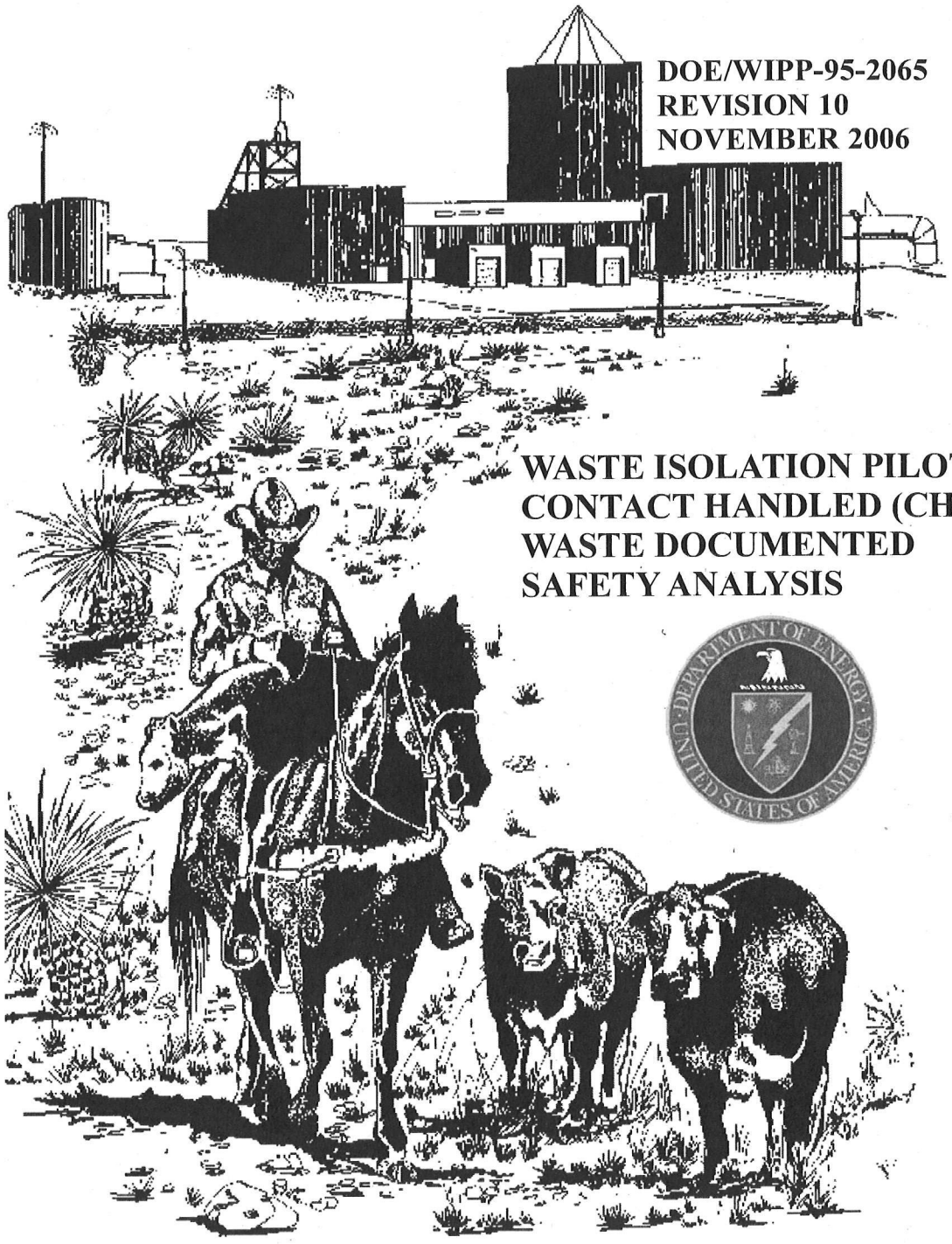
DOE/WIPP-95-2065
REVISION 10
NOVEMBER 2006



WASTE ISOLATION PILOT PLANT
CONTACT HANDLED (CH)
WASTE DOCUMENTED
SAFETY ANALYSIS

CONTENTS

1.4.1.2 Tornadoes

For the period 1916-1958, 75 tornadoes were reported in New Mexico on 58 tornado days.[20] Data for 1953 through 1976 indicate a statewide total of 205 tornadoes on 152 tornado days,[12] or an average of 9 tornadoes a year on 6 tornado days. The greatest number of tornadoes in one year was 18 in 1972; the least was 0 in 1953. The average tornado density in New Mexico during this period was 0.7 per 1,000 square miles ($mi.^2$) or 2,590 square kilometer (km^2). Most tornadoes occur in May and June.[21] From 1955 through 1967, 15 tornadoes were reported within the 1° square containing the WIPP surface facility.[22]

H.C.S. Thom has developed a procedure for estimating the probability of a tornado striking a given point.[23] The method uses a mean tornado path length and width and a site-specific frequency. Applying Thom's method to WIPP yields a point probability of 0.00081 on an annual basis, or a recurrence interval of 1,235 years. An analysis by Fujita yields a point tornado recurrence interval of 2,832 years in the Pecos River Valley.[24]

According to Fujita, the WIPP design basis tornado (DBT) with a million year return period has a maximum wind speed of 183 miles per hour (mph) or 294.6 kilometer per hour (km/hr), translational velocity of 41 mph (66 km/hr), a maximum rotational velocity radius of 325 ft (99.1 km), a pressure drop of 0.5 pounds per square inch (psi) or 3.4 kilo pascal (kPa), and a pressure drop rate of 0.09 psi per second (0.62 kPa per second). There have been no tornadoes touch down at the WIPP.

1.4.1.3 Winds

The maximum 1 minute wind speeds recorded at Roswell are shown in Table 1.4-1. The fastest 1 minute wind ever recorded at Roswell was 75 mph (120.7 km/h) from the west in April 1953.[25] Windstorms with speeds of 57.6 mph (93 km/hr) or more occurred ten times (during the period between 1955 and 1967) about one a year.[25] The mean recurrence interval for annual high winds at 30 ft. (9.1 m) above the ground in southeastern New Mexico is shown in Table 2.4-2.[17, 23] The 100-year recurrence 30 ft. (9.1 m) level wind speed in southeastern New Mexico is 82 mph (132 km/hr). Based on a gust factor of 1.3,[28] the highest instantaneous gust expected once in 100 years at 30 ft. (9.1 m) above grade is 107 mph (172.2 km/h). The vertical wind profile for two 100-year recurrence intervals has been estimated from the 30 ft. (9.1 m) values and is presented in Table 1.4-2.

The predominant wind direction at the WIPP site is from the southeast. For accident consequence calculations, the most current three years of wind speed data are used.

From the WIPP site meteorological tower recorded data, March 2005 had the highest wind speeds of the year. The highest wind speed measured at the 10 meter level was 39 mph (17.24 meters per second [m/s]) and at the 50 meter level was 46 mph (20.66 m/s).

1.4.1.4 Sandstorms

Blowing dust or sand may occur in the region due to the combination of strong winds, sparse vegetation and the semiarid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. Dust storms covering an extensive area occur occasionally and may reduce visibility to less than 1 mi (1.6 km). Winds of 50 to 60 mph (80.5 to 96.6 km/h) and higher may persist for several days if the strongest pressure gradients, which are most likely to occur during winter and early spring, become stationary.[15] Ten windstorms of 58 mph (93.4 km/h) and greater were reported during 1955-1967 within the 1° square in which the WIPP site is located.[21] The 2004 site environmental report[13] did not report any significant sandstorms.

1.4.1.5 Temperature Summary

Temperatures are moderate throughout the year, although seasonal changes are distinct. The mean annual temperature in southeastern New Mexico is 63°F (17.2°C). In the winter (December through February), night time lows average near 23°F (−5°C), and average maxima are in the 50s. The lowest recorded temperature at the nearest Class A weather station in Roswell was −29°F (−33.8°C) in February 1905. In the summer (June through August), the daytime temperature exceeds 90°F (32.2°C) approximately 75 percent of the time.[11] The National Weather Service documented a measurement of 122°F (50°C) at the WIPP site as the record high temperature for New Mexico. This measurement occurred on June 27, 1994. From the 2004 site environmental report,[13] the minimum average temperature recorded for the WIPP region was 18.1°F (-7.71°C) in December and the maximum high temperature recorded was 101.53°F (38.63°C) in June 2004.

1.4.1.6 Site Meteorological Tower

The WIPP site meteorological tower and station is located approximately 1,970 ft. (600m) northeast of the WHB. The meteorological station measures and records wind speed, wind direction, and temperature at elevations of 6.5, 33, and 165 ft. (2, 10, and 50m). The data is measured and recorded continually, then downloaded into a database in fifteen minute averages. The data is validated and certified by Certified Meteorologist which is required for use for atmospheric dispersion calculations.

1.4.2 Hydrology

Surface and ground hydrology information can be found in DOE/CAO-1996-2184.[4] There are no major surface water bodies located within 10 miles (16 km) of the WIPP site. Several bodies of water including Brantley Lake and Lake Carlsbad are over 30 miles (48 km) to the north of the WIPP site and are at an approximate elevation of 3,245 ft. (989 m) and 3,097 ft. (944 m) respectively. The elevation of the WIPP surface is approximately 3,410 ft. (1039 m) above mean sea level, however, surface runoff from the WIPP site does not flow north. The Pecos River is about 14 miles (22.5 km) west of the WIPP site its closest point. In the vicinity of the WIPP site, there are limited occurrences of potable water and several water-bearing zones produce poor quality water. In the immediate vicinity of the WIPP site, groundwater above the Salado Formation is commonly of such poor quality that it is not usable for most purposes. There is shallow groundwater at the WIPP site. Hydrological characteristics of the WIPP site do not pose any operational safety hazards.

1.4.3 Geology

The land surface in the vicinity of the WIPP site is a semiarid, wind blown plain sloping gently to the west and southwest. Its surface is characterized by an abundance of sand ridges and dunes. The average slope within a 3 mile (4.8 km) radius is about 50 ft. per mile (9.5 m/km) from the east to west. A plot of terrain profiles from the center of the WIPP site out to 5 miles (8.1 km) is presented in Figure 1.4-1A through 1.4-1D for each of the 16 direction sectors.

Some of the tectonic structures of the region are shown in Figure 1.4-2, with the hatched lines indicating boundaries between the Central Basin Platform, the Midland Basin, and the Delaware Basin and the solid lines indicating pre-Permian age faults. Most of the large scale structures, including the Central Basin Platform, the Midland Basin, and the Delaware Basin developed from the late Pennsylvanian to early Permian time, about 270 million years ago.

The WIPP site is located in the Delaware Basin, a subbasin of the Permian Basin, about 60 miles (97 km) east of the western margin of the Permian Basin. The geologic structure and tectonic pattern of the