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FINAL TECHNICAL MEMORANDUM INTERIM REMEDIAL ACTION LOW LEVEL
RADIOACTIVE WASTE BURIAL SITE NAS FORT WORTH TX
11/13/1996
METCALF AND EDDY

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**NAVAL AIR STATION
FORT WORTH JRB
CARSWELL FIELD
TEXAS**

**ADMINISTRATIVE RECORD
COVER SHEET**

AR File Number 314

UNITED STATES AIR FORCE

INSTALLATION RESTORATION PROGRAM

**FINAL
TECHNICAL REPORT**

**INTERIM REMEDIAL ACTION
LOW-LEVEL RADIOACTIVE WASTE
BURIAL SITE - SWMU 60**

CARSWELL AIR FORCE BASE, TEXAS

November 13, 1996

**UNITED STATES AIR FORCE
INSTALLATION RESTORATION PROGRAM**

FINAL TECHNICAL REPORT

**INTERIM REMEDIAL ACTION
LOW-LEVEL RADIOACTIVE WASTE BURIAL SITE
SWMU 60**

Carswell Air Force Base, Texas

November 13, 1996

Prepared for:

**Air Force Center For Environmental Excellence
Base Closure Restoration Division (AFCEE/ERB)
3207 North Road
Brooks Air Force Base, Texas 78235-5363
Contract #F41624-92-D-8002
Delivery Order #0012**

Prepared By:

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FINAL TECHNICAL REPORT

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LIST OF ACRONYMS

AFB	Air Force Base
AFBCA	Air Force Base Closure Authority
AFCEE	Air Force Center for Environmental Excellence
bls	Below Land Surface
cpm	Counts Per Minute
DOT	Department of Transportation
FSP	Field Sampling Plan
HSP	Health and Safety Plan
LLRW	Low-Level Radioactive Waste
M&E	Metcalf & Eddy, Inc.
NORM	Naturally Occurring Radioactive Material
NRC	Nuclear Regulatory Commission
PPE	Personal Protective Equipment
QAPP	Quality Assurance Project Plan
RSO	Radiation Safety Officer
RAP	Remedial Action Plan
RRS	Risk Reduction Standard
SAP	Sampling and Analysis Plan
SWMU	Solid Waste Management Unit
TAC	Texas Administrative Code
TNRCC	Texas Natural Resource Conservation Commission
UTL	Upper Tolerance Limit

EXECUTIVE SUMMARY

Solid Waste Management Unit (SWMU) 60 is located within the Off-Site Weapons Storage Area approximately 5 miles west of Carswell Air Force Base, Fort Worth, Texas. SWMU 60 consists of three 12-inch diameter, 18 feet long, cast iron pipes which were buried vertically so that approximately 1 foot of each pipe extends above ground surface. Low-level radioactive waste reported to consist generally of radium-painted (luminous) aircraft instrument dials was placed into these tubes according to practices considered acceptable at the time of disposal. Steel caps were set on the top of each tube and a chain-link fence was constructed around the tubes to limit access and demarcate the known radiological hazard.

Prior to the initiation of tube excavation, a non-intrusive radiological survey was performed at SWMU 60 to ensure that radioactive materials other than Naturally Occurring Radioactive Material (NORM) were not present and to establish a background level for field screening purposes. During the survey, a background level of 10 $\mu\text{R}/\text{hour}$ was established for SWMU 60. No radioactivity above two times the established background level was detected in the immediate vicinity of the tubes.

Four soil borings were performed outside the perimeter fence of the Off-Site Weapons Storage Area to collect soil samples for laboratory analysis to establish soil background concentrations for naturally occurring radioisotopes. An Upper Tolerance Limit (UTL) for Radium-226 was calculated to be 0.89 pCi/gm.

The tubes were excavated and screened for radioactivity. Radioactivity was detected (25, 120 and 600 $\mu\text{R}/\text{hour}$) at a point approximately 4 to 6 feet from the bottom of each tube. No radioactivity above two times background levels were detected from the soil and grout immediately surrounding the tubes when scraped and isolated from the tubes. This indicates that the surrounding soils were unaffected by the underground storage of Low-Level Radioactive Waste (LLRW) at SWMU 60. The levels of radioactivity detected did not require an upgrade in Personal Protective Equipment (PPE) or a change in the proposed procedures for handling the tubes.

Throughout excavation activities, the excavation and excavated/stockpiled soils were screened for radioactivity. No radioactivity was detected in the soil above two times the background levels established for field screening purposes. In addition, all personnel and equipment exiting the work area/exclusion zone were screened for radioactivity. A background level of 100 counts per minute (cpm) had been established during the site preparation phase. No radioactivity was detected above the established background level throughout personnel/equipment "frisking" procedures.

The tubes containing LLRW were overpacked in steel containers and labeled with Department of Transportation (DOT) labels for radioactive materials. Radioactivity was detected outside the overpack containers at concentrations of 10, 80 and 80 $\mu\text{R}/\text{hour}$. These levels of radioactivity detected were well within the acceptable range for transportation of the LLRW as manifested.

Samples were collected from the stockpiled soil for laboratory analysis for radioactive, organic and metals characterization. Laboratory analytical results indicated that no radioactivity above the established site-specific range of background concentrations and no organic or metals concentration above acceptable limits were detected in these samples. In addition, confirmation soil samples were collected from the sidewalls and floor of the excavation for laboratory analysis by gamma spectroscopy only. The radioisotope concentrations detected in the soil confirmation samples were within the established range of background radioisotope concentrations.

As the radioactive source at SWMU 60 had been removed and laboratory analytical results from the stockpiled soil characterization samples and the excavation confirmation samples indicated no elevated radioactivity in the soils surrounding the tubes, the decision was made to backfill the excavation with the original soils. A second mobilization was performed to load the overpacked tubes onto a flat-bed trailer for transportation to the U.S. Ecology disposal facility in Richland, Washington. The overpacked tubes were accepted for disposal by U.S. Ecology on October 4, 1996. In addition, the stockpiled soils were returned to the excavation along with 14 cubic yards of additional fill material in order to complete site restoration activities.

1.0 INTRODUCTION

1.1 General

Under a contract with the Air Force Center for Environmental Excellence (AFCEE), Metcalf & Eddy, Inc. (M&E) has been issued a delivery order to remove and dispose of low-level radioactive wastes (LLRW) and affected soils buried at Solid Waste Management Unit 60 (SWMU 60) at the Off-Site Weapons Storage Area of Carswell Air Force Base (AFB) in Fort Worth, Texas. This report documents the field activities performed in order to accomplish the project objective of complete removal of the LLRW and affected soils, if encountered. Figure 1-1 is a location map for Carswell AFB. Figures 1-2 shows the site location for SWMU 60.

1.2 Site Background - SWMU 60

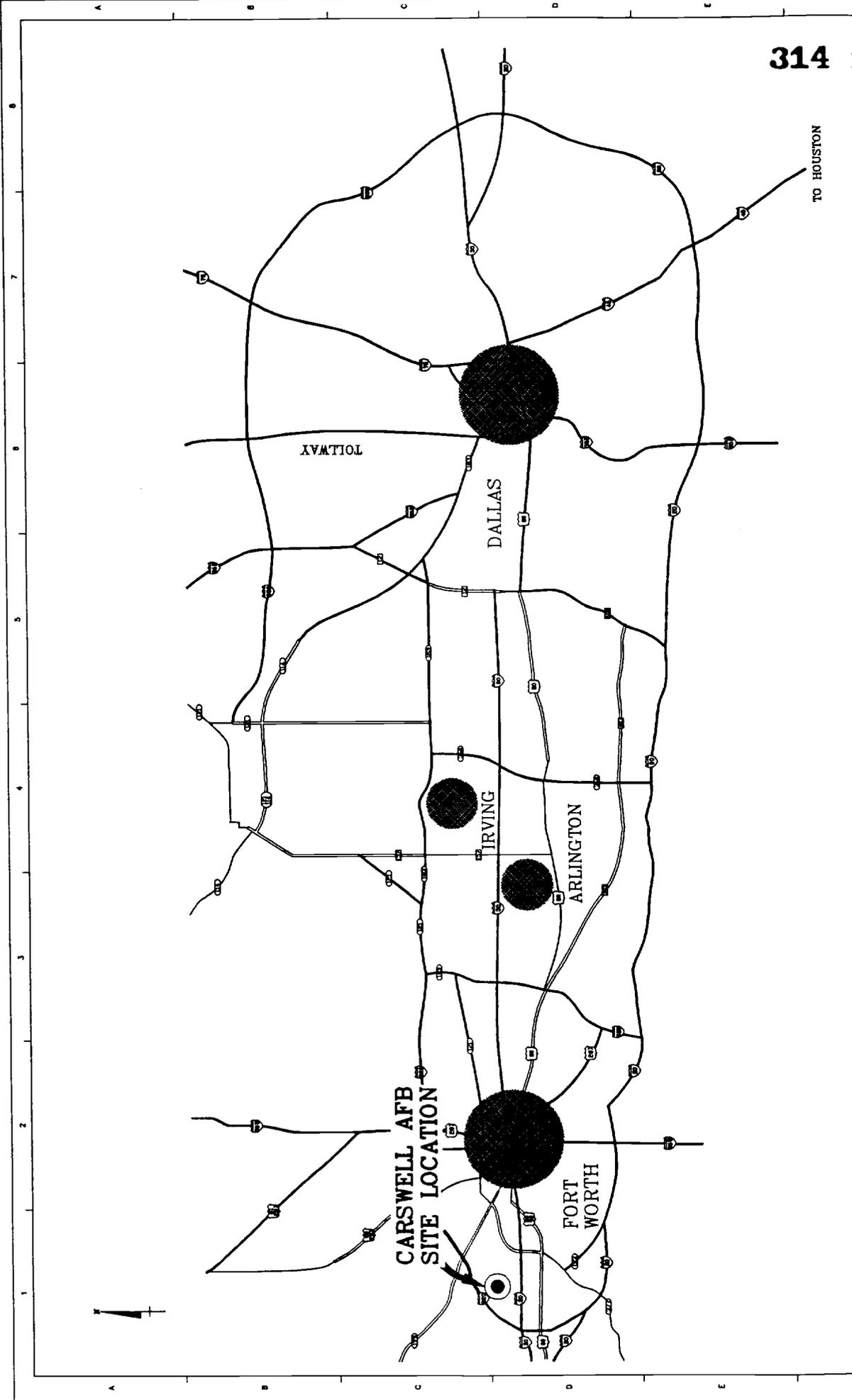
SWMU 60 is located five miles west of Carswell AFB at the Off-Site Weapons Storage Area. A chain-link fence approximately 10 feet by 10 feet encompasses the site which contains three buried tubes. Based upon "as built" drawings supplied by the Air Force, the tubes are constructed of cast iron with a diameter of 12 inches and extend approximately 12 inches above the ground surface. The length of each tube is 18 feet, thus extending approximately 17 feet below the ground surface. The bottom of each tube was sealed with a cast iron plug. At the surface, each tube was closed with a welded steel cap set over the top of the tube. Each tube is surrounded by approximately 3 inches of grout. The LLRW consisting of Radium-painted aircraft instrument dials was disposed of in the tubes according to rules and practices acceptable at the time of construction. Figure 1-3 is a copy of the "as built" drawings provided by the Air Force.

1.3 Purpose And Scope

This Technical Report documents the field activities performed to accomplish the project objective of complete removal of the LLRW material and affected soils, if any, at SWMU 60. It describes the procedures and equipment utilized in the following principal tasks as described in the work plans:

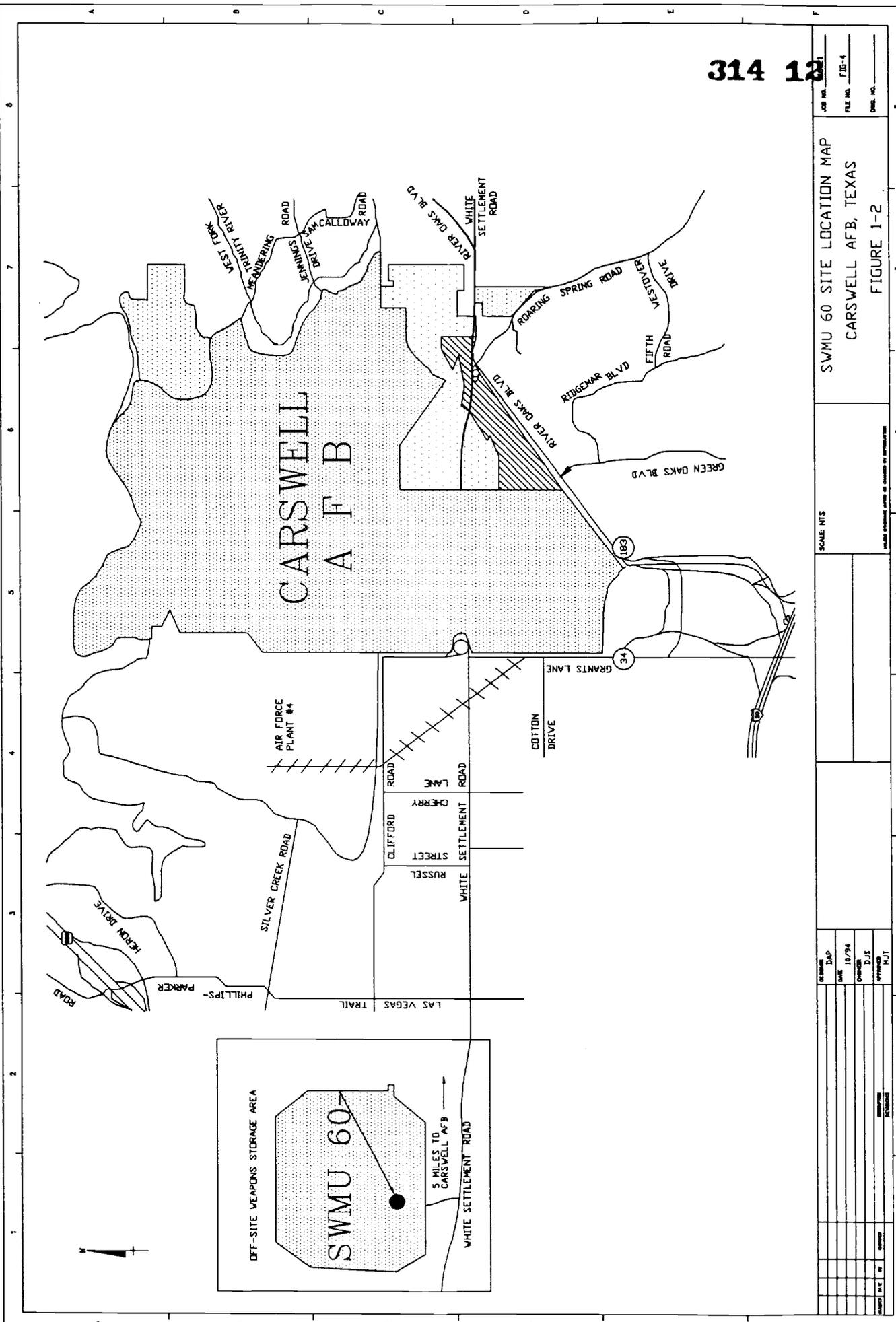
1. Mobilization of personnel, equipment, material, and subcontractors.
2. Preparation of the site.
3. Installation of background soil borings.
4. Performance of interim removal/remedial actions.
5. Management of wastes.
6. Sampling and analysis.
7. Transportation and disposal.
8. Site restoration.
9. Demobilization.
10. Reporting.

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APPROVED		DATE	APPROVED	DATE
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CHECKED		DATE	APPROVED	DATE
DESIGNED		DATE	APPROVED	DATE
PROJECT NO.		SCALE	MADE PROMPTING INFO AS CHECKED BY APPROVING	
		N.T.S.		
LOCATION MAP CARSWELL AFB, TEXAS FIGURE 1-1				
JOB NO. 211		FILE NO.	DATE	

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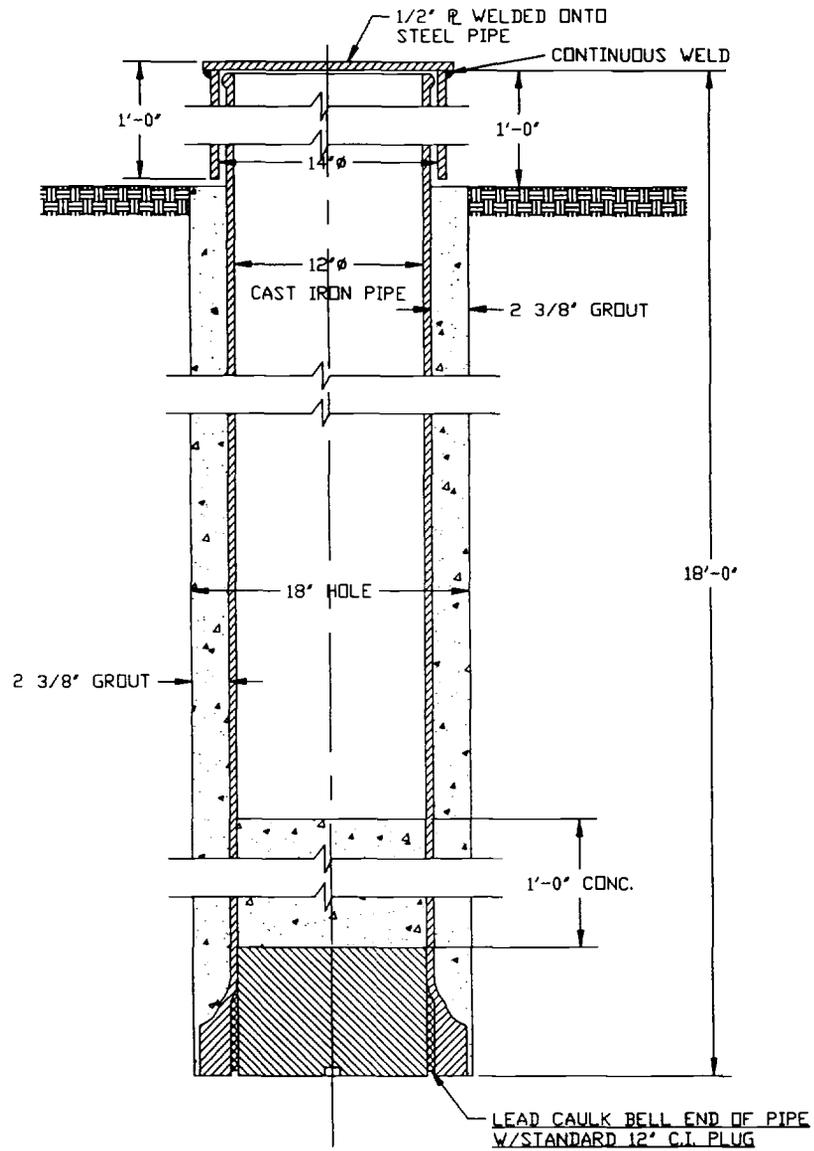


SWMU 60 SITE LOCATION MAP
 CARSWELL AFB, TEXAS
 FIGURE 1-2

SCALE: NTS

DATE	BY	APPROVED
18/94	DJS	JUT
DATE	BY	APPROVED

JOB NO.	FILE NO.	DRW. NO.
	FIG-4	



FILE NO. 08-07-92



METCALF & EDDY

"AS-BUILT" DETAIL OF LLRW
DISPOSAL TUBE
CARSWELL AFB, TEXAS

SCALE: 1" = 1'-0"

DAP

4-18-96

FIGURE 1-3

The work plans for this project included the Health and Safety Plan (HSP), the Remedial Action Plan (RAP), and the Sampling and Analysis Plan (SAP). The HSP covered topics such as personal protective equipment, decontamination, emergency procedures, and other related health and safety issues. The RAP described the waste and soil excavation, transportation and disposal activities. The SAP consists of two sections, the Quality Assurance Project Plan (QAPP) and the Field Sampling Plan (FSP). The SAP described the sampling, analytical, and quality assurance/quality control activities for both the laboratory and the field. These documents were reviewed and approved by the Texas Natural Resource Conservation Commission (TNRCC) prior to the initiation of any field activities.

2.0 REMEDIAL ACTION PLAN TASKS

2.1 Mobilization

Prior to the start of field activities, M&E procured and delivered to the site the materials, equipment, and services required to complete the scope of work. The services included a certified Radiation Safety Officer (RSO) to provide radiation safety training, radiation monitoring and radiation safety oversight for all LLRW removal activities.

This project required two mobilizations to the site. The mobilization of necessary personnel and equipment to Carswell AFB to perform the drilling, excavation, stockpiling, and sampling tasks was completed by June 5, 1996. Following the receipt and evaluation of analytical results, profiling of the wastes and coordination of waste transportation for disposal, a second mobilization to coordinate waste disposal and site restoration was required. The second mobilization occurred on September 29, 1996.

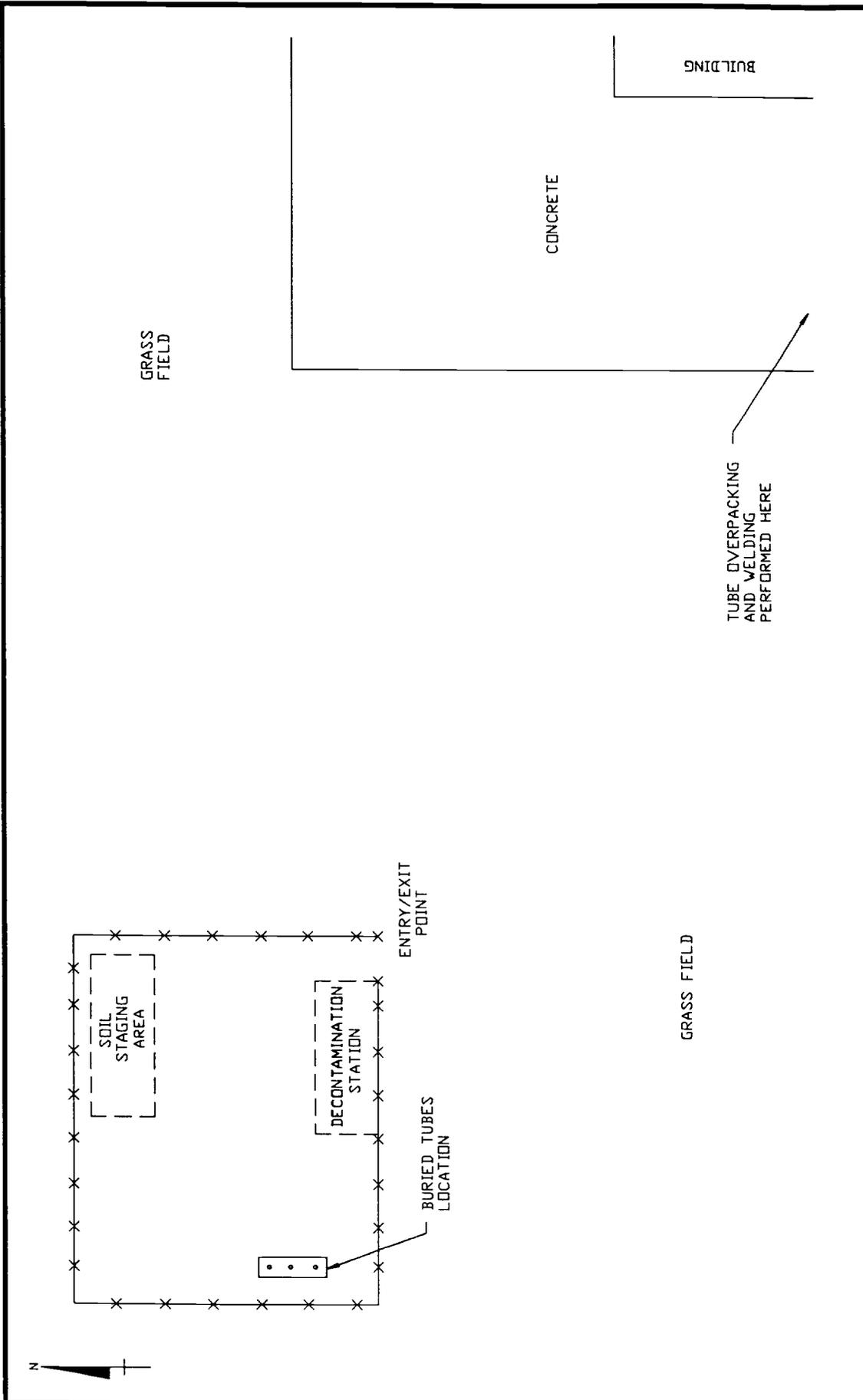
Between the two periods of on-site activity, site control was maintained by existing Air Force security measures. In addition, the excavation was demarcated with orange temporary fencing, caution tape and signs. Engineering controls were utilized on the stockpiled soil to avoid the spread of possible contaminants from the soil staging area.

2.2 Site Preparation

On June 5, 1996, prior to the initiation of remedial activities, a site orientation consisting of a review of the HSP and a site walkthrough was conducted for M&E and subcontractor personnel. In addition, radiation safety training was conducted on-site for field personnel by the designated RSO.

Prior to the initiation of excavation, the locations for temporary construction facilities were selected and each facility was constructed. The temporary facilities included a decontamination station, soil staging area and fencing/barricades required to demarcate and secure the area of excavation/exclusion zone. A plan of SWMU 60 depicting temporary facility locations is provided as Figure 2-1.

In conjunction with site preparation activities, a non-intrusive radiological survey was performed by the RSO at the tubes and the surrounding area to ensure that radioactive materials other than Naturally Occurring Radioactive Material (NORM) were not present. A Ludlum Model 3 Micro R meter with a Ludlum Model 44-2 gamma scintillator (Sodium Iodide probe) was utilized for the survey. This baseline survey established a background level of 10 $\mu\text{R}/\text{hour}$ for SWMU 60 and the maximum value recorded was 12 $\mu\text{R}/\text{hour}$. Field sheets from the non-intrusive (baseline) radiological survey are provided in Appendix A.



PLAN OF SWMU 60 AND
 TEMPORARY FACILITIES
 CARSWELL AFB, TEXAS

SCALE: NONE

11-12-96

DAP

FIGURE 2-1



2.3 Background Soil Boring Installation

On June 10 and 11, 1996, M&E personnel supervised the installation of four (4) soil borings outside the perimeter fence of the off-site weapons storage area. The borings were performed to obtain soil samples for laboratory analysis in order to determine background radioisotope concentrations. The location of each boring was determined after an evaluation of the local geology/soil maps, elevation relative to the buried LLRW, and local site constraints/accessibility. The approximate location of each boring is indicated in Figure 2-2.

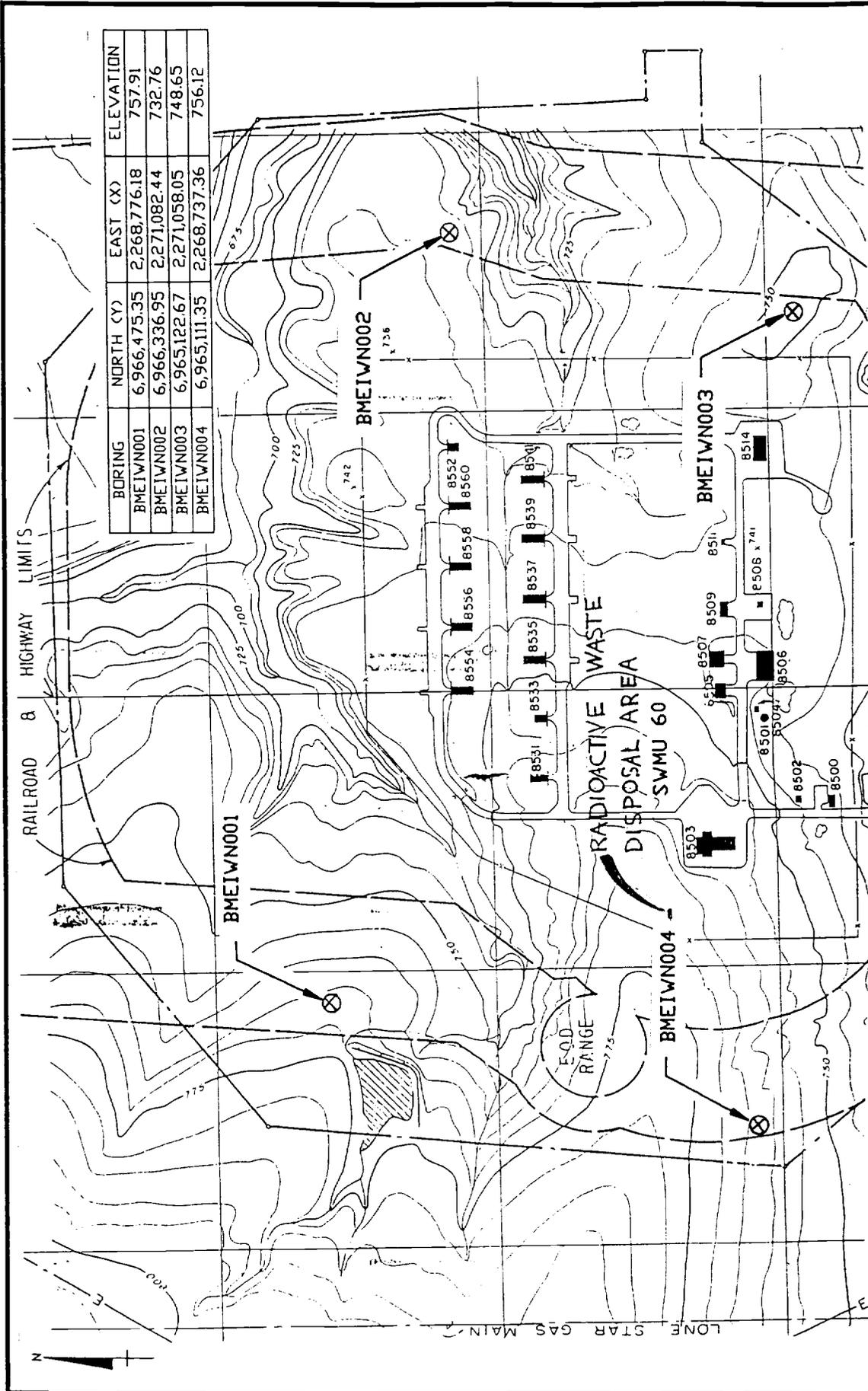
The borings were installed using a drilling rig with decontaminated hollow-stem augers. Surface soil samples at each location were collected with a clean Shelby tube sampler. Due to subsurface geology/conditions, Shelby tube or split spoon samplers could not be advanced for the deeper samples which warranted the use of a different drilling method. Therefore, continuous chip sampling in conjunction with the advancement of solid-stem augers was performed to collect the deeper samples.

Soil samples were collected from the intervals 0-1 feet, 5-6 feet, 11-12 feet, and 17-18 feet below land surface (bls) for a total of sixteen (16) samples. Each sample was logged for geological conditions, field screened for possible contamination using direct reading instruments and packaged for shipment off-site for laboratory analysis by gamma spectroscopy. No radioactivity was detected above background levels during field screening of the samples. Drilling logs for the background soil borings are provided in Appendix B.

Prior to drilling at each location, plastic sheeting was placed beneath the drill rig to contain the soil cuttings and any possible leaks or spills. The soil cuttings generated during drilling were placed in the soil staging/stockpile area. Potentially contaminated disposable items such as used plastic and PPE were separated and placed in plastic-lined drums labeled for temporary storage and later disposal.

Upon completion of each boring, the borehole was properly abandoned with bentonite/cement grout in accordance with state, federal, and Air Force-approved methods. In addition, each boring location was surveyed utilizing GPS technology to provide State Plane Coordinates and Mean Sea Level elevations. The survey data for the boring locations are provided in tabular form on Figure 2-2.

A Background Soil Summary Letter Report was issued to the Air Force on August 1, 1996. This report presented and compared all field screening results recorded and the laboratory analytical results for all samples collected for this project. A copy of this letter report is provided as Appendix C.



BACKGROUND SOIL BORING LOCATIONS
 CARSWELL AFB, TEXAS

M&E Metcalf & Eddy

SCALE: NONE 4-17-96 DAP FIGURE 2-2

2.4 Interim Removal/Remedial Actions

On June 6, 1996, following the non-intrusive radiological survey performed the day before, excavation was initiated with the intent of removing only those soils necessary to facilitate tube removal. A Caterpillar backhoe/loader was utilized initially to excavate soil from around the tubes. Due to several layers of hard material in the subsurface, the backhoe bucket was frequently exchanged for a hydraulic hammer to break up the rock prior to lifting it out of the excavation. All equipment and personnel were screened for radioactivity prior to initiating excavation activities and prior to each exit from the exclusion zone. Initially, all personnel entering the exclusion zone wore Modified Level D Personal Protective Equipment (PPE) as outlined in the HSP. Due to the threat of heat stress, the use of Tyvek suits with taped sleeve and leg openings was later discontinued.

Excavation was continued to a depth of approximately 16 feet bls. As no movement of the tubes had been observed at this point, a trackhoe excavator was procured in order to extend the excavation deeper. Another 2 feet of soil were removed by the excavator, extending the excavation to approximately 18 feet bls. This completely exposed the tubes and caused one tube to list slightly to one side. The three tubes were removed from the excavation using nylon slings and laid in the exclusion zone for radiological screening. The excavation and removal of the tubes was performed with care to avoid damage to the tubes thereby reducing the potential for release of their contents, and to ensure that the steel cap set on each tube remained in place.

All soils excavated during the tube removal process were considered potentially hazardous and were placed in the soil staging area for sampling and temporary storage while awaiting the receipt and review of analytical results. Approximately 170 cubic yards of soil were removed and staged at SWMU 60. Photographs documenting site activities are provided in Appendix D.

2.5 Waste Management

The Waste Management actions presented in this section describe procedures which were implemented for waste generation, handling, and temporary storage during the remedial activities at SWMU 60.

2.5.1 Soil and Tube Staging Area

Excavated soil and overpacked tubes remained stockpiled in the exclusion zone at the site until characterization results on the soil and other potentially hazardous materials were received and reviewed. Stockpiled soil and other excavated materials were placed on the floor of the staging area which was double-lined with 6-mil plastic sheeting. Berms constructed of large diameter PVC piping were placed along the perimeter of the soil staging area. The plastic sheeting was wrapped over and tucked under these pipe berms. The stockpiled material was then covered with polyethylene sheeting which was secured to prevent damage from adverse weather. These

engineering controls were put in place to control run-on and run-off of precipitation and to prevent stockpiled material from spreading beyond the controlled area. The final dimensions of the staging area were approximately 20 feet by 30 feet and contained approximately 170 cubic yards of excavated soil and associated materials.

Samples were collected from the stockpiled soils and shipped to Mountain States Analytical for characterization in accordance with the permit requirements of Envirocare, Inc., the proposed disposal facility. The characterization results were intended for use in developing waste profiles for the materials proposed to be disposed of at the Envirocare facility.

In preparation for the waiting period prior to disposal of the soil and associated material, the orange temporary fence was left intact with signs reading "Authorized Personnel Only." In addition, yellow caution tape was placed around the excavation.

2.5.2 Waste Minimization

All site activities were planned and performed in a manner that minimized the generation of waste during the remedial action at SWMU 60. The practices followed included: segregation of sanitary waste from potentially contaminated materials; performance of decontamination techniques designed to avoid the generation of radioactive or hazardous liquid materials and minimize the volume of liquid waste generated; and re-use of disposable equipment, if possible. The segregation of materials based on field screening and field analysis would have been practiced, but was not applicable for this remedial action as radioactivity was not detected above background levels on any material except the tubes themselves.

2.5.3 Field Screening and Packaging

Field screening of all derived wastes was performed by the RSO for the presence of gross alpha and beta/gamma activity. Radioactivity was not detected above background levels on any material except the tubes.

Personnel and equipment exiting the work area/exclusion zone were screened for radioactivity. A background level of 100 counts per minute (cpm) had been established during the site preparation phase. No radioactivity was detected above the established background level throughout personnel/equipment "frisking" procedures. Following the completion of each activity within the exclusion zone, used PPE and other disposables were placed into sealable plastic bags; labeled with the location, date, and screening information; and placed in a lined drum.

Throughout excavation activities, the excavation and excavated/stockpiled soils were screened for radioactivity. No radioactivity was detected in the soil above two times the 10 μ R/hour background level established for field screening purposes. As discussed in Section 2.5.1, soil cuttings were placed on and under plastic sheeting within the staging area.

Upon removal from the excavation, the RSO inspected the outside of the tubes for holes and leaks and screened the outside of the tubes for radioactivity and organic vapors. The tubes were screened for radioactivity with a Ludlum Model 3 Micro R meter utilizing a Ludlum Model 44-2 gamma scintillator. Background levels (10 to 12 $\mu\text{R}/\text{hour}$) were recorded at both ends of each tube until reaching the area approximately 4 to 6 feet from the bottom of each tube. In this area, radioactivity was detected at 600 $\mu\text{R}/\text{hour}$ from the tube originally buried on the north end of the line of three tubes (north tube). Elevated levels of radioactivity were detected at the same location on the other two tubes: 25 $\mu\text{R}/\text{hour}$ from the center tube and 120 $\mu\text{R}/\text{hour}$ from the south tube. Soil and grout were removed from the exterior of the tubes approximately 4 to 6 feet from the bottom of each tube for radiological screening to be performed in an isolated area away from the tubes. These soils exhibited only background levels of radioactivity when isolated from the tubes which indicated that the soil and material immediately outside the tubes had not been affected by the storage of LLRW inside the tubes. The levels of radioactivity detected did not require an upgrade in PPE or a change in the proposed procedures for handling the tubes.

The tubes were packaged in 24-inch diameter steel overpack containers with welded end caps for shipment to U.S. Ecology for proper disposal. In accordance with the "Hot Work" permit obtained for welding the overpack end caps, the tubes had to be moved to the nearest concrete surface which was approximately 50 yards away. Once the tubes were slid into the overpack containers and the end caps were welded, the RSO re-screened the outside of the overpack containers. Only background levels of radioactivity (10 $\mu\text{R}/\text{hour}$) were detected from the outside of the overpacked center tube while 80 $\mu\text{R}/\text{hour}$ were detected from the outside of the overpacked north and south tubes. The overpacked tubes were returned to the exclusion zone and labeled with Department of Transportation (DOT) labels indicating the following data:

Contents: "Radium 226 painted luminous aircraft dials"

Activity: Radioactivity in $\mu\text{R}/\text{hour}$

Date: "6/12/96"

Address: "Carswell AFB, Fort Worth, TX"

Pipe Designation: 001 (north tube), 002 (center tube) or 003 (south tube)

2.5.4 Reusing Disposable Equipment

As part of the Spill Prevention, Control and Countermeasures Implementation Plan, plastic sheeting was placed beneath the drill rig at each borehole location to contain possible equipment leaks or fuel spills. This sheeting extended into the driller work area and was used as temporary containment of soil cuttings prior to delivering the cuttings to the soil staging area inside the exclusion zone. Sheeting was reused where possible to minimize the amount of waste plastic generated at the site. At the end of drilling operations, plastic sheeting was placed in a plastic bag, sealed, labeled, and placed in a lined drum dedicated to suspected contaminated material.

2.5.5 Material and Waste Handling

This section presents the types and quantities of investigation-derived materials that were generated; procedures for drum labeling, transport, and temporary storage; and characterization procedures for investigation-derived materials.

The types of materials generated during investigation activities at SWMU 60 included both solid and liquid materials. Solid materials generated included drill cuttings, used PPE (gloves, Tyvek coveralls, ear plugs, etc.), other disposable items (i.e. swipes, plastic baggies, paper, etc.), and non-hazardous and exempt sanitary waste generated in the support zone. Liquids generated included rinsate from decontamination of sampling equipment, drill rig, augers and other down-hole tools and sampling equipment wash and rinse water including potable water with Liquinox/Alconox™ cleaning solution and possibly de-ionized water containing traces of methanol.

All solid and liquid materials generated during the site investigation were segregated according to type of material and placed into DOT-approved 55-gallon capacity drums except drill cuttings which were placed in the soil staging area. The drums containing solid wastes were lined with 4-mil plastic 55-gallon capacity bags which were sealed and labeled following the completion of specific activities. All empty drums stored on-site were labeled as "Empty." The drums containing waste materials were labeled immediately upon placement of material in the container, as follows:

"Carswell Air Force Base Environmental Restoration Program"

"SWMU 60"

Generation date

The specific type of material in the drum

An additional set of labels were attached to the drum in a clear, waterproof, sealable pouch. The following information was printed in bold letters and placed inside the pouch:

PENDING ANALYSIS

for additional information call:

Alan Flolo

Air Force Base Closure Authority

(817) 731-8973

A total of three 55-gallon capacity steel drums of potentially hazardous waste were generated during remedial activities at SWMU 60. One drum contained solid waste comprised generally of used PPE and plastic sheeting and other disposables generated inside the exclusion zone. Two drums contained liquids generated during the decontamination of drilling augers and other down-hole tools.

2.6 Sampling and Analysis

As described in Section 2.3, soil samples were collected from four soil borings performed on June 10 and 11, 1996, to establish background radioisotope concentrations at the Off-Site Weapons Storage Area of Carswell AFB. The samples were screened in the field for radioactivity and with a photo-ionization detector for volatile organic compound emissions. The same samples were then submitted for laboratory radiological analysis by gamma spectroscopy. A summary of background soil sample field screening results are presented in Table 1 and background soil sample laboratory analytical results are presented in Table 2. The laboratory analytical report is provided in Appendix E.

The laboratory analytical results from the soil samples collected from the four boring locations were used to establish background radioisotope concentrations. The Upper Tolerance Limit (UTL) for Radium-226 was calculated to be 0.89 pCi/gm. The calculations are contained in the letter report provided in Appendix C.

On June 11, 1996, confirmation soil samples were collected from the sidewalls and floor of the excavation by a third party sampling company to comply with Nuclear Regulatory Commission (NRC) guidelines. Figure 2-3 depicts soil confirmation sampling locations. These samples were screened in the field for radioactivity and then submitted for laboratory analysis by gamma spectroscopy. No radioactivity was detected on any of these soil samples when screened in the field. Laboratory analytical results indicated that only one sample, collected from the south wall of the excavation, was above the established UTL for Radium-226. A Radium-226 value of 1.03 pCi/gm was detected in this sample. Statistical procedures recommended by TNRCC were utilized to determine that although the UTL was exceeded by the sample, the value detected was still within the range of background concentrations noted for SWMU 60 (See Section 2.10.1). Table 3 provides the analytical results for the confirmation soil samples. The laboratory analytical report is provided in Appendix E.

On June 12, 1996, characterization samples were collected from the soil stockpiled in the staging area. These samples were submitted for laboratory radiological analysis and selected organics and metals analyses. Laboratory analytical results indicated that all soil characterization samples were below the established UTL for Radium-226 and therefore were within the established site-specific background levels. Analytical results of the selected organics and metals analyses indicate that the tested parameters were either not detected or within acceptable concentrations. Table 4 provides the analytical results for the soil characterization samples. The laboratory analytical report is provided in Appendix E.

2.7 Transportation and Disposal

As no radioactivity was detected above the established background levels by laboratory analysis of soil samples or by field screening procedures for any other generated waste, the only items transported from SWMU 60 were the overpacked tubes.

**SUMMARY OF BACKGROUND SOIL SAMPLE FIELD SCREENING RESULTS
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS**

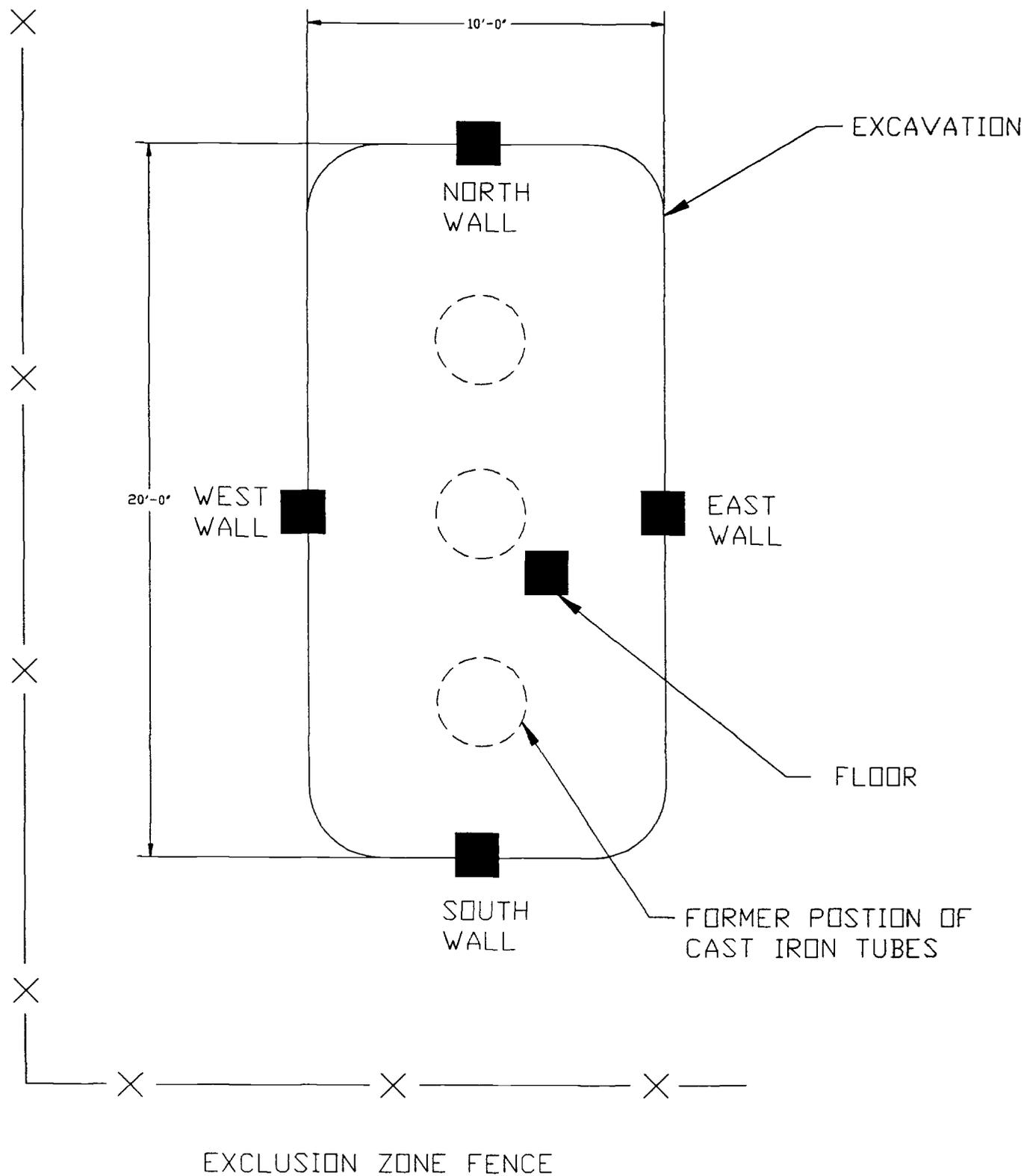
Sample I.D.	Sample Date	Depth	Ludlum Model 3 & 44-9 (cpm)	Ludlum Model 2200 (pCi/g)	Photo-ionization Detector (ppm)
Background:					
BMEIWN001					
000010	06/10/96	0' to 1'	0.3	3.21	0
050060	06/10/96	5' to 6'	0.3	0.59	0
110120	06/10/96	11' to 12'	0.3	1.88	0
170180	06/10/96	17' to 18'	0.3	2.83	0
BMEIWN002					
000010	06/10/96	0' to 1'	0.3	0.97	0
050060	06/10/96	5' to 6'	0.3	1.42	0
110120	06/10/96	11' to 12'	0.3	0.74	0
170180	06/10/96	17' to 18'	0.3	2.57	0
BMEIWN003					
000010	06/10/96	0' to 1'	0.3	0.75	0
050060	06/10/96	5' to 6'	0.3	1.15	0
110120	06/10/96	11' to 12'	0.3	2.3	0
170180	06/10/96	17' to 18'	0.3	1.32	0
BMEIWN004					
000010	06/11/96	0' to 1'	0.3	1.14	0
050060	06/11/96	5' to 6'	0.3	0.25	0
110120	06/11/96	11' to 12'	0.3	1.33	2
170180	06/11/96	17' to 18'	0.3	0.08	0
Excavation Confirmation:					
North Wall	06/11/96	10' to 12'	0.3	NA	0
South Wall	06/11/96	10' to 12'	0.3	NA	0
East Wall	06/11/96	10' to 12'	0.3	NA	0
West Wall	06/11/96	10' to 12'	0.3	NA	0
Floor	06/11/96	18' to 19'	0.3	NA	0
Notes: NA = Not Analyzed					

TABLE 2

**SUMMARY OF BACKGROUND SOIL SAMPLE ANALYTICAL RESULTS
 SWMU 60: OFF-SITE WEAPONS STORAGE AREA
 CARSWELL AFB, FT. WORTH, TEXAS**

Sample I.D.	Sample Date	Depth	Radionuclide Concentration (pCi/g)				Activity Radium 226	Uncertainty (95% confidence level)	MDA	
			Activity Bismuth 214	Uncertainty (95% confidence level)	MDA	Activity Lead 214				Uncertainty (95% confidence level)
BMEIWN001										
000010	06/10/96	0' to 1'	0.7		0.09	0.29		0.11	0.49	0.1
050060	06/10/96	5' to 6'	0.48		0.13	0.46		0.12	0.47	0.12
110120	06/10/96	11' to 12'	0.81		0.09	0.66		0.1	0.73	0.1
170180	06/10/96	17' to 18'	0.79		0.12	0.85		0.13	0.82	0.12
BMEIWN002										
000010	06/10/96	0' to 1'	0.8		0.11	0.72		0.11	0.76	0.11
050060	06/10/96	5' to 6'	0.87		0.09	0.7		0.09	0.78	0.09
110120	06/10/96	11' to 12'	0.77		0.08	0.76		0.08	0.76	0.08
170180	06/10/96	17' to 18'	0.7		0.06	0.82		0.08	0.76	0.07
BMEIWN003										
000010	06/10/96	0' to 1'	0.92		0.11	0.96		0.12	0.94	0.11
050060	06/10/96	5' to 6'	0.4		0.11	0.37		0.1	0.39	0.11
110120	06/10/96	11' to 12'	0.85		0.18	0.94		0.18	0.9	0.18
170180	06/10/96	17' to 18'	0.86		0.09	0.95		0.09	0.9	0.09
BMEIWN004										
000010	06/11/96	0' to 1'	1.24		0.13	1.29		0.14	1.27	0.13
050060	06/11/96	5' to 6'	0.67		0.08	0.62		0.09	0.64	0.08
110120	06/11/96	11' to 12'	1.26		0.1	1.22		0.12	1.24	0.11
170180	06/11/96	17' to 18'	0.67		0.06	0.66		0.07	0.67	0.07
Rinsate #1	06/10/96		NA			NA			22.8	18.4
Rinsate #2	06/10/96		NA			NA			-15.1	15.2

Notes:
 NA = Not Analyzed
 All soil analytical results in pCi/g
 All rinsate analytical results in pCi/l



STMA - 08-07-92



SOIL CONFIRMATION SAMPLING LOCATIONS
CARSWELL AFB, TEXAS

SCALE: NONE	DAP	4-18-96	FIGURE 2-3
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TABLE 3

**SUMMARY OF SOIL CONFIRMATION SAMPLE ANALYTICAL RESULTS
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS**

Sample I.D.	Sample Date	Depth	Bismuth 214	Lead 214	Radium 226
North wall	06/11/96	10' to 12'	0.67	0.62	0.64
North wall Dup	06/11/96	10' to 12'	0.64	0.59	0.62
South wall	06/11/96	10' to 12'	0.69	1.18	1.03
East wall	06/11/96	10' to 12'	0.59	0.44	0.52
West wall	06/11/96	10' to 12'	0.59	0.76	0.68
Floor	06/11/96	18' to 19'	0.67	0.73	0.7
Rinsate #3	06/11/96		NA	NA	-5.4

Notes:
NA = Not Analyzed
All soil analytical results in pCi/g
All rinsate analytical results in pCi/l

TABLE 4

314 27

**SUMMARY OF SOIL CHARACTERIZATION SAMPLE ANALYTICAL RESULTS
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS**

Sample I.D. Date Sampled	SMEISS001 06/12/96	SMEISS002 06/12/96	SMEISS003 06/12/96	SMEISS004 06/12/96
Gamma Spectroscopy				
Bismuth - 214 (pCi/g)	0.74	0.77	0.64	0.76
Lead - 214 (pCi/g)	0.71	0.42	0.86	0.74
Radium - 226 (pCi/g)	0.72	0.59	0.75	0.75
TCLP				
Volatiles:				
Benzene	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
2-Butanone (MEK)	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Semi-volatiles:				
2,4-Dinitrotoluene	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Hexachloro-1,3-butadiene	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND
2-Methylphenol (o-Cresol)	ND	ND	ND	ND
3 and 4-Methylphenol (m+p cresol)	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
Pesticides:				
Chlordane	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Herbicides:				
2,4-D (ug/l)	ND	ND	ND	ND
2,4,5-TP (Silvex) (ug/l)	ND	ND	ND	ND
Metals:				
Arsenic	ND	ND	ND	ND
Barium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Lead	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Miscellaneous:				
Cyanide (mg/kg)	ND	0.1	0.1	0.1
Amenable cyanide (mg/kg)	ND	ND	ND	ND
Reactivity - cyanide (mg/kg)	ND	ND	ND	ND
Reactivity - sulphide (mg/kg)	ND	ND	ND	ND
Total Organic Halogen (mg/kg)	ND	ND	ND	ND
pH at 5 minutes (SU)	7.95	7.84	8.23	7.87
pH at 30 minutes (SU)	7.97	7.74	7.99	7.78
Note: ND: Not Detected All analytical results in mg/l unless otherwise noted. Soil Proctor Test results = 12.4%				
Sample Description: SMEISS001: Outside the NW corner of the perimeter fence SMEISS002: Outside the NE corner of the perimeter fence SMEISS003: Outside the SE corner of the perimeter fence SMEISS004: Outside the SW corner of the perimeter fence				

On October 1, 1996, the overpacked tubes containing LLRW materials were loaded onto a truck for transportation to U.S. Ecology's facility for proper disposal. The overpacked tubes were manifested and transported from the site as conforming to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package - instruments or articles, 7, UN2910. The overpacked tubes were accepted for disposal by U.S. Ecology on October 4, 1996. Transportation and disposal documentation is provided in Appendix F.

2.8 Site Restoration

Following the review of the laboratory analytical results for the soil and excavation confirmation samples by M&E, the AFCEE representative and the U.S. Air Force Radioisotope Committee, the decision was made to backfill the excavation with the original material. Because no radioactivity was detected in any sample above two times the established background level, the decision was approved by the TNRCC.

On September 30, 1996, M&E and subcontracted personnel returned to SWMU 60 to perform site restoration activities. The excavated soil was returned to the excavation. Approximately 14 cubic yards of additional fill material was used to level the excavation and restore the surface of the site to conditions approximating the surrounding area. Materials used to construct temporary facilities such as fencing, plastic sheeting, PVC pipes, etc., were removed from the site for disposal as construction debris. Drummed materials were also disposed of as non-hazardous sanitary waste.

2.9 Demobilization

Two demobilizations were performed for the remedial actions at SWMU 60. On June 12, 1996, M&E demobilized equipment and subcontracted personnel from Carswell AFB after completing excavation, drilling, stockpiling, and sampling activities. No further on-site activities occurred until September 30, 1996, when the tubes were loaded for transportation to the disposal facility and site restoration activities were begun. Upon completion of site restoration activities, the following demobilization tasks were implemented in conjunction with site restoration activities and were completed on October 1, 1996:

1. Removal of temporary construction facilities;
2. Final clean up;
3. Final walkthrough with AFBCA representative; and
4. Demobilization of M&E/subcontracted personnel and equipment.

2.10 Reporting

2.10.1 Background Soil Summary Letter Report

A Background Soil Summary Letter Report was issued to the Air Force on August 1, 1996. This report presented and compared all field screening results recorded and the laboratory analytical results for the samples collected for this project. The report also contained the statistical methods used to determine the range of naturally occurring isotopes near SWMU 60. The report concluded with a recommendation that the excavated soil be returned to the excavation as backfill. A copy of this report is provided as Appendix C.

On August 9, 1996, the TNRCC issued a response to the Background Soil Summary Letter Report approving the return of excavated soils to the excavation. Their letter also indicated that because one soil confirmation sample contained Radium-226 at a concentration above the calculated UTL, SWMU 60 could be closed under Risk Reduction Standard (RRS) No.2. A copy of the TNRCC letter is provided in Appendix G.

On September 24, 1996, a second letter report was submitted to the TNRCC to demonstrate that SWMU 60 could be closed under RRS No.1 (closure to background levels) in accordance with Subchapter S of 30 Texas Administrative Code (TAC) 335. Statistical procedures recommended by TNRCC were utilized to determine that although the UTL was exceeded by the one sample, the value detected was still within the range of background concentrations noted for SWMU 60. A copy of this letter report is included in Appendix G.

The TNRCC issued an approval for closure of SWMU 60 under RRS No.1 on November 5, 1996. A copy of this approval letter is included in Appendix G.

2.10.2 Final Report

This Technical Report represents the Final Report documenting all site activities performed as required by the work plans. A Statement of Basis/Final Decision document was prepared for SWMU 60 and is provided as Appendix H.

3.0 CONCLUSIONS

Prior to the initiation of tube excavation at SWMU 60, a non-intrusive radiological survey was performed at SWMU 60 to ensure that radioactive materials other than NORM were not present and to establish a background level for field screening purposes. During the survey, no radioactivity above two times the established background level was detected in the vicinity of the tubes.

Four soil borings were performed outside the perimeter fence of the Off-Site Weapons Storage Area to collect soil samples for laboratory analysis to establish soil background concentrations for naturally occurring radioisotopes.

The tubes were excavated and screened for radioactivity. Radioactivity was detected (25, 120 and 600 $\mu\text{R}/\text{hour}$) at a point approximately 4 to 6 feet from the bottom of each tube. No radioactivity above two times background levels were detected from the soil and grout immediately surrounding the tubes when scraped and isolated from the tube. This indicates that the surrounding soils were unaffected by the underground storage of LLRW at SWMU 60. The levels of radioactivity detected did not require an upgrade in Personal Protective Equipment (PPE) or a change in the proposed procedures for handling the tubes.

Throughout excavation activities, the excavation and excavated/stockpiled soils were screened for radioactivity. No radioactivity was detected in the soil above two times the background level established for field screening purposes. In addition, all personnel and equipment exiting the work area/exclusion zone were screened for radioactivity. A background level of 100 counts per minute (cpm) had been established during the site preparation phase. No radioactivity was detected above the established background level throughout personnel/equipment "frisking" procedures.

The tubes containing LLRW were overpacked in steel containers and labeled with DOT labels for radioactive materials. Radioactivity was detected outside the overpack containers at concentrations of 10, 80 and 80 $\mu\text{R}/\text{hour}$. These levels of radioactivity detected were well within the acceptable range for transportation of the LLRW as manifested.

Samples were collected from the stockpiled soil for laboratory analysis for radioactive, organic and metals characterization. Laboratory analytical results indicated that the radioisotope concentrations detected in these samples were within the established site-specific range of background concentrations. Also, no organic or metals concentration above acceptable limits were detected in these samples. In addition, confirmation soil samples were collected from the sidewalls and floor of the excavation for laboratory analysis by gamma spectroscopy only. The radioisotope concentrations detected in these samples were within the established range of background concentrations.

As the radioactive source at SWMU 60 had been removed and laboratory analytical results from the stockpiled soil characterization samples and the excavation confirmation samples indicated no elevated radioactivity in the soils surrounding the tubes, the decision was made to backfill the excavation with the original soils. A second mobilization was performed to load the overpacked tubes onto a flat-bed trailer for transportation to the U.S. Ecology disposal facility in Richland, Washington. In addition, the stockpiled soils were returned to the excavation along with some additional fill material in order to complete site restoration activities.

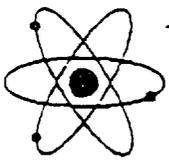
Based upon the information provided in this document, no further remedial action is required at SWMU 60 in regards to the buried tubes containing LLRW and the site will be closed in accordance with RRS No.1.

TAB

APPENDIX A

APPENDIX A

NON-INTRUSIVE RADIOLOGICAL SURVEY FIELD SHEETS

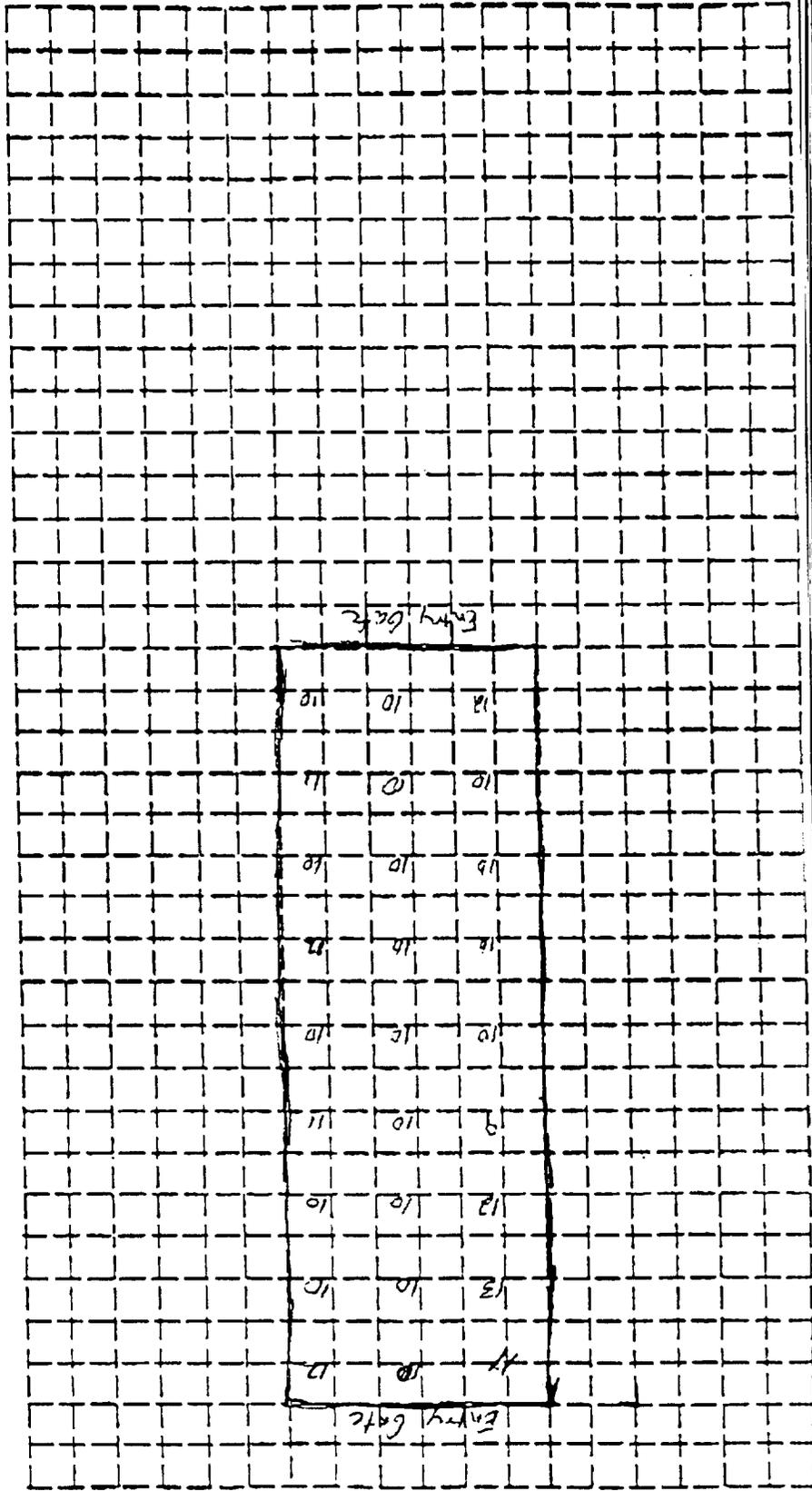


Source Environmental Services, Inc.

Site Survey

CLIENT: McCall & Eady DATE: 6-5-96
 LOCATION: Covsperl Air Force Base (Building) REMARKS: Storage of Equipment

Backgr = 10-df



314 36

TITLE: Lesson Subject: Physical
 SURVEYOR: Carl Bernhardt Benjamin Weber TIME: 10:30
 DATE: 6-5-96 SERIAL #: 13762
 INST. TYPE: Cushman 3 SIGNATURE: [Signature]
 # 's are in uR/hr - appx. 3m x 9m

CAL. DUE DATE: 7-22-96

TAB

APPENDIX B

APPENDIX B

BACKGROUND SOIL BORING DRILLING LOGS

SOIL BORING LOG

BMEIWN 314 39
001

PROJECT No.: 016021

BORING No.:

LOGGED BY:

DAW PHILLIPS / M+E

PROJECT NAME:

CARSWELL AFB - SWMU 60 - URW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA

FIELD LOCATION:

Outside NW corner of perimeter fence

SURFACE ELEV.:

DRILLER: TOM McCullough / PSI

DATE START: 6.10.96 - 1500

FINISH: 6.10.96 - 1700

DEPTH (FT)	SAMPLE				OVA READINGS			REC NO	USCS SOIL TYPE	W PP	L D A E Y P E S T R H	SOIL DESCRIPTION AND REMARKS
	No.	TYPE	FROM	TO								
0	1	Shelby	0	1	0	0	0		CLAY FINES			Dark brown clayey soils to 1.5 feet BLS
5	2	S-spm	5	6	0	0	0		CLAY FINES			Olive green to rust brown tight clay w/some white cherty limestone
10	3	Cuttings	11	12	0	0	0		FINES			Same as above Gray limestone encountered @ 12 feet BLS
15												Very hard @ 16 to 16.5 feet BLS
20	4	Cuttings	17	18	0	0	0		FINES			Gray limestone w/ gray clay seams Boring completed @ 18 feet BLS
25												
30												
35												
40												

SOIL BORING LOG

314 40

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEIWN 002
DAN PHILLIPS / MTE

PROJECT NAME: CARSWELL AFB - SWMU 60 - LLRW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA -

BORING LOCATION: Outside NE corner of perimeter fence

SURFACE ELEV.: _____

DRILLER: Tom McCullough / PSI

DATE START: 6.10.96 - 1100

FINISH: 6.10.96 - 1315

DEPTH (FT)	SAMPLE			OVA READINGS			REC NO	USCS SOIL TYPE	Wt % PP	L O A Y P E T A H	SOIL DESCRIPTION AND REMARKS	
	No.	TYPE	INTERVAL (FT)		Min	Max						WA
			FROM	TO								
0	1	Shelby	0	1	0	0	0				Dark brown clayey soils @ surface to 4 inches, then fractured limestone w/ seams of clay.	
5	2	S-Spoon	5	6	0	0	0				light brown chalky/silty clays - dry & not plastic. Gray limestone encountered @ 6 feet below surface. limestone w/ seams of gray clay.	
10	3	Cuttings	11	12	0	0	0				light gray limestone w/ clays	
15	4	Cuttings	17	18	0	0	0				light gray limestone w/ clays	
20											Boring completed @ 18 feet BLS	
25												
30												
35												
40												

Page: 1 of 2
PP: Pocket penetrometer reading
WA: OVA readings in the working area

SOIL BORING LOG

PROJECT No.: 016021

BORING No.:

314 41
DMEI WNT 053

LOGGED BY:

DAN PHILLIPS / MTE

PROJECT NAME: CARSWELL AFB - SWM 60 - LLRW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA

LOCATION: Outside SE corner of perimeter fence SURFACE ELEV.:

DRILLER: TOM MCCUNOUGH / PSI DATE START: 6.10.96 - 1400 1315 FINISH: 6.10.96 - 1315 1500

DEPTH H	SAMPLE				OVA READINGS			REC DN	USCS SOIL TYPE	W SP	L O A D Y P E T R H	SOIL DESCRIPTION AND REMARKS
	No.	TYPE	INTERVAL (FT)		Min	Max	WA					
			FROM	TO								
0	1	Shelby	0	1	0	0	0		CLAY FINES			Olive green to rust brown tight clays w/ some white chert.
5	2	S-spon	5	6	0	0	0		CLAY FINES			olive green to rust brown clays - tight continues to approx. 11 feet BLS
10	3	Cuttings	11	12	0	0	0		FINES			Tan limestone - hard - w/ some tan clays
15	4	Cuttings	17	18	0	0	0		FINES			Tan limestone continued to 18 feet BLS Boring completed @ 18 feet BLS
20												
25												
30												
35												
40												

SOIL BORING LOG

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEI ~~324~~ 42

DAN PHILLIPS / MTE

TEST NAME:

CARSWELL AFB - SWMU 60 - LLRW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA

LOCATION:

outside SW corner of perimeter fence

SURFACE ELEV.:

DRILLER: Tom McCullough / PSI

DATE START: 6.10.96 - 0730

FINISH: 6.11.96 - 0900

DEPTH FT	SAMPLE			OVA READINGS			REC ON	USCS SOIL TYPE	W %	L D A E Y P E T R H	SOIL DESCRIPTION AND REMARKS	
	No.	TYPE	INTERVAL (FT)		Min	Max						WA
			FROM	TO								
0	1	Shells	0	1	0	0	0				dark brown clayey soils with evidence of limestone @ 1.5 feet BLS	
5	2	S-spoon	5	6	0	0	0				white cherty limestone w/ tan clays light brown silty limestone w/ clay seams	
10	3	Cuttings	11	12	0	2	0				Tan limestone encountered @ 12 feet BLS - Hard! Gray limestone encountered @ 15 feet BLS	
15	4	Cuttings	17	18	0	0	0				Boring completed @ 18 feet BLS	
20												
25												
30												
35												
40												

TAB

APPENDIX C

APPENDIX C

BACKGROUND SOIL SUMMARY LETTER REPORT



August 1, 1996

016021-1357

Mr. Charles A. Rice
HQ AFCEE/ERB
3207 North Road, Bldg 532
Brooks Air Force Base, Texas 78235-5363

Reference: Prime Contract Number F41624-92-D-8002
Delivery Order 001201
Carswell Air Force Base
Fort Worth, Texas

Subject: Background Soil Summary Letter Report and Comparison of Characterization and Confirmation Sample Analytical Results to Background Conditions
SWMU No. 60 - Low Level Radioactive Waste Burial Site
Off-Site Weapons Storage Area
CDRL A008AC

Dear Mr. Rice:

This letter is intended as the Background Soil Summary Letter Report for the low level radioactive waste (LLRW) removal project at Carswell Air Force Base, Fort Worth, Texas. Removal activities for the three tubes containing the LLRW began on June 5, 1996. Four soil borings were installed on June 10 and 11, 1996, for the collection and laboratory analysis of soil samples to determine background radioisotope concentrations. Confirmation soil samples were collected from the excavation sidewalls and bottom to ensure that any affected soils had been removed. Characterization samples from the excavated soil stockpile were collected and analyzed to determine whether the excavated soils had been impacted by the presence of the tube and needed to be disposed of, or the soils could be replaced into the excavation.

Based on evaluation of the analytical results, Metcalf & Eddy, Inc. (M&E) recommends that the excavated soil be replaced into the excavation. The following sections provide support for such recommendation.

Background Soil Sampling

The background soil borings were located as close as possible to the locations proposed in the AFCEE-approved Remedial Action Plan (Figure 1). Prior to drilling at each location, plastic sheeting was placed beneath the drill rig to contain the soil cuttings and any leaks or spills. Soil samples were collected from the intervals of 0-1 feet, 5-6 feet, 11-12 feet and 17-18 feet below ground surface; therefore, a total of 16 background soil samples were collected for this project. The 0-1 feet samples were collected with a 3-inch diameter Shelby tube sampler and the 5-6 feet samples were collected with a 2-inch diameter split-spoon sampler. Due to geological conditions that caused sampler refusal,

Mr. Charles A. Rice
August 1, 1996
Page 2

samples from the 11-12 feet and 17-18 feet intervals were collected from auger cuttings. **Attachment 1** provides copies of the drilling logs for each boring.

Each soil sample was logged for geological conditions, field screened with direct reading instruments for radioactivity and total organic vapors, then shipped to the laboratory for analysis by gamma spectroscopy. A Ludlum Model 3 Gamma Scintillator with a Model 44-9 Ratemeter GM (pancake) detector was utilized to obtain radioactivity readings in counts per minute (cpm). No radioactivity was detected with the Ludlum direct reading instrument above the background level of 0.3 cpm. A photo-ionization detector (PID) was used to screen for total organic vapors. A maximum reading of 2 parts per million (ppm) was recorded for one soil sample, while organic vapors were not detected (0 ppm) for all of the other soil samples. In addition, each soil sample was field-analyzed with a Ludlum Model 2200 Multi-Channel Analyzer to obtain radioactivity readings in picoCuries/gram (pCi/g). The highest reading recorded for these background soil samples was 3.21 pCi/g in the soil sample from 0-1 feet at Boring BMEIWN001. Background soil sample field screening results are provided in **Table 1**.

Laboratory analytical results indicate that the highest concentrations of radioactivity recorded for these soil background samples were 1.26 pCi/g of Bismuth-214, 1.29 pCi/g of Lead-214 and 1.27 pCi/g of Radium-226. Radium-226 levels ranged from a low of 0.47 pCi/g to two instances at 1.27 pCi/g. As Radium-226 is the target isotope for this remedial action, an upper confidence limit was calculated to allow comparison with the Radium-226 levels in the soil characterization samples and soil confirmation samples from the excavation at SWMU 60. The upper limit was determined to be 0.89 pCi/g at the 95 percent confidence level using the methods described in NUREG/CR-5849. The NUREG states that the cleanup criteria for soil activity is three times the average guidance value. Thus, the cleanup criteria is 2.67 pCi/g. A summary of background soil sample laboratory analytical results is provided in **Table 2**. **Attachment 2** provides the calculations used to determine the upper confidence limit for Radium-226.

Confirmation Soil Sampling

On June 11, 1996, five soil confirmation samples were collected by a third party (Thermo NuTech Laboratory) from the side walls and floor of the excavation at the former LLRW burial site. These samples were field screened for radioactivity and total organic vapors. None were detected. These field screening results are included in **Table 1**. The samples were shipped to the laboratory for analysis by gamma spectroscopy. Laboratory analytical results indicate that the highest concentrations of radioactivity recorded for these soil excavation confirmation samples were 0.69 pCi/g of Bismuth-214, 1.18 pCi/g of Lead-214 and 1.03 pCi/g of Radium-226. The Radium activity of 1.03 pCi/g is less than the cleanup criteria. A summary of soil sample laboratory analytical results for excavation confirmation is provided in **Table 3**.

Mr. Charles A. Rice
August 1, 1996
Page 3

Soil Characterization Sampling

On June 12, 1996, four soil characterization samples were collected from the stockpile of soil excavated at SWMU No. 60 to characterize the soil for proper disposal. The samples were shipped to the laboratory for analysis by gamma spectroscopy and TCLP volatile organic compounds, semi-volatile organic compounds, pesticides, herbicides and metals. Laboratory analytical results indicate that no constituents were detected by TCLP analysis. In addition, the highest concentrations of radioactivity recorded for these soil characterization samples were 0.77 pCi/g of Bismuth-214, 0.86 pCi/g of Lead-214 and 0.75 pCi/g of Radium-226. Thus, the presence of the tube contents appears to have had little or no impact on the excavated soils. A summary of soil characterization sample laboratory analytical results is provided in **Table 4**.

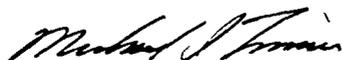
Summary and Recommendation

Based upon the field screening and laboratory analytical data provided in this document, the burial of LLRW at SWMU No. 60 appears to have had little impact on the native soils. A comparison of soil stockpile characterization and excavation confirmation samples indicates radioisotope concentrations are below the clean-up criteria calculated with the analytical results from the background samples. Based upon this criteria, Metcalf & Eddy recommends that the soil excavated at SWMU No. 60 be returned to the excavation as backfill.

Please call me if you have any questions concerning this letter report.

Sincerely,

METCALF & EDDY, INC.



Michael J. Timmer
Project Manager

MJT:eb

cc: Project files
p016021\usafcorr\usaf1357.ltr

TABLE 1

314 48

SUMMARY OF BACKGROUND SOIL SAMPLE FIELD SCREENING RESULTS
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS

Sample I.D.	Sample Date	Depth	Ludlum Model 3 & 44-9 (cpm)	Ludlum Model 2200 (pCi/g)	Photo-ionization Detector (ppm)
Background:					
BMEIWN001					
000010	06/10/96	0' to 1'	0.3	3.21	0
050060	06/10/96	5' to 6'	0.3	0.59	0
110120	06/10/96	11' to 12'	0.3	1.88	0
170180	06/10/96	17' to 18'	0.3	2.83	0
BMEIWN002					
000010	06/10/96	0' to 1'	0.3	0.97	0
050060	06/10/96	5' to 6'	0.3	1.42	0
110120	06/10/96	11' to 12'	0.3	0.74	0
170180	06/10/96	17' to 18'	0.3	2.57	0
BMEIWN003					
000010	06/10/96	0' to 1'	0.3	0.75	0
050060	06/10/96	5' to 6'	0.3	1.15	0
110120	06/10/96	11' to 12'	0.3	2.3	0
170180	06/10/96	17' to 18'	0.3	1.32	0
BMEIWN004					
000010	06/11/96	0' to 1'	0.3	1.14	0
050060	06/11/96	5' to 6'	0.3	0.25	0
110120	06/11/96	11' to 12'	0.3	1.33	2
170180	06/11/96	17' to 18'	0.3	0.08	0
Excavation Confirmation:					
North Wall	06/11/96	10' to 12'	0.3	NA	0
South Wall	06/11/96	10' to 12'	0.3	NA	0
East Wall	06/11/96	10' to 12'	0.3	NA	0
West Wall	06/11/96	10' to 12'	0.3	NA	0
Floor	06/11/96	18' to 19'	0.3	NA	0
Notes:					
NA = Not Analyzed					

TABLE 2

SUMMARY OF BACKGROUND SOIL SAMPLE ANALYTICAL RESULTS
 SWMU 60: OFF-SITE WEAPONS STORAGE AREA
 CARSWELL AFB, FT. WORTH, TEXAS

Sample I.D.	Sample Date	Depth	Radionuclide Concentration (pCi/g)						MDA	Error	MDA
			Activity Bismuth 214	Error	MDA	Activity Lead 214	Error	MDA			
BMEIWN001	06/10/96	0' to 1'	0.7	0.12	0.09	0.29	0.25	0.11	0.18	0.1	
	06/10/96	5' to 6'	0.48	0.10	0.13	0.46	0.23	0.12	0.17	0.12	
	06/10/96	11' to 12'	0.81	0.12	0.09	0.66	0.23	0.1	0.17	0.1	
	06/10/96	17' to 18'	0.79	0.12	0.12	0.85	0.20	0.13	0.16	0.12	
BMEIWN002	06/10/96	0' to 1'	0.8	0.12	0.11	0.72	0.19	0.11	0.16	0.11	
	06/10/96	5' to 6'	0.87	0.10	0.09	0.7	0.20	0.09	0.15	0.09	
	06/10/96	11' to 12'	0.77	0.10	0.08	0.76	0.18	0.08	0.14	0.08	
	06/10/96	17' to 18'	0.7	0.10	0.06	0.82	0.15	0.08	0.12	0.07	
BMEIWN003	06/10/96	0' to 1'	0.92	0.11	0.11	0.96	0.18	0.12	0.15	0.11	
	06/10/96	5' to 6'	0.4	0.11	0.11	0.37	0.20	0.1	0.15	0.11	
	06/10/96	11' to 12'	0.85	0.15	0.18	0.94	0.24	0.18	0.20	0.18	
	06/10/96	17' to 18'	0.86	0.12	0.09	0.95	0.17	0.09	0.14	0.09	
BMEIWN004	06/11/96	0' to 1'	1.24	0.16	0.13	1.29	0.27	0.14	0.22	0.13	
	06/11/96	5' to 6'	0.67	0.10	0.08	0.62	0.16	0.09	0.13	0.08	
	06/11/96	11' to 12'	1.26	0.14	0.1	1.22	0.22	0.12	0.18	0.11	
	06/11/96	17' to 18'	0.67	0.09	0.06	0.66	0.16	0.07	0.12	0.07	
Rinsate #1	06/10/96		NA		NA				18.4		
Rinsate #2	06/10/96		NA		NA				15.2		

Notes:

NA = Not Analyzed

All soil analytical results in pCi/g

All rinsate analytical results in pCi/l

TABLE 3

**SUMMARY OF SOIL SAMPLE ANALYTICAL RESULTS FOR EXCAVATION CONFIRMATION
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS**

Sample I.D.	Sample Date	Depth	Bismuth 214	Lead 214	Radium 226
North wall	06/11/96	10' to 12'	0.67	0.62	0.64
North wall Dup	06/11/96	10' to 12'	0.64	0.59	0.62
South wall	06/11/96	10' to 12'	0.69	1.18	1.03
East wall	06/11/96	10' to 12'	0.59	0.44	0.52
West wall	06/11/96	10' to 12'	0.59	0.76	0.68
Floor	06/11/96	18' to 19'	0.67	0.73	0.7
Rinsate #3	06/11/96		NA	NA	-5.4

Notes:
NA = Not Analyzed
All soil analytical results in pCi/g
All rinsate analytical results in pCi/l

**SUMMARY OF SOIL CHARACTERIZATION SAMPLE ANALYTICAL RESULTS
SWMU 60: OFF-SITE WEAPONS STORAGE AREA
CARSWELL AFB, FT. WORTH, TEXAS**

Sample I.D. Date Sampled	SMEISS001 06/12/96	SMEISS002 06/12/96	SMEISS003 06/12/96	SMEISS004 06/12/96
Gamma Spectroscopy				
Bismuth - 214 (pCi/g)	0.74	0.77	0.64	0.76
Lead - 214 (pCi/g)	0.71	0.42	0.88	0.74
Radium - 226 (pCi/g)	0.72	0.59	0.75	0.75
TCLP				
Volatiles:				
Benzene	ND	ND	ND	ND
Carbon tetrachloride	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND
2-Butanone (MEK)	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND
Vinyl chloride	ND	ND	ND	ND
Semi-volatiles:				
2,4-Dinitrotoluene	ND	ND	ND	ND
Hexachlorobenzene	ND	ND	ND	ND
Hexachloro-1,3-butadiene	ND	ND	ND	ND
Hexachloroethane	ND	ND	ND	ND
Nitrobenzene	ND	ND	ND	ND
Pyridine	ND	ND	ND	ND
2-Methylphenol (o-Cresol)	ND	ND	ND	ND
3 and 4-Methylphenol (m+p cres)	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND
2,4,5-Trichlorophenol	ND	ND	ND	ND
2,4,6-Trichlorophenol	ND	ND	ND	ND
Pesticides:				
Chlordane	ND	ND	ND	ND
Endrin	ND	ND	ND	ND
Heptachlor epoxide	ND	ND	ND	ND
gamma-BHC (Lindane)	ND	ND	ND	ND
Methoxychlor	ND	ND	ND	ND
Toxaphene	ND	ND	ND	ND
Heptachlor	ND	ND	ND	ND
Herbicides:				
2,4-D (ug/l)	ND	ND	ND	ND
2,4,5-TP (Silvex) (ug/l)	ND	ND	ND	ND
Metals:				
Arsenic	ND	ND	ND	ND
Barium	ND	ND	ND	ND
Cadmium	ND	ND	ND	ND
Chromium	ND	ND	ND	ND
Copper	ND	ND	ND	ND
Lead	ND	ND	ND	ND
Mercury	ND	ND	ND	ND
Selenium	ND	ND	ND	ND
Silver	ND	ND	ND	ND
Zinc	ND	ND	ND	ND
Miscellaneous:				
Cyanide (mg/kg)	ND	0.1	0.1	0.1
Amenable cyanide (mg/kg)	ND	ND	ND	ND
Reactivity - cyanide (mg/kg)	ND	ND	ND	ND
Reactivity - sulphide (mg/kg)	ND	ND	ND	ND
Total Organic Halogen (mg/kg)	ND	ND	ND	ND
pH at 5 minutes (SU)	7.95	7.84	8.23	7.87
pH at 30 minutes (SU)	7.97	7.74	7.99	7.78

Note:

ND: Not Detected

All analytical results in mg/l unless otherwise noted.

Soil Proctor Test results = 12.4%

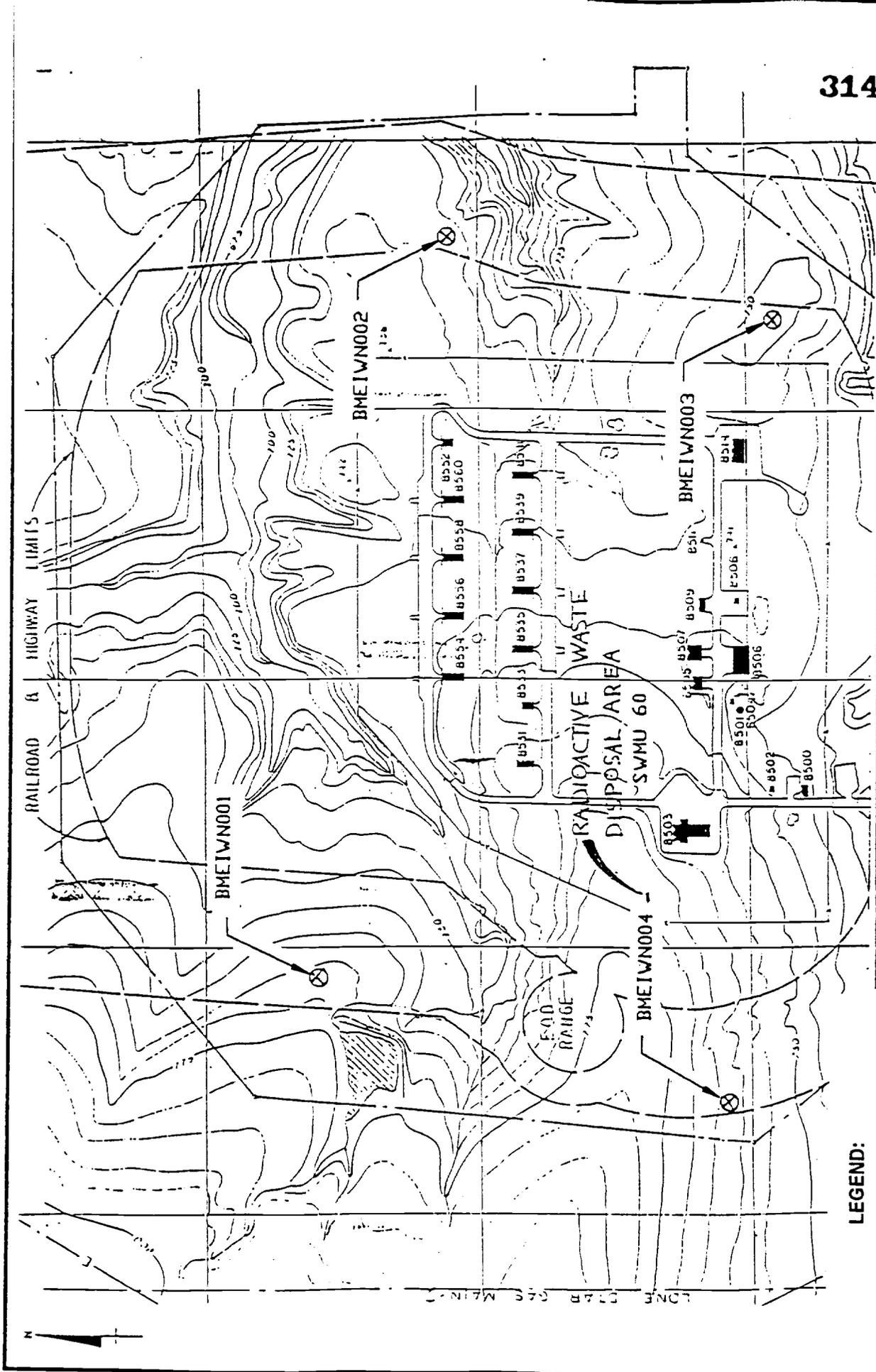
Sample Description:

SMEISS001: Outside the NW corner of the perimeter fence

SMEISS002: Outside the NE corner of the perimeter fence

SMEISS003: Outside the SE corner of the perimeter fence

SMEISS004: Outside the SW corner of the perimeter fence



31452

BACKGROUND SOIL BORING LOCATIONS
CARSWELL AFB, TEXAS



METCALF & EDDY

⊗ Background Soil Boring
BMEIWN004 Location and Designation

LEGEND:

SCALE: NONE 4-17-96 DAF Figure 1

ATTACHMENT 1

DRILLING LOGS

SOIL BORING LOG

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEIWA 0054
DAN PHILLIPS / MFE

PROJECT NAME: CARSWELL AFB - SWMU 60 - LRW Removal From OFF-SITE WEAPONS STORAGE AREA
 LOCATION: Outside NW corner of perimeter fence SURFACE ELEV.:
 DRILLER: Tom McCullough / PSI DATE START: 6.10.96 - 1500 FINISH: 6.10.96 - 1700

DEPTH (M)	SAMPLE			OVA READINGS			REC BN	USCS SOIL TYPE	SW (%)	LD (%)	SOIL DESCRIPTION AND REMARKS
	No.	TYPE	INTERVAL (FT) FROM TO	Min	Max	WA					
0	1	shelby	0	1	0	0		CLAY/FINES			Dark brown clayey soils to 1.5 feet BLS
5	2	S-spread	5	6	0	0		CLAY/FINES			Olive green to rust brown tight clay w/ some white cherty limestone
10	3	Cuttings	11	12	0	0		FINES			Same as above Gray limestone encountered @ 12 feet BLS
15											Very hard @ 16 to 16.5 feet BLS
20	4	Cuttings	17	18	0	0		FINES			Gray limestone w/ gray clay seams Boring completed @ 18 feet BLS
25											
30											
35											

SOIL BORING LOG

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEIWN 002

DAN PHILLIPS

PROJECT NAME: CARSWELL AFB - SWMU 60 - LLRW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA -

LOCATION: Outside NE corner of perimeter fence

SURFACE ELEV.:

OPERATOR: TOM McCULLOUGH / PSI

DATE START: 6.10.96 - 1100

FINISH: 6.10.96 - 1315

DEPTH (FT)	SAMPLE			OVA READINGS			REC IN	USCS SOIL TYPE	W (%)	L D (%)	SOIL DESCRIPTION AND REMARKS
	No.	TYPE	INTERVAL (FT) FROM TO	Min	Max	WA					
0	1	Shelby	0	1	0	0		CLAY/FINES			Dark brown clayey soils @ surface to 4 inches, then fractured limestone w/ seams of clay.
5	2	S-Spoon	5	6	0	0		CLAY/FINES			light brown cherty/silty clays - dry & not plastic. Grey limestone encountered @ 6 feet below surface. Limestone w/ seams of gray clay.
10	3	Cuttings	11	12	0	0		FINES			light gray limestone w/ clays
15	4	Cuttings	17	18	0	0		FINES			light gray limestone w/ clays
20											Boring completed @ 18 feet BLS
25											
30											
35											
40											
45											
50											
55											
60											
65											

drill cuttings are very fine dust to medium size clay. nodules

SOIL BORING LOG

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEI WY 003
DAN PHILLIPS / JAG

PROJECT NAME: CARSWELL AFB - SWMN 60 - LLRW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA

LOCATION: Outside SE corner of perimeter fence SURFACE ELEV.: _____

OPERATOR: TOM MCCULLOUGH / PSI DATE START: 6.10.96 - 1400 1315 FINISH: 6.10.96 - 1315 - 1500

DEPTH (FT)	SAMPLE			OVA READINGS			REC In	USCS SOIL TYPE	W PP	L A E Y P E T R H	SOIL DESCRIPTION AND REMARKS	
	No.	TYPE	INTERVAL (FT)		Min	Max						WA
			FROM	TO								
0	1	Shelby	0	1	0	0	0	CLAY FINES			Olive green to rust brown tight clays w/ some white chalk.	
5	2	S-spoon	5	6	0	0	0	CLAY FINES			olive green to rust brown clays - tight continues to approx. 11 feet BLS	
10	3	Cuttings	11	12	0	0	0	FINES			Tan limestone - hard - w/ some tan clays	
15												
20	4	Cuttings	17	18	0	0	0	FINES			Tan limestone continued to 18 feet BLS Boring completed @ 18 feet BLS	
25												
30												
35												
40												

Page: 1 of 2
PP: Pocket penetrometer reading
WA: OVA readings in the working area

SOIL BORING LOG

314 57

PROJECT No.: 016021

BORING No.:
LOGGED BY:

BMEILW004
DAN PHILLIPS / M+E

PROJECT NAME: CARSWELL AFB - SWMU 60 - LLW REMOVAL FROM OFF-SITE WEAPONS STORAGE AREA
 LOCATION: outside SW corner of perimeter fence SURFACE ELEV.:
 DRILLER: TOM McCULLOUGH / PSI DATE START: 6.10.96 - 0730 FINISH: 6.11.96 - 0900

DEPTH (FT)	SAMPLE			OVA READINGS			REC NO	USCS SOIL TYPE	W PP	L D A E Y P E T R H	SOIL DESCRIPTION AND REMARKS	
	No.	TYPE	INTERVAL (FT)		Min	Max						WA
			FROM	TO								
0	1	Shelby	0	1	0	0		CLAY FINES			Dark brown clayey soils with evidence of limestone @ 1.5 feet BLS	
5	2	S-Spoon	5	6	0	0		CLAY FINES			white cherty limestone w/ tan clays light brown silty limestone w/ clay seams	
10	3	Cuttings	11	12	0	2		FT FINES			Tan limestone encountered @ 12 feet BLS - Hard! Gray limestone encountered @ 15 feet BLS	
15	4	Cuttings	17	18	0	0		FINES			Boring completed @ 18 feet BLS	
20												
25												
30												
35												
40												

Page: 1 of 2
 PP: Pocket penetrometer reading
 WA: OVA readings in the working area

Upper Confidence Limit for Ra-226 Data from Background Soil Samples

Boring No.	Sample Depth	Ra-226 (pCi/g)
BMEIWN001	0'-1'	0.49
	5'-6'	0.47
	11'-12'	0.73
	17'-18'	0.82
BMEIWN001	0'-1'	0.76
	5'-6'	0.78
	11'-12'	0.76
	17'-18'	0.76
BMEIWN001	0'-1'	0.94
	5'-6'	0.39
	11'-12'	0.90
	17'-18'	0.90
BMEIWN001	0'-1'	1.27
	5'-6'	0.64
	11'-12'	1.24
	17'-18'	0.67

$$\text{UPPER LIMIT} = \text{MEAN} + \text{STDEV} * t(\text{df}^{0.5})$$

$$\text{MEAN} = 0.78 \text{ pCi/gm}$$

$$\text{STD DEV} = 0.23 \text{ pCi/gm}$$

$$t = 1.75 \text{ (TABLE B-1, NUREG/CR -5849)}$$

$$\text{UPPER LIMIT} = 0.89 \text{ pCi/gm}$$

$$3 \times \text{UPPER LIMIT} = 2.67 \text{ pCi/gm}$$

TAB

APPENDIX D

APPENDIX D

PHOTOGRAPHS DOCUMENTING SITE ACTIVITIES



Photo No. 1: Performance of the non-intrusive radiological survey.



Photo No. 2 : Removal of the chain-link fence and site conditions prior to excavation.



Photo No. 3: Initiation of tube excavation with a backhoe.



Photo No. 4 : Further excavation of the tubes using an excavator.

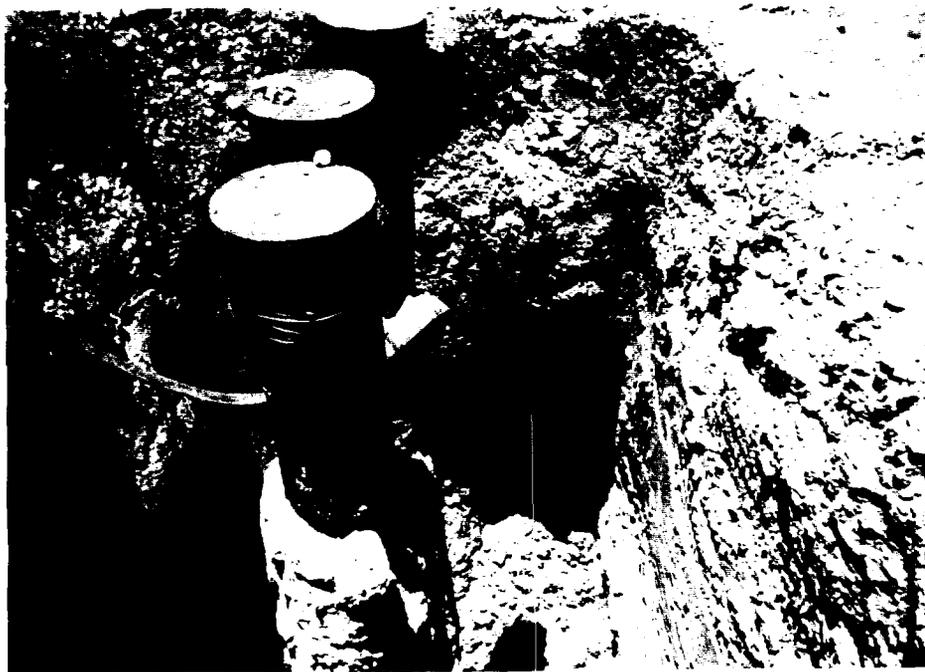


Photo No. 5 : Initial movement of the first tube indicating that removal can be attempted.



Photo No. 6 : Tube removal via nylon slings.



Photo No. 7 : Placement of the tubes into the steel overpack containers.



Photo No. 8 : Welding the end caps of the steel overpack containers.

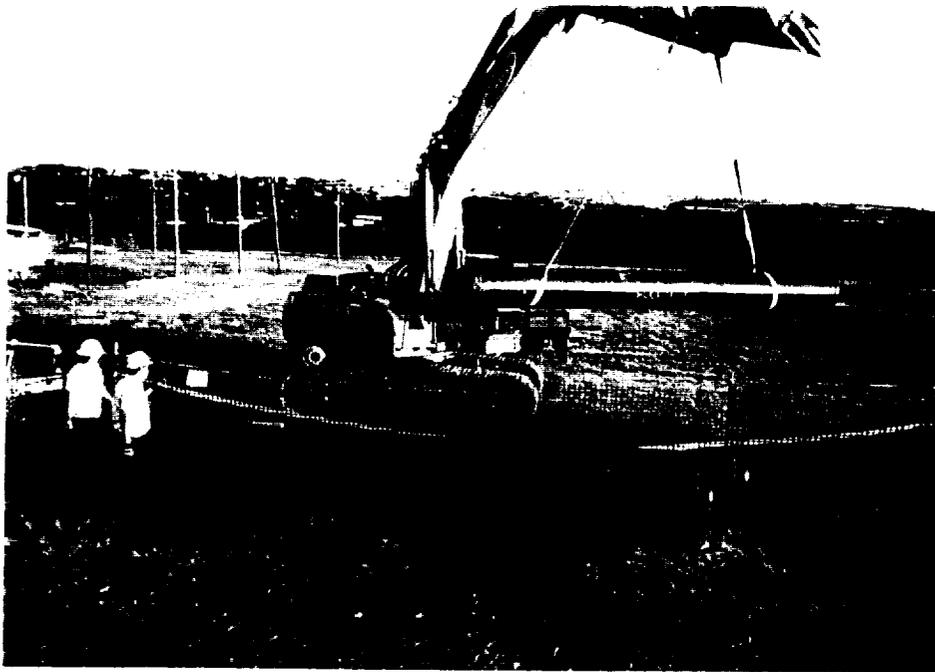


Photo No. 9 : Placing the overpacked tubes back into the exclusion zone .

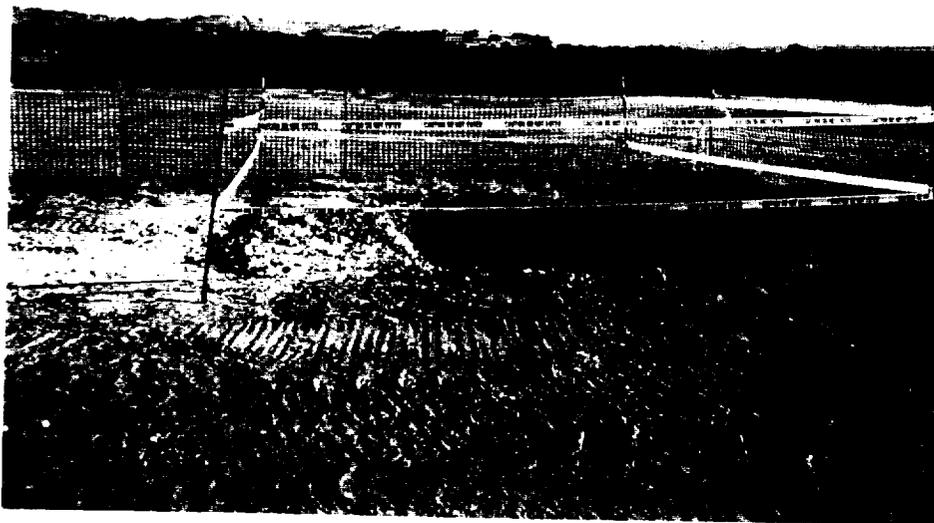


Photo No. 10 : Final limits of excavation.



Photo No. 11 : Performance of a background soil boring.

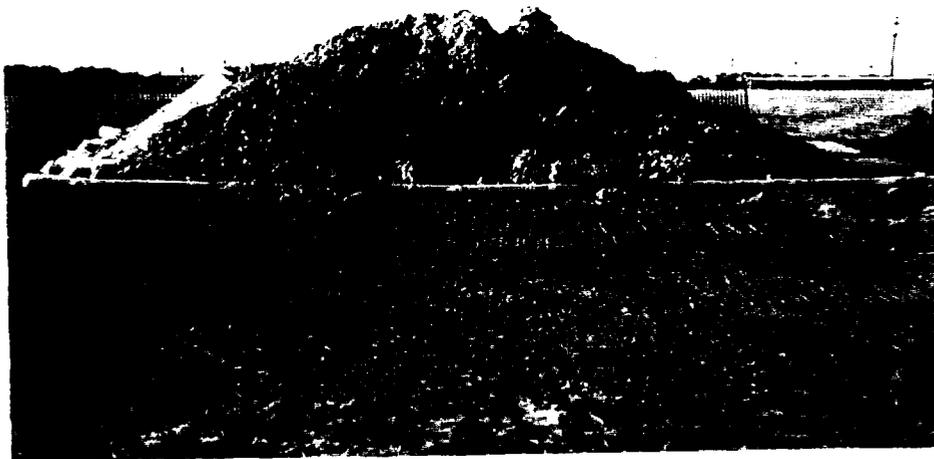


Photo No. 12 : Final stockpile of excavated soil



Photo No. 13 : Use of engineering controls to avoid run-on or run-off of precipitation in the soil staging area.



Photo No. 14 : Overpacked tubes loaded for transportation to the disposal facility.



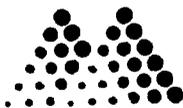
Photo No. 15 : Site restoration completion.

TAB

APPENDIX E

APPENDIX E

LABORATORY ANALYTICAL REPORTS



Mountain States Analytical

The Quality Solution

June 28, 1996

Mr. Mike Timmer
Metcalf & Eddy Services
3838 N. Sam Houston Parkway East
Suite 440
Houston, TX 77032

Reference:

Project: LLRW Removal/Carswell AFB
MSAI Group: 12445

Dear Mr. Timmer:

Enclosed are the analytical results for your project referenced above. The following samples are included in the report.

SMEISS001	SMEISS002
SMEISS003	SMEISS004
PROCTOR TEST SOIL	

All holding times were met for the tests performed on these samples.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Mountain States Analytical, Inc. to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

With Regards,

W. Scott Fraser
Project Manager



314 72

tes
n

s
rkw

er
Car

M&PI Sample: 4 116
 M&PI Group: 1 4-5
 Date Reported: 0 11/8/96
 Discard Date: 0 11/8/96
 Date Submitted: 0 11/13/96
 Date Sampled: 0 11/12/96
 Collected by: D
 Purchase Order:
 Project No

Sample
 Matrix:

Test	Units	Limit of Quantitation
0145G Barium Method: SW-846 8010A	mg/l	1.0
0149G Cadmium Method: SW-846 8010A	mg/l	0.02
0151G Chromium Method: SW-846 8010A	mg/l	0.02
0253G Copper by ICP, TCLP Method: SW-846 8010A	mg/l	0.10
0255G Lead by ICP, TCLP Method: SW-846 8010A	mg/l	0.2
0259T Mercury by CVAAS, TCLP Method: SW-846 8010A	mg/l	0.0005
0266G Silver by ICP, TCLP Method: SW-846 8010A	mg/l	0.02
0272G Zinc by ICP, TCLP Method: SW-846 8010A	mg/l	0.25
0392N Mercury Prep CVAAS, TCLP Method: SW-846 8010A	Complete	
0392T Flame/ICP Prep For Metals, TCLP Method: SW-846 8010A	Complete	
1045G Arsenic by ICP, TCLP Method: SW-846 8010A	mg/t	0.10



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Page 3

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MSAI Sample: 49 5
MSAI Group: 12 4

	Units	Limit of Quantitation
0948		
Heptachlor Epoxide	mg/l	0.500
Heptachlor Chloride	mg/l	0.0080
0949		
Heptachlor Epoxide	ug/l	10,000
Heptachlor Chloride	ug/l	1,000
0948		
Volatiles (TCLP)		
Method: SW-846 3510/3520		
Benzene	mg/l	0.050
Carbon tetrachloride	mg/l	0.050
Chloroform	mg/l	0.050
Chloroform	mg/l	0.050
1,1-Dichloroethane	mg/l	0.050
1,1-Dichloroethene	mg/l	0.050
2-Butanone (MEK)	mg/l	0.20
Tetrachloroethene	mg/l	0.050
Trichloroethene	mg/l	0.050
Vinyl chloride	mg/l	0.10
0949		
Semi-Volatiles (TCLP)		
Method: SW-846 3510/3520		
2,4-Dinitrotoluene	mg/l	0.040
Hexachlorobenzene	mg/l	0.040
Hexachloro-1,3-dioxane	mg/l	0.040
Hexachloroethane	mg/l	0.040
Nitrobenzene	mg/l	0.040
Pyridine	mg/l	0.040
2-Methylphenol (o-cresol)	mg/l	0.040
3 and 4-Methylphenol (m+p-cresol)	mg/l	0.040
Pentachlorophenol	mg/l	0.200
2,4,5-Trichlorophenol	mg/l	0.040
2,4,6-Trichlorophenol	mg/l	0.040

3000T SVOA Extraction, TCLP
Method: SW-846 3510/3520

Complete

3050T Pesticide Extraction, TCLP
Method: SW-846 3510/3520

Complete

14: 75

Page 4

ES
7

MSAI Sample: 49 56
MSAI Group: 12 45

Units Limit of
----- Quantitation

LP

ND - Not detected at the limit of quantitation

Respectfully Submitted,
Reviewed and Approved by:

W. Scott Fraser

W. Scott Fraser
Project Manager

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Ca:

MSAI Sample: 45 57
 MSAI Group: 12 45
 Date Reported: 06 28/96

Discard Date: 06 28/96
 Date Submitted: 06 13/96
 Date Sampled: 06 12/96
 Collected by: DI
 Purchase Order:
 Project No.:

	Units	Limit of Quantitation
	-----	-----
10100 Lead by ICP, TMLP Method: SW-846 80102	mg/l	1.0
10101 Cadmium by ICP, TMLP Method: SW-846 80102	mg/l	0.02
10102 Chromium by ICP, TMLP Method: SW-846 80102	mg/l	0.02
10103 Copper by ICP, TMLP Method: SW-846 80102	mg/l	0.10
10104 Zinc by ICP, TMLP Method: SW-846 80102	mg/l	0.2
10105 Mercury by ICP, TMLP Method: SW-846 80102	mg/l	0.0005
10106 Silver by ICP, TMLP Method: SW-846 80102	mg/l	0.02
10107 Barium by ICP, TMLP Method: SW-846 80102	mg/l	0.25
10300 Mercury Prep. OFAA, TMLP Method: SW-846 80102	Complete	
10301 Flame/ICP Prep For Metals, TMLP Method: SW-846 80102	Complete	
1045G Arsenic by ICP, TMLP Method: SW-846 80102	ND	0.10



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MSAI Sample: 49 57
MSAI Group: 12 15

		Units	Limit of Quantitation
		-----	-----
		mg/l	0.30
	DDI:		
		SU	0.01
		SU	0.01
		% Solids	0.001
	Oil		
		% Solids	0.001
	Sul		
		mg/kg	250
		mg/kg	410
	(Dormant)	mg/kg	100
	Cyanide, Total Available		
	Method: SW-845 8011		
	Cyanide	mg/kg	0.1
	Amenable Cyanide	mg/kg	0.1
	Pesticides TCLP		
	Method: SW-845 8011		
	Chlordane	mg/L	0.030
	Endrin	mg/L	0.020
	Heptachlor epoxide	mg/L	0.0080
	gamma-BHC (Lindane)	mg/L	0.400
	Methoxychlor	mg/L	10.0



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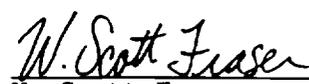
MSAI Sample: 49 57
MSAI Group: 12 45

Units	Limit of Quantitation
-----	-----

MLP

ND - Not detected at the limit of quantitation.

Respectfully Submitted,
Reviewed and Approved by:



W. Scott Fraser
Project Manager



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MSAI Sample: 49158
MSAI Group: 12445
Date Reported: 06/28/96

Discard Date: 07/28/96
Date Submitted: 06/13/96
Date Sampled: 06/12/96
Collected by: DP
Purchase Order:
Project No.:

Sample: 2
Matrix:

Test	Analysis	Units	Limit of Quantitation
0246G	Barium Method: SW-846 6010A	mg/l	1.0
0249G	Calcium by ICP, TCLP Method: SW-846 6010A	mg/l	0.02
0251G	Chromium by ICP, TCLP Method: SW-846 6010A	mg/l	0.02
0253G	Copper by ICP, TCLP Method: SW-846 6010A	mg/l	0.10
0255G	Lead by ICP, TCLP Method: SW-846 6010A	mg/l	0.2
0259T	Mercury by CVAA, TCLP Method: SW-846 7470	mg/l	0.0005
0266G	Silver by ICP, TCLP Method: SW-846 6010A	mg/l	0.02
0272G	Zinc by ICP, TCLP Method: SW-846 6010A	mg/l	0.25
0392N	Mercury Prep CVAA, TCLP Method: SW-846 7470	Complete	
0392T	Flame/ICP Prep For Metals, TCLP Method: SW-846 3010A	Complete	
1045G	Arsenic by ICP, TCLP Method: SW-846 6010A	mg/l	0.10

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Page 4

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7

MSAI Sample: 49: 8
MSAI Group: 12: 5

Units Limit of
----- Quantitation

MLP

ND - Not detected at the limit of quantitation.

Respectfully Submitted,
Reviewed and Approved by:



W. Scott Fraser
Project Manager



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MSAI Sample: 49 59
 MSAI Group: 1: 45
 Date Reported: 06 28/96

 Discard Date: 07 28/96
 Date Submitted: 06 13/96
 Date Sampled: 06 12/96
 Collected by: DJ
 Purchase Order:
 Project No.:

111
111

	Units	Limit of Quantitation
0254G Barium by ICP, TCEP Method: SW-846 6010A	mg/l	1.0
0255G Calcium by ICP, TCEP Method: SW-846 6010A	mg/l	0.02
0256G Chloride by ICP, TCEP Method: SW-846 6010A	mg/l	0.02
0257G Copper by ICP, TCEP Method: SW-846 6010A	mg/l	0.10
0258G Lead by ICP, TCEP Method: SW-846 6010A	mg/l	0.2
0259T Mercury by ICP, TCEP Method: SW-846 6010A	mg/l	0.0005
0266G Silver by ICP, TCEP Method: SW-846 6010A	mg/l	0.02
0272G Zinc by ICP, TCEP Method: SW-846 6010A	mg/l	0.25
0392N Mercury Prep CMAA, TCEP Method: SW-846 7400	Completed	
0392T Flame/ICP Prep For Metals, TCEP Method: SW-846 3010A	Completed	
1045G Arsenic by ICP, TCEP Method: SW-846 6010A	mg/l	0.10



3 4 85

Page 2

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7

MSAI Sample: 49009
MSAI Group: 12-05

		Units	Limit of Quantitation
		-----	-----
		ng/l	0.30
	DDI		
		SU	0.01
		SU	0.01
		% Solids	0.001
	til		
	Method		
		% Solids	0.001
		% Solids	0.001
		% Solids	0.001
1147X	Method	% Solids	0.001
	Method		
1181	Reaction	Sul	
	Method	7.1	
	Cyanide	mg/kg	250
	Sulfide	mg/kg	410
2144	Halogen	(Dol)	100
	Method		
6548	Cyanide		
	Method: SW-846		
	Cyanide	mg/kg	0.1
	Amenable cyanide	mg/kg	0.1
0950	Pesticides		
	Method: SW-846		
	Chlordane	mg/l	0.030
	Endrin	mg/l	0.020
	Heptachlor epoxide	mg/l	0.0080
	gamma-BHC (Lindane)	mg/l	0.400
	Methoxychlor	mg/l	10.0

3: 4 86

Page 3

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MSAI Sample: 49 59
MSAI Group: 12 45

Sample	Method	Units	Limit of Quantitation
0948	Heptachlor Epoxide	mg/l	0.500
	Heptachlor Epoxide	mg/l	0.0080
0948	Heptachlor Epoxide	ug/l	10,000
	Heptachlor Epoxide	ug/l	1,000
0948	Volatiles		
	Method: SW-846		
	Benzene	mg/l	0.050
	Carbon tetrachloride	mg/l	0.050
	Chloroform	mg/l	0.050
	Chlorobenzene	mg/l	0.050
	1,1-Dichloroethane	mg/l	0.050
	1,1-Dichloroethene	mg/l	0.050
	2-Butanone	mg/l	0.20
	Tetrachloroethene	mg/l	0.050
	Trichloroethene	mg/l	0.050
	Vinyl chloride	mg/l	0.10
0949	Semivolatiles		
	Method: SW-846		
	2,4-Dinitrochlorobenzene	mg/l	0.040
	Hexachlorobenzene	mg/l	0.040
	Hexachloro-1,3-cyclohexadiene	mg/l	0.040
	Hexachlorocyclopentadiene	mg/l	0.040
	Nitrobenzene	mg/l	0.040
	Pyridine	mg/l	0.040
	2-Methylphenol (o-cresol)	mg/l	0.040
	3 and 4-Methylphenol (m+p-cresol)	mg/l	0.040
	Pentachlorophenol	mg/l	0.200
	2,4,5-Trichlorophenol	mg/l	0.040
	2,4,6-Trichlorophenol	mg/l	0.040

3000T SVOA Extraction, TCLP
Method: SW-846 3510/3520

Complete

3050T Pesticide Extraction, TCLP
Method: SW-846 3510/3520

Complete

Analytical Report

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MSAI Sample: 49.60
MSAI Group: 13.45
Date Reported: 06 '28/96

Discard Date: 06 '28/96
Date Submitted: 06 '13/96
Date Sampled: 06 '12/96

Collected by: DI
Purchase Order:
Project No.:

Units	Limit of Quantitation
%	0.5

Respectfully Submitted,
Reviewed and Approved by:


W. Scott Fraser
Project Manager



Mountain States Analytical

Sample Chain of Custody

No 8961

Subcontract #

Client Name: METCALF + EDDY P.O. # 94-016021-002
 Phone #: (713) 590-8880 Fax #: (713) 590-5118
 Project Name#: LRLW Removal / Containers AFB
 Sampler: DAN PHILLIPS

Sample Identification	Date Collected	Time Collected	Total of Containers				Analysis Required						Remarks	Temp. of Samples Upon Receipt																																																																																																															
			Grab	Composite	Soil	Water	Other	Full TCLP	Tox	pH	Hydrogen Sulfide	Pink Filter Test			Proctor Test	Rush?																																																																																																													
SMEI 55 001	6.12.96	0815	X	X	X	X	X	X	X	X	X	X	X	0.02mm sieve Preserved																																																																																																															
SMEI 55 002	6.12.96	0820	X	X	X	X	X	X	X	X	X	X	X	4.0c																																																																																																															
SMEI 55 003	6.12.96	0825	X	X	X	X	X	X	X	X	X	X	X	Do not run																																																																																																															
SMEI 55 004	6.12.96	0830	X	X	X	X	X	X	X	X	X	X	X	w/o confirmation from M. Timmer																																																																																																															
PROCTOR TEST SOIL	6.12.96	0945	X	X	X	X	X	X	X	X	X	X	X	5-Gallon Bucket																																																																																																															
<table border="1"> <thead> <tr> <th>Name of Shipper</th> <th>Airbill No.</th> <th>Date</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>FED EX</td> <td>1179441896</td> <td>6.12.96</td> <td>1230</td> </tr> <tr> <td>Received By (Lab)</td> <td></td> <td>Date</td> <td>Time</td> <td>Seals Intact?</td> <td></td> <td>Sample relinquished by:</td> <td></td> <td>Sample received by:</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Sam O'Keefe</td> <td></td> <td>6/12/96</td> <td>0830</td> <td>YES</td> <td></td> <td>Dany Malya</td> <td></td> <td>Mail Services Etc. (CAB)</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Turnaround Time Requested (please circle):</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>Normal</td> <td></td> </tr> <tr> <td colspan="15"> (Rush TAT is subject to MSAI approval and surcharge) Report Results By: (Date) 7.1.96 Rush results requested by (please circle): Phone Fax Report Results to: MIKE TIMMER MTE HOUSTON </td> </tr> </tbody> </table>															Name of Shipper	Airbill No.	Date	Time	FED EX	1179441896	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	Received By (Lab)		Date	Time	Seals Intact?		Sample relinquished by:		Sample received by:								Sam O'Keefe		6/12/96	0830	YES		Dany Malya		Mail Services Etc. (CAB)								Turnaround Time Requested (please circle):																				Normal												(Rush TAT is subject to MSAI approval and surcharge) Report Results By: (Date) 7.1.96 Rush results requested by (please circle): Phone Fax Report Results to: MIKE TIMMER MTE HOUSTON																										
Name of Shipper	Airbill No.	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time																																																																																																														
FED EX	1179441896	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230	6.12.96	1230																																																																																																														
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Type of Disposal: _____ Date/Time of Disposal: _____ Authorized for Disposal by: _____ Disposed of by: _____																																																																																																																													

PAGE 1 of 1



Mountain States Analytical

The Quality Solution

July 8, 1996

Mr. Mike Timmer
 Metcalf & Eddy Services
 3838 N. Sam Houston Parkway East
 Suite 440
 Houston, TX 77032

Reference:

Project: LLRW Removal/Carswell AFB
 MSAI Group: 12424

Dear Mr. Timmer:

Enclosed are the analytical results for your project referenced above. The following samples are included in the report.

BMEIWN002 000010	BMEIWN002 050060	BMEIWN002 110120
BMEIWN002 170180	BMEIWN003 000010	BMEIWN003 050060
Rinsate/EQ Blank #1	BMEIWN003 110120	BMEIWN003 170180
BMEIWN003 180190	BMEIWN001 000010	BMEIWN001 050060
BMEIWN001 110120	BMEIWN001 120130	BMEIWN001 170180
BMEIWN004 000010	BMEIWN004 050060	BMEIWN004 110120
BMEIWN004 170180	Rinsate/EQ Blank #2	

All holding times were met for the tests performed on these samples.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Mountain States Analytical, Inc. to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

With Regards,

W. Scott Fraser
 Project Manager



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MSAI Group: 124 4
Date Reported: 07 08/96
Date Received: 06 13/96

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Purchase Order: 9--016021-002
Project No.:

		Units	Limit of Quantitation
		-----	-----
Sample: 49070 - BMEIWN001 000000	0	pCi/g	
Sample: 49071 - BMEIWN001 000000	10	pCi/g	
Sample: 49072 - BMEIWN001 000000	20	pCi/g	
Sample: 49073 - BMEIWN001 000000	30	pCi/g	
Sample: 49074 - BMEIWN001 000000	40	pCi/g	
Sample: 49075 - BMEIWN001 000000	50	pCi/g	
Sample: 49076 - BMEIWN003 000120 01007 Gamma Spectroscopy, sw	120	pCi/g	See Attached
Sample: 49077 - BMEIWN003 000180 01007 Gamma Spectroscopy, sw	180	pCi/g	See Attached
Sample: 49078 - BMEIWN003 000190 01007 Gamma Spectroscopy, sw	190	pCi/g	See Attached
Sample: 49079 - BMEIWN001 000010 01007 Gamma Spectroscopy, sw	10	pCi/g	See Attached

MSAI Group: 12 14

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Units	Limit of
-----	Quantitation

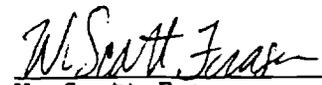
0

pCi/g

nk #:

pCi/l

Respectfully Submitted,
Reviewed and Approved by:



W. Scott Fraser
Project Manager



Thermo NUtech

601 Scarboro Road

314 93
Ridge, TN 37830
(423) 481-0683

FAX (423) 483-4621

FAX (423) 481-0121

TNU-OR-4544

July 3, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE

Work Order# 96-06062-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains seventeen soil samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

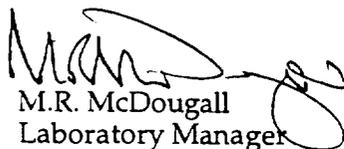
<u>CLIENT ID</u>	<u>LAB ID</u>	<u>CLIENT ID</u>	<u>LAB ID</u>
12424-49067	96-06062-04	12424-49078	96-06062-13
12424-49068	96-06062-05	12424-49079	96-06062-14
12424-49069	96-06062-06	12424-49080	96-06062-15
12424-49070	96-06062-07	12424-49081	96-06062-16
12424-49071	96-06062-08	12424-49082	96-06062-17
12424-49072	96-06062-09	12424-49083	96-06062-18
12424-49074	96-06062-10	12424-49084	96-06062-19
12424-49076	96-06062-11	12424-49085	96-06062-20
12424-49077	96-06062-12		

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


M.R. McDougall
Laboratory Manager

Date: 7/3/96

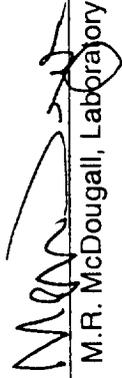
W. Scott Fraser
 Mountain States Analytical
 1645 West 2200 South
 Salt Lake City, UT 84119

P.O. #:12424
 SDG: 9606062
 MATRIX: Soil

Final Report of Analysis
 Date of Report: 7/3/96
 Page 1 of 3

314 94

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06062-01	K KNOWN		06/14/96	06/14/96	06/17/96	07/01/96	Cobalt-60	LANL ER-130 Modified	146.16	6.28	0.90	PCI/G
96-06062-01	K KNOWN		06/14/96	06/14/96	06/17/96	07/01/96	Cesium-137	LANL ER-130 Modified	87.30	3.58	1.03	PCI/G
96-06062-01	S SPIKE		06/14/96	06/14/96	06/17/96	07/01/96	Cobalt-60	LANL ER-130 Modified	144.50	1.39	0.90	PCI/G
96-06062-01	S SPIKE		06/14/96	06/14/96	06/17/96	07/01/96	Cesium-137	LANL ER-130 Modified	87.47	1.56	1.03	PCI/G
96-06062-02	B BLANK		06/14/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	-0.03	0.07	0.12	PCI/G
96-06062-02	B BLANK		06/14/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.03	0.08	0.12	PCI/G
96-06062-02	B BLANK		06/14/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.00	0.07	0.12	PCI/G
96-06062-03	D 12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.83	0.13	0.11	PCI/G
96-06062-03	D 12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.57	0.21	0.11	PCI/G
96-06062-03	D 12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.70	0.17	0.11	PCI/G
96-06062-04	12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.80	0.12	0.11	PCI/G
96-06062-04	12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.72	0.19	0.11	PCI/G
96-06062-04	12424-49067		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.76	0.16	0.11	PCI/G
96-06062-05	12424-49068		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.87	0.10	0.09	PCI/G
96-06062-05	12424-49068		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.70	0.20	0.09	PCI/G
96-06062-05	12424-49068		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.78	0.15	0.09	PCI/G
96-06062-06	12424-49069		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.77	0.10	0.08	PCI/G
96-06062-06	12424-49069		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.76	0.18	0.08	PCI/G
96-06062-06	12424-49069		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.76	0.14	0.08	PCI/G
96-06062-07	12424-49070		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.70	0.10	0.06	PCI/G
96-06062-07	12424-49070		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.82	0.15	0.08	PCI/G
96-06062-07	12424-49070		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.76	0.12	0.07	PCI/G

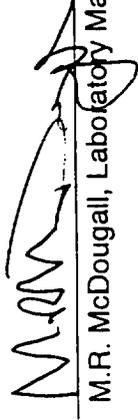
Approved by:  7/3/96
 M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

P.O. #:12424
SDG: 9606062
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06062-08	12424-49071		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.92	0.11	0.11	PCI/G
96-06062-08	12424-49071		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.96	0.18	0.12	PCI/G
96-06062-08	12424-49071		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.94	0.15	0.11	PCI/G
96-06062-09	12424-49072		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.73	0.11	0.08	PCI/G
96-06062-09	12424-49072		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.70	0.20	0.10	PCI/G
96-06062-09	12424-49072		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.72	0.15	0.09	PCI/G
96-06062-10	12424-49074		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.40	0.11	0.11	PCI/G
96-06062-10	12424-49074		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.37	0.20	0.10	PCI/G
96-06062-10	12424-49074		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.39	0.15	0.11	PCI/G
96-06062-11	12424-49076		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.85	0.15	0.18	PCI/G
96-06062-11	12424-49076		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.94	0.24	0.18	PCI/G
96-06062-11	12424-49076		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.90	0.20	0.18	PCI/G
96-06062-12	12424-49077		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.86	0.12	0.09	PCI/G
96-06062-12	12424-49077		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.95	0.17	0.09	PCI/G
96-06062-12	12424-49077		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.90	0.14	0.09	PCI/G
96-06062-13	12424-49078		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.95	0.12	0.11	PCI/G
96-06062-13	12424-49078		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.91	0.21	0.11	PCI/G
96-06062-13	12424-49078		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.93	0.16	0.11	PCI/G
96-06062-14	12424-49079		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.70	0.12	0.09	PCI/G
96-06062-14	12424-49079		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.29	0.25	0.11	PCI/G
96-06062-14	12424-49079		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.49	0.18	0.10	PCI/G

Approved by:  7/3/96
M.R. McDougall, Laboratory Manager

W. Scott Fraser
 Mountain States Analytical
 1645 West 2200 South
 Salt Lake City, UT 84119

P.O. #:12424
 SDG: 9606062
 MATRIX: Soil

Final Report of Analysis
 Date of Report: 7/3/96
 Page 3 of 3

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06062-15	12424-49080		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.48	0.10	0.13	PCI/G
96-06062-15	12424-49080		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.46	0.23	0.12	PCI/G
96-06062-15	12424-49080		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.47	0.17	0.12	PCI/G
96-06062-16	12424-49081		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.81	0.12	0.09	PCI/G
96-06062-16	12424-49081		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.66	0.23	0.10	PCI/G
96-06062-16	12424-49081		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.73	0.17	0.10	PCI/G
96-06062-17	12424-49082		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.95	0.14	0.12	PCI/G
96-06062-17	12424-49082		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.84	0.21	0.13	PCI/G
96-06062-17	12424-49082		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.89	0.18	0.12	PCI/G
96-06062-18	12424-49083		06/10/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.79	0.12	0.09	PCI/G
96-06062-18	12424-49083		06/10/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.85	0.20	0.10	PCI/G
96-06062-18	12424-49083		06/10/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.82	0.16	0.09	PCI/G
96-06062-19	12424-49084		06/11/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	1.24	0.16	0.13	PCI/G
96-06062-19	12424-49084		06/11/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	1.29	0.27	0.14	PCI/G
96-06062-19	12424-49084		06/11/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	1.27	0.22	0.13	PCI/G
96-06062-20	12424-49085		06/11/96	06/14/96	06/17/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.67	0.10	0.08	PCI/G
96-06062-20	12424-49085		06/11/96	06/14/96	06/17/96	07/01/96	Lead-214	LANL ER-130 Modified	0.62	0.16	0.09	PCI/G
96-06062-20	12424-49085		06/11/96	06/14/96	06/17/96	07/01/96	Radium-226	LANL ER-130 Modified	0.64	0.13	0.08	PCI/G

314 96

Approved by:  7/3/96
 M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUTECH

A Subsidiary of Thermo Remediation, a Thermo Electron Company

601 Scarborough Road Oak Ridge, TN 37830 423/481 0083 FAX 423/483 4621

Thermo NUtech

601 Scarboro Road

Oak Ridge, TN 37830

314 97 (423) 481-0683

FAX (423) 483-4621

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TNU-OR-4543

July 2, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE

Work Order# 96-06063-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains three soil samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

CLIENT ID

LAB ID

12424-49086

96-06063-04

12424-49087

96-06063-05

12424-49088

96-06063-06

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


M.R. McDougall

Laboratory Manager

Date: 7/3/96

P.O. #: 12424
SDG: 9606063
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06063-01	K KNOWN		06/14/96	06/14/96	06/18/96	07/01/96	Cobalt-60	LANL ER-130 Modified	146.16	6.28	0.98	PCI/G
96-06063-01	K KNOWN		06/14/96	06/14/96	06/18/96	07/01/96	Cesium-137	LANL ER-130 Modified	87.30	3.58	1.12	PCI/G
96-06063-01	S SPIKE		06/14/96	06/14/96	06/18/96	07/01/96	Cobalt-60	LANL ER-130 Modified	143.70	1.47	0.98	PCI/G
96-06063-01	S SPIKE		06/14/96	06/14/96	06/18/96	07/01/96	Cesium-137	LANL ER-130 Modified	88.54	1.60	1.12	PCI/G
96-06063-02	B BLANK		06/14/96	06/14/96	06/18/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.07	0.08	0.14	PCI/G
96-06063-02	B BLANK		06/14/96	06/14/96	06/18/96	07/01/96	Lead-214	LANL ER-130 Modified	0.02	0.07	0.12	PCI/G
96-06063-02	B BLANK		06/14/96	06/14/96	06/18/96	07/01/96	Radium-226	LANL ER-130 Modified	0.04	0.07	0.13	PCI/G
96-06063-03	D 12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Bismuth-214	LANL ER-130 Modified	1.33	0.14	0.11	PCI/G
96-06063-03	D 12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Lead-214	LANL ER-130 Modified	1.43	0.27	0.12	PCI/G
96-06063-03	D 12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Radium-226	LANL ER-130 Modified	1.38	0.21	0.11	PCI/G
96-06063-04	12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Bismuth-214	LANL ER-130 Modified	1.26	0.14	0.10	PCI/G
96-06063-04	12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Lead-214	LANL ER-130 Modified	1.22	0.22	0.12	PCI/G
96-06063-04	12424-49086		06/11/96	06/14/96	06/18/96	07/01/96	Radium-226	LANL ER-130 Modified	1.24	0.18	0.11	PCI/G
96-06063-05	12424-49087		06/11/96	06/14/96	06/18/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.67	0.09	0.06	PCI/G
96-06063-05	12424-49087		06/11/96	06/14/96	06/18/96	07/01/96	Lead-214	LANL ER-130 Modified	0.66	0.16	0.07	PCI/G
96-06063-05	12424-49087		06/11/96	06/14/96	06/18/96	07/01/96	Radium-226	LANL ER-130 Modified	0.67	0.12	0.07	PCI/G
96-06063-06	12424-49088		06/11/96	06/14/96	06/18/96	07/01/96	Bismuth-214	LANL ER-130 Modified	0.79	0.09	0.07	PCI/G
96-06063-06	12424-49088		06/11/96	06/14/96	06/18/96	07/01/96	Lead-214	LANL ER-130 Modified	0.71	0.17	0.07	PCI/G
96-06063-06	12424-49088		06/11/96	06/14/96	06/18/96	07/01/96	Radium-226	LANL ER-130 Modified	0.75	0.13	0.07	PCI/G

314 98

Approved by:  7/3/96
M.R. McDougall, Laboratory Manager

TNU-OR-4569

July 10, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE
Work Order# 96-06065-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains two water samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

CLIENT ID

LAB ID

12424-49075
12424-49090

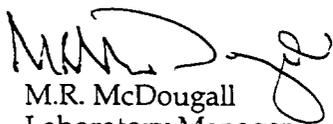
96-06065-04
96-06065-05

SPECIAL PROBLEMS OR UNUSUAL CIRCUMSTANCES

Samples were analysed by Gamma Spectroscopy for Radium-226 by Bismuth-214 daughter inference. This technique is not as sensitive as other preferred methods of detection for low activity Radium-226 in water samples such as Alpha Spectroscopy. On June 19, 1996 Mountain States Analytical was contacted to advise them concerning Radium-226 by Alpha Spectroscopy would provide more sensitive results and requested the client for instructions. We waited for this change of analysis technique and attempted contact several times without success. On Friday, July 5, 1996 MSA contacted us and we discussed these same issues. As a result of this conversation, we were directed to report Gamma Spectroscopy results. Results are subject to the limitations of the Gamma Spectroscopy technique employed and may not be applicable for the end user. A reanalysis is possible by Alpha Spectroscopy if needed.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


M.R. McDougall
Laboratory Manager

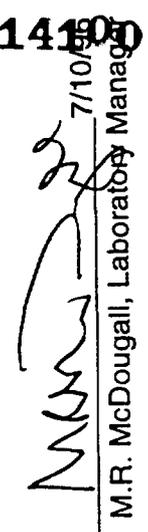
Date: 7/10/96

P.O. #: 12424
SDG: 9606065
MATRIX: Water

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06065-01	K KNOWN		06/14/96	06/14/96	06/18/96	06/19/96	Cobalt-60	LANL ER-130 Modified	133081.08	5722.49	668.70	PC/I/L
96-06065-01	K KNOWN		06/14/96	06/14/96	06/18/96	06/19/96	Cesium-137	LANL ER-130 Modified	79477.12	3258.56	700.00	PC/I/L
96-06065-01	S SPIKE		06/14/96	06/14/96	06/18/96	06/19/96	Cobalt-60	LANL ER-130 Modified	131100.00	985.00	668.70	PC/I/L
96-06065-01	S SPIKE		06/14/96	06/14/96	06/18/96	06/19/96	Cesium-137	LANL ER-130 Modified	80510.00	1090.00	700.00	PC/I/L
96-06065-02	B BLANK		06/14/96	06/14/96	06/18/96	06/19/96	Radium-226	LANL ER-130 Modified	-12.50	9.70	15.40	PC/I/L
96-06065-03	D 12424-49075		06/10/96	06/14/96	06/18/96	06/18/96	Radium-226	LANL ER-130 Modified	-6.70	14.10	18.20	PC/I/L
96-06065-04	12424-49075		06/10/96	06/14/96	06/18/96	06/19/96	Radium-226	LANL ER-130 Modified	22.80	15.20	18.40	PC/I/L
96-06065-05	12424-49090		06/11/96	06/14/96	06/18/96	06/18/96	Radium-226	LANL ER-130 Modified	-15.10	9.70	15.20	PC/I/L

314190

 7/10/96

Approved by: M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUTech

A Subsidiary of Thermo Remediation, a Thermo Electron Company
601 Seabrook Road Oak Ridge, TN 37830 TEL 37830 FAX 423/483-4621

TNU-OR-4522

July 1, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE
Work Order# 96-06087-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains one soil sample relogged 06/21/96 at the request of the client. This sample was analyzed for Isotopic Thorium and Isotopic Uranium.

CLIENT ID

12424-49067

LAB ID

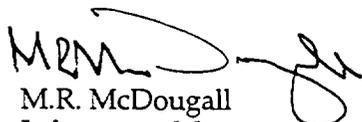
96-06087-04

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

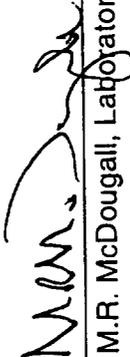

M.R. McDougall
Laboratory Manager

Date: 6/27/96
NM

P.O. #: 12424
SDG: 9606087
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-228	EML Th-01 Modified	5.40	0.19	0.10	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-228	EML Th-01 Modified	5.14	1.01	0.10	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-228	EML Th-01 Modified	0.14	0.10	0.15	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-228	EML Th-01 Modified	0.70	0.30	0.20	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-228	EML Th-01 Modified	1.02	0.37	0.16	PCI/G
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-230	EML Th-01 Modified	5.60	0.12	0.09	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-230	EML Th-01 Modified	4.81	0.96	0.09	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-230	EML Th-01 Modified	0.38	0.17	0.09	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-230	EML Th-01 Modified	1.45	0.48	0.14	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-230	EML Th-01 Modified	1.25	0.42	0.07	PCI/G
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-232	EML Th-01 Modified	5.40	0.19	0.10	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-232	EML Th-01 Modified	4.59	0.92	0.10	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/26/96	Thorium-232	EML Th-01 Modified	0.12	0.09	0.05	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-232	EML Th-01 Modified	1.02	0.38	0.15	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/26/96	Thorium-232	EML Th-01 Modified	0.45	0.23	0.16	PCI/G

Approved by:  7/1/96
M.R. McDougall, Laboratory Manager

314108

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

P.O. #: 12424
SDG: 9606087
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-234	EML U-02 Modified	8.80	0.33	0.10	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-234	EML U-02 Modified	8.01	1.57	0.10	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-234	EML U-02 Modified	0.40	0.20	0.15	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-234	EML U-02 Modified	0.84	0.33	0.12	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-234	EML U-02 Modified	0.51	0.23	0.13	PCI/G
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-235	EML U-02 Modified	0.40	0.02	0.07	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-235	EML U-02 Modified	0.48	0.24	0.07	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-235	EML U-02 Modified	0.03	0.06	0.08	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-235	EML U-02 Modified	0.03	0.06	0.19	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-235	EML U-02 Modified	0.05	0.08	0.07	PCI/G
96-06087-01	K KNOWN		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-238	EML U-02 Modified	8.50	0.32	0.10	PCI/G
96-06087-01	S SPIKE		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-238	EML U-02 Modified	8.88	1.71	0.10	PCI/G
96-06087-02	B BLANK		06/14/96	06/14/96	06/24/96	06/27/96	Uranium-238	EML U-02 Modified	0.37	0.20	0.13	PCI/G
96-06087-03	D 12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-238	EML U-02 Modified	0.81	0.32	0.12	PCI/G
96-06087-04	12424-49067		06/10/96	06/14/96	06/24/96	06/27/96	Uranium-238	EML U-02 Modified	0.66	0.27	0.15	PCI/G

314103

Approved by:  7/1/96
M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike



Mountain States Analytical

8872

Sample Chain of Custody

Subcontract #

Client Name: METCALF + EDDY P.O. # 94-016021-002
 Phone #: (713) 590-8880 Fax #: (713) 590-5118
 Project Name/ #: LLRW Removal / CARSWELL AFB
 Sampler: DAN PHILLIPS

Sample Identification	Date Collected	Time Collected	Sample re/inquished by:				Date	Time	Sample received by:	Date	Time	Remarks	Temp. of Samples Upon Receipt
			Grab	Composite	Soil	Water							
BMEIWN002 000010	6.10.96	1115	X	X								0.02	
BMEIWN002 050060	6.10.96	1130	X	X									
BMEIWN002 110120	6.10.96	1225	X	X									
BMEIWN002 170180	6.10.96	1240	X	X									
BMEIWN003 000010 + MS/MSD	6.10.96	1400	X	X							DO NOT ANALYZE		
BMEIWN003 050060	6.10.96	1415	X	X									
RINSATE/EQ BLANK #1	6.10.96	1450				X							
BMEIWN003 110120	6.10.96	1430	X	X									
BMEIWN003 170180	6.10.96	1450	X	X									
BMEIWN003 180190	6.10.96	1500	X	X									
Name of Shipper	Airbill No.	Date	Time	Date	Time	Date	Time	Date	Time	Date	Time		
FedEx	1129441896	6.12.96	1230	6.12.96	1230	6.12.96	1230	Ma: Semilas Ek.	6.12.96	1230			
Received By (Lab)	Date	Time	Seals Intact?	Dun M.M.		Mail Services Ek.		(AB)					
Turnaround Time Requested (please circle):	Normal												
(Rush TAT is subject to MSN approval and surcharge)													
Report Results By: (Date)	7.1.96												
Rush results requested by (please circle):	Normal												
Report Results to:	MILK-TIMMER												
3838 N. SAM HUNSTON PKWY EAST #440 HUNSTON TX 77032													
Type of Disposal:													
Date/Time of Disposal:													
Authorized for Disposal by:													
Disposed of by:													

314104

PAGE 1 of 2



Mountain States Analytical

8873

Sample Chain of Custody

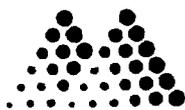
subcontract #

Client Name: METCALF + EDDY P.O. # 94-016021-002
 Phone #: (713) 590-8880 Fax #: (713) 590-5118
 Project Name#: LLRW Removal / CARSWELL AFB
 Sampler: DAN PHILLIPS

Sample Identification	Date Collected	Time Collected	Total of Containers				Rush?	Remarks	Temp. of Samples Upon Receipt		
			Grab	Composite	Soil	Water				Other	
BMEIWN001 000010	6.10.96	1535		X	X				0.02 ml/hr		
BMEIWN001 050060	6.10.96	1550		X	X						
BMEIWN001 110120	6.10.96	1610		X	X						
BMEIWN001 120130	6.10.96	1615		X	X						
BMEIWN001 170180	6.10.96	1640		X	X						
BMEIWN004 000010	6.11.96	0740		X	X						
BMEIWN004 050060	6.11.96	0755		X	X						
BMEIWN004 110120	6.11.96	0800		X	X						
BMEIWN004 170180 + MS/MSD	6.11.96	0820		X	X		DO NOT ANALYZE				
RINSATE/EQ. BLANK #2	6.11.96	0835							HNO3 Preserved		
Name of Shipper	Airbill No.	Date	Time	Sample Relinquished by:	Date	Time	Sample received by:	Date	Time		
FEDX	1179441896	6.12.96	1230	Dan Phillips	6.12.96	1230	Mail Services Etc.	6.12.96	1230		
Received By (Lab)	Date	Time	Seals Intact?	Mail Services etc			(CAB)				
Turnaround Time Requested (please circle):	Normal Rush										
Report Results By: (Date)	7.1.96										
Report Results to:	MIKE TIMMER										
3826 N. SAM HOUSTON PKWY EAST, HOUSTON TX 77032											
Type of Disposal:				Date/Time of Disposal:				Authorized for Disposal by:		Disposed of by:	
										314105	

PAGE 2 of 2

314106



Mountain States Analytical

The Quality Solution

July 8, 1996

Mr. Mike Timmer
Metcalf & Eddy Services
3838 N. Sam Houston Parkway East
Suite 440
Houston, TX 77032

Reference:

Project: LLRW Removal/Carswell AFB
MSAI Group: 12423

Dear Mr. Timmer:

Enclosed are the analytical results for your project referenced above. The following samples are included in the report.

SMEISS001
SMEISS004

SMEISS002

SMEISS003

All holding times were met for the tests performed on these samples.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Mountain States Analytical, Inc. to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

With Regards,

W. Scott Fraser
Project Manager



Analytical Report

31 1107

ites

Y E

MSAI Group: 124 3
Date Reported: 07 08/96
Date Received: 06 13/96

wel

Purchase Order: 9--016021-002
Project No.:

Sample 1
Sample 2
Sample 3
Sample 4
Test Method
01007

Units	Limit of Quantitation
-----	-----
pCi/g	
pCi/g	
pCi/g	
pCi/g	

Respectfully Submitted,
Reviewed and Approved by:

W. Scott Fraser

W. Scott Fraser
Project Manager

Thermo NUtech

601 Scarboro Road

314108
Ridge, TN 37830

(423) 481-0683

FAX (423) 483-4621

FAX (423) 481-0121

TNU-OR-4553

July 8, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE
Work Order# 96-06067-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains two soil samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

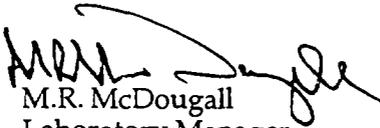
<u>CLIENT ID</u>	<u>LAB ID</u>
12423-49063	96-06067-04
12423-49064	96-06067-05

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


M.R. McDougall
Laboratory Manager

Date: 7/8/96

P.O. #: 12423
SDG: 9606067
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06067-01	K KNOWN		06/14/96	06/14/96	06/19/96	07/02/96	Cobalt-60	LANL ER-130 Modified	146.16	6.28	0.91	PCI/G
96-06067-01	K KNOWN		06/14/96	06/14/96	06/19/96	07/02/96	Cesium-137	LANL ER-130 Modified	87.30	3.58	1.04	PCI/G
96-06067-01	S SPIKE		06/14/96	06/14/96	06/19/96	07/02/96	Cobalt-60	LANL ER-130 Modified	146.80	1.41	0.91	PCI/G
96-06067-01	S SPIKE		06/14/96	06/14/96	06/19/96	07/02/96	Cesium-137	LANL ER-130 Modified	89.07	1.58	1.04	PCI/G
96-06067-02	B BLANK		06/14/96	06/14/96	06/19/96	07/02/96	Bismuth-214	LANL ER-130 Modified	-0.06	0.07	0.12	PCI/G
96-06067-02	B BLANK		06/14/96	06/14/96	06/19/96	07/02/96	Lead-214	LANL ER-130 Modified	-0.06	0.06	0.10	PCI/G
96-06067-02	B BLANK		06/14/96	06/14/96	06/19/96	07/02/96	Radium-226	LANL ER-130 Modified	-0.06	0.06	0.11	PCI/G
96-06067-03	D 12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.76	0.14	0.15	PCI/G
96-06067-03	D 12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Lead-214	LANL ER-130 Modified	0.85	0.28	0.15	PCI/G
96-06067-03	D 12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Radium-226	LANL ER-130 Modified	0.80	0.21	0.15	PCI/G
96-06067-04	12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.74	0.18	0.14	PCI/G
96-06067-04	12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Lead-214	LANL ER-130 Modified	0.71	0.28	0.16	PCI/G
96-06067-04	12423-49063		06/12/96	06/14/96	06/19/96	07/02/96	Radium-226	LANL ER-130 Modified	0.72	0.23	0.15	PCI/G
96-06067-05	12423-49064		06/12/96	06/14/96	06/19/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.77	0.12	0.11	PCI/G
96-06067-05	12423-49064		06/12/96	06/14/96	06/19/96	07/02/96	Lead-214	LANL ER-130 Modified	0.42	0.22	0.12	PCI/G
96-06067-05	12423-49064		06/12/96	06/14/96	06/19/96	07/02/96	Radium-226	LANL ER-130 Modified	0.59	0.17	0.12	PCI/G

314100 7/8/96

Approved by:  M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUtech

314110 601 Scarboro Road

Oak Ridge, TN 37830

(423) 481-0683

FAX (423) 483-4621

FAX (423) 481-0121

TNU-OR-4552

July 8, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE

Work Order# 96-06077-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains two soil samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

CLIENT ID

LAB ID

12423-49065

96-06077-04

12423-49066

96-06077-05

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.



M.R. McDougall
Laboratory Manager

Date: 7/8/96

W. Scott Fraser
 Mountain States Analytical
 1645 West 2200 South
 Salt Lake City, UT 84119

P.O. #: 12423
 SDG: 9606077
 MATRIX: Soil

Final Report of Analysis
 Date of Report: 7/8/96
 Page 1 of 1

314111

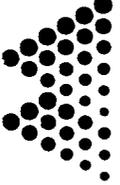
Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06077-01	K	KNOWN	06/14/96	06/14/96	06/19/96	07/03/96	Cobalt-60	LANL ER-130 Modified	146.16	6.28	0.78	PCI/G
96-06077-01	K	KNOWN	06/14/96	06/14/96	06/19/96	07/03/96	Cesium-137	LANL ER-130 Modified	87.30	3.58	0.95	PCI/G
96-06077-01	S	SPIKE	06/14/96	06/14/96	06/19/96	07/03/96	Cobalt-60	LANL ER-130 Modified	144.70	1.25	0.78	PCI/G
96-06077-01	S	SPIKE	06/14/96	06/14/96	06/19/96	07/03/96	Cobalt-60	LANL ER-130 Modified	92.85	1.37	0.95	PCI/G
96-06077-02	B	BLANK	06/14/96	06/14/96	06/19/96	07/03/96	Bismuth-214	LANL ER-130 Modified	-0.05	0.05	0.11	PCI/G
96-06077-02	B	BLANK	06/14/96	06/14/96	06/19/96	07/03/96	Lead-214	LANL ER-130 Modified	-0.03	0.06	0.11	PCI/G
96-06077-02	B	BLANK	06/14/96	06/14/96	06/19/96	07/03/96	Radium-226	LANL ER-130 Modified	-0.04	0.06	0.11	PCI/G
96-06077-03	D	12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Bismuth-214	LANL ER-130 Modified	0.89	0.11	0.10	PCI/G
96-06077-03	D	12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Lead-214	LANL ER-130 Modified	0.87	0.22	0.11	PCI/G
96-06077-03	D	12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Radium-226	LANL ER-130 Modified	0.88	0.16	0.11	PCI/G
96-06077-04		12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Bismuth-214	LANL ER-130 Modified	0.64	0.13	0.10	PCI/G
96-06077-04		12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Lead-214	LANL ER-130 Modified	0.86	0.23	0.11	PCI/G
96-06077-04		12423-49065	06/12/96	06/14/96	06/19/96	07/03/96	Radium-226	LANL ER-130 Modified	0.75	0.18	0.10	PCI/G
96-06077-05		12423-49066	06/12/96	06/14/96	06/19/96	07/03/96	Bismuth-214	LANL ER-130 Modified	0.76	0.13	0.10	PCI/G
96-06077-05		12423-49066	06/12/96	06/14/96	06/19/96	07/03/96	Lead-214	LANL ER-130 Modified	0.74	0.24	0.11	PCI/G
96-06077-05		12423-49066	06/12/96	06/14/96	06/19/96	07/03/96	Radium-226	LANL ER-130 Modified	0.75	0.18	0.10	PCI/G

Approved by:  7/8/96
 M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

Thermo NUtech

A Subsidiary of Thermo Remediation, a Thermo Electron Company



Mountain States Analytical

Sample Chain of Custody

No 8961

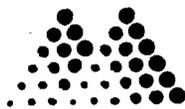
Subcontract #

Client Name: METCALF + EDDY P.O. # 94-016021-002
 Phone #: (713) 590-8860 Fax #: (713) 590-5118
 Project Name#: LRRW Removal / Caswell AFB
 Sampler: DAN PHILLIPS

Sample Identification	Date Collected	Time Collected	Total of Containers				Analysis Required				Remarks	Temp. of Samples Upon Receipt																																																												
			Grab	Composite	Soil	Water	Other	Proctor Test	Hydrogen Sulfide	Blank Filter Test			Rush?																																																											
SMEI 55 001	6.12.96	0815	X	X	X																																																																			
SMEI 55 002	6.12.96	0820	X	X	X																																																																			
SMEI 55 003	6.12.96	0825	X	X	X																																																																			
SMEI 55 004	6.12.96	0830	X	X	X																																																																			
PROCTOR TEST SULL	6.12.96	0945	X	X																																																																				
<table border="1"> <thead> <tr> <th>Name of Shipper</th> <th>Airbill No.</th> <th>Date</th> <th>Time</th> <th>Sample relinquished by:</th> <th>Date</th> <th>Time</th> <th>Sample received by:</th> <th>Date</th> <th>Time</th> </tr> </thead> <tbody> <tr> <td>FED EX</td> <td>1179441896</td> <td>6.12.96</td> <td>1230</td> <td>Dan Miller</td> <td>6.12.96</td> <td>1230</td> <td>Met Services Etc. (LAB)</td> <td>6.12.96</td> <td>1230</td> </tr> <tr> <td>Received By (Lab)</td> <td></td> <td>Date</td> <td>Time</td> <td>Seals Intact?</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Ray Oliver</td> <td>0830</td> <td></td> <td>4:00</td> <td>Met Services Etc.</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td colspan="10"> Turnaround Time Requested (please circle): (Normal) Rush (Rush TAT is subject to MSAI approval and surcharge) </td> </tr> <tr> <td colspan="10"> Report Results By: (Date) 7.1.96 Rush results requested by (please circle): Phone Fax Report Results to: MIKE TIMMER MTE HOUSTON </td> </tr> </tbody> </table>													Name of Shipper	Airbill No.	Date	Time	Sample relinquished by:	Date	Time	Sample received by:	Date	Time	FED EX	1179441896	6.12.96	1230	Dan Miller	6.12.96	1230	Met Services Etc. (LAB)	6.12.96	1230	Received By (Lab)		Date	Time	Seals Intact?						Ray Oliver	0830		4:00	Met Services Etc.						Turnaround Time Requested (please circle): (Normal) Rush (Rush TAT is subject to MSAI approval and surcharge)										Report Results By: (Date) 7.1.96 Rush results requested by (please circle): Phone Fax Report Results to: MIKE TIMMER MTE HOUSTON									
Name of Shipper	Airbill No.	Date	Time	Sample relinquished by:	Date	Time	Sample received by:	Date	Time																																																															
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Received By (Lab)		Date	Time	Seals Intact?																																																																				
Ray Oliver	0830		4:00	Met Services Etc.																																																																				
Turnaround Time Requested (please circle): (Normal) Rush (Rush TAT is subject to MSAI approval and surcharge)																																																																								
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Authorized for Disposal by:										314112																																																														
Date/Time of Disposal:										Disposed of by:																																																														

PAGE 1 of 1

314113



Mountain States Analytical

The Quality Solution

July 8, 1996

Mr. Mike Timmer
Metcalf & Eddy Services
3838 N. Sam Houston Parkway East
Suite 440
Houston, TX 77032

Reference:

Project: LLRW Removal/Carswell AFB
MSAI Group: 12425

Dear Mr. Timmer:

Enclosed are the analytical results for your project referenced above. The following samples are included in the report.

North Wall	North Wall Dup
South Wall	East Wall
West Wall	Floor
Rinsate #3/Confirmation	

All holding times were met for the tests performed on these samples.

If the report is acceptable, please approve the enclosed invoice and forward it for payment.

Thank you for selecting Mountain States Analytical, Inc. to serve as your analytical laboratory on this project. If you have any questions concerning these results, please feel free to contact me at any time.

We look forward to working with you on future projects.

With Regards,

W. Scott Fraser
Project Manager

TNU-OR-4551

July 8, 1996

Mr. W. Scott Fraser
 Mountain States Analytical
 1645 West 2200 South
 Salt Lake City, UT 84119

CASE NARRATIVE
 Work Order# 96-06064-OR
 State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains eight soil samples received 06/14/96. These samples were analyzed for Gamma Spectroscopy.

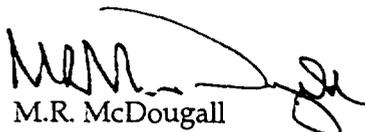
<u>CLIENT ID</u>	<u>LAB ID</u>	<u>CLIENT ID</u>	<u>LAB ID</u>
12425-49091	96-06064-04	12425-49095	96-06064-08
12425-49092	96-06064-05	12425-49096	96-06064-09
12425-49093	96-06064-06	12425-49097	96-06064-10
12425-49094	96-06064-07	12425-49098	96-06064-11

PROBLEMS OR UNUSUAL CIRCUMSTANCES

No problems or unusual circumstances were noted during the analytical process.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.


 M.R. McDougall
 Laboratory Manager

Date: 7/8/96

P.O. #: 12425
SDG: 9606064
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06064-01	K	KNOWN	06/14/96	06/14/96	06/17/96	07/02/96	Cobalt-60	LANL ER-130 Modified	146.16	6.28	0.96	PCI/G
96-06064-01	K	KNOWN	06/14/96	06/14/96	06/17/96	07/02/96	Cesium-137	LANL ER-130 Modified	87.30	3.58	1.10	PCI/G
96-06064-01	S	SPIKE	06/14/96	06/14/96	06/17/96	07/02/96	Cobalt-60	LANL ER-130 Modified	144.60	1.47	0.96	PCI/G
96-06064-01	S	SPIKE	06/14/96	06/14/96	06/17/96	07/02/96	Cesium-137	LANL ER-130 Modified	87.78	1.74	1.10	PCI/G
96-06064-02	B	BLANK	06/14/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	-0.06	0.08	0.13	PCI/G
96-06064-02	B	BLANK	06/14/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	-0.03	0.07	0.12	PCI/G
96-06064-02	B	BLANK	06/14/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	-0.05	0.07	0.12	PCI/G
96-06064-03	D	12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.68	0.14	0.12	PCI/G
96-06064-03	D	12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	0.61	0.26	0.12	PCI/G
96-06064-03	D	12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	0.65	0.20	0.12	PCI/G
96-06064-04		12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.67	0.14	0.11	PCI/G
96-06064-04		12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	0.62	0.24	0.13	PCI/G
96-06064-04		12425-49091	06/11/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	0.64	0.19	0.12	PCI/G
96-06064-05		12425-49092	06/11/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.64	0.10	0.10	PCI/G
96-06064-05		12425-49092	06/11/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	0.59	0.15	0.22	PCI/G
96-06064-05		12425-49092	06/11/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	0.62	0.13	0.16	PCI/G
96-06064-06		12425-49093	06/11/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.89	0.16	0.14	PCI/G
96-06064-06		12425-49093	06/11/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	1.18	0.23	0.16	PCI/G
96-06064-06		12425-49093	06/11/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	1.03	0.20	0.15	PCI/G
96-06064-07		12425-49094	06/11/96	06/14/96	06/17/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.59	0.11	0.11	PCI/G
96-06064-07		12425-49094	06/11/96	06/14/96	06/17/96	07/02/96	Lead-214	LANL ER-130 Modified	0.44	0.19	0.10	PCI/G
96-06064-07		12425-49094	06/11/96	06/14/96	06/17/96	07/02/96	Radium-226	LANL ER-130 Modified	0.52	0.15	0.10	PCI/G

314116
Approved by:  7/8/96
M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

P.O. #: 12425
SDG: 9606064
MATRIX: Soil

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06064-08	12425-49095		06/11/96	06/14/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.59	0.12	0.12	PCI/G
96-06064-08	12425-49095		06/11/96	06/14/96	07/02/96	Lead-214	LANL ER-130 Modified	0.76	0.19	0.12	PCI/G
96-06064-08	12425-49095		06/11/96	06/14/96	07/02/96	Radium-226	LANL ER-130 Modified	0.68	0.16	0.12	PCI/G
96-06064-09	12425-49096		06/11/96	06/14/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.67	0.13	0.09	PCI/G
96-06064-09	12425-49096		06/11/96	06/14/96	07/02/96	Lead-214	LANL ER-130 Modified	0.73	0.19	0.12	PCI/G
96-06064-09	12425-49096		06/11/96	06/14/96	07/02/96	Radium-226	LANL ER-130 Modified	0.70	0.16	0.11	PCI/G
96-06064-10	12425-49097		06/11/96	06/14/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.69	0.14	0.13	PCI/G
96-06064-10	12425-49097		06/11/96	06/14/96	07/02/96	Lead-214	LANL ER-130 Modified	0.72	0.28	0.13	PCI/G
96-06064-10	12425-49097		06/11/96	06/14/96	07/02/96	Radium-226	LANL ER-130 Modified	0.71	0.21	0.13	PCI/G
96-06064-11	12425-49098		06/11/96	06/14/96	07/02/96	Bismuth-214	LANL ER-130 Modified	0.58	0.13	0.12	PCI/G
96-06064-11	12425-49098		06/11/96	06/14/96	07/02/96	Lead-214	LANL ER-130 Modified	0.74	0.18	0.12	PCI/G
96-06064-11	12425-49098		06/11/96	06/14/96	07/02/96	Radium-226	LANL ER-130 Modified	0.66	0.15	0.12	PCI/G

Approved by:  7/8/96
M.R. McDougall, Laboratory Manager

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike

TNU-OR-4568

July 10, 1996

Mr. W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

CASE NARRATIVE

Work Order# 96-06066-OR
State of Utah Certificate #E-235

SAMPLE RECEIPT

This work order contains one water sample received 06-14-96. This sample was analyzed for Gamma Spectroscopy.

CLIENT ID

12425-49099

LAB ID

96-06066-04

SPECIAL PROBLEMS OR UNUSUAL CIRCUMSTANCES

Sample was analysed by Gamma Spectroscopy for Radium-226 by Bismuth-214 daughter inference. This technique is not as sensitive as other preferred methods of detection for low activity Radium-226 in water samples such as alpha spectroscopy. On June 19, 1996 Mountain States Analytical was contacted to advise them concerning Radium-226 by Alpha Spectroscopy would provide more sensitive results and requested the client for instructions. We waited for this change of analysis technique and attempted contact several times without success. On Friday, July 5, 1996 MSA contacted us and we discussed these same issues. As a result of this conversation, we were directed to report Gamma Spectroscopy results. Results are subject to the limitations of the Gamma Spectroscopy technique employed and may not be applicable for the end user. A reanalysis is possible by Alpha Spectroscopy if needed.

CERTIFICATION OF ACCURACY

I certify that this data report is in compliance with the terms and conditions of the Purchase Order, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hard copy data package has been authorized by the cognizant project manager or his/her designee to be accurate as verified by the following signature.

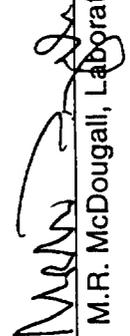

M.R. McDougall
Laboratory Manager

Date: 7/10/96

P.O. #: 12425
SDG: 9606066
MATRIX: Water

W. Scott Fraser
Mountain States Analytical
1645 West 2200 South
Salt Lake City, UT 84119

Lab ID	Sample ID	Client ID	Sample Date	Receipt Date	Prep Date	Analysis Date	Analyte	Method	Result	Error	MDA	Units
96-06066-01	K	KNOWN	06/14/96	06/14/96	06/18/96	06/19/96	Cobalt-60	LANL ER-130 Modified	133081.08	5722.49	668.70	PCI/L
96-06066-01	K	KNOWN	06/14/96	06/14/96	06/18/96	06/19/96	Cesium-137	LANL ER-130 Modified	79477.12	3258.56	700.00	PCI/L
96-06066-01	S	SPIKE	06/14/96	06/14/96	06/18/96	06/19/96	Cobalt-60	LANL ER-130 Modified	131100.00	985.00	668.70	PCI/L
96-06066-01	S	SPIKE	06/14/96	06/14/96	06/18/96	06/19/96	Cesium-137	LANL ER-130 Modified	80510.00	1090.00	700.00	PCI/L
96-06066-02	B	BLANK	06/14/96	06/14/96	06/18/96	06/19/96	Radium-226	LANL ER-130 Modified	-12.50	9.70	15.40	PCI/L
96-06066-03	D	12425-49099	06/11/96	06/14/96	06/18/96	06/18/96	Radium-226	LANL ER-130 Modified	-9.70	10.80	14.40	PCI/L
96-06066-04		12425-49099	06/11/96	06/14/96	06/18/96	06/19/96	Radium-226	LANL ER-130 Modified	-5.40	10.85	14.90	PCI/L

Approved by:  7/10/96
M.R. McDougall, Laboratory Manager

314119

K=Known, S=Spike, B=Blank, D=Duplicate, MS=Matrix Spike



Mountain States Analytical

Sample Chain of Custody

8874

Subcontract #

Client Name: METCALF + EDDY P.O. # 94-016021-002

Phone #: (713) 590-8880 Fax #: (713) 590-5118

Project Name/ID: LLRW Removal / CARSWELL AFB

Sampler: ALAN GRIGSBY - THERMO NUTECH

Sample Identification	Date Collected	Time Collected	Sample Relinquished by:					Date	Time	Sample received by:	Date	Time	Remarks	Temp. of Samples Upon Receipt
			Grab	Composite	Soil	Water	Other							
NORTH WALL	6.11.96	1630		X	X									
NORTH WALL DUP	6.11.96	1630		X	X									
SOUTH WALL	6.11.96	1630		X	X									
EAST WALL	6.11.96	1630		X	X									
WEST WALL	6.11.96	1630		X	X									
FLOOR + MS + MSD	6.11.96	1630		X	X									
RINSATE III - CONFIRMATION	6.11.96	1345					X							HNO ₃ Preserved
FEDEX	117944	896	6.12.96	1230										
Received By (Lab)	Date	Time	Seals Intact?	Sample Relinquished by:		Date	Time	Sample received by:	Date	Time	Temp. of Samples Upon Receipt			
				Dun Hill		6.12.96	1230	Mail Services Etc.	6.12.96	1230				
				Mail Services Etc				(LAB)						
Turnaround Time Requested (please circle):	Normal													
(Rush TAT is subject to MSAL approval and surcharge)	Rush													
Report Results By: (Date)	7.1.96													
Rush results requested by (please circle):	Phone Fax													
Report Results to:	MIKE TIMMER													
3638 N. Sam Houston Pkwy. East, #440, Houston TX	33032													
Type of Disposal:													Authorized for Disposal by:	
Date/Time of Disposal:													Disposed of by:	

314120

PAGE 1 of 1

TAB

APPENDIX F

APPENDIX F

TRANSPORTATION AND DISPOSAL DOCUMENTATION



May 2, 1996

016021-1242

Mr. Roland Weiskittel
U.S. Ecology, Inc.
109 Flint Road
Oak Ridge, Tennessee 37830

Reference: Prime Contract No. F41624-92-D-8002
Delivery Order Number 0012
NORM Waste Removal and Disposal
Carswell AFB, Texas

Subject: Request for NARM Determination

Dear Mr. Weiskittel:

In accordance with the October 27, 1995 Memorandum for the State of Washington provided by Mr. Roger Johnson of the Air Force's Low Level Radioactive Waste Program, Metcalf & Eddy, Inc. (M&E) is providing this letter to request assistance in the acquisition of a NARM determination to allow the disposal of exhumed radioactive waste units from Carswell AFB, Texas at your facility in Richland, Washington. The following paragraphs provide the information listed in Item 6 of the Memorandum.

A. Background

Under a contract with the Air Force Center for Environmental Excellence (AFCEE), Brooks AFB, Texas, M&E has been issued a delivery order (0012) to remove and dispose of naturally-occurring radioactive materials (NORM) and affected soils buried at SWMU 60 of Carswell AFB in Fort Worth, Texas. SWMU 60 is located five miles west of Carswell AFB at the Off-Site Weapons Storage Area.

A chain-link fence approximately 10 feet by 20 feet encompasses SWMU 60 which contains three buried pipes. The pipes are reported to contain radium-painted luminous dials from aircraft instruments that were disposed of in the pipes according to rules and practices acceptable at the time of construction in the early 1950's. Based on visual inspection by the Air Force representatives, no evidence of any release of hazardous constituents to the environment has occurred.

The field activities to be performed include the following:

1. Mobilization of personnel, equipment, and materials;
2. Installation of four boreholes to approximately 18 feet below ground surface (bgs) and the collection of four soil samples from each borehole.

Mr. Roland Weiskittel
 May 2, 1996
 Page 2

These boreholes will be located so as to collect background soil samples for laboratory analysis to determine the concentration of naturally-occurring isotopes in background soils;

3. Excavation of the pipes and stockpiling of approximately 50 cubic yards of soil;
4. Performance of verification survey of the pipes and overpacking them into steel containers with welded caps or covers for shipment;
5. Collection and analysis of representative samples of the stockpiled soils and confirmation samples of soils remaining in the excavation;
6. Transportation and disposal of the stockpiled soil and the pipes to approved waste disposal facilities; and
7. Restoration of the site by backfilling the excavation and demobilization.

B. Waste Unit Description

According to "as built" drawings provided by the Air Force, the pipes are cast iron with a diameter of 12 inches and extend approximately 12 inches above the ground surface. The length of each pipe is 18 feet, thus extending approximately 17 feet below the ground surface. The bottom end of each pipe was capped with a cast iron plug and lead caulk. At the surface, each pipe was closed with a welded steel cap set over the top of the pipe. Each pipe is surrounded by approximately 3 inches of concrete grout.

1. Activity Calculation

In accordance with the Memorandum, the activity calculation is based on the worst case scenario with all the dials having 15 microcuries of Radium-226 with a maximum device loading of two items per linear inch of pipe. Thus, the maximum activity is determined as follows:

$$\frac{15 \mu\text{Ci}}{\text{item}} * \frac{2 \text{ items}}{\text{inch}} * \frac{12 \text{ inches}}{\text{foot}} * \frac{18 \text{ ft}}{\text{pipe}} * \frac{1000 \text{ nCi}}{1 \mu\text{Ci}} = 6.48 \times 10^6 \text{ nCi/pipe}$$

2. Mass

The mass of the contents of each pipe is determined by finding the interior volume of the pipe, then assuming that it is full of concrete at a specific weight of 123 pounds per cubic foot. This weight is then converted to its mass in grams.

Mr. Roland Weiskittel
May 2, 1996
Page 3

314125

$$M = \pi r^2 h W = \pi * (6 \text{ inches} * \frac{1 \text{ ft}}{12 \text{ in}})^2 * 18 \text{ ft} * \frac{123 \text{ lbs}}{\text{cu ft}} * \frac{454 \text{ gms}}{1 \text{ lb}} = 789,400 \text{ gms}$$

3. Specific Activity

The worst case (highest) specific activity for each pipe is determined as the activity divided by the mass:

$$\frac{6.48 \times 10^6 \text{ } \eta\text{Ci/pipe}}{789,400 \text{ gms}} = 8.21 \text{ } \eta\text{Ci/gm}$$

C. Proposed Packaging Methodology

The pipes and surrounding concrete will be placed intact into one or more steel containers. An approved adsorbent will be placed around each pipe to fill the volume of the container. The container will be closed by welding its cover or end plates directly to the container. The expected volume of the container(s) is expected to be 400 cubic feet. Some containers may also or only contain affected soil with a specific activity of up to 9 $\eta\text{Ci/gm}$.

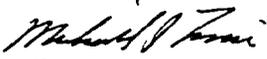
D. Approximate Shipping Date

The approximate shipping date is expected to be the second week in July 1996.

Please call us if you have any questions or need additional information. Thank you for your assistance.

Sincerely,

METCALF & EDDY, INC.


Michael J. Timmer
Project Manager

cc: Mr. Roger Johnson, USAF LLRW Program
Mr. Charles Rice, AFCEE/ERB



314126

STATE OF WASHINGTON
DEPARTMENT OF HEALTH
DIVISION OF RADIATION PROTECTION
Airdustrrial Center, Bldg. 5 • P.O. Box 47827 • Olympia, Washington 98504-7827

July 30, 1996

Sandra M. Beeler, Deputy Chief
Radiological Control and Safety Officer
American Ecology Corporation
120 Franklin Road
Oak Ridge, Tennessee 37830

Dear Ms. Beeler:

This is in response to your letter dated May 20, 1996, requesting on behalf of Carswell Air Force Base, Texas, department review (NARM determination) and approval to dispose of Radium-226 in a concentration less than ten nanocuries per gram, and not evenly distributed within a homogeneous waste form.

According to your letter, the waste consists of three identical pipes (12 inches in diameter by 18 feet long) containing exhumed radium painted dials from aircraft instruments, having a total Ra-226 activity of 19.44 millicuries. The pipes are surrounded by approximately 3 inches of concrete (closed at both ends) and will be placed into a steel container, and the container's void filled with an approved absorbent. The container will be closed by welding its cover end plates directly to the container. The specific activity of Ra-226 in the steel container will be 8.21 nCi/gm. The waste will be disposed of as Class A unstable waste.

License Condition 37 of your Washington State Radioactive Material License WN-I019-2 requires in part that specific approval of the department be obtained prior to the disposal of Ra-226 in concentrations less than 10 nanocuries per gram and not evenly distributed within a homogeneous waste form. This letter constitutes that approval. An application to obtain the necessary site use permit from the Washington State Department of Ecology is enclosed. It is expected that all statements made in your letter will be strictly adhered to.

All shipments must conform to the requirements and regulations of DOT, NRC, state of Washington, as well as US Ecology, Inc.'s license. This waste must be disposed by December 31, 1996.

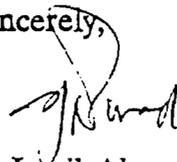


Sandra M. Beeler
Page Two

314127

If you should have any questions, do not hesitate to contact me at (360) 586-9135.

Sincerely,



S. Jamil Ahmad
Radiation Health Physicist



Mikel J. Elsen
Radiation Health Physicist

SJA:krf

cc: Diane Hallisy, WDOE
US Ecology, Inc., Richland, WA
DOH Onsite Inspector

314128

American Ecology

August 8, 1996

Mr. Michael Timmer
Metcalf and Eddy
3838 N. Sam Houston Parkway East
Suite 440
Houston, Texas 77032

Dear Mr. Timmer:

This is to inform you that the Washington Department of Health (WDOH) has approved the NARM determination and variance to Condition 37 for the Carswell Air Force Base radium painted dials contained in three pipes.

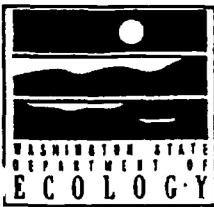
The attached letter from WDOH explains the packaging and disposal requirements. A copy of that letter must accompany the shipment for disposal. A 1996 NARM Site User Permit application was sent to you by Federal Express August 5th.

Please call me at (423)220-5232 if I can be of any further assistance.

Sincerely,



Sandra M. Beeler
Deputy Chief Radiological Control
and Safety Officer



STATE OF WASHINGTON
1996

314129

APPLICATION FOR A
SITE USE PERMIT FOR DISPOSAL OF N.A.R.M WASTES
AT THE
COMMERCIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITE
RICHLAND, WASHINGTON

A. Name of the company, organization, institution, etc., that is the original generator of the waste to be disposed of under this permit. (If the name changes, you must notify us by mail on the new letterhead.) Original generator means the last person who puts radioactive material to practical use. A broker may not list itself as the original generator of its client's radioactive material or waste, nor sign on behalf of the generator.

U.S. Air Force (Texas Sites)
APPLICANT'S NAME:

B. Address where waste is generated (MUST include the 9-digit Zip. Contact your Post Office to obtain your Zip Code).

<u>Off-site Weapons Storage Area</u>	<u>LLRW Program Office SA-ALC/EMP</u>
ADDRESS WHERE WASTE IS GENERATED	MAILING ADDRESS (IF DIFFERENT)
<u>Carswell Air Force Base</u>	<u>307 Tinker Drive, Bldg. 306</u>
<u>Fort Worth, TX 76114-3520</u>	<u>Kelly AFB, TX 78241-5917</u>
CITY STATE ZIP CODE (9 DIGITS)	CITY STATE ZIP CODE (9 DIGITS)

C. Name of the contact person who will be able to provide answers to any questions we may have on your application, waste generating activities or shipments. (NOTE: Permits will be mailed addressed to contact person; ensure mailing address and contact name agree.)

<u>Roger W. Johnson</u>	<u>Program Manager</u>	<u>210-925-8635</u>
(FIRST) (M.I.) (LAST)	TITLE	PHONE Ext

D. If this is a renewal of a site use permit please enter your permit number and volume of waste disposed of at the Richland site in the most recent calendar year in which you held a permit. Indicate if you are a first-time applicant.

RENEWAL - SITE USE PERMIT # N4062 - VOLUME DISPOSED < 500 (CU FT) 95 (YEAR)
 FIRST-TIME APPLICANT

E. Volume of waste in cubic feet, and amount of activity in millicuries (mCi) that you are authorized by the Department of Health to dispose of in Washington State. DO NOT USE SCIENTIFIC NOTATION.

205 ft³ 19.44 mCi

F. Calculate the permit fee due using the enclosed fee schedule and enter amount of fee enclosed.

AMOUNT ENCLOSED \$ 750.

G. Types of N.A.R.M. wastes (e.g. pipe scale, decontamination waste, building rubble, etc.), and all radionuclides that you have approval by the Department of Health to dispose of in Washington State.

1. Radium-painted dials from aircraft instruments.
TYPES OF WASTES

2. Radium - 226
RADIONUCLIDES

H. Do you use a broker's services? If yes, indicate your broker's name and its Washington State Broker Site Use Permit number. If you use more than one broker, list them all.

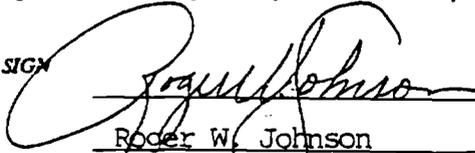
YES NO - Metcalf & Eddy, Inc. - B421
BROKER NAME(S) BROKER'S SITE USE PERMIT #(S)

I. The permit fee is required at time of submitting application (WAC 173-326-040(1)). It is not possible to invoice. Make check payable to the State of Washington, with your Washington State Site Use Permit number (if applicable) written on the check. Please provide the following information:

CHECK # 1201 NAME OF COMPANY ISSUING CHECK Metcalf & Eddy, Inc. **314430**

J. I certify that I am fully authorized to enter into the terms and conditions of this permit and am legally authorized to bind the applicant thereto. I hereby agree to comply with all applicable state and federal regulations related to the safe management of radioactive waste (including the assurance that the waste contains no hazardous components as defined in Washington Administrative Code, Chapter 173-303 WAC, Dangerous Waste Regulations, and complies with the site operator's Radioactive Materials License and with all Department of Transportation packaging and shipping requirements as defined in 49 CFR 170 through 179). I understand that the State of Washington reserves the right to suspend or revoke this permit. The information provided on this form is complete and true to the best of my knowledge.

SIGNATURE OF PERSON AUTHORIZED TO SIGN THIS APPLICATION (IN INK)



PRINTED NAME OF PERSON SIGNING

Roger W. Johnson

TITLE

Program Manager

DATE OF SIGNATURE

15 Aug 96

K. Mail check and application form (with original ink signature) to:

Department of Ecology
Cashiering Section
PO Box 5128
Lacey, WA 98509-5128

L. Correspondence (other than application forms) may be addressed to:

Department of Ecology
Nuclear Waste Program
PO Box 47600
Olympia, WA 98504-7600

Telephone number for information is (360) 407-7109. Internet address is diha461@ecy.wa.gov.

PLEASE ALLOW A MINIMUM OF 4 WEEKS TO PROCESS AND ISSUE SITE USE PERMIT. INCOMPLETE APPLICATION OR LATE PAYMENT WILL CAUSE DELAY.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY



BROKER SITE USE PERMIT

for Commercial Low-Level Radioactive Waste Disposal Site

EXPIRATION DATE: 2/28/97

PERMIT NUMBER: B421

Registrant:
METCALF & EDDY INC
3838 N SAM HOUSTON PARKWAY E.
SUITE 440 TX 77032-3415
HOUSTON

314131

The person or firm to whom this certificate is issued must comply with applicable federal and state regulations related to the safe management of low-level radioactive waste

Permit Does Not Imply Approval

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY



N.A.R.M. * SITE USE PERMIT
for Commercial Low-Level Radioactive Waste Disposal Site

N4316

3/31/97

PERMIT NUMBER: _____

EXPIRATION DATE: _____

Registrant:

U.S. AIR FORCE (CARSWELL AFB)
LLRW PROGRAM OFFICE SA-ALC/EMP
307 TINKER DRIVE BLDG 306
KELLY AFB TX 78241-5917

The person or firm to whom this certificate is issued must comply with applicable federal and state regulations related to the safe management of radioactive waste

* (Naturally Occurring and Accelerator Produced Radioactive Material)

Permit Does Not Imply Approval

314132

314133

Gutierrez-Palmenberg, Inc.
2922 W. Clarendon Ave., Phoenix, AZ 85017

Shipment Control #

95106-01

LENGTH WIDTH HEIGHT
LEGAL LEGAL LEGAL

Tractor 4348
Trailer 848008

STRAIGHT BILL OF LADING—ORIGINAL—NOT NEGOTIABLE.

RECEIVED, subject to the classifications and tariffs in effect on the date of the issue of this Bill of Lading

The property described below, in apparent good order, except as noted (contents and condition of contents of packages unknown). Marked, consigned, and destined as indicated below, which said carrier (the word carrier being understood throughout this contract as meaning any person or corporation in possession of the property under the contract) agrees to carry to its usual place of delivery at said destination. If on its route, otherwise to deliver to another carrier on the route to said destination. It is mutually agreed, as to each carrier of all or any of said property over all or any portion of said route to destination. And as to each party at any time interested in all or any of said property, that every service to be performed hereunder shall be subject to all the terms and conditions of the uniform domestic straight bill of lading set forth (1) in official, Southern, Western and Illinois Freight Classifications in effect on the date hereof, if this is a rail or a rail-water shipment. Or (2) in the applicable motor carrier classification or tariff if this is a motor carrier shipment.

Shipper hereby certifies that he is familiar with all the terms and conditions of the said bill of lading, including those on the back thereof, set forth in the classification or tariff which governs the transportation of this shipment, and the said terms and conditions are hereby agreed to by the shipper and accepted for himself and his assigns.

(MAIL OR STREET ADDRESS OF CONSIGNEE FOR PURPOSES OF NOTIFICATION ONLY.)

FROM OFFSITE WEAPONS STORAGE AREA
CARSWELL AFB Date 10/01/96
At FT WORTH TX 76114-3520

CONSIGNEE TO: USECOLOGY LLRW DISPOSAL FACILITY
DESTINATION: RICHLAND STATE WA 98352 COUNTY:

***** EMERGENCY CONTACT: Gutierrez-Palmenberg, Inc. (602) 234-0696 *****

No.	HM	KIND OF PACKAGE, DESCRIPTION OF ARTICLES, LINER NUMBERS, SPECIAL MARKS & EXCEPTIONS	WEIGHT
3	X	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, INSTRUMENTS AND ARTICLES, 7, UN 2910 RADIOISOTOPES: Ra 226 CHEMICAL FORM: OXIDES CONTAINER TYPE: STRONG TIGHT SPEC LABELS: N/A PLACARDING: NONE TI: N/A EXCEPTION STATEMENT IS ON EACH CONTAINER	19629
		TOTAL ACTIVITY: 19.44 mCi PHYSICAL FORM: SOLID CONTAINER SPEC: N/A SPEC MARKINGS: N/A EXCLUSIVE USE	

IMPORTANT: This is to certify that the above named materials are properly classified, described, packaged, marked and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Signature [Signature]
Company GPI Date 10/01/96

Received the property described above in good condition, except as otherwise noted.

Carrier TRISTATE MOTOR TRANSIT
Driver T. J. Hall
Date and time 10/01/96 1300

SCHEDULED TO	DATE	TIME	COMPLETED	DATE	TIME	SHIPPER'S SIGNATURE
ARRIVE	10/01/96	0800	LOADING	10/01/96	1130	[Signature]
ARRIVED AT	10/01/96	0800	LEFT SHIPPER	10/01/96	1400	[Signature]

SHIPPER IMPORTANT NOTE: Your signature certifies that the above dates and times are correct for record keeping and billing purposes.

SHIPPING PAPERS PG 1 of 4

LIMITED QUANTITY CERTIFICATION

CONSIGNEE:
US Ecology
Low Level Radioactive Waste Disposal Facility
Richland WA, 99352

CONSIGNOR:
U.S. Air Force (Carswell AFB)
Offsite Weapons Storage Area
Carswell AFB
Fort Worth, TX 76114 - 3520

Mark the applicable exception statement

- This package conforms to the ~~conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, 7, UN2910.~~ A
- This package conforms to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package-instruments or articles, 7, UN2910.
- This package conforms to the conditions and limitations specified in 49 CFR 173.426 for radioactive material, excepted articles manufactured from natural or depleted uranium or natural uranium, 7, UN2910. A
- This package conforms to the conditions and limitations specified in 49 CFR 173.428 for radioactive material, excepted empty packaging, 7, UN2910.

This applies to the following packages:

CAR-001

CAR-002

CAR-003

**APPENDIX F
DRIVER'S INSTRUCTIONS FOR
EXCLUSIVE USE VEHICLES
HANFORD**

The Code of Federal Regulations, 49 CFR 173.403(i) and 173.441(c and e) requires that specific instructions for maintenance of exclusive use shipment controls be provided by the shipper to the carrier. These instructions must be included with the shipment documents.

The following instructions shall be complied with for all exclusive use vehicles:

- Do not move or transfer packages within the conveyance or between conveyances while enroute to destination, without notifying shipper.
- The shipment must be loaded by consignor and unloaded by consignee from the transport vehicle in which originally loaded.
- Shipments must be braced so as to prevent leakage or shifting of load under conditions normally incident to transportation.
- The vehicle must be placarded " RADIOACTIVE " on all four sides when applicable until shipment is unloaded.
- Notify the Richland, Washington (Hanford) burial site within 24 hours of arrival: (509) 377-2411
- Notify Washington Port of Entry four (4) hours prior to arrival. I-90: (509) 226-3360; I-84: (509) 783-4014.

If the vehicle is involved in an accident or is required to make emergency braking which would shift the load and change radiation levels, notify the shipper immediately.

In case of an accident, vehicle malfunction, or deviation from the above instructions immediately contact one of the following GPI employees:

Dave Wise	(800) 796-7363	PIN# 1046393 (pager)
	(602) 739-1885	(cellular) (24 Hour)
Dixie Wells	(800) 796-7363	PIN# 1047956 (pager)
	(702) 395-2814	(home)
Thomas O'Dou	(800) 796-7363	PIN# 1047962 (pager)
	(702) 395-2814	(home)
Walter Cunningham	(800) 710-2003	(pager)
	(800) 445-8393	(office)

Any deviation from these instructions is a violation of State and Federal laws and could result in carrier penalty.


10-1-96

 Signature Date

POTENTIAL HAZARDS

314138

HEALTH HAZARDS

Low-level radioactive material; little personal radiation hazard.

Many packages are not required to have radioactive materials labels or markings.

Some radioactive materials cannot be detected by commonly available instruments.

FIRE OR EXPLOSION

Some of these materials may burn, but none of them ignites readily.

Radioactivity does not change flammability or other properties of the materials.

EMERGENCY ACTION

Keep unnecessary people away; isolate hazard area and deny entry.

Response actions may be performed prior to any radiation measurements.

Positive pressure self-contained breathing apparatus (SCBA) and structural firefighters' protective clothing will provide limited protection.

Notify Radiation Authority of accident conditions.

Detain uninjured persons, isolate equipment with suspected contamination, and delay cleanup until instruction of Radiation Authority.

CALL CHEMTREC AT 1-800-424-9300 FOR EMERGENCY ASSISTANCE.

FIRE

Do not move damaged containers; move undamaged containers out of fire zone.

Small Fires: Dry chemical, CO₂, water spray or regular foam.

Large Fires: Water spray, fog (flooding amounts).

SPILL OR LEAK

Do not touch damaged containers or spilled material.

Small Liquid Spills: Take up with sand, earth or other noncombustible absorbent material.

Cover powder spill with plastic sheet or tarp to minimize spreading.

FIRST AID

Use first aid treatment according to the nature of the injury.

Advise medical personnel that victim may be contaminated with low-level radioactive material.

This Emergency Response Guide applies to the following Identification Numbers :

- | | | |
|-------------------------------------|--------|--|
| <input type="checkbox"/> | UN2910 | Radioactive Material, Excepted Package - Articles Manufactured from Natural or Depleted Uranium or Natural Thorium |
| <input type="checkbox"/> | UN2910 | Radioactive Material, Excepted Package - Empty Packaging |
| <input checked="" type="checkbox"/> | UN2910 | Radioactive Material, Excepted Package - Instruments or Articles |
| <input type="checkbox"/> | UN2910 | Radioactive Material, Excepted Package - Limited Quantity of Material |

IMPORTANT NOTICE, PLEASE READHAZARDOUS MATERIAL DRIVER:

THE MATERIAL YOU ARE CARRYING IS TO BE TRANSPORTED TO LLRW DISPOSAL FACILITY, RICHLAND, WASHINGTON FOR PROCESSING. YOU MUST ENTER THE STATE OF WASHINGTON AT ONE OF THE TWO ENTRY POINTS LISTED BELOW AND STOP FOR AN INSPECTION OF YOUR VEHICLE TO INSURE COMPLIANCE WITH STATE OF WASHINGTON AND DEPARTMENT OF TRANSPORTATION REQUIREMENTS FOR VEHICLES CARRYING HAZARDOUS MATERIALS. YOU WILL NOT BE ALLOWED ENTRY INTO THE STATE UNTIL YOUR VEHICLE PASSES THIS INSPECTION. YOU WILL NOT BE ALLOWED TO UNLOAD YOUR VEHICLE AT THE DISPOSAL SITE WITHOUT A CERTIFICATION OF INSPECTION FROM ONE OF THESE CHECKPOINTS:

- A) WEIGH STATION AT PLYMOUTH (I-82)
PHONE: (509) 783-4014
- B) I-90 NEAR SPOKANE
PHONE: (509) 226-3366

YOU MUST NOTIFY ONE OF THE ABOVE CHECKPOINTS BY PHONE AT LEAST 4 HOURS PRIOR TO ENTERING THE STATE. A PERSONAL MONETARY FINE OF \$100.00 WILL BE LEVIED BY THE STATE OF WASHINGTON FOR FAILURE TO STOP AT ONE OF THE ABOVE CHECKPOINTS. A LENGTHY DELAY MAY ALSO BE EXPECTED IN ADDITION TO THE \$100.00 FINE.

STATEMENT OF CERTIFICATION

I HAVE READ AND UNDERSTAND THE ABOVE STATEMENTS CONCERNING THE PROPER DELIVERY OF RADIOACTIVE MATERIALS.

F. J. Hall
SIGNATURE OF DRIVER

DATE: 10/01/96

SHIPMENT No.: 95106-01

LOW-LEVEL RADIOACTIVE WASTE SHIPMENT
CERTIFICATION FOR THE FEDERAL GOVERNMENT AS A
GENERATOR/PACKAGER, AND ITS BROKERS AND CARRIERS

314140

The following certification, completed as applicable, is made to the State of Washington:

Certification is hereby made to the State of Washington that Radiation Shipment Record No. N003580 of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection has revealed no items of non-compliance with all applicable laws, rules and regulations.

As determined under the provisions of the Federal Tort Claims Act (28 USC § 2671-2680), the undersigned shall be liable for and hold harmless the State of Washington from any and all claims, suits, losses, damages or expenses on account of injuries to any and all persons whomsoever, and any and all property damage, arising or growing out of or in any manner connected with any activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION A:

FOR THE GENERATOR/PACKAGER: AFBCA / Carswell AFB, TX
(Company Name)

PERMIT NUMBER: N4316

VOLUME OF WASTE IN THIS SHIPMENT: 200.7

DATE: 1 Oct 96 BY: Alan W. Flolo Alan W. Flolo

TITLE: Engineering Tech.

Certification is hereby made to the State of Washington that Radiation Shipment Record No. N003580 of low-level radioactive waste has been inspected in accordance with requirements of the Governor of Washington's Executive Order dated November 19, 1979, prior to its shipment. Further certification is made that the inspection have revealed no items of non-compliance with all applicable laws, rules and regulations.

The undersigned shall indemnify and hold harmless the State of Washington, in an amount not to exceed \$1,000,000.00 per individual who may be injured, provided that indemnification shall not exceed \$5,000,000.00 in total, for each occurrence, from any and all claims, suits, losses, damage, injury and expenses to any person whomsoever or to property arising or growing out of or in any manner connected with the activities performed under this order.

Except for any violation of applicable existing state or federal statute or regulation respecting packaging and shipment, inspection and acceptance of any item, or container or material covered by this certification by the State of Washington or a duly authorized contractor shall release the party who executed this certificate from any and all requirement of indemnification from injury or loss.

SECTION B:

FOR THE BROKER: GUTIERREZ - PALMENBERG INC. (GPI)
(Company Name)

PERMIT NUMBER: B419

VOLUME OF WASTE IN THIS SHIPMENT: 200.7

DATE: 10/01/96 BY: DAVID A. WISE [Signature]

TITLE: BROKER

SECTION C:

FOR THE CARRIER: TSMT
(Company Name)

VOLUME OF WASTE IN THIS SHIPMENT: 200.7

DATE: 10-1-96 BY: [Signature]

TITLE: DRIVER



WMT WORK FORMS

6 PE
AT 60

314141

ALARON Shipment # 95106-01 Disposal Shipment # 95106-01
 Carrier name/address TSMIT P.O. Box 113, Joplin, MO USDOT Hazmat Reg # 4348 Tractor # 848008
 Driver's Name: PAUL Hall State: OR License #: 2327421 Exp Date: 3-31-98

1	Operator's License	(X) SAT () UNSAT	Driver possesses valid commercial driver's license (with a tank vehicle /hazardous materials endorsement)
2	Windshield, Side Glass & Mirror	(X) SAT () UNSAT	No cracked or broken glass that would affect the driver's vision. Mirror(s) in place and usable.
3	Wipers	(X) SAT () UNSAT	Wipers operate and are in good condition.
4	Horn	(X) SAT () UNSAT	Air/electric horn works.
5	Suspension	(X) SAT () UNSAT	Visually check for loose, broken, or damaged spring leaves, "U" bolts, shackles, pads, torque arms, and locking pins.
6	Brake Lines	(X) SAT () UNSAT	Brake lines and connectors do not have cracks, crimps, restrictions, or evidence of damage or audible air leaks.
7	Brake Pots & Cams	(X) SAT () UNSAT	Brake pots are in good physical condition and mechanical linkages are intact and in good condition.
8	Exhaust System	(X) SAT () UNSAT	No loose or broken brackets and no evidence of leaks which would affect driving/sleeping compartment.
9	Fuel System	(X) SAT () UNSAT	No damage affecting fuel tank integrity, no visible leaks, no loose or broken mounting brackets, no evidence of damage to vents, and fuel cap is securely in place.
10	Structure & Welds	(X) SAT () UNSAT	No cracks in load bearing welds or assemblies.
11	Frame	(X) SAT () UNSAT	No cracked, loose, sagging, or broken frame.
12	Van/Trailer Floor	(X) SAT () UNSAT	No holes or projecting nails. Capable of bearing weight of load and fork truck (if used).
13	Van walls, ceiling	(X) SAT () UNSAT	No holes, severe dents, or buckling.
14	Van doors	(X) SAT () UNSAT	Can be closed and secured properly.
15	Rims	(X) SAT () UNSAT	Rims are not bent or cracked, and stud nuts are in place.
16	Tires	(X) SAT () UNSAT	Tires appear properly inflated, tread depths appear greater than minimum (major tread depth at least 1/8" on front and 1/16" on all others) and show no evidence of cuts or damage affecting the plycord.
17	Hubs	(X) SAT () UNSAT	Oil level visible, no visible oil leakage from seals.
18	Head lights	(X) SAT () UNSAT	Both low beams working.
19	Running Lights	(X) SAT () UNSAT	All affixed running lights operable.
20	Turn Signals	(X) SAT () UNSAT	Front and back working.
21	Brake Lights	(X) SAT () UNSAT	Must work on tractor and trailer.
22	Bracing	(X) SAT () UNSAT	Bracing/shoring must be sufficient to prevent shifting of lading during conditions normally incident to transportation.

Tractor & Trailer (X) are () are not acceptable for use.

PRIOR NOTIFICATION CALL SHEET
SHIPMENT OF LLRW or NORM/NARM TO
U.S. ECOLOGY (HANFORD, WA)
509-377-2411

Date of Call: 10/01/96

Time of Call: 1315

Name of Person Contacted: LAURA LEE BARRY

MESSAGE:

" This is to inform you that the CARSWELL AFB plant at FT WORTH TX
will make a truck shipment of 0 drums, 3 CYLINDERS boxes of radioactive material for burial in
accordance with your license at your Hanford, Washington, site through arrangements with GPI
Corporation.

Plant shipment number is 95106-01

GPI Control number is 95106-01

Carrier is TRI-STATE MOTOR

Driver's name is PAUL HALL

Trailer ID number is 848008

Tractor number is 4348

Date of departure is 10/01/96

Estimated date of departure is 10/01/96

Estimated date of arrival at Hanford, Washington, is 10/04/96

ADDITIONAL MESSAGE

COMMENTS of CONTACT

314143

USEcology, Inc.
P.O. Box 838
Richland, Washington 99352
509/377-2411

RECEIVED OCT 15 1996

Attachment 41-6

22124

GUTIERREZ-PALMENBERG, INC
WALTER CUNNINGHAM
2922 W. CLARENDON AVE
PHOENIX, AZ 85017

USEcology

an American Ecology company

This is to certify that the waste shipment described below was received for disposal at the US Ecology Richland, Low-Level Radioactive Waste Disposal Facility. This certification satisfies the Acknowledgement of Receipt of Waste Conditions of the State of Washington Radioactive Materials License WN-1019-2 issued to US Ecology, Inc.

BATES NUMBER: 22124

GENERATOR NUMBER: TXR-99-975-1570

SHIPMENT NUMBER: 95106-01

DATE RECEIVED: 10/04/96

SIGNATURE: 

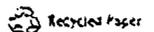
DATE: 10/09/96

Discrepancies (if any) between wastes listed on the manifest and waste materials received in the shipment:

NONE

NOTE: This certification does not necessarily imply that the waste has been buried. You will be advised if any problems with the shipment are encountered during the burial process.

Any inquiries to this acknowledgement should be directed to Michael Ault, Assistant Manager.



TAB

APPENDIX G

APPENDIX G

**TNRCC / M&E CORRESPONDENCE REGARDING APPROVAL OF
SITE CLOSURE TO RISK REDUCTION STANDARD No.1**

314146

Barry R. McBee, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Dan Pearson, *Executive Director*



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

August 9, 1996

Mr. Charles A. Rice
Team Chief
Base Closure Restoration Division
Air Force Center for Environmental Excellence
8001 Inner Circle Drive, Suite 2
Brooks AFB, Texas 78235-5328

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: Naval Air Station Ft. Worth JRB/Carswell AFB (NAS Ft. Worth)
TNRCC Solid Waste Registration No. 65004
EPA ID NO. TX0571924042
Hazardous Waste Permit No. 50289
Solid Waste Management Unit (SWMU) 60
Request for Approval for Actions To Be Taken for Project 94-7007 Normally Occurring
Radioactive Material Removal, Dated August 1, 1996

Request for Modifications

Dear Mr. Rice:

The staff of the Texas Natural Resource Conservation Commission (TNRCC) Corrective Action Section has completed its review of the above referenced request from Air Force Center for Environmental Excellence (AFCEE). The request included an August 1, 1996, report by Metcalf and Eddy which characterized background soil conditions at SWMU 60 as well as the SWMU's condition after the Low Level Radioactive Waste (LLRW) was removed from the unit. The report letter was entitled Background Soil Summary Letter Report and Comparison of Characterization and Confirmation Sample Analytical Results to Background Conditions. AFCEE's letter also requested approval to return the soils resulting from the removal action back into the original excavation.

The analytical results furnished in Metcalf and Eddy's letter/report indicate that the soils at SWMU 60 are in excess of background for Radian-226; however, they are below the Disposition Criteria for Radian-226 as provided in the Texas Regulations for Control of Radiation (TRCR), Part 21, 1302(c). As such, it appears the soils can be closed in accordance with Risk Reduction Standard 2 (RRS 2, 30 Texas Administrative Code (TAC) §335, Subchapter S), provided the Air

314147

Mr. Charles A. Rice

Page 2

August 9, 1996

Force submits a document to fulfill the deed certifications requirements of 30 TAC, §335.560. Final closure of this SWMU cannot be approved until the Air Force demonstrates that any groundwater contamination that may be associated with this SWMU does not pose a threat to human health and/or the environment.

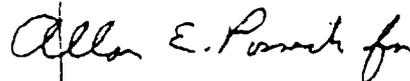
We understand that the Air Force is about to begin an evaluation of the Off-site Weapons Storage Area that includes an investigation of the groundwater quality at the LLRW. Deed certification for SWMU 60 may be incorporated into the certification for the entire Off-site Weapons Storage Area, since the area will likely be excised from the Air Force as a single parcel.

The Air Force's request to place the excavated soils back into the SWMU excavation is approved. Our decision is based on the analytical results, which indicate the soil contaminants are below background levels.

Please be aware that it is the continuing obligation of persons associated with a site to assure that municipal hazardous waste and industrial solid waste are managed in a manner which does not cause the discharge or imminent threat of discharge of waste into or adjacent to waters in the state, a nuisance, or the endangerment of the public health and welfare as required by Title 30 Texas Administrative Code (TAC) §335.4. If the actual closure/corrective action fails to comply with these requirements, the burden remains upon the Air Force to take any necessary and authorized action to correct such conditions. A TNRCC field inspector may review your certification information and may conduct a closure inspection of the site.

If you have any questions or need further assistance with this matter, please contact Mr. Geoffrey Meyer in the Corrective Action Section in Austin at (512) 239-2577, mail code MC127, or via the e-mail address gmeyer@smtpgate.tnrcc.state.tx.us.

Sincerely,



Paul S. Lewis, Manager
Corrective Action Section
Industrial and Hazardous Waste Division

314148

Mr. Charles A. Rice
Page 3
August 9, 1996

PL/GM

cc: Mr. Joel Sanders, Southern Division, Naval Facilities Engineering Command, P.O. Box
190010, North Charleston, SC 29419-9010
Ms. Stacy Gent, Department Head, Environmental Department/Code 110, Department of
the Navy, Building 1215, NAS JRB Ft. Worth, Texas 76127-6200
Mr. Ohlen Long, P.E., AFBCA, 6550 White Settlement Road, Ft. Worth, Texas 76114-
3520
Ms. Judith Black, USEPA Region 6
Mr. Tim Sewell, TNRCC Region 4 Office, Duncanville

314149



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CENTER FOR ENVIRONMENTAL EXCELLENCE
BROOKS AIR FORCE BASE TEXAS

TO:

FAX#: 713 590 5110
POC: Mike Timmer
ORGN: WFE
PHONE: 713 590 8800
No. of Pages (Including This Sheet): 4

FROM:

CHARLIE RICE	(210) 536-6452
HQ AFCEE/ERB	DSN 240-6452
3207 North Road, Bldg 532	FAX (210) 536-3609
Brooks AFB, TX 78235- 5363	FAX DSN 240-3609

REMARKS: TNRCC Letter on soil at Cagwell AFB.
 Charlie Rice
 26 Aug 96
 1235

If you do not receive all pages, or receive illegible copies,
please call our office.



September 24, 1996

016021-1375

Mr. Charles A. Rice
HQ AFCEE/ERB
3207 North Road, Bldg 532
Brooks Air Force Base, Texas 78235-5363

Reference: Prime Contract Number F41624-92-D-8002
Delivery Order 001201
Carswell Air Force Base
Fort Worth, Texas

Subject: Response to TNRCC Letter Concerning Recommendation to Backfill
SWMU No. 60 - Low Level Radioactive Waste Burial Site
Off-Site Weapons Storage Area

Dear Mr. Rice:

Metcalf & Eddy, Inc. (M&E) has reviewed the August 9, 1996, letter from the Texas Natural Resource Conservation Commission (TNRCC) concerning the recommendation to backfill the excavation at SWMU 60 with excavated soil. In their letter the TNRCC staff indicated that the soils at SWMU 60 are in excess of background for Radium-226 and that the site should be closed in accordance with Risk Reduction Standard 2 of 30 Texas Administrative Code 335, Subchapter S.

M&E has reevaluated the analytical results and has concluded that the Radium-226 concentrations in the soils are not in excess of background concentrations. M&E used the statistical procedures recommended by TNRCC to arrive at this conclusion. The procedures and results are described below.

Statistical Procedures for Evaluation of Inorganics (Metals) in Soils

The procedure recommended by the TNRCC for evaluation of metals in soils is provided as Attachment 1. This procedure consists of the following steps. These steps are described schematically on Figures 1 and 2 of Attachment 1.

1. Test the data sets for normality using the Shapiro Wilk test (Attachment 2).
2. Calculate the Upper Tolerance Limit (UTL) from the background concentrations of the metals of concern.
3. Compare each metal concentration from the SWMU to the respective UTL to identify the samples that exceed the UTL.



4. Compare the means of the background and SWMU data sets by using Student's t-test.

The procedure indicates that inorganic contamination will be concluded when a SWMU data set: 1) contains a datum that exceeds the UTL; and 2) exceeds the background data set mean. When SWMU data exceed background in only one of the tests, the data are to be evaluated further by evaluating the magnitude and frequency by which the one test failed to determine whether inorganic concentrations at the site represent background or contamination.

Site-Specific Radium-226 Evaluation

Table 1 provides the results of the Shapiro Wilk tests to indicate whether the background and SWMU 60 data sets are normally distributed. The results indicate that both the background data set and the SWMU 60 data set are normally distributed.

Table 2 provides the calculation of the Radium-226 UTL at the 95 percent confidence level using the sixteen background soil sample results. The UTL of 0.89 pCi/gm was compared to the Radium-226 concentrations from the five confirmation samples collected from the sidewalls and bottom of the excavation and the four characterization samples collected from the excavated soil stockpile.

One of the samples, that from the south wall of the excavation, contained a Radium-226 concentration that exceeded the UTL. However, this was the only sample of the nine in the SWMU 60 data set that exceeded the UTL. Also, the Radium-226 concentration of this sample at 1.03 pCi/gm is considerable less than radium-226 concentrations of two of the background samples at 1.27 and 1.24 pCi/gm. Thus, the Radium-226 concentration of 1.03 is well within the range of background concentrations noted for this site.

Table 3 provides the comparison of the means of the two data sets. At the 95 percent confidence level, the mean for the SWMU 60 data set is less than the mean of the background data set.

Conclusions

The above evaluation indicates that, while a Radium-226 concentration exceeded the UTL, it was the only one of nine to do so. This concentration is well within the range of background concentrations noted at the site. In addition, the mean of the Radium-226 concentrations at SWMU 60 is less than that of the background data set. For these reasons, and in accordance with the TNRCC recommended procedure, M&E has concluded that the soil at SWMU 60 does not exceed background concentrations and that SWMU 60 can be closed in accordance with Risk Reduction Standard 1.

Mr. Charles A. Rice
September 24, 1996
Page 3

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Please call me if you have any questions concerning this letter.

Sincerely,

METCALF & EDDY, INC.



Michael J. Timmer
Project Manager

MJT:eb

cc: Project files
p\016021\corresp\tnrccresp.ltr

Table 1

Shapiro-Wilk Test for Normal Distribution

Background Data

i	α	X_{n-i+1}	X_i	Numerator	D	D	Mean =0.78
1	0.5056	1.27	0.39	0.444928	0.237656	0.154056	
2	0.329	1.24	0.47	0.25333	0.209306	0.097656	
3	0.2521	0.94	0.49	0.113445	0.024806	0.085556	
4	0.1939	0.90	0.64	0.050414	0.013806	0.020306	
5	0.1447	0.90	0.67	0.033281	0.013806	0.012656	
6	0.1005	0.82	0.73	0.009045	0.001406	0.002756	
7	0.0593	0.78	0.76	0.001186	6.3E-06	0.000506	
8	0.0196	0.76	0.76	0	0.000506	0.000506	
			sum =	0.905629	0.5013	0.374	
			square of sum =	0.820164		0.8753	

T3 = 0.937009 which is between quantiles 0.10 and 0.50, thus, the null hypothesis can be accepted since $\alpha = 0.05$

SWMU 60 Data

i	α	X_{n-i+1}	X_i	Numerator	D	D	Mean =0.71
1	0.5888	1.03	0.52	0.300288	0.103112	0.035679	
2	0.3244	0.75	0.59	0.051904	0.00169	0.014135	
3	0.1976	0.75	0.64	0.021736	0.00169	0.004746	
4	0.0947	0.72	0.68	0.003788	0.000123	0.000835	
5	0	0.70	0.70	0	0.000079	0.000079	
			sum =	0.377716	0.106695	0.055473	
			square of sum =	0.142669		0.162168	

T3 = 0.879763 which is between quantiles 0.10 and 0.50, thus, the null hypothesis can be accepted since $\alpha = 0.05$

Note: See Attachment 2 for test procedures.

Table 2

Upper Tolerance Limit for Ra-226 Data from Background Soil Samples

Boring No.	Sample Depth	Ra-226 (pCi/g)
BMEIWN001	0'-1'	0.49
	5'-6'	0.47
	11'-12'	0.73
	17'-18'	0.82
BMEIWN001	0'-1'	0.76
	5'-6'	0.78
	11'-12'	0.76
	17'-18'	0.76
BMEIWN001	0'-1'	0.94
	5'-6'	0.39
	11'-12'	0.90
	17'-18'	0.90
BMEIWN001	0'-1'	1.27
	5'-6'	0.64
	11'-12'	1.24
	17'-18'	0.67

$UTL = MEAN + STDEV * t/(df^{0.5})$
 MEAN = 0.78 pCi/g
 STD DEV = 0.23 pCi/g
 t = 1.753 (TABLE B-1, NUREG/CR -5849)
 df = 15
 UTL = 0.89 pCi/g

Comparison of Concentration Values

SWMU 60 Location or Sample No.	Ra-226 (pCi/g)
North Wall	0.64
South Wall	1.03
East Wall	0.52
West Wall	0.68
Floor	0.70
SMEISS001	0.72
SMEISS002	0.59
SMEISS003	0.75
SMEISS004	0.75

MEAN = 0.709 pCi/g
 STD DEV = 0.134
 n = 9
 t (crit) = 1.753
 t (calc) = -1.65

Since t (calc) is less than t (crit),
 than we can conclude that background
 has not been exceeded.

Table 3

Comparison of Data Set Means

Boring No.	Sample Depth	Ra-226 (pCi/g)
BMEIWN001	0'-1'	0.49
	5'-6'	0.47
	11'-12'	0.73
	17'-18'	0.82
BMEIWN001	0'-1'	0.76
	5'-6'	0.78
	11'-12'	0.76
	17'-18'	0.76
BMEIWN001	0'-1'	0.94
	5'-6'	0.39
	11'-12'	0.90
	17'-18'	0.90
BMEIWN001	0'-1'	1.27
	5'-6'	0.64
	11'-12'	1.24
	17'-18'	0.67

MEAN = 0.78 pCi/gm
 STD DEV = 0.23 pCi/gm
 t = 1.753 (TABLE B-1, NUREG/CR -5849)

SWMU 60 Location or Sample No.	Ra-226 (pCi/g)
North Wall	0.64
South Wall	1.03
East Wall	0.52
West Wall	0.68
Floor	0.70
SMEISS001	0.72
SMEISS002	0.59
SMEISS003	0.75
SMEISS004	0.75

MEAN = 0.708889 pCi/gm
 STD DEV = 0.134201
 n = 9
 t (crit) = 1.753
 t (calc) = -1.64554

Since t (calc) is less than t (crit), we can conclude that mean for the SWMU 60 data set does not exceed the mean for the background data set.

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ATTACHMENT 1

**TNRCC STATISTICAL PROCEDURES FOR INORGANICS
(METALS) IN SOILS**

Statistical Procedures for Inorganics (Metals) in Soils

TNRCC recommends the following methods for statistically determining whether or not inorganic concentrations in soils are greater than background.

A. Upper Tolerance Limit (UTL)

1. Calculate the UTL (95% confidence and 95% coverage) for each inorganic of concern in shallow soils at the facility (Figure 1). The background data for the shallow soils should be combined into one data set in order to establish one facility wide UTL for each inorganic of concern. Additionally, the background data set for each inorganic must contain at least 15 values (excluding any sample duplicates).
2. Compare each inorganic soil datum from the SWMU (investigation or verification data) to the respective UTL in order to identify "hot spots" or individual samples that exceed the UTL.

B. Background and SWMU Data Set Comparison of the Means - Complete two group comparisons of the means (see Figure 2) based upon the following: 1) SWMU investigation and verification sample data groups must be compared separately with the background data set; and 2) SWMU investigation sample data groups for different depth intervals must be compared separately with the background data set. Each of the SWMU data groups identified above must contain 8 or greater data in order to complete the comparison.

C. Conclusions - Inorganic contamination will be concluded when a SWMU data group: 1) Contains a datum that exceeds the UTL; and 2) Exceeds the background data group mean. When SWMU data exceed background in only one of the tests, the data will be evaluated further (i.e., by evaluating the magnitude and frequency by which the one test was failed) to determine whether the inorganic concentrations at the site represent background or contamination.

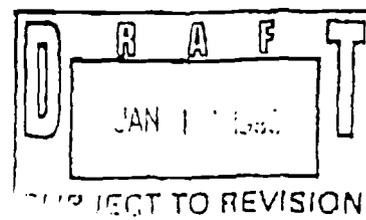
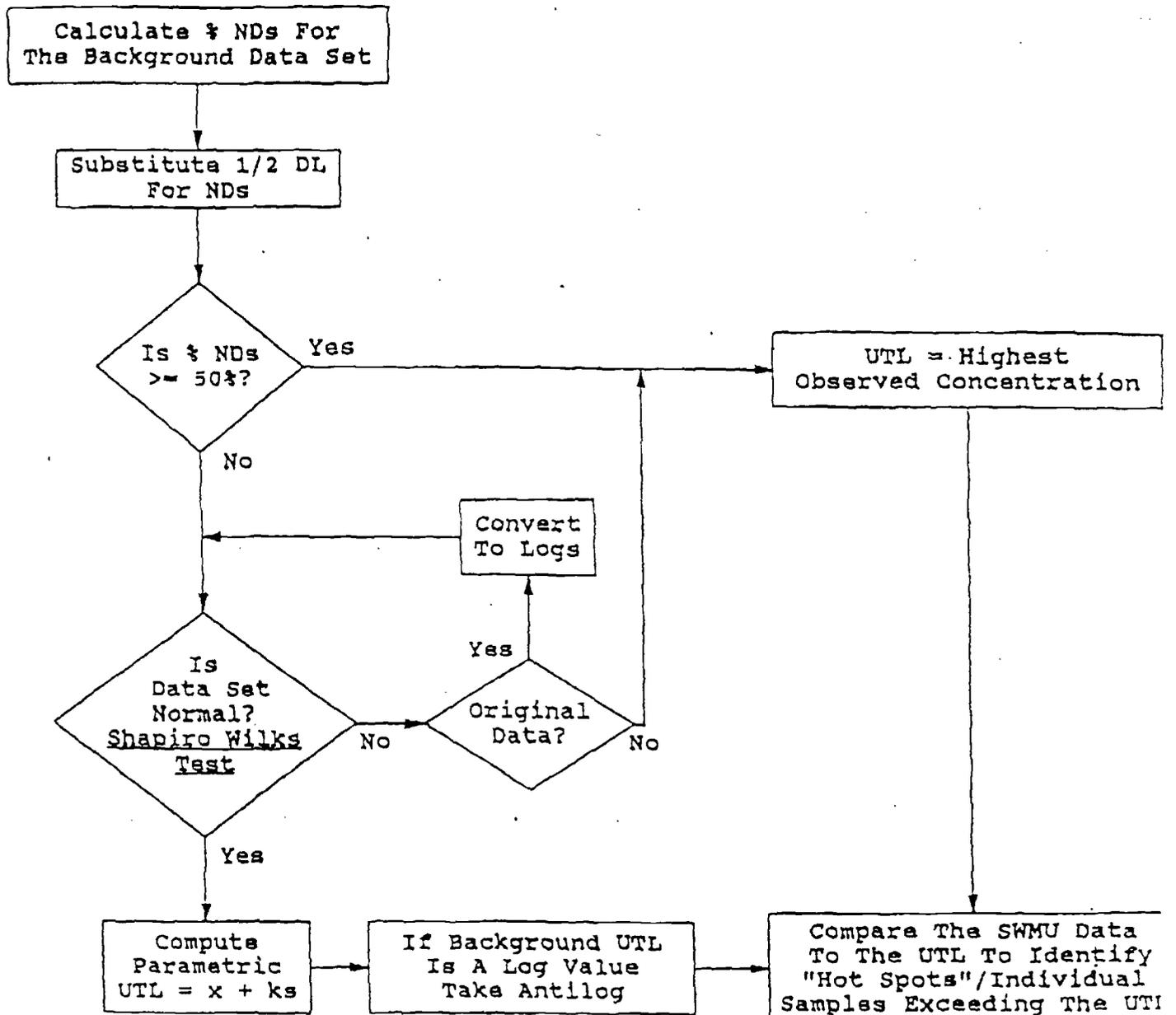
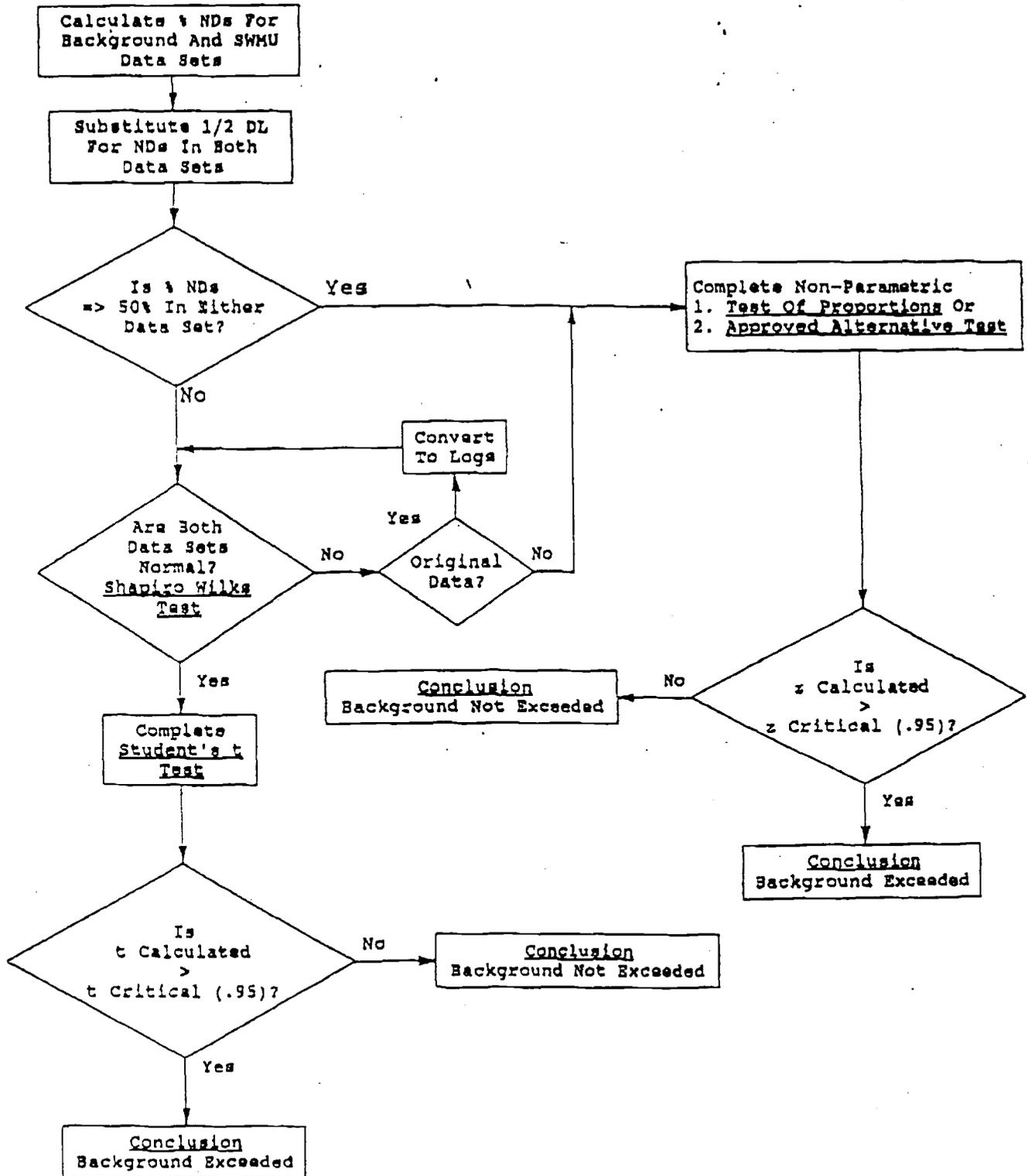


Figure 1
95% Upper Tolerance Limit (UTL) Determination



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Figure 2
Background And SWMU Data Set Mean Comparisons 314159



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ATTACHMENT 2

SHAPIRO WILK TEST FOR NORMALITY

6.2. Goodness-of-Fit Tests for Families of Distribution 363

i	X_i	$Z_i = X_i/\bar{X}$	$1 - e^{-Z_i}$	$i/10 - 1 + e^{-Z_i}$	$1 - e^{-Z_i} - (i-1)/10$
1	1	0.1754	.1609	-.0609	.1609
2	2	0.3508	.2959	-.0959	.1959
3	3	0.5263	.4092	-.2092	.2092
4	4	0.7018	.5043	-.1043	.2043
5	6	1.0526	.6510	.1510	.2510*
6	6	1.0526	.6510	-.0510	.1510
7	6	1.0526	.6510	.0490	.0510
8	8	1.4035	.7543	.0457	.0543
9	10	1.7544	.8270	.0730	.0270
10	11	1.9298	.8548	.1452*	-.0452

* Largest difference $S(x) - F^*(x)$.

† Largest difference $F^*(x) - S(x)$.

The largest absolute deviation between $S(x)$ and $F^*(x)$ is seen to equal .2510. The null hypothesis of an exponential distribution may be rejected at $\alpha = .05$ only if T_2 exceeds .3244 (from Table A16, $n = 10$, $1 - \alpha = .95$). Since $T_2 = .2510$, the null hypothesis is accepted. The critical level is obtained by interpolation in Table A16: $\hat{\alpha} = .25$. The times for the long-distance phone calls could be following a random process.

The Kolmogorov test has been extended to the gamma distribution when parameters must be estimated by Lilliefors (1973) and Schneider and Clickner (1976). A similar version of the Cramér-von Mises test is presented by Pettitt (1978). Other tests of a similar type are discussed by Green and Hegazy (1976).

We conclude this section by presenting a well-known goodness-of-fit test for normality that may be used instead of the Lilliefors test if desired. Some empirical studies indicate that this test has good power in many situations when compared with many other tests of the composite hypothesis of normality, including the Lilliefors test and the chi-square test (Shapiro, Wilk, and Chen, 1960; La Breccque, 1977). Although this test is not a Kolmogorov-type test, it is included here because of its usefulness.

The Shapiro-Wilk Test for Normality

DATA. The data consist of a random sample X_1, X_2, \dots, X_n of size n associated with some unknown distribution function $F(x)$.

ASSUMPTIONS

1. The sample is a random sample.

HYPOTHESES

H_0 : $F(x)$ is a normal distribution function with unspecified mean and variance

H_1 : $F(x)$ is nonnormal

364 Statistics of the Kolmogorov-Smirnov Type

TEST STATISTIC. First compute the denominator D of the test statistic

$$(8) \quad D = \sum_{i=1}^n (X_i - \bar{X})^2$$

where \bar{X} is the sample mean. Then order the sample from smallest to largest,

$$X^{(1)} \leq X^{(2)} \leq \dots \leq X^{(n)}$$

and let $X^{(i)}$ denote the i th order statistic. From Table A17, for the observed sample size n , obtain the coefficients a_1, a_2, \dots, a_k , where k is approximately $n/2$.

The test statistic T_3 is given by

$$(9) \quad T_3 = \frac{1}{D} \left[\sum_{i=1}^k a_i (X^{(n-i+1)} - X^{(i)}) \right]^2$$

Note that this test statistic is often denoted by W , and the test is often called the W test.

DECISION RULE. Reject H_0 at the level of significance α if T_3 is less than the α quantile as given by Table A18. If a more precise critical level for an observed value of T_3 is desired, the instructions in Table A19 allow T_3 to be converted to an approximately normal random variable, which may then be compared with the normal distribution in Table A1 to obtain $\hat{\alpha}$.

COMMENT. Although existing tables allow the Shapiro-Wilk test to be used only if $n \leq 50$, D'Agostino (1971) presents a test that may be used for n larger than 50, and Shapiro and Francia (1972) suggest an approximate test for n greater than 50 that is similar to the Shapiro-Wilk test.

Example 3. The 50 two-digit numbers in Example 4.5.3 were drawn from a telephone book. The chi-square goodness-of-fit test accepted the hypothesis of normality with $\hat{\alpha}$ well above .25. The Lilliefors test accepted the same hypothesis in Example 1 with $\hat{\alpha}$ greater than .20. The same data will be analyzed using the Shapiro-Wilk test.

The coefficients from Table A17 and the order statistics $X^{(n-i+1)} - X^{(i)}$ are given next.

i	a_i	$X^{(n-i+1)} - X^{(i)}$	i	a_i	$X^{(n-i+1)} - X^{(i)}$
1	.3751	97-23	14	.0846	66-42
2	.2574	95-25	15	.0764	65-43
3	.2260	89-24	16	.0685	64-45
4	.2032	87-27	17	.0603	63-44
5	.1847	81-29	18	.0532	62-45
6	.1691	77-31	19	.0459	61-48
7	.1554	75-32	20	.0386	61-48
8	.1430	74-33	21	.0314	59-54
9	.1317	73-33	22	.0244	58-54
10	.1212	73-35	23	.0174	58-56
11	.1113	70-36	24	.0104	58-57
12	.1020	68-37	25	.0035	58-57
13	.0932	68-40			

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The numerator of the test statistic becomes

$$\left[\sum_{i=1}^k a_i (X^{(n-i+1)} - X^{(i)}) \right]^2 = [(.3751)(97-23) + \dots + (.0035)(58-57)]^2 \\ - [130.65]^2 = 17,064$$

and the denominator is given by

$$D = \sum_{i=1}^n (X_i - \bar{X})^2 = 17,698$$

so the test statistic becomes

$$T_3 = \frac{17,064}{17,698} = .9642$$

which lies somewhere between the .10 and the .50 quantiles of the distribution. Interpolation in Table A18 gives $\hat{\alpha} = .29$ approximately.

In order to find a more precise value for $\hat{\alpha}$, the coefficients from Table A19 are obtained for $n = 50$; $b_{50} = -7.677$, $c_{50} = 2.212$, and $d_{50} = .1436$. The observed value of T_3 is substituted into the formula

$$G = b_{50} + c_{50} \ln \left(\frac{T_3 - d_{50}}{1 - T_3} \right) \\ = -7.677 + (2.212) \ln \left(\frac{.9642 - .1436}{1 - .9642} \right) \\ = -.7488$$

which corresponds to $\hat{\alpha} = .227$ from Table A1. This is a more precise value of the critical level than the one we obtained by interpolation earlier.

The theory behind the Shapiro-Wilk test is too lengthy to present here, but the interested reader is referred to the original papers by Shapiro and Wilk (1965, 1968). Some efforts to extend existing tables (Stephens, 1975) apparently have not yet resulted in extended tables as far as we know. Other goodness-of-fit tests for the same composite hypothesis of normality have been offered by Hartley and Pfaffenberger (1972), Bowman and Shenton (1975), and Pearson, D'Agostino, and Bowman (1977).

One useful feature of the Shapiro-Wilk test is that several independent goodness-of-fit tests may be combined into one overall test of normality. This is convenient when several small samples from possibly different populations are insufficient by themselves to reject the hypothesis of normality, but their combined evidence is enough to disprove normality. The technique is illustrated in the following example.

Example 4. When an offshore lease is made available for bids, several oil companies usually submit bids for the right to drill for oil in that area. The distribution of these bids is often assumed to follow the "lognormal" distribution; that is, the logarithm of the bids is assumed to follow the normal distribution. However, the means and variances may vary from lease

Table A17 (Continued) Four the Stearns Work Test

	1	2	3	4	5	6	7	8	9	10
1	0.7071	0.2071	0.6812	0.6646	0.6431	0.6213	0.6052	0.5884	0.5739	
2	0.4000	0.1667	0.2413	0.2405	0.2031	0.1664	0.1248	0.1329		
3	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	
4	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
5	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
6	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
7	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
8	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
9	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000
10	0.4000	0.1667	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000	0.4000

	11	12	13	14	15	16	17	18	19	20
1	0.5601	0.3175	0.5359	0.5231	0.5150	0.5056	0.4968	0.4886	0.4808	0.4734
2	0.3115	0.1425	0.3325	0.3318	0.3306	0.3290	0.3271	0.3253	0.3232	0.3214
3	0.2260	0.2147	0.2412	0.2460	0.2495	0.2521	0.2540	0.2553	0.2561	0.2565
4	0.1429	0.1586	0.1707	0.1802	0.1878	0.1939	0.1988	0.2027	0.2059	0.2085
5	0.0695	0.0927	0.1099	0.1240	0.1353	0.1447	0.1524	0.1587	0.1641	0.1686
6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
8	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
10	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Source: Reprinted from Pearson and Hoadley (1972), with permission from the Biometrika Trustees.
 *The entries in this table are the coefficients a_i for use in the Shapiro-Wilk test statistic for normality given by Equation 6.2.9.

Table A17 (Continued)

	21	22	23	24	25	26	27	28	29	30
1	0.4643	0.4590	0.4542	0.4493	0.4450	0.4407	0.4366	0.4329	0.4291	0.4254
2	0.3185	0.3156	0.3126	0.3098	0.3069	0.3043	0.3018	0.2992	0.2968	0.2944
3	0.2578	0.2571	0.2563	0.2554	0.2543	0.2533	0.2522	0.2510	0.2499	0.2487
4	0.2119	0.2131	0.2139	0.2145	0.2148	0.2151	0.2152	0.2151	0.2150	0.2148
5	0.1736	0.1764	0.1787	0.1807	0.1822	0.1836	0.1848	0.1857	0.1864	0.1870
6	0.1399	0.1443	0.1480	0.1512	0.1539	0.1563	0.1584	0.1601	0.1616	0.1630
7	0.1092	0.1150	0.1201	0.1245	0.1283	0.1316	0.1346	0.1372	0.1395	0.1415
8	0.0804	0.0878	0.0941	0.0997	0.1046	0.1089	0.1128	0.1162	0.1192	0.1219
9	0.0530	0.0618	0.0696	0.0764	0.0823	0.0876	0.0923	0.0965	0.1002	0.1036
10	0.0263	0.0358	0.0459	0.0539	0.0604	0.0662	0.0714	0.0762	0.0802	0.0836
11	0.0000	0.0122	0.0228	0.0321	0.0403	0.0476	0.0540	0.0598	0.0650	0.0697
12	0.0000	0.0107	0.0203	0.0281	0.0358	0.0424	0.0483	0.0537	0.0587	0.0633
13	0.0000	0.0094	0.0178	0.0253	0.0320	0.0381	0.0438	0.0491	0.0541	0.0588
14	0.0000	0.0084	0.0159	0.0227	0.0288	0.0344	0.0396	0.0444	0.0488	0.0530
15	0.0000	0.0076	0.0146	0.0212	0.0272	0.0328	0.0380	0.0428	0.0472	0.0514

Source: Reprinted from Pearson and Hoadley (1972), with permission from the Biometrika Trustees.
 *The entries in this table are the coefficients a_i for use in the Shapiro-Wilk test statistic for normality given by Equation 6.2.9.

Table A17 (Continued)

	31	32	33	34	35	36	37	38	39	40
1	0.4220	0.4188	0.4156	0.4127	0.4096	0.4068	0.4040	0.4015	0.3989	0.3964
2	0.2921	0.2898	0.2876	0.2853	0.2831	0.2813	0.2794	0.2774	0.2755	0.2737
3	0.2473	0.2462	0.2451	0.2439	0.2427	0.2415	0.2403	0.2391	0.2380	0.2368
4	0.2145	0.2141	0.2137	0.2132	0.2127	0.2121	0.2116	0.2110	0.2104	0.2098
5	0.1874	0.1878	0.1880	0.1882	0.1883	0.1883	0.1883	0.1883	0.1883	0.1878
6	0.1641	0.1651	0.1660	0.1667	0.1673	0.1678	0.1683	0.1686	0.1689	0.1691
7	0.1433	0.1449	0.1463	0.1475	0.1481	0.1489	0.1496	0.1503	0.1513	0.1520
8	0.1243	0.1265	0.1284	0.1301	0.1317	0.1331	0.1344	0.1356	0.1366	0.1376
9	0.1066	0.1093	0.1118	0.1140	0.1164	0.1189	0.1211	0.1231	0.1248	0.1263
10	0.0890	0.0931	0.0961	0.0986	0.1013	0.1036	0.1056	0.1075	0.1092	0.1108
11	0.0739	0.0777	0.0812	0.0844	0.0873	0.0900	0.0924	0.0947	0.0967	0.0986
12	0.0585	0.0629	0.0669	0.0706	0.0739	0.0770	0.0798	0.0824	0.0848	0.0870
13	0.0435	0.0485	0.0530	0.0572	0.0610	0.0645	0.0677	0.0706	0.0733	0.0759
14	0.0289	0.0344	0.0395	0.0441	0.0484	0.0523	0.0559	0.0592	0.0622	0.0651
15	0.0144	0.0206	0.0262	0.0314	0.0361	0.0404	0.0444	0.0481	0.0515	0.0546
16	0.0000	0.0068	0.0131	0.0187	0.0239	0.0287	0.0331	0.0372	0.0409	0.0444
17	0.0000	0.0062	0.0119	0.0172	0.0220	0.0264	0.0305	0.0343	0.0379	0.0414
18	0.0000	0.0057	0.0101	0.0146	0.0191	0.0233	0.0273	0.0311	0.0348	0.0384
19	0.0000	0.0053	0.0091	0.0131	0.0171	0.0211	0.0250	0.0288	0.0324	0.0359
20	0.0000	0.0049	0.0084	0.0124	0.0164	0.0204	0.0243	0.0281	0.0318	0.0354

Source: Reprinted from Pearson and Hoadley (1972), with permission from the Biometrika Trustees.
 *The entries in this table are the coefficients a_i for use in the Shapiro-Wilk test statistic for normality given by Equation 6.2.9.

Table A18 Quantiles of the Shapiro-Wilk Test Statistic*

n	0.01	0.02	0.05	0.10	0.50	0.90	0.95	0.98	0.99
3	0.753	0.756	0.767	0.789	0.959	0.998	0.999	1.000	1.000
4	0.687	0.707	0.748	0.792	0.935	0.987	0.992	0.996	0.997
5	0.686	0.715	0.762	0.806	0.927	0.979	0.986	0.991	0.993
6	0.713	0.743	0.788	0.826	0.927	0.974	0.981	0.986	0.989
7	0.730	0.760	0.803	0.838	0.928	0.972	0.979	0.985	0.988
8	0.749	0.778	0.818	0.851	0.932	0.972	0.978	0.984	0.987
9	0.764	0.791	0.829	0.859	0.935	0.972	0.978	0.984	0.986
10	0.781	0.806	0.842	0.869	0.938	0.972	0.978	0.984	0.986
11	0.792	0.817	0.850	0.876	0.940	0.973	0.979	0.984	0.986
12	0.805	0.828	0.859	0.883	0.944	0.973	0.979	0.984	0.986
13	0.814	0.837	0.866	0.889	0.945	0.974	0.979	0.984	0.986
14	0.825	0.846	0.874	0.895	0.947	0.975	0.980	0.984	0.986
15	0.835	0.855	0.881	0.901	0.950	0.975	0.980	0.984	0.986
16	0.844	0.863	0.887	0.906	0.952	0.976	0.981	0.985	0.987
17	0.851	0.869	0.892	0.910	0.954	0.977	0.981	0.985	0.987
18	0.858	0.874	0.897	0.914	0.956	0.978	0.982	0.986	0.988
19	0.863	0.879	0.901	0.917	0.957	0.978	0.982	0.986	0.988
20	0.868	0.884	0.905	0.920	0.959	0.979	0.983	0.987	0.989
21	0.873	0.888	0.908	0.923	0.960	0.980	0.984	0.988	0.990
22	0.878	0.892	0.911	0.926	0.961	0.980	0.984	0.988	0.990
23	0.884	0.895	0.914	0.928	0.962	0.981	0.984	0.988	0.990
24	0.888	0.898	0.916	0.930	0.963	0.981	0.984	0.988	0.990
25	0.888	0.901	0.918	0.931	0.964	0.981	0.984	0.988	0.990
26	0.891	0.904	0.920	0.933	0.965	0.982	0.985	0.989	0.991
27	0.894	0.906	0.923	0.935	0.965	0.982	0.985	0.989	0.991
28	0.896	0.908	0.924	0.936	0.966	0.982	0.985	0.989	0.991
29	0.898	0.910	0.926	0.937	0.966	0.982	0.985	0.989	0.991
30	0.900	0.912	0.927	0.939	0.967	0.983	0.985	0.989	0.991
31	0.902	0.914	0.929	0.940	0.967	0.983	0.985	0.989	0.991
32	0.904	0.915	0.930	0.941	0.968	0.983	0.985	0.989	0.991
33	0.906	0.917	0.931	0.942	0.968	0.983	0.985	0.989	0.991
34	0.908	0.919	0.933	0.944	0.969	0.983	0.985	0.989	0.991
35	0.910	0.920	0.934	0.944	0.969	0.984	0.986	0.990	0.991
36	0.912	0.922	0.935	0.945	0.970	0.984	0.986	0.990	0.991
37	0.914	0.924	0.936	0.946	0.970	0.984	0.986	0.990	0.991
38	0.916	0.925	0.938	0.947	0.970	0.984	0.986	0.990	0.991
39	0.917	0.927	0.939	0.948	0.971	0.984	0.987	0.991	0.991
40	0.919	0.928	0.940	0.949	0.972	0.984	0.987	0.991	0.991
41	0.920	0.929	0.941	0.950	0.972	0.985	0.987	0.991	0.991
42	0.922	0.930	0.942	0.951	0.972	0.985	0.987	0.991	0.991
43	0.923	0.932	0.944	0.953	0.973	0.985	0.987	0.991	0.991
44	0.924	0.933	0.945	0.954	0.973	0.985	0.987	0.991	0.991
45	0.926	0.934	0.945	0.953	0.973	0.985	0.988	0.991	0.991
46	0.927	0.935	0.945	0.953	0.974	0.985	0.988	0.991	0.991
47	0.928	0.936	0.946	0.954	0.974	0.985	0.988	0.991	0.991

Table A18 (Continued)

n	0.01	0.02	0.05	0.10	0.50	0.90	0.95	0.98	0.99
48	0.929	0.937	0.947	0.954	0.974	0.985	0.988	0.990	0.991
49	0.929	0.937	0.947	0.955	0.974	0.985	0.988	0.990	0.991
50	0.930	0.938	0.947	0.955	0.974	0.985	0.988	0.990	0.991

Source: Reprinted from Pearson and Hartley (1972), with permission from the Biometrika Trustees.

*The entries in this table are quantiles w_α of the Shapiro-Wilk test statistic given by Equation 6.2.9. Reject H_0 at the level α if $T_n < w_\alpha$.

Table A19 A Method for Converting the Shapiro-Wilk Statistic to Approximate Normality

n	3	4	5	6	n	3	4	5	6
$u(L)$	(0.7500)	(0.6297)	(0.5521)	(0.4963)	$u(L)$	(0.7500)	(0.6297)	(0.5521)	(0.4963)
-7.0	-3.29	—	—	—	2.2	0.52	0.74	0.75	0.64
-6.4	2.81	—	—	—	2.6	0.67	1.00	1.09	1.06
-5.0	-2.68	—	—	—	3.0	0.81	1.23	1.40	1.45
-4.6	-2.54	—	—	—	3.4	0.95	1.44	1.67	1.83
-4.2	-2.40	—	—	—	3.8	1.07	1.65	1.91	2.17
-3.8	-2.25	-3.50	—	—	4.2	1.19	1.85	2.15	2.50
-3.4	-2.10	-3.27	—	—	4.6	1.31	2.05	2.47	2.77
-3.0	-1.94	-3.05	-4.01	—	5.0	1.42	2.19	2.85	3.09
-2.6	-1.77	-2.84	-3.78	—	5.4	1.52	2.34	3.14	3.54
-2.2	-1.59	-2.64	-3.58	—	5.8	1.62	2.48	3.64	—
-1.8	-1.40	-2.44	-3.31	—	6.2	1.72	2.62	—	—
-1.4	-1.21	-2.22	-3.04	—	6.6	1.81	2.75	—	—
-1.0	-1.01	-1.96	-2.56	-3.72	7.0	1.90	2.87	—	—
-0.6	-0.80	-1.66	-2.20	-2.88	7.4	1.98	2.97	—	—
-0.2	-0.60	-1.31	-1.81	-2.27	7.8	2.07	3.08	—	—
0.2	0.39	0.93	1.41	1.85	8.2	2.15	3.27	—	—
0.6	-0.19	-0.57	-0.97	-1.38	8.6	2.23	3.36	—	—
1.0	-0.60	-0.19	-0.51	-0.84	9.0	2.31	—	—	—
1.4	0.18	0.15	-0.06	-0.33	9.4	2.38	—	—	—
1.8	0.35	0.45	0.37	0.18	9.8	2.45	—	—	—

Source: Reprinted from Pearson and Hartley (1972), with permission from the Biometrika Trustees.

For $3 \leq n \leq 6$, first compute $u = \ln\{T - d_n\}$ where d_n is given at the top of the table and T is the Shapiro-Wilk statistic. Then enter the table with u and n to find G , which is approximately normal.

For $7 \leq n \leq 10$, enter the table with n to find the coefficients b_n , c_n , and d_n . Then compute $G = b_n + c_n \ln\{T - d_n\}$ which is approximately standard normal.

Barry R. McBee, *Chairman*
 R. B. "Ralph" Marquez, *Commissioner*
 John M. Baker, *Commissioner*
 Dan Pearson, *Executive Director*



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

November 5, 1996

Mr. Charles A. Rice
 Team Chief
 Base Closure Restoration Division
 Air Force Center for Environmental Excellence
 8001 Inner Circle Drive, Suite 2
 Brooks AFB, Texas 78235-5328

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: Naval Air Station Ft. Worth JRB/Carswell AFB (NAS Ft. Worth)
 TNRCC Solid Waste Registration No. 65004
 EPA ID No. TX0571924042
 Hazardous Waste Permit No. 50289
 Solid Waste Management Unit (SWMU) 60
 Request for Revised Approval for Actions To Be Taken for Project 94-7007, Normally
 Occurring Radioactive Material Removal, Dated September 23, 1996

Partial Closure Approval

Dear Mr. Rice:

The Texas Natural Resource Conservation Commission (TNRCC) Federal Facilities Team received your supplemental report dated September 23, 1996, and received on September 28, 1996. The report states that radium levels observed in the soils at Solid Waste Management Unit (SWMU) 60, a Low Level Radioactive Waste site, are at or below background levels. As such, the Air Force's closure activities for the soils at this site have been completed in accordance with the TNRCC Risk Reduction Rules (RRR) Standard No. 1, pursuant to 30 Texas Administrative Code (TAC) Chapter 335 Subchapters A and S.

In order to attain RRR Standard No. 1, all industrial solid waste and municipal hazardous waste and waste residues must be removed or decontaminated from affected media (i.e., soil, surface water, groundwater, air) to naturally occurring background levels. We cannot approve final closure of SWMU 60 until the Air Force completes its study of background radium in groundwater. The background investigation was approved by the TNRCC in our letter of October 24, 1996. Once the Air Force has established that the groundwater at this site has attained RRR Standard No. 1, no further action will be required at SWMU 60.

P.O. Box 13087 - Austin, Texas 78711-5087 - 512/239-1000

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FROM HQ AFCE/CC

11-08-96 11:21AM

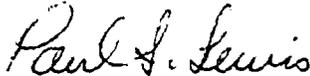
314167

Mr. Charles A. Rice
Page 2
November 5, 1996

Please be aware of the continuing obligation of 30 TAC §335.8(b)(5), which requires the Air Force to conduct additional remedial activities in the event that a substantial change in circumstances at the facility, or area, results in an unacceptable threat to human health or the environment. Finally, 30 TAC §335.4 requires that persons associated with a site are under the continuing obligation to assure that municipal hazardous waste and industrial solid waste are managed in a manner which does not cause the discharge or imminent threat of discharge of waste into or adjacent to waters in the state, a nuisance, or the endangerment of the public health and welfare. A TNRCC field inspector may review your Final Report and may conduct a closure inspection of the site.

If you have any questions or need further assistance with this matter, please contact Mr. Geoffrey Meyer in the Corrective Action Section in Austin at (512) 239-2577, mail code MC127, or via the e-mail address gmeyer@mrcc.state.tx.us.

Sincerely,



Paul S. Lewis, Manager
Corrective Action Section
Industrial and Hazardous Waste Division

PL/GM

cc: Mr. Joel Sanders, Southern Division, Naval Facilities Engineering Command, P.O. Box 190010, North Charleston, SC 29419-9010
Ms. Stacy Gent, Department Head, Environmental Department/Code 110, Department of the Navy, Building 1215, NAS JRB Ft. Worth, Texas 76127-6200
Mr. Ohlen Long, P.E., AFBCA, 6550 White Settlement Road, Ft. Worth, Texas 76114-3520
Mr. Michael W. S. Hayes, Esq., GM-0905-14/ CAR(sel), JAGC, USNR Counsel, Office of the Asst. General Counsel, 4400 Dauphine St., New Orleans, LA 70146-5000
Ms. Judith R. McCulley, USEPA Region 6
Mr. Tim Sewell, TNRCC Region 4 Office, Duncanville
Ms. Ginny King, Natural Resource Trustees, CD Division (MC 142)

TAB

APPENDIX H

APPENDIX H

STATEMENT OF BASIS/FINAL DECISION

STATEMENT OF BASIS/FINAL DECISION	REGION VI
Air Force Base Conversion Agency OL-K Carswell Air Force Base Fort Worth, TX	
Facility/Unit Carswell Air Force Base Solid Waste Management Unit No. 60 (SWMU 60).	
Type: A Low-Level Radioactive Waste burial site.	
Remedy: No Further Action	
FACILITY DESCRIPTION Carswell Air Force Base is located on the west side of Fort Worth Texas. SWMU 60 is located at the off-site weapons storage area approximately 5 miles west the main AFB and is the burial site for three cast iron tubes containing Low Level Radioactive Waste (LLRW). The LLRW reportedly consisted of Radium-painted luminous dials from aircraft instruments.	
INSTALLATION RESTORATION PROGRAM INVESTIGATIONS <p>Prior to excavation of the tubes, a non-intrusive radiological survey performed at SWMU 60 did not detect any radioactivity above two times the established background level.</p> <p>Four soil borings were performed outside the perimeter fence of the Off-Site Weapons Storage Area to collect soil samples for laboratory analysis to establish background radioactivity levels.</p> <p>The tubes were excavated and screened for radioactivity. Elevated levels of radioactivity were detected at a point approximately 4 to 6 feet from the bottom of each tube. No radioactivity above two times background levels were detected from the soil and grout immediately surrounding the tubes when isolated from the associated tube.</p> <p>Throughout excavation activities, the excavation and excavated/stockpiled soils were screened for radioactivity. In addition, all personnel and equipment exiting the work area/exclusion zone were screened for radioactivity. No radioactivity was detected above two times the established background level.</p> <p>Samples were collected from the stockpiled soil for laboratory analysis for radioactive, organic and metals characterization. No radioactivity above the established range of background concentrations and no organic or metals concentration above acceptable concentrations were detected in these samples. In addition, confirmation soil samples were collected from the sidewalls and floor of the excavation for laboratory analysis by gamma spectroscopy only. No radioactivity above the established range of background concentrations was detected in these samples.</p>	
DECLARATION STATEMENT The AFB Closure Authority agrees that no further investigation or remedial action is required at this site based on the results of Interim Remedial Action / Installation Restoration Program Investigation.	
Olen Long Carswell Air Force Base - AFBCA	Date Approved _____
TNRCC Concurrence	Date Received _____
EPA Concurrence	Date Received _____
REFERENCES Metcalf & Eddy, July 1996, Final Remedial Action Plan (SWMU 60) Metcalf & Eddy, November 1996, Final Technical Report (SWMU 60)	

314171

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE

FINAL PAGE

ADMINISTRATIVE RECORD

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