEMENT, 1983

MEMORANDUM OF UNDERSTANDING

BETWEEN

UNITED STATES
DEPARTMENT OF ENERGY
WIPP PROJECT OFFICE

AND

UNITED STATES
DEPARTMENT OF THE INTERIOR
NEW MEXICO STATE OFFICE, BUREAU OF LAND MANAGEMENT

This Memorandum is effective the 29th day of June, 1983, between the U.S. Department of Energy (hereinafter called "DOE"), represented by the Project Manager, Waste Isolation Pilot Plant (WIPP) Project Office and the Bureau of Land Management, U.S. Department of the Interior (hereinafter called "BLM"), represented by the State Director, New Mexico BLM and concurrence by the Secretary of the Interior.

WITNESSETH THAT:

WHEREAS, DOE desires to develop the Waste Isolation Pilot Plant (WIPP), research and development facility to demonstrate the safe disposal of radioactive waste materials generated in defense programs; and

WHEREAS, this activity is authorized by Public Law 96-164, "Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980," Project 77-13-f; and

WHEREAS, public lands, as described in Appendix 1, "Legal Description" of lands withdrawn, identified for the development of the WIPP facility are lands administered by the BLM except for the 640 acres in the DOE Exclusive Use Area which are reserved for the exclusive use of the DOE; and

WHEREAS, the BLM Resource Management Plan (Appendix 2) concerning these public lands calls for the management of these lands in a manner consistent with protection of the site for development of the WIPP facility; and

WHEREAS, this Agreement is consistent with the policies set forth in the Federal Land Policy and Management Act of 1976, 43 U.S.C.-1701 et seq.; and

WHEREAS, this agreement is consistent with the administrative land withdrawal application filed by the DOE for construction of the WIPP facility and protection of the WIPP site;

NOW THEREFORE, the parties hereto agree as follows:

1. Facility Development

a. DOE is authorized to proceed with the development of the Waste Isolation Pilot Plant (WIPP) as described in the Final Environmental Impact Statement on the project (DOE/EIS-0026) and WIPP Safety Analysis Report during the period preceding enactment of a legislative land withdrawal for the herein described public domain lands. However, approval to conduct any action on lands administered by the BLM will be obtained by the DOE from BLM prior to initiation of that action.

b. The environmental impact of this action and the mitigation measures to be employed as part of the action authorized under this Memorandum of Understanding are reported in the documents cited in Section 1a, above.

c. State and Federal permits and approvals required to conduct the actions authorized under this Memorandum shall be obtained by the DOE. Copies of the applications and permits shall be transmitted to the BLM.

d. The Roswell District Manager, BLM, shall be provided with Waste Isolation Pilot Plant (WIPP) summary schedules and shall be notified as in 2f below.

e. No radioactive materials other than radiological instruments normally used for non-destructive testing and geophysical logging will be transported to or used on the site during the term of the administrative withdrawal unless specifically authorized by the Secretary of the Interior.

2. Site Protection

a. The withdrawal will close the lands to applications and proposals for land use that could result in the transfer of title to the surface and subsurface estate. Such applications and proposals will not be accepted by the BLM.

b. The BLM shall immediately notify the DOE of any request for permits to drill on existing mineral leases within the withdrawal area in order that DOE may initiate condemnation actions.

c. The DOE withdraws any objection to leasing, drilling and mining outside the withdrawal area; however, the BLM will notify the DOE of any requests for permits for resource recovery activities within one mile of the WIPP site boundary.

d. The BLM shall not allow any habitation within one mile of the outer edge of the withdrawal area and will place a "no-habitation" (no permanent inhabitants) stipulation on all leases within this one-mile buffer zone.

e. The BLM shall authorize DOE to enter BLM administered lands adjacent to the withdrawal area for emergency decontamination purposes.

f. The Roswell District Manager shall be provided with a draft copy of all project specifications and/or Request for Bid packages involving surface disturbing activities outside the exclusive use area not less than 30 days prior to finalization of the specification and/or Request for Bid packages. This is necessary so that resource protection stipulations can be included in each authorization for DOE use of BLM administered lands. Modification of a BLM approved DOE action will not be made by DOE or its subcontractor(s) without BLM concurrence if the modification involves a surface disturbing activity.

g. BLM shall submit comments relative to the approval for land use to the Project Manager, DOE, within 15 days of BLM's request receipt of DOE's request for approval or modification as identified under 2f above.

h. Allowance of applications and proposals for land use other than those described in part 2a above, that are subject to the discretion of the Secretary of the Interior shall be subject to comments by the DOE. Notification of the DOE as to the consideration of such applications and proposals shall be made by the Roswell District Manager, BLM.

i. DOE shall submit comments relative to the allowance of applications and proposals for land use to the Roswell District Manager, BLM, within 15 working days of DOE's receipt of notification by the BLM under part 2h above.

3. Stipulations

a. DOE will comply with the BLM stipulations contained in Appendix 3.

4. Administration

a. This Memorandum of Understanding will be administered on behalf of DOE by the Project Manager, WIPP Project Office, DOE/ALO, P.O. Box 5400, Albuquerque, NM.

b. This Memorandum of Understanding will be administered on behalf of the BLM by the State Director, BLM, New Mexico State Office, P.O. Box 1449, Santa Fe, NM.

5. Term

a. The parties to this Memorandum of Understanding may negotiate revisions after a 30-day written notice by either party. This Memorandum supercedes all existing agreements and shall continue in effect unless and until it is terminated by agreement of the parties hereto or is terminated by either party upon 30 days written notice to the other.

IN WITNESS WHEREOF, the parties hereto have executed this Memorandum of Understanding on the respective dates indicated.

BUREAU OF LAND MANAGEMENT
U.S. DEPARTMENT OF THE INTERIOR

By _____

Date June 14, 1983

U.S. DEPARTMENT OF ENERGY

By _____
J. D McGough, Project Manager

Date June 10, 1983

Concurrence:

Assistant Secretary of the Interior

/s/ Garrey E. Carruthers

By _____

JUN 17 1983

Date _____

APPENDIX 1

LEGAL DESCRIPTION

Lands Withdrawn

Federal Lands (Public Domain)

T22S - R31E		Acres
DOE Exclusive Use Area		
Section 20	SE 1/4	160
Section 21	SW 1/4	160
Section 28	NW 1/4	160
Section 29	NE 1/4	160
BLM Managed Surface Area		
Section 15	All	640
Section 17	All	640
Section 18	All	640
Section 19	All	640
Section 20	W 1/2 and NE 1/4	480
Section 21	NW 1/4 and E 1/2	480
Section 22	All	640
Section 27	All	640
Section 28	E 1/2 and SW 1/4	480
Section 29	SE 1/4 and W 1/2	480
Section 30	All	640
Section 31	All	640
Section 33	All	640
Section 34	All	640
Total		8960

State lands within withdrawal area

T22S - R31E		Acres
Section 16	All	640
Section 32	All	640
Total		1280

Total acreage within withdrawal area boundary 10240

APPENDIX 2

RESOURCE MANAGEMENT PLAN FOR LANDS UNDER THE BLM/DOE MEMORANDUM OF UNDERSTANDING FOR THE WASTE ISOLATION PILOT PLANT

This Resource Management Plan summarizes actions and activities which will be authorized by BLM to take place on the public lands administered by BLM within the withdrawal area, and except for those actions and activities that are mutually determined to be inconsistent with the mission of WIPP, this RMP also applies to the DOE exclusive use area which will be administered by DOE. This plan takes into account any recommendations for management of these lands as outlined in the BLM's East Eddy/Lea Management Framework Plan (MFP) and the Rangeland Management Program of April 1980, as revised in January 1981.

Minerals

Oil and Gas--One 80 acre tract of the public lands within the BLM Managed Surface Area is leased for oil and gas development. DOE will be notified in the event that an application to drill is submitted by the lessee. BLM concurrence will be withheld until comments are received from DOE.

Potash--The MFP decision was to continue to process all potash leases within the Economic Reserve Areas. The exception was to hold lease applications within the WIPP withdrawal until such time as the provisions of the withdrawal are accepted or rejected. Therefore, the leases in this zone will not be processed.

Sand, Gravel and Caliche--There are saleable deposits of caliche and sand and gravel within this area. Sales or free use permits will be made on an "as needed" basis to support the WIPP, road building, adjacent oil and gas development.

Realty and Lands

Applications and proposals for land uses, that could result in the transfer of title to the surface and subsurface estate, will not be accepted by the BLM.

Allowance of applications and proposals for land uses, other than those described above that are subject to the discretion of the Secretary of the Interior, will be subject to comments by the DOE. Notification of the DOE as to the consideration of such applications and proposals shall be made by the BLM authorized officer.

All proposals for land uses shall be submitted to the Roswell District Manager, BLM, for review, comment and authorization. In order for resource protection activities to be carried out as an integral part of each action, BLM "standard stipulations" and/or "Special Stipulations" shall be made a part of all land use authorizations, as applicable.

Range Management

Grazing will continue as recommended in the MFP outside the DOE fenced area. Range management will attempt to improve forage production on the allotments in order to attain maximum productivity of the range.

This area is located on two grazing allotments, the J. C. Mills allotment, No. 7032, and the Kenneth Smith allotment, No. 7027. The Mills allotment is currently being run under a management plan whereas the Smith allotment has no formal mangement plan. A plan will be formalized in the future for the Smith allotment. Grazing will be administered as outlined in the Rangeland Management Program of April 1980 as revised in January 1981.

Several range monitoring studies are located on the two grazing allotments within the boundaries of this area. These studies will continue.

Future projects will be implemented as needed, including possible chemical brush control. DOE will be allowed to review the proposed range improvements and submit comments.

Wildlife

This area will be managed to protect existing wildlife resources. In particular, this is an area of heavier-than-usual raptor nesting. The Harris hawk, a species which is declining nationwide, is a common nester here. Raptor nests and broadleaf trees are to be protected primarily because of this, as recommended by the MFP.

In certain locations, wildlife water is nonexistent or available only to certain species. Methods such as bird ramps, pipeline waters and dirt tank enclosures may be implemented in the future to improve habitat.

Threatened or Endangered Species

This area is not considered to be habitat for any Federally listed threatened or endangered plant or animal species.

Cultural Resources/Paleontology

The BLM will retain all management responsibilities for cultural resources and paleontological resources in this area. All potential impacts to these resources, which are attributable to the WIPP Project in general, will be assessed by the BLM. The BLM will then develop appropriate mitigation plans for these resources in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. Mitigation plans will be implemented by the DOE under the direction of the BLM.

Recreation

Except as set forth in the physical access sub-section of this plan, the lands will continue to be designated as "open" to recreational use by the public. Hunting, sightseeing and off-road vehicle use will continue to be the major recreational uses of the area.

No developed recreation sites are planned for the area.

Off-Road Vehicles

Except as set forth in the physical access sub-section of this plan, the area will continue to be designated as "open" to off-road vehicle use.

Physical Access

Physical protection of the DOE exclusive use area is deemed necessary. The DOE is responsible for controlling the entry of unauthorized personnel and the transport of unauthorized personal property into the DOE exclusive use area.

Wilderness

No land within this area is suitable for wilderness designation as defined by the 1964 Wilderness Act.

Visual Resources Management (VRM)

This area is managed as a Class IV VRM area.

Fire

The BLM will continue to be responsible for wildland fire suppression efforts on public lands in this area. DOE is assigned the responsibility to take initial attack effort on any fire within this area until BLM can relieve them.

Watershed

The BLM does not expect to engage in any major watershed management projects in the area. Watershed management will be limited to brush control, rehabilitation areas, etc.

Air Quality

Air quality for this area will be managed consistent with existing laws and regulations.

Prime and Unique Farmlands

No prime and unique farmlands exist within this area.

General

Upon request, DOE or their contractors will supply BLM with a copy of any studies or reports done in connection with the WIPP Project.

The Resource Management Plan for lands under the BLM/DOE Memorandum of Understanding for the WIPP Project withdrawal is hereby approved by the two agencies.

Department of the Interior
Bureau of Land Management
Roswell District

Richard Gaskin
Associate District Manager

Date 6/13/1983

Department of Energy
Albuquerque Operations Office
WIPP Project Office

Roger Dutcher for
J. H. McGough, Project Manager

Date June 10, 1983

APPENDIX 3

BLM STIPULATIONS FOR WIPP ADMINISTRATIVE WITHDRAWAL

DOE agrees to comply with the following stipulations to the satisfaction of the BLM Roswell District Manager or his authorized representative.

1. All projects and/or facilities authorized by previous Cooperative Agreements and/or Memorandum of Understanding shall be either maintained to acceptable BLM standards and/or design standards or will be removed. If removed, rehabilitation of the sites will be prescribed by BLM.

2. DOE will remove caliche and/or other mineral material only from BLM approved sites. DOE will submit a pit development and rehabilitation plan to BLM and receive BLM approval prior to the removal of any caliche. The pit plan will include estimated depth, lateral extent of mining, estimated quantity of material to be removed, and restoration/rehabilitation methods.

3. DOE will sign applications for Bureau of Land Management Free Use Permits for the borrowing of caliche, sand, gravel and other construction materials in such quantities as may be reasonably required for this project. WIPP Site contractors shall be responsible for locating the source, obtaining and completing applications, processing applications and complying with all Bureau of Land Management requirements. The DOE's sole responsibility will be limited to signing properly compiled applications for Free Use Permits.

4. To protect livestock DOE will either maintain the barbed wire fence surrounding the area previously identified as the Drilling Fluid Disposal Area or, if necessary remove the old fence and reconstruct a new barbed wire fence surrounding the same Fluid Disposal Area now identified as a Sanitary Landfill Area. Fence will be constructed to BLM's standard Type A-11 special 4-strand barbed-wire fence specifications.

5. DOE will provide BLM, Roswell Office, with WIPP technical specifications and drawings.

6. DOE will dispose of vegetation in accordance with the design specifications.

7. Unless BLM approval to close a road is given, DOE will keep all roads open to public access outside the DOE fenced area.

8. The DOE plan for mitigation of all adverse impacts to cultural resources generated by this project will be reviewed and approved by the BLM Roswell District Manager or his authorized representative.

9. Upon completion of SPDV surface disturbing operations, DOE will comply with the following rehabilitation measures:

a. Restoration of caliche pits and their access roads; i.e., ripping, leveling, and reseeding with seed mixture #2 (sandy sites). If pit is required for future use, restoration may be waived by the BLM.

b. All roads and pads constructed in conjunction with SPDV that are no longer needed for SPDV or WIPP require ripping, leveling, and reseeding with seed mixture #2 (sandy sites). Specific roads and/or pads to be rehabilitated will be identified by the Roswell District Manager or his authorized representative in consultation with DOE. Rehabilitation will be initiated by January 1, 1985.

10. If the WIPP site is abandoned for any reason, DOE will comply with the following rehabilitation measures:

a. Restoration of caliche and/or other mineral material pits and their access roads, i.e., ripping, leveling and reseeding with seed mixture #2 (sandy sites). If pits are required for future use, restoration may be waived by BLM.

b. All salt from the stockpile shall be removed from the site surface.

c. The salt stockpile base shall be ripped, leveled, mixed with soil and reseeded with seed mixture #2 (sandy sites). DOE shall make provisions to return this soil to basically original conditions.

d. The stripping stockpile areas shall be ripped, leveled, mixed with soil, and reseeded with seed mixture #2 (sandy sites).

e. All roads and pads constructed in conjunction with WIPP may require ripping, leveling, and reseeding with seed mixture #2 (sandy sites). Specific roads and pads to be rehabilitated will be identified by the Roswell District Manager or his authorized representative during project phase-out.

f. All fences constructed in conjunction with the project may require removal.

g. Abandonment of the surface facilities, including support facilities such as power lines, etc. and underground facilities shall be done by DOE in accordance with all applicable laws, rules, and regulations in effect at the time. BLM recommended procedures for underground work derived from similar abandonments in the known potash area will be considered. In the areas where surface facilities are removed, the areas shall be ripped, leveled, mixed with soil and reseeded with seed mixture #2 (sand sites).

11. Physical access will be controlled in accordance with the DOE site physical access plan which has been approved by the BLM.

APPENDIX J1

SOLID WASTE MANAGEMENT UNIT (SWMU) CHARACTERIZATION SHEETS

001 MUD PITS

Unit Type:	Mud Pits
Unit Use:	Storage/Settling
Operational Status:	Decommissioned
Use Period:	1970s-1980s
Materials Managed:	Solid Waste
Hazardous Release:	None
Radioactive Release:	None
Information source(s):	Seward, 1982 USGS, 1978 Winstanley and Carrasco, 1986

Unit Description

Refer to Figure J-1 for location. Approximately 46 decommissioned mud pits are located on 28 drill pads at the WIPP facility. They were used for settling drill cuttings out of the drilling fluids being used in drilling holes to support hydrologic testing and monitoring, potash evaluation, and drilling for hydrocarbons. Each mud pit was approximately 100 feet by 50 feet by 5 feet. Diesel fuel was added to the drilling mud to reduce dissolution of the water soluble rocks and to help lubricate the drill rods. It is not known how many of the wells were drilled using diesel in the drilling mud. Each mud pit was lined with a plastic sheet and used for one to two months during drilling, then allowed to dry out. To facilitate drying, holes were cut in the bottom of the liner. Once a pit was dry, it was covered with the soil that had been removed to make the berms and then graded to the original contours. The individual mud pits in SWMU No. 001 are listed on Table J1-1. It is difficult to determine the exact location of most of the mud pits because of the grading and revegetation that has taken place.

Many of these mud pits were the result of exploration activity that was conducted prior to the selection of the area for the WIPP facility and, therefore, were not created by DOE in support of the WIPP Project. All such locations are indicated in Table J1-1

Waste Description

Materials in the mud pits consisted of sodium- and potassium chloride-saturated brine to which starch, bentonite gel, and diesel fuel were added; drill cuttings; metal cuttings; trace amounts of hydraulic fluid, grease, and motor oil; and the plastic liner.

Release Information

Potential releases from each of the drill sites occurred when the mud pits were drained by cutting holes in the liner. The materials released consisted of saturated brines, which are not considered hazardous under RCRA. All of the solids confined in the plastic liner of the mud pits were buried when the pits were covered with soil and graded.

TABLE J1-1
SWMU DATA - MUD PITS

SWMU	LOCATION[1]	HOLE #	# OF PITS[2]	PERIOD OF USE	WELL STATUS	SIZE OF DRILL PAD (ACRES)
001-a	SW, NE, NE, 29	H-1	1	5/76 - 6/76	Open	8
001-b	SW, NE, NW, 29	H-2a H-2b1 H-2b2 H-2c	3	2/77 & 5/84 2/77 7/83 & 5/84 2/77 & 8/83	Sampled once/yr. Sampled once/yr. Open Open	3
001-c	NE, NE, SE, 29	H-3b1 H-3b2 H-3b3	3	8/76 & 4/86 11/83 1/84	Sampled once/yr. Open Sampled once/yr.	3
001-d	SE, NE, NE, 15	H-5a H-5b H-5c P-21	2	6/78 6/78 6/78 10/76	Open Sampled once/yr. Sampled once/yr. Plugged	3
001-e	NW, NW, NW, 18	H-6a H-6b H-6c P-13	2	7/78 7/78 6/78 9/76	Open Sampled once/yr. Sampled once/yr. Plugged	6
001-f	SE, NE, SE, 33	H-11b1 H-11b2 H-11b3 P-9	2	8/83 11/83 1/84 9/76	Open Open Sampled once/yr. Plugged	1
001-g	SW, SW, SW, 29	H-14 P-1	2	9/86 8/76	Sampled once/3 yrs. Plugged	1
001-h	NE, NE, NE, 28	H-15	1	10/86-11/86	Sampled once/3 yrs.	1
001-i	NE, NW, NW, 20	H-18	1	11/87	Sampled once/3 yrs.	1
001-j	SE, SE, SW, 20	P-3	1	8/76-9/76	Plugged	1/2
001-k	SE, SW, SE, 28	P-4	1	8/76-9/76	Plugged	3/4
001-l	SE, SE, SE, 17	P-5 WIPP-12	3	9/76 11/78 & 10/85	Plugged Open	6
001-m	SW, SW, NW, 30	P-6	1	9/76	Plugged	1
001-n	SW, SW, SW, 31	P-15	1	10/76	Plugged	1
001-o [3]	NW, NE, SW, 15	Badger Unit	1	1974	Plugged	2
001-p [3]	SW, NE, SW, 34	Cotton Baby	1	1973-1974	Plugged	3
001-q	SE, SE, SE, 28	DOE-1	2	1982	Open	3

TABLE J1-1
SWMU DATA - MUD PITS
(CONTINUED)

SWMU	LOCATION[1]	HOLE #	# OF PITS[2]	PERIOD OF USE	WELL STATUS	SIZE OF DRILL PAD (ACRES)
001-r [3]	NE, NE, SE, 34	D-123	1	Unknown (pre-1975)	Plugged	1/2
001-s	SE, SE, SE, 20	ERDA-9	1	4/76 - 6/76	Open	2
001-t [3]	SE, SE, SW, 30	IMC-374	1	Unknown (pre-1975)	Plugged	1
001-u [3]	NW, NW, NW, 20	IMC-376	1	Unknown (pre-1975)	Plugged	1
001-v [3]	SE, SE, SW, 22	IMC-456	1	Unknown (pre-1975)	Plugged	1
001-w [3]	SE, SW, SW, 27	IMC-457	1	Unknown (pre-1975)	Plugged	1
001-x	NW, NE, SW, 17	WIPP-13	2	8/78 & 10/85	Open	4
001-y	NW, NW, NW, 21	WIPP-18	2	4/78 & 10/85	Open	1
001-z	SW, SW, NW, 21	WIPP-19	2	5/78 & 10/85	Sampled once/yr.	1
001-aa	SW, NW, SW, 21	WIPP-21	2	5/78 & 10/85	Open	3
001-ab	NW, NW, SW, 21	WIPP-22	2	5/78 & 10/85	Open	1

1 All of the mud pits are in T22S, R31E. The location column gives the 1/4 of the 1/4 of the 1/4 of the section.
2 Probable number of mud pits. Many of the drill pads were used to drill several holes, requiring the use of more than one mud pit.
3 These are wells that were not drilled at the request of DOE; they were drilled for hydrocarbon and potash exploration.

002 SALT AND TOP SOIL STORAGE AREAS

Unit Type:	Storage Areas
Unit Use:	Storage
Operational Status:	Active
Use Period:	1981-present
Materials Managed:	Solid Waste
Hazardous Release:	None
Radioactive Release:	None
Information source(s):	Process knowledge Annual aerial photos Westinghouse, 1984

Unit Description

Refer to Figure J-1 for location. Two areas have been used for salt storage at the WIPP facility. The older area (002-a), located due east of Zone I, was active during the early excavation phases of the underground, starting in 1981. This area holds about 155,000 cubic yards of salt and covers about 7 acres. It was used until the main salt storage area (002-b) became active in April, 1984. This salt storage area, located north of Zone I, is still active, contains about 402,000 cubic yards of salt, and covers about 15 acres. Berms and a holding pond are used to control run-off from the main salt storage area, but just a berm is used for the older area.

Two other areas have been used to store top soil from the WIPP facility. The first area (002-c), first used in 1981, was located 470 feet due east of the Salt Handling Shaft and covered approximately three acres. Most of this stockpile has been covered by the expansion of Zone I; the east end of it is still visible at the eastern boundary of Zone I. A second area (002-d), located on the east side of SWMU No. 002-a, has been used since 1981 to store the top soil removed to clear the salt pile location. It covers about 3.1 acres.

Waste Description

Based on process knowledge, material stored at the salt storage sites is primarily salt with trace amounts of hydraulic oil, motor oil, diesel, and scrap steel. The impurities in the salt are from the heavy equipment used for excavation of the repository and transport of the salt to the salt pile. Material stored at the top soil storage areas is only top soil.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at these sites. There is an area of vegetation kill along the outer edge of the berm near the older salt storage area that appears to have been caused by the salt. The maximum extent of the vegetation kill was an area of approximately 50 feet by 100 feet. The vegetation kill area is decreasing in size as it recovers.

003 LANDFILLS

Unit type:	Landfill
Unit use:	Disposal
Operational status:	Active
Use period:	1976-present
Materials managed:	Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Annual aerial photos DOE, 1988 Flynn, 1989 Westinghouse, 1991a

Unit Description

Refer to Figure J-1 for location. Two areas have been used as landfills at the WIPP facility. The older location, called the Brinderson Landfill (003-a), is located 1 mile due south of Zone I. Prior to use as a landfill, the area was used as a quarry for road bed materials. It was an active landfill from 1976 to January 1988 and covers about 4 acres. The closure of the Brinderson Landfill was approved by the U.S. Department of Interior, Bureau of Land Management (BLM). Since it was closed, the Brinderson Landfill has been covered over and reseeded. The new landfill (003-b) is located 1/2 mile south of Zone I. The new construction landfill is actually two landfills. One, to the south of the current one, was excavated on BLM land and operated under a BLM permit until 1989. It was closed at the request of the BLM and a new landfill was opened on land designated by the BLM as part of the DOE Exclusive Use Area in Public Land Order 6403. Ground was first broken for the new landfill area in November, 1982; it is still active and covers about 15 acres. All necessary permits were obtained from the BLM for both landfills.

Waste Description

Both of the landfills have been used to bury construction debris consisting of foundation excavation soils, waste concrete, scrap wood, and metal. In addition, it has been reported that small amounts of non-construction debris (most likely office wastes) were dumped in the Brinderson Landfill. No asbestos materials are known to have been disposed of in the landfills. Administrative controls in WP 02-5, Nonradioactive Hazardous Materials Environmental Compliance Manual, prohibit the disposal of RCRA hazardous waste or hazardous constituents in the construction landfill (Westinghouse, 1991a).

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at these sites.

004 STORAGE YARDS

Unit type:	Storage Areas
Unit use:	Storage
Operational status:	Active
Use period:	1976-present
Materials managed:	Solid Waste
	Hazardous Waste
	Oils
Hazardous release:	Potential
Radioactive release:	None
Information source(s):	Process knowledge
	Annual aerial photos
	Sampling/laboratory analysis data
	Westinghouse, 1992a

Unit Description

Refer to Figure J-1 for location. Two areas outside of Zone I are presently used for storage. One storage yard, the portacamp (004-a), is located about 1,000 feet southeast of Zone I. The yard is used to store construction and maintenance materials, including approximately 100 drums of virgin petroleum products, and as temporary storage for wastewater and waste oils awaiting laboratory analysis. The waste oils are recycled if free of hazardous contamination. The area is approximately 2 acres in extent and has been active since 1976. The other area, the reclaimables yard (004-b), is located 1/2 mile due south of Zone I, just east of the new landfill (SWMU No. 003-b). The yard is about 1/2 acre in extent and is used as temporary storage for materials that can be recycled or reclaimed. It has been in use since February, 1987.

Waste Description

The wastes stored at the portacamp are water contaminated with motor oil, hydraulic oil, and diesel fuel from the vehicle wash bays; used hydraulic oil; used motor oil; glycol-based oils; used antifreeze; and discontinued oils. In 1987, the excess chemical grout from grouting the Exhaust Shaft and the Waste Handling Shaft was stored in this yard prior to being shipped off site for disposal as hazardous waste.

The materials in the reclaimables yard consist of used batteries, empty 55-gallon drums, and scrap metal. Some of the 55-gallon drums are used for fork-truck practice and are filled with caliche or lead pellets.

Release Information

There have been no releases of RCRA hazardous waste or hazardous constituents from either area; however, small areas of stained soil under the pallets where the virgin petroleum products are stored indicate there have been minor releases of oil and petroleum products (non-RCRA regulated materials) from the drums. Any releases from the area used for staging wastewater and waste oils are remediated as per the applicable WIPP facility procedure. Materials collected from the remediation activities are managed in accordance with procedures in WP 02-6 and 02-7 (Westinghouse, 1992a).

005 CONCRETE BATCH PLANTS

Unit type:	Concrete Batch Plants
Unit use:	Storage/Production
Operational status:	Decomissioned
Use period:	1984-1989
Materials managed:	Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge Annual aerial photos

Unit Description

Refer to Figure J-1 for location. Three areas at the WIPP facility have been used as temporary locations for cement batch plants. The first area (005-a) was located in the southeast corner of Zone I where the Waste Handling Building is now located. It was active from early 1984 to December, 1984. The second area (005-b) was located just west of Zone I and the main salt storage area (SWMU No. 002-b) and the evaporation pond (SWMU No. 007-c). It covers about 2 acres and was active from late 1988 to early 1989. Since the plant has been removed from this location the area has been reclaimed. The south of Zone I, next to the drill pad for well H-1 (SWMU No. 001-a). It covers about 5 acres, was active from January, 1985 to early 1987, and is currently used as an aggregate storage area.

Waste Description

Releases of RCRA hazardous waste or hazardous constituents have not occured at these sites. The waste consists of small amounts of spilled concrete and possibly trace amounts of motor oil and grease that leaked from the trucks and equipment.

Release Information

The only releases from these sites consist of spillage that occurred during filling of the trucks and stockpiling materials. The material released was water mixed with concrete, sand, and gravel and is considered nonhazardous. In addition, trace amounts of non-RCRA regulated motor oil, grease, and diesel may have leaked from the trucks during loading.

006 HOLDING PONDS

Unit type:	Holding Ponds
Unit use:	Storage/Settling
Operational status:	Decommissioned
Use period:	1981-1984
Materials managed:	Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge Annual aerial photos Westinghouse, 1984

Unit Description

Refer to Figure J-2 for location. During the drilling of the first two shafts at the WIPP facility, brine was used as a drilling fluid and each shaft had a separate holding pond for the brine. The holding pond for the Exploratory Shaft (006-a), now called the Salt Handling Shaft, covered 1-1/2 acres, was about 10 feet deep, and was located 75 feet east of the current Salt Handling Shaft. This pond was active from June 1981 to April 1983. The holding pond for the Ventilation Shaft (006-b), the current Waste Handling Shaft, covered 1/2 acre and was 10 feet deep. It was located 115 feet west of the current Waste Handling Shaft. It was active from December 1981 until late 1984. Both ponds were allowed to dry and were then covered with soil. Both areas were later excavated for construction purposes. The Engineering Building was constructed on top of 006-a and the Waste Handling Building was constructed on top of 006-b.

Waste Description

Based on process knowledge, material stored in the holding ponds consisted of saturated brine with bentonite added, drill cuttings, and trace amounts of hydraulic oil and grease that may have leaked from the drilling equipment. The solid material left in the mud pits after drilling still contained a high percentage of water at the time they were covered. This resulted in a gelatinous material consisting of the drill cuttings, bentonite, and water being encountered during excavation for the Engineering Building foundation. The gelatinous material was excavated and disposed of in the construction landfill.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at these sites. Potential releases from these ponds may have occurred because holes were cut in the lining after the water had evaporated. The holes were cut to prevent the ponds from holding water after they were covered over. The solids confined in the plastic liner of the holding ponds were buried when the ponds were covered with soil and graded. The material released was sodium-and potassium-saturated brine, which is considered nonhazardous.

007 EVAPORATION PONDS

Unit type:	Evaporation Ponds
Unit use:	Storage/Disposal
Operational status:	Active
Use period:	1981-present
Materials managed:	Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Annual aerial photos Westinghouse, 1984

Unit Description

Refer to Figure J-1 for location. Three ponds have been used for evaporation of water. The oldest pond (007-a) was located in the southwest corner of Zone I. It covered about 1/2 acre and was about 4 feet deep. It received water from the employee showers in temporary buildings and was active from 1981 to 1983. The area is presently covered by the Waste Handling Building and the paved area southwest of the Waste Handling Building. Another pond (007-b), which also received water from the showers, was located about 770 feet due west of the Waste Handling Shaft. This pond was present from late 1983 to early 1984. The third pond (007-c) is used to collect run-off from the main salt storage area. It is located on the west side of the main salt storage area (SWMU No. 002-b), covers 3 acres, and is 5 feet deep. It has been active since May 1984.

Waste Description

Based on process knowledge, the waste in the inactive ponds (007-a and 007-b) consisted of water containing soap, nonhazardous cleaning solutions, and trace amounts of oil. The third pond (007-c) receives runoff from the main salt storage area, consisting primarily of unsaturated salt brine.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at this site.

008 SURFACE SATELLITE ACCUMULATION AREAS

Unit type:	Storage Areas
Unit use:	Storage
Operational status:	Active
Use period:	1988-present
Materials managed:	Hazardous Waste
	Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge
	Westinghouse, 1992a
	Westinghouse, 1992b
	Westinghouse, 1991b

Unit Description

Refer to Figure J-2 for location. The satellite accumulation areas on the surface all use DOT-approved containers for storing all hazardous waste. Specifics of the satellite accumulation areas are listed on Table J1-2.

Waste Description

The wastes collected in surface satellite accumulation areas consist of chlorinated solvents, motor oil, hydraulic oil, oily rags, aerosol cans, antifreeze, and developing fluid. Satellite accumulation areas are managed (e.g., inspected, sample collection and analysis) in accordance with procedures in WP 02-6 and 02-7, Resource Conservation and Recovery Act (RCRA) Compliance Manual (Westinghouse, 1992a). Corrective actions for potential releases are described in WP 02-8, WIPP Spill Prevention, Control, and Countermeasures Plan (Westinghouse, 1991b) (for nonhazardous releases) and WP 02-12, WIPP Contingency Plan (Westinghouse, 1992b) (for hazardous releases).

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred aat these sites.

TABLE J1-2
SWMU DATA - SURFACE SATELLITE ACCUMULATION AREAS

SWMU	Date Started	Location	Status	Material Stored
008-a	1988	Maintenance Warehouse Bldg. 455	Active	Chlorinated solvents, oily rags, aerosol cans
008-b	1988	Outside Bldg. 455, east side	Active	Spent oils, solvents, oily rags, aerosols
008-c	1988	Sandia Calibration Lab Bldg. 993	Active	Aerosols and solvents
008-d	1989	Sandia Cable Shop Bldg. 911G	Active	Aerosols and solvents
008-e	1988	Security Armory Bldg. 473	Active	Powder solvents, gun oil, oily rags
008-f	1987	Drafting Area Engineering Bldg. 486	Active	Solvent concentrates, developing fluid, aerosols
008-g	April 1989	Emergency Services Bldg. vehicle wash bay	Active	Water with solvents and minor amounts of motor oil, grease, and hydraulic oil
008-h	Unknown	Overpack Repair Room Bldg. 411	Active	Derived waste

009 UNDERGROUND SATELLITE ACCUMULATION AREAS

Unit type:	Storage Areas
Unit use:	Storage
Operational status:	Active
Use period:	1983-present
Materials managed:	Hazardous Materials Hazardous Waste Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge Westinghouse, 1992a Westinghouse, 1992b Westinghouse, 1991b

Unit Description

Refer to Figure J-3 for location. The underground satellite accumulation areas are located at various locations in the waste repository. The satellite accumulation areas in the underground all use DOT-approved containers for storing all hazardous waste. Unit information for these areas is provided in Table J1-3.

Waste Description

The materials stored in the underground satellite accumulation areas are nonradioactive, site-generated wastes that include new and used storage batteries; waste motor oil; waste hydraulic oil; naphtha-based solvents; oily rags; aerosols; wastewater contaminated with motor oil; grease; diesel; hydraulic oil and salt; and silicon grout. Satellite accumulation areas are managed (e.g., inspected, sample collection and analysis) in accordance with procedures in WP 02-6 and 02-7, Resource Conservation and Recovery Act (RCRA) Compliance Manual (Westinghouse, 1992a). Corrective actions for potential releases are described in WP 02-8, WIPP Spill Prevention, Control, and Countermeasures Plan (Westinghouse, 1991b) (for nonhazardous releases) and WP 02-12, WIPP Contingency Plan (Westinghouse, 1992b) (for hazardous releases).

Release Information

Releases of RCRA hazardous waste or hazardous consituents have not occurred at these sites.

TABLE J1-3
SWMU DATA - UNDERGROUND SATELLITE ACCUMULATION AREAS

SWMU	Dates	Location	Status	Material Stored
009-a	1988-present	S1300/W30 Maintenance Shop	Active	Naphtha-based solvents, oily rags, aerosols
009-b	1990-present	E300 Experimental Programs Shop	Active	Aerosols
009-c	1989-present	S1300/W170 Intersection	Active	Storage batteries, waste oil
009-d	1989-present	West End of S1300	Active	Petroleum, oil, lubricants storage and 1 drum of waste oil
009-e	1988-present	S1000 Tool Room	Active	Storage batteries
009-f	1990-present	S1950 Storage area	Active	Silicon grout, purple K (fire extinguishing agent), rockbolts
009-g	1990-present	S1600/W30 Underground Wash Rack	Active	Water contaminated with salt, grease, hydraulic oil, motor oil, and diesel
009-h	1990-present	S1000/E140	Active	Oily rags, naphtha-based solvents, aerosols
009-i	1989-present	N780 Shop	Active	Aerosols, oily rags
009-j	1983-1988	SPDV Rm. 1 Old Maintenance Shop	Inactive	Oily rags, naphtha-based solvents, aerosols, used oil
009-k	1983-1988	SPDV Rm. 2 Storage Area	Inactive	Scrap metal, portable brine sump
009-l	1983-1988	SPDV Rm. 4 Storage Area	Inactive	Drill core, rock cutting oil (for rock saw), scrap metal, grout, solvent, cement
009-m	1983-1988	West End N1420	Inactive	Scrap metal, waste oil, solvents, grout, cement, blasting powder
009-n	---	Panel 1 undesignated	Inactive	Derived waste

010 SHAFT SUMPS

Unit type:	Shaft Sumps
Unit use:	Collection/Storage
Operational status:	Active
Use period:	1981-present
Materials managed:	Solid Waste Hazardous Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge Westinghouse, 1984 DOE, 1987

Unit Description

Refer to Figure J-3 for location. Four shafts have been completed to the WIPP acility underground. The Salt Handling and the Waste Handling Shafts have sumps (010-a and 010-b) that extend below the facility horizon (148 feet and 119 feet, respectively). The sumps have been cut into the salt of the repository and have not been lined. The other two shafts, the Exhaust Shaft and the Air Intake Shaft, end at the facility horizon and do not have sumps. The bottoms of these shafts are 010-c and 010-d, respectively. The bottoms of all four shafts have received construction debris. The Salt Handling and Waste Handling Shafts have been grouted and there is no wastewater accumulation. The solid material cleaned up from the bottom of the shafts without sumps is disposed of on the main salt storage area. The Air Intake Shaft currently receives brine from the Rustler Formation. On January 17, 1992, the New Mexico Environment Department issued an approved Discharge Plan to expand the WIPP sewage facility. The discharge plan allows for the disposal of Air Intake Shaft brine waters in the evaporation lagoon and the expanded sewage facility. Until the new sewage lagoon expansion is complete, the discharge plan permits the disposal of wastewater generated by observation well pumping at the site in the evaporation basin (SWMU No. 007-c), west of the main salt storage area (SWMU No. 002-b). Unit information for these SWMUs is listed on Table J1-4. Engineering drawings of the Waste Handling and Exhaust Shafts are included in Appendix D3 of this permit application.

Waste Description

The wastes consist of welding debris, scrap steel, concrete from the shaft lining, cement grout, chem grout, grease, wash water, brine from the Rustler Formation, and salt.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at these sites.

TABLE J1-4
SWMU DATA - SHAFT SUMPS

SWMU	Dates	*Location and Description	Status	Material Stored
010-a Salt Handling Shaft	1981	0/0 Sump extends 148 feet below the facility horizon.	Active	Welding residue, scrap wood and metal, salt, class C cement, chem-seal, bentonite, grease, oil
010-b Waste Handling Shaft	1982	S400/E30 Sump extends 119 feet below the facility horizon.	Active	Concrete, salt, cement grout, chem grout, brine from Rustler Formation, wash water, grease, oil
010-c Exhaust Shaft	1985	S400/E480 The shaft ends at the facility horizon.	Active	Salt, concrete, cement grout, chem grout, brine from Rustler Formation, grease, oil
010-d Air Intake Shaft	1989	0/W620 The shaft ends at the facility horizon.	Active	Salt, brine from Rustler Formation, concrete, grease, oil

*All locations given by underground coordinates.

011 SEWAGE TREATMENT FACILITY

Unit type:	Sewage Treatent Facility
Unit use:	Treatment
Operational status:	Active
Use period:	May 1985-present
Materials managed:	Sanitary Waste Suspected Solid Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge Westinghouse, 1992a

Unit Description

Refer to Figure J-1 for location. The sewage treatment facility consists of five ponds, primary cells 1A and 2A, polishing cells 1B and 2B, and the effluent pond. The primary and polishing cells are lined with Dynaloy and each has a capacity of 9,250 gallons. The facility is located about 1/4 mile southwest of Zone I and covers an area of about 4 acres. No chemicals are added to the effluent for treatment. The effluent pond is unlined and has a capacity of 18,500 gallons. A discharge plan for the WIPP facility was submitted to the New Mexico Environment Department on January 7, 1992. The discharge plan identifies all WIPP facility discharge streams. The New Mexico Environment Department approved the plan on January 17, 1992.

Waste Description

The sewage treatment facility treats sanitary waste. Neutralized film developer, solvents, and oils are reported to have been disposed of through this system in the past.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at this site. The releases from this unit are part of the treatment process and consist of infiltration of the water from the unlined effluent pond. The water is considered nonhazardous. The water undergoes routine sampling and analysis as described in WP 02-6 and 02-7. If hazardous constituents are detected, the water will be handled as site-generated hazardous waste in accordance with procedures in WP 02-6 and 02-7 (Westinghouse, 1992a).

012 NONHAZARDOUS SOLID WASTE COLLECTION BINS

Unit type:	Collection Bins
Unit use:	Storage
Operational status:	Active
Use period:	Jan. 1985-present
Materials managed:	Nonhazardous Waste
Hazardous release:	None
Radioactive release:	None
Information source(s):	Process knowledge

Unit Description

Not shown on figure. There are two 30-cubic-yard rolloff bins and eighteen 6-cubic-yard end dump bins located at various locations around the WIPP facility. These units are portable and their locations vary. After it is collected, the waste is disposed of at the Dark Canyon Landfill located south of the city of Carlsbad. These solid wastes do not contain RCRA-regulated hazardous waste or hazardous constituents.

Waste Description

Nonhazardous solid waste is collected in the bins at the WIPP facility.

Release Information

Releases of RCRA hazardous waste or hazardous constituents have not occurred at these sites.

List of References for Appendix J1

DOE, see U.S. Department of Energy.

Flynn, D. T., (ed.), 1989, "Annual Site Environmental Report for the Waste Isolation Pilot Plant, 1988," DOE/WIPP 89-005, U.S. Department of Energy, Carlsbad, New Mexico.

Seward, P. D., 1982, "Abridged Borehole Histories for the Waste Isolation Pilot Plant Studies," SAND82-0080, Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Department of Energy (DOE), 1988, "Annual Site Environmental Report for the Waste Isolation Pilot Plant, CY 1987," DOE/WIPP 88-009, U.S. Department of Energy, Carlsbad, New Mexico.

U.S. Department of Energy (DOE), 1987, "Geotechnical Field Data and Analysis Report, July 1986 - June 1987," DOE/WIPP 87-017, U.S. Department of Energy, Carlsbad, New Mexico.

U.S. Geological Survey (USGS), 1978, "Test Drilling for Potash Resources: Waste Isolation Pilot Plant, Eddy County, New Mexico," Open File Report 78-592, U.S. Geological Survey.

USGS, see U.S. Geological Survey.

Westinghouse, see Westinghouse Electric Corporation.

Westinghouse Electric Corporation (Westinghouse), 1992a, "Resource Conservation and Recovery Act (RCRA) Compliance Manual," WP 02-6 and 02-7, Westinghouse Waste Isolation Division, Carlsbad, New Mexico.

Westinghouse Electric Corporation (Westinghouse), 1992b, "WIPP Contingency Plan," WP 02-12, Westinghouse Waste Isolation Division, Carlsbad, New Mexico.

Westinghouse Electric Corporation (Westinghouse), 1991a, "Nonradioactive Hazardous Materials Environmental Compliance Manual," WP 02-5, Westinghouse Waste Isolation Division, Carlsbad, New Mexico.

Westinghouse Electric Corporation (Westinghouse), 1991b, "WIPP Spill Prevention, Control, and Countermeasures Plan," WP 02-8, Westinghouse Waste Isolation Division, Carlsbad, New Mexico.

APPENDIX K1

ENVIRONMENTAL PROTECTION STANDARDS

APPENDIX K1
ENVIRONMENTAL PROTECTION STANDARDS

This appendix, while not all-inclusive, includes major federal Executive Orders, statutes, and implementing regulations. Those that are applicable, or potentially applicable, to the WIPP facility are indicated by an asterisk.

1. Executive Orders (EO)

   a. EO 11987, Exotic Organisms.
   b. EO 11988, Floodplain Management.
   c. EO 11989, Off-Road Vehicles on Public Lands.*
   d. EO 11990, Protection of Wetlands.
   e. EO 11514 and EO 11991, Protection and Enhancement of Environmental Quality.*
   f. EO 11593, Protection and Enhancement of the Cultural Environment.*
   g. EO 12088, Federal Compliance with Pollution Control Standards.*
   h. EO 12146, Management of Federal Legal Resources.*
   i. EO 12342, Environmental Safeguards on Activities for Animal Damage Control on Federal Lands.*
   j. EO 12344, Naval Nuclear Propulsion Program.
   k. EO 12580, Superfund Implementation.

2. The National Historic Preservation Act of 1966, As Amended*

   a. 36 CFR Part 800, Protection of Historic and Cultural Properties.*
   b. 43 CFR Part 7, Protection of Archaeological Resources.*

3. Title 42 U.S.C. secs. 7401 et seq., The Clean Air Act, As Amended*

   a. 40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards.*
   b. 40 CFR Part 52, Approval and Promulgation of Implementation Plans.
   c. 40 CFR Part 53, Ambient Air Monitoring Reference and Equivalent Methods.*
   d. 40 CFR Part 58, Ambient Air Quality Surveillance.*
   e. 40 CFR Part 60, Standards of Performance for New Stationary Sources.*
   f. 40 CFR Part 61, National Emission Standards for Hazardous Air Pollutants.*
   g. 40 CFR Part 65, Delayed Compliance Orders.
   h. 40 CFR Part 66, Assessment and Collection of Noncompliance Penalties by EPA.

i. 40 CFR Part 69, Special Exemptions from Requirements of the Clean Air Act.
j. 40 CFR Part 81, Designation of Areas for Air Quality Planning Purposes.*

4. Title 33 U.S.C. secs. 1251 et seq., The Clean Water Act, As Amended*

a. 33 CFR Parts 153-157, Control of Pollution by Oil and Hazardous Substances.*
b. 33 CFR Part 159, Marine Sanitation Devices.
c. 33 Parts 320, 322-329, Permit Programs Regulations.*
d. 40 CFR Part 109, Criteria for State, Local, and Regional Oil Removal Contingency Plans.
e. 40 CFR Part 110, Discharge of Oil.
f. 40 CFR Part 112, Oil Pollution Prevention.
g. 40 CFR Part 113, Liability Limits for Small Onshore Storage Facilities.
h. 40 CFR Part 114, Civil Penalties for Violation of Oil Pollution Prevention Regulations.
i. 40 CFR Part 116, Designation of Hazardous Substances.*
j. 40 CFR Part 117, Determination of Reportable Quantities for Hazardous Substances.*
k. 40 CFR Part 121, State Certification of Activities Requiring a Federal License or Permit.
l. 40 CFR Part 122, EPA Administered Permit Programs: The National Pollutant Discharge Elimination System.
m. 40 CFR Part 125, Criteria and Standards for the National Pollutant Discharge Elimination System.
n. 40 CFR Part 129, Toxic Pollutant Effluent Standards.
o. 40 CFR Part 131, Water Quality Standards.
p. 40 CFR Part 133, Secondary Treatment Regulation.
q. 40 CFR Part 136, Guidelines Establishing Test Procedures for the Analysis of Pollutants.
r. 40 CFR Part 140, Marine Sanitation Device Standard.
s. 40 CFR Parts 220-225, 227-229, Ocean Dumping Regulations and Criteria.
t. 40 CFR Part 230 sec. 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material.
u. 40 CFR Part 231 sec. 404(c) Procedures.
v. 40 CFR Part 401, General Provisions for Effluent Guidelines and Standards (Note: 40 CFR sec. 401.14, Cooling Water Intake Structures).
w. 40 CFR Part 403, General Pretreatment Regulations for Existing and New Sources of Pollution.
x. 40 CFR Part 413, Electroplating Point Source Category.
y. 40 CFR Part 423, Steam Electric Power Generating Point Source Category.
z. 40 CFR Part 457, Explosives Manufacturing Point Source Category.
aa. 40 CFR Part 459, Photographic Point Source Category.

5. Title 42 U.S.C. secs. 300 F et seq., The Safe Drinking Water Act, As Amended

   a. 40 CFR Part 141, National [Interim] Primary Drinking Water Regulations.
   b. 40 CFR Part 142, National Primary Drinking Water Regulations Implementation.
   c. 40 CFR Part 143, National Secondary Drinking Water Regulations.
   d. 40 CFR Part 144, Underground Injection Control Program.
   e. 40 CFR Part 146, Underground Injection Control Program: Criteria and Standards.
   f. 40 CFR Part 147, State Underground Injection Control Programs.
   g. 40 CFR Part 149, Sole Source Aquifers.

6. Title 16 U.S.C. secs. 1451 et seq., The Coastal Zone Management Act of 1972, As Amended

   a. 15 CFR Part 921, NOAA (National Oceanographic and Atmospheric Administration) Guidelines on Estuarine Sanctuaries.
   b. 15 CFR Part 923, NOAA Coastal Zone Management Program Approval Regulations.
   c. 15 CFR Part 930, NOAA Regulations on Federal Consistency with Approval Coastal Management Program.
   d. 15 CFR Part 931, NOAA Regulations on Coastal Energy Impact Program.

7. Radiation Protection

   a. 10 CFR Part 712, Grand Junction Remedial Action Criteria.
   b. 40 CFR Part 190, Environmental Radiation Protection Standards for Nuclear Power Operations.
   c. 40 CFR Part 191, Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-Level and Transuranic Radioactive Wastes.*
   d. 40 CFR Part 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings.

8. Title 42 U.S.C. secs. 9601 [9615] et seq., The Comprehensive Environmental Response, Compensation, and Liability Act of 1980, As Amended*

   a. 40 CFR Part 300, National Oil and Hazardous Substances Pollution Contingency Plan.
   b. 40 CFR Part 302, Designation, Reportable Quantities, and Notification.*
   c. 40 CFR Part 305, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Arbitration Procedures.

d. 40 CFR Part 306, Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Natural Resources Claims Procedures.
e. 43 CFR Part 11, Natural Resources Damage Assessments.

9. Title 7 U.S.C. secs. 136 et seq., The Federal Insecticide, Fungicide, and Rodenticide Act, As Amended

a. 40 CFR Part 162, Regulations for the Enforcement of the Federal Insecticide, Fungicide, and Rodenticide Act.
b. 40 CFR Part 165, Regulations for the Acceptance of Certain Pesticides and Recommended Procedures for the Disposal and Storage of Pesticides and Pesticides Containers.*
c. 40 CFR Part 166, Exemption of Federal and State Agencies for Use of Pesticides Under Emergency Conditions.*
d. 40 CFR Part 170, Worker Protection Standards for Agricultural Pesticides.
e. 40 CFR Part 171, Certification of Pesticide Applicators.

10. Title 42 U.S.C. secs. 6901 et seq., The Resource Conservation and Recovery Act of 1976, As Amended*

a. 40 CFR Part 240, Guidelines for the Thermal Processing of Solid Wastes.
b. 40 CFR Part 241, Guidelines for the Land Disposal of Solid Wastes.
c. 40 CFR Part 243, Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste.*
d. 40 CFR Part 244, Solid Waste Management Guidelines for Beverage Containers.*
e. 40 CFR Part 245, Promulgation Resource Recovery Facilities Guidelines.*
f. 40 CFR Part 246, Source Separation for Materials Recovery Guidelines.*
g. 40 CFR Part 247, Guidelines for Procurement of Products that Contain Recycled Material.
h. 40 CFR Part 256, Guidelines for Development and Implementation of State Solid Waste Management Plans.
i. 40 CFR Part 257, Criteria for Classification of Solid Waste Disposal Facilities and Practices.
j. 40 CFR Part 260, Hazardous Waste Management System: General.*
k. 40 CFR Part 261, Identification and Listing of Hazardous Waste.*
l. 40 CFR Part 262, Standards Applicable to Generators of Hazardous Waste.*
m. 40 CFR Part 263, Standards Applicable to Transporters of Hazardous Waste.*
n. 40 CFR Part 264, Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.*
o. 40 CFR Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.*

p. 40 CFR Part 266, Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities.

q. 40 CFR Part 267, Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities.

r. 40 CFR Part 268, Land Disposal Restrictions.*

s. 40 CFR Part 270, EPA Administered Permit Programs: The Hazardous Waste Permit Program.*

t. 40 CFR Part 272, Approved State Hazardous Waste Management Programs.*

u. 40 CFR Part 280, Underground Storage Tanks.*

11. Title 16 U.S.C. secs. 1531 et seq., The Endangered Species Act of 1973, As Amended*

a. 50 CFR Part 17, Fish and Wildlife Service List of Endangered and Threatened Wildlife and Plants.*

12. Title 15 U.S.C. secs. 2601 et seq., The Toxic Substances Control Act, As Amended*

a. 40 CFR Part 761, Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions.*

13. Title 42 U.S.C. secs. 4901 et seq., The Noise Control Act of 1972, As Amended

14. Title 16 U.S.C. secs. 1131 et seq., The Wilderness Act, As Amended

a. 43 CFR Part 19, Wilderness Preservation.

APPENDIX K2

SUMMARY OF AGREEMENTS BETWEEN DOE AND THE STATE OF NEW MEXICO THAT AFFECT THE WIPP ENVIRONMENTAL PROGRAM AND THE JULY 9, 1987, MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF ENERGY AND THE U.S. DEPARTMENT OF LABOR

SUMMARY OF AGREEMENTS BETWEEN DOE AND THE STATE OF NEW MEXICO THAT AFFECT THE WIPP ENVIRONMENTAL PROGRAM

APPENDIX K2
SUMMARY OF AGREEMENTS BETWEEN DOE AND THE STATE OF NEW MEXICO THAT AFFECT THE WIPP ENVIRONMENTAL PROGRAM

Stipulated Agreement on Civil Action No. 81-0363 JB -- This agreement, approved by the U.S. District Court when it stayed (held in abeyance) proceedings in the lawsuit against DOE by the State of New Mexico, was executed on July 1, 1981. The eight-page agreement assures that a binding, enforceable "consultation and cooperation" agreement will be entered into by DOE and the state and that DOE will make a "good faith effort" to resolve certain state off-site concerns (which are covered in the Supplemental Stipulated Agreement). The Stipulated Agreement also addresses a number of additional studies and experiments to be conducted by DOE for the Site Preliminary and Design Validation phase of the WIPP facility. It was signed by Jeff Bingaman, Attorney General, State of New Mexico, and Myles Flint, Attorney, U.S. Department of Justice, and issued July 1, 1981, by Juan G. Burciaga, U.S. District Judge, District of New Mexico.

Agreement for Consultation and Cooperation -- Usually referred to as the "C&C Agreement," this agreement is contained in Appendix A to the Stipulated Agreement. It affirms the intent of the Secretary of Energy to consult and cooperate with New Mexico with respect to state public health and safety concerns. It was signed in July 1981 by Bruce King, Governor, State of New Mexico, and James B. Edwards, Secretary, U.S. Department of Energy.

Working Agreement for Consultation and Cooperation, Appendix B, Article IV, Revision I -- This agreement, Appendix B to the Stipulated Agreement, identifies in Article IV over 60 "key events" and "milestones" in the construction and operation of the WIPP facility that must be reviewed by the state before they are commenced. Many environmental items are included. It was signed in March 1983 by Robert McNeill, Chairman, Radioactive Waste Task Force, and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy. (Article IV of the Working Agreement was revised on April 8, 1983.)

Supplemental Stipulated Agreement Resolving Certain State Off-Site Concerns Over WIPP -- This agreement, dated December 27, 1982, addresses five state concerns including the need for state "verification" of the WIPP Environmental Monitoring Program. The concerns addressed are: state liability (for a nuclear incident), emergency response preparedness, transportation monitoring of the WIPP facility waste, the WIPP facility environmental monitoring by the state, and upgrading of state highways. It was signed in December 1982 by Bruce King, Governor, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

First Modification to the July 1, 1981, Agreement for Consultation and Cooperation on WIPP by the State of New Mexico and the U.S. Department of Energy -- This modification was signed November 30, 1984, wherein DOE and the state agree to address certain concerns of the state regarding: (1) the specific mission of the WIPP Project, (2) a demonstration of retrievability prior to waste emplacement, (3) post-closure control and responsibility, (4) completion of certain additional scientific testing and reports, (5) compliance with applicable federal regulatory standards for waste repositories, and (6) a program for encouraging and reporting on the hiring of New Mexico residents at the WIPP Project. It was signed in November 1984 by Joseph Goldberg, Secretary, Health and Environment Department, State of New Mexico, and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

Second Modification to the July 1, 1981, Agreement for Consultation and Cooperation on WIPP by the State of New Mexico and the U.S. Department of Energy -- Signed August 4, 1987, wherein DOE and the state agree to address certain concerns of the state regarding: (1) surface and subsurface mining and drilling after closure of the WIPP site; (2) the disposal of salt tailings at the WIPP site; and (3) compliance with U.S. Environmental Protection Agency, U.S. Department of Transportation, and U.S. Nuclear Regulatory Commission regulations. It was signed in August 1987 by Garrey Carruthers, Governor, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

1988 Modification to the Working Agreement of the Consultation and Cooperation Agreement Between the U.S. Department of Energy and the State of New Mexico on the Waste Isolation Pilot Plant -- This modification deleted the sorbing tracer test from the list of required reports and substituted additional tests. In addition, the state is allowed to operate a fixed-air sampler in the mine ventilation effluent air stream. It was signed in March 1988 by Kirkland Jones, Deputy Director, New Mexico Environmental Improvement Division, State of New Mexico, et al., and R. G. Romotowski, Manager, Albuquerque Operations Office, U.S. Department of Energy.

Environmental Oversight and Monitoring Agreement -- This agreement states that DOE will provide additional technical and financial support for state activities in environmental oversight, monitoring, access, and emergency response to ensure compliance with applicable federal, state, and local laws at several DOE facilities including the WIPP facility. It was signed in October 1990 by Garrey Carruthers, Governor, State of New Mexico; Dennis Boyd, Secretary, Health and Environment Department; and Bruce G. Twining, Manager, Albuquerque Operations Office, U.S. Department of Energy.

THE JULY 9, 1987, MEMORANDUM OF UNDERSTANDING BETWEEN THE U.S. DEPARTMENT OF ENERGY AND THE U.S. DEPARTMENT OF LABOR

Memorandum of Understanding
Between the
U.S. Department of Energy
and the
U.S. Department of Labor

I. Introduction

A. Background

The Department of Energy (DOE), Albuquerque Operations Office, is responsible for the construction of the Waste Isolation Pilot Plant (WIPP), a research and development facility under construction near Carlsbad, N.M., to demonstrate the safe, geologic disposal of defense-generated radioactive waste. The project will include underground facilities at a depth of 2150 feet.

A major concern of DOE in carrying out these activities is the safety and health protection of all underground workers at the site, both for the personnel involved in extractive processes as well as for the underground operating personnel.

Under the Federal Mine Safety and Health Act of 1977 (the Mine Act), the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor (DOL) is responsible for conducting mine inspections and investigations and developing and enforcing regulations and standards to protect the safety and health of miners. In the course of carrying out this responsibility, MSHA has developed technical expertise in mine safety and health.

B. Purpose

The purpose of this Memorandum of Understanding (MOU) is to accomplish the following:

1. To formalize a working arrangement whereby MSHA inspects operations at WIPP to determine compliance with MSHA standards. The results of these inspections will be furnished to DOE so that DOE can implement its policy of compliance to MSHA standards (as though the WIPP was a commercial mine) by taking the necessary actions with the DOE contractors to assure the prompt and effective correction of any deficiencies and to otherwise ensure general compliance with MSHA's mining health and safety requirements, and

2. To establish a procedural framework for the furnishing of MSHA technical assistance and consultation services to DOE with respect to mine geology, underground construction techniques, and related matters concerning the protection of life, the promotion of health and safety, and the prevention of accidents in DOE's underground repository operations.

C. Authorities

This MOU is consistent with and is entered into under the following statutory authorities: Section 601 of the Economy Act of 1932, as amended (31 U.S.C. 1535); Section 161 (f) of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2201 (f); Section 646 of the Department of Energy Organization Act (42 U.S.C. 7256); P.L. 96-164, the WIPP authorization; the Federal Mine Safety and Health Act of 1977, as amended (30 USC 801 et. seq.); and Section 100 of the Departments of Labor, Health and Human Services, and Education and Related Agencies Appropriations Act of 1986 (30 USC 962).

II. Inspections, Investigations and Technical Assistance

A. MSHA will conduct periodic, health and safety compliance assistance inspections of WIPP mining operations to assess the conformance of such operations with MSHA standards.

B. The following MSHA standards are relevent to underground operations conducted by the WIPP project:

30 CFR Parts 31, 32, 36, 48, 49 and 57.

In addressing these standards, DOE may encounter situations in which DOE considers that an alternative approach to that specified in the standards is required. In those instances, DOE will consult with MSHA to arrive at a mutually agreeable solution.

C. The results of all compliance assistance inspections will be furnished to the WIPP Project Office in writing at the conclusion of each inspection and DOE will thereafter take the necessary actions to assure the timely correction of any deficiencies. In the results of inspections forwarded to DOE, MSHA will

indicate conditions which would constitute a violation of MSHA standards and also, where appropriate, will include recommendations for remedial actions.

D. DOE's health and safety program encourages its contractors' employees to bring any health or safety complaints to either the employer or to DOE directly. Any such complaint or other information received by MSHA while performing work under this MOU will be transmitted to DOE and DOE will inform MSHA of its disposition of the complaint.

E. When requested by DOE, MSHA will participate in any accident or fatality investigation at the WIPP site.

F. In addition to inspections, MSHA will provide technical assistance as well as review and consultation services regarding mine safety and health matters for the WIPP project when requested by DOE via the WIPP Project Office subject to the availability of MSHA manpower.

G. Property

When available, DOE shall furnish the use of working space and other equipment (e.g., office equipment) required for the performance of this MOU, except such types of equipment as MSHA normally furnishes in connection with its regular mission.

H. Radiological Safety and Health, and Security

MSHA agrees to conform to all radiological safety and health, and security regulations and requirements of DOE while performing services in connection with this agreement.

III. Administration

This MOU will be administered on behalf of DOE by the WIPP Project Office. Normal working contacts with DOE shall be with the Project Manager, or by such other representative(s) as the Project Manager shall designate in written notice to MSHA. Administration on the behalf of MSHA will be by the Administrator for Metal and Nonmetal Mine Safety and Health, or by such other representative(s) as he/she shall designate in written notice to DOE.

IV. Reimbursement

Subject to future specific agreement of the parties, DOE will reimburse MSHA for the cost of services provided under this MOU.

V. Public Release of Information

MSHA and DOE shall consult with each other before release of information under the Freedom of Information Act, 5 U.S.C. 552, regarding activities carried out pursuant to this MOU.

VI. Effective Date, Amendment and Termination

This MOU shall become effective when signed by both parties. It may be modified or amended by written agreement between DOE and MSHA. It shall continue in effect until terminated by either party upon 30 days written notice to the other.

U.S. DEPARTMENT OF LABOR	U.S. DEPARTMENT OF ENERGY
BY: Roy L. Bernard	R. G. Romatowski
Title: Administrator for Metal and Nonmetal Mine Safety and Health	Manager, Albuquerque Operations Office
Date: 6/9/87	July 9, 1987

APPENDIX L1

CONDITIONAL AND PROPOSED NO-MIGRATION DETERMINATIONS FOR THE WASTE ISOLATION PILOT PLANT

FINAL CONDITIONAL DETERMINATION

NOVEMBER 14, 1990

federal register

Wednesday
November 14, 1990

Part VI

Environmental Protection Agency

Department of Energy Waste Isolation Pilot Plant; Notice of Final No-Migration Determination

ENVIRONMENTAL PROTECTION AGENCY

[FRL-3860-1]

Conditional No-Migration Determination for the Department of Energy Waste Isolation Pilot Plant (WIPP)

AGENCY: Environmental Protection Agency.

ACTION: Notice of final no-migration determination.

SUMMARY: In response to a petition from the Department of Energy (DOE), the Environmental Protection Agency (EPA) is today making a determination of no migration for placement of hazardous waste at DOE's Waste Isolation Pilot Plant (WIPP), located near Carlsbad, New Mexico. Today's determination imposes several conditions on such placement and is for a maximum of ten years. As a result of this determination, DOE may place a limited amount of untreated hazardous waste subject to the land disposal restrictions of the Resource Conservation and Recovery Act (RCRA) in the WIPP for the purposes of testing and experimentation. DOE submitted a petition to EPA for a no-migration determination in March 1989; EPA proposed to grant the petition in April 1990. After a careful review of public comments on the proposal, EPA has concluded that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the WIPP disposal unit during the testing period proposed by DOE, and that DOE has otherwise met the requirements of 40 CFR 268.6 for the WIPP. The approved petition requires DOE to remove the hazardous wastes from the underground repository if it cannot demonstrate the long-term acceptability of the disposal site by the end of the test period.

EFFECTIVE DATE: November 14, 1990.

ADDRESSES: The public docket for this determination is available for public inspection in Room M2427, U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC, 20460, Monday through Friday, excluding Federal holidays. Members of the public may make an appointment to review docket materials by calling (202) 475-9327. Copies of docket materials may be made at no cost, with a maximum of 100 pages of material from any one regulatory docket. Additional copies are $0.15 per page.

FOR FURTHER INFORMATION CONTACT: General questions about the regulatory requirements under RCRA should be directed to the RCRA/Superfund Hotline at 800-424-9346 (toll free) or 202-382-3000 (local).

Specific questions about the issues discussed in this notice should be directed to Matthew Hale, Office of Solid Waste (OS-341), U.S. Environmental Protection Agency, 401 M Street SW, Washington, DC 20460, at 202-382-4746.

SUPPLEMENTARY INFORMATION:

Preamble Outline

I. Background

A. RCRA Land Disposal Restrictions

The Hazardous and Solid Waste Amendments (HSWA) of 1984, which amend the Resource Conservation and Recovery Act (RCRA), imposed substantial new requirements on the land disposal of hazardous waste. In particular, the amendments prohibit the continued land disposal of hazardous wastes, unless either (1) the wastes meet treatment standards specified by EPA, or (2) the Administrator determines that the prohibition is not required in order to protect human health and the environment. This latter determination must be based on a demonstration by the owner/operator of the facility receiving the waste "that there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the wastes remain hazardous." (RCRA sections 3004(d)(1), (e)(1), and (g)(5).) The Department of Energy (DOE) has chosen to comply with the land disposal restrictions for certain transuranic (TRU) wastes to be shipped for testing and experimentation at its Waste Isolation Pilot Plant (WIPP) by pursuing the second option. Today's notice approves, with conditions, DOE's petition for the WIPP site.

EPA first promulgated standards and procedures for review of no-migration petitions under 40 CFR 268.6 in November 1986. These regulations, which apply to land disposal units other than underground injection wells, codify the statutory standard for no-migration findings, specify the information required in no-migration petitions, and establish EPA's procedures for approving or denying petitions (November 7, 1986, 51 FR 40572). EPA amended these regulations on August 17, 1988 (53 FR 31138) to add further procedural requirements and standards.[1] EPA is now developing additional no-migration standards to clarify or expand on certain parts of the current regulations. The Agency expects to propose these standards in the near future. In conjunction with this proposal, EPA has also developed draft no-migration guidance, a copy of which is available in the docket for this rulemaking.

To date, EPA has received 31 no-migration petitions submitted in accordance with 40 CFR 268.6. Today's notice, which addresses disposal of mixed radioactive and hazardous waste in a mined salt bed, is the Agency's first decision on any of these petitions under § 268.6. The other § 268.6 petitions, which primarily address land treatment operations, are currently under Agency review. In addition, EPA has received approximately 65 no-migration petitions for underground injection wells under 40 CFR part 148. Of these, 30 have been approved, 28 are still under review, and a number of others have been withdrawn.

B. Regulatory Status of Mixed Wastes

The hazardous wastes that are subject to today's notice are "mixed wastes." Mixed wastes are defined as a mixture of hazardous wastes regulated under Subtitle C of RCRA and radioactive wastes regulated under the Atomic Energy Act (AEA). Because section 1004 of RCRA excludes "source," "special nuclear," and "byproduct materials," as defined under the Atomic Energy Act,

[1] On July 26, 1988, EPA also promulgated standards under 40 CFR part 148 for no-migration determinations for underground injection wells (53 FR 28122).

from the definition of RCRA "solid waste," there has been some confusion in the past as to the scope of EPA's authority over mixed waste under RCRA. EPA clarified this question in a **Federal Register** notice on July 3, 1986.

EPA's clarification stated that the section 1004 exclusion applies only to the radioactive portion of mixed waste, not to the hazardous constituents. Therefore, a mixture of "source," "special nuclear," or "byproduct materials" and a RCRA hazardous waste must be managed as a hazardous waste, subject to the requirements of RCRA subtitle C (that is, RCRA standards for the management of hazardous waste). EPA's oversight under RCRA, however, extends only to the hazardous waste components of the mixed waste, not to the source, special nuclear, or byproduct materials themselves. The exempted radionuclides are instead addressed under the AEA.[2] DOE subsequently confirmed and clarified this interpretation in the **Federal Register** on May 1, 1987. Sections I.D and V.A of this notice further discusses the relationship between the AEA standards and the no-migration finding.

EPA's July 3, 1986 interpretation went into effect immediately in states not authorized to administer the RCRA hazardous waste program—that is, in the ten states and territories where EPA directly regulates hazardous waste under the Federal RCRA regulations. At the same time, the July 3, 1986 notice informed authorized states that they were required to apply for and receive authorization from EPA to regulate mixed waste under RCRA. To date, twenty-three states and territories (including New Mexico, where the WIPP is located) have obtained authority to regulate mixed waste under the state RCRA hazardous waste programs. Thus, mixed wastes are currently regulated as hazardous under Federal RCRA requirements in thirty-three states and territories.

C. WIPP Project

Today's notice addresses mixed waste that DOE intends to ship for testing and experimentation to the WIPP site near Carlsbad, New Mexico, during a preliminary test phase. At the site, the waste will be placed in a mined underground repository, located in a salt bed approximately 2,150 feet below the earth's surface. Over an approximately five-year period, DOE plans to test and evaluate the behavior of the waste in the repository, as well as the characteristics of the surrounding formation, to determine the site's acceptability for the long-term disposal of radioactive waste. Today's no-migration determination requires DOE to remove the waste from the repository if the site proves to be unacceptable for long-term disposal.

Over the long-term, the WIPP repository has been designed as a permanent disposal site for transuranic (TRU) radioactive wastes resulting from nuclear weapons production at ten DOE sites around the country.[3] TRU wastes are defined as wastes contaminated with alpha-emitting radionuclides with an atomic number greater than 92 (that is, heavier than uranium) in concentrations of greater than 100 nanocuries per gram of waste. In addition, TRU wastes by definition have half-lives of more than twenty years, although the actual half-lives of radionuclides in waste to be placed in the WIPP are often hundreds or thousands of years. The TRU wastes targeted for the WIPP consist of a variety of materials, including tools, equipment, protective clothing, rags, graphite, glass, and other material contaminated during the production and reprocessing of plutonium; contaminated organic and inorganic sludges; contaminated process and laboratory wastes; and contaminated items from decontamination and decommissioning activities at DOE facilities. As TRU wastes, these wastes are distinguished from high-level radioactive waste, such as used reactor fuel, and low-level radioactive waste. Other disposal strategies are being developed for high-level and low-level radioactive wastes.

The land in the area of the WIPP is owned by the Federal government and administered by the Bureau of Land Management. The four-mile by four-mile plot of land overlying the repository has been temporarily withdrawn from public use by the Department of Interior; it is now under the control of DOE. Before DOE can bring waste to the site, however, either Congress or the Department of Interior must take new land withdrawal action. The repository is designed to hold TRU wastes that are currently stored at the DOE generating facilities, as well as new TRU wastes that will be generated over the next 35 years. The underground waste disposal area of the WIPP, when completed, will cover 100 acres, with a total design capacity of 8.45 million cubic feet (or approximately 850,000 drums of waste). To date, 15 acres of underground disposal rooms have been mined.

Although DOE has conducted extensive studies of the WIPP site and the repository performance, uncertainties still remain. For example, concerns have been raised over the possibility that gas generated underground at the WIPP could, over the long term, build up to unacceptable pressures, leading to possible releases from the repository. To address this and other questions, DOE plans to conduct testing and experimentation over the next several years. This testing will include in-situ experiments with actual TRU wastes underground, as well as other investigations. These in-situ tests would initially involve wastes amounting to approximately 0.5 percent of the total repository capacity. From these tests, DOE hopes to gather data that will allow it to demonstrate compliance with EPA's standards for disposal of radioactive materials (40 CFR part 191 subpart B) and long-term no-migration of RCRA hazardous constituents, as well as in identifying any engineering modifications that may be necessary to meet these standards. DOE is also considering the need for an "operations demonstration" during the test period. The purpose of this demonstration, which might involve up to an additional three to eight percent of the total WIPP capacity, would be to show DOE's operational readiness to ship waste to the WIPP and to place it underground. (Today's approval does not cover placement of wastes for the purposes of the "operations demonstration." DOE would have to submit for EPA's consideration an amendment to its no-migration petition; any EPA decision on such an amendment would be proposed in the **Federal Register**, with opportunity for public comment.)

As a condition to today's approved petition, DOE must remove all hazardous wastes from the repository if it is unable to meet EPA standards for permanent disposal of hazardous and radioactive wastes at the conclusion of the test period.[4] However, if the WIPP

[2] This interpretation, however, does not preclude EPA from requiring data on radionuclide content of wastes where necessary to carry out EPA's authorities under RCRA—for example, to ensure protection of personnel carrying out RCRA inspection or oversight sampling.

[3] The DOE facilities that intend to send TRU waste to the WIPP are Idaho National Engineering Laboratory, Idaho Falls, Idaho; Rocky Flats Plant, Golden, Colorado; Los Alamos National Laboratory, Los Alamos, New Mexico; Argonne National Laboratory, Argonne Illinois; Savannah River Plant, Aiken, South Carolina; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Hanford Reservation, Richland, Washington; Mound Plant, Miamisburg, Ohio; Lawrence Livermore National Laboratory, Livermore, California; and Nevada Test Site, Mercury, Nevada.

[4] Under 40 CFR 268.6(a)(3), petitioners seeking a no-migration demonstration must provide sufficient

Continued

proves acceptable as a permanent repository, and if DOE successfully petitions EPA for a long-term no-migration determination. DOE will then be able to begin full-scale disposal of waste at the site. Drums, metal boxes, and metal canisters of waste will be shipped to the WIPP from the generating sites and placed in underground rooms. Under current plans, the rooms will be backfilled with crushed salt and sealed. After an operating period of approximately 25 years, DOE plans to seal the shafts of the mine with cement-clay plugs and compacted salt and decommission the facility. After decommissioning, the salt of the Salado Formation will creep inward and is expected to encapsulate the waste within 60 to 200 years.

Access to the WIPP site will be restricted. The Department of Interior temporarily withdrew the lands on the WIPP site from public use in 1983, allowing DOE to begin construction of the facility. Before DOE can bring waste to the site, however, either Congress or the Department of Interior must take new land withdrawal action. In addition, DOE and the State of New Mexico have agreed to prohibit in perpetuity all subsurface mining, drilling, and resource exploration unrelated to the WIPP project at the WIPP site. As a further protection, the Federal government has acquired the entire surface and subsurface estate at the WIPP site. Finally, to discourage drilling in the vicinity of the repository in the distant future, DOE intends to place permanent warning markers at the site.

D. Regulatory Status of the WIPP

The WIPP is located in the State of New Mexico, which received authorization for mixed waste on July 25, 1990. (See 55 FR 28397, July 11, 1990.) As an "existing" hazardous waste management facility at the time of New Mexico's authorization for mixed waste, the WIPP is eligible for RCRA interim status. Facilities "in existence" (which include facilities under construction) at the time a waste is identified as hazardous under RCRA can obtain interim status if their owner/operators submit a part A application to EPA or the appropriate state. If DOE submits an application to New Mexico and secures interim status, it will be legally authorized to receive mixed waste at the WIPP—subject of course to the land disposal restrictions. The WIPP must also comply with the RCRA interim status standards, codified at 40 CFR part 265, and eventually obtain a RCRA permit under 40 CFR parts 264 and 270.

The interim status requirements of part 265 establish general facility standards. For example, the WIPP is required under these standards to have a waste analysis plan for its mixed waste, a contingency plan describing procedures that DOE will take in the case of an emergency, and a closure plan describing how the facility will be closed. In addition, the State of New Mexico has recently requested that DOE submit to it the RCRA part B permit application for the WIPP; this application must be submitted no later than six months after the State's request, or by February 28, 1991. The RCRA permit for the WIPP (if granted) will establish detailed operating, closure, and post-closure conditions in accordance with 40 CFR part 264, subpart X. (As a geological repository, the WIPP is regulated under the RCRA category of subpart X "miscellaneous units.") The permit's scope would extend to all facility activities related to mixed waste.

Several commenters on EPA's proposed decision on the WIPP expressed confusion over the relationship between a no-migration decision by EPA and a RCRA permit issued by the State. In explanation, EPA notes that its no-migration determination is relatively narrow in scope, only addressing the question of whether hazardous constituents will or will not migrate from the underground repository. To ensure no-migration, EPA's determination imposes certain conditions (e.g., a volume limitation and retrievability of waste); these conditions will be enforced by EPA. On the other hand, the State RCRA permit is significantly broader than a no-migration finding, since it will impose the full technical and general facility standards of 40 CFR part 264, and it will apply to the above-ground operations as well as operations underground. The permit may include certain requirements already imposed under EPA's no-migration determination, or it may establish more stringent requirements, if the State of New Mexico determines that they are necessary. The State permit will be issued under State procedures, which include public notice, comment, and an opportunity for a public hearing. The conditions of the permit will be enforced by the State.

As discussed earlier, EPA's authority under RCRA over waste destined for the WIPP extends only to mixed hazardous and radioactive waste, and it is further limited to the hazardous components of the mixed waste. The potential release of radioactive material from the WIPP is addressed under the Atomic Energy Act (AEA). EPA has promulgated standards under the AEA limiting releases associated with the disposal of radioactive wastes. These standards, which are codified at 40 CFR part 191, consist of two parts: Subpart A dealing with releases during the operational phase of a permanent disposal facility, and subpart B, dealing with long-term releases after decommissioning. Under these regulations, a facility is not defined as a disposal site until it has been designated as a permanent respository and removal is not contemplated; since this decision will not be made for the WIPP until after the test phase, the WIPP is not legally subject to the part 191 standards. Under an agreement with the State of New Mexico, however, DOE has agreed to comply with the subpart A standards, beginning with the initial receipt of waste at the WIPP—that is, before the facility has been designated as a permanent repository. The subpart standards also do not yet apply to the WIPP because they have been remanded to EPA by the U.S. Court of Appeals at the First Circuit, and therefore are not in effect at this time. DOE, however, has agreed with the State of New Mexico to demonstrate compliance with the remanded standards (if final standards have not been developed) before a final decision is made to dispose of waste permanently in the repository. This decision will be made on the basis of data gathered during the test phase at the WIPP.

Finally, EPA emphasizes that today's finding addresses only the specific question of whether hazardous constituents will or will not migrate from the WIPP as long as the waste remains hazardous. Issues raised by the transportation of waste to the WIPP site, or by handling and possible treatment of waste before it reaches the WIPP, are beyond the scope of EPA's legal authority in evaluating no-migration petitions, and thus are not addressed in this notice.

II. DOE Petition and EPA Proposed Determination

The mixed waste DOE intends to ship to the WIPP for testing includes solvent-contaminated wastes, which became subject to the land disposal restrictions on November 8, 1988, and characteristic wastes (containing heavy metals such as lead), which became subject to the land

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Information to assure the Administrator that the disposal area will comply with other applicable Federal, State, and local laws. Therefore, if the WIPP cannot comply with radioactive disposal standards under 40 CFR part 191, it would not satisfy the conditions for a long-term no-migration determination.

disposal restrictions on August 8, 1990. (However, it should be noted that EPA granted a two-year national capacity variance to mixed characteristic wastes, deferring the effective date of the disposal prohibition until May 8, 1992 (June 1, 1990, 55 FR 22520).) In addition, some mixed wastes are likely to include wastes that are hazardous under EPA's new toxicity characteristics rule (55 FR 11798), although the Agency has not yet promulgated land disposal restrictions for these wastes.

To comply with the land disposal restrictions, DOE has sought to demonstrate to EPA, in a non-migration petition submitted in March 1989, that placement of these wastes untreated in the WIPP repository will not lead to migration of hazardous constituents beyond the disposal unit boundary. In response to EPA concerns, DOE provided additional supporting material after its initial submission, including addenda in October 1989 and January 1990. DOE's final petition was bound into eight volumes in March 1990 (DOE/WIPP 89-003, Revision 1) and is included in the docket for this rulemaking.

After careful review of DOE's petition as well as information from numerous other sources, EPA proposed in the **Federal Register** of April 8, 1990 to grant DOE's petition with certain conditions. (See 55 FR 13068 for a more detailed discussion of the information provided by DOE and of the basis for EPA's proposed decision.) Under EPA's proposal, DOE would be allowed to place untreated mixed waste in the WIPP repository within the scope of the testing and experimentation activities described in the petition. EPA's proposal would not have allowed DOE to conduct its proposed operations demonstration, nor would it have allowed DOE to conduct two pilot-room tests, which had originally been suggested by EPA. If the testing failed to show that the WIPP could meet the no-migration standards for the longterm disposal of mixed waste, DOE would be required to remove the waste from the underground repository. The proposal also included the following conditions: (1) The waste must be placed in the WIPP in a retrievable form; (2) DOE must provide annual written reports on the test phase progress to EPA; (3) a carbon adsorption device capable of achieving a 95 percent efficiency must be installed in the discharge system of the bin experiment rooms; (4) DOE must implement a specific air monitoring plan; (5) DOE must certify that it has secured control of the surface and subsurface estate at the WIPP site before wastes can be placed in the repository;[5] and (6) during the test phase, DOE must provide detailed waste characterization and analyses on the waste emplaced in the WIPP.

EPA provided a 60-day public comment period on its proposed determination and held public hearings in Carlsbad, Albuquerque, and Santa Fe, New Mexico, during the comment period. The Agency received 103 written comments on its proposal from both individuals and organizations, and more than 300 people testified at the three hearings. Today's decision is based on a careful review of the public's comments and clarifying information provided by DOE, as well as EPA's further evaluation of the suitability of the site based on a field visit to the WIPP site on July 28, 1990.

III. Summary of EPA Determination

After a review of DOE's petition, supporting information, and public comment, EPA finds that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the WIPP repository as a result of its planned test activities, as required by the statute and regulations at 40 CFR 268.6. This determination is based on the condition that DOE only place hazardous waste within the scope of the test phase operations described in its no-migration petition and its performance assessment test plan. Consistent with the determination, EPA is approving DOE's no-migration petition for the WIPP for the test phase operations, subject to the conditions laid out in section VI of this notice. It should be noted that the proposed operations demonstration and pilot room tests cannot be conducted under the terms of today's decision. Before these activities could be carried out, DOE would have to submit an amendment to its no-migration petition, which EPA would evaluate. EPA would then propose a decision for comment before a final decision would be made.

EPA's action today allows DOE to place untreated mixed waste subject to the RCRA land disposal restrictions in the WIPP for testing and experimentation to determine whether the site is appropriate for the long-term disposal of mixed waste (that is, whether disposal at the site will conform with standards for the permanent disposal of hazardous wastes). Only the waste specified by DOE in is petition may be placed in the WIPP under this determination.[6] The quantity of waste that may be placed in the WIPP is limited to 8,500 drums, or 1 percent of the facility's final capacity. DOE may not begin permanent disposal of the mixed waste subject to the RCRA land disposal prohibitions at the site and must remove all waste from the underground repository if it cannot demonstrate no migration of hazardous constituents over the long term. (In addition to EPA's requirement that hazardous waste be removed from the respository, DOE has also committed to carry out such a removal in a consent agreement with the State of New Mexico.)

In making its no-migration finding, EPA concentrated on whether releases of non-radioactive hazardous constituents from the repository might occur during the test phase. In doing so, EPA addressed all possible routes of release, but focused in particular on the potential for volatile organic constituents released during testing to migrate out of the WIPP unit through the ventilation exhaust shaft. Because of the nature of the tests that will be conducted in the WIPP and their relatively short duration, EPA has concluded that releases of hazardous constituents from the unit through brine, salt, or other geological media is implausible during the test phase.

The retrievability of waste placed in the WIPP during the test phase is central to EPA's finding. Therefore, EPA has reviewed both the technical feasibility of retrieval and the practicability of DOE's retrieval plan. EPA has concluded that retrieval of wastes from the WIPP can be accomplished safely, and that DOE's commitment to retrieving the wastes and taking it above ground, if it proves necessary, is satisfactory. Finally, EPA considered the general design, construction, and mine maintenance program at the WIPP and has concluded that the mine is well-designed and will remain stable during

[5] DOE recently secured the last outstanding mineral lease at the WIPP site, thereby satisfying this condition. As a result, EPA has eliminated this condition in its final determination.

[6] In its no-migration petition, DOE identified listed solvents and EP (Extraction Procedure) characteristic wastes as hazardous under RCRA. In addition, some of the waste described in DOE's petition may now be hazardous under the EPA's recently promulgated Toxicity Characteristics (TC) rule (55 FR 11798). EPA has not yet promulgated treatment standards for TC wastes; however, it is required to do so under this statute. Once these standards have been promulgated, TC wastes placed in the WIPP will be subject to the land disposal restrictions. Because EPA's review of DOE's petition considered potential migration of hazardous constituents from all of the waste DOE identified as scheduled for the WIPP, today's no-migration determination applies to wastes that are hazardous under the TC rule, as well as solvents and EP characteristic wastes, as long as the wastes were included in the petition.

the test period and well beyond. The specific conditions of today's finding are discussed in the following section and listed in summary form in section VI of this notice.

Although EPA's granting of DOE's petition is specifically based on a finding of no-migration of hazardous constituents from the unit during the test phase, EPA has thoroughly reviewed available information on the expected long-term performance of the WIPP repository. Given the geological stability of the area; the depth, thickness, and very low permeability of the salt formation in which the repository has been mined; and the properties of rock salt as an encapsulating medium, EPA believes that the WIPP is a promising site for the permanent disposal of mixed waste. To be sure, a number of uncertainties related to the long-term performance of the WIPP remain—for example, the extent and effects of gas generation, the effects of brine inflow into the repository, and the influence of a "disturbed rock zone" around the mined repository. DOE will be investigating these uncertainties in the test phase at the WIPP, and it will review whether technical modifications to the repository design or the waste are necessary to ensure compliance with the regulatory standards.

It should be remembered that today's decision is only for the disposal of mixed waste during the test phase for testing and experimentation to determine whether the site is appropriate for the long-term disposal of mixed wastes. Before DOE may move from the test phase to full-scale operations, it must petition EPA again and demonstrate no migration over the long term—that is, it must successfully address current uncertainties about long-term WIPP performance. Information gathered by DOE during the test phase will be central to such a demonstration. Any EPA decision to approve (or deny) a no-migration petition for permanent disposal at the conclusion of the test phase will be made with full opportunity for public comment, as prescribed in 40 CFR 268.6(g).

Further technical details regarding EPA's final decision are provided in a background document. In addition, major issues raised by public commenters are discussed in section V of today's notice, as well as in a response to comments document. Both the background document and the response to comments document are available in the public docket for this action.

IV. Discussion of EPA Determination and Conditions of Determination

A. *No-Migration Finding*

To make a no-migration determination, sections 3004 (d)(1), (e)(1), and (g)(5) of RCRA require EPA to find that "there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the wastes remain hazardous." As EPA explained in the preamble to its proposed decision, it interprets this requirement to mean that constituents listed in appendix VIII of 40 CFR part 261 cannot migrate at hazardous levels from the disposal unit during the time that hazardous waste is present in the unit. If the hazardous waste within the unit becomes non-hazardous or if it is removed from the unit, further migration from the unit ceases to be an issue. In the case of the WIPP, DOE will have to remove all hazardous waste from the underground repository if it cannot demonstrate the long-term acceptability of the site; therefore, the effective period of EPA's finding is the test phase. Thus, EPA's decision today is based on the conclusion that the Appendix VIII constituents will not migrate at hazardous levels from the underground repository during the test phase and that DOE will remove all hazardous waste from the unit if testing cannot show that the site meets long-term no-migration standards.

EPA's no-migration finding for the WIPP test phase falls into several categories: Migration of hazardous constituents under anticipated test conditions in the repository; short-term stability of the repository; feasibility of retrieval; possible effect of accidents and spills; and effectiveness of controls against human intrusion during the test phase. These aspects of EPA's determination are discussed below.

No migration of hazardous constituents beyond the unit boundary. In the proposal, EPA explained in some detail its definition of the unit boundary for the WIPP and its standards for determining whether a constituent migrating from the unit is "hazardous." The proposed unit boundary was the Salado Formation at the WIPP site, bounded by the four-mile by four-mile land withdrawal area, except that, for air emissions during operations, the unit boundary was the point where the air exhaust ventilation shaft met the surface. EPA's definition of the unit boundary in today's decision is largely unchanged from the proposal; however, in response to public comment, it has slightly modified the unit definition as it applies to air emissions. In the final decision, the unit refers to that portion of the Salado Formation that falls within the WIPP land withdrawal area; specifically, any movement of constituents above "hazardous" levels into overlying or underlying formations, or beyond the lateral boundaries of the land withdrawal area would constitute migration. This unit boundary would apply to migration via air emissions during operations as well as via ground water or other routes after closure of the unit. (This issue is discussed in more detail in section V.H of today's notice.) EPA's definition of "hazardous" levels of migration remains unchanged from the proposal. As discussed below in section V.G, EPA is relying on "health-based levels" to define migration—that is, levels that would be hazardous to a person exposed at the unit boundary for an entire lifetime.

The no-migration standard applies to all possible routes of release from the unit. EPA, however, has concluded that migration of hazardous constituents out of the unit during the test period is implausible by any route other than air. Waste will be containerized during the test period, and even if it were released from a container, there is no possibility that waste could migrate from the unit by ground water or directly through the salt rock within the test period. No commenters questioned this conclusion, which EPA discussed in the proposal.

Potential for Migration via Air Emissions. For air emissions during the test period, EPA's finding is based on a careful review of possible releases from the bin-scale and alcove tests DOE is planning to conduct during the test period. For reasons described below, EPA has concluded that any releases from the alcove-scale tests will be negligible. Therefore, it has focused its attention on the bin-scale tests. In these tests, headspace gases will be vented into the bin discharge system whenever the bins become pressurized through a pressure relief valve installed on each bin. The gases will then be passed on to the exhaust shaft. Because the purpose of the experiments is to gather data on the gas generation potential for the various types of wastes intended for disposal at the WIPP, the rate of gas generation and thus the amount of hazardous constituents expected to be released can only be estimated. Because of this uncertainty, DOE has proposed and EPA's decision today requires the inclusion of a carbon canister in the bin gas discharge system to remove any volatile organic constituents released from the bins. This carbon adsorption control device must be designed to achieve a control efficiency of at least 95 percent. As explained in its proposal,

EPA has taken this control device into account in its no-migration finding for air emissions.

For its assessment of releases from the bin-scale tests, EPA used the concentrations of volatile organic compounds measured in the headspace of 200 drums containing waste generated at DOE's Rocky Flats Plant and stored at the Idaho National Engineering Laboratory. As described in the WIPP no-migration proposal, DOE has been able to provide little or no information on sampling plans, sample handling procedures, or quality assurance/quality control measures for these data. Therefore, EPA views the analytical results on these headspace samples as being semiquantitative. Nevertheless, even if these data underestimate the constituent concentrations by as much as an order of magnitude, the concentration of constituents at the unit boundary are still expected to be below health-based levels.

The results of EPA's assessment are shown in Table 1 below along with levels of regulatory concern.

TABLE 1.—TEST PHASE COMPLIANCE POINT CONCENTRATIONS IN AIR

Constituents	Average headspace concentrations (g/m3)	Compliance point concentrations (μg/m3)	Levels of regulatory concern* (μg/m3)
Carbon tetrachloride	1.86	0.0027	0.03
Methylene chloride	0.47	0.00068	0.3
Trichloroethylene	0.70	0.0010	0.3
1,1,1-Trichloroethane	13.2	0.019	10,000
1,1,2-Trichloro-1,2,2-trifluoroethane	1.22	0.0018	30,000

EPA conservatively assumed that both test rooms planned for the bin-scale tests are filled to capacity. The capacity of each room is 120 bins; therefore, the total number of bins is 240. EPA then assumed an average gas generation rate of 5 moles per drum per year, a figure that DOE characterizes as representing the upper bound of the range of credible gas generation rates (Test Plan: WIPP Bin-Scale CH TRU Waste Tests, January 1990; SAND 89-0462). Each bin can hold the equivalent of six drum volumes of waste. Therefore, DOE's upper bound gas generation rate is equivalent to a total gas generation rate from all 240 experimental bins of 0.5 cubic meters per day. DOE has specified the general ventilation rate through the repository as 425,000 cubic feet per minute, which is equivalent to 17 million cubic meters per day. This entire volume of air is exhausted at the exhaust shaft and is available to mix with any gases released from the bin discharge system. The resulting dilution factor at the exhaust shaft is 34 million. EPA applied the dilution factor to the average headspace concentrations, together with the control device efficiency, to calculate the concentration of constituents in the exhaust shaft.

The compliance point concentrations (with the carbon adsorption control device installed in the bin discharge system) are an order of magnitude below the level of regulatory concern for carbon tetrachloride and are two to seven orders of magnitude below any other level of regulatory concern. These figures represent the bin-scale tests alone; however, the contribution of the alcoves is negligible by comparison. Although it would not be allowable under today's decision, DOE has provided data to show that even when 10 percent of the wastes, equivalent to 85,000 drums are emplaced in the repository before sealing of the rooms, the concentrations in the exhaust shaft would be two to eight orders of magnitude below the levels of regulatory concern.

Because the alcove experiments involve only 3,850 drums (more than a factor of 20 lower), the concentrations in the exhaust shaft from the alcove drums would be a factor of at least three to nine orders of magnitude below the level of a regulatory concern. The actual concentrations would be even lower than this once the alcoves are sealed at the start of the experiment.

EPA recognizes that the actual bin gas generation rate may be higher than 5 moles per drum per year. However, even if the rate were significantly higher, concentrations at the unit boundary would still be below health-based levels, given the requirement for a carbon adsorption system designed for 95 percent efficiency. Therefore, EPA finds that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate beyond the repository boundary during the test phase at greater than health-based levels.

Short-term stability of the site. In the long term, salt creep will be the primary mechanism to seal the WIPP repository. In the short term, however, salt creep—which can lead to localized fracturing and rock fall—must be mitigated to ensure a stable repository environment. Repository stability has been greatly enhanced during the test phase by several design modifications to the experimental area. The most significant alteration is rockbolting, a standard mining technique to ensure stability. The roofs of all test alcoves and bin test rooms will be rockbolted. This practice alone should prevent excessive cracking and rockfall during the entire test phase. The effects of early room closure, however, are of greater significance for the test alcoves because they cannot be inspected while the tests are underway, and because drums must be retrievable after the tests have been completed. For this reason, DOE will be reducing the dimensions of the test alcoves, which will slow down the rate of creep closure. Finally, DOE intends partially to backfill several alcoves with crushed salt to simulte disposal conditions. Backfilled test alcoves will be fitted with "stand-off" walls between the backfill and the mine walls, so that room closure does not impinge on the backfilled drums. These modifications ensure the successful retrieval of the drums from the alcoves at the conclusion of the test phase, if it proves necessary.

Feasibility of retrieval. Several commenters expressed concern that retrieval may not be technically feasible, and that, given this uncertainty, EPA cannot assume removal in its no-migration finding. These commenters pointed out specific instances where retrieval might be difficult or infeasible, such as in the case of fire or explosion. They also suggested that creep closure of the test alcoves would preclude removal—an issue discussed in the previous section. Finally, they argued that retrieval from backfilled alcoves has not been demonstrated and that considerable shuffling of waste underground during retrieval may have inherent risks.

EPA has concluded that DOE's Waste Retrieval Plan, in combination with mock retrievals, demonstrates that retrieval is technically feasible. All major aspects of the retrieval process are addressed in the plan, including radiological and hazardous waste contamination control, drum and bin handling, overpacking procedures for corroded or damaged drums, clean up of contamination, and backfill retrieval. While release or leakage of hazardous constituents from containers within the repository during the test period would certainly complicate retrieval, it would not render retrieval technically infeasible. Such events are adequately addressed by emergency response procedures defined for the WIPP. The specifics of the various emergency response procedures are detailed in several DOE publications referenced in the Waste Retrieval Plan. In addition, while EPA agrees with commenters that a fire or explosion would make retrieval more difficult, the Agency is imposing additional conditions to minimize the potential for such an event. (See section V.I.1 of today's notice for a detailed

description of this point.) Thus, adequate safeguards have been imposed and will be implemented in the event of an accidental release of hazardous constituents.

It should be noted that the Waste Retrieval Plan is backed by successful mock retrieval demonstrations, although EPA recognizes that mock retrieval demonstrations performed thus far at the WIPP did not include removal of waste from the alcoves themselves. Other aspects of the removal process, however, were simulated in the retrieval demonstration. Mock retrieval experiments on backfilled alcoves and on bins will be performed before any waste is placed in the WIPP.

EPA agrees with commenters that shuffling of the waste during the retrieval process could increase the risk of a release; however, safe movement of the waste containers is technically feasible, and EPA has concluded that DOE's routine container-management procedures are adequate. Furthermore, any removal activities will be conducted under the oversight of the State of New Mexico, either during RCRA interim status or under permit conditions, which will ensure an appropriate level of care. Finally, the Environmental Evaluation Group, an independent group established by Congress to provide review of the WIPP project, provides oversight over waste management and safety aspects of WIPP operations, including removal.

A number of commenters raised the possibility of drum corrosion during the test phase, which could lead to spillage and complicate retrieval. EPA has concluded, however, that the potential for significant drum corrosion during the test phase is limited and will not substantially affect the retrieval of wastes. While it is true that salt is very corrosive, the rate of corrosion of the drums being stored in the repository is expected to be low. This is because several key factors affecting the rate of drum corrosion allow for favorable drum storage conditions. In particular, the rate of corrosion is affected by the composition of the brine contacting the drums. That is, corrosion proceeds most rapidly if the brine is unsaturated and contains dissolved oxygen. However, the brine in the WIPP repository is both saturated with salt and contains low levels of dissolved oxygen; therefore, drum corrosion would be inhibited. Moreover, the rate of corrosion is directly affected by the amount of brine contacting the drums. Since the repository is expected to remain dry during the test period and thus there will be minimal drum-brine contact, EPA does not expect the drums to corrode significantly. For these reasons, EPA has concluded that the useful drum life in the WIPP will exceed the period of this determination, including retrieval time, and it sees no reason to question DOE's statement that the drums will maintain integrity for twenty years.

In addition, EPA notes that containers at the WIPP will be subject to monitoring and inspection procedures required under RCRA 40 CFR part 265 (and, once a permit has been issued, under 40 CFR part 264). These requirements will be administered by the New Mexico Environmental Improvements Division, with EPA oversight. If any questionable drums were identified, mitigative measures—such as overpacking—could be undertaken. To be sure, drums that are sealed in the alcoves during the alcove tests cannot be routinely inspected. However, under DOE's test plan, these tests are expected to last approximately five years. Thus, inspection would be possible well within the useful life of the drum.

Finally, as EPA discusses in this and the following section, spillage from drums (however unlikely) can be contained and cleaned up, and corroded drums can be overpacked. Thus, EPA disagrees with commenters that drum corrosion might prevent the safe removal of drums from the WIPP, if removal proves necessary.

Limited effect of accidents and spills. Numerous commenters argued that accidents or spills at the WIPP site would complicate retrieval of wastes or might lead to migration. EPA agrees that accidents or spills might complicate retrieval, but it has nevertheless concluded that the cleanup of spills and the removal of contaminated material from the WIPP is technically feasible. The WIPP Retrieval Plan outlines DOE's planned approach to the removal of contaminated material; in addition, the feasibility of safe removal of such material was demonstrated in DOE's mock retrievals. Moreover, neither EPA nor public commenters identified any spill situations that by themselves would lead to a release from the repository.

EPA has addressed the possibility of fire or explosion in the WIPP by new waste characterization requirements in today's decision. Under these requirements, DOE must test every container shipped to the WIPP for flammable gases. If flammable gases are identified, the waste cannot be placed in the repository. Therefore, under the terms of EPA's determination, explosion or fire in the WIPP is not a credible event. (After DOE has developed a greater body of data on wastes shipped to the WIPP, it is likely that waste characterization requirements addressing flammability can be relaxed. However, this could only take place through a modification of the determination, with opportunity for public comment.)

Effectiveness of controls against human intrusion. During the period covered by today's determination, DOE will maintain active control over the WIPP site, and unauthorized access will be prohibited. Furthermore, the site will be operating under RCRA interim status and permit conditions, administered by the State of New Mexico, and therefore will have to comply with the RCRA security requirements. These requirements include prevention of unknown entry of persons or livestock to the active portion of the facility. Finally, DOE has secured all mineral leases at the WIPP site, eliminating the possibility of the disturbance of the repository as a result of mining or drilling. For these reasons, the Agency has concluded that migration resulting from human intrusion will not occur during the term of the determination.

B. Conditions of Determination

1. Limitation to Testing and Experimentation

In EPA's proposed finding, it limited activities involving mixed waste at the WIPP repository to the testing and experimentation described in DOE's petition and referenced documents. The Agency has retained this condition in its final determination. Consequently, DOE will be restricted to its planned test phase activities, as described in the "WIPP Test Phase Plan: Performance Assessment," Revision 0 (DOE/WIPP 89-011, April 1990). Before DOE could conduct activities beyond the scope of this test plan, it would have to petition EPA to modify its no-migration finding.

Several commenters on the proposal expressed uncertainty about what specific activities would fall under the definition of "testing and experimentation"; in addition, the commenters asked for clarification of when DOE would have to notify EPA of changes from activities described in the performance assessment test plan.

With respect to the first point, DOE could conduct in the repository only those tests or experiments designed to provide data to demonstrate the long-term acceptability of the WIPP. Thus, DOE's planned "operations demonstration" has been explicitly excluded from the allowed activities;

other nontesting activities would similarly be excluded. For clarification, EPA has modified this condition, which originally read "placement of waste for the primary purpose of conducting an operations demonstrated is prohibited under this variance * * *," by dropping the word "primary." Several commenters suggested that the inclusion of the word "primary" amounted to an invitation to DOE to conduct a full-scale operations demonstration with the excuse that some testing was also going on. This was not EPA's intention, and therefore it has modified the condition accordingly. EPA, however, stresses that it does not understand this condition as preventing DOE from incidentally testing some operational aspects of its system when it places waste underground for permissible testing. Such activity, in EPA's view, would not constitute an "operations demonstration" in the sense that DOE as well as DOE critics have used the phrase up to this point. In addition, EPA recognizes that some mixed wastes might be generated underground as a result of legitimate experimentation or air monitoring in the WIPP repository. These wastes, which might no longer have any experimental purposes, could nevertheless be stored in the repository until a final determination on the site was made. Because the materials were originally placed in the WIPP for permissible testing, continued storage of the wastes in the repository would be consistent with the terms of EPA's decision.

With respect to the second point, tests and experiments conducted under today's determination would have to be consistent with the activities described in DOE's performance assessment test plan and its no-migration petition. For example, where substantially different wastes or waste containers are used, where waste volumes were increased above 0.5 percent (but less than one percent), or where tests outside DOE's planned three-phase bin and alcove-scale tests are contemplated, DOE would be required to notify EPA and, if the changes might affect the basis of EPA's finding, seek a modification to that finding. The only exception to this would be those wastes that are described in DOE's no-migration petition that are modified through various treatment technologies; because the composition of these wastes, if changed, would contain fewer toxic constituents, the Agency does not believe it would have to be notified before the wastes could be placed in the repository. EPA does note, however, that the pilot-room tests originally suggested by EPA and now contemplated by DOE, would be excluded under today's decision, because they go substantially beyond the program described in DOE's test plan and furthermore are inconsistent with other conditions of the determination (e.g., the volume limit and retrievability of wastes).

2. Limitation on Volume

In its proposed determination, EPA did not set a specific limit on the amount of mixed waste that DOE could place in the repository during the test phase. Instead, EPA argued that, because of the experimental nature of the test phase, DOE needed a reasonable degree of flexibility in carrying out its experimental program. Although several commenters supported EPA's approach, many opposed it, arguing that it was open-ended and allowed DOE to expand the scope of the test phase indefinitely. Although EPA continues to believe that its no-migration finding, as proposed, significantly restricts the nature of DOE activities during the test phase, the Agency nonetheless understands the concerns of the commenters. Therefore, it has decided to place a volume limitation of 8,500 drums or 1 percent of the total projected WIPP volume on wastes that can be placed in the repository under this determination.

In setting a volume limit, EPA notes that DOE's "WIPP Test Phase Plan" called for bin and alcove-scale testing of waste amounting to 0.5 percent of the projected WIPP capacity, while in Congressional testimony, DOE indicated that bin, alcove, and pilot-room tests might require waste amounting to approximately 2 percent of the WIPP capacity. Because EPA has determined that the pilot-room tests, as currently planned, could not be conducted under the proposed no-migration finding, it believes that the 2 percent volume limit would be inappropriate. At the same time, EPA also believes that limiting DOE to the amounts specified in the current test plan might not provide sufficient flexibility for DOE to modify those plans, particularly in response to comments from reviewing organizations. Consequently, EPA has decided to impose a limit of 1 percent of total WIPP capacity (or 8,500 drums), a figure that provides some flexibility to DOE and at the same time gives the public assurance of an opportunity to comment if significant increases over DOE's proposed waste volumes are needed.

EPA emphasizes that it is not basing the 1 percent limit on any technical determination of how much waste would be necessary for DOE to carry out an adequate testing program. Rather, EPA in effect is defining a limit that it would consider to be a significant departure from the activities described in DOE's no-migration petition and its final test plan. Before DOE could exceed that limit, it would have to repetition EPA, and any EPA approval of an expanded test program would have to undergo public comment. EPA also emphasizes that the 1 percent figure represents an upper limit on the amount of waste that may be placed in the WIPP under today's determination. This limit would not override the condition that waste could be placed in the WIPP only for testing and experimentation within the scope of DOE's test plan. Waste would not be allowed in the repository for purposes other than testing and experimentation, even if the volume of waste involved did not exceed the 1 percent limit.

Many commenters also suggested that EPA shorten the proposed ten-year expiration date for petition approval. EPA has not adopted this suggestion, because, as it discussed in the proposed decision, it believes such a limit might artificially constrain legitimate testing. EPA does not believe the difference between five years (the projected length of DOE's test phase) and ten years is significant in terms of the likelihood of release of hazardous constituents from the repository. Furthermore, it has concluded that this difference in time will not significantly effect retrievability. However, EPA acknowledges that the timing and procedures for removal of waste if DOE is not able to demonstrate the long-term acceptability of the WIPP at the close of the ten-year period was not clear in the proposed finding. Therefore, the Agency has amended the conditions of the finding to address this concern. This issue is discussed below.

3. Waste Retrieval

The requirement that DOE retrieve wastes from the repository if it cannot demonstrate the long-term acceptability of the site remains unchanged from the proposal. As discussed above in section IV.A, EPA has found such retrieval to be feasible within the general parameters of the plans submitted with the petition. In addition, EPA has added a clause spelling out in more detail the timing of retrieval. Under this requirement, DOE must submit to EPA a specific retrieval schedule no later than six months after it is determined that the WIPP cannot meet the long-term disposal standards, or six months before the expiration of the petition approval (*i.e.*, 10 years after petition approval), whichever comes first. This schedule would have to detail

retrieval procedures and include a schedule for the removal of the waste as rapidly as technically feasible. Before retrieval took place, the plan would be subject to public comment and EPA approval.

4. Waste Retrievability

DOE is required to place all waste in the repository in a readily retrievable manner. This condition is unchanged from the proposal. By "readily retrievable," EPA means adoption of the specific measures identified in DOE's petition to maintain room stability (*i.e.*, room sizing, rock bolting), the use of easily retrieved waste containers (*e.g.*, boxes, bins, and drums), and the absence of backfilling—except in alcove tests where standoff walls will be used. (EPA notes that testing in pilot-scale rooms, which the Agency originally suggested and DOE is now considering, would not be allowed under this condition, because—as currently planned—they would involve backfilling of waste in the pilot rooms without standoff walls. DOE would have to seek a modification of the no-migration finding, with opportunity for public comment, before conducting such tests.)

5. Carbon Adsorption Device

Today's decision requires DOE to install a carbon adsorption control device in the bin discharge system of each room designed to achieve a 95 percent control efficiency. The Agency believes a 95 percent control efficiency is readily achievable. (See 55 FR 25454.) The design must be based on a total design gas volume consisting of a design gas generation value of at least 5 moles per drum per year from the bins and the volume of gas used to purge the bin exhaust manifold. EPA also wishes to clarify that the design value for the frequency of carbon replacement must be verified by testing and modified as needed to prevent breakthrough from occurring. The testing must consist of measurements of the adsorption capacity of carbon for the bin exhaust gases, as described in the petition. EPA is also requiring DOE to maintain design records, including any test data, and operating records in the facility operating record, as described in the notice of the proposed decision. (See 55 FR 13068, Section IV.J.) Records must be maintained for the term of today's determination (i.e., ten years from today's date), or three years after the creation of the records, whichever is longer. In addition, the records must be maintained during the course of any enforcement action for which they are relevant.

EPA is not requiring DOE to perform testing to verify the control efficiency of the carbon bed. However, DOE must monitor the bin exhaust manifold to show that no migration above health-based levels occurs at the unit boundary. This must be further confirmed by monitoring at the exhaust shaft. Although the 5 moles per drum per year design value for gas generation is believed to be conservative, the overall average rate of gas generation from TRU wastes is not known with certainty; this is the purpose of the bin and alcove tests. The control efficiency actually achieved will be higher or lower depending on the rate at which gas is generated during the tests. However, even if gas generation rates were to be as high as 25 moles per drum per year, the design would still achieve the no-migration standard.

6. Air Monitoring Plan

EPA is requiring air monitoring for activities conducted under today's no-migration finding to confirm that there is no migration of hazardous constituents above health-based levels beyond the unit boundary. As described in its notice of proposed decision (55 FR 13068), EPA has concluded that the only possible migration pathway during the test phase is through the exhaust shaft. Therefore, in accordance with the requirements of 40 CFR 268.6(c), the Agency is requiring DOE to implement the air monitoring plan submitted with its petition, subject to the clarifications, modifications, and reporting requirements described in the notice of proposed decision, except as noted below.

In its proposed decision, EPA solicited comment on whether additional monitoring should be conducted in the underground repository with portable explosimeters to detect any buildup of methane, hydrogen, or other flammable gases. No comments were received in favor of portable explosimeters. Therefore, EPA has decided not to require their use. At the same time, however, EPA has determined that only by testing individual waste containers to be placed in the WIPP can it be assured that no fire or explosion hazard exists. Thus, EPA is including an additional condition requiring such testing, as described in section IV.B.7.a of today's notice.

EPA also solicited comment on whether to allow a reduction in monitoring frequency from weekly to monthly. EPA received no comments on this question and has decided to retain a weekly minimum monitoring frequency. Furthermore, EPA solicited comment on whether other constituents, in addition to the five constituents proposed, should be targeted for routine quantitation. No comments were received on this question; therefore, EPA has decided to retain the five target constituents listed in the notice of proposed decision, with provisions for targeting additional constituents, as described in the proposal.

In the proposal, EPA spelled out a variety of quality assurance and quality control requirements, making mention of the "Report on Minimum Criteria to Assure Data Quality." Since that time, EPA has revised this report and has retitled it "Quality Assurance and Quality Control" (August 1990), a copy of which has been placed in the docket to this rule. Therefore, EPA is requiring DOE to follow the requirements of the revised report, in addition to adhering to the specific quality control requirements described in the DOE monitoring plan and EPA's notice of proposed decision. EPA wishes to clarify that it intends the "method limit of quantitation," the term used in the notice of its proposed decision, to be synonymous with the term "method detection limit," or MDL, used in the report, "Quality Assurance and Quality Control." In addition, EPA is requiring DOE to maintain documentation of all aspects of quality assurance and quality control, as described in the revised report, in the WIPP facility operating record; this documentation must be available for inspection by the Agency. The records must be maintained for the term of today's determination or three years after they are created, whichever is longer. In addition, the records must be maintained during the course of any enforcement action for which they are relevant.

Initial monitoring results underground at the WIPP have revealed significant background levels of 1,1,1-trichloroethane and carbon tetrachloride.[1] The levels measured can interfere with the evaluation of accuracy if the approach described in the notice of proposed decision is used. Therefore, EPA is changing the method by which relative accuracy is determined. Instead of computing accuracy based on a matrix spike alone (as the relative difference between the concentration recovered from the sampler and the concentration of the targeted analyte as determined from the known concentration in the audit gas cylinder), the computation should be adjusted for

[1] Significant levels of methylene chloride were also detected in background samples. However, laboratory contamination is the most likely explanation for the measured levels of methylene chloride.

the actual background concentration measured in a matrix duplicate at the time the matrix spike is collected. Therefore, DOE must collect and analyze both a matrix spike and a concurrent matrix duplicate.

EPA further solicited comment on what specific quality assurance (QA) objectives it should require for data acceptability. DOE requested that EPA allow less accurate measurements at concentrations near the detection limit. The data provided by DOE, however, gave no basis for establishing an alternative QA objective for accuracy, due to high background levels. Because of this, and because EPA is not requiring data that are below the method detection limit (MDL) to be used in the evaluation of relative accuracy (the MDL is generally considerably higher than the limit of sensitivity of the analytical procedure), EPA has concluded that the plus or minus 10 percent requirement can be achieved. Therefore, no change is being made to the QA objectives established in the notice of proposed decision.

Finally, EPA proposed to require calibration of the ventilation exhaust fans on a quarterly basis. In its comments on the proposal, DOE interpreted this to mean a full dynamic calibration, which it argued is needed only on a yearly basis. EPA means to require only a check on the fan calibration on a quarterly basis, using the methods described in the notice of proposed decision. EPA agrees that a full calibration is needed only on a yearly basis.

Several commenters expressed concern that EPA is allowing monitoring at the top of the exhaust shaft instead of at the entrance to the shaft. They argued that EPA should require DOE to monitor the entrance and exit of the shaft to demonstrate EPA's statement that there will be no difference between measurements. EPA disagrees with these commenters. Even if, as suggested by one commenter, the integrity of the concrete shaft liner were compromised, it is inconceivable that any depletion of concentrations of hazardous constituents could be detected, given the large volume of air that the exhaust shaft is designed to handle during operation. EPA's overriding concern regarding the specific location of the exhaust shaft monitoring station is that it be situated so as to enable ready access for operation and maintenance purposes. Indeed, EPA views ready accessibility as one of a number of important quality assurance objectives. Therefore, EPA continues to accept monitoring at the top of the exhaust shaft.

7. Waste Analysis

a. *Flammability.* EPA received a number of comments that flammable gases could build up in waste containers, creating a fire and explosion hazard. After reviewing these comments and new information made available during the public comment period, EPA has concluded that, while a fire or explosion is unlikely, the possibility of accidental ignition of flammable gases in waste containers cannot be ruled out. Were a fire or explosion to occur as a result of accidental ignition of flammable gases in the void space of a waste container, retrieval could be much more difficult, should retrieval become necessary. Moreover, such an event could itself cause migration above hazardous levels beyond the unboundary.

For these reasons, EPA believes that no waste container should be emplaced in the underground repository if it contains flammable mixtures of gases in any layer of confinement, or mixtures of gases that could become flammable when mixed with air. To assure a sufficient margin of safety, EPA defines any mixture as potentially flammable if it exceeds 50 percent of the lower explosive limit (LEL) of the mixture in air.

To ensure that individual waste containers have met the prohibition on flammable gases, the Agency is requiring that every waste container be tested for hydrogen, methane, and volatile organic compounds (VOCs) as a class. Given the heterogeneity of the waste package, the Agency is also requiring that headspace sampling be representative of the entire void space of the waste container. EPA expects that all layers of confinement in a container will have to be sampled until DOE can demonstrate to the Agency, based on the data collected, that sampling of all layers is either unnecessary or can be safely reduced. The testing of wastes that exhibit high rates of radiolysis should be performed a relatively short time before the container is actually emplaced underground. Otherwise, hydrogen levels could build up to flammable levels following sample collection and analysis. Therefore, DOE must determine, and document, the length of time that headspace gases can be expected to remain below flammable levels (i.e., 50 percent of the mixture LEL) after sampling has been performed, for both newly generated and retrievably stored wastes, and to ensure that the waste containers are emplaced in the WIPP within that time.

If testing reveals the presence of significant levels of flammable VOCs, DOE must perform an explicit flame test to determine if a flammable mixture can be formed with air. Significant levels of flammable VOCs are defined as measured concentrations (excluding methane) of 500 parts per million or greater. If testing shows that VOCs are insignificant, i.e., below 500 parts per million, DOE may determine the lower explosive limit of the mixture from the lower explosive limits of methane and hydrogen using the Le Chatelier formula, as described in Section V.I.a of today's notice.

All testing must satisfy the quality assurance and quality control requirements described in EPA's report "Quality Assurance and Quality Control" (August 1990) and must meet quality assurance objectives of plus or minus 10 percent on precision and accuracy. DOE must also maintain records on all testing performed and other documentation needed to comply with this condition at the generating site or in the WIPP facility operating record. These records must be available for inspection by EPA, and must include documentation of all aspects of quality assurance and quality control, as described in the above-referenced document. Records must be maintained for the term of today's decision, or three years after they are generated, whichever is longer. They also must be retained for the duration or any enforcement action related to this part of today's decision.

b. *RCRA Constituents—Short-term characterization.* In response to comments regarding the accuracy of the waste composition estimates provided by DOE in its no-migration petition, EPA is modifying its proposal to require that DOE analyze headspace gases in containers that are shipped to the WIPP and compare the results of this analysis to the estimated values provided in the no-migration petition. Since it was the values in the petition that EPA evaluated in today's decision, DOE must ensure that the analytical data derived from the actual test-phase wastes are similar to the petition estimates. Wastes that are not compositionally similar may not be placed in the WIPP.

(1) *Bin-scale tests.* DOE must compare actual measurements of headspace concentrations of volatile organics in each of the drums containing wastes to be used in the bin-scale tests to the headspace concentrations reported in DOE's petition. The comparisons must be made in terms of both maximum and mean concentrations. (EPA considers only headspace concentrations to be

necessary because migration through air was determined to be the only viable route of migration during the test phase.)

The comparison of the maximum concentrations is designed to ensure that the wastes to be emplaced in the WIPP are in fact similar to the wastes described in the petition. In its proposed decision, EPA noted concerns with the precision and accuracy of some of the analytical data in the petition and took this uncertainty into account during its evaluation. To address concerns over the quality of its data, DOE will be conducting an extensive characterization program on wastes to be shipped to the WIPP for the bin-scale and alcove tests under greatly improved quality assurance/quality control (QA/QC) procedures. (See e.g., DOE's Pre-Test Waste Characterization Plan, Revision 6, in the docket to today's decision.) Because of improved data quality, EPA expects these new data to differ somewhat from those contained in the petition. However, the Agency believes that the measured maximum concentrations identified in individual drums in DOE's pretest waste characterization program should be generally comparable to the maximum values reported in the petition.

There are no established criteria for quantitatively defining "comparability" in this context. EPA, however, has concluded that, if the measured headspace concentration in a given drum are no more than a factor of two over the maximum reported for the drum in the petition, the wastes are reasonably comparable. In selecting a factor of two, EPA notes that some differences between the new data and that contained in the petition are expected. This is because the new data will represent a larger sample and analytical results may be more accurate. (As noted in EPA's proposal, the precision and accuracy of the analytical data in the petition were not always well documented.) For these reasons, EPA has concluded that it is reasonable to expect some concentrations will be measured that will exceed the maximum values reported in the petition. EPA, however, also believes that the data should not be significantly different and concludes that a factor of two represents a reasonable expectation.

Accordingly, DOE may place the contents of individual drums into bins for the bin-scale tests if the measured headspace concentrations do not exceed the reported maximums by more than a factor of two.[8] Testing and verification must be completed before the waste is shipped to the WIPP. If the measured concentration of any of the pertinent hazardous constituents in a drum headspace exceeds the allowable maximum, the contents of the drum from which the sample was collected cannot be shipped to or emplaced in the WIPP, unless DOE subsequently treats the waste so as to reduce headspace concentrations to below the maximum levels. Alternatively, DOE may petition EPA to modify the conditions of its determination. Any such modification would require public comment. Further, DOE must maintain records of all relevant test data at the generating site or the WIPP for the term of today's determination, or three years after the data are generated, whichever is longer. In addition, records must also be retained for the duration of any enforcement action for which they are relevant.

The maximum allowable concentrations for hazardous constituent by waste type (the maximum reported concentrations multiplied by two) are presented in Table 2.

TABLE 2.—MAXIMUM HEADSPACE CONCENTRATIONS

[In volume percent]

Constituent	Type I	Type II	Type III	Type IV
Carbon tetrachloride	0.08	0.18	0.58	8.18
Methylene chloride	0.44	0.84	0.50	1.42
1,1,1-Trichloroethane	1.88	5.68	2.12	14.96
Trichloroethylene	0.08	0.34	0.28	0.28
1,1,2-Trichloro-1,2,2-trifluoroethane	0.05	1.62	5.74	20.80

EPA's no-migration finding for air releases was based upon the mean headspace concentrations of volatile constituents reported by DOE. Accordingly, EPA has concluded that comparison of the new, pre-test characterization data with the mean concentrations reported in the petition is also necessary to ensure that EPA's estimates of volatile emissions are valid for the actual test-phase wastes. In determining a reasonable factor for this comparison, EPA considered the "safety margin" indicated by the no-migration demonstration. For the constituents of concern, this safety margin ranges from approximately eleven to well over sixteen million, varying by constituent. EPA has no reason to believe that the headspace concentrations for 1,1,1-trichloroethane and 1,1,1-trichloro-1,2,2-trifluoroethane (with safety factors of six and seven orders of magnitude, respectively) could be high enough to alter the no-migration finding. For the other constituents (carbon tetrachloride, methylene chloride, and trichloroethylene), the safety factors are lower (one, two, and two orders of magnitude, respectively). EPA, therefore, has concluded that DOE must compare the new headspace data for these constituents to the mean values reported in the petition.[9] To ensure that the no-migration finding remains valid for these constituents, EPA is requiring that the mean values for the test phase wastes cannot exceed ten times the mean values reported in the petition.

EPA is confident that the factor of ten (back-calculated from the modeling for carbon tetrachloride) is sufficiently conservative for all three of the constituents. Even though no additional safety factor has been added for carbon tetrachloride, EPA notes that the modeling upon which the calculation was based contains several conservative assumptions (e.g., that both test rooms are filled to capacity). EPA also notes that, during the test phase, emissions will be monitored and it will be clear well in advance if emission levels are approaching the no-migration limits, and corrective measures could be taken. Therefore, EPA is comfortable with a safety factor of ten for the comparison of the mean values.

DOE must compare the predicted mean values (multiplied by ten) against the average of the measured concentrations of the headspaces of all drums of a single waste type used to make up each bin. That is, the mean from the population of drums going to each bin (by waste type) must be compared with the reported mean for that waste type. If the calculated mean exceeds the reported mean by more than a factor of ten, that bin cannot be emplaced at the WIPP under today's decision. Testing and verification must be completed before the waste is shipped to or emplaced in the WIPP. As with comparisons of maximum concentrations, DOE must maintain records of all relevant test data at the generating site or at the WIPP facility for the term of today's determination, or for three years after generation, whichever is longer.

The allowable average concentrations for each waste type in drums to be used

[8] As with the condition related to flammability discussed previously, DOE must demonstrate that samples collected for these analyses are representative of the entire headspace within the drum, including the headspace within inner bags.

[9] See footnote 8.

in a single bin are presented in Table 3.[10]

TABLE 3.—MEAN HEADSPACE CONCENTRATIONS

(In volume percent)

Constituent	Type I	Type II	Type III	Type IV
Carbon tetrachloride	0.24	0.25	0.30	6.90
Methylene chloride	0.39	0.42	0.33	0.93
Trichloroethylene	0.25	0.28	0.29	0.38

(2) *Alcove tests.* EPA has found emissions from the alcove tests to be inconsequential in comparison to the bin-scale tests. Accordingly, EPA is not requiring testing of the headspace of drums used in the alcove tests to demonstrate comparability with reported concentrations in DOE's petition.[11] Before any drums can be shipped to the WIPP for alcove tests, however, DOE must verify (by waste type), through results of the bin-scale tests conducted up to that point, that the measured mean concentrations for specific hazardous constituents do not exceed the reported mean values by more than a factor of ten. (See Table 3.) (This condition would not require DOE to conduct all bin-scale tests before the alcove tests could proceed; however, based on discussions with DOE, EPA believes that most of the bin-scale tests will be conducted before the alcove tests begin.) EPA is also not requiring DOE to test the drums to determine maximum concentrations for specific hazardous constituents, because it believes that sufficient data will have been compiled from tests conducted in bin-scale drums to determine if there is a concern. In this regard, EPA notes that the drums for both the bin-scale and the alcove tests will be randomly selected from the population of each appropriate waste type. Therefore, there is no reason to believe that the wastes used in the alcove tests will be any more or less accurately characterized by the data in the petition than will be the wastes used in the bin-scale tests. For this reason, EPA has concluded that the data collected from the drums selected for the bin-scale tests can be appropriately extrapolated to the drums for the alcove tests.

c. *RCRA Constituents—Long-term characterization.* In its proposed decision, EPA expressed some concern over the limited waste characterization data provided by DOE in support of its petition. While EPA concluded that the data were sufficient for the no-migration demonstration for the test phase, it also believed that further characterization was required, before any finding could be made for the operational and post-closure phases. EPA believes that this further characterization will be necessary both to further confirm DOE's estimates of waste composition and to ensure that the wastes are sufficiently similar to allow the results of test-phase experimentation to be extrapolated to the wastes that DOE wishes to emplace at the WIPP in the operational phase. That is, the Agency wished to ensure that the test-phase wastes are accurately represented by the estimates and are representative of the remainder of the wastes.[12] In addition, more accurate source term data may prove necessary, EPA believes, in long-term modeling exercises. Toward these ends, the Agency proposed to require DOE to report all characterization data that will be collected.

After carefully reviewing public comments, EPA continues to believe that the data provided by DOE in its petition are sufficient for its finding with respect to the WIPP test phase, where air emissions are the major concern (especially given the standards on headspace concentrations and flammability imposed in today's decision). The additional waste characterization data under development by DOE during the test phase will be important for any review of a subsequent no-migration petition for operational and post-closure periods, where groundwater migration and other issues may arise; however, the data are not needed for today's decision. Accordingly, EPA has not included detailed requirements for waste characterization of the test-phase wastes (beyond the headspace concentrations and flammability limits) or of wastes generated at the ten DOE sites as a condition for today's final decision. However, DOE is developing waste characterization plans, including sample collection, preservation, and analytical procedures, to demonstrate the extent to which the test phase wastes are representative of the other wastes from the ten sites, and to confirm the actual levels of RCRA constituents in headspace gases and sludges. If certain wastes that are generated at the ten sites are not represented (as defined in footnote 12) by the wastes that were tested during the test phase, they could not be shipped to the WIPP without further Agency evaluation, including the possibility for public comment or treatment of the waste.

Over the past several months, EPA—and the state of New Mexico—has reviewed a number of documents concerning DOE's pre-test waste characterization plans. EPA will continue to provide comments to DOE to assist DOE in evaluating whether the waste characterization data that DOE will be collecting are sufficient to make a long-term finding for the WIPP. If adequate data are not collected, EPA will not be in a position to approve any no-migration petition for the operational and post-closure phases, if DOE submits such a petition. At a minimum, the wastes should be analyzed for the following constituents:

Acetone	Hydrazine
Benzene	Methanol
Bromoform	Methylene chloride
Butanol	4-Methyl-2-pentanone
Nitrobenzene	1,1,1-Trichloroethane
1,1,2,2-Tetrachloroethane	Trichloroethylene
Tetrachloroethylene	1,1,2-Tricholoro-1,2,2-trifluoroethane
Toluene	1,3,5-Trimethylbenzene
2-Butanone	1,2,4-Trimethylbenzene
Carbon tetrachloride	m-Xylene
Chloroform	o-Xylene
Chlorobenzene	p-Xylene
Cyclohexane	Cadmium
1,1-Dichloroethane	Chromium
1,2-Dichloroethane	Lead
1,2-Dichloroethene	Mercury
cis-1,2-Dichloroethene	Selenium
Ethyl benzene	Silver
Ethyl ether	
Formaldehyde	

Testing for these constituents should include headspace analysis of all waste types for the organic compounds, as well as total analysis of the sludges for both the organic compounds and the metals.[13] Since these date are not

[10] The allowable concentrations are the reported mean concentrations for each waste type multiplied by ten. In calculating the mean headspace concentrations, EPA used one-half the detection limit indicated in the no-migration petition to represent concentrations where the constituent was not detected.

[11] Although today's decisions does not require DOE to characterize RCRA constituents in the drums to be used in the alcove tests, DOE has informed EPA that it intends to test some statistical number of drums that are to be used in the alcove test. In addition, as discussed earlier, DOE will be required to test the headspace of drums used in the alcove tests for flammability.

[12] By "representative," EPA is referring to those factors that should contribute to migration of hazardous constituents. The purpose of the test-phase experiments is to evaluate gas-generation processes and provide a database of information that can be used to predict gas generation potential of the wastes that are planned to be emplaced during the operational phase. Thus, the issue of whether the test-phase wastes are "representative" deals with whether the results of the test-phase experiments can be extrapolated to the remaining wastes. To that end, DOE's approach is based upon an "envelope" or "bounding" concept wherein wastes whose characterization (for gas-generation potential) is within that envelope would be considered "represented" by the test-phase wastes.

[13] As indicated in Section I.D of today's notice, the state of New Mexico is responsible for enforcing

Continued

necessary for today's finding, but rather will be evaluated as part of a subsequent review of a petition for the operational and post-closure periods (if DOE chooses to submit such a petition). EPA has concluded that the specifics of this testing should not constitute a condition in today's decision.

d. Reporting Requirements

Reporting requirements associated with EPA's final no-migration determination are unchanged from the proposal—that is, annual written reports are required on the status of DOE's performance assessment during the test phase—except that the final determination requires that DOE send reports to EPA's Region VI office in Dallas, Texas, as well as to the EPA Office of Solid Waste at EPA headquarters. Because Region VI will have direct enforcement authority over the WIPP, EPA believes that it is important for reports to go directly to the regional office as well as to EPA headquarters.

V. Discussion of Major Issues

EPA received more than 400 comments on its proposal, some supporting EPA's proposed decision and others opposing it. Commenters raised a wide variety of issues, including the general scope of EPA's review and its proposed decision; the suitability of the site; the consistency of EPA's proposed approach with the statutory no-migration standards; adequacy of waste characterization; the feasibility and likelihood of retrieval; the impact of possible human intrusion; and many other issues. The major issues raised by the public are discussed below as well as in other sections of this notice. These and the other issues raised by commenters are also discussed in detail in a Response to Comment document prepared by EPA. This document is available in the public docket to this decision.

A. *Appropriateness of "Exemption" for DOE*

A number of commenters criticized EPA for proposing to grant to DOE what they regarded as an "exemption" from the hazardous waste regulations for its WIPP operations. They questioned why EPA would grant an "exemption" or "variance" to DOE for radioactive wastes, given the risks of this material. Numerous commenters also questioned DOE's record at other sites, and argued that DOE should be required to comply with all applicable regulations—without special "exemptions" or "variances"—before it was allowed to place waste in the WIPP repository for any purposes.

EPA stresses that it is not granting an "exemption" to DOE from the hazardous waste regulations. This action, however, is a "variance" only in a very narrow sense. HSWA establishes two routes by which a regulated party may dispose of waste in compliance with the land disposal restrictions: It may pretreat wastes according to specified treatment standards, or it may dispose of the waste in a unit that meets the stringent no-migration standard. DOE has chosen the second route of complying with these restrictions—an option that is in some respects the more stringent of the two. For example, if DOE were to choose treatment as its approach, DOE would no longer be required to demonstrate that no hazardous constituents would migrate from the WIPP before the treated waste (which might still remain hazardous) could be placed underground. In any case, EPA reemphasizes that its action today in no way exempts DOE from the hazardous waste regulations; instead, it is a determination by EPA that the placement of untreated mixed waste in the WIPP during the test phase complies with the statutory and regulatory restrictions on land disposal under RCRA. Furthermore, it should be noted that the WIPP must also comply with the other hazardous wastes standards of RCRA, as well as other applicable standards. Other standards applicable to the WIPP are described in Section I.D of this notice.

EPA recognizes the concerns of many commenters over acknowledged problems at other DOE sites. EPA, however, does not believe that problems at other sites should rule out approval of a no-migration petition for the WIPP. The issue at hand is whether there will be any migration of hazardous constituents from the WIPP disposal unit. EPA has carefully and independently reviewed all the information from other sources. As a consequence of this review, EPA has concluded that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate from the disposal unit, under the conditions prescribed in Section VI of this notice.

B. *Timing of EPA Decision*

A number of commenters expressed concern about what they considered to be EPA's undue haste in proposing to grant DOE's no-migration petition for the WIPP, and they criticized EPA's tentative schedule for a final decision. They suggested that EPA may have taken undue shortcuts in the regulatory process, or that DOE's petition was given an insufficient level of technical review.

EPA disagrees with these commenters. The Agency deliberated on DOE's original petition for more than a year before its proposed no-migration determination for the WIPP in April 1990, and it spent an additional five months in the review of public comments before reaching a final decision. In the course of this review EPA conducted a complete and thorough evaluation of DOE's petition, material provided by DOE in support of its petition, independent studies of the WIPP, and public comments on the proposed no-migration determination. In addition, EPA staff conducted three investigatory visits to the WIPP site. The results of EPA's review are summarized in today's notice and in the Agency's proposed decision in April 1990. Technical details are provided in EPA's Response to Comments Document and its Background Document, both of which are available in the docket for this rulemaking.

EPA acknowledges that it placed a high priority on the review of DOE's WIPP petition. The Agency disagrees, however, that it took any undue shortcuts in the review or omitted any significant procedural steps. EPA's decision was made in full accord with the procedures for no-migration determinations, codified at 40 CFR 268.6, and with EPA's procedures for site-specific decisions under RCRA. EPA modeled its procedures for handling the WIPP no-migration petition (as well as other no-migration petitions now under review) on its procedures for handling RCRA delisting petitions. These procedures ensure a thorough and complete Agency review, with public notice and full opportunity for public comment.

C. *Scope of Determination*

In its proposed no-migration determination for the WIPP, EPA noted that it did not consider the release and possible risks associated with radioactivity; rather, its review addressed the release of hazardous constituents from the disposal unit. EPA pointed out in its proposal that the statutory language on no-migration referred to the release of hazardous constituents, which do not include radionuclides, and risks of radioactivity from the materials DOE is placing in the WIPP fall within the scope of the Atomic

RCRA interim status standards at the WIPP and for issuing a RCRA permit to the facility. In carrying out these responsibilities, the State may require additional or more stringent waste characterization requirements.

Energy Act rather than RCRA. The Agency further noted that risks associated with transportation lay outside the scope of its no-migration review. Finally, EPA did not seek to determine whether the approach proposed by DOE—that is, deep geologic disposal of TRU wastes at the WIPP site—was the best possible alternative for handling that waste. Despite EPA's explanation of the scope of its no-migration review, numerous commenters raised issues related to radioactivity, transportation, and alternatives to the WIPP. EPA understands that concerns of these commenters; however, its continues to believe these concerns lie outside the scope of its legal authority and are better addressed in other forums.

Radioactivity was a major concern of many commenters. A number, in particular, argued that, since EPA's charge is to protect human health and the environment, it must address the release of radionuclides in any evaluation of the non-migration potential of waste from the WIPP. EPA, however, believes that the potential for radioactive releases from source, special nuclear, and byproduct material is not within the scope of the non-migration determination. First, as EPA explained in its proposed no-migration finding for the WIPP, the Agency's authority over mixed wastes under RCRA extends only to the hazardous components of the waste, not to the radionuclides exempted from RCRA. (EPA explained this position more fully in its mixed waste clarification notice of July 3, 1986, 51 FR 37045. See also Section I.B above). Second, release of radionuclides is not within the specific mandate of the no-migration language in RCRA or the regulatory standards codified at 40 CFR 268.6. Under the statute, EPA may not find a method of disposal protective of human health unless "* * * it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit * * * for as long as the waste remains hazardous." Hazardous constituents are a term of art under the statute, referring to compounds listed in 40 CFR part 261, appendix VIII. No type of radionuclide is listed in the appendix. Moreover, EPA regulations at 40 CFR 268.6 do not contemplate evaluation of the radioactive risks of a given unit.

EPA acknowledges that it has a general authority and responsibility under RCRA and other acts to protect human health and the environment, and that this standard is an overriding consideration in any no-migration decision, including a decision regarding the WIPP. The Agency believes, however, that the standards issued by EPA under the Atomic Energy Act and the Clean Air Act are the proper standards for protection of human health and the environment for radiation risks at the WIPP site. Air emissions from the WIPP during the test phase will have to comply with the Clean Air Act standards for radioactive releases in 40 CFR part 61 and (under agreement with the State of New Mexico) with AEA standards issued under 40 CFR part 191 subpart A. In chapter 6 of its Final Safety Analysis Report, DOE calculated radionuclide emissions from the WIPP according to EPA-approved models to document compliance with Clean Air Act and AEA standards. DOE is also preparing a NESHAP notice of anticipated start-up to file with EPA, in accordance with Clean Air Act standards. Finally, long-term releases of radionuclides will be controlled under AEA disposal standards codified at 40 CFR part 191 subpart B. These regulations, which were specifically designed to address potential radioactive releases, are the appropriate authority for addressing any such releases at the WIPP site.

EPA also acknowledges public concerns about transportation safety and agrees that it is important for DOE to take every necessary measure to ensure the safety of shipments to the WIPP. The question of transportation risks, however, lies outside the scope of EPA's no-migration authority, and therefore the Agency has not addressed them in its review. Instead, overall issues of transportation safety for the WIPP project are addressed under the National Environmental Policy Act (NEPA) through the Environmental Impact Statement process and by the Nuclear Regulatory Commission, which by agreement with DOE has oversight over shipping containers and the waste form during transportation.

Finally, EPA has reviewed comments suggesting that alternatives other than the WIPP—for example, long-term storage of TRU wastes at the sites of generation—should be chosen for management of TRU wastes. The Agency continues to believe that deep geological burial is a promising strategy for the disposal of radioactive waste. But, in any case, the question of whether acceptable alternatives to the WIPP exist, or whether other approaches might be preferable, lies outside the scope of EPA's review. Under the statute, DOE may place untreated mixed waste in the WIPP repository if it can meet the statutory standards for no migration. Alternative approaches to deep geological burial are more appropriately addressed under the NEPA process.

D. EPA Oversight Over the Test Phase

Several commenters of EPA's proposed determination argued that EPA should assert direct oversight over the testing and experimentation during the test phase. For example, some commenters argued that, before any waste was placed in the repository, EPA should make a finding that in-situ testing at the repository was both necessary and sufficient. Others identified what they considered to be flaws in DOE's test plans—e.g., sealing the alcoves in the alcove-scale tests—and argued that EPA should not allow waste to be placed in the repository before those flaws were addressed.

Although EPA believes that DOE has generally laid out a reasonable test program for the WIPP, it disagrees with commenters who argue that the Agency must find, as part of today's determination, that DOE's test plans are necessary and sufficient. The question before EPA is whether there will be any migration of hazardous constituents beyond the unit boundary for as long as the waste remains hazardous, not whether alternatives to in-situ testing are available, or whether DOE's testing program has shortcomings. If DOE can demonstrate no migration for the test phase, which EPA concludes it has done, then it has met the statutory standard for placement of untreated hazardous wastes in the WIPP.

At the same time, the results of the test phase will be critical in review of a no-migration petition for long-term disposal at the WIPP, if DOE chooses to submit one. EPA, therefore, has put DOE on notice that data from the bin and alcove tests must be of good quality. For example, if the adequacy of alcove seals cannot be demonstrated, any data derived from the alcove tests will be of questionable value. Similarly, it is essential for the long-term finding that DOE adequately characterize test waste for RCRA constituents. Toward this end, EPA has described in some detail in section IV.B.7 of this notice the types and quality of data on waste characterization it expects to see in any petition for long-term disposal. However, for the reasons discussed above, the Agency has concluded that it is not appropriate to address the scope or details of DOE's test plans in today's decision—except insofar as they involve possible migration of waste from the disposal unit or the retrievability of the waste.

E. Site Suitability

In reaching its proposed determination, EPA reviewed more than 300 studies of the WIPP site, not only by DOE and its contractors, but also by independent researchers and groups such as the U.S. Geological Survey and the Environmental Evaluation Group. The overwhelming conclusion that EPA drew from these studies is that the WIPP has been located in a remarkably stable formation, and that it is a promising site for the permanent disposal of radioactive waste. Although there remain some questions about the site, which DOE will be addressing during the test phase, EPA expressed its conclusion that the site was sufficiently well characterized for the test phase to proceed. Thus, EPA agreed with the National Academy of Sciences and DOE's Blue Ribbon Panel that it makes sense to begin testing in the WIPP repository as soon as regulatory requirements are satisfied.

Several commenters on the petition, however, raised issues associated with the suitability of the WIPP site. Commenters, for example, expressed concern about the possibility of karst formation in the vicinity of the WIPP site and the general role of dissolution processes in the area; the assumed existence of a pressurized brine pool below the repository; and the rate of brine inflow into the repository. These issues are discussed briefly below and are addressed in more detail in EPA's Response to Comment document for this rulemaking.

A number of commenters expressed concern that the WIPP landscape had the characteristics of a karst terrain. A karst terrain is a kind of topography that is typically formed over limestone, dolomite, or gypsum through dissolution processes; it is usually characterized by closed depressions or sinkholes, caves, and underground drainage. The implication for the WIPP, according to commenters, is that contamination from the repository if it reached the overlying Rustler formation, could be transported rapidly to the accessible environment. Commenters also suggested that ground water in overlying karst formations might attack the repository shaft seals, after closure, and enter the Salado Formation—the salt bed in which the WIPP repository has been constructed. This might lead to dissolution of the halite, allowing a potential pathway for migration past the unit boundary.

The commenters argument that the WIPP area is karstic is based primarily on the presence of several acknowledged and alleged dissolution features in the WIPP area. These include sinkholes in Nash Draw, several kilometers from the WIPP site; dissolution features identified in the WIPP 33 drill hole, just outside the site boundary; and "Barrows Bathtub," a depression about one kilometer from the proposed underground disposal area. Such features, according to commenters, demonstrate that the WIPP site is found in a mature karst area and that wastes can be expected to leak from the WIPP shortly after closure.

As a result of commenters' concerns, EPA reevaluated the question of karst in reaching its final decision. This reevaluation included a field investigation of the WIPP site, in the company of one of the commenters. The tour covered the most important features that the commenters believed were karstic in the vicinity of the WIPP. The closest of these was approximately one kilometer from the surface buildings at the facility. On the basis of this review, EPA has concluded that karst is not now an issue at the WIPP, and is unlikely to become one for many thousands of years, if ever.

EPA recognizes the presence of some localized, surface dissolution features in the general area of the WIPP, particularly in Nash Draw. This is not surprising, given that the geologic units within the area are composed of rock that would be susceptible to dissolution under the correct hydrologic and geochemical conditions. However, evidence suggests that these are ancient features and that current rates of dissolution are extremely slow. For example, dissolution rates at the Nash Draw have been estimated at one-third of a foot every one thousand years, rates that would not threaten the WIPP repository for millions of years. In addition, the widespread occurrence of caliche—a surface feature indicating arid conditions and limited surface dissolution—in the WIPP area suggest the stability of the surface landscape over at least the last 10,000 years. At the same time, borings drilled at and near the WIPP site have failed to encounter solution channels indicative of a karst environment. Finally, it should be noted that the Salado Formation lies 260 meters below the surface, shielded by relatively impermeable rocks. Thus, the repository horizon is isolated from any ongoing dissolution process. The fact that the Salado Formation in the area of the WIPP has remained largely unaffected by dissolution processes over its 225-million-year history is evidence of its stability.

Numerous commenters also expressed concern about the presence and possible effects of pressurized brine in the Castile formation underlying the Salado. One bore hole in the immediate vicinity of the repository—WIPP 12—encountered a large brine pocket in the Castile. Geophysical measurements suggest that this pocket extends underneath the repository itself. Commenters expressed the concern that this brine might, in the long run, threaten the WIPP through dissolution processes or, if a bore hole were drilled at some future date through the repository into the brine pocket, pressurized brine might force contamination to the surface.

After reviewing the comments and other data in the record, EPA continues to believe that the brine pockets in the Castile formation—although they contain a substantial amount of fluid—do not offer a significant threat to the repository. Castile deformation, which led to the formation of the brine pockets, was initiated millions of years ago in association with major tectonic tilting of strata in the Delaware Basin. The region is tectonically inactive at present, implying that new development of major Castile features is not occurring. In addition, the brine pool is completely saturated with respect to halite and therefore has no potential to dissolve the surrounding host rock. Since the Castile and Salado Formations are hydrologically distinct, there is no credible hydrologic connection between the two formations. Finally, because of restrictions on access, there is no realistic possibility of a borehole reaching brine pockets below the repository during the test period. Therefore, this issue does not arise for today's determination. DOE's performance assessment, however, is addressing the possible effects of such a borehole after repository closure.

A number of commenters also expressed concern about the effects of brine inflow into the repository and the validity of permeability values used for the Salado Formation. EPA has reviewed the information pertinent to this discussion and believes that, while a good understanding of brine inflow into the repository exists, additional studies must be conducted to understand the true nature of brine inflow and to quantify inflow in a manner more indicative of facility conditions. These tests will be performed during the WIPP test phase. They will be important in any decision on the long-term acceptability of the WIPP site. Brine inflow, however, will not be a problem during the test phase and thus is not an issue for today's decision.

Finally, commenters expressed concern that DOE's petition and EPA's proposed decision did not fully address the long-term closure scenario expected at the repository. Commenters cited data predicting high rates of gas generation and argued that this gas might delay or prevent creep closure of the repository. As a worst case, gas generation exceeding lithostatic pressure might fracture surrounding salt or threaten the seal system of the repository. In fact, DOE, EPA, and other groups have recognized that the issue of gas generation, and its relation to repository performance, must be adequately addressed before permanent disposal of waste takes place at the WIPP. The major purpose of DOE's in-situ tests in the WIPP with actual wastes is to explore the issue of gas generation. Today's decision will allow these tests to proceed. The Agency believes that the end of the test phase is the appropriate time for it to make a determination of whether the repository is or is not suited for long-term disposal, since the results of the experiments performed during the test phase will help quantify gas generation rates, as well as identify different mitigative measures if the rates prove unacceptable.

F. Conditional Determination

Several commenters took issue with EPA's "conditional" approach in its proposed decision. EPA's proposed determination was based on: (1) The finding that hazardous constituents would not migrate from the disposal unit during the test period, and (2) the requirement that DOE remove the waste at the conclusion of the test period unless it could demonstrate that there would be no migration over the long-term. According to commenters, this approach is inconsistent with the statute, which requires a finding that hazardous constituents will not migrate from the unit as long as the waste remains hazardous. The commenters argued that, under the statutory standard, DOE should be required to demonstrate that hazardous waste permanently place in the repository would not migrate from the unit before DOE could place any waste underground, even temporarily. EPA, however, continues to believe that its proposed approach is consistent with the statute and has not amended its finding.

As commenters point out, RCRA specifies that hazardous constituents must not migrate from the unit for as long as the waste remains hazardous. The phrase "from the unit" is a key element of this standard. If the waste is removed from the unit at the end of the test period, migration of hazardous constituents from the unit after that time is clearly impossible, because there are no longer any hazardous constituents in the unit to migrate. Consequently, in the case of temporary placement, for example during the WIPP test phase, the appropriate question is whether hazardous constituents will migrate during the period of temporary placement. (As discussed elsewhere in today's notice, EPA has concluded that hazardous constituents will not migrate from the unit during the test phase.) At the same time, of course, it is important to see that removal at the end of the test period is reasonably assured. EPA judge DOE's no-migration petition for the WIPP on these grounds. (See Section V.G for discussion of this point.)

One group of commenters argued further that, if EPA were to continue with its "conditional" approach, it should review DOE's test plan to ensure that in-situ testing at the WIPP was necessary to demonstrate long-term no migration and that the specific tests to be conducted would be sufficient. Although EPA has commented on DOE's test plan, EPA disagrees with these commenters on the type of EPA review that is necessary. On the basis of its review, EPA has concluded that DOE's test plan is well designed and the testing will yield important information on the long-term performance of the repository. EPA, however, has not and believes that it should not formally analyze DOE's in-situ testing at the WIPP to determine whether it is necessary of sufficient, and it does not believe such an analysis is within the scope of a no-migration review. As long as DOE can demonstrate that hazardous constituents will not migrate from the disposal unit, it is legally entitled to place prohibited waste in the WIPP. There is nothing in the statute that further compels a petitioner to demonstrate that placement in the unit is "necessary."

G. Definition of No Migration

Sections 3004 (d)(1), (e)(1), and (g)(5) of RCRA state that land disposal is prohibited, unless "it has been demonstrated to the Administrator, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone as long as the waste remains hazardous." In its proposed no-migration decision on the WIPP, EPA adopted the same interpretation of this standard as it had in its no-migration regulations for underground injection wells; that is, the Agency interpreted the standard to prohibit the migration of hazardous constituents in concentrations high enough to render the waste hazardous. (See 53 FR 28122, July 26, 1988.) Critics of this approach argued that Congress clearly meant that not a single molecule of a hazardous constituent could migrate from the unit, as long as the waste remaining in the unit was hazardous. Under this standard, DOE's WIPP no-migration petition could not have been approved, because at least some molecules of volatile organics listed as hazardous constituents will migrate via the air route during operations—although most likely at several orders of magnitude below levels of detection.

In today's decision, EPA is retaining its proposed definition of "no migration" of hazardous constituents. As explained in detail in the preamble to the proposed decision, EPA believes that this approach is fully consistent with the language of the statute and is protective of human health and the environment. EPA also notes that its interpretation of "no migration" was recently upheld in a decision on the underground injection well rules by the U.S. Court of Appeals for the District of Columbia. (*NRDC* v. *EPA* No. Slip. Op. (D.C. Cir. 1990).) In this decision, the Court accepted EPA's argument that "no migration of hazardous constituents * * * for as long as the waste remains hazardous" may be read to mean no migration of constituents above hazardous (or health-based) levels. As a result, EPA has decided to retain the same standard in its final decision on the WIPP petition.

H. Definition of Unit Boundary

In today's finding, EPA has slightly modified its definition of the disposal unit boundary in response to public comments. In the proposal, EPA defined the unit boundary (or point of compliance) for groundwater migration as the Salado Formation, laterally bounded by the limits of the four-mile by four-mile land withdrawal area. For air emissions during operations of the WIPP, EPA defined the unit boundary as the point where the air shaft met the surface.

Numerous commenters expressed concern about the extent of the unit boundary for groundwater, arguing that it might allow broad areas of contamination underground; they objected to EPA arguing that there would be no migration from the unit even if the hazardous constituents moved up to two miles laterally. Several commenters suggested that the unit boundary in no case should be greater than the mined repository, and should probably be less. One group of

commenters also pointed to what they believed was an inconsistency between the unit boundary for air and for groundwater. They argued that the unit boundary should be the same in both cases and that the unit boundary for air, therefore, should be no farther than the top of the Salado. After reviewing these comments, EPA has decided to retain its definition of the lateral boundary of the unit (i.e., the boundary of the land withdrawal area within the Salado Formation), but to define the boundary for air emissions as the top of the Salado Formation.

EPA has rejected commenters suggestion that the unit boundary be defined as the mined area (or some smaller area). As the Agency explained in detail in its proposed finding, it believes that, in the context of a geological repository, some credit should be given for the surrounding formation in which a waste is placed. The purpose of placing waste in a geologic repository is to isolate it from the general environment; it is not to prevent any movement of waste, however slight, within that formation. In fact, some lateral movement of waste into the surrounding formation can be an inevitable, and desirable, aspect of repository performance—as it is in the case of the WIPP. A no-migration standard that prohibited any lateral movement would run counter to the concept of a geological repository, without providing for any additional environmental protection or protecting against any meaningful release.

In taking this general position, EPA believes that it is being consistent with the intent of Congress, for example as expressed in the Senate Report on the 1984 HSWA amendments: "In determining appropriate confinement from which migration shall not be allowed to occur, the term disposal unit or injection zones should be construed * * * in terms of the overall integrity of the disposal practice, keeping in mind, in particular, the potential for contamination of ground-water or surface water resources" (S. Rep. No. 284 98th Cong. 1st Sess. at 15). Wastes confined to the boundaries of the unit, as defined in EPA's final determination, would remain more than 1,000 feet from the nearest unconfined ground water. EPA also notes that its position is consistent with the recent court decision on its no-migration rules for underground injection wells. (*NRDC* v. *EPA* No. Slip. Op. (D.C. Cir. 1990).) In this decision, the court supported EPA's position that the term injection zone (which for underground injection wells is analogous to the unit) includes confining material surrounding the porous formation into which the waste is actually injected. Similarly, EPA believes it is appropriate to consider at least a portion of the confining salt at the WIPP as part of the unit.

Critics of EPA's proposed definition of the WIPP unit suggested no alternative boundaries, other than somewhere within the furthest extent of the mined area. As discussed above, EPA has rejected this alternative. In the absence of any rationale for an intermediate boundary between the mined area and the proposed boundary, EPA has decided to retain the proposed approach. EPA emphasizes that the WIPP unit, under this definition, is fully isolated from the surrounding environment. If waste remains within the unit boundary, no meaningful movement of waste will have occurred, and no contamination of ground-water resources will result. Further, although there will undoubtedly be some lateral migration of contaminated material along marker beds within the salt formation, all projections indicate that this migration will be very limited, in no way approaching the boundaries of the unit. (The most likely route of migration, instead, would be up the closed shafts to overlying formations.) Therefore, extensive underground movement of waste is not expected, regardless of the definition of unit.

In the case of air migration, EPA recognizes that its proposed definition caused some confusion. To address commenters' concerns, EPA has amended the unit definition for air during operations, placing the boundary at the top of the Salado Formation. The issue of where DOE should monitor to demonstrate compliance at that point, however, is a different question. (See section IV.B.6 for a discussion of this point.)

I. Waste Characterization

1. Flammability

In evaluating the potential for release of hazardous constituents in its proposed decision, EPA considered the potential for fire and explosion at the WIPP. The Agency noted that the Waste Acceptance Criteria (WIPP-WAC) prohibits explosives and compressed gases in TRU Wastes and requires that pyrophoric materials be rendered safe by mixing them with chemically stable materials, such as concrete or glass, or be processed to render them nonhazardous. In addition, the Nuclear Regulatory Commission requires that all waste containers be equipped with one or more carbon composite filters designed to prevent pressure buildup or the accumulation of flammable gases prior to shipment to the WIPP, as specified in "TRUPACT-II Authorized Methods for Payload Control" (TRAMPAC).[14] EPA suggested that these requirements, in conjunction with the maintenance of general ventilation in the underground repository, make the possibility of fire or explosion extremely unlikely.[15]

EPA continues to believe that a fire or explosion is unlikely. It acknowledges, however, the concerns of commenters that flammable gases could build up in waste containers, creating a fire and explosion hazard. The Agency has reanalyzed the available information and has concluded that the accidental ignition of flammable gases in waste containers cannot be ruled out, given the available data on waste characterization. At the same time, EPA has concluded that spontaneous combustion within an individual waste container, i.e., without an ignition source, is not credible.[16]

Were a fire or explosion to occur as a result of accidental ignition of flammable gases in the void space of a waste container, retrieval could become more difficult, should retrieval be necessary. Moreover, such an event could itself cause migration of hazardous constituents above health-based levels beyond the unit boundary. For these reasons, EPA has concluded that no waste container should be emplaced in the underground repository if it contains flammable mixtures of gases in any layer of confinement, or mixtures of gases that could become flammable when mixed with air. To assure a sufficient margin of safety, EPA considers any mixture to be potentially flammable if it exceeds 50 percent of the lower explosive limit (LEL) of the mixture in air.

EPA, consequently, is requiring DOE to ensure that individual waste containers have met the prohibition of flammable gases. DOE must implement this provision by testing each waste drum or individual container for hydrogen, methane, and volatile organic compounds (VOCs) as a class. EPA is

[14] The Agency notes that TRAMPAC also sets limits on the thermal wattage, i.e., decay heat of individual waste containers to control the rate of generation of hydrogen gas by radiolysis (DOE, *Safety Analysis Report for the TRUPACT-II Shipping Package, Appendix 1.3.7 revision 2, June 1989*).

[15] The Agency notes that the WIPP-WAC also place restrictions on the total quantity of fissile material in a waste container to ensure criticality safety.

[16] See the conclusions in the Sandia National Laboratory memorandum from Sieszak and Lappin to Marcer and Fredrickson, January 5, 1990.

establishing this condition because it does not judge available process knowledge to be sufficiently reliable or accurate to allow a determination on the flammability hazard of individual waste packages.

EPA recognizes that headspace testing of every drum or individual container on a continuing basis may pose a significant burden on DOE. Without sufficient data, however, EPA feels compelled to require that DOE conduct testing, given the potential consequences of a fire or explosion. Once sufficient data have been collected, however, EPA will consider the extent to which continued testing is necessary. Test data may well show that flammable gases are only present at levels well below the lower explosive limit, either for certain wastes (e.g., TRUCON content code or item description code) or from particular generating sites. If the test data in fact show that no fire or explosion hazard exists, DOE should submit the data to EPA and request that the testing requirement be modified accordingly. Any change in the terms of this condition will be made under the procedures of 40 CFR 268.6(e), which include public notice and opportunity for comment.

EPA is also requiring that headspace sampling be representative of the entire void space of the waste container. Initially, the Agency believes that each individual layer of confinement within the container will have to be sampled, given the limited data available for inner bags. EPA, however, expects that once DOE accumulates enough data, it may be able to show that for most package configurations in which bags are twisted and taped, similar levels of flammable gases will be found in all layers of confinement.[17] However, it is anticipated that the occurrence of detectable quantities of free liquids, as determined by real-time radiography of visual inspection, will continue to indicate the need to sample the layer in which it occurs, unless DOE can demonstrate otherwise.

EPA also believes that testing of wastes that exhibit high rates of radiolysis should be conducted within a relatively short time period of when the container is actually placed underground. Otherwise, hydrogen levels could build up to flammable levels following sample collection and analysis. DOE has accumulated considerable data on radiolysis rates for various materials in TRU wastes. DOE used such data in its application to the Nuclear Regulatory Commission for a certificate of compliance for the TRUPACT-II shipping package to determine the length of time a waste drum must aspirate (i.e., vent) before it can be shipped after retrieval from storage.[18] Similarly, EPA is requiring DOE to determine, and document, the length of time during which headspace gases can be expected to remain below flammable levels (i.e., 50 percent of the mixture LEL) after sampling has been performed, for both newly generated and retrievably stored wastes, and to ensure that waste containers are emplaced at the WIPP within that time.

If testing reveals the presence of significant levels of flammable VOCs, an explicit flame test must be performed to determine if a flammable mixture can be formed with air. American Society for Testing and Materials (ASTM) Method E 681-85, "Concentration Limits of Flammability of Chemicals," or equivalent, are acceptable test methods. Significant levels of flammable VOCs are indicated by measured concentrations (excluding methane) of 500 parts per million or greater, as propane, as determined by gas chromatography and flame ionization detection (GC/FID) or of 300 parts per million or greater, by volume, as determined by gas chromatography and mass spectrometry (GC/MS.)[19] If testing shows that VOCs are insignificant, i.e., below 500 parts per million, the lower explosive limit of the mixture may be determined from the lower explosive limits of methane and hydrogen using the Le Chatelier formula as follows: If LEL_1 and LEL_2 are the lower explosive limits of hydrogen and methane, respectively, and C_1 and C_2 are the measured concentrations of hydrogen and methane, respectively, expressed as volume percent, then if the fraction, C_1/LEL_1 and C_2/LEL_2 sum to 0.5 or greater, the mixture is considered to be flammable when mixed with air.[20]

2. RCRA Constituents

In its proposal, EPA expressed some concern with the quality of the waste characterization data provided by DOE in support of its petition. However, given the nature of the wastes, the safety margins between predicted emission levels and health-based levels, and required controls on air emissions, EPA concluded that the information provided by DOE (based primarily upon process knowledge) was sufficient to demonstrate, to a reasonable degree of certainty, no migration of hazardous constituents during the test phase. Many commenters, nevertheless, criticized the quality and completeness of DOE's waste characterization information and DOE's approach to waste characterization. Several commenters noted the critical role played by waste characterization in the prediction of no migration and stressed that EPA needed accurate waste descriptions, supported by detailed analysis, to evaluate the potential evironmental impacts of waste disposal. In responding to these comments, EPA has differentiated between short-term issues (relevant to today's decision for the test phase) and long-term issues (relevant to a decision for the operational and post-closure phases, should DOE submit a petition for these phases).

a. *Short-term issues.* Many of the commenters expressed concern with the Agency's acceptance of waste characterization data based primarily upon process knowledge. Commenters stated that, in the case of the WIPP, waste characterization requirements have not been met.

EPA disagrees with the commenters' position that DOE's waste characterization information is insufficent for a no-migration determination for the test phase. DOE's analysis of the wastes incuded an evaluation of the materials and processes from which the wastes were generated as well as actual chemical analysis of the wastes. In the former case, DOE provided flow diagrams and narrative descriptions of the processes that generated all 128 of the identified waste Content Codes as well as an identification of the RCRA hazardous constituents used in the process. DOE also provided estimated concentrations for each of the hazardous constituents expected in the wastes. This was designed to be a conservative characterization, in which it was assumed that any hazardous constituents that were used in a process would be present in the resulting waste stream, regardless of known physical

[17] EPA notes that DOE intends to open up and disassemble the drums selected for the bin-scale tests for visual inspection. Therefore, this requirement should not increase radiation exposure to workers.

[18] DOE, *TRUPACT-II Content Codes (TRUCON)*, DOE-WIPP 88-004, Revision 3, July 1989, and DOE, *Safety Analysis Report for the TRUPACT-II Shipping Package*, Appendix 1.3.7, Revision 2, June 1988.

[19] For purposes of determining concentration levels using GC/MS, only noncombustible compounds may be excluded from the sum total of non-methane VOC, e.g., carbon tetrachloride, tetrachloroethylene, chloroform, and bromoform.

[20] The lower explosive limits of hydrogen and methane are 4.0 and 5.0 percent, respectively, in air (Bureau of Mines, "Flammability Characteristics of Combustible Gases and Vapors," Bulletin 627, 1966).

processes that would reduce the likelihood that the constituents would in fact be present (e.g., volatilization). EPA notes that no comments were received indicating that wastes from the processes described by DOE would be expected to be compositionally different from the DOE-estimated compositions.

The bulk of the analytical data presented by DOE to corroborate the conclusions of the above-described characterization were focused on the only viable route of release during the test phase—namely, through the air. For this characterization, DOE provided results from over 200 headspace analyses, representing all four of the identified waste types; these samples were analyzed for numerous gases, including nine organics. Other analyses for which results were reported included Toxicity Characteristic and Extraction Procedure leaching tests, total volatiles, and total metals. While these analyses were not typically conducted on all four of the waste types, EPA notes that these tests are not directly relevant for characterizing the most likely route of release during the period that is subject to today's decision (i.e., the test phase).

Additionally, EPA in its proposal considered the "safety margin" indicated by calculations of air emissions. That is, even if the concentrations of hazardous constituents were significantly underestimated, the no-migration standard would still be met during the test phase.[21] Additional assurances are provided by the air monitoring systems that will be operated to allow detection of emissions. Based upon the safety margin indicated by these factors, the Agency concludes that the level of waste characterization is acceptable for the test phase. Nevertheless, to ensure that the wastes to be used in the bin-scale tests are similar in composition to those described in the no-migration petition, EPA is requiring that DOE test the headspace of the wastes shipped to the WIPP (as a measure of the waste constituents' propensity to migrate through air) and compare the results to the values provided in DOE's no-migration petition. This comparison must be conducted and the waste must be found to be compositionally similar before the waste can be sent to and emplaced in the WIPP; if the waste is not similar to the estimated concentrations provided in the no-migration petition, the waste cannot be shipped to the WIPP unless it is modified compositionally, such that it is compositionally similar. The details of this comparison are described in section IV.B.7.b of today's notice.

Other commenters stated that, to the extent that DOE has provided any laboratory analysis of wastes intended for the WIPP, it is solely headspace analysis (i.e., analysis of the constituents' concentrations in the air under the lid of the drum) used as a surrogate for the waste in the drum. These commenters maintained that headspace analysis, while extremely useful for homogeneous phases, is limited, at best, for analyzing heterogeneous wastes such as those intended for the WIPP. In the opinion of these commenters, headspace analysis is unreliable as a surrogate for direct analysis of liquids and solids in drums due to uneven partitioning of constituents.

The Agency recognizes that there are limitations on the utility of headspace analysis as a surrogate for analysis of waste composition. Certainly headspace analysis is not appropriate for all evaluations for all waste types. In some cases, however, headspace analysis is the most relevant measurement. For purposes of the test-phase determination, headspace analysis is primarily used in the evaluation of gas generation and explosivity hazards. Since it is the composition of the gas that is of concern, analysis of the headspace (*i.e.*, the actually evolved gas) is the most appropriate parameter to consider. If concentrations in the waste were used for the explosivity evaluation, the composition of the evolved gas would be modeled, or predicted, rather than actually measured.

EPA agrees with the commenters' concerns regarding the validity of a single headspace sample (under the lid) as representative of potentially evolved gases from heterogeneous wastes. This is especially problematic when the drums contain several inner layers of confinement, as do the drums that will be emplaced in the WIPP. Specifically, questions exist as to whether the headspace beneath the lid is compositionally different from the headspace in the inner layers. EPA is addressing this issue in the context of the testing condition related to headspace analysis. In that condition, EPA is requiring that DOE take representative samples of the headspace (which may require, in some cases, for DOE to take samples from inner bags) and analyze them to confirm its assertion that the headspace beneath the lid is, in fact, representative of the total evolved gas within the drums.

EPA also agrees that headspace analysis is not a suitable surrogate for direct analyses of the waste for purposes of evaluations where the total composition is a factor. However, for volatile organic constitutents, EPA believes that headspace analysis can be a useful tool for determining whether the constituents are present. That is, if a volatile constituent is present in the waste, it is reasonable to assume that it will also be present in the headspace. Accordingly, results from headspace analyses were used to confirm the presence of volatile hazardous constituents, not to quantify their concentrations in the wastes.

Several commenters argued that DOE's quality assurance/quality control of waste characterization data was deficient. Others noted that DOE had been unable to provide adequate sampling plans and sample handling procedures for analytical work. EPA raised similar concerns with DOE's procedures, but, for the reasons described in the proposal and further elaborated upon above, the Agency has concluded that the data are sufficient for the test phase demonstration. At the same time, EPA advises DOE that it expects additional analytical data to support a long-term demonstration, where significantly greater quantities of waste are involved and routes of possible migration are not limited to release of volatiles to the air during operations.

b. *Long-term issues.* EPA notes that the "safety margin" for the long-term showing (*i.e.*, the operational and post-closure phases) has not been determined. For that reason, the Agency believes that additional waste characterization data are needed to reduce the uncertainties before a decision on a long-term no-migration determination can be made. EPA, however, has decided not to make such testing a condition of today's decision, because the collection of such data is not relevant to the decision during the test phase; EPA, however, expects DOE to develop and implement waste characterization plans, including appropriate sample collection, preservation, and analytical procedures, that will allow a demonstration of the extent to which the test phase wastes are representative of the other wastes from the ten generating sites and that allows greater precision in estimating potential for long-term migration (*e.g.*, through routes such as ground water). If such data are not collected, EPA will not be in a position to approve a no-

[21] The safety factor assumes that an explosivity hazard is not present. To ensure against such a hazard, EPA placed an additional condition on the decision (see section IV.B.7).

migration petition for the operational and post-closure phases, if DOE submits such a petition. EPA's expectations related to these data are presented in Section IV.B.7.b of today's notice.

Many commenters expressed concerns regarding the extent to which the wastes that will be used for the test phase are representative of the other wastes that DOE wishes to emplace at the WIPP during the operational phase. It was stated by many commenters that, for the test phase, adequate waste characterization is vital to assure that tests will be performed on representative wastes. Commenters pointed out that almost 70 percent of the wastes proposed for storage do not yet exist. They asked what controls and safeguards were in place to ensure that these future wastestreams are adequately represented by existing wastes.

The Agency agrees with commenters' concern that the use of representative wastes in the test phase will be critical to the success of any DOE no-migration petition for the later (operational and post-closure) phases. More specifically, the test-phase wastes must be sufficiently representative of the other wastes that DOE wishes to emplace at the WIPP to allow extrapolation of data from the test-phase experiments to the behavior of the other wastes.[22] This issue is, in fact, the basis for the selection of wastes that will be used in the test phase experiments. The selection process will be based upon those parameters that contribute to gas generation and is designed to identify wastes that represent the spectrum of expected values for those parameters. Since waste selection and characterization, as part of the design of the experiments, is the responsibility of DOE, EPA believes that it is DOE's responsibility to establish and implement procedures to demonstrate that the wastes are, in fact, sufficiently representative.

Many commenters also argued that EPA's proposed decision did not clearly establish whether all waste analysis data would be provided to EPA prior to emplacement of any waste or whether the data would be provided incrementally as waste is being emplaced. These commenters stated that they had serious concerns if the Agency is proposing to allow DOE to provide waste analysis data simultaneously with waste emplacement. They argued that waste analysis should be provided to the Agency not only before the waste is put into the ground, but before EPA can make a decision about a no-migration variance. They believed that this condition would allow EPA independently to asses the quality of the data. In the opinion of some commenters, delivering waste analysis information while the waste was "nding the Carlsbad elevators" would essentially render EPA's independent technical review of the data inconsequential.

EPA is not requiring that DOE submit the analytical data on the test waste for EPA review before the test wastes are emplaced. Much of the analytical work to be conducted by DOE is related to the eventual demonstration of no-migration over the long term. Since EPA will evaluate these data as part of any subsequent petition for the later phases, EPA disagrees with the commenters' statement that this evaluation will be "inconsequential." Rather, it will be a critical element of that evaluation.

EPA, however, is requiring DOE during the test phase to evaluate headspace data before waste is placed in the repository, as described earlier. For example, DOE must evaluate the explosivity-related testing before shipping test wastes to the WIPP. Similarly, DOE must compare the analytical results of newly conducted headspace analyses to the waste characterization data in the no-migration petition before the waste is emplaced in the underground repository. Because the standards for both the flammability and the RCRA constituent analyses are objective and straightforward, EPA does not believe that Agency review of the data before placement is necessary.

The flammability and RCRA constituent requirements, described in detail in section IV.B.7, will address many of the commenters' concerns with the accuracy of the data. These requirements will also ensure that the wastes emplaced during the test phase are, in fact, the wastes characterized by DOE in the petition and evaluated by the Agency and the public.

J. Retrievability

Commenters also raised concerns about whether waste would ever be retrieved from the WIPP if it were placed in the repository, regardless of the technical feasibility of retrieval. Some questioned DOE's commitment to retrieval, even if the WIPP site proved unacceptable. Others argued that, even if DOE were willing to remove the waste, no other site would accept it, and therefore the waste would not be retrieved. Several commenters argued that DOE should identify a permitted site ready to receive retrieved waste before any waste should be allowed underground.

EPA believes that it has placed adequate safeguards in today's determination to ensure that DOE in fact removes the hazardous waste from the repository, if it cannot demonstrate the repository's long-term acceptability. Condition 3 in Section VI of today's determination explicitly requires retrieval of wastes if DOE cannot demonstrate compliance with the standards of 40 CFR Part 268 before the expiration of the petition approval. Failure on the part of DOE to remove wastes under these circumstances would constitute a violation of the terms of EPA's determination, leading to possible enforcement action by EPA. In addition, citizens could sue DOE under section 7002 to enforce retrieval of waste from the repository.

Because of this condition, EPA has not found it necessary to require DOE to identify a specific site where waste retrieved from the WIPP would be stored, or to require that a permit be granted for storage of retrieved waste before any waste is placed underground. Furthermore, EPA questions whether any such condition would be useful, given that wastes would probably not be removed (if removal proved necessary) for a five-to-ten year period. Current predictions on the best storage site for the waste up to ten years in the future would be at best open to question, and valuable permitting resources would be expended on a site that might never receive the waste.

K. Human Intrusion

Commenters generally accepted that DOE could maintain institutional controls over the test period to preclude human intrusion. One group of commenters, however, argued that EPA must consider the possible effects of human intrusion in the distant future before allowing the placement of any waste for testing. These commenters expressed particular concern about potential mineral resources at the WIPP site, and the possibility that knowledge of the site would disappear after decommissioning. Other commenters argued that permanent markers should be erected at the WIPP site once the facility is closed, and information regarding the type and location of the markers should be published.

[22] It should be noted that, if one or more wastes that are generated at any of the DOE sites are not "represented" by the test wastes, these wastes should not be sent to the WIPP without further evaluation. However, this would not invalidate the testing for all other wastes that are generated at the ten DOE sites and are represented by the test wastes.

EPA generally believes that the issue of human intrusion is a long-term question, not relevant to the short-term operation of the WIPP during the test and operational phases. In the short-term, DOE management of the site and RCRA permit controls will ensure limited access. Long-term issues would be addressed at the time a petition is considered for permanent disposal. For this reason, EPA disagrees with commenters who argue that it must consider human intrusion in the distant future before allowing any testing at the WIPP.

More generally, EPA believes that, in the context of RCRA no-migration decisions, it should address the question of human intrusion by considering the likelihood of the intrusion, and imposing controls to make such intrusions unlikely. EPA agrees that permanent markers will be necessary (in fact, they are required under 40 CFR part 191 subpart B) and that information on the markers should be published. These issues will be addressed in any no-migration decision allowing permanent disposal.

In its final determination, EPA has removed one proposed condition related to human intrusion. In the proposal, EPA required that "DOE certify to EPA that it has secured control of the entire surface and subsurface estate at the WIPP site." This condition is now moot, because DOE has now secured control over all oil and gas and mineral leases at the site. EPA has placed documentation of this fact in the record for this rulemaking. Thus, because the condition has been satisfied, EPA has dropped it from its final determination.

VI. Conditions of No-Migration Determination

As a condition of granting DOE's no-migration petition, EPA is requiring that the following conditions by met by DOE:

(1) No wastes subject to this determination may be placed in the WIPP repository for purposes other than testing or experimentation to determine the long-term acceptability of the WIPP. In accordance with 40 CFR 268.6(e), DOE must notify EPA before it conducts any testing or experimentation not within the scope of the "WIPP Test Phase Plan: Performance Assessment," April 1990 (DOE/WIPP 89-011, Revision 0), as further explained in Section IV.B.1 of this notice. Placement of waste for the purpose of conducting an operations demonstration is prohibited.

(2) Wastes placed in the repository may not exceed 8,500 drums or 1 percent of the total capacity of the repository, as currently planned.

(3) All wastes placed in the WIPP must be removed if DOE cannot demonstrate compliance with the standards of 40 CFR 268.6, before the expiration of this petition approval, with respect to permanent disposal of mixed waste in the repository. DOE must submit a detailed schedule for retrieval of the waste, including times for completing retrieval as quickly as reasonably feasible, no later than six months after a determination that the repository cannot meet standards for long-term disposal under 40 CFR 268.6 or six months before the expiration of this petition approval, whichever occurs first.

(4) All wastes placed in the WIPP must be placed in a readily retrievable manner, as described in section IV.B.4 of this notice.

(5) DOE must install and operate a carbon adsorption device designed to achieve a control efficiency of 95 percent in the discharge system of the bin experiment rooms. DOE must monitor the control device outlet airstream in accordance with the monitoring plan described in section IV.K of EPA's proposed decision (55 FR 13089) as amended by section IV.B.7 of today's notice, and it must maintain design and operating records as described in section IV.J of EPA's proposed decision, as amended by section IV.B.6 of today's notice. Records must be maintained at the WIPP facility for the term of this determination or for three years after they are created, whichever is longer. Records must also be maintained during the course of any enforcement actions for which they are relevant.

(6) DOE must implement the air monitoring plan described in section IV.K of EPA's proposed decision (55 FR 13089), as amended in section IV.B.7 of today's notice. Records must be maintained at the WIPP facility for the term of this determination or for three years after they are created, whichever is longer. Records must be maintained during the course of any enforcement action for which they are relevant.

(7) Conditions relating to waste analysis:

(a) DOE must ensure that each waste container emplaced underground at the WIPP has no layer of confinement which contains flammable mixtures of gases *or* mixtures of gases that could become flammable when mixed with air. This prohibition must be implemented by analytical testing of a representative sample of headspace gases from each waste drum or individual container, as described in section IV.B.7.a and V.F.1.a of today's notice.

(b) DOE must analyze representative samples of the headspaces of containers to be used in the bin-scale test and compare these results to the estimated compositions provided in its petition for each waste type, as detailed in IV.B.7.b of today's notice. If the waste is not compositionally similar, as defined in Tables 2 and 3 in IV.B.7.b, that waste cannot be shipped to the WIPP until the waste has been treated or modified such that it is compositionally similar to the estimates provided in the no-migration petition. In addition, as prescribed in IV.B.7.b, DOE must demonstrate the comparability of bin-scale wastes to wastes described in DOE's petition before placing waste in the WIPP for the alcove tests.

(c) Waste analysis records must be maintained for the term of this determination or for three years after generation, whichever is longer. Records must also be maintained during the course of any enforcement action for which they are relevant. The records may be maintained at the generating site or at the WIPP facility.

(8) DOE must provide to the EPA Office of Solid Waste and EPA Region VI annual written reports on the status of DOE's performance assessment during the test phase. These reports must include: A description of the tests to date and their results, modifications to the test plan, a summary of DOE's current understanding of the repository's performance, waste characterization data from pre-test waste characterization, and an annual summary of air monitoring data required in Item 6 above.

Beyond these specific conditions, the wastes placed by DOE in the WIPP and DOE's activities under this variance must be consistent with those described in the petition. Under § 268.6(e), DOE must notify EPA of "any changes in conditions at the unit and/or environment that significantly depart from the conditions described in the variance and affect the potential for migration of hazardous constituents from the unit * * *." If the change is planned, EPA must be notified in writing 30 days in advance of the change; if it is unplanned, EPA must be notified within ten days.

Under § 268.6(f), if DOE determines that there has been migration of hazardous constituents from the repository in violation of part 268, it must suspend receipt of prohibited wastes at the unit and notify EPA within ten days of the determination. Within 60 days, EPA is required to determined whether DOE may continue to receive prohibited waste in the unit

and whether the variance should be revoked.

Finally, under § 268.6(h), the term of today's petition approval runs for ten years, that is until November 14, 2000.

Dated: October 31, 1990.

Don R. Clay,

Assistant Administrator for Solid Waste and Emergency Response.

[FR Doc. 90-26836 Filed 11-13-90; 8:45 am]

BILLING CODE 6560-50-M

PROPOSED DETERMINATION

APRIL 6, 1990

federal register

Friday
April 6, 1990

Part VII

Environmental Protection Agency

Hazardous and Solid Waste; Conditional Variance to Department of Energy Waste Isolation Pilot Plant; Notice of Proposed Decision

ENVIRONMENTAL PROTECTION AGENCY

[FRL-3753-3]

Notice Proposing To Grant a Conditional Variance to the Department of Energy Waste Isolation Pilot Plant (WIPP) From Land Disposal Restrictions

AGENCY: Environmental Protection Agency.

ACTION: Notice of proposed decision.

SUMMARY: The Environmental Protection Agency (EPA) is today proposing to grant a conditional no-migration variance to the U.S. Department of Energy (DOE). This variance would allow DOE to place hazardous waste subject to the land disposal restrictions of the Resource Conservation and Recovery Act (RCRA) in DOE's Waste Isolation Pilot Plant (WIPP) near Carlsbad, NM, for the limited purposes of testing and experimentation. DOE submitted a petition to EPA under 40 CFR 268.6 requesting a no-migration variance from the RCRA land disposal treatment standards on the grounds that treatment was unnecessary to protect human health and the environment because there would be no migration of hazardous constituents from the disposal unit. After a review of DOE's petition and supporting information, EPA has tentatively concluded that DOE has demonstrated, to a reasonable degree of certainty, that hazardous constituents will not migrate out of the WIPP disposal unit during the testing period proposed by DOE.

DATES: Comments on this proposed decision should be submitted on or before June 5, 1990.

EPA notes that it is providing the public a 60-day comment period on this proposed decision, which is longer than it generally provides for site-specific actions. For example, the Agency allows 30 days for comments on proposed no-migration variance decisions for underground injection wells, and 45 days for comments on RCRA permits. The Agency has provided extended time for comment on today's proposal because of the scope of the record, and because it is the Agency's first proposed decision on a variance request under 40 CFR 268.6. EPA, however, considers the extended comment period sufficient, and does not intend to grant any further extensions to the period.

Comments on today's proposal should be addressed to the docket clerk at the following address: U.S. Environmental Protection Agency, RCRA Docket (OS-305), 401 M Street, SW., Washington, DC 20460. One original and two copies should be sent and identified by regulatory docket reference number F-90-NMWP-FFFFF. The docket is open from 9 a.m. to 4 p.m., Monday through Friday, excluding Federal holidays. Docket materials may be reviewed by appointment by calling (202) 475-9327. Copies of docket materials may be made at no cost, with a maximum of 100 pages of material from any one regulatory docket. Additional copies are $0.15 per page.

A copy of the record supporting this proposal is also available to the public in Albuquerque, New Mexico, at the National Atomic Museum Library, Building 20358, Wyoming Boulevard, Kirkland Air Force Base, from 9 a.m. to 5 p.m., Monday through Friday; and in Carlsbad, New Mexico, at the WIPP Office and Information Center, 101 W. Greene Street, from 7:30 a.m. to 4:30 p.m.

Public hearings on this proposed decision have been scheduled for May 22, 1990, in Carlsbad, New Mexico, at the Park Inn International, 3706 National Parks Highway, beginning at 9:00 a.m., and for May 23 to 26, 1990, in Albuquerque, New Mexico, at the Albuquerque Convention Center, 401 Second St. NW. The hearing on May 23 in Albuquerque will begin at 1:00 p.m.; the hearing on subsequent days will begin at 9 a.m. Persons interested in testifying at either hearing should telephone 1-800-955-9477 to register. Requests to testify must be received by May 11, 1990.

FOR FURTHER INFORMATION CONTACT: General questions about the regulatory requirements under RCRA should be directed to the RCRA/Superfund Hotline, Office of Solid Waste (OS-305), U.S. Environmental Protection Agency, Washington, DC 20460, 800-424-9346 (toll free) or 202-382-3000 (local).

Specific questions about the issues discussed in this notice should be directed to Matthew Hale, Office of Solid Waste (OS-341), U.S. Environmental Protection Agency, 401 M Street, SW., Washington, DC 20460, at 202-382-4746.

SUPPLEMENTARY INFORMATION:

I. Background

A. RCRA Land Disposal Restrictions: No-Migration Variances

The Hazardous and Solid Waste Amendments (HSWA) of 1984, which amend the Resource Conservation and Recovery Act (RCRA), imposed substantial new requirements on the land disposal of hazardous waste. In particular, the amendments prohibit the continued land disposal of hazardous wastes, unless the wastes meet the treatment standards specified by EPA. "Land disposal" is defined to include placement "in a landfill, surface impoundment, waste pile, injection well, land treatment facility, salt dome formation, salt bed formation, or underground mine or cave" (RCRA section 3004(k)).

The statute requires EPA to establish treatment standards for wastes subject to the land disposal restrictions; these standards define when a hazardous waste may be land disposed. In its implementing regulations, EPA has established these standards based on the best demonstrated available technology (BDAT). The HSWA amendments also lay out specific dates by which the land disposal restrictions become effective, beginning with November 8, 1986, for solvents and dioxins. By May 8, 1990, restrictions will be in effect for all wastes that were listed or identified as hazardous before November 8, 1984, although EPA may extend the land disposal prohibition dates for up to two years if it finds a lack of national treatment capacity. EPA may also grant a 1-year case-by-case capacity extension, which can be extended once, in certain circumstances. Once the land disposal prohibition date for a specific waste has passed, that waste cannot be placed in a land disposal unit, unless it has been treated to meet or otherwise meets BDAT standards, or "unless the Administrator determines that the prohibition * * * is not required in order to protect human health and the environment for as long as the waste remains hazardous * * *" (RCRA sections 3004 (d)(1), (e)(1), and (g)(5).) This determination must be based on a demonstration by the facility owner/operator "that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous." (RCRA sections 3004 (d)(1), (e)(1), and (g)(5).) A determination under this authority is referred to as a "no-migration" variance; a request from a facility owner/operator for such a variance is called a "no-migration" variance petition.

The Agency first promulgated no-migration standards under 40 CFR 268.6 on November 7, 1986. These regulations, which apply to land disposal units other than underground injection wells, codify the statutory standard for no-migration variances, specify information to be included in variance petitions, and establish procedures for the granting or denying of a variance (November 7,

1986, 51 FR 40572).[1] EPA amended the regulations on August 17, 1988 (53 FR 31138), to add further procedural requirements and standards. EPA is now developing additional no-migration standards, including a generic definition of "no-migration," for land disposal units other than underground injection wells. The Agency expects to propose these standards in the near future. In conjunction with this proposal, EPA has also developed draft no-migration variance petition guidance, a copy of which is available in the docket for this rulemaking.

The current standards and procedures for no-migration variances (for units other than injection wells) are laid out in 40 CFR 268.6. Under this section, persons seeking a no-migration variance must submit a petition to the EPA Administrator "demonstrating, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the disposal unit or injection zone for as long as the wastes remain hazardous." Petitions must identify the waste and the specific unit that is the subject of the petition; provide waste analysis; characterize the unit, including background conditions; provide monitoring to confirm that no migration has occurred after the disposal has begun; and demonstrate compliance with other federal, state, and local laws.

Under 40 CFR 268.6, the Administrator must publish a tentative decision to grant or deny a no-migration variance for public comment in the Federal Register. EPA is required to publish final decisions in the Federal Register, after considering and responding to public comments. Variances may be valid for up to 10 years, but for no longer than the term of the facility permit. (Variances, however, may be reissued after their term has expired.) If petitions are granted, facility owners/operators must report changes in operating conditions from those described in the petition and notify EPA if hazardous constituents are detected migrating from the unit. If migration is detected, further disposal of wastes subject to the petition is suspended.

To date, EPA has received 24 no-migration variance petitions submitted in accordance with 40 CFR 268.6. Today's notice, which addresses disposal of mixed radioactive and hazardous waste in a mined salt bed, is the Agency's first proposed decision on any of these petitions. The other petitions submitted under § 268.6 primarily address land treatment operations. They are currently under Agency review. In addition, EPA has received approximately 65 no-migration petitions under 40 CFR part 148 for underground injection wells. Of these petitions, one has been granted final approval, several have been granted preliminary approval, and certain others have been withdrawn.

B. Regulatory Status of Mixed Wastes

The hazardous wastes that are subject to today's notice are "mixed wastes." Mixed wastes are defined as a mixture of hazardous wastes regulated under Subtitle C of RCRA and radioactive wastes regulated under the Atomic Energy Act (AEA). Because section 1004 of RCRA excludes "source," "special nuclear," or "byproduct material," as defined by the Atomic Energy Act from the definition of RCRA "solid waste," there has been some confusion in the past as to the scope of EPA's authority over mixed wastes under RCRA. EPA clarified this question in a Federal Register notice on July 3, 1986. EPA's clarification stated that the Section 1004 exclusion applies only to the radioactive portion of mixed waste, not to the hazardous constituents. Therefore, a mixture of "source," "special nuclear," or "byproduct materials," and a RCRA hazardous waste must be managed as a hazardous waste, subject to the requirements of RCRA subtitle C (that is, RCRA standards for management of hazardous waste). EPA's oversight under RCRA, however, extends only to the hazardous components of the mixed waste, not to the radionuclides themselves; the radionuclides (and any risks they may pose) are instead addressed under the AEA. DOE subsequently confirmed and clarified this interpretation in an interpretive rule, published in the Federal Register on May 1, 1987.

EPA's July 3, 1986 interpretation went into effect immediately in states not authorized to administer the RCRA hazardous waste program—that is, in the ten states and territories where EPA directly regulates hazardous wastes under federal RCRA regulations. At the same time, the July 3, 1986 notice informed authorized states that they are required to apply for and receive authorization from EPA to regulate mixed waste under RCRA. Until an authorized state has received mixed waste authorization, mixed waste is not considered to be hazardous under federal RCRA regulations in that state. To date, fourteen states or territories have obtained authority to regulate mixed waste under the state RCRA hazardous waste program, bringing the total to twenty-four states and territories where mixed wastes are subject to the RCRA hazardous waste requirements.

Mixed wastes, like other hazardous wastes, are subject to the land disposal restrictions. Treatment standards for mixed wastes containing solvents and dioxins—which are generally based on levels achieved through incineration—went into effect on November 8, 1986, and November 8, 1988. Disposal prohibitions for mixed wastes containing "California list" wastes went into effect on July 8, 1987. The remaining mixed wastes (for example, mixed wastes exhibiting a toxicity characteristic) are included in the "third thirds" category; the effective date of the land disposal restrictions for wastes in this category is May 8, 1990. In a recent proposal, however, EPA proposed a two-year national capacity variance for mixed wastes falling into the third thirds (54 FR 48492, November 22, 1989). If this variance is retained in the final regulation, the effective date of land disposal restrictions for these wastes would be extended until May 8, 1992.

It should be noted that the facility addressed in today's proposal is located in New Mexico, a state that has not yet been authorized for mixed waste. EPA recently proposed to grant the state mixed waste authorization (55 FR 10076, March 19, 1990), and expects a final decision on this question in the near future. Until the state has been authorized for mixed waste, however, mixed waste is not a RCRA hazardous waste in the State of New Mexico and the Federal land disposal restrictions do not apply to it.

C. WIPP Project

1. Introduction

In March 1989, the Department of Energy (DOE) submitted a no-migration variance petition for its Waste Isolation Pilot Plant (WIPP), a program to dispose of mixed transuranic (TRU) radioactive and hazardous waste in a mined salt bed near Carlsbad, New Mexico. DOE has designed the WIPP as a permanent repository for TRU wastes that are generated and stored at ten DOE sites around the country.[2] These wastes,

[1] On July 28, 1988, the Agency also promulgated standards under 40 CFR 148 for no-migration variances for underground injection wells (53 FR 28122).

[2] The DOE facilities that would send wastes to the WIPP are Idaho National Engineering Laboratory, Idaho Falls, Idaho; Rocky Flats Plant, Golden, Colorado; Los Alamos National Laboratory, Los Alamos, New Mexico; Argonne National Laboratory, Argonne, Illinois; Savannah River Plant, Aiken, South Carolina; Oak Ridge National Laboratory, Oak Ridge, Tennessee; Hanford Reservation, Richland, Washington; Mound Plant,

Continued

which result from the production of nuclear weapons, consist of a variety of materials, including tools, equipment, protective clothing, and other material contaminated during the production and reprocessing of plutonium; contaminated organic and inorganic sludges; contaminated process and laboratory wastes; and contaminated items from decontamination and decommissioning activities at DOE installations.

Wastes emplaced in the WIPP will be limited to transuranic (TRU) wastes, a specific category of radioactive wastes. TRU wastes are defined as wastes contaminated with alpha-emitting radionuclides with atomic numbers greater than 92 (that is, heavier than uranium) in concentrations of greater than 100 nanocuries per gram of waste. In addition, TRU wastes by definition have half-lives of greater than 20 years, although the actual half-lives of radionuclides in waste to be placed in the WIPP are often hundreds or thousands of years. Two types of TRU wastes are targeted for the WIPP: (1) Contact-handled (CH) wastes, which have a measured radiation dose rate at the container surface of 200 millirems per hour and can be safely handled without special equipment when drummed; and (2) remote-handled (RH) wastes, which have a measured radiation dose rate at the container surface of above 200 millirems per hour and must be heavily shielded with lead for safe handling. The upper limit for radiation dose rate of RH wastes to be placed in the WIPP is 1,000 rems per hour. The great majority (97%) of the wastes that will be shipped to the WIPP will be contact-handled. TRU wastes are distinguished from high-level radioactive waste, such as used reactor fuel, and low-level radioactive waste. Other treatment and disposal strategies are being developed for high-level and low-level wastes.

A significant portion of the waste destined for the WIPP (up to 60%, according to current DOE estimates) is contaminated with RCRA hazardous waste, making this waste a "mixed waste" potentially subject to RCRA jurisdiction, although the concentration of hazardous constituents in these wastes is generally very low. The hazardous wastes in question are primarily solvents and EP toxic metals, especially lead. Of these wastes, the solvents are currently subject to treatment standards under the land disposal restrictions, and the EP toxic metals will be subject by May 1990 (or May 1992 at the latest). DOE intends, at this time, to dispose of these wastes in the WIPP without treating them in conformance with BDAT standards.[3] As a result, DOE has applied for a no-migration variance for the mixed wastes to be emplaced in the WIPP.

2. History of the WIPP Project

The effort to locate a permanent disposal site for TRU waste began over 30 years ago, when the National Academy of Sciences recommended that radioactive waste be permanently disposed of in salt beds. After a decade of experimentation, and the rejection of one site for technical reasons, the Atomic Energy Commission, the Oak Ridge National Laboratory (ORNL), and the U.S. Geological Survey (USGS) began a formal selection process for a site in 1973. A set of selection criteria addressing factors such as stratigraphy, hydrogeology, seismicity, population density, and land ownership, were defined, and the USGS reviewed most of the larger rock-salt deposits in the United States against these criteria. On the basis of this review, USGS selected eastern New Mexico as the area best satisfying the site-selection criteria. After further review against detailed, site-specific criteria (e.g., minimum distances were set from the Capitan reef aquifer, existing boreholes, and dissolution fronts), the WIPP site was chosen in 1975.

The WIPP project was authorized by Congress in the Department of Energy National Security and Military Applications of Nuclear Energy Authorization Act of 1980. DOE began construction of the repository in the early 1980s. Construction of the surface buildings, the underground experimental rooms, and the first underground disposal rooms is now essentially complete.

3. Description of WIPP

The WIPP repository is an underground mine, located approximately 2,150 feet below the surface in the Salado Formation—a 2,000-foot-thick salt bed that extends laterally for approximately 36,000 square miles. The land in the area of the WIPP is owned by the Federal government and administered by the Bureau of Land Management. The four-mile by four-mile plot of land overlying the repository has been temporarily withdrawn from public use by the Department of Interior; it is now under the control of DOE. The repository is designed to hold TRU wastes that are currently stored at the ten DOE generating facilities, as well as new TRU wastes that will be generated over the next 25 years. If the WIPP site is eventually determined to be a permanent repository, the underground waste disposal area of the WIPP will cover 100 acres, with a total design capacity of 6.45 million cubic feet (or approximately 850,000 barrels of waste). To date, 15 acres of underground disposal rooms have been mined.

Although DOE has conducted extensive studies of the WIPP site and the repository's performance, uncertainties remain. For example, concerns have been raised over the possibility that gas generated underground at the WIPP will, over the long term, build up to unacceptable pressures, leading to possible releases from the repository. To address this and other questions, DOE plans to conduct testing over a 5-year period. This period will involve in-situ tests with actual TRU wastes underground, as well as other investigations. Under DOE's current plans, the in-situ tests would initially involve wastes amounting to approximately 0.5% of the total repository capacity. From these tests, DOE expects to demonstrate compliance with EPA's standards for disposal of radioactive materials (40 CFR part 191 subpart B) and long-term no-migration of RCRA hazardous constituents, as well as to identify any engineering modifications that may be necessary to meet these standards.

DOE is also considering the need for an "operations demonstration" during the 5-year test period. The purpose of this demonstration, which might involve up to an additional 3 to 8% of the total WIPP capacity, would be to show DOE's operational readiness to ship waste to the WIPP and to place it underground.

If DOE is unable to meet EPA hazardous and radioactive waste disposal standards at the conclusion of the test period, it has committed to remove all wastes from the WIPP.

If the WIPP proves acceptable as a permanent repository, DOE will then begin full-scale disposal of waste at the site. Drums, metal boxes, and canisters of waste will be shipped to the WIPP from the generating sites and placed in the underground rooms. Under current plans, the wastes will be backfilled with crushed salt and the rooms sealed. After an operating period of approximately 25 years, DOE plans to seal the shafts of the mine with cement and clay plugs and compacted salt, and decommission

Miamisburg, Ohio; Lawrence Livermore National Laboratory, Livermore, California; and Nevada Test Site, Mercury, Nevada.

[3] Since the no-migration petition was first submitted, DOE has formed an Engineering Alternatives Task Force that, among other things, will consider treatment alternatives for TRU wastes before they are disposed of at the WIPP.

the facility. After decommissioning, the salt of the Salado Formation will creep inward on the waste and is expected to encapsulate the waste within 60 to 200 years.

Access to the WIPP site will be restricted during operations and decommissioning, and possibly for longer periods. The Department of Interior temporarily withdrew the lands on the WIPP site from public use in 1983, allowing DOE to begin construction of the facility. Before DOE can place waste at the site, however, either Congress or the Department of Interior must take new land withdrawal action. In addition, DOE and the State of New Mexico have agreed to prohibit in perpetuity all subsurface mining, drilling, and resource exploration unrelated to the WIPP project at the WIPP site. The Federal government has acquired, or is in the process of acquiring, the entire surface and subsurface estate at the WIPP site, including leasehold interests in subsurface resources. Finally, to prevent drilling in the vicinity of the repository in the distant future, DOE intends to place permanent warning markers at the site.

D. Regulatory Status of the WIPP

The WIPP is located in the State of New Mexico, which is expected to receive authorization for mixed waste in the near future. (See 55 FR 10078, March 19, 1990.) Once mixed waste becomes subject to the RCRA hazardous waste regulations in New Mexico, the WIPP will be eligible for RCRA interim status. Facilities "in existence" (which includes those under construction) at the time a waste is identified as hazardous may obtain interim status by submitting a Part A permit application to EPA or the appropriate state. If DOE submits the appropriate application to New Mexico and secures interim status, it will be legally authorized to receive mixed waste—subject, of course, to the land disposal restrictions. The WIPP must also comply with interim status standards, codified at 40 CFR part 265, and obtain a RCRA permit under 40 CFR parts 264 and 270.

The interim status requirements of part 265 establish general facility standards. For example, the WIPP will be required under these standards to have a waste analysis plan for its mixed waste, a contingency plan describing procedures that DOE will take in the case of an emergency, and a closure plan describing how the facility will be closed. At the same time, DOE will be required to submit a RCRA Part B permit application to the State of New Mexico no later than six months after a request by the state.

The RCRA permit for the WIPP, which would be issued by New Mexico, would establish detailed operating, closure, and post-closure conditions for the facility in accordance with 40 CFR subpart X. (As a geological repository, the WIPP is regulated under the RCRA category of subpart X "miscellaneous units.") The permit's scope would potentially extend to all facility activities related to mixed waste. In this respect, the permit is significantly broader than the no-migration variance, which addresses the specific issue of whether hazardous constituents will migrate from the WIPP disposal unit. At the same time, the permit provides an opportunity to ensure that DOE manages the facility in a way that ensures that migration will not occur.

As discussed earlier, EPA's authority under RCRA over waste destined for the WIPP extends only to mixed hazardous and radioactive waste, and it is further limited to the hazardous components of the mixed waste. The potential release of radioactive material from the WIPP is addressed under the Atomic Energy Act (AEA). EPA has promulgated standards under the AEA limiting releases associated with the disposal of radioactive wastes. These standards, which are codified at 40 CFR part 191, consist of two parts: Subpart A dealing with releases during the operational phase of a permanent disposal facility, and subpart B, dealing with long-term releases after decommissioning. Under an agreement with the State of New Mexico, DOE will comply with the Subpart A standards, beginning with the initial receipt of waste at the WIPP, before the facility has been designated as a permanent repository. The Subpart B standards have been remanded to EPA by the U.S. Court of Appeals for the First Circuit, and therefore are not in effect at this time. DOE, however, has agreed with the State of New Mexico to demonstrate compliance with the remanded standards before a final decision is made to dispose of waste permanently in the repository. This decision will be made on the basis of data gathered during the test phase at the WIPP.

Finally, EPA emphasizes that today's proposal addresses only the specific question of whether hazardous constituents will or will not migrate from the WIPP for the purposes of the RCRA no-migration variance. Issues raised by the transportation of waste to the WIPP site, or by the handling and possible treatment of waste before it reaches the WIPP, are beyond the scope of this notice.

II. Summary of DOE Petition

DOE initially submitted its no-migration petition for the WIPP in early March 1989, with two addendums submitted on October 1, 1989, and January 22, 1990. For the convenience of commenters, DOE has consolidated the various parts of the petition and reprinted them as a single document, dated March 1990. This consolidated document has been placed in the public docket for today's proposal as DOE's complete no-migration variance petition. This petition, which consists of six volumes, provides the information required by 40 CFR 268.6, including facility description, site characterization, waste characterization, description of anticipated repository performance, modeling of potential environmental releases, air monitoring plan, seal designs, demonstration of compliance with other federal, state, and local requirements, and other items. EPA has carefully reviewed this document and concluded that, together with other materials submitted by DOE in support of the petition, it constitutes a complete submission, providing sufficient information for EPA to propose a tentative decision on the variance request.

Beyond the petition itself, several documents have been critical to EPA's review and its proposed decision. Two documents, in particular, are important adjuncts to DOE's petition: DOE's "Draft Final Plan for the Waste Isolation Pilot Plant Test Phase: Performance Assessment" (December 1989, DOE/WIPP 89-011) and its "Draft Waste Retrieval Plan" (January 1990, DOE/WIPP 89-022). The first document provides important details on DOE's planned activities during the test phase; the second describes the procedures by which DOE will retrieve waste from the repository if it cannot demonstrate the long-term acceptability of the facility. DOE's test plans and the retrievability of any waste placed in the WIPP are central considerations in the approach EPA is proposing today.

In addition, EPA has paid particular attention to DOE's Draft and Final Supplemental Environmental Impact Statements (April 1989 and January 1990, DOE/EIS-0026-FS), which discuss in detail many aspects of facility performance; the Design Validation Report (October 1986, DOE/WIPP 86-010), which discusses the validation of the design for underground openings; and DOE's draft "Final Safety Analysis

Report" (June 1989, WP-02-9). Also particularly important has been DOE's "Safety Analysis Report for the TRUPACT-II Shipping Package" (June 27, 1989), which provides information on waste compatibility, gas release, and other questions developed by DOE to support the Nuclear Regulatory Commission's approval of waste shipment. Beyond these sources, DOE provided EPA with several hundred additional reports, studies, and other documents, as background support to the no-migration petition.

These, and all other documents considered by EPA in reaching its proposed decision, have been included in the public docket for this rulemaking. The docket also contains a complete list of items considered.

III. Summary of Proposed Decision

EPA is proposing today to grant a "conditional" no-migration variance to the DOE for the WIPP. This variance would allow DOE to place mixed waste subject to the RCRA land disposal restrictions in the WIPP for testing and experimentation to determine whether the site is appropriate for the long-term disposal of mixed waste. The proposed variance would be restricted to mixed wastes emplaced in the WIPP repository for the purpose of testing and experimentation designed to show the long-term acceptability of the WIPP (that is, its conformance with standards for permanent disposal of radioactive and hazardous wastes). DOE would not be allowed to conduct an "operations demonstration," involving the placement of waste underground for the purposes of demonstrating that the facility is operationally ready to receive waste. Furthermore, DOE would not be allowed to begin the permanent disposal of waste subject to RCRA land disposal prohibitions at the site under today's proposal. Finally, DOE would be required to remove all wastes subject to the variance from the repository if it could not demonstrate no migration of hazardous wastes over the long term. (It should be noted that DOE has committed to conducting such a removal in its no-migration variance petition, as well as in a consent agreement with the State of New Mexico.)

In support of today's proposal, EPA has tentatively determined that there is a reasonable degree of certainty that hazardous constituents will not migrate from the WIPP disposal unit during the test period. In making this tentative determination, EPA has considered all possible routes of release, but has focused in particular on the release of volatile constituents in the course of testing and the potential for these constituents to migrate out of the WIPP unit through the ventilation shaft. Because of the nature of the tests that will be conducted, and their relatively short duration, EPA believes that release of hazardous constituents from the unit through brine, salt, or other geologic media is implausible during the test phase.

The retrievability of waste placed in the WIPP during the test phase is central to the conditional variance EPA is proposing today; therefore, EPA also reviewed both the technical feasibility of retrieval and the practicability of DOE's retrieval plan. EPA has tentatively concluded that retrieval of wastes from the WIPP can be accomplished safely, and that DOE's commitment to retrieval, if it proves necessary, is satisfactory. Finally, EPA has considered the general design, construction and mine maintenance program at the WIPP, and has concluded that the mine is well-designed and will remain stable (with proper maintenance) during the test period and well beyond.

Although today's proposed variance is specifically based on a finding of no migration of hazardous constituents from the unit during the test phase, EPA has thoroughly reviewed available information on the expected long-term performance of the WIPP repository. Given the geologic stability of the area; the depth, thickness, and the very low permeability of the salt formation in which the repository has been mined; and the properties of rock salt as an encapsulating medium, EPA believes that the WIPP is a promising site for a permanent mixed-waste repository. Nevertheless, a number of uncertainties related to the long-term performance of the WIPP remain—for example, the extent and effects of gas generation, the effect of brine inflow into the repository, and the influence of a "disturbed rock zone" around the mined repository. DOE will be investigating these uncertainties in the test phase at the WIPP, and it will review whether technical modifications to the repository design or the waste are necessary to ensure compliance with the regulatory standards.

Before DOE can permanently dispose of untreated mixed wastes in the WIPP, it must demonstrate no migration over the long term—that is, it must successfully address current uncertainties about long-term WIPP performance. Information gathered by DOE during the test phase will be central to such a demonstration. Any EPA decision to grant (or deny) a variance for permanent disposal will be made with full opportunity for public comment, as prescribed in 40 CFR 268.6(g).

The specific conditions of today's proposed variance for the test phase are listed in Section V of this notice. The basis for EPA's tentative decision and the major issues addressed in the course of EPA's review are discussed in the following section. EPA has also developed a background document, which discusses in more detail the geology of the site, repository performance, waste characterization, and air monitoring. This document is available in the public docket for this proposed action.

IV. Discussion of Issues and Basis of Proposed Finding

A. Definition of No Migration for as Long as the Waste Remains Hazardous

Section 268.6(a) of 40 CFR states that petitioners for a no-migration variance must demonstrate, to a reasonable degree of certainty, that hazardous constituents will not migrate from the disposal unit or injection zone for as long as the waste remains hazardous. EPA proposes to interpret this standard to mean that hazardous constituents cannot migrate from the unit at hazardous levels. In other words, to show "no migration," the petitioner must demonstrate that constituents released from the unit do not exceed health-based standards at the point where they exit from the unit.

EPA adopted this interpretation of "no migration" in its final standards for underground injection wells under 40 CFR part 148 (53 FR 28122, July 26, 1988), and it is taking the same approach in its review of other no-migration petitions submitted under section 268.6. EPA believes that this interpretation of the no-migration standard is a permissible reading of the statute, because the logical focus of the statutory language is whether what escapes from the unit is hazardous. The ultimate judgment required by the statute is whether the prohibition on land disposal "is required in order to protect human health and the environment," a determination that will depend on the concentration levels of constituents. Similarly, in making this determination, the Agency must take the toxicity of waste constituents into account, which necessarily involves consideration of the concentration of the constituents.

The legislative history of the statute likewise indicates that the no-migration demonstration should focus on whether what migrates is hazardous. The Senate Report states that "the Administrator is required to find that the nature of the

facility and the waste will assure that migration of the waste will not occur while the wastes still retain their hazardous characteristics in such a way that would present any threat to human health and the environment." S. Rep. No. 284, 98th Cong., 1st Sess., 15. Waste constituents migrating from a unit at allowable risk to human health and the environment satisfy this standard, as negligible harm to human health and the environment would result.

The statute refers to migration of "hazardous constituents" without defining the term. In other EPA regulations, the term "hazardous constituents" normally has regulatory consequence only if the concentrations of hazardous constituents are significant enough to pose a risk above allowable levels. (See 52 FR 32453, August 27, 1987, which describes the Agency's use of the term in the listing, delisting, closure, and groundwater protection standard regulations.) It is a reasonable construction of the statute that Congress intended the same approach here. It is possible that Congress was equating wastes and hazardous constituents, so that when Congress stated that there shall be "no migration of hazardous constituents * * * for as long as the wastes remain hazardous," it was referring to waste constituents whose migration is prohibited for as long as they remain hazardous, i.e., are at hazardous levels. The passage from the Senate Report cited above appears to support this reading, since its uses the terms "waste" and "constituent" interchangeably.

EPA acknowledges that the statute could also be interpreted as requiring that a single molecule of any hazardous constituent (i.e., substances listed in Apendix VIII of 40 CFR part 261) may not migrate for as long as the waste in the unit remains hazardous. EPA believes that this is not a preferred reading of the statute, given that the health and environmental concerns focus on whether hazardous levels of constituents leave the unit, and not whether hazardous levels remain in the unit. The alternative reading is not compelled by the statutory language nor the legislative history, and is not necessary to protect human health and the environment. A zero molecule standard would be impossible to meet, both because it is impossible to monitor or realistically model the fate of individual molecules (or atoms) of waste constituents and because certain waste constituents are substances that persist indefinitely. Congress simply would have forbidden all land disposal of untreated hazardous waste if this were its intent. Congress, however, expected that some individual land disposal units might be able to satisfy the standard. S. Rep. No. 284 at 14; H. Rep. No. 198, 98th Cong., 1st Sess. at 34; S. 9153. In addition, even under this latter reading, nonhazardous levels of constituents would be allowed to migrate once wastes in the unit were no longer hazardous. Thus, EPA believes the appropriate focus is on whether constituents ever migrate at hazardous levels. The Natural Resources Defense Council has challenged this Agency construction of RCRA in the context of EPA's regulations for underground injection at 40 CFR part 148, *NRDC* v. *EPA* No. 88-1657 (D.C. Cir.). The court decision is pending.

In establishing hazardous levels of hazardous constituents—that is, the levels of a compound that would fail the no-migration standard—EPA proposes to rely on peer-reviewed health and environmental effects data, where available. These data are based for the most part on the drinking water Maximum Contaminant Levels (MCLs), surface water quality criteria (Ambient Water Quality Criteria, 45 FR 79318, November 18, 1980; 49 FR 5831, February 15, 1984; 50 FR 30784, July 29, 1985), verified Reference Doses (RfDs) for systemic toxicants developed by the Agency's Risk Assessment Forum (Verified Reference Doses of USEPA, ECAO-CIN-475, January 1986), and Risk-Specific Doses (RSDs) for carcinogens developed by the Agency's Carcinogen Assessment Group. EPA typically combines these dose levels with standard exposure numbers for each medium (e.g., groundwater and air) to obtain allowable health and environmental exposure levels. The standard exposure numbers assume direct human exposure at the point of compliance or, to be specific, the unit boundary. This is consistent with the approach EPA promulgated in the 40 CFR part 148 regulations for no-migration petitions for underground injection wells.

Finally, the statute requires the petitioner to demonstrate no-migration for "as long as the waste remains hazardous." Typically, EPA would judge this demonstration on the basis of an understanding of the waste transformation process and of the long-term performance of the disposal site, in combination with predictive modeling. In many cases, hazardous wastes can be expected to degrade over time, limiting the scope of predictive modeling required. For example, in the case of land treatment facilities—which are specifically designed to degrade organic wastes through microbial action—degradation of hazardous constituents might take place over a 90-day time period. In other cases, degradation will take significantly longer. In the context of underground injections, EPA provides that, if petitioners can demonstrate no-migration over a 10,000-year period, they will have met the statutory standards (40 CFR 148.20). Petitioners may also demonstrate that their wastes would be nonhazardous or otherwise immobilized on the basis of a showing of chemical transformation or fate. (Id.)

In the case of the WIPP, heavy metals such as lead will not degrade, and therefore will remain hazardous virtually indefinitely—certainly far beyond the predictive capabilities of any models. For this reason, EPA believes that its final determination concerning the WIPP's conformance with the no-migration standard over the long term must rest on the Agency's professional judgment regarding the containment properties of the Salado formation within the vicinity of the WIPP, and on any transformation or immobilization of wastes within the unit. The Agency's views on the long-term acceptability of the WIPP are discussed in Section IV.F of this notice.

At the same time, predictive modeling can act as a check and provide insight into the long-term performance of the site. In its no-migration petition, DOE has modeled possible waste migration out of the WIPP through brine flow along the sealed shafts over a 10,000-year period. Under this model, hazardous constituents would not come anywhere near the upper edge of the Salado formation within the modeling period. (DOE's modeling exercise is discussed in more detail in section IV.F of this notice.) Because of the uncertainties of long-term modeling, EPA believes that, for the purposes of determining compliance with RCRA no-migration standards, it is not particularly useful to extend this model beyond 10,000 years into the future. While modeling over longer periods had certain uses—for example, in comparing the performance of different repositories—EPA questions whether models have the precision to be used in making a meaningful prediction of whether a specific unit will or will not meet no-migration standards after many thousands or millions of years. The Agency, however, does believe that modeling over a 10,000-year period provides a useful tool in assessing the long-term stability of the repository and the potential for migration of hazardous constituents. In summary, the Agency is not proposing a specific limit on the time

over which no-migration must be demonstrated. Instead, it believes that the final determination should be based primarily on a knowledge of the geologic conditions at the site, supported by modeling.

B. Unit Definition

The definition of the disposal unit's boundary is critical to any decision on a no-migration variance. The boundary of the unit will define the point of compliance; that is, the point at which potential migration would be measured. If waste constituents migrated beyond this point at hazardous levels, a variance could not be granted, while movement of wastes within the unit boundary would be acceptable. In the case of the WIPP, the question of the unit boundary is of particular importance, because there is limited regulatory precedent for defining the boundary of geologic repositories, and because of the general absence of clear engineered barriers designed to contain the waste.

Under current regulations, a "hazardous waste management unit" is defined as a "contiguous area of land on or in which hazardous waste is placed, or the largest area in which there is significant likelihood of mixing hazardous waste constituents in the same area" (40 CFR 260.10). This definition on its face allows considerable flexibility when it is applied to underground repositories. Clearly, the salt bed formation in the vicinity of the repository represents a contiguous "area" of land in which the waste is placed. The regulatory definition does not preclude the inclusion of at least a portion of the surrounding formation in the "disposal unit." It provides little guidance, however, on where the exact points of compliance should be drawn.

EPA has discussed the issue of unit definition in a draft guidance on no-migration petition variances for land disposal units other than underground injection wells. In this guidance, EPA explained that, for units with engineered barriers, the unit boundary should be considered the outermost extent of the engineered barrier. Thus, for a landfill, the outer boundary of the unit would be the outside of the berms and engineered liners (either clay or synthetic). In the case of units without such barriers, other rules would have to apply. For example, the boundary of an unlined land treatment unit would be set at the base of the maximum treatment zone (which cannot exceed a depth of 5 feet from the soil surface). In this case, EPA has recognized that the purpose of a land treatment unit is to allow some movement of a waste down into the soil, as it is being treated, absorbed, or transformed. However, if constituents move out of the treatment zone at hazardous levels, migration from the unit has occurred. In its draft guidance, EPA also recognizes that defining the unit boundary of a geological repository raises special issues. Although the guidance does not discuss the specific issues raised by these units, it states that their boundaries should be defined on a site-specific basis.

One final precedent should be mentioned. RCRA 3004 (d), (e), and (g) require that a no-migration variance be based on no migration of hazardous constituents from the disposal unit or the injection zone. EPA discussed the meaning of the term "injection zone" in its recent regulations establishing standards for no-migration variances for underground injection wells. In the preamble to those regulations, EPA explained that an injection zone is defined in 40 CFR 146.3 as "a geologic formation, group of formations, or part of a formation receiving fluids through a well." The Agency went on to clarify that the injection zone includes confining material as well as the more permeable material into which the waste is injected (53 FR 28122, July 26, 1988). EPA emphasizes that, for the purposes of RCRA compliance, it considers the WIPP to be a miscellaneous land disposal unit rather than an injection well. Therefore, the relevant standard for the WIPP is the "unit boundary," rather than the "injection zone." The underground-injection rule, nevertheless, does define the concept of no-migration in the context of somewhat similar underground disposal and, thus, has some relevance to the WIPP.

The boundaries of the WIPP must be defined in light of these general precedents, as well as the specific circumstances of the facility. As described earlier, the WIPP is an underground geologic repository mined within a relatively homogeneous salt bed. After waste has been placed in the WIPP and the shafts have been sealed, the salt bed will creep and encapsulate the waste. If the WIPP works as intended, the encapsulating salt will act as a barrier and prevent the migration of the waste out of the immediate vicinity of the mined area. Clearly, migration of hazardous constituents at hazardous levels from out of the sealed repository into unconfined aquifers lying above or below the salt bed would constitute migration from the unit; similarly, movement of constituents at such levels via air to the surface atmosphere during the operations of the facility would also constitute migration.[4] Beyond these general limits, however, there is no immediately obvious point where the boundaries of the underground repository must be drawn. In today's notice, the Agency discusses alternatives for defining the WIPP boundary and proposes an approach that, it believes, fully protects human health and the environment, meets the statutory and regulatory standards, and accurately reflects the particular situation of an underground salt-bed repository.

To begin with, the immediate underground disposal area and the shafts of the WIPP are clearly within the disposal unit. The shafts, however, are a hypothetical route of migration out of the salt bed as a result of brine flow. The Agency proposes that the point of compliance, for the purpose of assessing migration out of the unit by way of the shafts, be defined as the point where the Salado formation (i.e., the salt bed) meets the overlying Rustler formation. This is the point at which migrating constituents could be expected to escape from the long-term engineered barrier designed to contain the waste—that is, the compacted salt shaft seal ending at the top of the Salado formation—and potentially move into an overlying aquifer. Although the possibility of human or significant environmental exposure is virtually nonexistent at this point, EPA belives that compliance with the no-migration standard should nevertheless be measured there. The appropriate standard is whether hazardous constituents have migrated from the unit at hazardous levels, not whether exposure is likely or whether the concentration of hazardous constituents will be significantly reduced in the course of migration outside the unit boundary.

The point of compliance for the WIPP is more difficult to define if hazardous constituents move through the salt bed itself, rather than along sealed shafts. Theoretically, hazardous constituents may migrate laterally or horizontally in the salt bed—for example, along

[4] The Agency believes that it must consider the air exposure pathway in assessing the no-migration standard. The statute does not limit the environmental pathways to be considered in making the no-migration demonstration. Moreover, given the policy goal of the land disposal prohibition provisions to end land disposal of wastes that have not been treated to satisfy the section 3004(m) standards, except for wastes disposed of in units that meet the rigorous no-migration standard, it is not appropriate to ignore a major environmental pathway in assessing whether the no-migration standard is met.

fractures or anhydrite marker beds. The Agency believes that, considering the purpose and design of the WIPP, a certain amount of movement within the confining salt bed should be considered movement within the unit. The underground repository has been designed so that the salt bed will creep, encapsulate the waste, and contain it. If the WIPP works as planned, there will be limited movement of contaminants into the salt bed, but the constituents will be effectively blocked from potential routes of release. In this respect, movement within the salt bed is analogous to movement within the treatment zone of a land treatment facility, the engineered clay liner of a landfill or surface impoundment, or the confinement material of an injection zone. EPA therefore proposes that the disposal unit include at least part of the surrounding Salado formation, bounded on top by the Rustler formation and underneath by the Castile formation.

The Salado formation, it should be noted, extends horizontally for approximately 36,000 square miles. While EPA believes, for the reasons stated above, that some movement from the original repository through this bed should not constitute "migration from the unit," it also believes that unlimited lateral movement would be inconsistent with the overall integrity of the disposal practice. The Salado formation surrounding the WIPP (unlike an underground injection zone) is very low in permeability and is intended to encapsulate and confine the waste. If the waste disposed of at the WIPP moved laterally for significant distances into the encapsulating formation, the repository clearly would not be operating as intended, and the integrity of the disposal practice would be called into question. It would be hard in this case to argue that migration was not occurring.

Extensive lateral migration might also be problematic because there are a number of potential routes of waste migration in the Salado formation outside of the immediate vicinity of the WIPP. These include numerous boreholes and mines, both old and currently operating, and localized areas of salt dissolution. If wastes moving laterally from the WIPP reached these possible routes of migration, hazardous constituents could conceivably be released to overlying aquifers. To address this concern, EPA believes that it is appropriate and necessary to set lateral boundaries on the movement of waste within the Salado formation, beyond which "migration" from the unit would be considered to occur.

After reviewing the specifics of the WIPP site, the Agency has tentatively concluded that the 4-mile by 4-mile WIPP land withdrawal area represents the most appropriate lateral boundary of the disposal unit. This area is clearly defined, relatively limited in size (compared to the Salado formation), and coincident with the land under DOE control. The Agency has carefully reviewed the geology of this specific area, and has tentatively concluded that no realistic routes of migration lie within it—other than the hypothetical route of escape up the shaft seals. Defining the unit boundary at the edge of the WIPP site, therefore, would effectively isolate the wastes from possible routes of migration beyond the immediate limits of the WIPP site and confine it to an area whose geology EPA has examined in detail. At the same time, this boundary will allow some relatively limited movement of hazardous constituents through the encapsulating salt, which as discussed above is consistent with the design of the WIPP. In addition, as discussed below, the possibility of human intrusion resulting from future drilling operations would be minimized because of federal control of the land area and mineral rights in perpetuity, as well as other institutional controls that will be required at the site.

EPA believes that this approach is not only consistent with current practice, but also reflects Congressional intent. The legislative history of the 1984 amendments states that "in determining appropriate confinement from which migration should not be allowed to occur the terms disposal unit or injection zone should be construed • • • in terms of overall integrity of the disposal practice, keeping in mind, in particular the potential for contamination of groundwater or surface water resources" (S. Rep. No. 284 98th Cong., 1st Sess. at 15). If hazardous constituents disposed of at the WIPP remain within the Salado formation and within the WIPP land withdrawal area, the overall integrity of the disposal practice will clearly be intact, and any potential for contamination of groundwater, surface water, or other resources will be eliminated.

Another option considered by EPA was to define the unit boundary as the walls of the salt mine, or alternatively as the furthest extent of the disturbed rock zone surrounding the excavated area. (The rock surrounding the open repository has been found to fracture as a result of salt creep. The disturbed rock zone is believed to extend one to five meters beyond the mine walls.) The Agency has rejected this approach in today's proposal because defining the unit boundary at this point would run contrary to the intended performance of the WIPP. The WIPP is designed to confine wastes within the salt bed, not to prevent any movement of constituents into the surrounding salt formation as the formation encroaches on the waste and encapsulates it. For example, it is possible that waste would migrate limited distances laterally along horizontal marker beds within the Salado formation. Yet this migration, as long as it remained within the immediate vicinity of the original repository, would in no way threaten the "overall integrity of the disposal practice." Drawing the unit boundary right at the repository walls or at the furthest extent of the disturbed rock zone therefore would be inappropriately limiting, and would not accurately reflect the intended performance of the WIPP. For these reasons, EPA has not proposed the mine walls or the disturbed rock zone as the WIPP unit boundary. (It should be noted that the proposed unit boundary at the WIPP is based on site- and unit-specific considerations, which may not apply to other types of units.)

The preceding discussion focuses on long-term migration of hazardous constituents, once the repository has been sealed. It is also possible that hazardous constituents will migrate from the unit via air during the operation of the WIPP. It is clearly a permissible, if not mandated, construction of the RCRA no-migration provisions to consider an air pathway as part of the no-migration demonstration. The statute requires the demonstration of encompass "no migration of hazardous constituents for as long as the waste remains hazardous," and consequently includes all potential migration pathways. In addition, there is no logical reason to ignore the air migration pathway in assessing no-migration petitions. For this reason, EPA is proposing to consider migration via air at the WIPP.

Air migration at the WIPP would be a potential concern during both testing and oeprations at the facility. During these activities, bins and drums underground will be vented to prevent buildup of gas pressure within the containers. To ensure mine safety, the repository will be ventilated, with exhaust air flowing up an air shaft and out into the general atmosphere. This shaft, therefore, represents a possible route of escape for hazardous constituents from the disposal unit.

The Agency proposes that the point of compliance for the air route during

operations be defined as the point where vented repository air exits from the exhaust shaft and enters into the general atmosphere. During its operational period, the WIPP is in effect an enclosed or "covered" unit, with a single point of air release. Once hazardous constituents have exited from the point of release and entered the general atmosphere, EPA believes that migration from the enclosed unit has occurred. Up until that point, however, air emissions are contained within the repository, and should not be considered to have migrated from the unit. This proposed approach is consistent with the approach EPA is considering for covered surface impoundments or waste piles. In its draft guidance for no-migration petitions, EPA has defined "the outer limit of any engineered barrier over the unit (roof, dome, etc.)" as the air point of compliance for covered units. For the WIPP, the outer limit of the engineered barrier over the unit is the point of release from the shaft. (In the case of the WIPP, the question of where in the air exhaust migration is measured is in fact moot. Because the shaft is nothing more than a vent, concentrations of hazardous constituents will be the same at all points in the shaft. Therefore, for all practical purposes, the unit boundary for air releases could be defined as anywhere in the shaft.)

In summary, the Agency is proposing the following points of compliance for determining no migration from the WIPP:

1. For upward movement out of the repository (e.g., along shaft seals): The point of contact between the Salado and the Rustler formation.

2. For downward movement: The point of contact between the Salado and the Castile formation.

3. For lateral movement: The boundary of the 4 × 4 mile WIPP land withdrawal area within the Salado formation.

4. For air migration: The point where the air exhaust shaft releases to the ambient environment.

The Agency solicits comments on these proposed points of compliance as well as on other alternatives.

C. Conditional Variance

As described earlier, DOE intends to begin WIPP operations with a 5-year test program. The purpose of this program is to demonstrate the long-term acceptability of the WIPP and to show compliance with EPA's disposal standards for TRU wastes. Although substantial information on the long-term performance of the WIPP has been gained over the last fifteen years, important issues remain, particularly in relation to gas generation. DOE plans to investigate these and other issues during the test period. The results of this investigation may confirm the acceptability of the WIPP as currently planned, or may identify necessary engineering or other modification to the waste or the facility. It is also possible that, at the conclusion of the test period, the WIPP will fail to meet AEA or RCRA standards for permanent disposal. In this case, DOE will be required, and has committed, to remove the waste from the underground repository and seek another disposal strategy.

The no-migration variance EPA is proposing today would allow DOE to place waste in the WIPP for the purpose of conducting tests or experiments to demonstrate the long-term acceptability of the facility. The variance would be granted on the condition that DOE remove waste placed underground for testing if its performance assessment fails to show that the WIPP meets the no-migration standard over the long term. Testing and experimentation would include the bin and alcove tests outlined in DOE's draft test plan for the WIPP, but would not include the "operations demonstration." This demonstration is aimed at showing the readiness of the WIPP to receive waste, but not to show its long-term acceptability. The variance would have to be modified, or a revised variance issued, before untreated mixed waste subject to the RCRA land disposal procedures could be placed in the WIPP for purposes other than testing or experimentation. Modification or reissuance of the variance, in this case, would take place according to the full variance approval procedures of 40 CFR 268.6(g). For example, the operations demonstration would not be allowed under the variance proposed today without public notice in the Federal Register, opportunity for public comment, and EPA approval.

EPA believes that a conditional variance, limited to testing and experimentation, is appropriate for the WIPP because the Agency has tentatively concluded that migration will not occur during the test phase. In addition, WIPP shows promise as a permanent disposal site. Because of the possible consequences of gas generation as well as other uncertainties, however, DOE cannot at this time demonstrate no-migration of hazardous constituents over the long term. The conditional variance proposed today would provide DOE with the opportunity to conduct this in-situ testing on gas generation with actual mixed waste, while ensuring that no migration occurs during the test period itself, and that wastes will be removed from the WIPP if the demonstration ultimately cannot be made.

EPA notes that the concept of a conditional no-migration variance for the WIPP is consistent with the approach it intends to propose in other cases as well. For example, EPA is now considering "conditional" no-migration variances for a number of land treatment demonstrations involving petroleum refinery wastes. The purpose of these demonstrations is to provide data necessary to show no-migration during full commercial operation, as well as to allow EPA or an authorized state to collect data to set specific permit conditions. Under a "conditional" variance, a demonstration could proceed, as long as the facility operator could show that no migration would occur during the demonstration, and that the long-term demonstration for a permanent disposal had a reasonable chance of succeeding. If the demonstration succeeded, permanent disposal could then begin. If it failed, the operator would be required to remove the waste placed during the demonstration and dispose of it according to RCRA Subtitle C requirements. Similarly, EPA is also reviewing a no-migration variance petition for the temporary storage of untreated hazardous waste in a pile before incineration. In this case, the facility owner would be required to demonstrate that no migration would occur during the storage period; the owner would also be required to remove the pile completely at the end of the storage period. EPA believes that the approach it is proposing today for the WIPP is similar to the approach it is considering for land treatment demonstrations and temporary storage in waste piles. Today's proposal would allow placement of untreated hazardous waste in the WIPP for the limited purpose of testing, as long as migration did not occur during the test period, and the waste would be removed if long-term no-migration could not be demonstrated. See also 51 FR 40605 (November 7, 1986), where the Agency indicated that a potential no-migration situation would be one involving storage in a land disposal unit where wastes would be removed at the end of the storage period.

Section V of this notice describes in detail the specific conditions of the proposed variance. The key condition is the restriction of the variance to the placement of wastes in the WIPP for purposes of testing and experimentation. This condition would allow DOE to

conduct the testing outlined in its petition and other sources—specifically, the bin and alcove-scale tests described in DOE's "Draft Final Plan for the Waste Isolation Pilot Plant Test Phase: Performance Assessment" (December 1989, DOE/WIPP 89-011). (EPA recognizes that DOE's test plan is currently in draft form, and that a final version is not expected until May 1990. If the activities described in the final document differ substantially from those in the draft, EPA will provide the public with an opportunity to comment on how the changes might affect the proposed variance.)

As an alternative to the approach proposed today, EPA considered the possibility of setting a specific limit on the amount of waste that might be placed in the WIPP. The Agency, however, has tentatively rejected this approach. It is difficult at this time to estimate exactly how much waste may have to be placed in the WIPP to satisfy testing needs. DOE currently estimates that the initial phases of the test period will require waste amounting to 0.5% of the total capacity of the WIPP, but the actual amount finally needed is likely to depend on the results of early tests, as well as the extent to which it is necessary for DOE to explore different engineering modifications. EPA thus believes that any specific quantity limit would be difficult to justify, and might artificially constrain legitimate and necessary testing. The Agency solicits comments on the appropriateness of its proposed approach and on the advisability of a volume limit on the waste that may be placed in the WIPP under the variance. It also solicits comments on the specific limit that might be imposed, as well as the justification for setting such a limit.

EPA also considered, but is not proposing, a time limit on the conditional variance, other than the regulatory limit of ten years, which applies to any no-migration variance (40 CFR 268.6(h)). DOE's current plans, as outlined in the December 1989 draft Final Plan for the Waste Isolation Pilot Plant Test Phase (DOE/WIPP 89-011), call for the development of a "final EPA compliance report" four years after first placement of waste in the WIPP, and a final "disposal phase decision" after five years. One option, therefore, would be for EPA to limit any conditional variance to five years. EPA, however, has tentatively rejected this approach because it believes that, like limits on volume of waste placed, specific time limits could artificially constrain legitimate testing. Instead, EPA believes that restricting placement to wastes used in testing and experimentation will sufficiently limit activities under the conditional exemption.

EPA also notes that today's variance applies only to the activities and conditions described in DOE's no-migration variance petition and in the supporting material provided by DOE. These were the activities and conditions that EPA reviewed in proposing to grant the variance, and therefore they define the limits and scope of that variance. This requirement is enforced through 40 CFR 268.6(e), which requires that facility owners/operators subject to a variance report to EPA "any changes in conditions at the unit and/or the environment that significantly depart from the conditions described in the variance and affect the potential for migration of hazardous constituents from the unit * * *" If a significant change from the petition is planned—for example, a significant change in testing plans or the addition of a test—the owner/operator must notify EPA 30 days in advance, and the change cannot take place without Agency approval. Where the change affects the basis of the no-migration finding, it could not occur before EPA modified the variance through the variance issuance procedures of 40 CFR 268.6. In the case of unplanned changes (e.g., significant new information related to repository performance is discovered), EPA must be notified within 10 days of learning of the unplanned change. If the information warrants such a step, EPA may require that the variance be modified, or it may revoke the variance.

D. Retrievability

As a condition of granting the no-migration petition during the test phase, the Agency is proposing to require that DOE remove all TRU waste subject to this variance from the underground repository if the no-migration demonstration cannot be made for permanent disposal. EPA believes that DOE has reasonably demonstrated that the waste can be retrieved by: (1) Successfully performing mock retrieval demonstrations, (2) providing technical information to show that waste can be removed from the underground repository, (3) demonstrating mine stability during the test phase, and (4) storing the waste in retrievable containers. DOE has committed to removing the waste, if it cannot demonstrate compliance with the no-migration standards for permanent disposal or the disposal standards of 40 CFR 191 for radioactive waste.

DOE's commitment to retrieve test-phase waste has been clearly delineated in several documents, including the "Working Agreement for Consultation and Cooperation" with the State of New Mexico (Article IV).[4] This document establishes, under Public Law 96-164, eight milestones that must be met before the retrievability decision can be made. Key milestones outlined in that agreement include development of a waste retrieval plan and conduct of mock retrieval demonstrations of CH and RH TRU waste. Successful mock retrieval demonstrations have been conducted at the site, and no unsafe conditions occurred during the demonstrations. These demonstrations have been described in two DOE documents, "Report of the Remote-Handled Transuranic Waste Mock Retrieval Demonstration" (May 1987) and "Final Report for the Contact-Handled Transuranic Waste Mock Retrieval Demonstration" (January 1988), which have been included in the docket for this proposed decision. DOE has also developed a draft retrieval plan; under the retrieval plan, an additional alcove retrieval simulation will be conducted. The final waste retrieval plan is expected to be published in April 1990. If there are significant changes in the final plan affecting the no-migration decision, EPA will reopen the comment period to allow comment on those changes.

The stability of rooms during the test period has at times been raised as an issue. The repository rooms have experienced a creep closure rate, at least initially, that is three times what was originally predicted. (The closure rate has been measured at a few inches per year, although the rate depends somewhat on room size.) As a result, early room closure and fracturing of walls or ceilings have been a concern. DOE will address this concern in the alcove test rooms by reducing their size (and thus increasing stability), rock bolting the backs (roofs), and constructing standoff walls in those alcoves to be backfilled with salt. (Standoff walls are walls placed between the drums and the repository walls to ensure that room closure does not impinge on the backfilled drums.) The bin-scale test rooms will be rock bolted to insure stability, and will not be sealed. The Agency has reviewed the design of the test rooms, including the use of rock bolts, and believes that the rooms will be stable during and after the test phase. The petition also indicates

[4] In addition, DOE has committed to removing test-phase waste in the Final Supplemental Environmental Impact Statement for WIPP (Volume 1, page 2-15) and in its no-migration variance petition.

that during the test phase all waste will be placed in the repository in a readily retrievable manner, i.e., all wastes will be in retrievable containers, and wastes will not be backfilled (except in the case of two alcoves, where "standoff" walls will be used). After reviewing the material DOE provided with its petition, EPA has tentatively concluded that the measures to be taken will allow for the safe removal of the waste within the time-frame required for the test phase.

Since room stability and waste containment are critical to the assurance of waste retrieval at the end of the test phase, EPA is proposing to require that all waste emplaced in the repository during that period be placed in a readily-retrievable manner. By "readily-retrievable," EPA means adoption of the specific measures identified in DOE's petition to maintain room stability (i.e., room size, rock bolting, and standoff walls) and the use of easily-retrieved waste containers (boxes, bins, drums). Significant changes to these conditions would require a modification to the variance.

The draft retrieval plan identifies several options for alternative storage of the TRU waste if it is retrieved. While a specific storage and disposal alternative or site was not selected, the Agency believes that DOE has made a satisfactory commitment to remove the waste, if considered necessary. To ensure that any mixed waste removed from the repository is handled appropriately, EPA has included as a condition the requirement that removed waste be managed in accordance with RCRA subtitle C requirements.

E. Post-Closure Controls

Although today's proposed variance for the WIPP is based on a finding of no-migration during the test period, EPA has extensively reviewed a significant body of information related to the long-term performance of the WIPP. In this review, EPA has focused on the "undisturbed" performance of the repository. In other words, the Agency has not specifically reviewed or assessed possible releases from the WIPP that might occur if the facility were disturbed as a result of human intrusion—for example, in the course of oil and gas exploration at some point in the future. EPA believes that, in the context of RCRA no-migration variance decisions, the question of human intrusion, either during operations or after closure, is best addressed through a consideration of the likelihood of intrusion, and the imposition of controls to make such intrusions unlikely events.

EPA emphasizes that this approach to human intrusion is consistent with its general approach under RCRA, both in permitting and variances. Under RCRA, EPA typically relies on institutional controls (both active and passive) imposed through general regulatory standards and site-specific conditions (e.g., in RCRA permits) to ensure that access to a hazardous waste disposal site is appropriately restricted. EPA believes that any permanent no-migration variance for the WIPP will have to impose long-term passive institutional controls, such as land withdrawal, records, and markers—to ensure that the likelihood of human intrusion is appropriately reduced, even after active control of the facility has ceased and any permits at the site may have terminated.

The specific conditions that EPA might impose in a no-migration variance for the WIPP to reduce the possibility of human intrusion in the future would be addressed in the context of any decision that EPA might make on a variance for permanent disposal. Thus, for today's proposal, which applies solely to the test period, the issue of human intrusion in the distant future is not relevant. Nevertheless, EPA notes that DOE has taken, or has committed to taking, several important steps to reduce the possibility of human intrusion after closure of the facility. The most important of these steps, which would likely be conditions for a no-migration variance for permanent disposal, are described below.

First, DOE states that the site will remain under federal jurisdiction in perpetuity, and therefore it or successor agencies will be in a position to restrict access. Furethermore, in August 1987, DOE and the State of New Mexico agreed to prohibit in perpetuity all subsurface mining, drilling, or resource exploration on the WIPP site unrelated to the WIPP project. Finally, the Federal government owns the entire surface and subsurface estate at the WIPP site, with the exception of a single potash leasehold interest; DOE states it is now negotiating with the owner of that leasehold interest. DOE also states that, at WIPP closure, it will notify all state and county planning, deed and record offices, oil and gas commissions, and other agencies, to prevent access by unknowing parties. It will also place permanent warning markers at the site, as required by 40 CFR part 191 standards.

These specific controls, and perhaps others, would constitute assurances against human intrusion for the variance for permanent disposal. But in one area EPA believes a specific condition may be appropriate for today's proposed variance. As mentioned above, DOE is now attempting to secure a potash leasehold interest at the site; it has indicated that it will resolve this issue by mid-May 1990. EPA, however, is concerned about the possibility that this interest might not be secured before mixed waste is placed in the WIPP. Therefore, it is proposing to require, as a condition of a variance for the test phase, that DOE must certify to EPA that it has secured control of the entire surface and subsurface estate at the WIPP (including the potash leasehold), before waste is placed in the WIPP. At the same time, EPA notes that the current land withdrawal at the WIPP site prohibits mining, and any future land withdrawal is likely to include a similar prohibition. Therefore, EPA solicits comment on the appropriateness and the need for this proposed condition.

F. Site Geology and Hydrology

40 CFR 268.6(a) requires that a petitioner seeking a no-migration variance provide a comprehensive characterization of the disposal unit site. For a facility such as the WIPP, this characterization must address the regional and site-specific geologic and hydrologic characteristics in the vicinity at the site. This section of the preamble describes the general site geology and hydrology of the WIPP.

EPA believes that DOE has provided sufficient information to demonstrate that hazardous constituents will not migrate from the unit by any geologic pathway during the WIPP test period. (For a discussion of this issue, see sections IV.J and IV.K of this notice.) Furthermore, the general area of the site has been shown to be geologically stable, and the confining unit (that is, the Salado Formation) appears to be a good medium for disposal, given its thickness, general homogeneity, and low permeability. In addition, the relative remoteness of the site and the limited ground water in the area, while not relevant to a no-migration finding under RCRA, were an important consideration in site selection. While several uncertainties remain concerning the long-term performance of the repository, the Agency believes that the site will not present a problem during the test phase. These uncertainties are being investigated by DOE as part of the test program. Data from this assessment will be essential in any EPA finding of no-migration with respect to the permanent disposal of waste at the WIPP.

1. Site Overview

The WIPP site is located in southeastern New Mexico, in the Pecos

Valley section of the southern Great Plains physiographic province, a broad highlands that slopes gently eastward from the Basin and Range physiographic province. The site is located in the northern section of the Delaware Basin, which is a portion of the larger Permian Basin of the Texas/New Mexico area. The Delaware Basin is a broad, oval north-south trending trough, in which there are over 6,100 meters of structural relief on top of the Precambrian basement. The basin rocks show little deformation, and have undergone only minor tectonic activity since the end of Permian time, approximately 225 million years ago. In ascending order, the Permian units at the site are the Delaware Mountain Group of the Guadalupian Series (Brushy Canyon, Cherry Canyon, and Bell Canyon Formations), followed by the Ochoan Group (the Castile, Salado, and Rustler Formations, and the Dewey Lake Red Beds). Above these formations is the Triassic Dockum Group (undivided), followed by Quaternary deposits of the Pleistocene Epoch (Gatuna Formation and Mescalero Caliche). The rocks described above represent approximately 4,000 meters of the stratigraphic column at the site. The repository is located in the Salado Formation, approximately 655 meters (or 2,150 feet) below the surface.

2. Castile Formation Hydrogeology

The Castile Formation is the rock formation directly underlying the Salado. At the WIPP site it is approximately 400 meters thick and is a major halite-bearing unit. The halites, which are of varying purity and thickness, are separated by three relatively thick anhydrite and carbonate beds. Significant volumes of fluid are usually not encountered in the formation. However, reservoirs of pressurized gas and brine have been found in the Castile.

Borehole ERDA-6, drilled in 1975, encountered a reservoir of pressurized brine in the Castile Formation, about 8 kilometers from the current WIPP site. More recently, Borehole WIPP-12, located about 1.5 kilometers from the site center, encountered another brine reservoir in the Castile. Data from recent geophysical studies have led DOE to assume that the WIPP-12 reservoir may extend underneath a portion of the waste emplacement section of the repository. However, the brines are 250 meters or more stratigraphically below the repository horizon, and there appears to be no natural mechanism that would cause the movement of these brines to the repository. Uranium disequilibrium studies performed on the brine in both the ERDA-6 and the WIPP-12 reservoirs indicate that the fluids are between 360,000 and 800,000 years old; there is also no evidence to show contributions from present precipitation. Furthermore, the brines are saturated with respect to halite, so there is no mechanism for halite dissolution from the fluids. Consequently, after reviewing the data, the Agency has concluded that these brine reservoirs do not present a threat to the integrity of the repository under undisturbed conditions. (DOE is assessing the possible effects of a borehole penetrating through the repository and into an underlying Castile brine pocket, leading to the upward flow of brine into the repository. The issue of possible human intrusion is discussed in section IV.E of this notice.)

3. Rustler Formation Hydrogeology

The Rustler Formation is the rock unit that overlies the Salado Formation. It is composed of five members, in ascending order: The unnamed member at the Rustler/Salado contact, the Culebra Dolomite, the Tamarisk Member, the Magenta Dolomite, and the Forty-Niner Member. Two of the members will be discussed in this notice, because one is in contact with the proposed unit boundary of the disposal unit (unnamed member), and the other member overlying it is the most significant water-bearing stratum (Culebra Dolomite).

The unnamed lower member of the Rustler Formation is a layered sequence of siltstone, gypsum/anhydrite, and halite. Near the WIPP site the average thickness of this member is approximately 35 meters. It contains a siltstone water-producing portion, which may be hydraulically continuous with the upper Salado residuum and any dissolution member of the upper Salado. However, since the Rustler-Salado contact contains water that is saturated with respect to halite, it is not capable of dissolving pure halite.

The member directly above the unnamed lower member is the Culebra Dolomite. If migration from the repository were to occur, this formation is considered the most important potential pathway for release to the environment. The Culebra is a finely crystalline, locally argillaceous and arenaceous, vuggy dolomite, with an average thickness at the site of approximately 10 meters. As a result of fracturing, Culebra transmissivities (which are very low) have been found to range over six orders of magnitude near the WIPP site.

Approximately 60 wells have been completed in the Culebra since WIPP studies began; water-level measurements have been taken for most of these wells over the life of the project. In these measurements, a good correlation was found to exist between water-level measurements from well to well at the site. However, limited quantities of the water in the formation drained into the shafts of the facility with the drilling of the construction and salt handling shaft. This, coupled with wide variations in fluid density within the formation and very low hydraulic gradients, have made flow directions difficult to define, particularly in the southern area of the site. The freshwater head contours at wells in the area indicate a southwestern flow direction across Nash Draw, a southern flow direction across the WIPP site, and an area of apparent western flow south of the site (apparent because of low hydraulic gradients). In this instance, it is noteworthy to remember that the Culebra Formation is approximately 400 meters above the respository level, meaning that, under undisturbed conditions, the potential for hydrologic interference by the Culebra into the Salado or the possibility of the Culebra being a sink for contaminants from the respository is very low.

As mentioned above, the geochemistry of the Culebra formation waters is highly variable. The total dissolved solids (TDS) concentration of the Culebra in the area of the WIPP varies from 10,000 to greater than 200,000 mg/L. These values render the waters of the Culebra at the site considerably saline and not a source of drinking water. It has been noted that the variability of the salinity of the Culebra waters is such that modern flow directions within the Culebra do not appear consistent with modern salinity distribution. This provides evidence that there is no modern contribution of recharge water into the Culebra at the WIPP site. Evidence suggests that the Culebra has been hydrologically isolated for several thousand years.

The Agency believes that the DOE has adequately described the general hydrologic and geologic conditions for the Rustler Formation for the purposes of this petition. In addition, during the performance assessment, DOE will continue to measure the hydrologic responses of the Rustler with respect to flow direction. This assessment should serve to confirm and refine the current understanding of the uppermost water-bearing stratum in the area.[6]

[6] It should be reiterated that these studies, while pertinent to an understanding of hydrology in the

Continued

4. Salado Formation Hydrogeology

Because the repository has been constructed in the Salado Formation, the Salado is the formation of the most interest at the WIPP site. It is located between the Castile and Rustler Formations. The Salado is informally divided into three members: An unnamed upper member, the McNutt potash zone (the informal regional name for the unnamed middle member), and an unnamed lower member. The rationale for this division is the type and composition of laterally-consistent beds of halite, polyhalite, and anhydrite, with varying amounts of other potassium-bearing minerals. The beds of anhydrite and polyhalite alternate with the thicker beds of halite within the Salado. Indeed, approximately 85 to 90 percent of the Salado is pure halite. The composition of the Salado and the Castile Formations are similar, but the lateral extent of the two formations differ. Unlike the Castile, the Salado is not confined to the Delaware Basin, but extends well beyond the Capitan Reef complex onto the Northwestern Shelf and Central Basin Complex.

The porosity of the Salado is extremely low. While the near-field permeability (immediately surrounding the mined repository) is estimated to range from 1 x 10 E-14 to 2.5 x 10 E-11 m2 (0.01 to 25 microdarcies, where one darcy = 10 E-4 m2), with an average of approximately 0.3 microdarcy, the far-field permeability has been measured at approximately 10 E-20 m2 (one nanodarcy). The Salado Formation was initially thought to contain only very small amounts of water (brine). This liquid was postulated to be held only within the small pockets of the salt crystals themselves (intragranular). Later research, however, showed that the brine was also situated in the interstices of the individual crystals (intergranular), or it saturated very thin and discontinuous pockets and layers of clay.

This is the fluid that has been seen at the WIPP in the form of brine seeps. These studies showed that the brine content of the Salado may be approximately 2 percent by volume. The question of brine inflow and formation permeability is discussed in more detail in the next section.

5. Geologic Stability

The geologic stability of the WIPP site is a key element in any no-migration finding for long-term disposal at the repository. In the course of its review of DOE's petition, EPA addressed a number of questions related to site stability, the most important of which are brine inflow into the facility, potential for dissolution of the Salado Formation, seismicity, and the occurrence of maker beds in the Salado Formation. These questions are discussed below.

a. *Brine inflow.* There are two main potential sources for brine infiltration into the repository: Leakage from the Rustler formation above the WIPP and brine inflow from the Salado Formation into the WIPP.

While there has been some leakage from the Rustler Formation down each of the four WIPP shafts into the repository, the leakage rate does not exceed 0.06 liters per second, even when the shaft is unlined and no effort is made to correct the situation. This is not considered a problem with respect to the overall integrity of the Salado, but did lead to inflow of water into the facility. As a result, the WIPP shafts have been concrete-lined and grouted through the Rustler Formation, successfully eliminating the inflow into the shafts. This will be adequate (with proper maintenance) to control leakage from the Rustler over the operating life of the facility, at which time the shaft seals will be constructed. Therefore, the shafts do not contribute fluid to the repository, and thus do not threaten the unit through dissolution or provide a driving force for the transport of hazardous constituents from the underground.

Underground experience with the WIPP has also allowed more information to be gathered on the occurrence and movement of brine within the Salado. The movement of brine in the area immediately surrounding the repository (the disturbed rock zone) has consisted of small, low flow "weeps" that commonly develop on the walls and ceiling of an excavation shortly after the mining of an area. It has been observed that the weeps generally occur at random intervals along planes of heterogeneity within the repository, which means along clay and anhydrite seams found within the Salado. Only rarely does the inflow from a particular weep exceed the evaporation rate of the mine ventilation. In this case, the small amounts of brine will accumulate on the salt surface (usually at a rate of a few tenths of a milliliter per day) until the flow from the weep diminishes, which usually occurs within a few months. The current view, accepted by EPA, is that brine movement into the repository is from the disturbed rock zone, and may be the result of stress-driven flow, with little or no contribution of flow from the far-field (which is the area beyond the zone affected by the underground workings). The fluid inflow question is an important one because brine is a key factor in gas generation, which is partially caused by the corrosion of the waste containers. Gas generation may affect the amount of time required for creep closure of the facility, and, if gas pressure is sufficient, it could also fracture surrounding walls or seals. Gas may also generate enough pressure to drive liquid out of the repository. (The question of gas generation is discussed later in this section.)

Because of these uncertainties, DOE has developed several conceptual models to predict brine movement within the Salado Formation. One model is based on far-field Darcy flow. It assumes that the Salado is hydraulically saturated in the far-field, that fluid flow is the controlling or limiting factor in the long term, and that fluid flow can be modeled effectively through the Darcy equation. (Darcy flow means that fluid flow is directly proportional to the pressure gradient, even when these gradients are very low.) The other concept for modeling the Salado assumes that Darcy permeability is valid only in those regions that have been significantly distrubed. In this approach, the far-field Salado permeability would be essentially zero under any pressure gradient, and brine would flow into or out of the WIPP (along with any hazardous constituents) only in response to the formation of a disturbed rock zone in which deformation of the halite produced interconnected porosity. A third model, which falls between these two approaches, assumes that there is some interconnected porosity within the Salado even under undisturbed conditions, and that fluid flow would take place in the near field in the absence of mechanical disturbance, but there would be no far-field fluid flow due to the absence of sufficient gradients.

Currently it is not certain that the different models of fluid flow within the Salado have significantly different impacts to the long-term behavior of the repository. In general, interpretations assuming Darcy flow in the far-field are conservative in that they do not result in a zero far-field flow rate and do not indicate maximum amounts of brine

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area, are not directly relevant to the Agency's decision on a no-migration variance, even for permanent disposal. If contaminants pass beyond the Salado at greater than health-based levels, migration has occurred regardless of the fate of the contaminants in the Rustler formation.

inflow. Based on the models, however, DOE estimates that the brine inflow might total 40.6 m3 in 200 years, the estimated date by which the repository will be closed. This is a relatively small volume of liquid, representing 1.2 percent of the initial room volume. DOE believes that this amount of brine would be absorbed by salt backfill that will be placed around the waste.

To verify these results, DOE has scheduled Salado Formation fluid flow behavior studies for the test period at the WIPP; during these studies, DOE will validate the models against in-situ data, and will evaluate the fluid flow characteristics of the Salado in the shafts and in the salt surrounding the disposal rooms.

During the test phase, DOE will also refine the current understanding of the hydraulic characteristics of the Salado Formation, including: (1) The state of the hydraulic saturation in the far-field; (2) the driving forces for fluid flow; and (3) the relevant flow paths. As a result of these studies, DOE will obtain a better understanding of the long-term rates of brine inflow, and the long-term fate of wastes placed in the repository.

b. *Seismicity.* The WIPP site is located in an area of low seismic risk. The possibility is extremely low that faulting at the site is of a magnitued that could significantly affect site integrity. Geophysical investigations performed at the site show that no major faults occur in the area, and that those minor faults that are present do not appear physically to displace repository-horizon strata. The Agency agrees with the conclusion presented by the petitioner that regional tectonic activity is not an issue in terms of maintaining repository integrity.

c. *Dissolution features.* Because halite of the Salado formation is soluble in waters that are undersaturated with respect to the minerals in halite, removal of salt surrounding the repository by dissolution could affect repository performance and provide a route of migration out of the facility. In reviewing the potential for dissolution at the WIPP, EPA considered: (1) The influence of a dissolution front at nearby Nash Draw; (2) the possibility of shallow dissolution at the WIPP; (3) the likelihood of climatic changes affecting the hydrologic system, including the dissolution rate; and (4) the effect of deep-seated dissolution on repository performance and the origin of "breccia pipes" found near WIPP.

The nearest major geomorphic feature to the WIPP is Nash Draw, which is approximately eight kilometers northwest of the site. Nash Draw is an undrained physiographic depression which probably developed as a result of differential dissolution of the anhydrite, gypsum, and halite beds of the Rustler and Upper Salado Formations. It is believed that dissolution on top of the massive Salado Formation produced a uniform lowering of the land surface within Nash Draw, while surficial features were produced and modified by dissolution of the Rustler Formation. The dissolution process also produced individual sink holes within Nash Draw, which vary in size from a few tens of meters to approximately two kilometers across. There are also very small sinkholes elsewhere in the area.

The shallow dissolution features in the WIPP area where formed during wetter climatic periods, primarily during the formation of the Pleistocene Gatuna Formation. Even during the period of greatest dissolution, only units within approximately 75 meters of the surface were affected. Shallow dissolution can only become a major process in the Salado, which is over 250 meters from the ground surface, if large quantities of halite-unsaturated water gain access to the Rustler Formation. Several factors will inhibit this process. The geologic units above the Salado are confining layers with transmissivities so low as to prevent recharge of surface water. Since the Rustler/Salado contact contains water that is staturated with respect to halite, it is not capable of dissolving additional halite. Lastly, the head-gradient from the Rustler/Salado contact is upward through the Rustler, which means that if water did exist and flow through this area, it would flow away from the Salado.

Significant increases in precipitation in the area of the WIPP could in theory increase the likelihood of surface dissolution. Data, however, indicate that the Quaternary climate of the past 500,000 years has for the most part remained semi-arid, with limited periods of increased precipitation. For example, the Mescalero Caliche, a type of formation characteristics of warm, semi-arid climates, has remained intact since its formation approximately 500,000 years ago; its continued presence is evidence that the climate has been relatively dry since its formation. As part of the performance assessment, DOE is studying further the possible effects of significant climatic changes on the WIPP.

Another type of dissolution feature found in the region is breccia pipes, or dome-like features of fractured rock. Four of these domal features occur in the immediate vicinity of the WIPP area. Two of these have been drilled and tested. These features appear to be the result of localized, deep-seated dissolution wherein a void is created and overlying material collapses into the void. In the Delaware Basin, these breccia pipes form where soluble units overlie the Capitan Reef aquifer system. The pipes are formed by dissolution of the rock and the subsequent collapse of overlying beds, followed by differential solution of upper units, producing subsidence of ground around the collapsed pipe and creating a brecciated "domal" structure. There are two proposed scenarios for collapse: formation of a cavern inside the Capitan and dissolution and collapse of overlying units, or influx of water to the Salado from an outside source through fractures, resulting in Salado dissolution and collapse. EPA agrees with DOE in its conclusion that formation of these features will not affect the WIPP site because the Capitan Formation, necessary as a fluid source for dissolution, does not underlie the WIPP site.

d. *Occurrence and significance of marker beds.* The occurrence of 48 correlatable marker beds throughout the Salado indicates that the formation exhibits lateral continuity. Geologic mapping within the repository and shafts further supports this contention.

The WIPP repository is bounded by two markers beds (MB), an upper MB 138 and an underlying MB 139. Marker Bed 139 is located approximately 1.5 meters below the floor of the repository, and is composed by anhydrite, polyhalite, and halite. It varies in thickness from 0.3 to 1.3 meters, with an average thickness of 0.8 meter. The bed is fractured in the area below the repository as a result of the excavation of the repository. This marker bed is a potential contaminant migration pathway if fluids/gases were to exist in sufficient quantities to allow a driving force. DOE will review the possible role of Marker Bed 139 during the test phase, and will evaluate the need for specific approaches designed to control migration through the bed, including grouting and excavation of the fractured portions.

Marker Bed 138 lies approximately 9 to 10 meters above the repository and is composed of microcrystalline, partly laminated anhydrite that contains scattered halite growths. This bed is typically 0.25 meters thick, and has a very thin clay seam at the base.

Detailed assessment of marker beds surrounding the repository is important because these beds may act as parting surfaces during repository closure and may also serve as fluid migration pathways. DOE is conducting a number of studies to provide a full

understanding of the significance of these marker beds with respect to repository performance. The role of these beds and how the performance assessment will address outstanding issues such as fluid migration pathways are discussed later in this notice.

e. Ground-water modeling. In its no-migration variance petition, DOE provided the results of ground-water modeling that address the possible migration of hazardous constituents in the Salado Formation. The modeled pathway was one in which wastes moved downward from the waste storage panels, through the underlying salt, and into Marker Bed 139. Waste then moved laterally through this bed to the vertical shafts and upward through the seals and salt backfill within the shaft. DOE modeled this scenario using the SWIFT III code, a widely accepted code used to assess contaminant transport underground, and made very conservative assumptions—for example, one-dimensional flow, constant concentration source of 100 percent solubility, high longitudinal dispersivities, and no retardation or attenuation of wastes.

Results of the SWIFT III modeling indicate that the maximum distance from the source of a 10 ppt (part per trillion) concentration level is 350 meters after 10,000 years, assuming a dispersivity value of 10. This is significant, because the 10 ppt "front" would not have reached the sealed shafts by 10,000 years, and would still be over 400 meters from the top of the Salado Formation. Even with an unrealistic dispersivity value of 100, and 10 ppt contaminant front would still be 240 meters from the top of the Salado.

These results indicate that if the enhanced permeability of the marker bed is limited to the area around the disturbed rock zone, and the permeabilities of the constructed seals are low, contaminants will not migrate vertically up the shaft beyond the unit boundary under the modeled scenario and within the period of the model. If significant fracturing of rock were to occur or the seals were to fail, however, more extensive migration might occur. Although DOE considers these conditions unlikely, it will evaluate them during the test phase.

C. Repository Performance

1. Construction and Maintenance of the Repository

The WIPP repository was excavated according to accepted industry techniques, and has been under Mine Safety and Health Administration (MSHA) oversight and inspection since 1987. The basic mine design is "room and pillar," in which large rooms are excavated from the salt bed and the structural support is provided by the intact pillars of salt that remain. The width of the pillars is determined by the structural properties of the in-situ material. During and after construction, some fracturing of the repository walls has been observed. As a result, rock bolts have been used extensively throughout the underground openings. These bolts retard fracturing and are used in areas of the mine that will remain open for extended periods of time, such as the waste unloading areas and the main access drifts. Roofs of many high traffic areas are pattern bolted for extra safety. Both resin and mechanical bolts are used in most areas. The bolts are tested to meet MSHA standards by MSHA-qualified personnel.

The room and pillar type of excavation is used in various mining activities, such as anthracite and potash mining. In fact, much structural information for the WIPP repository was derived from the potash industry experience from mining the Salado Formation. As a result, the Agency is satisfied with the procedures used by DOE with respect to the basic construction of the WIPP underground. The Agency believes that DOE has demonstrated, with reasonable certainty, the stability of the WIPP repository during the period of the proposed variance.

2. Closure Mechanisms

One of the most attractive characteristics of bedded salt is its plasticity, which enables it over time to flow or "creep," a process that enables fractures in the salt to heal at feasible repository depths. The National Academy of Sciences' original recommendation of salt as a repository medium was based in part on the assumption that the salt would creep to closure and that the salt pillars (or the room and pillar concept) would provide sufficient support to prevent premature collapse and failure of the repository.

These are four major elements of the closure mechanism for the WIPP underground: (1) Brine inflow (discussed earlier); (2) rate of closure of the repository; (3) the disturbed rock zone and Marker Bed 139; and (4) gas generation (which is discussed in the next section).

The observed closure behavior of the openings at the facility is more rapid and more complex than originally anticipated. The total macroscopic wall-to-wall and ceiling-to-floor closure to date have proved, at least initially, to be approximately three times the predicted value. Under the most favorable conditions, the more rapid closures would result in time estimates of 60 to 200 years for closure to a near final state, depending on the initial waste and backfill density, brine influx rate, gas generation rate, and creep closure rate. One of the tasks of the performance assessment is to ascertain in more detail the specific mechanisms and timing of repository closure.

EPA believes that the creep closure process will be a step-functioned phenomena, in which slabs of halite, or variable size, will break along fractures and fall into the remaining open space of the mine, or will be involved in floor heave. These fractures will occur mainly along pre-existing microfractures, incipient joints, and bedding planes, following the excavation of underground openings at the WIPP facility. These are the fractures that make up the disturbed rock zone, which is a zone of rock in which mechanical properties have changed in response to the excavation. The term "near-field" describes the rock within the disturbed rock zone, and "far-field" describes the rock outside the zone. The disturbed rock zone extends approximately 1 to 5 meters from the excavation.

Underground observations of the disturbed rock zone indicate that coherent creep of the Salado Formation outside of the disturbed rock zone is the dominant structural process involved in the closure of the repository. The disturbed rock zone, however, may serve as a sink for some or all of the brine that seeps into the rooms and shafts. It may also enlarge the effective room dimensions by moving the area at or near atmospheric pressure to its outer limits. This would increase the time required for complete closure of the repository openings, allowing the potential for increased brine accumulation. It has also been suggested that, if the fractures in the disturbed rock zone or Marker Bed 139 in particular do not heal, they might serve as a route for migration for hazardous waste or radionuclides. A major portion of the test phase will be devoted to exploring the extent and behavior of the disturbed rock zone.

3. Gas Generation in Waste Disposal Rooms

Microbial and radiolytic decomposition of the waste and corrosion of containers will generate a large quantity of gas. This may result in the pressurization of the waste disposal rooms, particularly if the rate of gas production exceeds the rate at which

gas could be consumed in chemical reactions or be diffused into the host rock. This pressurization could become a driving force for the migration of radionuclides and/or hazardous constituents. If gas pressure exceeds lithostatic pressure, it may result in near-field fracturing of the Salado Formation, impede the structural closing of the repository, or result in gases or brines escaping around the shaft and panel seals. (Seal design will be discussed in section IV.H.) While this is a question that DOE is addressing as part of the performance assessment, it will not be a concern during the test phase.

From the viewpoint of long-term performance of the WIPP, the fundamental questions are whether brine inflow will be sufficient to saturate backfill, waste, and the disturbed rock zone, either before or after compaction of the repository to the final mechanical state, and whether the far-field permeability will be sufficient to dissipate brine and/or gas pressures at or near the final repository state at some fluid pressure below lithostatic pressure.

The impacts of potential gas generation cannot be fully assessed at this time. The most important factor with regard to impacts at the site is the rate at which gases will be produced. To some extent, gases may be absorbed into the Salado Formation. The results of experiments performed during the test phase will help quantify the rate of gas generation within the repository, and will determine if any additional engineering modifications or safeguards are needed to meet the long-term performance goals.

4. Evaluation of Engineered Alternatives

The potential for releases as a result of the interactions among wastes, brine, and gas at the WIPP has led DOE to consider whether some type of waste treatment process or some other system modification may be required. Several engineered components might be added to the system to mitigate the effects of gas generation, wastes might be treated before placement to reduce the amount of gas generated, or other measures taken. DOE formed a task force to review and evaluate the technical effectiveness of waste, backfill, and facility design modifications in mitigating problems associated with gas generation. Engineered alternatives that might provide improved performance will be included in the WIPP experimental programs.

H. Seal Design

The WIPP repository is connected to the ground surface by four mine shafts ranging in diameter from 3.7 meters to 6.1 meters. These shafts are used to remove excavated salt, provide fresh air intake, provide for exhaust air outflow, and handle waste, personnel and construction equipment. At site closure, these shafts must be filled and plugged to prevent the escape of hazardous constituents. In addition, each panel and drift of the repository itself must eventually be sealed to prevent migration of wastes to the shaft seals and minimize release in the event of a penetration. Since DOE will not be installing permanent seals during the test phase, the variance proposed today does not require an approved final design. However, for the Agency to be assured that an implementable design will be available at the end of the test phase, it has required DOE to provide in its petition a reference design and a plan for development of a detailed design.

The primary function of the seal system is to limit the release of hazardous constituents (and radionuclides) through the shafts and past the unit boundary. For the purpose of the no-migration petition, hazardous constituents must not escape from the seal system in excess of health-based levels, and the seals must be capable of limiting the inflow of ground water from overlying water-bearing zones. Furthermore, the seals must function effectively for as long as the waste remains hazardous.

In its petition, DOE has developed a two-phase reference seal design. The first phase provides a "short-term" barrier to fluid flow and is designed to function for at least 100 years. The purpose of this "short-term" barrier is to provide containment until the long-term barrier of compressed salt consolidates. The second phase provides the long-term barrier to fluid flow and is expected to become effective at approximately the 100-year time frame.

DOE has chosen salt as the principal long-term barrier to fluid flow from the repository. Salt has been selected because: (1) It is compatible with the surrounding host rock, providing long-term mechanical and chemical stability unmatched by any other material considered; (2) it is emplacable with conventional techniques; and (3) emplaced crushed salt is expected to reconsolidate as a result of creep closure of the mine and shaft openings, resulting in a fluid conductivity approaching that of the host rock salt.

Laboratory testing and numerical modeling have demonstrated the feasibility of rock salt as the long-term seal; however, complete consolidation of the salt columns within the shafts and mine drifts is expected to take up to 100 years. Therefore, DOE has proposed a short-term seal system to provide waste containment during the period of salt seal consolidation.

The materials chosen for the short-term seals must satisfy the following criteria: (1) They must provide an effective fluid barrier; (2) they must be emplacable in the mine environment; (3) they must provide mechanical and chemical stability for at least 100 years; and (4) they must be compatible with and capable of containing the hazardous waste constituents found in the TRU wastes. (Although the Senate legislative history indicates that the no-migration applicant must "sustain the burden of meeting this standard without the use of artificial barriers such as liners" (S. Rep. No. 284 at 15), EPA does not read this language as precluding assessment of artificial barriers for temporary containment. The concern expressed in the legislative history is that artificial barriers do not provide indefinite containment. Since the artificial seals at the WIPP would only provide a barrier to migration during the temporary period (i.e., 100 years) between closure and consolidation of the permanent salt seal, the concern expressed in the legislative history does not appear to be presented.)

DOE's ongoing seal development program has evaluated a number of seal materials for use in short-term seals, including clays, grouts, concretes, and asphalt. After substantial investigation, including laboratory and small-scale field testing, literature review, and modeling, DOE has proposed a multicomponent reference or conceptual design for the short-term seals. The reference seal materials chosen were concrete and sodium bentonite (a type of clay). They are expected to satisfy the above criteria, although their effectiveness will be the subject of further study during the test phase.

Within the repository shafts there will be three major seal subsystems—the water-bearing zone seal system, the upper shaft seal system, and the lower shaft seal system. The water-bearing zone and upper shaft seal systems are located in the Rustler Formation, while the lower shaft seal system is in the Salado Formation. The water-bearing zone seal system is composed of a 4-meter-thick compacted sodium bentonite seal sandwiched between massive 10-meter-thick concrete bulkheads. The upper shaft seal system is composed of three 4-meter-thick sodium bentonite

seals, each sandwiched between massive concrete bulkheads 10 meters in thickness. The redundant nature of the approximately 60-meter-long shaft system in the Salado Formation can be expected to assure that water-bearing zones are isolated from the shafts.

The lower shaft seal system, which will be in the Salado formation, is expected to function for the long term. This seal system will be composed primarily of compacted crushed salt, ultimately returning the shaft area to a state of permeability to fluids comparable to that of intact host rock salt. The expected height of the final column of reconsolidated salt in each of the four shafts is approximately 200 meters.

A short-term seal will be installed at the top of the Salado formation, above the compacted crushed salt column. The seal will be composed, from top to bottom, of (1) a 10-meter-thick concrete bulkhead, (2) a 4-meter-thick compacted sodium bentonite seal, (3) a 5-meter-thick preconsolidated crushed salt core, (4) a 4-meter-thick compacted sodium bentonite seal, and (5) a 10-meter-thick concrete bulkhead. This upper component will provide redundant protection of the preconsolidated salt from infiltration by water from strata above the Salado formation. The concrete used in this seal, and all other seals within the Salado formation, will be salt saturated to increase compatibility with the host rock. At the bottom of each shaft another short-term seal similar to the one emplaced at the top of the Salado formation will provide a base for the shaft's preconsolidated salt seal, and will limit the movement of fluids between the salt column and the repository itself. A redundant seal similar to the two mentioned above is also proposed to be located within the Salado formation just below the Vaca Triste marker bed, which is a halitic siltstone approximately 240 meters above the repository horizon.

DOE also intends to place a series of horizontal seals within the drifts and panels of the repository itself, and along the four long North-South access drifts leading to the panels. The purpose of these seals is to provide an interval within each panel that has a permeability to fluids comparable to the permeability of undisturbed host rock salt. These seals will be composed of a preconsolidated salt core (either tamped salt or salt block) with 10-meter concrete bulkheads at each end. Considerable overexcavation is anticipated within the drift and panel seal areas just prior to placement of the seals to reduce the disturbed rock zone and remove areas of Marker Bed 139, which might permit migration of the waste constituents. Swelling clays are not now included in the panel and drift seal design.[7]

In its petition, DOE provided a reference design for this seal system. A significant portion of test phase activities is devoted to seal system development based on the reference design. To characterize seal system behavior and performance more fully, DOE is conducting an in-situ and laboratory testing, analysis, and design program. The primary activities or issues addressed by the program are:

1. *Geochemical stability.* Additional laboratory work is necessary to confirm that short-term components will perform adequately throughout their design life. During the test phase, DOE will evaluate the potential for chemical degradation for the seal materials as a result of interaction with the hazardous waste (and other waste) to be disposed of in the repository.

2. *Crushed salt consolidation.* The effect of consolidation on crushed salt properties requires verification with further laboratory tests, including an expansion of the testing program to include brine-saturated crushed salt. Consolidation rates of crushed salt under deviatoric loading will be determined. Measurements will then be made on samples saturated with brine to determine how fluid-filled pores inhibit compaction. The extent to which reconsolidation is accelerated by moisture will be measured in tests on samples containing controlled quantities of added brine. The relationship between reconsolidation, density, and permeability will also be determined.

3. *Cementitious materials development.* DOE will also investigate anhydrite bonding concrete, principally to support the development of material to seal Marker Bed 139 as well as anhydrite markerbeds of less importance. Testing of previously-developed concretes will continue.

4. *Crushed-salt consolidation modeling.* DOE will update the numerical crushed salt consolidation model to include the latest data from laboratory tests. Calculations will be made of crushed salt consolidation in proposed seal excavation shapes to guide the choice of seal shapes for rapid consolidation to high density and low permeability.

5. *Seal system design integration.* An architectural/engineering contractor will prepare a design for the WIPP sealing system after evaluating the results of the testing and model development activities. The design will provide the basis for preparing a WIPP construction design.

6. *Small- and large-scale seal tests.* DOE has placed a number of vertical and horizontal bore holes in the experimental area of the repository. Various candidate seal materials have been placed in these boreholes to provide in-situ data on their efficacy. To more fully simulate the effects of the disturbed rock zone and to test emplacement techniques, DOE will emplace large-scale seals during the test phase. These seals will simulate typical panel seals, and will be composed of crushed salt or salt blocks and concrete.[8]

The Agency believes that DOE's seals development program, as outlined in the no-migration variance, is appropriate. The reference materials currently selected exhibit key properties of mechanical and chemical stability, emplaceability, and hydraulic impermeability. The overall seal design is redundant and calls for seals in critical portions of the repository and shafts. The test phase will address outstanding data needs, verify existing data, and develop new models, as well as improve models developed previously. Information developed during the test phase will be used to develop a preliminary seal design suitable for a construction design.

The Agency solicits comments on DOE's current reference design as well as DOE's program for developing a preliminary seal design during the test phase.

I. Waste Characterization

1. Waste Sources and Types

The TRU wastes intended for emplacement in the WIPP are generated at the ten DOE facilities involved in production operations and research and development activities related to national defense. Many of the processes conducted at the DOE generating facilities are typical manufacturing operations—machining, degreasing, foundry operations, assembly, laboratory operations, etc.; the major difference is the use of radioactive

[7] In addition to isolating each panel from the rest of the repository, the panel seals will also function as a barrier for backfilled salt placed in each panel. The backfilled salt and other absorbent or getter material will aid in the encapsulation of the waste material, absorb brine infiltrating individual rooms, and reduce the time necessary for final closure.

[8] DOE is also continuing to participate in international salt seal development programs. Advanced programs with salt, bentonite, and concrete are being conducted concurrent to the DOE program in Sweden, Canada, Germany, and the Netherlands.

materials to produce defense-related materials. The wastes that are generated from these processes include: (1) Laboratory hardware such as glassware, ring stands, piping, and other metal structures, (2) cellulosic materials such as towels, tissues, and wiping cloths, (3) protective gloves and clothing; (4) inorganic process sludges, many of which are stabilized, (5) various plastic, rubbers, and resins, (6) stabilized organic wastes, and (7) worn out or contaminated equipment and tools. The specific DOE facilities that generate these wastes are:

Rocky Flats Plant, Golden, CO
Idaho National Engineering Laboratory, Idaho Falls, ID
Los Alamos National Laboratory, Los Alamos, NM
Argonne National Laboratory-East, Argonne, IL
Savannah River Plant, Aiken, SC
Oak Ridge National Laboratory, Oak Ridge, TN
Hanford Reservation, Richland, WA
Mound Plant, Miamisburg, OH
Lawrence Livermore National Laboratory, Livermore, CA
Nevada Test Site, Mercury, NV

While the wastes originate from numerous sources within each facility, they have been categorized into four general waste types based upon their physical form and primary chemical content (i.e., organic or inorganic). These types, an example of each, and the approximate volumes of waste they represent, are depicted in Table 1.

TABLE 1—VOLUMES OF WASTE BY WASTE TYPE

Waste type	Examples	Volumes (ft^3) [1]
Solidified aqueous or homogeneous inorganic solids (Waste Type I).	Wastewater Treatment Sludges; Cemented inorganic process solids; Solidified aqueous wastes.	800,000
Solid inorganics (Waste Type II)	Graphite waste; Metal waste—tools, equipment; Glass waste; Pyrochemical salt waste	850,000
Solid organics (Waste Type III)	Combustible waste—paper, rags, soft plastics, cloth coveralls; Filter wastes; Leaded rubber; Exchange resins.	1,750,000
Solidified organics (Waste Type IV)	Solidified lab waste; Solidified solvents	100,000
Total		3,500,000

[1] The volumes reflect previously generated wastes plus the expected volumes that will be generated during the operating life of the WIPP facility.

As can be seen, the largest percentage (approximately 75%) of waste is solid organic- and inorganic-types wastes—paper, protective clothing, tools, equipment, etc.—while solidified organics (the waste that is expected to contain the highest amount of toxicants) will comprise a relatively small percentage of waste (approximately 3 percent).

All wastes to be sent to the WIPP must comply with the Waste Acceptance Criteria (WAC) established by the DOE WIPP Project Office. (These criteria are normally referred to as the WIPP-WAC.) These criteria specify requirements regarding the physical, chemical, and radiological characteristics of the wastes, as well as package labeling requirements. For example, the WIPP-WAC prohibits wastes containing free liquids except in residual amounts.[9] Therefore, wastes destined for emplacement at the WIPP must be in a solid or solidified form. Similarly, corrosive materials and nonradioactive pyrophorics are also prohibited by the WIPP-WAC. Therefore, all corrosive materials must be neutralized or processed to render them noncorrosive, and all nonnuclide pyrophorics must be stabilized or processed to render them nonhazardous. The WIPP-WAC also place limits on the radionuclide levels allowed in individual waste packages. Compliance with the WAC is verified by a combination of process controls: visual inspection during waste packaging, real-time radiography, nondestructive radiological assay, and waste sampling. DOE requires that each waste generator or storage site certify that all wastes meet the WIPP-WAC requirements prior to being sent to the WIPP.

[9] One of the concerns expressed by EPA over the long-term fate of the wastes is the potential for liquids contained in the wastes to be released due to increased pressure after the closure of the repository and, thus, creating the potential for movement of hazardous constituents. As a result of this concern, DOE provided information which indicates that the potential for liquids to be released from the solidified inorganic process sludges (Waste Type I) during the closure period is minimal. Similar assurance needs to be provided for the solidified organic sludges and the wastes that are stabilized by the addition of absorbent. Since the repository will remain open during the testing period, the potentials for liquid release is not a concern during the testing period. However, additional data will be necessary before the Agency can reach a decision on the operational and post-operational periods.

2. Waste Characterization Data

DOE's characterization of the RCRA hazardous constituents in the TRU wastes to be emplaced at the WIPP facility is primarily based upon best engineering judgment, considering the processes from which the wastestreams originate, the materials used in each process, and the technologies used in treating the wastes. In compiling these data, DOE grouped wastes together into Content Codes which comprise wastes of similar types (e.g., combustibles, metals, etc.). Each Content Code indicates where the waste is stored or generated and consists of one or more Item Description Codes (IDCs). These IDCs are site-assigned codes for wastes: they represent more detailed waste descriptions than are contained in the Content Codes. For example, Content Code RF 116 represents combustible wastes currently being generated at Rocky Flats. This Content Code is composed of IDC 831 (dry combustibles), IDC 832 (wet combustibles), and IDC 833 (plastics). (The Content Code 116 wastes previously generated at Rocky Flats and currently stored at the Idaho National Engineering Laboratory are designated as ID 116.)

In support of its petition, DOE provided information on each of 138 Content Codes. For the various codes, the information was provided in two parts. The first part contains a description of the waste in the Content Code and its corresponding IDCs. This description includes flow diagrams and narrative descriptions of the processes which generate the waste, as well as identification of the RCRA hazardous constituents that are used in the process and estimated concentrations for each of the hazardous constituents expected in the waste.

In using process knowledge to establish the identity and concentration of RCRA hazardous constituents in particular wastestreams, DOE assumed that, if a constituent was used in a process contributing to a wastestream, then the constituent would be present in the treated waste. DOE notes that this is a conservative approach since many of

the identified constituents (i.e., the solvents) are very volatile and are likely not to be present in the wastestreams, or are present at very low levels.

The second part of the Content-Code-specific information references available analytical data; these data, DOE argues, support its conclusions on waste composition based upon process knowledge. These data include results from total volatile organic analysis, total metals analysis, Toxicity Characteristic Leaching Procedure (TCLP) tests for organics and metals, Extraction Procedure (EP) tests for metals, and headspace gas analysis for organics. Except in a few cases, all the analytical results represent wastes that were generated at the Rocky Flats Plant, the Idaho National Engineering Laboratory, or the Los Alamos National Laboratory.

Total volatile analysis data were reported for 15 samples. Thirteen of the samples represented Waste Type I and two represented Waste Type IV. Total metals analysis data were reported for six samples. These samples represented Waste Type I and were also tested for the RCRA hazardous waste characteristics of ignitability, corrosivity, and reactivity.

TCLP results were reported for ten samples, all representing Waste Type I. Nine of the samples were analyzed for organics and metals while one was analyzed for organics only. EP toxicity test results were reported for fifteen samples. All these samples represented Waste Type I.

Two sets of gas headspace analysis results were provided. In the first set, results were reported for 22 samples. Ten samples represented Waste Type I; five samples represented Waste Type II; three samples represented Waste Type III; and four samples represented Waste Type IV. In the second set, headspace analysis results were reported for 209 samples.[10] Thirty-two samples represented Waste Type I; 78 samples represented Waste Type II; 77 samples represented Waste Type III; and 23 samples represented Waste Type IV. In both sets of headspace data, the samples were analyzed for numerous gases, including nine organics.

It should be noted that one of the goals of DOE's waste characterization program is to ensure that the wastes used in the experimental or test phase are representative of all of the wastes that will be placed in the WIPP facility during its operational period. DOE believes that wastes from Rocky Flats (newly generated) and the Idaho National Engineering Laboratory (stored and newly generated) will be representative of wastes from the other facilities because Rocky Flats will generate 46% of the newly generated waste over the next 26 years and INEL contains 62% of the stored waste that will be shipped to the WIPP facility, much of which was generated at Rocky Flats. DOE further notes that Rocky Flats produces wastes described by most of the Content Codes.

[10] Forty-one gas headspace samples were also analyzed for wastes generated at the Los Alamos National Laboratory. These analyses indicate that no RCRA VOCs were detected in the headspace.

3. Summary of Waste Characterization Data

The RCRA hazardous constituents in the wastes destined for the WIPP are certain toxic metals and both halogenated and nonhalogenated solvents. Based upon the process information and analytical data, DOE compiled a table (Table 2-1 of the Waste Analysis Plan) which identifies the RCRA hazardous constituents and estimated concentrations expected to be present in each Content Code. The maximum estimated concentrations of the predominant hazardous constituents are presented in Table 2.

The toxic metals cadmium, chromium, lead, mercury, selenium, and silver are predominantly present in discarded tools and equipment, solidified inorganic sludges, and cemented laboratory liquids. Lead is the most prevalent EP metal and is present mostly in lead-lined gloves, aprons, and gloveboxes; lead bricks; and piping.

TABLE 2—MAXIMUM ESTIMATED CONCENTRATION VALUES

Hazardous Constituent [1]	Waste Type I	Waste Type II	Waste Type III	Waste Type IV
Acetone			T	
Butanol	T		T2	T
Carbon tetrachloride	T	T	T	D
Methanol	T		T2	T
Methylene chloride	T	T	T	M
Tetrachloroethylene	T			T
1,1,1-Trichloroethane	T	T	T	D
Trichloroethylene	T		T	M
1,1,2-Trichloro-1,2,2-trifluoroethane	T	T	T	M
Xylene	T		T	M
Cadmium	T	T2	D	T
Chromium	T	T	T	T3
Lead	T	D	D	T
Mercury	T	T1	T	
Selenium	T2	T2		
Silver	T2	T2	T	

[1] The following chemicals in this table are defined in the hazardous waste regulations solely for their ignitability characteristics: (1) Acetone, (2) butanol, (3) methanol, and (4) xylene. The other chemicals identified in the table are defined as toxic in the hazardous waste regulations.

Key: T3 = < 1 ppm; T2 = Few ppm; T = < 0.1%; T = < 1%; M = 1-10%; D = > 10%.

The primary halogenated organic compounds identified as being present in the wastes are tetrachloroethylene, trichloroethylene, methylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and 1,1,2-trichloro-1,2,2-trifluoroethane. These constituents are regulated as hazardous under RCRA due to their toxicity. The compounds are commonly used as degreasing solvents to clean metal surfaces and to solubilize other compounds. As indicated in table 2, DOE estimates that halogenated organics are not present in any of the Type I, II, or III wastestreams at greater than 1%.

The primary nonhalogenated organic compounds identified as being present in the wastes are xylene, acetone, methanol, and butanol. These constituents are regulated as hazardous

under RCRA due to their ignitability only. Like the halogenated compounds, these compounds are used as degreasers and solubilizers. As indicated in Table 2, DOE estimates that these constituents also are not present in any of the Type I, II, or III wastestream at greater than 1%.

4. DOE's Analysis of Waste Compatibility

DOE used the compositional data described above to perform analyses to demonstrate the compatibility of the various wastes to be emplaced in the WIPP. DOE first identified potential incompatibilities; it then analyzed the potential incompatibilities to determine whether or not they would actually occur. In performing these analyses, DOE considered wastes to be incompatible if the potential existed for any of the folowing reactions: Corrosion, explosion, heat generation, gas generation (flammable gases), pressure build-up (nonflammable gases), and toxic by-product generation.

To identify incompatibilities, DOE listed the materials and chemicals (with their estimated concentrations) contained in each Content Code according to 41 reaction groups (e.g., metals and compounds, caustics, *etc.*). That is, for each Content Code, all pertinent reaction groups were identified. DOE then identified all of the reaction group combinations that could occur within the same Content Code and between different Content Codes (assuming that wastes with different Content Codes are mixed).

DOE performed compatibility analyses for Rocky Flats wastes (both within each Content Code and across Content Codes) and for wastes across all sites. In analyzing compatibilities within each Rocky Flats Content Code, 19 potential incompatibilities were identified. DOE evaluated each of the 19 cases and concluded that the required processing (prior to placing the waste into the containers) would eliminate the potential incompatibility.

DOE's analysis of potential incompatibilities across Rocky Flats Content Codes were designed to simulate a scenario in which individual waste containers within TRUPACT-II containers were breached and the contents mixed. DOE identified six potential reactions due to incompatibilities. DOE discussed each of the potential incompabilities and concluded that, based upon a more detailed analysis of the identity and concentration of constituents within the reaction groups, the reactions would not occur.

In its analysis of compatibility of wastes across all sites, DOE considered reaction of wastes with brine as well as with wastes from other Content Codes. DOE identified 59 potential incompatibilities. After further evaluation, however, DOE concluded that the wastes would not result in a reaction.

5. Agency Analysis of Data

In comparing the process descriptions with DOE's judgments as to the identification of RCRA hazardous constituents in the wastes, the Agency believes that DOE's estimates to be reasonable in most instances. The Agency agrees with DOE's assertion that assuming all hazardous constituents associated with a process to be present in the resultant wastestreams provides for a conservative approach. Further, the process descriptions suggest that the hazardous solvent constituents are not expected to be present in the wastes in high concentrations,[1] except for Waste Type IV—Solidified Organics. (The Agency notes that Waste Type IV will account for only 3 percent of the wastes that are to be emplaced in the WIPP facility.) With respect to those wastes that contain toxic heavy metals, while these wastes may contain significant concentrations of certain metals (e.g., lead), the Agency believes that the potential for these constituents to leach from the waste (and escape into the environment) is minimal, considering the form of the waste.

While this information is an important basis for the Agency's conclusions, it should be noted that in certain instances DOE's judgments were not always correct. In particular, in a number of cases, DOE predicted that hazardous constituents would not be present in certain wastes; however, the analytical results for these wastes indicated that hazardous constituents were present, albeit in low concentrations. Therefore, the engineering judgments must be viewed in concert with other information (i.e., analytical data).

With respect to the analytical results, the Agency is concerned with the quality of DOE's analytical data. For most of the data, DOE has been able to provide little or no information as to sampling plans and sample handling procedures. Thus, the Agency is unable to evaluate the extent to which the samples are representative of the wastes, although the Agency recognizes that analytical data was provided for all the various wastes generated at Rocky Flats and the Idaho National Engineering Laboratory. In addition, much of the data contain no indication as to whether appropriate quality assurance/quality control measures were employed. As a result of these shortcomings, the Agency believes that additional analytical data will be required before the Agency can consider DOE's petition for the operational and post-operational period. Nevertheless, the Agency believes that sufficient information was provided for DOE to proceed with testing during the five-year test phase. In particular, as is described later in today's notice, the concentrations at the unit boundaries (using DOE's waste characterization estimates) are expected to be well below health-based levels. Therefore, even if the characterization data underestimate the hazardous constituent concentrations by an order of magnitude, the boundary concentrations would still be expected to be below hazardous levels. In addition, during the test phase, the monitoring described in Section IV.K of today's notice will confirm that no migration of hazardous constituents occurs during this period. Should problems develop, the wastes will be retrievable.

The Agency has also evaluated DOE's analysis of waste compatibility. The Agency agrees with DOE that no incompatible reactions should occur as a result of possible waste mixing. The Agency reached this determination for Rocky Flats wastes (both within each Content Code and across Content Codes) and for waste across all DOE generator sites.

Finally, it should be noted that for DOE to demonstrate no migration for the operational and post-operational periods, it will be necessary for it to extrapolate information gained during the test phase to behavior of the wastes during the later phases. Thus, the Agency is proposing to require that DOE provide to the Agency the results of detailed waste characterization and analyses performed on the waste to be emplaced in the WIPP during the test phase (see Section V of today's notice); in addition, as already indicated, the Agency believes that during the test phase additional waste characterization data will need to be developed for those wastes to be emplaced during the operational phase. While DOE believes that the wastes to be used in the test phase (from Rocky Flats and Idaho National Engineering Laboratory, as

[1] While the data indicate that Waste Types I, II, and III may contain up to 1% of certain volatile organics, the Agency would expect that most of the wastes that contained these constituents (not every Content Code contained each of the hazardous constituents identified in Table 2) would contain them at much lower levels based on waste type, the volatility of these solvents, and the manner in which these wastes are generated. This point is in some extent confirmed by the analytical data.

described in section IV.I.3, above) are representative of the wastes to be emplaced in the WIPP, the Agency recognizes that variations in the composition of wastes from different facilities—even though the processes are similar—are not uncommon. The Agency therefore believes that additional waste analysis will be necessary to demonstrate more clearly that the wastes from Rocky Flats and Idaho National Engineering Laboratory that are to be emplaced in the WIPP during the test phase are, in fact, representative of all of the wastes scheduled for emplacement in the WIPP facility.

J. No-Migration Demonstration

During the test phase, DOE intends to conduct two types of in-situ tests involving mixed wastes: bin-scale and alcove tests. In the bin-scale experiments, waste will be placed in specially designed bins with various combinations of brine, backfill, and gas getter materials. In the alcove tests, drummed wastes will be placed in sealed alcoves. (These tests are described in more detail in section IV.L of this notice.) The Agency assessed the possible levels of hazardous volatile organic constituents at the unit boundary during these experiments for the organic solvents most commonly present in TRU mixed wastes. The proposed unit boundary for the air pathway is the point where the air exhaust shaft releases to the ambient environment at the WIPP. As discussed in section IV.K, air is the only plausible pathway during the test phase for migration from the land disposal unit.

In the bin-scale experiments, headspace gases will be vented into the bin discharge system whenever the bins become pressurized through a pressure relief valve installed on each bin. The gases will then be passed on to the exhaust shaft. Since the purpose of the experiments is to gather data on the gas generation potential for the various types of wastes intended for disposal at the WIPP, the rate of gas generation can only be estimated from data gathered in previous laboratory studies. In its review of the gas generation data, the Agency concluded that the possibility that health-based levels might be exceeded in the exhaust shaft could not be eliminated. Therefore, the DOE has provided for the inclusion of a carbon canister in the bin gas discharge system to remove any volatile organic constituents released from the bins. Given the uncertainty inherent in conducting the experiments, the Agency agrees that such a control device is appropriate. (Although this part of the no-migration demonstration depends on the integrity of artificial containment mechanisms, EPA does not believe the use of air control devices for a temporary period (i.e., the operational period) precludes an approval of the no-migration petition. As noted earlier in the discussion of the temporary seals, EPA does not read the legislative history (S. Rep No. 284 at 15) as precluding EPA from considering the integrity of artificial barriers during a limited period.)

To be assured that there is no migration above health-based levels, the Agency is proposing to require the carbon adsorption control device to be installed in the bin discharge system of each room be designed to achieve a control efficiency of at least 95 percent.[18] The Agency believes a 95 percent control efficiency is readily achievable by carbon adsorption systems (see 52 FR 3748, February 5, 1987). In addition, the Agency is proposing to require that certain records be maintained in the facility operating record to ensure that the above requirement is met and that the spent carbon (which will contain the hazardous constituents) will not be improperly regenerated or disposed. In particular, the following records would have to be kept in the facility operating record: (1) The date and time when the carbon in the control device is replaced with fresh carbon and when samples are collected for monitoring carbon breakthrough, along with records of the monitoring results; (2) engineering design analyses used to size the control device and to determine the frequency of carbon replacement; and (3) a signed certification that all carbon removed from the control device is regenerated or reactivated by a process that minimizes the release of organics to the atmosphere by means of a condenser, thermal vapor incinerator, catalytic incinerator, or similar emission control system; is incinerated in a device that meets the performance standards of 40 CFR part 264, subpart O; or is disposed in compliance with Federal and State regulations.

The Agency used for its assessment the concentrations of volatile organic compounds measured in the headspace of 209 drums and standard waste boxes sampled at random from waste form categories generated at the Rocky Flats Plant and stored at Idaho National Engineering Laboratory. The waste form categories when sampled were expected to comply with the requirements of the WIPP-WAC, although upon subsequent visual examination and radionuclide reassay DOE found only 179 of the original 209 to be WAC certifiable (after modifying the initial WAC assessment to allow a free liquid residual of up to 1 percent by volume). The Agency views the analytical results from these headspace samples as being semi-quantitative, for the reasons previously described in section IV.I of this notice.

The results of the Agency's assessment are shown in Table 3 below along with levels of regulatory concerns. The Agency conservatively assumed that both rooms reserved for the bin-scale experiments are filled to capacity. The capacity of each room is 120 bins; therefore, the total number of bins is 240. The Agency then assumed an average gas generation rate of 5 moles per drum per year, a figure the DOE characterizes as representing the upper bound of the range of credible gas generation rates (Test Plan: WIPP Bin-Scale CH TRU Waste Tests, January 1990; SAND89-0462). Each bin can hold the equivalent of 6 drum volumes of waste. Therefore, DOE's upper bound gas generation rate is equivalent to a total gas generation rate from all 240 experimental bins of 0.5 cubic meters per day.[19] The DOE has specified the general ventilation rate through the repository as 425,000 cubic feet per minute which is equivalent to 17,000,000 cubic meters per day. This entire volume of air is exhausted at the exhaust shaft and is available to mix with any gases released from the bin discharge system. The resulting dilution factor at the exhaust shaft if 34,000,000. The dilution factor is applied to the average headspace concentrations, together with the control device efficiency, to calculate the concentration of constituents in the exhaust shaft.

[18] While DOE has submitted a preliminary design of the carbon adsorption control device, the Agency has not been able to determine with the information provided what control efficiency the device will achieve. Therefore, EPA is proposing to require that the carbon adsorption control device be designed to achieve at least a level of 95 percent efficiency.

[19] The Agency notes that even if the gas generation rate is higher (e.g., 25 moles per drum per year), the concentrations at the unit boundary would still be below health-based levels, given the requirement for a carbon adsorption system with a 95 percent control efficiency.

TABLE 3—TEST PHASE COMPLIANCE POINT CONCENTRATIONS IN AIR

Constituents	Average headspace concentrations (g/m^3)	Compliance point concentrations ($\mu g/m^3$)	Levels of regulatory concern [1] ($\mu g/m^3$)
Carbon tetrachloride	1.85	0.0027	0.03
Methylene chloride	0.47	0.00069	0.3
Trichloroethylene	0.70	0.0010	0.3
1,1,1-Trichloroethane	13.2	0.019	10,000
1,1,2-Trichloro-1,2,2-trifluoroethane	1.22	0.0018	30,000

[1] See "Docket Report on Health-based Regulatory Levels for Volatile Organic Compounds in TRU Mixed Wastes."

The compliance point concentrations (with the carbon adsorption control devices installed in the bin discharge system) are an order of magnitude below the level of regulatory concern for carbon tetrachloride and are two to seven orders of magnitude below any other level of regulatory concern. These represent the bin-scale experiments alone; however, the contribution of the alcoves is negligible by comparison. Although it would not be allowable under today's proposed action, DOE has provided data to show that even when 10 percent of the wastes, equivalent to 85,000 drums, are emplaced in the repository prior to sealing of the rooms, the concentrations in the exhaust shaft would be two to eight orders of magnitude below the levels of regulatory concern. Since the alcove experiments involve only 3,850 drums (more than a factor of 20 fewer drums), the concentrations in the exhaust shaft from the alcove drums would be a factor of at least three to nine orders of magnitude below the levels of regulatory concern. The actual concentrations would be even lower than this once the alcoves are sealed at the start of the experiments.[14]

The agency recognizes that the actual bin gas generation rate may be higher or lower than 5 moles per drum per year. However, the Agency agrees with DOE that this figure likely overestimates the average gas generation rate from wastes representative of the entire range of TRU wastes. Therefore, the Agency believes that the DOE has demonstrated, to a reasonable degree of certainty, that during the test phase hazardous constituents will not migrate beyond the land disposal unit above health-based levels.

[14] The Agency notes that for the carbon composite filter volatile organic compound diffusion experiments, QA/QC data on accuracy and precision for the sampling and analysis procedures were not submitted with DOE's petition. However, the diffusion coefficient was determined for three different filters for most experimental conditions. Comparison of the diffusion coefficients between filters generally indicate consistent results, although the comparisons are not favorable in every case.

K. Monitoring

As described in the previous section, the Agency believes that DOE has demonstrated, to a reasonable degree of certainty, that there will be no migration of hazardous constituents from the WIPP disposal unit above health-based levels during the test phase. Nevertheless, regulations at 40 CFR 268.6(c) require that monitoring of all environmental media be conducted to confirm that no migration of hazardous constituents beyond the unit boundary occurs, unless the Agency determines that monitoring of one or more media are unnecessary or infeasible.

In evaluating the possible pathways for migration of hazardous constituents, the Agency has concluded that hazardous constituents will not migrate to ground water or surface water during the test phase. Therefore, the Agency does not believe that ground water or surface water monitoring is necessary. In reaching its conclusion, the Agency notes that all waste emplaced at the WIPP during the test phase will be contained within steel drums or standard waste boxes which serve as the primary containment barrier. The waste itself is in an immobile form. Although the salt bed formation in which the repository is located contains small amounts of trapped brine, the permeability of the salt formation is exceedingly low, creating a natural barrier to transport. Furthermore, full retrievability of the waste will be maintained during the test phase; retrieval will be accomplished by means of the removal of the waste containers and any salt which has become contaminated. (See section IV.D in today's notice for a discussion of retrievability.) Upon completion of the test phase, the Agency will reconsider whether ground water or surface water monitoring will be necessary before waste disposal operations are initiated.

The Agency believes that the only credible pathway for transport beyond the unit boundary during the test phase is through the underground exhaust shaft. The exhaust shaft is the discharge point for all ventilation air from the underground facility. Because the waste containers and experimental bins are vented to prevent the buildup of gases generated by the wastes, some gases and vapors will be released into the underground environment. It should be noted that all waste containers are vented through high efficiency particulate filters that prevent the release of any airborne particulate material during routine waste handling operations. In the event that one or more waste containers are accidentally breached causing radiation to be detected by the WIPP radiation monitoring system, all underground ventilation air will be automatically routed through high capacity HEPA filter assemblies. Therefore, any particulate matter contaminated with RCRA hazardous constituents, e.g., EP metals, will be prevented from being released from the exhaust shaft. Thus, only those constituents that are in the gas phase, e.g., organic solvent vapors, could be released to the environment during the test phase.

The Agency considered the potential for fire and explosion hazard in evaluating the potential for release of hazardous constituents as part of its review of the no-migration petition. The Agency notes that the WIPP-WAC prohibits explosives and compressed gases in TRU waste and requires that pyrophoric materials be rendered safe by mixing with chemically stable materials, such as concrete or glass, or be processed to render them nonhazardous. In addition, the Nuclear Regulatory Commission requires that all waste containers be equipped with one or more carbon composite filters designed to prevent pressure buildup or the accumulation of flammable gases prior to shipment to the WIPP, as described in the TRUPACT-II Methods for Payload Control. The performance of these filters has been specifically tested with respect to hydrogen gas diffusivity. The Agency believes that these requirements, in conjunction with the maintenance of general ventilation in

the underground repository, make the possibility of fire or explosion extremely unlikely. The Agency notes that, while DOE is planning to monitor the repository for explosive or flammable gases, monitoring is limited to three fixed locations within the repository. The Agency, therefore, is soliciting comment on whether routine monitoring should be conducted with portable explosimeters to detect any localized buildup of methane, hydrogen, or other flammable gases underground.

In accordance with the requirements of 40 CFR 268.6(c), the petition includes an air monitoring plan which describes DOE's plan to monitor for the presence of organic solvent vapors and other volatile organic compounds at the unit boundary during the test phase. The monitoring plan involves localized monitoring of gases released during the course of experimental activities with TRU mixed wastes, confirmatory monitoring at the underground repository exhaust shaft, and background monitoring at the main air intake shaft. The Agency is proposing to require that DOE implement the air monitoring plan submitted with the petition, subject to the clarifications and modifications discussed below.

The Agency is proposing to require that the monitoring in the exhaust shaft begin 30 days prior to the emplacement of any experimental wastes underground. Monitoring of the bin-scale experiment rooms under today's proposal would have to commence prior to emplacement of any bins containing TRU wastes in the rooms. Monitoring of the alcoves would have to commence prior to the initiation of experiments in the alcoves, after the alcoves are sealed and prior to any purging of the alcove atmosphere. The Agency does not believe that monitoring of the alcoves should be required to begin with emplacement of the first drum of waste. The DOE has demonstrated that migration above health-based levels will not occur if as many as 85,000 waste drums are emplaced in the repository prior to sealing the rooms. By comparison, only 3,850 drums of experimental waste are to be emplaced in the alcoves. Given the small number of drums and given that monitoring will be conducted in the exhaust shaft during the emplacement of waste drums in the alcoves, the Agency has concluded that monitoring of the alcoves may begin when the alcove experiments are initiated.

1. Location and Frequency

The monitoring plan provides for air monitoring at the following underground locations: (1) The gas discharge system for each of two rooms containing the experimental bins; (2) the ventilation air intake and outlet passageways serving the two rooms containing the bins; (3) the atmospheres within the five alcoves containing wastes; (4) the exhaust shaft; and (5) the main air intake shaft. (See the Background Document for a diagram that indicates the specific monitoring points.) Flow rates will be monitored at the downstream end of the gas discharge system for the bins and at the exhaust shaft. The Agency is also proposing to require that the leakage rate of the sealed alcoves be measured by means of the injection of tracer gases into the atmosphere within each alcove and monitoring of the tracer gas levels. The Agency believes this is necessary to ensure the validity of the data collected from the alcoves. As provided for in the monitoring plan, air concentrations in the exhaust shaft will be calculated from the analytical results from the bin and alcove samples and the measured air flow and alcove leakage rates. Monitoring of the exhaust shaft and the main air intake shaft will provide additional measurements for comparison with the calculated concentrations.

To obtain representative samples, DOE will collect integrated 24-hour samples at all locations with the exception of the alcoves, where the gas composition is expected to remain relatively stable over time. Grab samples are judged to be sufficient for monitoring the alcoves.

Initially, samples will be collected daily at all locations except for the exhaust shaft and the main air intake shaft. After 30 days of daily sampling at a monitoring location, the frequency of sampling at that location may be reduced from daily to weekly if the monitoring results are relatively constant over time, as indicated by a relative standard deviation (RSD) of not more than 25 percent over the last 30-day period for any targeted constituent. DOE requested in its petition that the monitoring frequency be allowed to be reduced further, from weekly to monthly, if after 12 weeks the RSD of any targeted constituent was not more than 25 percent. The Agency is concerned that monitoring on a monthly schedule may not adequately detect or characterize changes in air releases that may occur with the inclusion of new waste forms in experimental bins and alcoves as the testing program progresses. Therefore, the Agency is proposing that, at a minimum, samples be collected weekly. The Agency is also proposing that the exhaust shaft and air intake locations be monitored weekly for the same reasons. However, the Agency is soliciting comment on whether to allow a further reduction in monitoring frequency. In addressing this point, commenters should specify a sampling frequency and the rationale for selecting a particular frequency.

EPA believes, however, that in no event should the monitoring frequency for the bin discharge system be reduced to less than 20 percent of the minimum time required for the consumption of the total working capacity of the carbon adsorption system. The Agency believes this requirement is necessary to ensure that, should the total working capacity of the carbon bed be exceeded prematurely and breakthrough occur, the event will be detected in sufficient time to take corrective action and replace the carbon charge.

In the event that weekly monitoring results exhibit increased variability, the Agency believes that daily sampling should be reinstituted. Therefore, the Agency is proposing to require that daily sampling be resumed if the calculated RSD for the preceding 4-week period at a monitoring location exceeds 75 percent for any targeted constituent. Daily sampling would have to continue until such time as the criteria for a reduction in frequency to weekly sampling are met again.

2. Hazardous Constituents

Air monitoring will be conducted for the organic solvents most commonly present in the wastes destined for the WIPP facility. The constituents specifically targeted for routine quantitation in the monitoring plan are carbon tetrachloride, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, and 1,1,2-trichloro-1,2,2-trifluoroethane. In addition to these five compounds, the presence of other volatile organics will be investigated and evaluated for possible inclusion in the monitoring program. Specifically, the Agency is proposing to require that any volatile organic compound be targeted for routine quantitation if the average estimated concentration at the point of sampling is 1 ppm or more during any 4-month period and the compound is detected in at least 10 percent of the samples collected from the gas discharge system from either room containing bins or 50 percent of the samples collected from any alcove. The Agency believes that identification and semiquantitative analysis of other compounds is reasonable and necessary as a precautionary requirement, given the limited waste sampling and analysis data available at DOE's waste-

generating sites and the limitations on those data.

To carry out this requirement most effectively, EPA is proposing to require that DOE implement standard operating procedures that will provide positive identification of the following compounds: Perchloroethylene; chloroform; bromoform; dichloroethane; dichloroethylene; toluene; and chlorobenzene. These hazardous constituents have been identified by DOE as being present in TRU mixed wastes at low concentrations and can be determined quantitatively with the TO-14 method. Therefore, the Agency believes these constituents are good candidates for inclusion in the monitoring program as targeted constituents if detected in significant amounts.[16]

As a criterion for inclusion of a constituent as one targeted for routine quantitation, the Agency is proposing to allow a higher frequency of detection for the alcoves than for the bins because once an alcove is filled with experimental wastes and sealed and the experiment begins, the composition of the alcove gases is expected to change only slowly. In contrast, because each bin represents a separate experiment, a highly heterogeneous and time-varying composition of gases is expected in the bin discharge system.

Although the Agency believes that monitoring for the five target constituents listed above in conjuction with specific criteria for inclusion of additional constituents is sufficient, the Agency is soliciting comment on whether other constituents should be targeted for routine quantitation.

3. Sampling and Analysis

The monitoring plan provides for sampling and analysis to be performed using EPA Compendium Method TO-14. The Agency believes the method is well suited for routine monitoring of the more toxic and most prevalent organic solvents found in TRU mixed wastes. The method is capable of detecting the hazardous constituents targeted for quantitation with a sensitivity below 1 part per billion. Samples will be collected in pressurized six liter SUMMA® passivated stainless steel canisters. Sample storage stability has been demonstrated for a variety of volatile organic compounds with this type of container. Individual canisters are required to be certified clean and free of leaks prior to each usage. The method requires that all samplers, including pumps and valves, also be certified to ensure cleanliness and reliable sample recovery.

Samples will be analyzed by high-resolution gas chromatography, followed by full scanning mass spectrometry (GC/MS/SCAN) to provide the capability to identify a wide variety of volatile organic compounds. Cryogenic focusing can be used to concentrate samples as needed to meet analytical detection limits. The GC/MS analytical system is required to be certified clean with humidified zero air prior to sample analysis. Consistent with "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods" Method 8240 "Gas Chromatography/Mass Spectrometry for Volatile Organics" (EPA Publication SW-846, Third Edition), the Agency is proposing to require that an average response factor for each target analyte, as determined by a five-point instrument calibration, be used for quantitation. (Target analytes are the five constituents initially targeted plus any other constituents subsequently targeted for routine quantitation based on the criteria described previously.) In addition, the initial calibration and any subsequent recalibrations would be required to satisfy the criterion that any single response factor differ by no more than 25 percent from the average of the five. However, if it can be demonstrated that the instrument response is nonlinear, the initial calibration and any subsequent recalibrations would have to satisfy the criterion that any single response factor differ by no more than 25 percent from the expected value derived from regression analysis. For the purpose of investigating the presence of other volatile organic compounds, EPA proposes that a forward search of the National Bureau of Standards library of mass spectra be performed on each sample analyzed.

4. Quality Assurance and Quality Control

The Agency is proposing to require that standard operating procedures be adopted to ensure the validity of the monitoring data. These would cover a range of activities, including sampling and analysis certification procedures, instrument calibration checks, duplicate sampling, audit cylinder sampling, technical systems audits, and data quality audits.

All flow measurement instrumentation used in the calculation of exhaust shaft concentrations would have to be calibrated in accordance with EPA Reference Method 2 "Determination of Stack Velocity and Volumetric Flow Rate (Type S Pitot Tube)," Method 2A "Direct Measurements of Gas Volume Through Pipes and Small Ducts" (40 CFR part 60 appendix A), or an equivalent method approved by EPA. EPA is also proposing to require that the calibrations be performed quarterly due to the possible effect of salt aerosols in the repository environment on flow measurement instrumentation.

To ensure sample integrity, Method TO-14 requires that all sample canisters be cleaned, pressure tested, and certified with humidified zero air initially and following each sampling event prior to reuse. Method TO-14 also requires that all samplers (which includes pumps, valves, and peripheral equipment used for sampling) be removed from service for routine maintenance and be leak tested and certified with humidified zero air and humidified gas calibration standards. The monitoring plan submitted by DOE indicates that all samplers will be certified on a quarterly schedule.

Method TO-14 requires that GC/MS tuning be performed daily with 4-bromofluorobenzene to verify proper analytical system functioning, that instrument calibration be checked daily with a one point midrange humidified calibration gas standard for each targeted analyte, and that the GC/MS analytical system be certified clean with humidified zero air daily prior to sample analysis. Consistent with SW-846 Method 8240, the Agency is proposing to require that the instrument be recalibrated by a full five point calibration if the response factor from the calibration check differs by greater than 25 percent of the average or expected response factor. All gas calibration standards must be traceable to a National Bureau of Standards standard reference material or an EPA-approved certified reference material.

To ensure that constituents are capable of being detected with the necessary degree of sensitivity, the Agency is proposing to require that the method limit of quantitation be established for each target analyte prior to the initiation of the monitoring program and that it be reevaluated annually thereafter in accordance with the specifications in "Report on Minimum Criteria to Assure Data Quality" (EPA/530-SW-90-021, December 12, 1989). The Agency is further proposing to require that the method limit of quantitation be determined separately for the bin, alcove, and exhaust shaft monitoring locations due to the possible occurrence of differential matrix effects associated

[16] The Agency notes that most other volatile organic constituents found in TRU mixed wastes are listed as hazardous in 40 CFR part 261 because of their exhibiting the characteristic of ignitability rather than their being toxic. Such constituents are generally only hazardous when present at high concentrations.

with the presence of salt aerosols in the repository environment.

In addition to the implementation of canister and sampler certification and analytical calibration procedures, routine quality control procedures must be implemented to evaluate data accuracy, precision, and completeness. In order to evaluate the accuracy of the monitoring data, the Agency is proposing to require that recovery samples be collected from audit cylinders and analyzed at a frequency of 10 percent at each monitoring location. In order to evaluate the precision of the monitoring data, the Agency is also proposing to require that duplicate samples be collected and analyzed at a frequency of 10 percent at each monitoring location, including the exhaust shaft. In addition, the Agency is proposing to require that data completeness be evaluated by data validation audits at a frequency of not less than 5 percent. The Agency believes that data validation is an essential part of the monitoring program and that the proposed audit frequency represents an adequate but not burdensome level of quality control. To ensure that any sampling and analysis problems which may occur are detected and corrected, accuracy, precision, and completeness would have to be tracked and evaluated after every 20 quality control analyses.

DOE's monitoring plan indicates that a systems audit will be conducted at the start of the monitoring program. The Agency is proposing to require that systems audits be performed not only prior to the initiation of the monitoring program but also semi-annually thereafter to be consistent with good operating practice. In addition, corrective action must be taken whenever a condition or practice is found which is outside system specifications or standard operating procedures, or which could reasonably be expected to compromise the ability of the monitoring program to meet established quality assurance objectives for data acceptability.

The Agency is also proposing to establish specific quality assurance objectives for data acceptability for the WIPP air monitoring program consistent with method capability and good operating practice. DOE has raised concerns regarding the establishment of specific quality assurance objectives due to the presence of salt aerosols in the underground repository environment. EPA believes that regular maintenance of sampling equipment will adequately address sampling and analysis difficulties imposed by the repository environment. The Agency believes the following quality assurance objectives are achievable: plus or minus 10 percent for relative accuracy as indicated by the relative difference between the measured concentration recovered from a sampler and the known concentration of the targeted analyte in the audit gas cylinder; 15 percent for precision as indicated by the relative difference between field duplicate samples; 90 percent for data completeness as adjusted statistically to account for the results of data validation audits; and 0.5 part per billion by volume for method limit of quantitation or one fifth of any established health-based level for a targeted constituent, whichever is greater. The Agency is therefore proposing to require these as quality assurance objectives for data acceptability and to require that corrective action be taken whenever these objectives are not being met.[16]

5. Reporting

If during the course of the monitoring program migration above health-based levels of any hazardous constituent is detected, DOE is required under 40 CFR 268.6(f)(2) to notify the Administrator in writing within 10 days. To determine whether migration has occurred (i.e., any of the targeted constituents exceed health-based levels at the unit boundary), the Agency is proposing that concentrations be averaged over an annual time period. This is consistent with the approach the Agency is taking in providing guidance to other parties submitting no-migration petitions to the Agency. The Agency believes that concentrations should be averaged over an annual time period because the health-based levels are derived by assuming chronic or lifetime exposures. The Agency is further proposing that the incremental contribution from the land disposal unit, over and above measured background levels at the site, be used in making the determination. The Agency does not believe that background levels should be a reason for the Agency to deny or revoke the variance proposed in today's notice.[17]

In order that the Agency be notified at the earliest possible time of any likelihood that migration is occurring, the Agency is proposing to require that DOE notify the Administrator in writing within 10 days if during any three-month period the average concentration of any hazardous constituent measured or calculated in the exhaust shaft over and above background levels exceeds a health-based level established by the Agency. In addition, the Agency is proposing to require the submittal of annual data summaries and summaries of data accuracy, precision, and completeness at each monitoring location, together with calculated concentrations at the exhaust shaft and documentation of the actual method limit of detection achieved for each targeted analyte. These data would have to be submitted to the Chief, Technical Assessment Branch, Characterization and Assessment Division, Office of Solid Waste, U.S. Environmental Protection Agency. In addition, documentation on all aspects of quality assurance and quality control as described in "Report on Minimum Criteria to Assure Data Quality" [EPA/530-SW-90-021, December 12, 1989] must be maintained in the WIPP facility operating record and be available for inspection by the Agency.

L. Performance Assessment

A primary objective of the test phase is to demonstrate compliance with the applicable standards that would govern long-term disposal of TRU wastes in the WIPP. These standards will include 40 CFR part 191 for disposal of the radioactive wastes and 40 CFR 268.6 to demonstrate no migration of the chemical hazardous constituents of the TRU mixed waste. The process through which DOE will investigate compliance with these standards is called performance assessment. This will consist of an analysis of all aspects of repository performance under all conditions of interest as well as experiments to collect data and verify models used in the analyses. The analytical and experimental processes will be coordinated to arrive at predictions of repository performance.

During the test phase, DOE has an extensive and varied series of experiments planned. For example, the test plan contains 66 different categories of supporting activities for the

[16] DOE has recently submitted data from an experimental study designed to address the question of what quality assurance objectives can be achieved in the underground repository environment (see Research Triangle Institute, Analysis of Very Volatile Organic Compounds in Canisters from the Waste Isolation Pilot Plant, March 20, 1990). Because the experimental data were submitted very recently, the Agency has not had the time to evaluate it. However, EPA will evaluate these data in comparison to the proposed quality assurance objectives in today's notice. The Agency solicits public comment on DOE's experimental study results, and on what specific quality assurance objectives EPA should require DOE to meet.

[17] As described previously, DOE plans to perform monitoring of background levels in the main air intake shaft.

performance assessment, of which 30 involve in-situ experiments of different types. These experiments will include measurements to better define the characteristics of the surrounding geology, as well as studies of the performance of each component of the repository system (e.g., seals, backfill, etc.). Most of these activities involve experiments that do not use radioactive wastes.

One of the major areas of uncertainty to be addressed during the test phase, however, is the amount of gas that may be generated from the waste proposed for disposal at the WIPP. Gas will primarily be generated by corrosion of the waste containers, microbial decomposition of the waste and radiolysis of the waste. Gas generation is important because the amount of gas generated could affect the way in which the repository reconsolidates over time, and the amount of brine that may flow into the repository. Too much gas generation could even lead to extra fracturing in the surrounding geologic media and could create pathways for waste migration.

DOE plans to conduct several types of gas-generation experiments in the underground repository. One series of tests would use instrumented metal bins containing specially-prepared transuranic wastes and various combinations of backfill, brine, and gas getter materials. These bin-scale experiments are to be conducted in three phases. Phase 1 will involve approximately 48 waste-filled bins of different waste compositions and backfills. Phase 2 will incorporate another 68 bins with more moisture conditions, gas-getter materials and supercompacted high-organic and low-organic wastes. The details of Phase 3 of the bin-scale tests will be defined later. DOE, however, anticipates that these tests will be based on new developments, the results of Phases 1 and 2, and future data needs.

In addition to underground bin-scale tests, the DOE test plan proposes underground alcove tests with TRU wastes. A test alcove is a room mined in the salt with one blind end and one open end sealed with a leak-tight closure plug. Each of the six planned alcoves is approximately 100 feet long, 25 feet wide, and 13 feet high. A total of 3,650 drums of TRU wastes will be emplaced in five of the six alcoves; one alcove will be left empty to provide gas reference baseline data. These tests will continue until the data acquired are sufficient to provide confidence in the reliability of the information being obtained.

DOE will also study modifications to the backfill material, repository design, and the wastes that may reduce the gas generation problem. Types of modifications to be considered will include waste compaction, waste processing (e.g., incineration or immobilization), modifying the storage room or panel configuration, and other changes in the WIPP design, such as modified seals. DOE has established an Engineered Alternatives Task Force to evaluate such potential modifications. Whenever feasible, modifications that appear beneficial will be included in the test program so that their effects on gas generation and repository performance can be measured. (Some of these modifications will not have a direct bearing on gas generation, but will affect other aspects of repository performance, such as brine inflow, that may affect potential releases of waste from the respository).

At the end of the test phase, DOE expects to be in a position to predict the amounts of gas generated by different combinations of waste forms, container materials, and repository design steps such as gas getters, backfill modifications, etc. The effects of gas generation on long-term repository performance will then be predicted by analytical models, with validation of certain aspects of these models by in-situ testing. The net result of all of these activities will be recommendations about the appropriate waste forms and repository design to use for the WIPP, or even whether the WIPP is appropriate to use for permanent disposal of transuranic wastes. These recommendations will be based in part upon comparisons with the various EPA standards for radioactive and hazardous wastes.

The Agency believes that gas generation and its effects are significant questions that need to be better understood before a decision can be made as to the use of WIPP as a permanent repository. The Agency believes that DOE has laid out a reasonable approach for defining the amount of gas that should be generated by different combinations of waste and engineering controls. Perhaps the most difficult part of the problem is predicting the effects of different levels of gas generation on long-term repository performance. In its comments on DOE's test plan, the Agency has requested that DOE publish, as soon as possible, a summary of its models, describing the effects of gas generation, and more information about its plans to validate these models. DOE has agreed to develop a summary of the current status of its performance assessment, scheduled for June 1990.

In addition, DOE plans to develop annual "consequence analysis reports" throughout the test program to document the project's progress, and it has agreed to give periodic briefings on the project to EPA, the National Academy of Sciences WIPP Panel, the State of New Mexico, and the Environmental Evaluation Group (EEG) (an organization established by act of Congress to provide an independent technical evaluation of the WIPP). To ensure that EPA is adequately informed of the progress of the test phase, EPA is proposing to require that DOE provide annual reports describing tests conducted to date (including results), modifications to the test plan, and a summary of DOE's understanding of the repository performance.

V. Conditions of Proposed Variance

As a condition of granting this proposed variance from the land disposal restriction requirements, EPA is proposing that the following conditions be met by DOE:

(1) No wastes subject to this variance may be placed in the WIPP repository for purposes other than testing or experimentation to determine the long-term viability of the WIPP. In accordance with 40 CFR 268.6(e), EPA must be notified before DOE conducts any testing or experimentation not within the scope of the "Draft Final Plan For the Waste Isolation Pilot Plant Test Phase: Performance Assessment" (December 1989, DOE WIPP 89-011). Placement of waste for the primary purpose of conducting an operations demonstration is prohibited under this variance.

(2) All wastes placed in the WIPP under this variance must be removed if DOE's Performance Assessment cannot demonstrate compliance with the standards of 40 CFR 268.6 with respect to permanent disposal of mixed waste in the repository. Hazardous wastes removed from the WIPP must be handled in accordance with RCRA subtitle C requirements. (A condition of 40 CFR 268.6(a)(5) is in compliance with other applicable Federal, State and local laws. Therefore, removal will also be required under this variance if DOE cannot comply with 40 CFR part 191 standards for the disposal of radioactive materials.)

(3) All wastes placed in the WIPP under this variance must be placed in a readily retrievable manner, as described in section IV.D of this notice.

(4) DOE must provide to the EPA Office of Solid Waste annual written reports on the status of DOE's performance assessment during the test

phase. These reports must include: a description of the tests to date and their results, modifications to the test plan, a summary of DOE's current understanding of the repository's performance, and an annual summary of air monitoring data required in item 6 below.

(5) DOE must install and operate a carbon adsorption control device designed to achieve a control efficiency of 95 percent in the discharge system of the bin experiment rooms. DOE must monitor the control device outlet airstream in accordance with the monitoring plan described in section IV.K of today's notice, and it must maintain design and operating records as described in section IV.J.

(6) DOE must implement the air monitoring plan described in section IV.K.

(7) Before placing waste in the repository, DOE must certify to EPA that it has secured control of the entire surface and subsurface estate at the WIPP site.

(8) DOE must provide to EPA the results of detailed waste characterization and analyses performed on the waste to be emplaced in the WIPP during the test phase.

Beyond these specific conditions, the wastes placed by DOE in the WIPP and DOE's activities under this variance must be consistent with those described in the petition. Under § 268.6(e), DOE must notify EPA of "any changes in conditions at the unit and/or environment that significantly depart from the conditions described in the variance and affect the potential for migration of hazardous constituents from the unit * * *." If the change is planned, EPA must be notified in writing 30 days in advance of the change; if it is unplanned, EPA must be notified with in ten days.

Under § 268.6(f), if DOE determines that there has been migration of hazardous constituents from the repository in violation of part 268, it must suspend receipt of restricted wastes at the unit and notify EPA within ten days of the determination. Within 60 days, EPA is required to determine whether DOE can continue to receive prohibited waste in the unit and whether the variance should be revoked.

Finally, under § 268.6(h), the term of today's proposed variance would run for ten years from the date of approval.

Dated: April 2, 1990.

Don R. Clay,

Assistant Administrator for Solid Waste and Emergency Response.

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