ENTERED

Department of Energy
Carlsbad Field Office
P. O. Box 3090
Carlsbad, New Mexico 88221
March 8, 2002

Mr. Steve Zappe, WIPP Project Leader
Hazardous Waste Permits Program
Hazardous Waste Bureau
New Mexico Environment Department
2905 E. Rodeo Park Dr. Bldg. 1
Santa Fe, New Mexico 87505-6303

RE: Geotechnical Analysis Report for July 1999 - June 2000 WIPP Hazardous Waste Facility Permit EPA I.D. Number NM4890139088
Response to NMED Comments Dated February 1, 2002

Dear Mr. Zappe:

Enclosed are U.S. Department of Energy's Carlsbad Field Office (CBFO) responses to the 41 comments NMED provided on the Geotechnical Analysis Report for July 1999 - June 2000 WIPP Hazardous Waste Facility Permit, EPA I.D. Number NM4890139088, in its letter dated February 1, 2002. CBFO received this letter on February 6, 2002 and was required to respond within 30 days of receipt.

Each comment is identified by a number which corresponds to the NMED comment number. Also enclosed is Volume II of the above-mentioned report on CD-ROM, along with several geotechnical reports referenced in the response to NMED's comments.

We believe that CBFO has carefully considered each of NMED's questions, performed a complete review for basis of each question, and provided a full and complete response to each question. Should NMED have any remaining concerns, please contact Mr. Jody Plum at 505-234-7462.

Sincerely,

Lawrence C. Bailey Jr. for
Dr. Ines R. Triay, Manager
Carlsbad Field Office

John Lee
J. L. Lee, General Manager
Westinghouse TRU Solutions LLC

Enclosure

020306

CBFO:ORC:HLP:LM:02-0742:UFC:5486

cc: w/enclosure
J. Bearzi, NMED
J. Kieling, NMED
C. Walker, TechLaw

CBFO:ORC:HLP:LM:02-0742:UFC:5486

Response to NMED letter of February 1, 2002
Comments on DOE/WIPP-01-3177, Volume 1, Geotechnical Analysis Report for July 1999 – June 2000

1. Section 3.1.2, Instrumentation (page 3-3, paragraph 2)

All closure rates presented in this report were calculated on an annualized basis. Annual displacement rates are calculated as the difference in collar displacement readings from the final reading of this reporting period to the final reading of the previous reporting period divided by the time between those two readings, usually approximately one year.

In this specific case the, data from extensometer 37X-GE00209 was used. The cumulative displacement on January 4, 2000 was 0.814 inch and the cumulative displacement value at the end of the previous reporting period was 0.775 inch on May 3, 1999. This is an increase of 0.039 inches over a period of 246 days, a rate of 0.00016 inches/day or 0.058 inches/year. The similarity between this calculated rate and the one using the 14-year period is a coincidence. The method used to calculate these rates will be clarified in future reports.

2. Section 3.1.2, Instrumentation (page 3-3, paragraph 2)

There are no plans to replace failed instrumentation installed in any of the shafts. Replacement of failed instrumentation could, at times, compromise the integrity of the shaft. The project has a good understanding of the expected movements in the shafts. The monitoring results, up to the point of instrument failure, did not indicate any unusual shaft movements or displacements. The instrument readings, as measured, are used primarily as indicators to establish and monitor trends. This is supplemented by regular inspections performed by the Operator (Westinghouse TRU Solutions) and outside agencies (MSHA and NM State Mine Inspector). These inspections verify the performance of the shafts on a regular basis.

3. Section 3.1.2, Instrumentation (page 3-3, last paragraph)

The earth pressure cells are not calibrated regularly. This type of instrument, as well as others installed in the shaft, cannot be accessed once they are installed in the concrete liner. It is impracticable to attempt to calibrate these instruments because gaining access to the transducers will result in damage to the shaft liner and the instrument itself. Therefore, this type of instrument is only calibrated prior to installation. (In passing, this is also true of virtually all instrumentation installed within the rock mass, such as borehole extensometers, for example.)

There are no plans to replace any non-functional cells in the Salt Handling Shaft. See response to 2 above.

The difference in the lower readings is not significant. The range of these pressure cells is 0 to 1000 psi. with an advertised resolution of 1 psi. As with most instruments, minor changes near the ends of the working range are difficult to interpret accurately. Finally, small changes around zero can give extremely large percentage changes. The current readings are, therefore, essentially the same and indicate a reading about 0 psi. Historical data from these installations indicate that seasonal effects may cause variations in excess of 15 psi.

4. Table 3-1 (page 3-8)

The requested information is presented as follows.

Field Tag	Location	Total Displacement (in.)		Total Displacement (in.)		Elapsed Time,	
		Report Date		Previous Date		days	in/yr
31X-GE-00204	1566 level, N45W	06/05/2000	0.687	06/02/1999	0.653	369	0.0336
31X-GE-00205	1566 level, N75E	06/05/2000	0.575	06/02/1999	0.548	369	0.0267
31X-GE-00206	1566 level, S15W	06/05/2000	0.694	06/02/1999	0.659	369	0.0354

31X-GE-00207	2059 level, N45W	05/01/2000	1.733	06/02/1999	1.66	334
31X-GE-00208	2059 level, N75E	06/05/2000	1.640	06/02/1999	1.559	369
31X-GE-00209	2059 level, S15W	06/05/2000	1.852	06/02/1999	1.756	369

0.080
0.080
0.095

5. Table 3-1 (page 3-8)

The instrument associated with the "instrument malfunction" identified in Table 3-1 is extensometer 31X-GE-00202. This instrument has not functioned properly since August 1993, consequently there is no data recorded from this instrument since that time. There are no plans to replace/repair this installation. See response to 2 above.

6. Section 3.2.2, Instrumentation (page 3-8, paragraph 3)

The reported displacement rate of 0.007 in/yr. is based on the averaged annualized rate for two instruments at the 1071' level of the Waste Shaft. Monitoring data from this location includes more than just two readings as these instruments were monitored on a monthly basis. The derived rate values for this location were calculated in the same manner as the rest of the displacement rates. See response to 7 below.

7. Section 3.2.2, Instrumentation (page 3-11 and in other places)

The natural variability of rock materials leads to variability in behavior and hence monitoring results. The philosophy used is at WIPP is consistent, repetitive evaluation of monitoring results looking for trends in those results that cannot be reasonably explained. This iterative process takes both the value and the rate of change of that value into account. Instrumentation results are never used alone and are always supplemented by careful observation of the physical conditions around the observation point. Variations in the displacement trend may be caused by various factors such as seasonal thermal effects; response to stress changes caused by nearby mining or maintenance; or increased rock deterioration. Displacement rates are considered acceptable when they do not indicate an adverse deformation trend of the rock mass. Displacement rate trends may be considered unacceptable, for example, if they trend towards an unstable situation that can not be controlled by the installed ground support system.

8. Section 3.3.2, Instrumentation (page 3-13, paragraph 2)

Continued monitoring of the Exhaust Shaft extensometers indicate that the transducer associated with the collar installed in extensometer 36X-GE-00202 continues to provide a reading response. However, the general displacement trend of these readings is negative, indicating that either the rock is contracting or an anchor is slipping. It is our experience that there is some seasonal thermal expansion and contraction of the salt, but not to the extent indicated by the readings.

There are no plans to replace or repair instrumentation in the Exhaust Shaft. See response to 2 above.

9. Table 3-2 (page 3-16)

There are no plans to make repairs or replace instrumentation in the Exhaust Shaft. See response to 2 above.

10. Table 4-1 (page 4-5)

The closure rates presented in the previous report used data from a different period to that used in the current report. As part of normal floor maintenance the convergence floor points in this location were trimmed out and subsequently replaced during the early part of 1999. Both the removal of floor material and the replacement influence the monitoring results and it is likely that there will be a difference between the rates before and after this work. The current report uses the data obtained after completion this work as they are more comparable with the current conditions. See also the response to 14 below.

11. Table 4-2 (page 4-10)

The method used to calculate these rates will be clarified in future reports.

12. Section 5.3, Analysis of Extensometer and Convergence Point Data (page 5-7, footnote 3)

The annual Geotechnical Analysis Report is now produced in two volumes. Volume 1 presents an extensive summary of the performance of the instrumentation and monitoring results. Volume 2 presents graphic documentation of the instrument data, tabular documentation of instrument history, and geologic and hydrologic observations. Over the years the GAR became rather unwieldy and many users commented that they did not desire the data package. The report was then split into the current two volumes and it has been presented in this manner for a number of years. A copy of Volume 2 is enclosed and it will be provided in the future.

13. Tables 5-3 and 5-4 (pages 5-8 and 5-9)

The rate change percentage were calculated by dividing the change in readings by the value of the initial reading then multiplying by 100%.

$(R_2-R_1)/R_1 \times 100\%$

where R_1 = rate value at beginning of analysis period
R_2 = rate value at the end of analysis period

14. Section 5.3, Analysis of Extensometer and Convergence Point Data (page 5-6, paragraph 3) and Table 5-3 (page 5-8)

The increase in closure rate at this location can be attributed to trimming the floor during the prior year reporting period. Displacement rates are calculated as the difference in displacement readings between the final reading of this reporting period and the final reading of the previous reporting period divided by the time between those two readings, usually approximately one year to minimize seasonal effects. Removal of floor material changes the stress configuration around the opening, which in turn causes a change in the displacement behavior. This usually increases the observed closure rate for a period. The timing of the replacement of the convergence floor point may also affect the result of the calculated convergence rate. This may cause the closure rate values to be calculated over different lengths of time, allowing, for example, the result to be influenced by seasonal variations. Therefore, the comparison between the closure rate increase presented in this report and that from the prior year report is not strictly comparable. See also the response to 10 above.

The closure rate increases are not significant due to the physical condition of the rock, the general condition of installed ground support, and the predictable nature for variation in closure rates due to seasonal effects.

15. Table 6-1 (page 6-3)

The values provided in Table 6-1 are correct. The readings are generated in inches and are subsequently converted to metric. While the previous report listed the metric value first, this value was still converted from inches.

16. Table 6-2 (page 6-4)

The difference between these tables is the order that the data is presented. In Table 6-2 the beginning value column is presented to the left of the ending value column. Tables 5-3 and 5-4 have the beginning value column to the right of the ending value column. The rate change percentages were calculated by dividing the change in readings by the value of the beginning reading then multiplying by 100%.

$(R_2-R_1)/R_1 \times 100\%$

where R_1 = rate value at beginning of analysis period
R_2 = rate value at the end of analysis period

We will be consistent in tabular presentation in future issues.

17. Section 6.5, Analysis of Convergence Data (page 6-5, paragraph 2)

The convergence rate data for wire convergence meters installed in the eastern end of N1100 and N1420 are presented in the current and prior reports in Section 6.4, Table 6-2.

18. Section 8, Geoscience Program, (page 8-3)

See response to comment 12 above.

19. Section 9.1, Hydrologic Monitoring Background (page 9-1, paragraph 1, last sentence)

Video inspections of the Exhaust Shaft have been performed since about 1989. The first indication of water seepage in the Exhaust Shaft was May 1995. Video inspections of the Exhaust Shaft are required under the HWDF permit and have been performed on a quarterly basis since May 1995. Since it is not possible to physically enter the Exhaust Shaft, the flow rate of 1-3 gpm is an estimate based on visual inspection of Exhaust Shaft borehole videos. The flow appearance at the approximate Santa Rosa horizon on the videos is variable and this rate only applies to that horizon.

20. Section 9.1, Hydrologic Monitoring Background (page 9-1, paragraph 2, 2nd sentence)

The values are those used in a report by Duke Engineering and Services, "Modeling of Exhaust Shaft Water Seepage" (1999). Subsequent unpublished re-assessments suggest better values are from 28 feet to 75 feet below ground surface at WIPP with an average thickness of about 25 feet. The reference DOE (1999) should be DOE (2000B). The publication number was issued in 1999 but published in 2000.

21. Section 9.3 Hydrologic Monitoring Background (page 9-2, paragraph 1, last sentence)

Figure 9-5 is intended to schematically show typical construction and should show the screen extending across the Santa Rosa formation. The drawing will be revised in the next issue.

The top of the Dewey Lake formation is weathered and eroded, so picking the top of the Dewey Lake is difficult and somewhat subjective. Because of this, it is almost certain that there is communication between the Santa Rosa and the upper few feet of the Dewey Lake. There is no evidence that communication extends below this horizon.

DOE-WIPP 99-2302, Section 1.0, contains construction diagrams for wells C-2505, C-2506, C-2507, and piezometers PZ-1 through PZ-12. A copy is included for your information.

22. Section 9-3,Water Level Monitoring (page 9-2, paragraph 2, 1st sentence)

Monthly water-level measurements have been collected from C-2505, C-2506, and C-2507 since October 1996 when the wells were completed (DOE 97-2119). Water-level measurements have been collected from PZ-1 through PZ-12 since July 1997 when the piezometers were completed (DOE 97-2278).

23. Section 9.3, Water Level Monitoring (page 9-2, paragraph 2, 3rd sentence) and Figure 9-6 (page 9-9)

The direction of flow has been consistently the same since 1997. See DOE-WIPP 97-2278, Section 4, Figure 4.2. At present over 100 water level measurements have been collected from the wells and piezometers monitoring the Santa Rosa/ upper Dewey Lake Formations as part of the Exhaust Shaft hydrologic studies.

24. Section 9.3, Water Level Monitoring (page 9-2, paragraph 3, 5th sentence.)

The principal flow direction across the site is primarily to the south and east. Because there are no monitoring wells west of PZ-11, there is little basis for predicting the amount and extent of this perched water-bearing horizon to the west of this piezometer. See Duke Engineering and Services, "Modeling of Exhaust Shaft Water Seepage", 1999 and DOE WIPP 99-2302, "Exhaust Shaft Phase III Hydraulic Assessment Data Report, October 1997 – October 1998".

25. Section 9.3, Water Level Monitoring (page 9-2, paragraph 3)

The assumption that there was a natural perched water table at the Santa Rosa horizon is not correct. Section 9.1 discusses the background of this investigation and as noted the second paragraph, there is substantial evidence that this interval was essentially dry during the construction period (1980-1988).

The Salt Water Evaporation Pond and two southern storm-water retention ponds have a six-inch layer of compacted caliche and therefore are potential sources of focused recharge. PZ-7 located on the south side of the Salt Water Evaporation Pond has the highest head of any monitoring well. This condition and the age and past uses of the Salt Water Evaporation Pond lead to the conclusion that it is a principle recharge area. There are also indications from water level and precipitation data that the fluid level in the Santa Rosa increases during periods of high rainfall and decreases during droughts. See DOE WIPP 99-2302 for further discussion.

26. Table 9-1 (page 9-5)

The bottom of the Gatuña and top of the Santa Rosa in borehole C-2505 should be 39.6 feet, and the top of the Gatuña interval in borehole PZ-11 should be 12.5 feet. The table will be revised in the next issue. The acronym TD is the total depth of the borehole.

27. Section 9.4, Water Quality (page 9-10, paragraph 1)
28. Section 9.4, Water Quality (page 9-10, paragraph 1, 2nd sentence)
29. Section 9.4, Water Quality (page 9-10, paragraph 4, 1st sentence)

See response to 12 above. Table 8-3 found in Volume 2, Section 8 of the GAR provides a list of the dates of sampling events conducted between March 1997 and February 2000. All water quality parameters are presented in Table 8-3. The next data report will include a simple means of identifying those parameters that have exceeded the MCLs and/or NMWQCCs standards. Thank you for your recommendation.

30. Section 9.4, Water Quality (page 9-10, paragraph 4, 1st sentence)

Chromium was identified in section 9.4.6 as having exceeded groundwater standards and should also be included in section 9.4.1. Section will be revised in the next report.

31. Table 9-2 (page 9-11) – Typographical errors:

The NMWQCC standard for silver should be 0.05 mg/L. The NMWQCC standard for sulfate should be 600 mg/L. The EPA standards were entered instead of the NMWQCC standards. Table will be revised in the next report.

32. Section 9.4.1 (page 9-11, paragraph 2, 1st sentence) and Figure 9-7 (page 9-12)

Since the data report period ended June 2000, a potentiometric surface map was generated with June 2000 data and presented in Figure 9-6. In addition, a contour plot of Total Dissolved Solids and Potentiometric Surface data was generated for February 2000 data (the last geochemical data available in the report period) and presented in Figure 9-7. There was no significant change in the potentiometric surface contour lines between February and June 2000. Examination of water-level data indicates that the fluid levels in the monitoring wells changed only a few inches between February and June 2000. The contour lines would not change with the scales used.

33. Section 9.4.1, Total Dissolved Solids (page 9-11, paragraph 2, 1st bullet)

From 1992 through 1993, drainage collected underground at the base of the Air-Intake Shaft was hauled from underground and discharged into the Salt Water Evaporation Pond at a rate of approximately 24,000 gallons per month. The statement will be clarified in the next report.

34. Section 9.4.1, Total Dissolved Solids (page 9-13, paragraph 1, 1st sentence)

Volume II, Section 8.0, Figure 8-3 presents a modified Stiff diagram showing the variability in major-ion ratio compositions of the perched groundwater in the Santa Rosa. Two wells, PZ-10 and C-2507 have unique chloride signatures containing less than 60% chlorides relative to carbonate and sulfate ions. All other monitoring wells have greater than 80% chloride. These unique signatures suggest differences in the types of recharge. Note that PZ-10 is located on the edge of the retention pond south of the WIPP site parking lot and C-2507 is located just northeast of the retention pond near ERDA-9. Both of these retention ponds are sources of fresh-water recharge. On the other hand, the Salt Water Evaporation Pond retains runoff from an area that generates runoff high in total dissolved solids.

35. Section 9.4.1, Total Dissolved Solids (page 9-13, paragraph 1, 3rd sentence) – typographical error

The nearest recharge area to PZ-10 is the retention pond located south of the WIPP site parking lot, while the nearest recharge area to C-2507 is the retention pond located northeast of ERDA-9. Figure 9-4 should be Figure 9-3. Corrections will be made in the next report

36. Section 9.4.2, Chlorides (page 9-13, 4th sentence)

In section 9.4.1 the ratio of the ion concentrations were examined to distinguish differences in the signatures of the groundwater. See response 34 above. This section focuses on the range of variability in the concentration of chlorides across the site. Figure 9-4 referenced in sentences 6 and 7 should be Figure 9-3. Corrections will be made in the next report.

37. Section 9.4.2, Chlorides (page 9-13, last sentence)

Wording will be clarified in the next report.

38. Section 9.4.2, Chromium (page 9-14)

See response to 30 above.

39. Section 9.4.7, Nitrate (page 9-14, 1st , 2nd, and 4th sentence)

The EPA and NMWQCC standard for nitrate is 10mg/L, reported as nitrogen. Results from the Wastren analytical laboratory are reported as nitrate, not nitrogen. To obtain the correct EPA and NMWQCC standard as nitrate multiply the NMWQCC standard by 4.4 to obtain 44 mg/L. The value presented in Table 9-2 is reported as 44 mg/L (as nitrate) as is section 9.4.7. A note to clarify how nitrate is reported will be added in the next report.

40. Section 9.4.8, Mercury (page 9-14) The EPA MCLs and NMWQCC standard for mercury is 0.002 mg/L.

The typographical error will be corrected in the next report. Mercury levels exceeded the EPA MCLs and NMWQCC standards for samples collected in PZ-9 and PZ-3 in February 2000. Mercury results that exceed the established standard are probably artifacts of laboratory contamination or poor instrument performance as mercury is nearly insoluble in solutions containing elevated chloride concentrations.

41. General Questions

41a. Have Permittees seen a correlation in the results of groundwater quality between samples originating from the cracks of the Exhaust Shaft water and those collected from the wells and piezometers monitoring the Santa Rosa Formation?

There is no correlation between the fluid collected from the Exhaust Shaft Catch Basin and the fluid collected from the wells monitoring the Santa Rosa Formation. The water-quality data collected from wells C-2505 and C-2506 located closest to the Exhaust Shaft have risen slowly over the past four years with TDS values of less than 20,000 mg/L. On the other hand, samples collected from the Exhaust Shaft catch basin are highly variable brines with TDS values ranging from less than 200,000 mg/L to over 800,000 mg/L. The extreme variability of brine composition and concentration is a complex function of the time the fluid remains in the catch basin; environmental conditions including humidity, temperature, and ventilation rate; and the interaction between fluids and shaft materials such as the galvanized fence used for support. See the following documents: Exhaust Shaft Hydraulic Assessment Data Report, DOE/WIPP 97-2219; Exhaust Shaft: Phase 2 Hydraulic Assessment Data Report Involving Drilling, Installation, Water-Quality Sampling, and Testing of Piezometers 1-12, DOE/WIPP 97-2278; and Modeling of Exhaust Shaft Water Seepage by Duke Engineering and Services, 1999 for further detail.

41b. Have tracer tests been attempted or performed in the Santa Rosa wells and piezometers to determine the groundwater flow characteristics and, perhaps its eventual flow to the exhaust shaft?

No tracer tests have been performed on the Santa Rosa Formation at WIPP. Hydraulic tests have been conducted on each well and piezometer. Test results were reported in the Exhaust Shaft Data Report: 72-Hour Pumping Test on C-2505 and 24-Hour Pumping Test on C-2506, May 1997 and the Exhaust Shaft Hydraulic Assessment Data Report III, October 1997 – October 1999 (DOE/WIPP 99-2302). Water level and water quality data are consistent with our understanding of the flow system at WIPP. Potential recharge areas have been identified and those areas that have caused short-term impacts to water quality augmented by focused recharge documented. See Modeling of Exhaust Shaft Water Seepage Report by Duke Engineering and Services, 1999 for further detail.

41c. Are there any other Santa Rosa wells located outside the WIPP Property Protection Area as demarcated by Figure 9-3?

Well C-2811 was drilled in March 2001 through the Santa Rosa Formation and into the upper forty feet of the Dewey Lake. Well C-2811 is located approximately 2250 feet south of the Exhaust Shaft, half way between the H-1 and H-3 hydropads. Fluid was intercepted in C-2811 at a depth of about 60 feet below land surface. The fluid level elevation at C-2811 is about 3337 feet above mean sea level, one or two feet above the point at which fluid enters the well. The water-bearing horizon appears to lie within the top 20 feet of the Dewey Lake Formation. Based on grab samples, the Santa Rosa interval is estimated at 35 to 40 feet below land surface. The 5-foot thickness, stratigraphic position, and elevation relative to the land surface are consistent with the known geology of the Santa Rosa Formation. The Santa Rosa Formation pinches out to the south and west of the WIPP site while the Dewey Lake surfaces to the west. .

41d. Were the later shafts constructed with different techniques and/or construction materials when compared to the Exhaust Shaft?

The shafts were drilled and constructed using a variety of techniques, as shown in the attachment entitled WIPP Shaft Characteristics.

41e. Although this has probably been documented, have the Permittees considered engineering controls to minimize the infiltration of water to the Santa Rosa due to WIPP surface features and activities?

Several alternative methods to reduce either the infiltration of fluid into the Santa Rosa or the flow of fluid into the Exhaust Shaft were evaluated for effectiveness. One option evaluated was lining the site NPDES storm water retention ponds to reduce or eliminate this potential source of recharge to the Santa Rosa. Other options considered to reduce the flow into the Exhaust Shaft included grouting the shaft from the surface and constructing and operating interception wells. Each alternative was modeled in order to compare effectiveness, cost, risk, and return on investment relative to the current process of off-site disposal at a permitted Treatment Storage and Disposal Facility. Some of the alternatives, such as pond liners, were ineffective. Some, such as grouting from surface or interception wells, may be effective but the risks associated with successful completion are considered unacceptably high at this time. In the unlikely event that remediation is required, these studies will updated as necessary