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Annual Report
RCRA Post-Closure Monitoring
and Inspections for the
Mercury Landfill Hazardous
Waste Trenches
for the Period
October 1995 - October 1996

January 1997

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Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

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ANNUAL REPORT
RCRA POST-CLOSURE MONITORING
AND INSPECTIONS FOR THE
MERCURY LANDFILL HAZARDOUS WASTE
TRENCHES

FOR THE PERIOD
OCTOBER 1995 - OCTOBER 1996

DOE/NV-11718-092
UC-712

Prepared for
U.S. Department of Energy
Nevada Operations
Environmental Restoration Division

Prepared by
Bechtel Nevada
Remediation Projects!

JANUARY 1997

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Table of Contents

List of Tables	iii
List of Figures	iv
Abbreviations and Acronyms	v
Executive Summary	ES-1
1.0 Introduction	1
1.1 Scope and Objective	1
1.2 Site History	1
1.3 Site Geology and Hydrology	4
2.0 Regulatory Criteria	6
2.1 Background	6
2.2 Site Inspection Compliance Criteria	9
2.3 Soil Moisture Monitoring Compliance Criteria	9
3.0 Site Inspections and Annual Subsidence Survey	11
3.1 Introduction	11
3.2 Findings From Quarterly Inspections	11
3.2.1 Fourth Quarterly Inspection 1995	11
3.2.2 First Quarterly Inspection 1996	11
3.2.3 Second Quarterly Inspection 1996	11
3.2.4 Third Quarterly Inspection 1996	11
3.2.5 Fourth Quarter Inspection 1996	12
3.3 Annual Subsidence Survey	12
4.0 Soil Moisture Monitoring	13
4.1 Introduction	13
4.2 Operating Procedures	14
4.3 Precipitation Data	15
4.4 Soil Moisture Monitoring Results	18
4.4.1 Data Presentation	18
4.4.1.2 Discussion of Analytical Data Trends	24
4.4.1.2.1 Hazardous Waste Trench A (Row A)	24
4.4.1.2.2 Hazardous Waste Trench B (Row B)	25
4.4.1.2.3 Hazardous Waste Trench C (Row C)	26

4.4.1.2.4	Hazardous Waste Trench S-1 (Row S-1)	27
4.4.1.2.5	Hazardous Waste Trench S-2 (Row S-2)	28
4.4.1.2.6	Vertical Control Tube V-1	28
5.0	Summary, Conclusions, and Recommendations	30
5.1	Summary and Conclusions	30
5.2	Findings	32
5.3	Recommendations	32
6.0	References	33

Appendices

- A. Neutron Access Tube Installation Summary
- B. Monthly Inspection Checklists
- C. Subsidence Survey Plat
- D. Precipitation Records
- E. Baseline Difference Graphs

List of Tables

Number	Title	Page
1.	Neutron Access Tubes Monitored at the Area 23 Hazardous Waste Landfill RCRA Unit	8
2.	Subsidence Monument Coordinates and Elevations	12
3.	Precipitation Data for the Mercury Nevada, Meteorological Station, MER	16

List of Figures

Number	Title	Page
1.	Site Location, Area 23 Landfill Hazardous Waste Trenches	2
2.	Closure Site, Area 23 Landfill Covers and Access Tubes	3
3.	Precipitation Area 23 Meta Station	17
4.	Cumulative Residual Moisture Content Trench A	19
5.	Cumulative Residual Moisture Content Trench B	20
6.	Cumulative Residual Moisture Content Trench C	21
7.	Cumulative Residual Moisture Content Trench S-1	22
8.	Cumulative Residual Moisture Content Trench S-2, V-1	23

List of Abbreviations and Acronyms

BN	Bechtel Nevada
cm	centimeter(s)
CRMC	Cumulative Residual Moisture Content
DOE	U.S. Department of Energy
DOE/NV ERD	DOE Nevada Operations Office/Environmental Restoration Division
EPA	Environmental Protection Agency
ET _{POT}	Potential Evapotranspiration
ft	foot (feet)
gal	gallon
in	inch(es)
km	kilometer
l	liter
m	meter(s)
mCi	millicurie
mi	mile
NDEP	Nevada Division of Environmental Protection
NTS	Nevada Test Site
RCRA	Resource Conservation and Recovery Act
REEC _o	Reynolds Electrical and Engineering Company
RVMC	Residual Volumetric Moisture Content
sec	seconds
VMC	Volumetric Moisture Content
yr	year

Executive Summary

INTRODUCTION

The Area 23 Hazardous Waste Trenches were closed in-place in September 1993. Post-closure monitoring of the Area 23 Hazardous Waste Trenches began in October 1993. The post-closure monitoring program is used to verify that the Area 23 Hazardous Waste Trench covers are performing properly, and that there is no water infiltrating into the waste trenches. The performance of the Area 23 Hazardous Waste Trenches is currently monitored using 30 neutron access tubes positioned on and along the margins of the covers. Soil moisture measurements are obtained in the soils directly beneath the trenches and compared to baseline conditions from the first year of post-closure operation. This report documents the post-closure activities between October 1995 and October 1996.

REGULATORY CRITERIA

The compliance criteria of 14 percent moisture content, as originally established in the Amended Closure Plan has not been used as a reporting criteria since the first quarterly monitoring in 1993, as it was found to be inappropriate for the soils beneath the hazardous waste trenches. While the criteria has not been formally changed, an interim compliance criteria was developed and is in use pending formal approval from the Nevada Division of Environmental Protection (NDEP). The formal change of the compliance criteria for the Unit Nevada Test Site (NTS) RCRA Part B Permit was submitted to NDEP in December 1996 with formal approval pending.

The interim level of concern, point of compliance, and schedule of actions is summarized below. Action is required if residual volumetric moisture contents (RVMC) above five percent (relative to baseline conditions) are observed and confirmed in two consecutive monitoring periods, at a point directly beneath each respective hazardous waste trench. The NDEP must be notified within seven days of determination of a valid trend. A preliminary written assessment detailing recommendations to determine the nature, cause, and action to be taken is to be submitted to NDEP for concurrence within 30 days of the notification.

RESULTS OF INSPECTIONS AND THE MONITORING PROGRAM

The unit was inspected quarterly. No significant concerns were observed.

PRECIPITATION

Precipitation for the period October 1995 through October 1996 was 4.50 cm (1.77 in) (U. S. National Weather Service, 1996). This was well below the historical average of approximately 12.5 cm (4.9 in) in Area 5. The highest 30 day cumulative rainfall occurred on March 14, 1996 with a total of 2.49 cm (0.98 in). The heaviest precipitation occurred during the period January 31, 1995 through March 14, 1996.

The Part B Permit (NDEP, 1995) specifies that rainfall events that exceed one inch in any 30-day period will require monthly monitoring for one quarter. The highest 30 day cumulative precipitation occurred on March 14, with a 30 day cumulative precipitation of 2.49 cm (0.98 in), just below the reporting criteria of one inch. The monthly monitoring criteria was not triggered for any of the four quarterly monitoring periods.

SOIL MOISTURE MONITORING

Graphs of cumulative residual moisture content (CRMC) relative to the regulatory level of concern (5 percent RVMC) are found for each trench in Figures ES-1 through ES-4. The CRMC graph tracks changes over time from the baseline conditions at the point of compliance (directly beneath the hazardous waste trench) for each access tube. The residual moisture content is calculated by subtracting the soil moisture content for each monitoring period from the first year average soil moisture content (baseline) at that depth. The soil moisture content point of compliance is located at a depth of three feet from the bottom of each neutron access tube (the point directly beneath each hazardous waste trench). The monitored depth varies from tube to tube because the angled boreholes have varying stand-off distances to each respective trench.

The residual soil moisture is plotted as *Residual Volumetric Moisture Content vs Logging Date* for each access tube. The level of regulatory concern is indicated as the dark line at the five percent residual moisture level (Figures ES-1 through ES-4). Values exceeding this limit for two consecutive monitoring periods require notification to NDEP and the submittal of an Action Plan to investigate the cause.

INDIVIDUAL TRENCH SUMMARY

No significant concerns were observed during the site inspections over the period November 1995 through October 1996.

The annual subsidence survey of the two covers indicates that subsidence has not been detected to date.

Soil conditions remain dry and stable beneath the trench through the October 1995 to October

1996 monitoring period.

Moisture contents at the point of compliance for all access tubes remain below the compliance criteria of five percent RVMC. Trench conditions are summarized below:

Trench A

Cumulative Residual Moisture Contents at the point of compliance indicates that soil surrounding the access tubes are stable, dry, and below the compliance level of five percent RVMC.

Trench B

The Row B access tubes remain at less than one percent RVMC and have returned to baseline conditions at the point of compliance in the fourth quarter monitoring period. The increase of 0.5 percent RVMC after February 1995 until the fourth quarter is attributed to the movement of ponded surface water down along the neutron access tubes. This had locally raised the moisture content of the soil surrounding the access tubes.

Row B access tubes remain dry and below the five percent RVMC compliance criteria.

Trench C

Cumulative residual moisture contents at the point of compliance for all Row C tubes remain at less than one percent RVMC with no trends evident. The Row C access tubes remain stable, dry, and below the compliance criteria of five percent RVMC.

Trench S-1

Cumulative residual moisture contents at the point of compliance for all Row S-1 tubes remain at less than one percent RVMC with no trends evident.

All access tubes remain dry, stable and below the compliance criteria of five percent RVMC.

Trench S-2

Cumulative residual moisture contents at the point of compliance for all Row S-2 tubes remain at less than one percent RVMC with no trends evident.

Row S-2 access tubes remain stable, dry, and below the compliance criteria of five percent RVMC.

Control Well V-1

The Vertical Control Tube V-1 is a 15.24 meter (50 feet) vertical neutron access tube located at the north margin of the cover. This tube is located in a slight depression that frequently fills with ponded water from runoff from the covers and from a catchment area located to the north. As a result, this "control" tube best represents a worse case scenario rather than typical conditions. Evidence of ponded water, as well as cracks and erosion in the soils surrounding the concrete access box have been noted. As result of this ponding this access tube has shown significantly more leakage than observed on any of the other access tubes.

The Cumulative Residual Moisture Contents at the point of compliance for Control Tube V-1 varies from about - 0.5 to 1.5 percent RVMC and is the result of moisture infiltrating down along the access tube.

The cumulative residual moisture content for access Tube V-1, while noisier than other access tubes, remains below the compliance level of five percent RVMC.

FINDINGS

1. The annual elevation survey of the subsidence markers was conducted in August 1996. No subsidence has been detected to date.
2. All monitored access tubes are within the compliance criteria of less than five percent residual volumetric moisture content at a point directly beneath each respective trench.
3. Most access tubes located along the periphery of the cover (Tubes A, B, C-1 through C-4, and S-2) show low levels of infiltration occurring down along the access tubes to depth. Access tubes located on, and penetrating the cover, indicate infiltration is limited to 1.83 m (6 ft) where the geomembrane liner is located. No leakage across the liner has been observed.
4. Visual inspections of the soils surrounding the access boxes have indicated areas with ponded water, erosion, and cracks in the soil. Evidence of infiltrating water moving down these cracks and erosion was also observed. In several locations, water runoff from the cap and surrounding areas tends to pond along the margins of the cap which allows water to infiltrate down along the access box.
5. As discussed in the previous annual report (DOE 1995), the nature of the increase in moisture content observed along most of the neutron access tubes was interpreted based on the following observations:

- Site inspections note the evidence of surface water ponding and infiltrating down along the access boxes;
- Wetting fronts progress from the surface down along the length of the access tube over a period of less than two months;
- Small changes in residual moisture content were observed;
- After surface drying conditions had begun, moisture contents of less than baseline conditions beneath the access box indicate that shrinkage or erosion of the soils occur due to water infiltration along the access tube;
- Wetting events are limited only to neutron tubes located along the periphery of the cover;
- Dry stable conditions are observed for the neutron tubes that extend through the cap into the core of the unit.

These effects are considered to be the result of an accelerated transport path down along the access tubes and not infiltration of water through the cover or wastes.

RECOMMENDATIONS

1. Installation of bentonite seals or grout beneath the concrete access box is needed to seal the leakage path down along the access tubes that are located along the periphery of the cover.
2. Surface drainage needs to be redirected away from the northern portion of both covers and between the two separate covers to prevent surface water run-off from the covers or from the diversion trenches on to several of the neutron access tube pads.
3. Small topographic depressions along the periphery of the covers need to be filled and run-off redirected away from the cover edges.
4. Temporary maintenance activities need to include routinely filling visible cracks, soil deflation, holes, and rodent burrows with bentonite to prevent the infiltration and build-up of surface waters down along the access tubes.

Mercury Hazardous Waste Trench- Row A

Cumulative Residual Moisture Content Beneath Trench

Residual Volumetric Moisture Content % = Volumetric moisture for a given date minus the baseline (first year average) volumetric moisture.

FIGURE ES-1 ROW A CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row B

Cumulative Residual Moisture Content Beneath Trench

FIGURE ES-2 ROW B CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row C

Cumulative Residual Moisture Content Beneath Trench

FIGURE ES-3 ROW C CUMULATIVE RESIDUAL MOISTURE CONTENT

FIGURE ES-4 ROW S1 CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row S2 **Cumulative Residual Moisture Content Beneath Trench**

Residual Volumetric Moisture Content % = Volumetric moisture for a given date minus the baseline (first year average) volumetric moisture.

FIGURE ES-5 ROW S2,V1 CUMULATIVE RESIDUAL MOISTURE CONTENT

1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVE

This annual Neutron Soil Moisture Monitoring report provides an analysis and summary for site inspections, meteorological information, and neutron soil moisture monitoring data obtained at the Area 23 Hazardous Waste Landfill, RCRA Unit, located in Mercury, Nevada. This report covers the period October 1995 through October 1996.

Inspections of the Area 23 Hazardous Waste Landfill are conducted to determine and document the physical condition of the covers, facilities, and any unusual conditions that could impact the proper operation of the landfill closure.

The objective of the neutron logging is to monitor the stability in soil moisture conditions beneath the trenches and detect changes that may be indicative of moisture entering through the landfill cover and therefore producing leachate movement beneath the landfill.

1.2 SITE HISTORY

The Area 23 Landfill (Figure 1) has been in operation for approximately 25 years. During that time various trenches were excavated and used for the disposal of sewage from portable toilets, sanitary waste, aerosol cans, wood waste, non-infectious medical waste, and hazardous wastes. All the trenches were originally covered with a soil cover. A portion of the landfill (Figure 2) was closed under RCRA using an engineered soil/synthetic geomembrane cover. The cover was completed in August 1993. Soil moisture monitoring began in October 1993.

The unit consists of two covers, a smaller cover for Trench A, and a larger, separate cover for Trenches B, C, S-1, and S-2. Hazardous Waste Trench A is greater than 51.8 m (170 ft) in length and approximately 0.61 m (2 ft) wide and 1.68 m (5.5 ft) deep. The northern portion of this trench was identified as containing hazardous waste and is approximately 16.76 m (55 ft) in length, with the remaining portions filled with sanitary wastes. The southern extent of the trench (containing sanitary waste) is not known (U.S. DOE, 1992).

Trench B is 135 m (442 ft) long, 0.61 to 0.91 m (2 to 3 feet) wide and 1.68 to 2.13 m (5.5 to 7 ft) deep. Monuments for Trench B were labeled "Medical Waste" and "Sanitary Waste" on the north end of the trench. Medical waste was found overlying hazardous waste on the north end of the trench during characterization studies (U.S. DOE, 1992).

FIGURE 1
**SITE LOCATION, AREA 23 LANDFILL
HAZARDOUS WASTE TRENCHES**

SOURCE: USGS, CAMP DESERT ROCK AND MERCURY 7.5' QUADRANGLE

FIGURE 2
CLOSURE SITE, AREA 23 LANDFILL
COVERS AND NEUTRON ACCESS TUBES

SOURCE: REEC_o DRAWING NO. 23-ML-556-C2.1, 10-12-93

Trench C is 114.6 m (376 ft) long, to 0.91 m (2 to 3 ft) wide and 0.15 to 2.44 m (0.5 to 8 ft) deep. Concrete monuments on the north end of Trench C were labeled "Sanitary Waste", "Aerosol Cans", and "Hazardous Waste" (U.S. DOE, 1992).

Trench S-1 is approximately 84.12 m (276 ft) long, 0.91 to 1.37 m (3 to 4.5 ft) wide and varies from 1.52 to 3.96 m (5 to 13 ft) deep. Trench S-1 was marked with a concrete monument labeled "Sewage" on the north end of the trench and unmarked on the south end (U.S. DOE, 1992).

Trench S-2 is greater than 70.7 m (232 ft) long, 1.07 to 2.13 m (3.5 to 7 ft) wide, and 3.05 to 4.27 m (10 to 14 ft) in depth. Trench S-2 was marked with a concrete monument as "Sewage" on the north end, but unmarked on the southern end. The southern end was not determined in exploratory excavations (U.S. DOE, 1992).

Waste inventories (Earth Technology, 1988) indicate that approximately 62,459 liters (16,500 gallons) of hazardous wastes were disposed of in trenches A, B, and C at the Area 23 Landfill. This waste includes 37,854 l (10,000 gal) of corrosive material and 20,820 l (5,500 gal) of ignitable materials. Approximately 13,249 l (3,500 gal) of miscellaneous non-hazardous chemicals were also disposed of in the trenches. Waste inventory data are not available for Trenches S-1 and S-2. Waste oil was observed in both trenches during exploratory excavation of these trenches (U.S. DOE, 1992).

1.3 SITE GEOLOGY AND HYDROLOGY

The Area 23 Hazardous Waste Landfill is located approximately 1.21 km (3/4 mi) west of Mercury, Nevada on the Nevada Test Site, (NTS) Nye County, Nevada (Figure 1). The site lies within the Mercury Valley and is underlain by unconsolidated alluvium derived from the Specter Range, Red Mountain, and Mercury Range. These ranges consist of Paleozoic carbonates and quartzites. The near surface alluvium is composed of silty sands containing abundant gravel and cobbles. Some boulders, up to three feet in diameter, have been noted. Localized caliche development is present in the near surface and is observed in the boreholes used to emplace the neutron access tubes.

The NTS is underlain by the Ash Meadows aquifer. It is an interbasin flow system above a carbonate basement rock and is relatively independent of the topographic boundaries. The Ash Meadows aquifer beneath the Area 23 Landfill occupies the lower Cenozoic alluvial fill with the ground water table estimated at about 244 to 335 m (800 to 1,100 ft) below the ground surface with flow to the southwest (Winograd et al, 1975). The nearest water well is located approximately 5.63 km (3.5 mi) to the southwest at Army Well Number 1. A ground water monitoring well for the Area 23 Sewage Lagoons was drilled approximately 0.4 km (1/4 mi) south of the trenches. This well was completed in March 1996 to a depth about 350 m (1300 ft). Ground water was intercepted at approximately 396 m (1300 ft) under 45 m (150 ft) of head. Groundwater level in the well is currently in equilibrium at approximately 350 m (1,150 ft).

The longest continuous rainfall records for the Nevada Test Site (NTS) available were recorded in Area 5 over a 31-year period. The average rainfall was 12.45 cm, (4.9 in), while the annual total ranged between a minimum of 2.79 cm (1.1 in) to a maximum of 23.42 cm (9.22 in). Estimates of Potential Evapotranspiration (ET_{POT}) obtained from characterization studies in Area 5 indicate an ET_{POT} of about 157.5 centimeters/year (62 in/yr), which is significantly higher than the mean annual precipitation (U.S. DOE, 1995).

2.0 REGULATORY CRITERIA

2.1 BACKGROUND

The Amended Closure Plan (U.S. DOE, 1993) included a proposal that the level of concern triggering notification to the NDEP would be based on the hydraulic conductivity of the soils beneath the trenches. A hydraulic conductivity vs. saturation curve was proposed to determine the moisture content at which the soils had a hydraulic conductivity of 1×10^{-7} cm/sec (3.94×10^{-8} in/sec), which is the EPA criteria for clay liners. For soils in Area 5, this value was reached for a measured water content of 14 percent. This value was chosen for the Area 23 Hazardous Waste Trenches as the action threshold above which water movement may occur. The reporting criteria to NDEP as stated in the Amended Closure Plan was:

- "If the measured water content of 14 percent is exceeded in two consecutive monthly measurements, or obvious damage occurs to the cover....action would be taken".

Once the closure drilling and construction program was completed and the first neutron logs were obtained, it was found that the fundamental assumption of homogeneous soils similar to those in Area 5 was incorrect. The soils beneath the site are heterogeneous and inter-fingered with caliche lenses producing an environment that is not hydrologically similar to that of Area 5. Drill logs and neutron logs indicate that it would be extremely difficult, if not impossible, to use the hydraulic conductivity method originally proposed due to lithologic variability of the alluvium. Doing so would lead to numerous false positives and negatives.

Instead, it was proposed in the first quarterly neutron logging report (U.S. DOE, 1994a) to use the traditional method of a time series analysis to monitor and report wetting and drying changes over time. For the first year (baseline), RVMC was calculated monthly by the difference between the current month and the previous month's moisture content at each depth interval. The observation of a progressive wetting front (one that continues for two consecutive monthly measurements) and is greater than five percent RVMC would be tracked and reported to NDEP in the quarterly reports. Positioning errors of the neutron probe (tool), which could incorrectly infer changes in moisture content, are excluded. A further set of actions are necessary to determine the cause for progressive wetting fronts if observed in two consecutive months and infiltrating deeper than 4.27 m (14 ft).

The five percent RVMC criteria was based on data observed on other neutron logs and infiltration studies conducted at comparable sites on the Nevada Test Site. Changes of up to 15 percent RVMC over an interval of 0.9 m to 1.5 m (3 to 5 ft) have been observed in soil covers from rainfall events in the lower elevations of Area 5. Considering that the neutron probe has a repeatability of ± 1 percent RVMC due to system noise, a level of concern of five percent RVMC was chosen as a conservative initial action level for compliance reporting.

The first year data set (1994) was conducted on a monthly basis to obtain baseline data (U.S. DOE, 1994a,b,c and 1995)

Based on the data collected over the first year, the monitoring program was modified by the NDEP and DOE in late 1994 (NDEP, 1994). The following changes were made:

- Conduct moisture monitoring and liner inspections quarterly;
- Monitor only 30 neutron access tubes rather than 72 tubes. Table 1 provides the tubes selected for monitoring;
- Report monthly precipitation data to NDEP annually;
- If precipitation exceeds 2.54 cm (1 in) in any 30-day period, or 2.54 cm (1 in) in any six hour period, then monitoring will be conducted within two weeks of the end of the 30-day period and monthly, thereafter, for one quarter;
- After two years of post-closure monitoring, during which time the annual precipitation was average or above average, the DOE may submit a request to NDEP to reevaluate the monitoring/inspection schedule.

The NDEP requested that a uniform reporting format and specific changes in the presentation of the soil moisture data be developed in September 1995. The emphasis is to produce a simplified presentation of trends to observe whether the compliance level is being exceeded. The compliance criteria was modified in subsequent meetings between DOE, NDEP, and REEC Co (now Bechtel Nevada) placing the "point of compliance" beneath each respective hazardous waste trench. The neutron access tubes were installed with the bottom of the access tube at a point directly beneath each respective trench. The depth from the original grade of the landfill (before the installation of the cover) to this point is provided in Appendix A. To avoid measurement errors associated with geometry problems at the end of the access tube, a point 0.91 m (3 ft) from the bottom of the access tube was selected as the measurement point.

A request was submitted to NDEP in December 1996 requesting the interim monitoring criteria be formally adopted. Formal approval is currently pending.

TABLE 1 -- NEUTRON ACCESS TUBES MONITORED AT THE AREA 23 HAZARDOUS WASTE LANDFILL RCRA UNIT¹

TRENCH A	TRENCH B	TRENCH C	TRENCH S-1	TRENCH S-2
A-1	B-2	C-1	S1-2	S2-2
A-2	B-4	C-3	S1-5	S2-5
A-4	B-7	C-6	S1-8	S2-8
	B-10	C-9	S1-11	S2-11
	B-13	C-12	S1-14	S2-14
	B-16	C-15		
	B-19	C-18		
	B-22	C-21		

¹ Background control well V-1 is also monitored

2.2 SITE INSPECTION COMPLIANCE CRITERIA

Visual inspections and photographs of the Area 23 Hazardous Waste Landfill RCRA Trenches are done on a quarterly basis and are reported in the annual report. Monthly inspections are done if Precipitation Action Levels are exceeded (see Section 2.3). Inspections consist of the following observations:

- Condition of the gate (locked, open);
- Condition of signs (faded, missing, detached);
- Problems with fencing (breaks, needed repairs);
- Erosion of two overland flow diversion trenches;
- Condition of two covers (subsidence, erosion, excessive vegetation);
- Deterioration of the neutron access tube concrete pads, covers; and
- Unusual activity that could impact the proper operation of the covers.

2.3 SOIL MOISTURE MONITORING COMPLIANCE CRITERIA

The compliance criteria of 14 percent moisture content, as originally established in the Amended Closure Plan (U.S. DOE, 1993) has not been used as a reporting criteria since the first quarterly monitoring in 1993, as it was found to be inappropriate for the soils beneath the hazardous waste trenches. While the criteria has not been formally changed, an interim compliance criteria was developed and is in use pending formal approval from the Nevada Division of Environmental Protection (NDEP). A formal change of the compliance criteria for the Unit was submitted to NDEP in January 1997 (DOE 1997).

The interim level of concern, point of compliance, and schedule of actions is summarized below.

Soil moisture monitoring is accomplished using a calibrated neutron tool. Thirty neutron access tubes are logged at one-foot intervals. The data are collected based on the calendar year and analyzed quarterly (January, April, July, and October), with an annual report issued by January 31 of the following year. Data analysis is based on the calculated residual moisture content obtained by subtracting the quarterly soil moisture content value from the corresponding first year average (baseline) soil moisture value on a depth basis.

Neutron logging operations will be according to the following guidance and notification criteria based on discussions with the DOE and NDEP:

- Report monthly precipitation data to NDEP annually;
- If precipitation exceeds 2.54 cm (1 in) in any 30-day period, or 2.54 cm (1 in) in any six hour period, then monitoring will be conducted within two weeks of the end of the 30-day period and monthly, thereafter, for one quarter;
- Wetting events with greater than five percent RVMC, showing a progressive change in either moisture content or movement will be tracked and reported on a quarterly basis. Events that occur as single point anomalies (at one depth) that are attributable to logging tool positioning errors will be excluded;
- The NDEP is to be notified if the RVMC is confirmed to be above five percent relative to baseline conditions for two consecutive monitoring periods. The point of compliance is the point directly beneath each respective hazardous waste trench. Notification of NDEP will be within seven days of the confirmation. Within 30 days of the notification, a preliminary written assessment detailing recommendations to determine the nature, cause, and action to be taken will be submitted to NDEP for concurrence.

3.0 SITE INSPECTIONS AND ANNUAL SUBSIDENCE SURVEY

3.1 INTRODUCTION

The two covers and the surrounding area are thoroughly examined and photographed each Quarter. The inspection checklists for the reporting period are found in Appendix B. Inspections consist of criteria identified in Section 2.3.

3.2 FINDINGS FROM THE QUARTERLY INSPECTIONS

3.2.1 Fourth Quarter (October - November 1995) Inspection

Cleanup activities were conducted on November 1, 2, and 6, 1995. Both caps were raked to remove tire tracks. Tumbleweeds were removed from the caps and from around all of the tubes. Bolts that were missing from the covers have been replaced. The three brass identification markers missing from the concrete monuments have been ordered.

No additional subsidence was noted at any of the tubes. The fencing and signs are all in good condition. No significant concerns were noted.

3.2.2 First Quarterly (January - March 1996) Inspection

No significant concerns were noted.

The fencing was in good condition. One sign was repaired and replaced on the fence. Brass markers, which have been missing from concrete access tubes pads S1-1, S1-5, and S1-15, were replaced. No erosion or subsidence was noted at the base of the pads (other than that which has been previously identified) or along the diversion ditches.

3.2.3 Second Quarterly (April - June 1996) Inspection

The fencing was in excellent condition. One sign was on the ground and needed to be replaced on the fence. The rest of the site is in good condition.

3.2.4 Third Quarterly (July - September 1996) Inspection

The fencing and signs are all in good condition. Some holes were present at the base of some of the neutron tube concrete pads probably caused by rodents. Some erosional evidence was also present; however, it does not appear to be recent.

The fencing and signs are all in good condition. No significant concerns were noted.

3.2.5 Fourth Quarter (October 1996) Inspection

The monthly inspection was completed October 24, 1996. The unit is in good condition. Recent rain did not seem to impact the site.

3.3 ANNUAL SUBSIDENCE SURVEY

The elevation of the subsidence markers were confirmed with an elevation survey conducted August 1996. There has been no subsidence at any of the markers since monitoring began four years ago. The survey results are found in Table 2 and the survey plat is in Appendix C.

TABLE 2 -- SUBSIDENCE MONUMENT COORDINATES AND ELEVATIONS

Monument Number	Coordinates ¹		Elevation Top of Monument ²			
	Northing	Easting	August 1993	August 1994	July 1995	August 1996
SM-1	20380836.722	1832371.6774	3669.17	3669.17	3669.17	3669.17
SM-2	20380756.583	1832342.1769	3666.41	3666.41	3666.41	3666.41
SM-3	20380845.802	1832220.1677	3669.31	3669.31	3669.31	3669.31
SM-4	20380638.070	1832176.9730	3660.61	3660.61	3660.61	3660.61
SM-5	20380443.800	1832094.8852	3653.32	3653.32	3653.32	3653.32
SM-6	20380539.981	1832035.1841	3658.52	3658.52	3658.52	3658.52
SM-7	20380692.893	1832079.4908	3664.49	3664.49	3664.49	3664.49
SM-8	20380783.752	1832030.6240	3665.65	3665.65	3665.65	3665.65
SM-9	20380638.535	1831963.6795	3659.41	3659.41	3659.41	3659.41
SM-10	20380478.713	1831927.2693	3654.23	3654.23	3654.23	3654.23

¹ All coordinates based on the Nevada State Plane Grid - Central Zone - North American Datum of 1983 in feet.

² All elevations based on the North American Vertical Datum of 1929 in feet.

4.0 SOIL MOISTURE MONITORING

4.1 INTRODUCTION

The objective of the Mercury Landfill Hazardous Waste Unit vadose zone monitoring system is to monitor the performance of the two landfill covers, and provide an early warning of the potential for leachate migration from the landfill into the subsurface.

The Area 23 Landfill Hazardous Waste Trenches monitoring system uses a portable neutron moisture logging tool to determine changes in the moisture content in soils surrounding neutron access tubes which extend beneath the landfill. By monitoring changes in soil moisture content it is possible to detect the movement of wetting and drying fronts in the soils beneath the two hazardous waste trenches. The detection of changes in soil moisture content beneath the landfill provides an early warning of the potential movement of leachate from the landfill to the surrounding environment, indicating possible failure of one or both covers.

A total of 79 neutron access tubes have been drilled at approximately 45 degree angles along the margins of the trenches (Figure 2). The access tubes extend to a point directly beneath the trenches and range in length from 11.6 m (8.2 m in vertical depth) to 31.1 m (21.9 m in vertical depth) [38 ft (27 ft vertical depth) to 102 ft (72 ft vertical depth)]. The average length of the tubes is 19.8 m (14.0 m vertical depth) [65 ft (46 ft vertical depth)].

Two Campbell Pacific Nuclear Hydroprobes (Model 503DR) containing 50 mCi ²⁴¹Americium/Beryllium neutron sources are used to obtain moisture logs in the access tubes. Each logging tool has a published range of 0-32 percent volumetric moisture content (percent VMC), with a precision of 0.24 percent at 24 percent VMC at a one minute count time (CPN, 1894).

Calibration of the neutron logging tools were done in soil pits constructed at the Area 23 Landfill. Six different soil moisture contents were used (3.4, 5.4, 7.5, 7.8, 11.2 and 12.0 percent VMC). The pits were carefully constructed to match typical near surface in-situ formation conditions and used the same neutron access tubes (approximately 12.7 cm [5 in] outside-diameter steel ODEX 115 drill casing) as installed beneath the waste trenches.

The calibration procedure and results are discussed in the first quarterly post-closure report (U.S. DOE 1994a). Based on the results of the field calibration, the best fit linear regression equation for moisture content of the soil surrounding the neutron access tubes (percent VMC) is given by:

$$\text{Meter Serial No. 1304: } \% \text{ VMC} = 3.15 \times 10^{-3} \times (\text{COUNTS}) - 8.06$$

$$\text{Meter Serial No. 7074: } \% \text{ VMC} = 4.68 \times 10^{-3} \times (\text{COUNTS}) - 8.36$$

where "COUNTS" refers to the raw output from the neutron logging tool.

A coefficient of determination (r^2) of 0.98 was obtained for both linear regression calibration curves indicating that the calibration data set and calibration model are in excellent agreement over the range of volumetric water contents represented. These logging tools can provide accurate estimates of the moisture content in typical near surface geologic materials found at the landfill site.

The repeatability (precision) of the logging tools based on counting statistics can be determined from the approximate 95 percent confidence interval:

$$\text{Meter Serial No. 1304} = [3.15 \times 10^{-3}(\text{COUNTS}) - 8.06] \pm 6.17 \times 10^{-3} (\text{COUNTS}/k)^{0.5}$$

$$\text{Meter Serial No. 7074} = [4.68 \times 10^{-3}(\text{COUNTS}) - 8.36] \pm 9.17 \times 10^{-3} (\text{COUNTS}/k)^{0.5}$$

Where:

COUNTS are the instrument recorded and displayed value (actual count normalized to 16 seconds); and

k = count time in seconds divided by 16.

A 16-second count time is used at the site resulting in a k = 1.

The calibration was conducted over the range of three percent to 12 percent volumetric moisture content. It is valid (provides accurate moisture contents) over the range of moisture contents for soils with approximately the same mineralogy and density as the calibration soil.

Soil moisture monitoring was initially done on a monthly basis for the 79 neutron access tubes over the first year of operation (U.S. DOE, 1994a,b,c and 1995). This data set represents the baseline conditions to which all subsequent data (this report) are compared. After the first year of operation, permission was granted by the Nevada Division of Environmental Protection to reduce the number of monitored access tubes from 79 to 30, and begin quarterly monitoring (NDEP, 1994).

4.2 OPERATING PROCEDURES

Neutron logging operations follow Standard Operating Procedure AADzD.D.03.00 (REECo, 1990). The procedure was modified to operate without a centralizer on the downhole tool as the neutron access tubes are inclined at a 45 degree angle. Field quality control operations require a daily standard count test to be run at the start and end of the day. Failure to pass this statistical test, which is detailed in the Standard Operating Procedure, requires stopping operations,

notifying the supervisor, and determining the cause.

Using this procedure, neutron logs are obtained by lowering the neutron tool to within 0.61 m (2 ft) of the bottom of the access tube. A count is obtained using a 16-second count time at 0.3 m (1 ft) intervals along the length of the access tube. The data is recorded on field log sheets and stored in the data logger of the neutron probe as raw counts. The data logger is then downloaded to an office personnel computer on a daily basis where it is converted into absolute moisture content. Once the data have been converted to absolute moisture contents they are presented as two graphs; *Cumulative Residual Moisture Content* and *Baseline Difference*. These graphs are discussed later.

4.3 PRECIPITATION DATA

Precipitation data was collected from the National Weather Service Nuclear Support Office's CLINET station "MER" in Mercury, Nevada. This station is located approximately 1.2 km (3/4 mi) east of the Area 23 Landfill Hazardous Waste Trenches. Precipitation records for this station for the period October 1995 through October 1996 are found in Appendix D and are summarized in Table 3 and Figure 3. Due to budget constraints and personnel loss at the National Weather Service, the precipitation records have not been reviewed and qualified by a climatologist. The precipitation records dating from October 1995 through October 1996 have been released and classified as "preliminary" until they can be reviewed by the weather service climatologist.

Total precipitation for the reporting period October 1995 through October 1996 was 4.50 cm (1.77 in). The precipitation is below the yearly average. The highest daily precipitation event occurred February 20, 1996 with 0.97 cm (0.38 in) of precipitation occurring in that 24 hr period. The maximum 30 day integrated rainfall occurred on March 14, 1996 with a total of 2.49 cm (0.98 in) accumulating over the previous 30 day period. This accumulation event was 0.05 cm (0.02 in) below the action level of 2.54 cm (1.0 in) in any 30 period that would have required one quarter of monthly monitoring.

**TABLE 3 – PRECIPITATION DATA FOR THE MERCURY NEVADA,
METEOROLOGICAL STATION, MER**

DATE	PRECIPITATION inches	MONTHLY ACCUMULATION inches	30 DAY ACCUMULATION ¹ inches
October 29, 1995	0.02	0.02	0.02
January 21, 1996	0.02	0.02	0.02
January 31, 1996	0.20	0.22	0.24
February 20, 1996	0.38	0.38	0.58
February 25, 1996	0.17	0.55	0.75
February 28, 1996	0.12	0.67	0.87
March 12, 1996	0.19	0.19	0.86
March 13, 1996	0.10	0.29	0.96
March 14, 1996	0.02	0.31	0.98
April 12, 1996	0.02	0.02	0.04
May 25, 1996	0.05	0.05	0.05
June 26, 1996	0.11	0.11	0.11
August 16, 1996	0.03	0.03	0.03
October 28, 1996	0.09	0.09	0.09
October 30, 1996	0.25	0.34	0.34

Data from the U. S. National Weather Service Nuclear Support Office, 1995 and 1996

¹ To meet compliance requirements the 30-Day Accumulative records the total integrated rainfall that has occurred over the previous 30- day period . Monthly monitoring, rather than quarterly, is required for one quarter when 2.54 cm (1 in) of rainfall has occurred over a 30- day period.

Area 23 Hazardous Waste Trenches Precipitation Events - Regulatory Compliance Mercury Weather Station, MER

Figure 3

4.4 SOIL MOISTURE MONITORING RESULTS

4.4.1 DATA PRESENTATION

The *Cumulative Residual Moisture Content* graph (Figures 4-8) tracks changes over time from baseline conditions relative to the regulatory level of concern. The depth at which a tube intersects the centerline of a trench varies. This is due to the initial regulatory criteria provided to monitor underneath the trenches, and construction limitations to minimize the introduction of soil moisture through the Very Low Density Polyethylene (VLDPE) cover if tubes were placed through the cover.

The residual moisture content is calculated by subtracting the soil moisture content from each monitoring period from the first year average soil moisture content (Baseline). The depth used is approximately 0.91 m (3 ft) from the bottom of each neutron access tube. This corresponds to the point directly beneath each hazardous waste trench and avoids geometry problems associated with the end of the access tube. This residual value is plotted as *Residual Volumetric Moisture Content vs Date* for each access tube (Figures 4 through 8). The level of regulatory concern is indicated as a heavy line at the plus five percent residual moisture level. Values exceeding this limit for two consecutive monitoring periods require notifying the NDEP within seven days and the submittal of an Action Plan to investigate the cause within 30 days.

A second graph *Baseline Difference* (Appendix E) shows the changes occurring for one specific monitoring period along the entire length of a neutron access tube relative to baseline conditions. It is calculated by subtracting the current soil moisture content from the Baseline (first year average) soil moisture content on a depth basis. The result of this subtraction is referred to as the *Residual Soil Moisture Content (or Residual Moisture)*. The *Residual Soil Moisture Content* is plotted along with the actual *Volumetric Soil Moisture Content* of both the current and baseline data vs Depth from the top of the casing. A positive residual moisture content indicates conditions at that depth and point in time that are wetter than baseline conditions, while negative values indicate dryer conditions. Repeatability and instrumentation noise is approximately $\pm$ one percent RVMC. The *Baseline Difference* graph provides detailed information on the overall performance of the entire unit, while the *Cumulative Residual* graph focuses only on cumulative trends relative to the regulatory level of concern at a specific depth which are needed to make compliance decisions.

Mercury Hazardous Waste Trench- Row A

Cumulative Residual Moisture Content Beneath Trench

FIGURE 4 ROW A CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row B

Cumulative Residual Moisture Content Beneath Trench

FIGURE 5 ROW B CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row C

Cumulative Residual Moisture Content Beneath Trench

FIGURE 6 ROW C CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row S1

Cumulative Residual Moisture Content Beneath Trench

FIGURE 7 ROW S1 CUMULATIVE RESIDUAL MOISTURE CONTENT

Mercury Hazardous Waste Trench- Row S2

Cumulative Residual Moisture Content Beneath Trench

FIGURE 8 ROW S2,V1 CUMULATIVE RESIDUAL MOISTURE CONTENT

4.4.1.2 DISCUSSION OF ANALYTICAL DATA TRENDS

Figures 4 through 8 provide summary monitoring information with respect to the level of regulatory concern. Observations for each trench are provided below.

4.4.1.2.1 HAZARDOUS WASTE TRENCH A (ROW A)

Baseline Difference graphs for Tubes A-1, A-2, and A-4 in Trench A are found in Appendix E. Conditions remain dry and stable from January through October of 1996 with drying conditions occurring in the near surface (0 to 5 feet) in Tubes A-1 and A-2. Tube A-4 shows a wetting event with a peak of seven per cent Volumetric Moisture Content in the second quarter in the near surface (0 to 6 feet). With the exception of the two to three foot interval this tube has dried to baseline conditions in the third and fourth quarters. These near surface events are associated with leakage along the concrete wellhead protection access boxes.

The near surface changes, which are observed on most of the other trenches, indicate there is inadequate protection and sealing from ponded surface waters that accumulate around the periphery of the cover. These problems were discussed in the December 1994 - December 1995 annual monitoring report (DOE 1996). The near surface large negative residual moisture contents (apparently dryer conditions relative to baseline conditions) are most likely related to soil erosion or shrinkage beneath and adjacent to the access box. A clear example of this can be seen on access Tube A-2 (Appendix E, Row A Tube A-2, 10/14/96) where the near surface absolute moisture content is a -1 percent indicating that the geometry in this region has changed. This is most likely due to an air gap or loss of soil material due to erosion or soil shrinkage due to water infiltrating beneath the concrete wellhead protection box. Inspections of the access boxes (see Sec 3.2) indicate no new areas of infiltration, but do indicate some rodent burrows along the concrete access box margins. Additional problems of water leakage down along the access tube can be expected if ponded water from above-average rainfall events again accumulates in these areas.

The baseline difference graph (Appendix E) shows infiltration commonly occurs in the near surface along access tubes (Rows A, B, C-1, C-3, and S-2) located along the periphery of the cap where water collects and infiltrates down along the access box and access tube. Tubes that penetrate the cap (Row S-1, C-4 through C-21) have increased moisture contents limited to depths above 1.8 m (6 ft) which is where the geomembrane cover liner is located. Below this point the soils are dry and stable. The neutron access tubes that extend through the cap are providing a better seal than those drilled along the margin in order to avoid cap seal problems.

The nature of the increase in moisture content observed along most of the neutron access tubes can be explained based on the following observations:

- Site inspections note the evidence of surface water ponding and infiltrating down along the access boxes;

- After surface drying conditions had begun, moisture contents of less than baseline conditions beneath the access box indicate that shrinkage or erosion of the soils occur due to water infiltration along the access tube);
- Wetting events are observed to be limited only to neutron tubes located along the periphery of the cover;
- Dry stable conditions are observed for the neutron tubes that extend through the cap into the core of the unit.

Based on these observations, these effects are considered to be caused by an accelerated transport path down along the access tubes, and not the infiltration of water through the cover or waste.

The cumulative residual moisture contents for Row A, Tubes A-1, A-2, and A-4 are found in Figure 4. The vertical depth (from the original grade) beneath Trench A for Tubes A-1, A-2, and A-4 is approximately 16.8 m (55 ft).

The residual soil moisture content on Row A remains unchanged from the first year baseline conditions at less than one percent RVMC. Maximum variation is $\pm$ one percent which is within the range of instrumentation noise.

No trends are evident and conditions remain dry and stable and within the compliance criteria.

4.4.1.2.2 HAZARDOUS WASTE TRENCH B (ROW B)

Baseline Difference graphs (Appendix E) indicate similar conditions as observed on Row A. In the second quarter (April 1996), near surface Residual Volumetric Moisture Content in the first 0.61 to 0.91 m (2 to 3 ft) peaks in Tube B-2 at approximately 5.5 percent RVMC due to the 30 day cumulative rainfall of 2.49 cm (0.98 in) in March 1996. Other tubes typically range between zero to less than four percent. By the July monitoring period most of the tubes have returned to baseline conditions.

As discussed in the previous report (DOE 1995) Tube B-13 (and to a lesser extent Tubes B-10 and B-16) continue to show a progression of moisture moving to a depth of about 15.2 m (50 ft) where it is contained, probably due to a caliche layer. The RVMC has peak at about four percent and is continuing to redistribute at this depth. The surface to about 12 m (40 ft) has dried and returned to baseline conditions. The moisture that has moved down along the access tube appears to be contained at about 15 m (50 ft) at the boundary with an intrinsically higher moisture content material (probably caliche that is tightly sealed to the ODEX casing). It is expected that moisture content will continue to build at this boundary over time and then decrease as it equilibrates with the surrounding soils.

As discussed in the previous report the infiltration of ponded surface water down along the access tubes needs to be corrected. It is recommended that as an interim action bentonite be used to seal all visible cracks and fissures associated with the concrete well head protection box until an engineered solution is adopted. To properly correct this problem the well head protection box should be sealed around the access tube and the toe and drainage area along the cover needs to be graded and improved. Failure to rectify these problems will lead to more water infiltrating down along the access tubes which eventually will severely interfere with monitoring operations.

The cumulative residual moisture contents for Row B, Tubes B-2, B-4, B-7, B-10, B-13, B-16, B-19, and B-22 are found in Figure 5. The vertical depth (from the original grade) beneath Trench B for Tubes B-2 through B-7 varies from approximately 21.3 to 18.3 m (70 to 60 ft), while tubes B-10 through B-22 vary between 16.8 to 15.8 m (55 to 52 ft).

From January 1996 through July 1996 (first through third quarters) the cumulative residual moisture contents on Row B are somewhat noisy at ± 1 percent RVMC. This artifact, as discussed in the previous report (DOE, 1995), is most likely caused by water leakage down along the access tube as a result of the precipitation and ponding from the unusually heavy January - February 1995 precipitation events. The fourth quarter (October, 1996) data is more typical, with a scatter (noise level) of about ± 0.5 percent RVMC. This may indicate that the access tube is returning to baseline conditions.

Row B access tubes remain at less than one percent RVMC and are well within the compliance criteria.

4.4.1.2.3 HAZARDOUS WASTE TRENCH C (ROW C)

Access Tubes C-1 and C-3 are located along the northwest periphery of the cap. The remaining access Tubes C-6 through C-21 are located on and penetrate the cover. Tubes C-1 and C-3 are approximately 18.3 m (60 ft) beneath the original grade, while Tubes C-6 through C-21 are approximately 6.1 m (20 ft) beneath the original grade.

Baseline Difference graphs (Appendix E) for Tubes C-1 and C-3 are similar to those of Row A and B and those access tubes located along the periphery of the cover. The graph on access Tube C-1 indicates drying conditions (negative Residual Volumetric Moisture Contents) down to about the 1.8 m (6 ft) level with absolute moisture content decreasing to a -2 percent in the fourth quarter. The negative absolute moisture content is indicative of a change in geometry along the access tube and is probably due to an air gap from soil erosion or shrinkage caused by the seepage of ponded water down along the access tube as discussed previously.

As described in the previous report this infiltration has remained stable at 9.2 m (30 ft) with no detectable movement and slightly lower Residual Moisture Content in the fourth quarter 1996.

Access Tubes C-6 through C-21 are installed through the cover and are very similar in the

character of their soil moisture content profiles. A peak residual moisture content of about six percent RVMC occurs on Tube C-6 and C-15 in the second quarter. Most tubes show slightly wetter than baseline conditions down to the 1.8 m (6 ft) level. The geomembrane liner, located at 1.8 m (6 ft), provides a barrier to infiltration. Below this depth, the residual moisture contents remain at less than one percent. It is possible that the protective rock cover layer (Rip-Rap) may be preventing or slowing the natural evaporative processes from the surface to the 1.8 m (6 ft) depth of the liner.

Cumulative Residual Moisture Content graphs for Row C, Tubes C-1, C-3, C-6, C-9, C-12, C-15, C-18, and C-21 are found in Figure 6. The vertical depth (from original ground surface) beneath Trench C for Tubes C-1 and C-3 is approximately 18.3 m (60 ft). Both of these tubes lie along the margin of the cover. Tubes C-6 through C-21 are installed on the cover and extend through it to a vertical depth (from original ground surface) of approximately 6.1 m (20 ft).

Cumulative Residual Moisture Contents (Figure 6) at the point of compliance for all Row C tubes remain at less than one percent RVMC with no trends evident. Row C access tubes remain stable, dry and below the compliance criteria of five percent RVMC.

4.4.1.2.4 HAZARDOUS WASTE TRENCH S-1 (ROW S-1)

Access tubes for Row S-1 are installed on top of the cover and penetrate through it to a depth of approximately 6.1 m (20 ft) below the original ground surface.

Baseline Difference graphs (Appendix E) for tubes on Row S-1 are very similar to those of Row C. Drying trends in the first three to four feet are apparent by the fourth quarter of 1996. Tubes S1-2, S1-8, and S1-11 show negative residual values in the first several feet. This is probably indicative of soil shrinkage or loss beneath the concrete well head. As was observed on Row C, most of the tubes still have one to three percent residual moisture remaining just above the liner (at 1.8 m [6 ft]). This may be due to the protective rock cover layer (Rip-Rap) preventing, or slowing the natural evaporative processes. Below the liner the tubes remain stable and dry with the residual moisture contents remaining at less than one percent and with no leakage observed across the geomembrane liner.

Cumulative residual moisture content graphs for Row S-1, Tubes S1-2, S1-5, S1-8, S1-11, and S1-14 are found in Figure 7. All tubes are installed on the cover and extend through it to a vertical depth of approximately 6.1 m (20 ft) from the original ground surface.

Cumulative residual moisture contents at the point of compliance for all Row S-1 tubes (Figure 7) remain at less than one percent RVMC with no trends evident. Row S-1 access tubes remain stable, dry and below the compliance criteria of five percent RVMC.

4.4.1.2.5 HAZARDOUS WASTE TRENCH S-2 (ROW S-2)

Access tubes on Row S2 are located along the northwest periphery of the cover. Baseline Difference graphs (Appendix E) indicate similar conditions as observed on Row A and B. Near surface (0 to 1.5 m [0 to 5 ft]) Residual Moisture Contents typically have a negative response (drier than baseline conditions) which is probably due to soil erosion or shrinkage (air gap) beneath the cement well head protection box. As described in the previous annual report (DOE, 1995) some water (less than one percent RVMC) had infiltrated down along the access tube to about 9.2 to 12.2 m (30 to 40 ft). This moisture appears to have redistributed and residual moisture contents are returning to baseline conditions.

The increased moisture content (approximately three percent RVMC) noted at the bottom of the access tube S2-14 have decreased to approximately -1 percent RVMC in October 1996. As discussed in the previous report, it is still not clear if this represents a positioning error in the steep gradient in moisture content associated with the change in lithology or if it may also reflect a change in moisture content due to water or condensate that has moved down inside of the access tube.

The cumulative residual moisture contents for Row S-2, Tubes S2-2, S2-5, S2-8, S2-11, and S2-14, are found in Figure 8. The vertical depths (from the original surface) beneath Trench S-2 for Tubes S2-1 through S2-5 is approximately 16.8 m (55 ft). For tubes S2-8 to S2-14 the depth varies from 19.8 to 21.9 m (65 to 72 ft).

Cumulative Residual Moisture Contents at the point of compliance for all Row S-2 tubes remain at less than one percent RVMC with no trends evident. Row S-2 access tubes remain stable, dry and below the compliance criteria of five percent RVMC.

4.4.1.2.6 VERTICAL CONTROL TUBE V-1

The Vertical Control Tube V-1 is a 15.2 m (50 ft) vertical neutron access tube located at the north margin of the cover. Its purpose is to provide information on infiltration and evaporation sequences of the soils immediately surrounding the RCRA closure. It is used for background comparative purposes. Unfortunately, the tube is located in a slight depression that frequently fills with ponded water from runoff from the covers and a catchment area located to the north. As a result this "control" tube represents a worse case scenario in terms of the amount and degree of water infiltration, rather than typical conditions.

Baseline Difference graphs (Appendix E) indicate drying conditions in the surface to about 6.1 m (20 ft) for the period January - October 1996. As described in the previous annual report (DOE, 1995) the water that has infiltrated down along the access tube is beginning to return to baseline conditions in the near surface and decreasing slowly at depth. The moisture contents to about 4.6 m (15 ft) have returned to near baseline conditions where as at depth (12.2 to 15.2 m [40 to 50

ft)) the moisture content has increased about one to two percent RVMC relative to baseline conditions as this moisture redistributes and equilibrates. The peak change in moisture content occurs at about 9.2 m (30 ft) with a residual volumetric content of about four percent. Residual volumetric contents between 6.1 m to about 12.2 m (20 to 40 ft) are typically about two to 2.5 percent RVMC. Downward movement of this moisture has slowed considerably relative to the previous year. With the exception of the first 4.6 m (15 ft) of the access tube which has returned to baseline conditions, the remaining length of the access tube remains above baseline conditions.

Cumulative Residual Moisture Contents at the point of compliance for Control Tube V-1 (Figure 8) remains somewhat noisy varying from -0.5 to 1.5 percent RVMC within the reporting period January to October 1996.

The cumulative residual moisture contents for access Tube V-1, while noisier than other access tubes, remains below the compliance level of five percent RVMC.

5.0 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 SUMMARY AND CONCLUSIONS

1. Inspections of the cover were done to identify any significant changes to the unit requiring action. No significant concerns were observed.
2. An elevation survey of the subsidence markers was conducted in August 1996. There has been no subsidence at any of the markers since monitoring began four years ago.
3. Most access tubes located along the periphery of the cover (Tubes A, B, C-1 through C-4, and S-2) show low levels of infiltration occurring down along the access tubes to depth. Access tubes located on, and penetrating the cover, indicate infiltration is limited to 1.83 m (6 ft) where the geomembrane liner is located. No leakage across the liner has been observed.
4. All monitored access tubes are within the compliance criteria of less than five percent residual volumetric moisture content at the compliance point directly beneath each respective trench. Soil conditions remain dry and stable underneath the trenches.

Summary of trench conditions:

Trench A

Cumulative Residual Moisture Contents at the point of compliance indicates that soil surrounding the access tubes are stable, dry, and below the compliance level of five percent RVMC.

Trench B

The Row B access tubes remain at less than one percent RVMC and have returned to baseline conditions at the point of compliance in the fourth quarter monitoring period. The increase of 0.5 percent RVMC after February 1995 is attributed to the movement of ponded surface water down along the neutron access tubes as described in the previous annual report. This had locally raised the moisture content of the soil surrounding these access tubes.

Row B access tubes remain stable and dry, and are within the compliance criteria.

Trench C

Cumulative residual moisture contents at the point of compliance for all Row C tubes remain at less than one percent RVMC with no trends evident.

The Row C access tubes remain stable, dry, and below the compliance criteria of five percent RVMC.

Trench S-1

Cumulative residual moisture contents at the point of compliance for all Row S-1 tubes remain at less than one percent RVMC with no trends evident.

The Row S-1 access tubes remain stable, dry, and below the compliance criteria of five percent RVMC.

Trench S-2

Cumulative residual moisture contents at the point of compliance for all Row S-2 tubes remain at less than one percent RVMC with no trends evident.

The Row S-2 access tubes indicates that the soil remains stable, dry, and below the compliance criteria of five percent RVMC.

Control Well V-1

The Vertical Control Tube V-1 is a 15.24 m (50 ft) vertical neutron access tube located at the north margin of the cover. This tube is located in a slight depression that frequently fills with ponded water from runoff from the covers and from a catchment area located to the north. As a result, this "control" tube best represents a worse case scenario rather than typical conditions. Evidence of ponded water, as well as cracks and erosion in the soils surrounding the concrete access box have been noted. As result of this ponding, this access tube has shown significantly more leakage than observed on any of the other access tubes.

The Cumulative Residual Moisture Contents at the point of compliance for Control Tube V-1 varies from about - 0.5 to 1.5 percent RVMC and is the result of moisture infiltrating down along the access tube.

The cumulative residual moisture content for access Tube V-1, while noisier than other access tubes, remains below the compliance level of five percent RVMC.

5.2 FINDINGS

No significant concerns were observed during the site inspections over the period November 1995 through October 1996.

The annual subsidence survey of the two covers indicates that subsidence has not been detected to date.

Soil conditions remain dry and stable beneath the trench through the October 1995 to October 1996 monitoring period.

Moisture contents at the point of compliance for all access tubes remain below the compliance criteria of five percent RVMC.

5.3 RECOMMENDATIONS

1. Installation of bentonite seals or grout beneath each concrete access box is needed to seal the leakage path down along the access tubes located along the periphery of the cover.
2. Surface drainage needs to be redirected away from the northern portion of both covers and between the two separate covers to prevent surface water run-off from the covers or from the diversion trenches on to several of the neutron access tube pads.
3. Small topographic depressions along the periphery of the covers need to be filled and run-off redirected away from the cover edges.
4. Temporary maintenance activities need to include routinely filling visible cracks, soil deflation, holes, and rodent burrows with bentonite to prevent the infiltration and build-up of surface waters down along the access tubes.

6.0 REFERENCES

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APPENDIX A

NEUTRON ACCESS TUBE INSTALLATION SUMMARY

APPENDIX A -- NEUTRON ACCESS TUBE INSTALLATION SUMMARY

NEUTRON ACCESS TUBE NUMBER	DRILLING COMPLETION DATE	PLANNED		AS-BUILT		CALCULATED VERTICAL DEPTH ¹ (FEET)	VERTICAL POINT OF COMPLIANCE DEPTH ¹ (FEET)
		LENGTH (FEET)	ANGLE	LENGTH (FEET)	ANGLE		
V-1	5-28-93	50.0	90	50.0	90	50.0	48
A-1	5-18-93	78.0	45	78.0	45	55.1	53.0
A-2	5-19-93	80.0	45	71.5	45	50.6	48.8
A-3	5-19-93	84.0	45	84.0	45	59.4	NM ²
A-4	5-20-93	84.0	45	84.0	45	59.4	56.6
B-1	4-29-93	104.0	45	104.0	45	73.5	NM ²
B-2	4-30-93	98.0	45	98.0	45	69.3	67.2
B-3	4-30-93	92.0	45	92.0	45	65.0	NM ²
B-4	5-3-93	88.3	45	88.3	45	62.4	60.1
B-5	5-4-93	84.2	45	84.2	45	59.5	NM ²
B-6	5-4-93	84.0	45	84.0	45	59.4	NM ²
B-7	5-5-93	84.1	45	84.1	45	59.4	56.6
B-8	5-6-93	84.0	45	84.0	45	59.4	NM ²
B-9	5-7-93	79.5	45	79.5	45	56.2	NM ²
B-10	5-10-93	78.0	45	78.0	45	55.1	53.0
B-11	5-10-93	78.0	45	78.0	45	55.1	NM ²
B-12	5-11-93	79.0	45	79.0	45	55.8	NM ²
B-13	5-11-93	79.0	45	79.0	45	55.8	53.7
B-14	5-11-93	74.0	45	74.0	45	52.3	NM ²
B-15	5-12-93	74.0	45	74.0	45	52.3	NM ²
B-16	5-12-93	74.0	45	77.0	45	54.4	53.0
B-17	5-13-93	79.0	45	79.0	45	55.8	NM ²
B-18	5-13-93	79.5	45	79.5	45	56.2	NM ²
B-19	5-13-93	78.0	45	78.0	45	55.1	53.7
B-20	5-14-93	78.0	45	78.0	45	55.1	NM ²
B-21	5-14-93	79.0	45	79.0	45	55.8	NM ²
B-22	5-17-93	78.0	45	78.0	45	55.1	53.0
B-23	5-17-93	79.5	45	79.5	45	56.2	NM ²
C-1	5-26-93	88.0	45	88.0	45	62.2	60.1
C-2	5-27-93	92.0	45	75.0	45	53.0	NM ²
C-3	5-21-93	94.0	45	85.0	45	60.1	55.2
C-4	4-12-93	41.0	45	41.0	45	29.0	NM ²
C-5	4-12-93	41.0	45	41.0	45	29.0	NM ²
C-6	4-9-93	41.0	45	41.0	45	29.0	26.2
C-7	4-9-93	41.0	45	41.0	45	29.0	NM ²
C-8	4-7-93	41.0	45	41.0	45	29.0	NM ²
C-9	4-7-93	41.0	45	41.0	45	29.0	25.5
C-10	4-7-93	41.0	45	41.0	45	29.0	NM ²
C-11	4-7-93	41.0	45	41.0	45	29.0	NM ²
C-12	4-6-93	41.0	45	41.0	45	29.0	26.2
C-13	4-6-93	41.0	45	41.0	45	29.0	NM ²
C-14	4-6-93	41.0	45	41.0	45	29.0	NM ²

NEUTRON ACCESS TUBE NUMBER	DRILLING COMPLETION DATE	PLANNED		AS-BUILT		CALCULATED VERTICAL DEPTH ¹ (FEET)	VERTICAL POINT OF COMPLIANCE DEPTH ¹ (FEET)
		LENGTH (FEET)	ANGLE	LENGTH (FEET)	ANGLE		
C-15	4-5-93	41.0	45	41.0	45	29.0	26.9
C-16	4-5-93	41.0	45	41.0	45	29.0	NM ²
C-17	4-5-93	41.0	45	41.0	45	29.0	NM ²
C-18	4-5-93	41.0	45	41.0	45	29.0	27.6
C-19	4-2-93	41.0	45	41.0	45	29.0	NM ²
C-20	4-2-93	41.0	45	41.0	45	29.0	NM ²
C-21	4-2-93	41.0	45	41.0	45	29.0	27.6
S1-1	3-25-93	41.0	45	41.0	45	29.0	NM ²
S1-2	3-25-93	41.0	45	41.0	45	29.0	27.6
S1-3	3-26-93	41.0	45	41.0	45	29.0	NM ²
S1-4	3-26-93	41.0	45	41.0	45	29.0	NM ²
S1-5	3-30-93	41.0	45	41.0	45	29.0	26.9
S1-6	3-30-93	41.0	45	41.0	45	29.0	NM ²
S1-7	3-31-93	41.0	45	41.0	45	29.0	NM ²
S1-8	3-31-93	41.0	45	41.0	45	29.0	27.6
S1-9	3-31-93	41.0	45	41.0	45	29.0	NM ²
S1-10	3-31-93	41.0	45	41.0	45	29.0	NM ²
S1-11	4-1-93	41.0	45	41.0	45	29.0	27.6
S1-12	4-1-93	41.0	45	41.0	45	29.0	NM ²
S1-13	4-1-93	41.0	45	41.0	45	29.0	NM ²
S1-14	4-1-93	41.0	45	41.0	45	29.0	26.9
S1-15	4-2-93	41.0	45	41.0	45	29.0	NM ²
S2-1	4-13-93	74.2	45	74.2	45	52.4	NM ²
S2-2	5-18-93	78.0	45	78.0	45	55.1	53.0
S2-3	4-14-93	78.0	45	78.0	45	55.1	NM ²
S2-4	4-15-93	79.0	45	79.0	45	55.8	NM ²
S2-5	4-16-93	82.2	45	82.2	45	58.1	55.2
S2-6	4-19-93	82.2	45	82.2	45	58.1	NM ²
S2-7	4-19-93	92.0	45	92.0	45	65.0	NM ²
S2-8	4-21-93	92.0	45	92.0	45	65.0	63.6
S2-9	4-21-93	93.5	45	93.5	45	66.1	NM ²
S2-10	4-22-93	96.0	45	96.0	45	67.9	NM ²
S2-11	4-22-93	97.4	45	97.4	45	68.9	66.5
S2-12	4-23-93	99.0	45	99.0	45	70.0	NM ²
S2-13	4-26-93	103.6	45	103.6	45	73.2	NM ²
S2-14	4-27-93	101.9	45	101.9	45	72.0	69.3
S2-15	4-28-93	98.2	45	98.2	45	69.4	NM ²

Note: 1 Calculated depth is from existing grade prior to construction of the cover and is based upon the As-Built length of casing and angle

Note: 2 NM - Not Monitored

ATTACHMENT B
PHOTOGRAPH LOG

**RESOURCE CONSERVATION & RECOVERY ACT
AREA 3 U3fi WASTE UNIT
POST-CLOSURE SITE INSPECTION
PHOTOGRAPH LOG**

PHOTO NUMBER	DATE	DESCRIPTION
1	3/19/96	U3fi Waste Unit looking west, note "Buried Cable" sign in foreground
2	3/19/96	U3fi Waste Unit looking north
3	3/19/96	U3fi Waste Unit looking east
4	3/19/96	U3fi Waste Unit looking south
5	3/19/96	From the U3fi Waste Unit looking north
6	3/19/96	From the U3fi Waste Unit looking south
7	3/19/96	From the U3fi Waste Unit looking east
8	3/19/96	From the U3fi Waste Unit looking west
9	3/19/96	U3fi monument marker
10	3/19/96	ER-3-3 Monitoring Well looking south
11	3/19/96	ER-3-3 Monitoring Well looking north
12	3/19/96	ER-3-3 Monitoring Well locking cap
13	3/19/96	U3fi Waste Unit looking north
14	3/19/96	U3fi Waste Unit looking east
15	3/19/96	U3fi Waste Unit looking south
16	3/19/96	U3fi Waste Unit looking west
17	3/19/96	Typical interior of sign
18	3/19/96	Typical exterior of sign

APPENDIX B

MONTHLY INSPECTION CHECKLISTS

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST

PAGE 1 OF 4

Date of Last Inspection: February 22, 1996

Reason for Last Inspection: Monthly routine inspection

Responsible Agency: Bechtel Nevada Remediation Projects

Address: Nevada Test Site, Mercury, Nevada

Responsible Agency Official: Robert Dodge, Project Manager

Inspection Start Date and Time: March 19, 1996 @ 1030 AM

Chief Inspector: Angela L. Olson, Geologist/Hydrologist, Bechtel Nevada

Name	Title	Organization
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Assistant Inspector: Not Applicable

Name	Title	Organization
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A. GENERAL INSTRUCTIONS

1. All checklist items must be completed and detailed comments made to document the results of the site inspection. The completed checklist is part of the field record of the inspection. Additional pages should be used as necessary to ensure that a complete record is made. Attach the additional pages and number all pages upon completion of the inspection.
2. Inspectors are to provide an up-to-date resume or vitae for inclusion in the inspection report.
3. Any checklist line item marked by an inspector in a SHADED BOX, must be fully explained or an appropriate reference to previous reports provided. The purpose of this requirement is to provide a written explanation of inspector observations and the inspector's rationale for conclusions and recommendations. Explanations are to be placed on additional attachments and cross-referenced appropriately. Explanations, in addition to narrative, will take the form of sketches, measurements, annotated site maps.
4. The site inspection is a walking inspection of the entire site (i.e., the area within 1,000 feet of U-3fi and ER-3-3), including the perimeter and sufficient transects to be able to inspect the entire surface and all features specifically described in this checklist. Every monument, site marker, sign, monitoring well access, and erosion control marker will be inspected.
5. A standard set of color 35mm photographs is required. For this site, the standard set consists of 10 photographs (see instructions in Section D.6 of this checklist). In addition, all anomalous features or new features (such as changes in adjacent area land use) are to be photographed. A photo log entry will be made for each photograph taken.
6. Field notes taken to assist in completion of this checklist will become part of the inspection record. No form is specified for field notes, however, they must be legible and in sufficient detail to enable review by succeeding inspectors and the responsible agency.

B. PREPARATION (To be completed prior to site visit)

	YES	NO	EXPLANATION
1. Post-Closure Permit reviewed.		✓	See Explanation #1
2. Design basis documents reviewed.	✓		
3. Site as-built plans and site base map reviewed.	✓		
4. Previous inspection reports reviewed.	✓		
a. Were anomalies or trends detected on previous inspections?		✓	
b. Was maintenance performed?		✓	
5. Site maintenance and repair records reviewed.	✓		
a. Has site repair resulted in a change from as-built conditions?		✓	
b. Are revised as-builts available that reflect repair changes?		✓	No modifications have been made.
6. Aerial photos, if taken since last inspection, reviewed. For each set, enter the date, scale, and if interpreted.	✓		
a. Date: Aug/Sept 1994	✓		United States Department of Energy Nevada Test Site Grid Map, Roll 7874, Frame 155
b. Scale: 1" = 2000'	✓		
a. Date:	✓		
b. Scale:			
7. Were any of the following suggested by examination of the aerial photographs? (If yes, give photo set date).			
a. Intrusion by man?		✓	
b. Intrusion by animals?		✓	

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST (cont.)	YES	NO	EXPLANATION	PAGE 2 OF 4
c. Channelized erosion in area of cover?		✓		
d. Changes in washes in the drainage areas?		✓		
e. Faults?		✓		
f. Obstruction of diversion channel(s)?		✓		
g. Bank erosion of diversion channel(s)?		✓		
h. Change in surrounding vegetation?		✓		
i. Displacement of fences, site markers, boundary markers, or monuments?		✓		
j. Change in adjacent land use?		✓		
C. SITE INSPECTION PREPARATION				
Assemble the following equipment, as needed, to conduct inspections a. Camera and film b. Binoculars c. Tape measure d. Optical ranging device e. Brunton compass f. Photo scales g. Erasable board h. Keys to locks i. Hand lens j. Clipboard k. Other miscellaneous support equipment				
D. SITE INSPECTION (To be completed during inspection)	YES	NO	EXPLANATION	
1. Adjacent off-site features within watershed areas upslope of U-3fi Waste Unit.				
a. Have there been any changes in use of adjacent area?		✓		
b. Are there any new roads or trails?		✓		
c. Has there been a change in the position of nearby washes?		✓		
d. Has there been lateral excursion or erosion/deposition of nearby washes?		✓		
e. Are there new drainage channels?		✓		
f. Other?		✓		
2. Access roads, fences, gates, and signs.				
a. Is there a break in the fence?		✓		
b. Have any posts been damaged or their anchoring weakened?		✓		
c. Is there evidence of erosion or digging beneath the fence?		✓		
d. Does the gate show evidence of tampering or damage?		✓		
e. Is there any evidence of human intrusion?		✓		
f. Is there any evidence of large animal intrusion?		✓		
g. Have any signs been damaged or removed? (Number of signs replaced: _____)		✓		
h. Are access roads passable?	✓			
i. Other?		✓		

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST (cont.)		YES	NO	EXPLANATION	PAGE 3 OF 4
3. Monuments and other permanent features					
a. Have the survey or boundary monuments been defaced or disturbed?		✓			
b. Have the site markers been disturbed by man or natural processes?		✓			
c. Do natural processes threaten to integrity of any monument or site marker?		✓			
d. Other?		✓			
4. U-3fi Waste Unit cover					
a. Is there evidence of settling?		✓			
b. Is there cracking?		✓			
c. Is there evidence of erosion around the cap (wind or water)?		✓			
d. Is there evidence of animal burrowing?		✓			
e. Other?		✓			
5. Site drainage features (within 1,000 feet of U-3fi).					
a. Is the drainage as describe in the site plans?	✓				
b. Is there evidence of bank erosion?		✓			
c. Is there evidence of channel erosion?		✓			
d. Is there evidence of sedimentation?		✓			
e. Is there channel obstruction?		✓			
f. Is there any evidence that diversion channels (if present) are not performing their function?		✓			
g. Other?		✓			
6. Photo Instructions					
A total of 10 photographs are required to be taken during each inspection of the Area 3 U-3fi Waste Unit. Additional photos may also be taken. The required photographs shall be taken as follows:					
<ul style="list-style-type: none"> ● Four (4) from the center of the U-3fi Waste Unit cap, one <u>in</u> each compass direction (i.e., N, S, E, W). ● Four (4) of the U-3fi Waste Unit cap, one <u>from</u> each compass direction. ● Two (2) of the ER-3-3 monitoring well surface completion with compass directions noted on the photo log. 					
7. Photo Documentation					
a. Have all photos required by the photo instructions been taken? (see last page of checklist)	✓				
b. Has a photo log been prepared for each roll of film exposed?	✓				
c. Number of rolls exposed (<u>18 photos taken</u>)					
d. Other?		✓			
8. Monitoring well ER-3-3 access					
a. Has the monitoring well access been disturbed by man or natural processes?		✓			
b. Does any natural process threaten the integrity of the monitoring well access?		✓			
c. Is the monitoring well access label plate intact and legible?	✓				
d. Is the monitoring well access capped and properly secured?	✓				
e. Other?		✓			

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST (cont.)	YES	NO	EXPLANATION	PAGE 4 OF 4
E. FIELD CONCLUSIONS				
1. Is there an imminent hazard to the integrity of the U-3fi Waste Unit? (Immediate report required)		✓		
Person/Agency to whom report made:				
2. Are more frequent inspections required?		✓		
3. Are existing maintenance/repair actions satisfactory?	✓		No repairs have taken place since closure	
4. Is other maintenance/repair necessary?		✓		
5. Rationale for field conclusions:				
Explanation #1 - No Post-Closure Permit has been issued				
Inspector's Conclusions:				
No significant problems or concerns were identified during the preparatory research or during the site inspection. The site is in excellent condition. There were no signs of disturbance, damage, erosion to the unit and/or the area surrounding the unit. No maintenance or repair has been required in the past nor should any be required in the foreseeable future.				
E. CERTIFICATION				
I have conducted an inspection of the Area 3 U-3fi Waste Unit at the NTS in accordance with the procedures of the Post-Closure Permit (including the Post-Closure Plan) as recorded on this checklist, attached sheets, field notes, photo logs, and photographs.				
Chief Inspector's Signature <i>Angela Olson</i>		Printed Name <i>Angela Olson</i>		
Title <i>Geologist / Hydrogeologist</i>		Date <i>3-19-96</i>		

Tuesday, 3-19-96

0730 Kick-off meeting for surveying activities at the Area
Decon Pond. at Wet-n-Wild.

Conduct monthly RCA inspections. Will conduct
the biannual Post Closure Site inspection for
the Area 3 U3fi Waste Unit concurrently
with the monthly inspection.

0800 Weather - Unseasonably warm, slight breeze
Inspect Area 2 Bitcutter / Postshot Injection Well
& U2bu Subsidence Crater. Nothing unusual.

1030 Arrive Area 3 U3fi Waste Unit. Complete monthly
inspection form.

Conduct visual survey / walking inspection of the
area within 1,000 feet of U3fi + EL-3-3.

No evidence of changes of use in the adjacent
area, no new roads/trails, no change in position
of washes and/or lateral extension, changes, etc.

Photos:

#1 U3fi ~~Waste~~ Waste Unit looking west - note
buried cable sign in foreground.

#2 U3fi Waste Unit looking north

#3 U3fi Waste Unit looking east

#4 U3fi Waste Unit looking south

Conduct inspection of roads, fences, gates & signs.

No breaks, damage, tampering, erosion or digging
were noted. No evidence of human or
animal intrusion. Signs in excellent condition
Roads good.

Engelbren

3-19-96

2/12/96

Inspect nonuments. No detachment or disturbance noted. No threats to the integrity of either U3fi or ER-3-3. U3fi Waste Cover shows no evidence of settling, cracking and no erosion or burrowing has occurred around the concrete pad. The ER-3-3 monitoring well was locked and secure with name plate intact & legible. No disturbances were noted.

General observations:

No evidence of erosion, sedimentation or changes to the site's drainage features were observed. The unit is in excellent conditions. No overall changes have taken place, with respect to topography, in the last year I have conducted inspections.

Photos:

- #5 From the U3fi Waste Unit looking north
- #6 From the U3fi Waste Unit looking south
- #7 From the U3fi Waste Unit looking east
- #8 From the U3fi Waste Unit looking west
- #9 U3fi monument marker
- #10 ER-3-3 Monitoring Well looking south
- #11 ER-3-3 Monitoring Well looking north
- #12 ER-3-3 looking cap
- #13 Unit looking north
- #14 Unit looking east
- #15 Unit looking south

Angela Brown

WJH

DATE 3-19-96

DATE 3/20/96

#16 Unit looking west

#17 Typical interior of sign

#18 Typical exterior of sign

5 Prior to site inspection the Post-Closure Permit was reviewed, ~~along with~~ ^{were reviewed} Design basis documents as built plans + base map. I reviewed my past monthly inspection reports. Aerial photos ^{as} were also inspected. No significant changes

10 have occurred at the site other than addition of items used during the characterization + closure activities.

Completion of site inspection

15

20

25

Angela Bon

APPROVED BY

Angela Bon

PREPARED TO AND UNDERSTOOD BY

11.1.1

DATE

3-19-96

DATE

3/20/96

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST

PAGE 1 OF 4

Date of Last Inspection: August 28, 1996 Reason for Last Inspection: Monthly routine inspection

Responsible Agency: Bechtel Nevada Remediation Projects

Address: Nevada Test Site, Mercury, Nevada

Responsible Agency Official: Robert Dodge, Project Manager

Inspection Start Date and Time: September 30, 1996 @ 1430

Chief Inspector: Angela L. Olson, Geologist/Hydrologist, Bechtel Nevada

Name	Title	Organization
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Assistant Inspector: Not Applicable

Name	Title	Organization
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A. GENERAL INSTRUCTIONS

1. All checklist items must be completed and detailed comments made to document the results of the site inspection. The completed checklist is part of the field record of the inspection. Additional pages should be used as necessary to ensure that a complete record is made. Attach the additional pages and number all pages upon completion of the inspection.
2. Inspectors are to provide an up-to-date resume or vitae for inclusion in the inspection report.
3. Any checklist line item marked by an inspector in a SHADED BOX, must be fully explained or an appropriate reference to previous reports provided. The purpose of this requirement is to provide a written explanation of inspector observations and the inspector's rationale for conclusions and recommendations. Explanations are to be placed on additional attachments and cross-referenced appropriately. Explanations, in addition to narrative, will take the form of sketches, measurements, annotated site maps.
4. The site inspection is a walking inspection of the entire site (i.e., the area within 1,000 feet of U-3fi and ER-3-3), including the perimeter and sufficient transects to be able to inspect the entire surface and all features specifically described in this checklist. Every monument, site marker, sign, monitoring well access, and erosion control marker will be inspected.
5. A standard set of color 35mm photographs is required. For this site, the standard set consists of 10 photographs (see instructions in Section D.6 of this checklist). In addition, all anomalous features or new features (such as changes in adjacent area land use) are to be photographed. A photo log entry will be made for each photograph taken.
6. Field notes taken to assist in completion of this checklist will become part of the inspection record. No form is specified for field notes, however, they must be legible and in sufficient detail to enable review by succeeding inspectors and the responsible agency.

B. PREPARATION (To be completed prior to site visit)	YES	NO	EXPLANATION
1. Post-Closure Permit reviewed.		✓	No Post-Closure Permit has been issued.
2. Design basis documents reviewed.	✓		
3. Site as-built plans and site base map reviewed.	✓		
4. Previous inspection reports reviewed.	✓		
a. Were anomalies or trends detected on previous inspections?		✓	
b. Was maintenance performed?		✓	
5. Site maintenance and repair records reviewed.	✓		
a. Has site repair resulted in a change from as-built conditions?		✓	
b. Are revised as-builts available that reflect repair changes?		✓	No modifications have been made.
6. Aerial photos, if taken since last inspection, reviewed. For each set, enter the date, scale, and if interpreted.	✓		
a. Date: Aug/Sept 1994 b. Scale: 1" = 2000'	✓		United States Department of Energy Nevada Test Site Grid Map, Roll 7874, Frame 155
a. Date: b. Scale:	✓		
7. Were any of the following suggested by examination of the aerial photographs? (If yes, give photo set date)			
a. Intrusion by man?		✓	
b. Intrusion by animals?		✓	

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST (cont.)	YES	NO	EXPLANATION	PAGE 2 OF 4
c. Channelized erosion in area of cover?		✓		
d. Changes in washes in the drainage areas?		✓		
e. Faults?		✓		
f. Obstruction of diversion channel(s)?		✓		
g. Bank erosion of diversion channel(s)?		✓		
h. Change in surrounding vegetation?		✓		
i. Displacement of fences, site markers, boundary markers, or monuments?		✓		
j. Change in adjacent land use?		✓		
C. SITE INSPECTION PREPARATION				
Assemble the following equipment, as needed, to conduct inspections				
a. Camera and film				
b. Binoculars				
c. Tape measure				
d. Optical ranging device				
e. Brunton compass				
f. Photo scales				
g. Erasable board				
h. Keys to locks				
i. Hand lens				
j. Clipboard				
k. Other miscellaneous support equipment				
D. SITE INSPECTION (To be completed during inspection)				
1. Adjacent off-site features within watershed areas upslope of U-3fi Waste Unit.				
a. Have there been any changes in use of adjacent area?		✓		
b. Are there any new roads or trails?		✓		
c. Has there been a change in the position of nearby washes?		✓		
d. Has there been lateral excursion or erosion/deposition of nearby washes?		✓		
e. Are there new drainage channels?		✓		
f. Other?		✓		
2. Access roads, fences, gates, and signs.				
a. Is there a break in the fence?		✓		
b. Have any posts been damaged or their anchoring weakened?		✓		
c. Is there evidence of erosion or digging beneath the fence?		✓		
d. Does the gate show evidence of tampering or damage?		✓		
e. Is there any evidence of human intrusion?		✓		
f. Is there any evidence of large animal intrusion?		✓		
g. Have any signs been damaged or removed? (Number of signs replaced: _____)		✓		
h. Are access roads passable?	✓			
i. Other?		✓		

AREA 3, U-3fi POST-CLOSURE INSPECTION CHECKLIST (cont.)		YES	NO	EXPLANATION	PAGE 3 OF 4
3. Monuments and other permanent features					
a. Have the survey or boundary monuments been defaced or disturbed?		✓			
b. Have the site markers been disturbed by man or natural processes?		✓			
c. Do natural processes threaten to integrity of any monument or site marker?		✓			
d. Other?		✓			
4. U-3fi Waste Unit cover					
a. Is there evidence of settling?		✓			
b. Is there cracking?		✓			
c. Is there evidence of erosion around the cap (wind or water)?		✓			
d. Is there evidence of animal burrowing?		✓			
e. Other?		✓			
5. Site drainage features (within 1,000 feet of U-3fi).					
a. Is the drainage as describe in the site plans?	✓				
b. Is there evidence of bank erosion?		✓			
c. Is there evidence of channel erosion?		✓			
d. Is there evidence of sedimentation?		✓			
e. Is there channel obstruction?		✓			
f. Is there any evidence that diversion channels (if present) are not performing their function?		✓			
g. Other?		✓			
6. Photo Instructions					
A total of 10 photographs are required to be taken during each inspection of the Area 3 U-3fi Waste Unit. Additional photos may also be taken. The required photographs shall be taken as follows:					
<ul style="list-style-type: none"> • Four (4) from the center of the U-3fi Waste Unit cap, one <u>in</u> each compass direction (i.e., N, S, E, W), • Four (4) of the U-3fi Waste Unit cap, one <u>from</u> each compass direction, • Two (2) of the ER-3-3 monitoring well surface completion with compass directions noted on the photo log. 					
7. Photo Documentation					
a. Have all photos required by the photo instructions been taken? (see last page of checklist)	✓				
b. Has a photo log been prepared for each roll of film exposed?	✓				
c. Number of rolls exposed (<u>10 photos taken</u>)					
d. Other?		✓			
8. Monitoring well ER-3-3 access					
a. Has the monitoring well access been disturbed by man or natural processes?		✓			
b. Does any natural process threaten the integrity of the monitoring well access?		✓			
c. Is the monitoring well access label plate intact and legible?	✓				
d. Is the monitoring well access capped and properly secured?	✓				
e. Other?		✓			

[illegible]

ATTACHMENT C

INSPECTOR'S RESUME

Angela L. Olson
4584 East Armel Court
Las Vegas, Nevada 89115
Home: (702) 437-2573
Work: (702) 295-7276

Professional Qualifications

Ms. Olson is a geological engineer with over six years of experience in projects related to environmental restoration. She is familiar with site characterization and remediation techniques including RCRA closure activities and inspections, underground storage tank removal, facility Decontamination & Decommissioning, monitoring well installation and development, core logging, geotechnical testing, instrumentation, and slug testing. She has authored a variety of technical reports ranging from Health and Safety Plans to Closure Reports. In addition, her experience extends to all aspects of groundwater, soil, tank, and drum sampling, which encompasses sample collection, shipment, tracking, and data validation. She has been involved in slope stability analysis, and the design of surface water retention ponds and diversion ditches.

Education

B.S., Geological Engineering, S. D. School of Mines & Technology, Rapid City, SD, 1989

Additional Training:

OSHA Health & Safety Training, 40-hour
OSHA Supervisor's Health & Safety Training, 8-hour
USDOE Core Radiological Training (Rad Worker II)
Supervised Field Training, 24-hour
First Aid and CPR Training

Experience and Training

1996- **Geologist/Hydrogeologist , Bechtel Nevada, Nevada Test Site, Nevada**
Bechtel Nevada awarded O&M contractor for the Nevada Test Site. Including previous responsibilities, her additional duties include Property Management and Procurement.

1994- **Waste Management Specialist, Reynolds Electrical & Engineering Company, Inc.,**
1995 **Nevada Test Site, Nevada**

For the USDOE Nevada Test Site, Mercury, Nevada, she participated in several environmental Remediation projects including the Demolition and Decontamination Program, the Underground Storage Tank Program, the Abandoned Septic Tank Program, and Resource Conservation and Recovery Act site closures and monthly inspections.

- Supervised and responsible for all field operations and health & safety issues related to the Demolition and Decontamination of the Junior Hot Cell located at the Reactor Maintenance, Assembly, and Disassembly Facility. Sole author of the Closure Report.
- Supervised the excavation and removal of underground storage tanks and all related aspects such as verification sampling and closure report writing.

- Field manager for the clean closure of a RCRA site that involved preparation the Site Specific Health & Safety Plan, excavation of lead and hydrocarbon impacted soils; verification sampling, and preparation of the closure report that was submitted to the USDOE and Nevada Department of Environmental Protection.

1991- **Geological Engineer, IT Corporation, Englewood, CO**

1993 Involved in surface water flow and retention design projects including diversion ditch design and slope stability analysis. Computer skills include groundwater and PCSTABL5M slope stability modeling, STRATIFACT, Fortran and numerous PC applications.

- For the USDOE Nevada Test Site , Las Vegas, Nevada, she participated in the Environmental Restoration (ER) Site Inventory Program. Her responsibilities included:
 - Field verification and assessment of ER site
 - Development and implementation of a database utilizing dBase IV to organize sitewide historical information and identify potential new sites.

- For the USDOE Rocky Flats Nuclear Facility, Golden , Colorado, she played a key role in the research and development of the Historical Release Report. Her duties included:
 - Detailed review of Rocky Flats Plant documents
 - Extensive technical writing and organizational skills
 - Database management
 - Interpretation of aerial photographs
 - In-depth interviews with past and present employees with historical knowledge.

- Participate in Hazardous Waste Remediation Program for the Hardage Superfund Site which included:
 - Design of recovery trench utilizing slope stability and grain size analysis
 - Supervision of drilling crew
 - Installation of groundwater monitoring wells
 - Implementation of well development, sampling and slug testing plans
 - Core logging, geotechnical testing, and sampling
 - Cost estimation of trench construction efforts
 - Data validation.

1990- **Technical Support/Sampler, ERM Rocky Mountain, Englewood, CO**

1991 Participated in the environmental restoration program at the USDOE Rocky Flats Nuclear Facility. Experience included:

- Quarterly sampling of groundwater monitoring wells and sample tracking
- Calibration and maintenance of HNu, pH meter and spectrophotometer
- Utilization of radiation screening devices
- Development of Lotus Spreadsheets to coordinate field generated data
- Scheduling of sampling teams
- Quality Assurance/Quality control of field data and spread sheets

ATTACHMENT A

FIELD NOTES

- 46 Arrive Area 3 U3f Waste Unit
 Day's Activity: Conduct biannual Post-Closure inspection. Inspection will consist of photographing site + physically walking fire area within a 1,000 foot radius to identify changes in drainage, erosion, etc. The unit itself will be inspected for possible damage or deterioration of fencing, signs, monuments
 E-2.

Photo log

1	U3f	from south (looking north)
2	U3f	from west
3	U3f	from north
4	U3f	from east
5	From U3f	looking south
6	"	west
7	"	north
8	"	east
9	From ER3-3	looking west
10	From ER3-3	looking east

Inspect area. No erosional or drainage changes. Looks unchanged from last biannual inspection. Retrieved tumble seeds from inside fence. Gate has begun to sag. A chain + lock was installed on 99

98 the gate to prevent it from blowing open. Other than that the site is in excellent condition. No problems noted - No concerns or recommendations. Site will continue to be inspected informally on a monthly basis
 End of Day

ATTACHMENT B
PHOTOGRAPH LOG

**RESOURCE CONSERVATION & RECOVERY ACT
AREA 3 U3fi WASTE UNIT
POST-CLOSURE SITE INSPECTION
PHOTOGRAPH LOG**

PHOTO NUMBER	DATE	DESCRIPTION
1	9/30/96	U3fi Waste Unit looking west
2	9/30/96	U3fi Waste Unit looking north
3	9/30/96	U3fi Waste Unit looking east
4	9/30/96	U3fi Waste Unit looking south
5	9/30/96	From the U3fi Waste Unit looking north
6	9/30/96	From the U3fi Waste Unit looking south
7	9/30/96	From the U3fi Waste Unit looking east
8	9/30/96	From the U3fi Waste Unit looking west
9	9/30/96	ER-3-3 Monitoring Well looking south
10	9/30/96	ER-3-3 Monitoring Well looking north

APPENDIX C

SUBSIDENCE SURVEY PLAT

NOTICE

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APPENDIX D

PRECIPITATION RECORDS

MONTH/YEAR Dec 1995

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13	T	T	T	.01	T	T	T	.02	T	T	.01	.01	.01	T
14	T	.04		.01	.08	.05	T	T	.02	.05	.01	.05	.02	.05
15									.07					
16	T	T	T	T	T	T	T	T	.02	.02	T	T	T	T
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29									.03	.02				
30														
31														
TOTAL	T	.04	T	.02	.08	.05	T	.02	.14	.09	.02	.06	.03	.05

PRELIMINARY

PRELIMINARY
NTS PRECIPITATION

MONTH/YEAR JAN 1996

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19	T		.01	T	T	T	T	T	.05		.02	T	T	.03
20	.03				.02	.01				.10				
21	.02		.02	.02	.02	.02	.02	.05			.02	.01	T	.07
22												.01		
23														
24														
25														
26														
27														
28														
29														
30						.02								
31	.06	.05	.27	.05	.15	.08	.20	.15	.05	.02	.05	.15	.12	.05
TOTAL	.11	.05 ²	.30	.07	.19	.13	.22	.20 ²	.05	.12	.09	.17	.12	.15

MISSING DATA

PRELIMINARY

PRELIMINARY
NTS PRECIPITATION

MONTH/YEAR FEB - - 1996

	BJY	CS	DRA	4JA	40MIN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1	.04							.03				.02		.07
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19						.05								
20	.05	.60	.42	.07	.15	.22	.38	.56	.40	.24	.25	.10	.10	.17
21				.05	.10	.23			.02	.07		.18	.15	
22	.03		.02	.03	.02	.02		.03			.30			
23						.02								
24														
25		.12	.27	.25	.03	.03	.17	.37	.13			.17	.03	
26	.02			.02	.02	.03				.05			.07	
27	.09	.15	.05	.09	.02	.02		.05	.02	.02		.08	.01	.05
28	.15	.10	.05	.08	.05	.06	.12		.06	.20		.14	.01	.05
29														
30														
31														
TOTAL	.38	.97	.81	.59	.39	.68	.67	1.04	.63	.58	.55?	.69	.37	.34

PRELIMINARY NTS PRECIPITATION

	BJY	CS	DRA	4JA	40MIN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12	.14	.15	.17	.27	.37	.34	.19	.06			.20	.17		.09
13	.05		.06		.17	.35	.10	.10				.21		.10
14	.02		.11		.14	.05	.02	.07				.03		.03
15														
16														
17														
18														
19														
20														
21														
22														
23			T											
24														
25														
26														
27														
28														
29														
30														
31														
TOTAL	.21	.15	.34	.27	.68	.74	.31	.23	.60	.53	.20	.41	2	.22

PRELIMINARY

PRELIMINARY
NTS PRECIPITATION

MONTH/YEAR APR - - 1996

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1					.09			.27	.10			.10	.04	
2									.06					
3														
4														
5														
6														
7														
8														
9														
10														
11														
12		.07			.04		.02						.06	
13														
14														
15														
16			T											
17														
18														
19														
20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
TOTAL	Ø	.07	T	Ø	.13	Ø	.02	.27	.16	Ø	Ø	.10	.10	Ø

PRELIMINARY

PRELIMINARY
NTS PRECIPITATION

MONTH/YEAR MAY -- 1996

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22			T											
23														
24	.06	.05	.08	.08	.14	.08		.03	.03	.10	.07			
25	.16	.30	.02	.10		.02	.05	.25	.03	.56	.10	.12		.03
26					.10	.09			.10		.03	.05	.07	.10
27	.04		T					.05	.02	.07		.04		
28									.16					
29												.03		
30														
31														
TOTAL	.26	.35	.10	.18	.24	.19	.05	.33	.34	.73	.20	.24	.07	.13

PRELIMINARY

PRELIMINARY
NTS PRECIPITATION

MONTH/YEAR JUN -- 1996

	BJY	CS	DRA	4JA	40MIN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25		.05												
26	.33	.05	.05		.10	.09	.11	.17	.07	.23	.04	.24	.12	.35
27														
28														
29														
30														
31														
TOTAL	.33	.10	.05	0	.10	.09	.11	.17	.07	.23	.04	.24	.12	.35

NTS PRECIPITATION

MONTH/YEAR JUL -- 1996

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11					2.30	.03		.12	.07	.03		.16		.03
12	.14												.04	
13					.18	.03		.06				.10		
14	.22	.29	.13		.02	.02			.02			.20		.02
15														
16	*				*				*	*				
17						*		*				*	*	*
18		*		*			*				*			
19														
20														
21														
22														
23														
24														
25														
26														
27						.03		.02	.02					
28					.07			.05				.06		
29		.25			.03				.07				.03	
30														
31														
TOTAL	.36	.54	.13		2.60	.11		.25	.18	.03		.52	.07	.05

Data Tablated By 8/2/96 BFE

Data Qualtiy Contol QJ1

* CAL. ON RAIN GAGE
16 - 17 - 18

MONTH/YEAR AUG -- 1996 NTS PRECIPITATION

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12						.06								
13														
14														
15														
16	.05		.16				.03	.20	.22				.10	.10
17														
18														
19														
20														
21														
22														
23														.07
24									.16					
25														
26														
27														
28														
29														
30														
31														
TOTAL	.05	.00	.16	.00	.00	.06	.03	.20	.38	.00	.00	.00	.10	.17

Data Tablated By BF

Data Quality Control _____

MONTH/YEAR **SEP -- 1996** NTS PRECIPITATION

	BJY	CS	DRA	4JA	40MN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
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11														
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20														
21														
22														
23														
24														
25														
26														
27														
28														
29														
30														
31														
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Data Tablated By BF

Data Qualtiy Contol _____

NO PRECIP FOR THE MONTH OF SEPT. 1996

MONTH/YEAR **OCT -- 1996** NTS PRECIPITATION

	BJY	CS	DRA	4JA	40MIN	LF2	MER	MV	PM1	PHS	RV	TS2	W5B	UCC
1														
2														
3														
4														
5														
6														
7														
8														
9														
10														
11														
12														
13														
14														
15														
16														
17														
18														
19														
20														
21														
22														
23														
24														
25			T											
26								.30						
27		.20								.02				
28	.22	.05	.02		.08	.20	.09	.40		.00		.31	.26	.45
29										.07			.03	
30	.45	.72	.30	.21	.53	.58	.25	.24		.05		.38	.31	.50
31										.01		.17		.05
TOTAL	0.67	0.97	0.32	0.21	0.61	0.78	0.34	0.96	0.00	.25	0.00	0.92	0.60	1.00

Data Tablated By NOV 3 1996

BIC

Data Qualtiy Control

APPENDIX E

BASELINE DIFFERENCE GRAPHS

BASELINE DIFFERENCE

ROW A

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-1

01/23/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-1

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-1

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches **Baseline Difference - Tube A-1**

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-2

01/23/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-2

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-2

—△— 07/10/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-2

10/14/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube A-4

01/29/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-4

04/09/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-4

—△— 07/10/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube A-4

10/15/96

Baseline (1st yr. ave.)

Residual from Baseline

BASELINE DIFFERENCE

ROW B

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-2

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-2

04/04/96

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-2

—△— 07/10/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-2

10/14/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-4

01/23/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-4

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-4

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-4

10/14/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-7

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-7

—△— 04/09/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-7

07/10/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches **Baseline Difference - Tube B-7**

10/14/96

Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-10

01/25/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube B-10

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-10

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-10

10/14/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-13

01/25/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-13

—△— 04/08/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-13

—△— 07/10/96

—□— Baseline (1st yr. ave.)

—x— Residual from Baseline

Mercury Hazardous Waste Trenches **Baseline Difference - Tube B-13**

10/14/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-16

—△— 01/25/96

—□— Baseline (1st yr. ave.)

—×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-16

—△— 04/08/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-16

07/11/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-16

10/09/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-19

—△— 01/25/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-19

—△— 04/08/96

—□— Baseline (1st yr. ave.)

—×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-19

—△— 07/11/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-19

10/09/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube B-22

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-22

04/08/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-22

07/11/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube B-22

10/09/96 Baseline (1st yr. ave.) Residual from Baseline

BASELINE DIFFERENCE

ROW C

Mercury Hazardous Waste Trenches Baseline Difference - Tube C-1

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-1

04/03/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-1

07/11/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-1

—▽— 10/15/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-3

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-3

—▽— 04/03/96

—□— Baseline (1st yr. ave.)

—+— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-3

—△— 07/11/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-3

10/15/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-6

01/23/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-6

—△— 04/04/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-6

—△— 07/11/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches **Baseline Difference - Tube C-6**

10/16/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-9

01/23/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-9

—△— 04/04/96

—□— Baseline (1st yr. ave.)

—×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-9

—△— 07/11/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-9

10/16/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-12

—△— 01/23/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-12

—△— 04/04/96

—□— Baseline (1st yr. ave.)

—×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-12

07/11/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-12

10/16/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube C-15

01/23/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-15

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-15

07/11/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-15

10/16/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-18

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-18

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-18

—△— 07/11/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-18

10/16/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-21

—△— 01/23/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-21

04/04/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube C-21

—△— 07/11/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube C-21

10/16/96

Baseline (1st yr. ave.)

Residual from Baseline

BASELINE DIFFERENCE

ROW S1

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-2

01/29/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-2

04/09/96

Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-2

—▽— 07/11/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-2

10/15/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-5

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-5

—△— 04/09/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-5

07/11/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-5

10/15/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-8

01/29/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-8

04/09/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube S1-8

07/11/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-8

10/15/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-11

01/29/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube S1-11

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-11

—△— 07/11/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-11

Mercury Hazardous Waste Trenches Baseline Difference - Tube S1-14

Mercury Hazardous Waste Trenches Baseline Difference - Tube S1-14

Mercury Hazardous Waste Trenches **Baseline Difference - Tube S1-14**

07/11/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S1-14

10/15/96

Baseline (1st yr. ave.)

Residual from Baseline

BASELINE DIFFERENCE

ROW S2

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-2

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-2

04/02/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube S2-2

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-2

10/07/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-5

—△— 01/24/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-5

—△— 04/02/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-5

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-5

10/07/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-8

01/24/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-8

—▽— 04/02/96

—□— Baseline (1st yr. ave.)

—×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-8

07/10/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-8

10/08/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-11

01/24/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-11

04/02/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches Baseline Difference - Tube S2-11

07/10/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-11

10/08/96 Baseline (1st yr. ave.) Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-14

—△— 01/24/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches **Baseline Difference - Tube S2-14**

04/02/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-14

—△— 07/10/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube S2-14

10/09/96 Baseline (1st yr. ave.) Residual from Baseline

BASELINE DIFFERENCE

TUBE V-1

Mercury Hazardous Waste Trenches

Baseline Difference - Tube V-1

—△— 01/23/96 —□— Baseline (1st yr. ave.) —x— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube V-1

—△— 04/03/96 —□— Baseline (1st yr. ave.) —×— Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube V-1

07/18/96

Baseline (1st yr. ave.)

Residual from Baseline

Mercury Hazardous Waste Trenches

Baseline Difference - Tube V-1

10/09/96

Baseline (1st yr. ave.)

Residual from Baseline

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