PROPOSAL FOR CONFIRMATORY SAMPLING NO FURTHER ACTION ENVIRONMENTAL RESTORATION SITE 66, BOXCAR SITE OPERABLE UNIT 1332 July 1996

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ACRONYMS AND ABBREVIATIONS

ac	acre(s)
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOE	U.S. Department of Energy
DOE/AL	U.S. Department of Energy, Albuquerque Operations Office
EOD	explosive ordnance disposal
EORC	Environmental Operations Records Center
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
ft	feet
HSWA	Hazardous and Solid Waste Amendments
KAFB	Kirtland Air Force Base
LAS	Lockheed Analytical Services
MDL	minimum detection limit
mg/kg	milligram(s) per kilogram
mi	mile(s)
MS	matrix spike
MSD	matrix spike duplicate
NFA	no further action
PCB	polychlorinated biphenyls
PID	photoionization detector
PQL	practical quantitation limit
PRS	potential release site
QC	quality control
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SNL/NM	Sandia National Laboratories/New Mexico
SWMU	solid waste management unit
TNT	trinitrotoluene
TOP	technical operating procedure
UXO	unexploded ordnance
µg/g	microgram(s) per gram

1.0 INTRODUCTION

1.1 ER Site Identification Number and Name

Sandia National Laboratories/New Mexico (SNL/NM) is proposing a confirmatory sampling no further action (NFA) decision for Environmental Restoration (ER) Site 66, Boxcar Site, Operable Unit 1332. ER Site 66 was identified in the Hazardous and Solid Waste Amendment (HSWA) Module IV (EPA August 1993) of the SNL/NM Resource Conservation and Recovery Act (RCRA) Hazardous Waste Management Facility Permit (NM5890110518) (EPA August 1992).

1.2 SNL/NM Confirmatory Sampling NFA Process

The basis for the proposing an NFA with confirmatory sampling is thoroughly described in Section 4.5.3 of the Draft *Program Implementation Plan (PIP) for Albuquerque Potential Release Sites* (SNL/NM 1994), and in Annex B of the *Environmental Restoration Document of Understanding* (NMED November 1995). ER Site 66 is being proposed for a confirmatory sampling NFA decision based on NFA Criterion 3—No release to the environment has occurred nor is likely to occur in the future.

1.3 Local Setting

SNL/NM occupies 2,829 acres (ac) of land owned by the U.S. Department of Energy (DOE) with an additional 14,920 ac of land provided by land-use permits with Kirtland Air Force Base (KAFB), the U.S. Forest Service, the State of New Mexico, and the Isleta Pueblo lands. SNL/NM has been involved in nuclear weapons research, components development, assembly, testing, and other nuclear activities since 1945.

ER Site 66 (Figure 1-1) lies on U.S. Forest Service Withdrawn Lands and is located on the east side of Demolition Road approximately 1 mile (mi) north of the Optical Range. The site covers approximately 2.82 ac of land at a mean elevation of 6,000 feet (ft) above sea level (SNL/NM March 1995).

The nearest well to ER Site 66 is the High Energy Research and Test Facility well. Very little information exists pertaining to this well. It is located approximately 1.25 mi northeast of ER Site 22. Well records from the State Engineers Office indicate that the well was drilled in July 1990 to a total depth of 500 ft. Water was encountered at 405 ft below ground level and the water-bearing strata is "solid granite." (IT May 1994).

2.0 HISTORY OF THE SWMU

2.1 Sources of Supporting Information

In preparation to requesting a confirmatory sampling NFA decision for ER Site 66, SNL/NM conducted a background archival study and collected soil samples to confirm that no release of hazardous constituents occurred. Historical background information sources included existing records and reports of site activity. Additionally, analytical results from confirmatory samples verify that during the site operational activity, hazardous waste or constituents clearly were not released into the environment.

The following information sources, hierarchically listed with respect to assigned validity, were available for use in evaluating ER Site 66:

- Twenty-four soil sample analyses obtained from a random grid sampling pattern at the site.
- Twenty-two soil samples collected by the DOE Albuquerque Operations Office (DOE/AL) ER Program (DOE September 1987).
- Five interviews with SNL/NM facility personnel.
- Miscellaneous information sources, including the SNL/NM Geographic Information System and SNL/NM personnel correspondence (memoranda, letters, and notes).
- The Comprehensive Environmental Assessment and Response Program (CEARP) Phase I report (DOE September 1987) and CEARP records contained in the SNL/NM Environmental Operations Records Center (EORC).
- The RCRA Facility Assessment (RFA) report (EPA April 1987).

Using this information, a brief history of ER Site 66 and a discussion of all relevant evidence regarding past practices and releases at the site have been prepared and are presented in this proposal for a confirmatory sampling NFA decision.

2.2 Previous Audits, Inspections, and Findings

ER Site 66 was identified during investigations conducted under the CEARP (DOE September 1987) and the RFA (EPA April 1987). The CEARP noted that some lead, beryllium, depleted uranium, and high-explosive contamination may remain in the area of the site as a result of tests studying the serial effects of detonation in a railroad car carrying several weapon units. This CEARP statement was based on speculation not evidence of contamination. Sampling conducted by DOE in response to this speculation refuted this statement. The regulatory disposition of the site was uncertain for federal facility site discovery and identification findings,

preliminary assessment, and preliminary site inspection. Insufficient information prevented calculating a hazard ranking system and modified hazard ranking system score for the site.

In addition to the CEARP inspection, the EPA conducted an RFA. The RFA report (EPA April 1987) presents the same information as the CEARP.

2.3 Historical Operations

ER Site 66 (Figure 2-1) was the site of boxcar experiments conducted between 1958 and 1969. These experiments involved the detonation of explosives inside a boxcar (the type used to transport nuclear weapons) that contained simulated nuclear weapons. The boxcar was about 6 ft high and supported on wooden platforms. The simulated weapons were packaged inside transport containers in the boxcar (66-547). An estimated 2 to 12 shots were fired (66-547, 66-273). The amount of trinitrotoluene (TNT) used was estimated at 5 to 20 pounds per shot. Triangular concrete barriers were used to direct the blast and residuals out the open top of the boxcar. For this reason, subsurface contamination is not likely to have occurred. Although most references agree that no nuclear materials were used, the CEARP reports that ". . . lead, beryllium, depleted uranium, and high-explosive contamination may remain . . . " (DOE September 1987). The railcar has been removed.

3.0 EVALUATION OF RELEVANT EVIDENCE

3.1 Unit Characteristics

ER Site 66 was the site of the boxcar experiments. These experiments involved the detonation of explosives inside a railcar that contained simulated nuclear weapons.

3.2 Operating Practices

The boxcar was about 6 ft high and supported on wooden platforms. The simulated weapons were packaged inside transport containers in the boxcar (66-547). An estimated 2 to 12 shots were fired (66-547, 66-273). The amount of TNT used was estimated at 5 to 20 pounds per shot. Triangular concrete barriers were used to direct the blast and residuals out the open top of the box car.

3.3 Presence or Absence of Visual Evidence

The boxcar has been removed. End caps for rocket motor packing containers and debris were observed during the unexploded ordnance (UXO) visual surface survey, but are not thought to be associated with the ER Site 66 boxcar experiments.

3.4 Results of Previous Sampling/Surveys

3.4.1 Surface-Soil Sampling

In 1987, the DOE/AL ER Program collected twenty-two soil samples from ER Site 66 and analyzed them for metals, uranium, and TNT. X-ray fluorescence was used for metals analysis and barium was the only detected metal at levels ranging from 66.8 to 110 milligrams per kilogram (mg/kg). Background concentrations for barium in surface soil on SNL/NM and KAFB range from 0.086 to 232 mg/kg (IT March 1996). Uranium concentrations range from 0.091 micrograms per gram (µg/g) to 1.5 µg/g at the site. Background studies of the SNL/NM and KAFB area indicate a range of uranium levels from 0.005 to 4.66 µg/g, with a mean of 1.0 µg/g (IT March 1996). Thus both uranium and barium levels at the site are well within the background ranges for SNL/NM and KAFB. No detectable levels of TNT were measured.

3.4.2 Unexploded Ordnance/High Explosives Survey

An UXO visual surface survey was performed at ER Site 66 by KAFB Explosive Ordnance Disposal (EOD) personnel in February 1994. A mound of 5-inch rocket motor parts and debris was found (SNL/NM September 1994). This material was not used as part of the testing and

may have come from the EOD Range across the road from the site. No live ordnance was found.

3.4.3 Gamma Radiation Survey

RUST Geotech Inc. conducted a surface gamma radiation survey at ER Site 66 in 1994 and found that background gamma exposure rates ranged from 12 to 17 microroentgen per hour. No radiation levels above background were found (RUST Geotech Inc. December 1994).

3.5 Assessment of Gaps in Information

There is no definitive record stating the presence or absence of lead, beryllium and depleted uranium in the simulated weapons used in the boxcar experiments.

3.6 Confirmatory Sampling

Twenty four surface soil samples and one duplicate sample were collected from twenty four locations at ER Site 66 on July 17, 1995. Field screening for organic vapors was performed at the sampling locations during the sampling activities. Sampling equipment was cleaned and field blanks were collected. The sampling and analysis plan (Appendix A) provides details on the sampling event.

3.6.1 Field Screening

During soil sampling activities at ER Site 66, field-screening measurements were taken of all soil sampling horizons. The field screening was conducted in accordance with the methodologies prescribed in the sampling and analysis plan (Appendix A) and was performed with a photoionization detector (PID) for organic vapors. Organic vapors detected by the PID monitor during sampling activities never exceeded the action level of 5 parts per million that would warrant an upgrade to health and safety Level C attire.

3.6.2 Laboratory Analysis Results for Soil Samples

The analytical data package and quality assurance/quality control (QC) documentation are available and can be viewed in the SNL/NM EORC. The soil samples were analyzed for metals and explosives at two laboratories—Lockheed Analytical Services (LAS), located in Las Vegas, Nevada, and SNL/NM located in Albuquerque, New Mexico. Twenty soil samples were sent to SNL/NM and four verification samples along with a duplicate were sent to LAS.

Tables 3-1 and 3-2 present the analytical results for explosives from LAS and SNL/NM laboratories, respectively. Soil samples were analyzed for explosives using EPA Method 8330 (EPA November 1986). No explosives were detected in any of the samples at the

Table 3-1

Summary of Explosives Results, ER Site 66 Soil Samples,
Lockheed Analytical Services

Sample Location:		66-005	66-010	66-010	66-015	66-020
ER Sample ID:		024287-06-S-D	024288-06-S-D	024288-03-S-DD	024289-06-S-D	024290-06-S-D
LAL Sample No:		L4954-1	L4954-3	L4954-5	L4954-7	L4954-9
Sample Type:		On-site	On-site	Duplicate	On-site	On-site
Sample Depth:		Surface	Surface	Surface	Surface	Surface
Sample Date:		07/17/95	07/17/95	07/17/95	07/17/95	07/17/95
	PQL[b] (µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)	(µg/kg)
Explosives[a]						
1,3-Dinitrobenzene	250	<250	<250	<250	<250	<250
HMX	2,200	<2,200	<2,200	<2,200	<2,200	<2,200
Nitrobenzene	260	<260	<250[c]	<260	<260	<260
2-Nitrotoluene	250	<250	<250	<250	<250	<250
3-Nitrotoluene	250	<250	<250	<250	<250	<250
4-Nitrotoluene	250	<250	<250	<250	<250	<250
RDX	1,000	<1,000	<980[c]	<1,000	<1,000	<990[c]
Tetryl	650	<650	<640[c]	<650	<650	<640[c]
1,3,5-Trinitrobenzene	250	<250	<250	<250	<250	<250
2,4,6-Trinitrotoluene	250	<250	<250	<250	<250	<250
2-Am-4,6-DNT	250	<250	<250	<250	<250	<250
4-Am-2,6-DNT	250	<250	<250	<250	<250	<250
2,6-Dinitrotoluene	250	<250	<250	<250	<250	<250
2,4-Dinitrotoluene	260	<260	<250[c]	<260	<260	<260

[a]Explosives analyzed by EPA Method 8330 (EPA November 1986).
[b]Practical quantitation limit.
[c]Practical quantitation limit adjusted; preparation dilution ≠ 1.
µg/kg = micrograms per kilogram.

practical quantitation limit. Generally, the practical quantitation limits (PQL) for LAS explosives data are higher than the minimum detection limit (MDL) for SNL/NM (by about a factor of two), for high explosives compounds common to both laboratories.

Tables 3-3 and 3-4 present the analytical results for metals from LAS and SNL/NM laboratories, respectively. Soils were analyzed for metals using EPA Method 6010 (EPA November 1986). Generally, LAS PQLs for metals are approximately an order of magnitude below the MDLs for SNL/NM. The results from LAS are as follows: beryllium, cadmium, mercury, selenium, and silver were not detected in any of the samples at the project reporting limit. Arsenic, barium, chromium, and lead were detected in levels exceeding the project reporting limit. The results from SNL/NM are as follows: arsenic, cadmium, chromium, lead, mercury, selenium, and silver were not detected in levels exceeding minimum detection limits. Beryllium was detected in one sample below the practical quantitation limit. Barium was detected in levels exceeding the practical quantitation limits. All detections from both laboratories fall within or near the following SNL/NM and KAFB reported background ranges for surface soil: Arsenic (0.015 to 9.7 mg/kg), barium (0.086 to 232 mg/kg), chromium (0.004 to 240 mg/kg) and lead (0.005 to 104 mg/kg) (IT March 1996).

Table 3-2

Summary of Explosives Results, ER Site 66 Soil Samples, SNL/NM ER Chemical Laboratory

Sample Location: ER Sample ID: Sample Type : Sample Depth: Sample Date:	MDL[b] (µg/kg)	Site 66 66-GR-001-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-002-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-003-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-004-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-005-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-006-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-007-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-008-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-009-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-010-SS On-site Surface 07/17/95 (µg/kg)
Explosives[a]											
HMX	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
NG	30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
PETN	150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
RDX	150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
TNT	76	<76	<76	<76	<76	<76	<76	<76	<76	<76	<76

Sample Location: ER Sample ID: Sample Type : Sample Depth: Sample Date:	MDL[b] (µg/kg)	Site 66 66-GR-011-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-012-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-013-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-014-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-015-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-016-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-017-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-018-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-019-SS On-site Surface 07/17/95 (µg/kg)	Site 66 66-GR-020-SS On-site Surface 07/17/95 (µg/kg)
Explosives[a]											
HMX	100	<100	<100	<100	<100	<100	<100	<100	<100	<100	<100
NG	30	<30	<30	<30	<30	<30	<30	<30	<30	<30	<30
PETN	150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
RDX	150	<150	<150	<150	<150	<150	<150	<150	<150	<150	<150
TNT	76	<76	<76	<76	<76	<76	<76	<76	<76	<76	<76

[a]Explosives analyzed using modified EPA method 8330 (EPA November, 1996)
[b]MDL = Minimum detection limit.
µg/kg = Microgram per kilogram.

Table 3-3

Summary of Metals Results, ER Site 66 Soil Samples,
Lockheed Analytical Services

Sample Location:	66-005		66-010		66-010		66-015		66-020	
ER Sample ID:	024287-08-S-D		024288-08-S-D		024288-04-S-DD		024289-08-S-D		024290-08-S-D	
LAL Sample No:	L4954-2		L4954-4		L4954-6		L4954-8		L4954-10	
Sample Type:	On-site		On-site		Duplicate		On-site		On-site	
Sample Depth:	Surface		Surface		Surface		Surface		Surface	
Sample Date:	07/17/95		07/17/95		07/17/95		07/17/95		07/17/95	
	(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)		(mg/kg)	
	PRL[b]	Result	PRL[b]	Result	PRL[b]	Result	PRL[b]	Result	PRL[b]	Result
Metals[a]										
Arsenic	2.0	3.1	2.0	6.6	2.0	6.6	2.0	9.9	2.0	8.0
Barium	40	80	39	75	40	79	40	130	40	110
Beryllium	1.0	<1.0	0.98	<0.98	1.0	<1.0	1.0	<1.0	1.0	<1.0
Cadmium	1.0	<1.0	0.98	<0.98	1.0	<1.0	1.0	<1.0	1.0	<1.0
Chromium	2.0	5.0	2.0	4.9	2.0	5.6	2.0	9.9	2.0	8.3
Lead	0.60	17	0.60	8.9	0.60	13	0.60	19	0.59	17
Mercury	0.10	<0.10	0.10	<0.10	0.10	<0.10	0.096	<0.096	0.10	<0.10
Selenium	1.0	<1.0	1.0	<1.0	1.0	<1.0	1.0	<1.0	0.99	<0.99
Silver	2.0	<2.0	2.0	<2.0	2.0	<2.0	2.0	<2.0	2.0	<2.0

[a]Metals analyzed by EPA Method 6010/7000 (EPA November 1986).
[b]Project reporting limit.
mg/kg = milligrams per kilogram.

Table 3-5 summarizes results for gamma spectroscopy measurements obtained from the SNL/NM 881 Laboratory. All of the detections are below activity ranges established for select radionuclides in surface soil at SNL/NM (IT March 1996). There were no detections for uranium-235 and its decay progeny.

3.6.3 QC Summary

Field and laboratory QC samples were analyzed at LAS to evaluate data quality. The following subsections summarize the QC data and findings.

3.6.3.1 Data Verification and Validation

Verification and validation of chemical measurement data were performed in accordance with the SNL/NM EORC "Verification and Validation of Chemical and Radiochemical Data" Revision 0 (TOP [technical operating procedure] 94-03) (SNL/NM July 1994). Data validation was performed on the organic data using Level 1 and Level 2 checklists specified in the above-referenced procedure.

Table 3-4

Summary of Metals Results, ER Site 66 Soil Samples, SNL/NM ER Chemical Laboratory

Sample Location: / ER Sample ID: / Sample Type : / Sample Depth: / Sample Date:	MDL[a]/PQL[b] (mg/kg)		Site 66 66-GR-001-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-002-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-003-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-004-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-005-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-006-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-007-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-008-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-009-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-010-0-SS On-site Surface 07/17/95 (mg/kg)
Metals[c]												
Silver	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Arsenic	50	190	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Barium	10	38	73	83	77	65	90	84	73	92	78	61
Beryllium	0.11	0.44	<0.11	<0.11	<0.11	<0.11	<0.11	0.16 J	<0.11	<0.11	<0.11	<0.11
Cadmium	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chromium	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	0.06	0.24	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	0.06 J	<0.06	<0.06
Lead	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Selenium	50	191	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

Sample Location: / ER Sample ID: / Sample Type : / Sample Depth: / Sample Date:	MDL[a]/PQL[b] (mg/kg)		Site 66 66-GR-011-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-012-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-013-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-014-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-015-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-016-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-017-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-018-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-019-0-SS On-site Surface 07/17/95 (mg/kg)	Site 66 66-GR-020-0-SS On-site Surface 07/17/95 (mg/kg)
Metals[c]												
Silver	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Arsenic	50	190	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Barium	10	38	47	110	83	80	97	64	63	67	48	78
Beryllium	0.11	0.44	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11	<0.11
Cadmium	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Chromium	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Mercury	0.06	0.24	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Lead	10	38	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Selenium	50	191	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50

[a]MDL = Minimum detection limit.
[b]PQL = Practical quantitation limit.
[c]Metals analyzed by modified EPA Method 6010/7000 (EPA November 1986).
J = Estimated value that lies between the minimum detection limit and the practical quantitation limit.
mg/kg = Milligrams per kilogram.

Table 3-5

Summary of Gamma Spectroscopy Results for ER Site 66 Soil Samples
SNL/NM 881 Laboratory

Sample Location:	Background[a]	Site 66		Site 66		Site 66		Site 66		Site 66	
ER Sample ID:		1332-66-005-S-D		1332-66-010-S-D		1332-66-010-S-DD		1332-66-015-S-D		1332-66-020-S-D	
Lab Sample No:		50055901		50055902		50055903		50055904		50055905	
Sample Type:		On-site		On-site		On-site duplicate		On-site		On-site	
Sample Depth:	Surface	surface		surface		surface		surface		surface	
Sample Date:		07/17/95		07/17/95		07/17/95		07/17/95		07/17/95	
	Range (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)
Uranium-238 decay chain[b]											
Uranium-238	0.153 - 2.3	ND	2.09	ND	1.98	ND	1.99	ND	2.23	ND	2.05
Thorium-234	0.11 - 2.34	1.12	6.18E-01	ND	6.29E-01	ND	9.97E-01	1.30	6.65E-01	1.17	6.24E-01
Uranium-234	0.44 - <5.02	ND	1.98E+01	ND	1.81E+01	ND	1.74E+01	ND	2.14E+01	ND	1.81E+01
Radium-226	0.293 - 5.47	1.48	1.03	6.67E-01[e]	7.04E-01	1.45	1.11	1.60	1.09	1.67	1.08
Lead-214	NA	6.31E-01	1.01E-01	4.73E-01	9.01E-02	5.49E-01	1.19E-01	8.18E-01	1.06E-01	6.23E-01	7.96E-02
Bismuth-214	NA	5.62E-01	1.08E-01	4.45E-01	9.27E-02	5.46E-01	7.27E-02	6.38E-01	1.01E-01	6.13E-01	9.58E-02
Lead-210	NA	ND	1.18	ND	1.28	6.31E-01[e]	6.57E-01	ND	1.30	ND	1.23
Thorium-232 decay chain[b]											
Thorium-232	0.113 - 1.18	7.37E-01	3.57E-01	9.89E-01	3.15E-01	7.48E-01	2.77E-01	1.04	4.48E-01	8.94E-01	2.82E-01
Radium-228	0.113 - 1.10	6.54E-01	3.47E-01	6.19E-01	2.89E-01	1.07	1.96E-01	1.17	2.57E-01	8.29E-01	1.93E-01
Actinium-228	NA	1.03	1.82E-01	9.07E-01	1.95E-01	8.90E-01	1.73E-01	9.80E-01	2.31E-01	9.80E-01	1.73E-01
Thorium-228	NA	8.67E-01	7.24E-01	1.05	7.39E-01	1.23	7.68E-01	7.43E-01[e]	8.47E-01	8.11E-01	7.32E-01
Radium-224	NA	1.98	6.24E-01	1.79	6.99E-01	1.78	6.36E-01	ND	7.50E-01	1.92	6.08E-01
Lead-212	NA	1.10	5.94E-02	9.10E-01	6.76E-02	8.99E-01	6.03E-02	1.07	7.02E-02	1.03	5.60E-02
Bismuth-212	NA	8.69E-01	7.02E-01	1.00	5.65E-01	6.65E-01	5.93E-01	7.38E-01	6.72E-01	8.90E-01	5.96E-01
Thallium-208	NA	9.68E-01	1.11E-01	8.36E-01	1.27E-01	9.53E-01	1.53E-01	1.00	1.49E-01	8.42E-01	1.42E-01
Uranium-235 decay chain[c]											

Refer to footnotes at end of table.

Table 3-5 *(Continued)*

Summary of Gamma Spectroscopy Results for ER Site 66 Soil Samples
SNL/NM 881 Laboratory

Sample Location:		Site 66		Site 66		Site 66		Site 66		Site 66	
ER Sample ID:	Background[a]	1332-66-005-S-D		1332-66-010-S-D		1332-66-010-S-DD		1332-66-015-S-D		1332-66-020-S-D	
Lab Sample No:		50055901		50055902		50055903		50055904		50055905	
Sample Type:		On-site		On-site		On-site duplicate		On-site		On-site	
Sample Depth:	Surface	surface		surface		surface		surface		surface	
Sample Date:		07/17/95		07/17/95		07/17/95		07/17/95		07/17/95	
	Range (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)	activity (pCi/g)	MDA[d] (pCi/g)
Other Radionuclides											
Cesium-137	0.000 - 1.33	6.90E-01	6.62E-02	9.21E-01	5.62E-02	9.59E-01	4.57E-02	7.70E-01	7.50E-02	4.13E-01	5.58E-02
Potassium-40	NA	2.52E+01	5.46E-01	2.41E+01	4.70E-01	2.31E+01	4.56E-01	2.04E+01	5.92E-01	2.23E+01	4.62E-01

[a]IT March 1996.
[b]List includes only gamma emitting progeny.
[c]Uranium-235 and all gamma progeny are below the minimum detection activity.
[d]Minimum detection activity (MDA).
[e]The measured activity plus the reported 2-sigma error is greater than the MDA.
NA = Not available.
ND = Not detected.
pCi/g = Picocuries per gram.

3.6.3.2 *Field QC Data*

Field QC samples submitted to LAS during sampling activities at ER Site 66 included two field duplicate splits and two field blanks, two field blanks were also submitted to SNL/NM. A laboratory control sample and laboratory control sample duplicate were extracted and analyzed in addition to a matrix spike (MS) and matrix spike duplicate (MSD). Results for the QC samples are discussed below.

Field Duplicate Sample

Two duplicate soil splits were obtained from Sample Location 66-010 at the ground surface (0 ft) and sent to LAS. The duplicate splits were analyzed for metals (ER Sample ID 024288-04-S-DD) and explosives (ER Sample ID 024288-03-S-DD). The results of the duplicate explosives analysis are consistent with its counterpart (Table 3-1). The results of the duplicate metals analysis are consistent with its counterpart (i.e., ± 20 percent) with the exception of lead (Table 3-3). However, a relative percent difference of 28 between the original and duplicate is not of concern as both concentrations are nearly an order of magnitude lower than the upper background value of 104 mg/kg (IT March 1996).

Field Rinsate Blanks

Aqueous field rinsate blanks were collected following completion of soil sampling and final equipment decontamination at ER Site 66 and submitted to both laboratories. Neither metals nor explosives were detected in the blank samples (Tables 3-6 through 3-9). The results obtained from analysis of the blank samples indicate that project samples were not cross-contaminated by the sampling equipment or containers.

Matrix Spike Analysis

Analyses of MS and MSD were performed at LAS to assess sample matrix effects on analytical accuracy, in accordance with requirements of the sampling plan (Appendix A). The MS was performed for all fractions of the sample in accordance with approved laboratory procedures. MS results were reported in the laboratory analytical data report as percent recovery and relative percent difference calculations. Samples were analyzed for explosives and metals. The MS and MSD for explosives were within the acceptance limits established for percent recovery and relative percent difference (Table 3-10). MS and MSD samples for metals were within the QC limits, with the exception of silver and lead (Table 3-11). The laboratory report contains no explanation of the unrecovered silver spike in the MS sample, although it appears to be an anomaly as 97 percent of the silver spike was recovered in the MSD. A small amount of lead spike was recovered in the MS sample (8 percent) and 159 percent was recovered in the MSD sample. Although these recoveries are outside of the QC limits, results are well below the upper range reported for background lead concentrations

Table 3-6
Summary of Explosives Results, ER Site 66 Blank Samples, Lockheed Analytical Services

Sample Location:		66-022
ER Sample ID:		024292-09-O-FB
LAL Sample No:		L4954-14
Sample Type:		Aqueous Field Blank
Sample Depth:		NA
Sample Date:		07/17/95
	PQL[b] (µg/L)	(µg/L)
Explosives[a]		
1,3-Dinitrobenzene	0.30	<0.30
HMX	1.0	<1.0
Nitrobenzene	0.50	<0.50
2-Nitrotoluene	0.25	<0.25
3-Nitrotoluene	0.25	<0.25
4-Nitrotoluene	0.25	<0.25
RDX	0.85	<0.85
Tetryl	1.0	<1.0
1,3,5-Trinitrobenzene	0.45	<0.45
2,4,6-Trinitrotoluene	0.26	<0.26
2-Am-4,6-DNT	0.26	<0.26
4-Am-2,6-DNT	0.26	<0.26
2,6-Dinitrotoluene	0.25	<0.25
2,4-Dinitrotoluene	0.26	<0.26

[a]Explosives analyzed by EPA Method 8330 (EPA November 1986).
[b]Practical quantitation limit.
µg/L = micrograms per liter

Table 3-7
Summary of Explosives Results, ER Site 66 Blank Samples, SNL/NM ER Chemical Laboratory

Sample Location:		Site 66	Site 66
ER Sample ID:		66-GR-021-0-R	66-GR-022-0-FB
Sample Type :		Equipment Rinsate	Field Blank
Sample Depth:		NA	NA
Sample Date:		07/17/95	07/17/95
	MDL[b] (µg/L)	(µg/L)	(µg/L)
Explosives[a]			
HMX	100	<100	<100
NG	30	<30	<30
PETN	150	<150	<150
RDX	150	<150	<150
TNT	76	<76	<76

[a]Explosives analyzed using modified EPA Method 8330 (EPA November 1986)
[b]MDL = Method detection limit.
µg/L = Micrograms per liter.
NA = Not applicable.

Table 3-8
Summary of Metals Results, ER Site 66 Blank Samples, Lockheed Analytical Services

Sample Location:		66-021
ER Sample ID:		024291-05-O-FB
LAL Sample No:		L4954-11
Sample Type:		Aqueous Field Blank
Sample Depth:		NA
Sample Date:		07/17/95
	PRL[b] (mg/L)	(mg/L)
Metals[a]		
Arsenic	0.010	<0.010
Barium	0.20	<0.20
Beryllium	0.0050	<0.0050
Cadmium	0.0050	<0.0050
Chromium	0.010	<0.010
Lead	0.0030	<0.0030
Mercury	0.00020	<0.00020
Selenium	0.0050	<0.0050
Silver	0.010	<0.010

[a]Metals analyzed by EPA Method 6010/7000 (EPA November 1986).
[b]Project reporting limit.
mg/L = milligrams per liter

Table 3-9
Summary of Metals Results, ER Site 66 Blank Samples, SNL/NM ER Chemical Laboratory

Sample Location:			Site 66	Site 66
ER Sample ID:			66-GR-021-0-R	66-GR-022-0-FB
Sample Type :			Equipment Rinsate	Field Blank
Sample Depth:			NA	NA
Sample Date:			07/17/95	07/17/95
	MDL[a]	PQL[b]		
	(mg/L)		(mg/L)	(mg/L)
Metals[c]				
Silver	0.10	0.38	<0.10	<0.10
Arsenic	0.50	1.90	<0.50	<0.50
Barium	0.10	0.38	<0.10	<0.10
Beryllium	0.034	0.13	<0.034	<0.034
Cadmium	0.10	0.38	<0.10	<0.10
Chromium	0.10	0.38	<0.10	<0.10
Mercury	0.0006	0.0024	NT	NT
Lead	0.10	0.38	<0.10	<0.10
Selenium	0.50	1.9	<0.50	<0.50

[a]MDL = Method detection limit.
[b]PQL = Practical quantitation limit.
[c]Metals analyzed by modified EPA Method 6010 (EPA November 1986).
mg/L = Milligrams per liter.
NA = Not applicable.
NT = Not tested.

Table 3-10

Summary of Explosives Results for Matrix Spike and Matrix Spike Duplicate
ER Site 66 Soil Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (mg/kg)	Matrix Spike Concentration (mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
25754MS	Explosives[a]				NA[b]		NA[b]
	1,3-Dinitrobenzene	4.42	4.38	99		60-130	
	HMX	4.42	4.64	105		60-130	
	Nitrobenzene	4.42	4.52	102		60-130	
	2-Nitrotoluene	4.42	4.38	99		60-130	
	3-Nitrotoluene	4.42	4.39	99		60-130	
	4-Nitrotoluene	4.42	4.49	102		60-130	
	RDX	4.42	4.78	108		60-130	
	Tetryl	4.42	3.97	90		60-130	
	1,3,5-Trinitrobenzene	4.42	4.35	99		60-130	
	2,4,6-Trinitrotoluene	4.42	4.35	98		60-130	
	2-Am-4,6-DNT	4.42	4.26	96		60-130	
	4-Am-2,6-DNT	4.42	4.44	101		60-130	
	2,6-Dinitrotoluene	4.42	4.27	97		60-130	
	2,4-Dinitrotoluene	4.42	4.45	101		60-130	
25754MSD	Explosives[a]						
	1,3-Dinitrobenzene	4.35	4.34	100	1	60-130	30
	HMX	4.35	4.63	106	1	60-130	30
	Nitrobenzene	4.35	4.43	102	1	60-130	30
	2-Nitrotoluene	4.35	4.56	105	6	60-130	30
	3-Nitrotoluene	4.35	4.53	104	5	60-130	30
	4-Nitrotoluene	4.35	4.65	107	5	60-130	30
	RDX	4.35	5.07	116	7	60-130	30
	Tetryl	4.35	3.92	90	0	60-130	30
	1,3,5-Trinitrobenzene	4.35	4.29	99	0	60-130	30
	2,4,6-Trinitrotoluene	4.35	4.27	98	0	60-130	30
	2-Am-4,6-DNT	4.35	4.03	92	4	60-130	30
	4-Am-2,6-DNT	4.35	4.08	94	7	60-130	30
	2,6-Dinitrotoluene	4.35	3.69	85	13	60-130	30
	2,4-Dinitrotoluene	4.35	4.29	98	2	60-130	30

[a]Explosives analyzed by EPA Method 8330 (EPA November 1986).
[b]Not applicable to matrix spike analysis.
mg/kg = Milligrams per kilogram
QC = Quality Control

Table 3-11

Summary of Metals Results for Matrix Spike and Matrix Spike Duplicate ER Site 66 Soil Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (mg/kg)	Matrix Spike Concentration (mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
L4954-2MS	Metals[a]				NA[b]		NA[b]
	Arsenic	7.938	11.31	104		80-120	
	Barium	403.2	459.6	94		80-120	
	Beryllium	10.08	8.851	88		80-120	
	Cadmium	10.08	9.476	94		80-120	
	Chromium	40.32	46.21	102		80-120	
	Lead	3.969	17.13	8		80-120	
	Mercury	0.5040	0.5660	112		80-120	
	Selenium	1.984	1.965	99		80-120	
	Silver	10.08	<2.0	0		80-120	
L4954-2MSD	Metals[a]						
	Arsenic	7.938	11.71	109	3	80-120	20
	Barium	400.0	517.4	109	12	80-120	20
	Beryllium	10.00	9.681	97	9	80-120	20
	Cadmium	10.00	9.381	94	1	80-120	20
	Chromium	40.00	46.84	105	1	80-120	20
	Lead	3.969	23.12	159	30	80-120	20
	Mercury	0.5040	0.5575	111	2	80-120	20
	Selenium	1.984	1.766	89	11	80-120	20
	Silver	10.00	9.681	97	132	80-120	20

[a]Metals analyzed by EPA Method 6010 (EPA November 1986).
[b]Not applicable to matrix spike analysis.
mg/kg = Milligrams per kilogram.
QC = Quality Control.

in soil samples (IT March 1996). There is no laboratory narrative provided for this QC discrepancy.

3.6.4 Laboratory QC Data

Laboratory QC samples were analyzed at LAS, and the data are included in the analytical reports with cross-references to the corresponding ER samples. Laboratory QC data include laboratory control and laboratory control duplicate analyses for soil and water samples and a method blank analysis. Tables 3-12 and 3-13 provide results for the laboratory QC analyses of these samples.

3.6.5 Nonconformances/Variances to Sampling and Analysis Plan

A nonconformance is an unplanned and unintended deviation from the established sampling and analysis plan or procedures. A variance is an approved and controlled change to the established sampling and analysis plan or procedures. There were no nonconformance/ variance issues associated with the sampling at ER Site 66.

3.7 Rationale for Pursuing a Confirmatory Sampling NFA Decision

SNL/NM is proposing a confirmatory sampling NFA decision for ER Site 66 because no release to the environment has occurred, nor is likely to occur in the future (NFA Criterion 3).

The site was used to conduct the boxcar experiments, which involved the detonation of explosives inside a railcar that contained simulated nuclear weapons. Confirmatory sampling and analysis of soils below the former boxcar location indicate that explosives are not present at the site, and detected levels of arsenic, barium, chromium, and lead are within the range of background values for SNL/NM and KAFB. No other hazardous metals were detected in the soil samples.

Therefore, based on archival information and analytical results from confirmatory sampling, ER Site 66 is recommended for a confirmatory sampling NFA decision because no release to the environment has occurred, nor is likely to occur in the future (NFA Criterion 3).

Table 3-12

Summary of Explosives Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (water, µg/L) (soil, mg/kg)	Measured Concentration (water, µg/L) (soil, mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
25507LCS Water	Explosives[a]				NA[b]		NA[b]
	1,3-Dinitrobenzene	2.00	1.74	87		60-120	
	HMX	2.00	2.11	106		60-120	
	Nitrobenzene	2.00	0.436	22		60-120	
	2-Nitrotoluene	2.00	0.590	30		60-120	
	3-Nitrotoluene	2.00	0.619	31		60-120	
	4-Nitrotoluene	2.00	0.717	36		60-120	
	RDX	2.00	1.82	91		60-120	
	Tetryl	2.00	1.72	86		60-120	
	1,3,5-Trinitrobenzene	2.00	1.51	76		60-120	
	2,4,6-Trinitrotoluene	2.00	1.63	81		60-120	
	2-Am-4,6-DNT	2.00	1.77	89		60-120	
	4-Am-2,6-DNT	2.00	1.79	89		60-120	
	2,6-Dinitrotoluene	2.00	1.47	73		60-120	
	2,4-Dinitrotoluene	2.00	1.62	81		60-120	
25507LCSD Water	Explosives[a]						
	1,3-Dinitrobenzene	2.00	1.80	90	3	60-120	30
	HMX	2.00	2.11	106	0	60-120	30
	Nitrobenzene	2.00	0.000	0.00	200	60-120	30
	2-Nitrotoluene	2.00	0.000	0.00	200	60-120	30
	3-Nitrotoluene	2.00	0.000	0.00	200	60-120	30
	4-Nitrotoluene	2.00	0.185	9.3	118	60-120	30
	RDX	2.00	2.09	105	14	60-120	30
	Tetryl	2.00	1.75	88	2	60-120	30
	1,3,5-Trinitrobenzene	2.00	1.11	56	31	60-120	30
	2,4,6-Trinitrotoluene	2.00	1.66	83	2	60-120	30
	2-Am-4,6-DNT	2.00	1.92	96	8	60-120	30
	4-Am-2,6-DNT	2.00	1.88	94	5	60-120	30
	2,6-Dinitrotoluene	2.00	0.773	39	62	60-120	30
	2,4-Dinitrotoluene	2.00	1.37	69	17	60-120	30

Refer to footnotes at end of table.

Table 3-12 *(Continued)*

Summary of Explosives Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (water, µg/L) (soil, mg/kg)	Measured Concentration (water, µg/L) (soil, mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
25507MB Water	Explosives[a]	NA[b]		NA[b]	NA[b]	PQL[c] (µg/L)	
	1,3-Dinitrobenzene		<0.30			0.30	
	HMX		<1.0			1.0	
	Nitrobenzene		<0.50			0.50	
	2-Nitrotoluene		<0.25			0.25	
	3-Nitrotoluene		<0.25			0.25	
	4-Nitrotoluene		<0.25			0.25	
	RDX		<0.85			0.85	
	Tetryl		<1.0			1.0	
	1,3,5-Trinitrobenzene		<0.45			0.45	
	2,4,6-Trinitrotoluene		<0.26			0.26	
	2-Am-4,6-DNT		<0.26			0.26	
	4-Am-2,6-DNT		<0.26			0.26	
	2,6-Dinitrotoluene		<0.25			0.25	
	2,4-Dinitrotoluene		<0.26			0.26	
25754LCS Soil	Explosives[a]				NA[b]		NA[b]
	1,3-Dinitrobenzene	4.00	4.32	108		60-130	
	HMX	4.00	3.75	94		60-130	
	Nitrobenzene	4.00	4.29	107		60-130	
	2-Nitrotoluene	4.00	4.01	100		60-130	
	3-Nitrotoluene	4.00	4.08	102		60-130	
	4-Nitrotoluene	4.00	4.02	100		60-130	
	RDX	4.00	5.06	127		60-130	
	Tetryl	4.00	3.72	93		60-130	
	1,3,5-Trinitrobenzene	4.00	4.05	101		60-130	
	2,4,6-Trinitrotoluene	4.00	4.09	102		60-130	
	2-Am-4,6-DNT	4.00	3.89	97		60-130	
	4-Am-2,6-DNT	4.00	4.11	103		60-130	
	2,6-Dinitrotoluene	4.00	3.82	96		60-130	
	2,4-Dinitrotoluene	4.00	4.21	105		60-130	

Refer to footnotes at end of table.

Table 3-12 *(Continued)*

Summary of Explosives Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (water, µg/L) (soil, mg/kg)	Measured Concentration (water, µg/L) (soil, mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
25754LCSD Soil	Explosives[a]						
	1,3-Dinitrobenzene	3.98	3.82	96	12	60-130	30
	HMX	3.98	3.97	100	6	60-130	30
	Nitrobenzene	3.98	4.21	106	2	60-130	30
	2-Nitrotoluene	3.98	4.09	103	2	60-130	30
	3-Nitrotoluene	3.98	4.11	103	1	60-130	30
	4-Nitrotoluene	3.98	4.18	105	4	60-130	30
	RDX	3.98	3.58	90	34	60-130	30
	Tetryl	3.98	3.67	92	1	60-130	30
	1,3,5-Trinitrobenzene	3.98	4.02	101	0	60-130	30
	2,4,6-Trinitrotoluene	3.98	4.08	102	0	60-130	30
	2-Am-4,6-DNT	3.98	4.01	101	4	60-130	30
	4-Am-2,6-DNT	3.98	4.21	106	3	60-130	30
	2,6-Dinitrotoluene	3.98	4.00	100	5	60-130	30
	2,4-Dinitrotoluene	3.98	4.24	107	1	60-130	30
25754MB Soil	Explosives[a]	NA[b]		NA[b]	NA[b]	PQL[c] (mg/kg)	
	1,3-Dinitrobenzene		<0.25			0.25	
	HMX		<2.2			2.2	
	Nitrobenzene		<0.26			0.26	
	2-Nitrotoluene		<0.25			0.25	
	3-Nitrotoluene		<0.25			0.25	
	4-Nitrotoluene		<0.25			0.25	
	RDX		<1.0			1.0	
	Tetryl		<0.65			0.65	
	1,3,5-Trinitrobenzene		<0.25			0.25	
	2,4,6-Trinitrotoluene		<0.25			0.25	
	2-Am-4,6-DNT		<0.25			0.25	
	4-Am-2,6-DNT		<0.25			0.25	
	2,6-Dinitrotoluene		<0.25			0.25	
	2,4-Dinitrotoluene		<0.26			0.26	

Refer to footnotes at end of table.

Table 3-12 *(Continued)*

Summary of Explosives Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (water, µg/L) (soil, mg/kg)	Measured Concentration (water, µg/L) (soil, mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
26172LCS Water	Explosives[a]				NA[b]		NA[b]
	1,3-Dinitrobenzene	2.00	1.80	90		60-120	
	HMX	2.00	1.37	69		60-120	
	Nitrobenzene	2.00	1.47	73		60-120	
	2-Nitrotoluene	2.00	1.75	88		60-120	
	3-Nitrotoluene	2.00	1.74	87		60-120	
	4-Nitrotoluene	2.00	1.96	98		60-120	
	RDX	2.00	1.57	78		60-120	
	Tetryl	2.00	1.66	83		60-120	
	1,3,5-Trinitrobenzene	2.00	1.67	83		60-120	
	2,4,6-Trinitrotoluene	2.00	1.83	91		60-120	
	2-Am-4,6-DNT	2.00	1.81	90		60-120	
	4-Am-2,6-DNT	2.00	1.84	92		60-120	
	2,6-Dinitrotoluene	2.00	1.77	89		60-120	
	2,4-Dinitrotoluene	2.00	1.84	92		60-120	
26172LCSD Water	Explosives[a]						
	1,3-Dinitrobenzene	2.00	1.90	95	6	60-120	30
	HMX	2.00	1.32	66	3	60-120	30
	Nitrobenzene	2.00	1.60	80	9	60-120	30
	2-Nitrotoluene	2.00	1.49	75	16	60-120	30
	3-Nitrotoluene	2.00	1.79	90	3	60-120	30
	4-Nitrotoluene	2.00	1.66	83	17	60-120	30
	RDX	2.00	1.83	92	15	60-120	30
	Tetryl	2.00	1.71	85	3	60-120	30
	1,3,5-Trinitrobenzene	2.00	1.79	90	8	60-120	30
	2,4,6-Trinitrotoluene	2.00	1.88	94	3	60-120	30
	2-Am-4,6-DNT	2.00	1.91	95	5	60-120	30
	4-Am-2,6-DNT	2.00	1.87	93	2	60-120	30
	2,6-Dinitrotoluene	2.00	1.78	89	1	60-120	30
	2,4-Dinitrotoluene	2.00	1.94	97	5	60-120	30

Refer to footnotes at end of table.

Table 3-12 *(Concluded)*

Summary of Explosives Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (water, µg/L) (soil, mg/kg)	Measured Concentration (water, µg/L) (soil, mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
26172MB Water	Explosives[a]	NA[b]		NA[b]	NA[b]	PQL[c] (µg/L)	
	1,3-Dinitrobenzene		<0.30			0.30	
	HMX		<1.00			1.0	
	Nitrobenzene		<0.50			0.50	
	2-Nitrotoluene		<0.25			0.25	
	3-Nitrotoluene		<0.25			0.25	
	4-Nitrotoluene		<0.25			0.25	
	RDX		<0.85			0.85	
	Tetryl		<1.00			1.00	
	1,3,5-Trinitrobenzene		<0.45			0.45	
	2,4,6-Trinitrotoluene		<0.26			0.26	
	2-Am-4,6-DNT		<0.26			0.26	
	4-Am-2,6-DNT		<0.26			0.26	
	2,6-Dinitrotoluene		<0.25			0.25	
	2,4-Dinitrotoluene		<0.26			0.26	

[a]Explosives analyzed by EPA Method 8330 (EPA November 1986).
[b]Not applicable.
[c]Practical quantitation limit.
µg/L = Micrograms per liter
mg/kg = Milligrams per kilogram
QC = Quality control

Table 3-13

Summary of Metals Results for Laboratory Control, Laboratory Control Duplicate and Method Blank Samples, Lockheed Analytical Services

Laboratory Sample ID	Analyte	Spike Added (mg/kg)	Measured Concentration (mg/kg)	Percent Recovery	Relative Percent Difference	QC Limits	
						Percent Recovery	Relative Percent Difference
25605LCSS Soil	Metals[a]				NA[b]		NA[b]
	Arsenic	349.0	340.4	97.5		80-120	
	Barium	111.0	106.0	95.5		80-120	
	Beryllium	34.7	33.08	95.3		80-120	
	Cadmium	46.9	44.22	94.3		80-120	
	Chromium	115.0	122.6	106.6		80-120	
	Lead	52.4	46.80	89.3		80-120	
	Mercury	13.1	14.92	113.9		80-120	
	Selenium	185	194.0	104.9		80-120	
	Silver	154.0	159.7	103.7		80-120	
25605LCSSD Soil	Metals[a]						
	Arsenic	349	352.4	101	3	80-120	20
	Barium	111	101.4	91.4	4	80-120	20
	Beryllium	34.7	31.96	92.1	3	80-120	20
	Cadmium	46.9	42.84	91.3	3	80-120	20
	Chromium	115.0	119.2	103.7	3	80-120	20
	Lead	52.4	47.20	90.1	1	80-120	20
	Mercury	13.1	13.76	105	8	80-120	20
	Selenium	185	200.6	108.4	3	80-120	20
	Silver	154.0	158.9	103.2	1	80-120	20
25605MB Soil	Metals[a]	NA[b]		NA[b]	NA[b]	RDL[c] (mg/kg)	
	Arsenic		<2			2	
	Barium		<40			40	
	Beryllium		<1			1	
	Cadmium		<1			1	
	Chromium		<2			2	
	Lead		<0.6			0.6	
	Mercury		<0.1			0.1	
	Selenium		<1			1	
	Silver		<2			2	

[a]Metals analyzed by EPA Method 6010 (EPA November 1986).
[b]Not applicable.
[c]Reporting detection limit.
mg/kg = Milligrams per kilogram
QC = Quality control

4.0 CONCLUSION

Based upon the evidence cited above, no potential remains for a release of hazardous waste (including hazardous constituents) that may pose a threat to human health or the environment. Therefore, ER Site 66 is recommended for a confirmatory sampling NFA determination based on NFA Criterion 3: no release to the environment has occurred, nor is it likely to occur in the future.

5.0 REFERENCES

5.1 ER Site References

Section 5.1 contains a bibliographical list of ER Site 66 documents cited in this proposal. This list is arranged numerically by the numbers assigned to each document.

66-273. Sandia National Laboratories/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/66/85-69.

66-547. Sandia National Laboratories/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/58/INT/94-58.

5.2 Reference Documents

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

IT, see IT Corporation.

IT Corporation (IT), March 1996 draft, "Background Concentrations of Constituents of Concern to the SNL/NM ER Program and KAFB Installation Restoration Program," IT Corporation, Albuquerque, New Mexico.

IT Corporation (IT), May 1994. "Hydrogeology of the Central Coyote Test Area OU 1334," IT Corporation, Albuquerque, New Mexico.

NMED, see New Mexico Environment Department

New Mexico Environment Department (NMED), November 1995. "Environmental Restoration Document of Understanding," Santa Fe, New Mexico.

RUST Geotech Inc., December 1994. "Final Report, Surface Gamma Radiation Surveys for Sandia National Laboratories/New Mexico Environmental Restoration Project," prepared for the U.S. Department of Energy.

Sandia National Laboratories/New Mexico (SNL/NM), March 1995, draft. "RCRA Facility Investigation Work Plan for Operable Unit 1332, Foothills Test Area," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), February 1995, draft. "Program Implementation Plan for Albuquerque Potential Release Sites," Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), September 1994, "Unexploded Ordnance/High Explosives (UXO/HE) Visual Survey of ER Sites," Final Report, Sandia

National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), July 1994. "Verification and Validation of Chemical and Radiochemical Data," Rev. 0, TOP 94-03, Sandia National Laboratories, Albuquerque, New Mexico.

SNL/NM, see Sandia National Laboratories/New Mexico.

U.S. Department of Energy (DOE), September 1987, draft. "Comprehensive Environmental Assessment and Response Program (CEARP) Phase I: Installation Assessment, Sandia National Laboratories, Albuquerque," Department of Energy, Albuquerque Operations Office, Environmental Safety and Health Division, Environmental Program Branch, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), August 1993. Module IV of RCRA Permit No. NM58901105189. EPA Region 6, issued to Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), August 1992. Hazardous Waste Management Facility Permit No. NM5890110518, EPA Region 6, issued to Sandia National Laboratories, Albuquerque, New Mexico.

U.S. Environmental Protection Agency (EPA), July 1990. "Corrective Action for Solid Waste Management Units (SWMU) at Hazardous Waste Management Facilities, Proposed Rule," *Federal Register*, Vol. 55, Title 40, Parts 264, 265, 270, and 271.

U.S. Environmental Protection Agency (EPA), December 1987. "Hazardous Waste; Codification Rule for 1984 RCRA Amendments; Final Rule," *Federal Register*, Vol. 52, Title 40, Parts 144, 264, 265, 270, and 27, Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA), April 1987. "Final RCRA Facility Assessment Report of Solid Waste Management Units at Sandia National Laboratories, Albuquerque, New Mexico," Contract No. 68-01-70389. EPA Region 6.

U.S. Environmental Protection Agency (EPA), November 1986. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, *SW-846*, 3rd ed., Washington, D.C.

APPENDIX A

Confirmatory Sampling and Analysis Plan for ER Site 66

APPENDIX A

Confirmatory Sampling and Analysis Plan for ER Site 66

SITE # 66 - Confirmatory Sampling Plan

DRAFT

ER Site #66 is located off of Demolition Road approximately 1.3 miles due east of the intersection of Coyote Springs and Demolition Roads, and approximately 2.7 miles due east of the intersection of Coyote Springs and Lovelace Roads (see Figure 1). The size of the site is approximately 4 acres. The site is centered on four telephone poles, the approximate location of the test based on interviews (see Figure 2). The site is on US Forest Service Withdrawn Lands. Vegetation in the area is spotty in distribution and primarily comprised of junipers, sage brush, and desert grasses. The surrounding ridge slopes are littered with various pieces of shrapnel.

History of Unit

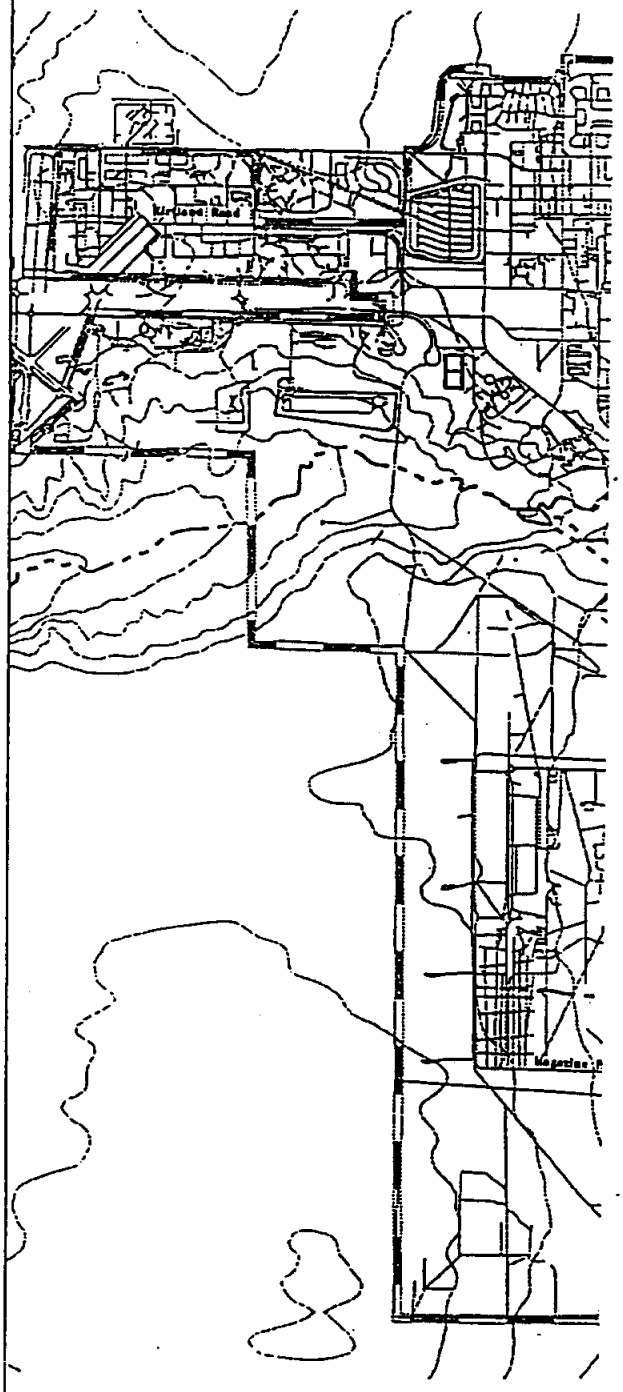
ER Site # 66 was the site of the Boxcar experiments, conducted between 1958-1969, which involved the detonation of explosives inside an ATMX railcar (the type used to transport nuclear weapons) that contained simulated nuclear weapons. The experiment was conducted to determine if the detonation of high explosives (HE) in the railcar would cause the detonation of the explosives inside a nuclear weapon. An estimated 2-12 shots were fired (ref 273, 547). The amount of TNT used was estimated at 5-20 lbs per shot. The simulated weapons were packaged inside transport containers(ref 547). The open-top boxcars were about 6 feet high and were supported on wooden platforms. The railroad car was used for numerous tests and was not destroyed by the tests. Triangular concrete barriers, 2.5 feet tall were used to shield the blast. The concrete triangular barriers that were placed between the weapons and the explosives would have directed the blast and any COCs (if present) out the open top of the boxcar, not through the bottom. Telephone poles with wires were used to hoist the weapon units. Four telephone poles, cut off at about 3 feet above ground level, are currently present in the approximate area of the tests (ref547).

A bunker, approximately 10 feet wide and 32 feet long, was used, prior to the Boxcar experiments, as a seismic station and to store detonators at the site. No release would have resulted from the these activities.

Materials Used and Released

Materials observed or suspected of being present at Site #66, as well as materials that are believed to have been released, are listed in Table 1. Materials released were determined based on interviews about the nature of the tests conducted at the site.

The weapon tested was a nuclear weapon with all its components, except the nuclear material(ref 40, 527, 547 and 273). An aluminum pit was substituted for the nuclear material(ref 547).



LEGEND

Roadways (all types)

KAFB Boundary

Surface Water

40 Foot Contours

N

0 1.25 2.5

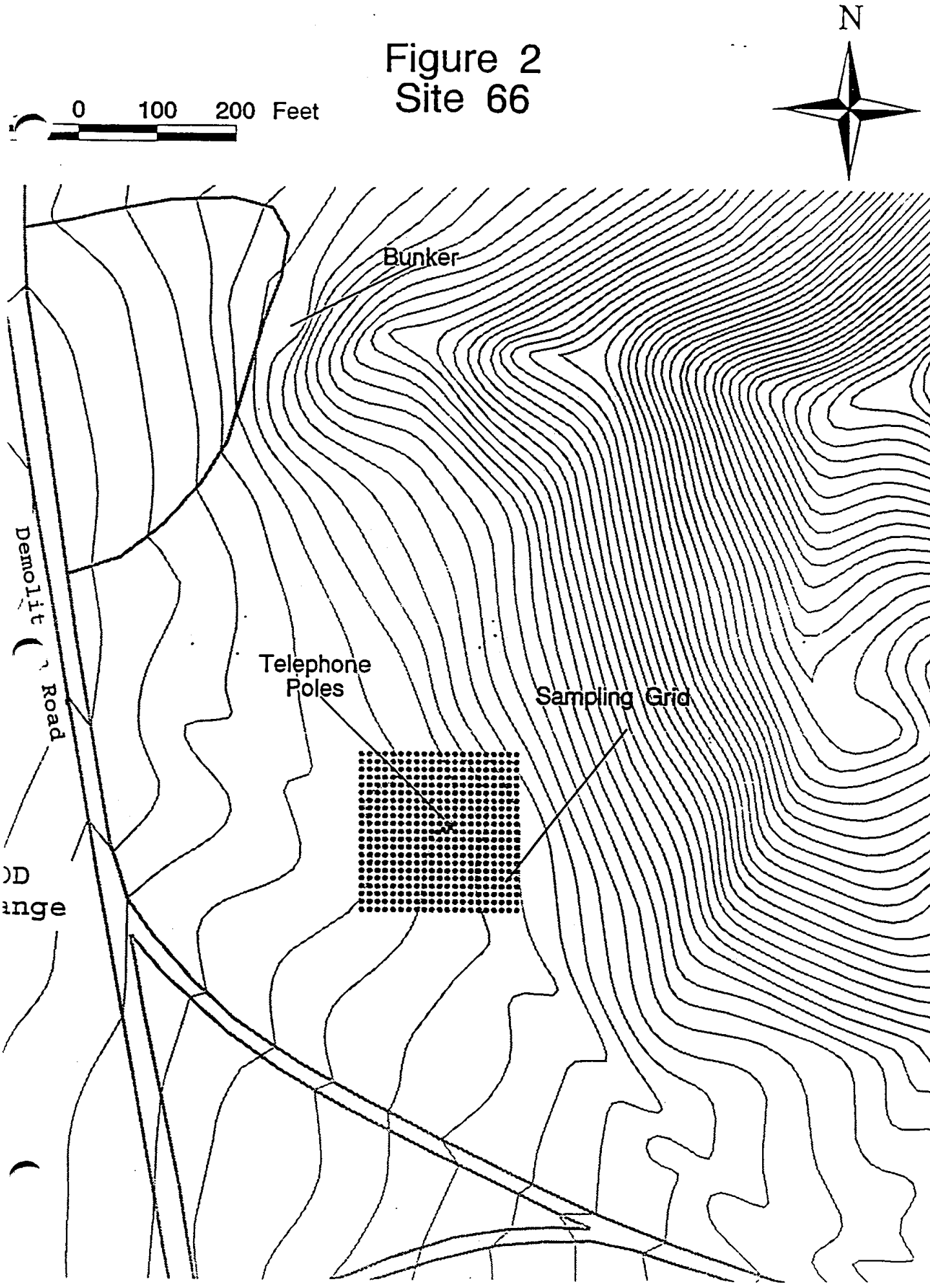
Scale in Miles

Figure 1

Environmental Restoration Project

SNL/KIRTLAND AIR FORCE BASE LOCATION MAP

Figure 2
Site 66



Most references agree that no nuclear materials were used, however, references 307 and 66 indicates that Depleted Uranium (DU) may have been used in the tests.

The fact that the railcar was used for numerous tests and was not destroyed strongly implies that the high explosives inside the simulated weapons did not detonate when exposed to external HE detonations during the tests. Two tests at other sites in which comparable simulated nuclear weapons did detonate completely destroyed the buildings in which they were contained. Thus fragments from the simulated weapons themselves are not expected to have been released at this site.

The concrete barriers placed between each weapon directed the blast out the top of the railcar. This ejected material would be primarily high explosive combustion by-products and possibly fragments from the concrete barriers and weapons shipping containers.

Uncombusted HE is not expected to have been released during the Boxcar tests based on a recent study on the open burning/open detonation of explosives and rocket propellant (DoD, 1992). This sampling plan should validate this conclusion by including HE analysis in the sampling program.

TABLE 1 - Materials Used/Released at ER Site # 66

Materials Used	Materials Released
TNT	Combustion by-products (97% CO_2, .5% CO, 1.7% soot, and .57% semi-volatile and nonvolatile carbon) (ref. 592)
Concrete	Not hazardous
Metal shipping containers	Not hazardous
Weapons components (possibly incl. Be and Pb)	Possibly beryllium or lead
DU (possibly)	DU (the radiation surface survey and previous sampling does not support a DU release scenario)

Past Waste Management Practices

There are no reports of past chemical spills or other incidents related to hazardous/radioactive waste storage and handling.

Past Cleanups Conducted

The rail car and other test debris have been removed. No information on other clean-up activities in the area surrounding site #66 was found during the site background investigation.

Previous Investigations

ER Site 66 was identified during investigations conducted under the Comprehensive Environmental Assessment and Response Program (CEARP) (DOE September 1987) and the RCRA Facility Assessment (EPA April 1987).

In 1987, soil sampling at site # 66 was conducted by the DOE Albuquerque Operations Office (DOE/AL) Environmental Restoration Program (DOE/AL, 1989). The results of this investigation are described in the section on the Nature and Extent of Contamination presented later in this document.

An Unexploded Ordnance (UXO) visual surface survey was performed at Site #66 by KAFB Explosive Ordnance Disposal (EOD) personnel and completed on 2/2/94. A pile of 5-inch rocket motor parts and debris were found (SNL/NM, Sept. 1994). This material was not used as part of the Boxcar testing. The EOD Range is directly west, across the road from the site and may be the source of this debris. No live ordnance was found.

In January and April of 1994, RUST Geotech Inc. conducted a surface gamma radiation survey at ER Site 66. The background gamma exposure rates ranged from 12 to 17 uR/hr. No areas of radiation levels above background were found (RUST Geotech Inc, Dec. 1994).

Conceptual Model

Initial Conceptual Model

The conceptual model presented for ER Site 66 is an explosive testing site that may have dispersed metal fragments and possibly though unlikely, HE.

Existing Information on Nature and Extent of Contamination

Site # 66 is in an area with sparsely distributed shrapnel from nearby test areas operated by various groups to the southeast and south, and EOD demolition range activities to west of the site. It is thus difficult to determine which pieces of shrapnel, if any, can be attributed to the Boxcar Tests. The interviews indicate that the boxcar was not destroyed in the tests and was used repeatedly. Based on these accounts, most of the shrapnel present is not considered an artifact of the Boxcar tests.

The shrapnel that might have been produced from the Boxcar Tests would have been non-hazardous metal fragments from the weapons storage containers (aluminum or steel). The concrete triangular barriers that were placed between the weapons and the explosives would have directed the blast, fragments and any COCs (if present) out the open top of the boxcar, not through the bottom. Therefore subsurface debris would not be generated by the tests and is not being evaluated. The nature of potential COCs in this sparse surface debris has not been documented.

In 1987 the DOE/AL Environmental Restoration Program collected twenty-two soils samples from the Boxcar site and analyzed them for metals, pesticides, PCBs, TNT, and semi-volatiles. No detectable levels of pesticides, PCBs and TNT were found. Uranium concentrations ranged from .091ug/g to 1.5 ug/g at the site. Background studies of the Kirtland Air Force Base area have a range of uranium levels from .005 to 4.66 ug/g, with a mean of .992 ug/g (IT Corporation, 1994). The soils were also measured for TCLP metals and EP toxicity. Barium was the only constituent detected in each of these analyses. Total HSL inorganics analysis found that barium levels ranged from 66.8 to 110 mg/kg. Background for barium on Kirtland Air Force Base ranges from .13 to 730 mg/kg (IT Corporation, 1994). Thus both uranium and barium levels at the site fall well within the ranges found for site background. An excerpt from the report on this sampling is included as Appendix 1.

In 1994, the RUST Geotech Inc. surface gamma radiation survey at ER Site 66 found background gamma exposure rates to range from 12 to 17 uR/hr. No areas of radiation levels above background were found (RUST Geotech Inc., 1994).

Potential Contaminant Migration Pathways

Potential pathways of contaminant migration include air, surface soil, surface water, infiltrating surface water (into the subsurface), and ground water.

The air pathway is primarily a concern if radioactive dust is present. The surface radiation survey did not find any evidence of elevated radiation levels, therefore, the air pathway is considered secondary.

The surface soil pathway is a concern from a direct ingestion, residential risk scenario, primarily since most of the potential contaminants of concern would have been deposited on the surface. Surface soil screening and sampling have not found any significant levels of COCs.

The surface water pathway was initially of concern due to the potential for contaminants at the surface and the presence of an arroyo south of the site. Since the surface soil sampling and screening surveys did not find significant COC levels, this

pathway does not appear to be significant

Infiltrating surface water could provide a way for potential contaminants located at the surface to reach the subsurface. Due to the lack of significant COCs found on the surface, and the local climate (very dry, low rainfall, and high evaporation rates), this pathway is secondary.

The ground water pathway is probably not significant due to the lack of significant COCs at the surface. The depth to ground water in the local area has not been determined. The nearest comparable well to site # 66 is the High Energy Research and Test Facility (HERTF), which encountered water at 405 ft. below ground level according to the State Engineer Office's well record. The wells in this area would be drilled in granite and the groundwater would be fracture controlled and thus the hydrologic properties are highly variable. The probable depth to groundwater and the lack of significant penetrating infiltration during rainfall events (high evaporation rates) result in this pathway being considered secondary.

Potential Public Health and Environmental Impacts

Public health and environmental impacts associated with ER Site 66 include the dermal exposure and ingestion of surface water from the surface-water pathway. However, because of the ephemeral nature of the arroyo channel and limited annual precipitation, exposure via the surface-water pathway is considered secondary. The receptor exposure via the air pathway includes inhalation and ingestion of particulates suspended by the wind and direct dermal exposures. Direct dermal exposure, inhalation, ingestion exposure via the air and soil pathways are considered the primary exposure routes, if COCs are present.

Data Needs/DQOs

The primary data need for ER Site 66 is characterization of the firing site as a potential source of hazardous waste or hazardous constituents. This characterization will include defining both the nature and the extent of waste, if present at the site (Table 2). If a hazardous source is identified, additional data may be required to characterize the underlying soil media or surface-water and groundwater pathways. Geotechnical characterization data will be obtained at other nearby sites in the ADS. Sensitive species surveys have been performed at the site to comply with NEPA requirements and to support potential ecological risk assessments. All other receptors and receptor scenarios have been identified in Sections 4.2.3.3.7 and 4.2.3.3.8, respectively of the PIP (SNL/NM February 1994). Level III data analyses will be performed on all samples used to support a baseline risk assessment if initial sampling shows COC concentrations above action levels and background concentrations.

TABLE 2 - DATA QUALITY OBJECTIVES

DATA TYPE	DATA NEEDS	ACTION
Source Characterization	Characterize the nature and extent of COCs in the surface soils.	Collect soil samples from the firing site and analyze for HE and TAL metals.
	Characterize the nature and extent of COCs at selected locations (contingency data).	Collect subsurface samples under each area where COCs were found above action levels and inadequate characterization exists. Analyze for HE and TAL metals.
Environmental Characterization	Geotechnical Parameters	None - obtained at other locations in the OU

Sampling Plan

Appendix 2 of this work plan describes the specific technical approaches for performing UXO/HE, radiological, and land surveys. QC samples (including duplicates, matrix spikes, field blanks, trip blanks, and equipment rinsates) will be collected as specified in the generic QAPjP of the PIP (SNL/NM February 1994). All samples collected for laboratory analyses will be screened for gross alpha, gross beta, and gamma activity by the Sample Management Operations (SMO) to meet DOT sample shipping requirements. Sample collection for all the sites in this OU (including site 66) will be performed according to the methodology presented in Appendix 2 of this sampling and analysis plan.

Sampling Plan Objectives and Technical Approach

The sampling plan at ER Site 66 is designed to collect adequate samples to meet the data needs outlined in Table 2. Specifically, sampling will be conducted to determine if regulated hazardous waste is present at the site and to determine if a release to the environment has occurred. Following supplemental UXO/HE and land surveys, intrusive sampling will be conducted to characterize the COCs in the test area. Random samples will be collected from the test area. Field screening

will be conducted to monitor the site for health and safety concerns. Contingent upon the concentrations of COCs found in surface soil samples obtained from the initial sampling, additional surface and/or subsurface sampling may be conducted to define the extent of COCs at the site. Air sampling may also be conducted at the site to support a baseline risk assessment if COCs are detected above action levels and background concentrations. The sections below provide details on the ER Site 66 sampling plan.

Non-intrusive Surveys

Prior to initiation of sampling activities at the site, a supplemental UXO/HE survey will be performed to clear the site for sampling activities. Subsequent to this survey, a land survey or global positioning system will identify the locations of the surface samples.

Intrusive Sampling

Surface soil and debris samples will be collected to characterize site according to the procedures and methodology presented in Appendix 2.

Surface Soil Samples

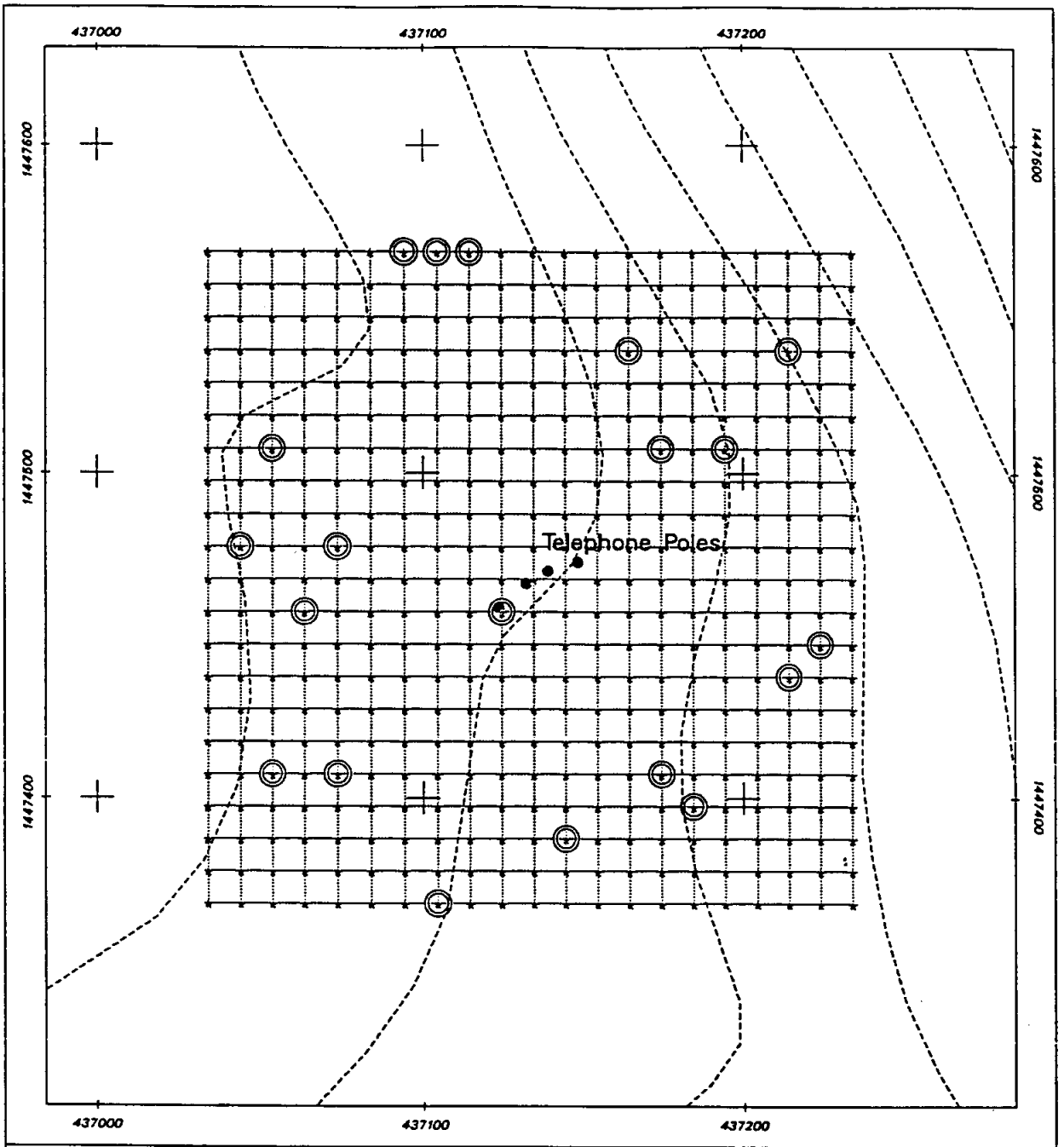
Surface soil samples will be collected at the firing site. A grid 200 feet by 200 feet, with ten foot centers will be set up as shown in Figure 3. This grid is centered on the Boxcar testing area. Twenty sampling locations were randomly selected from the grid using a random number generator. Samples will be analyzed for HE, and metals. If screening detects radiation levels 1.3 times site specific background or higher, the samples will also be analyzed for uranium.

Contingency Sampling

Contingency samples will be collected to determine the extent of COCs at the site, if any surface soil samples from the test area contain COC concentrations at or above action levels and background concentrations. Additional subsurface soil samples will be collected at the depths of 5-, 10- and 15- feet below the surface of the test area if COCs are detected in the surface soil samples. Additionally, air sampling will be conducted at the site to support a baseline risk assessment, if COC concentrations in surface soil samples are at or above action levels and background concentrations.

Analytical Requirements

ER Site 66 samples will be analyzed according to the methods listed in Table 3. The analytical requirements include:



Legend

- 5 Foot Contours
- 200 x 200 Grid
- Roads
- Fences
- Telephone Poles
- Grid Points
- Randomly Selected Sampling Points

Sandia National Laboratories, New Mexico
Environmental Restoration Geographic Information System

Figure 3
Potential Soil Sampling Locations at ER Site 66

0 25 50
Scale in Feet

0 6 12
Scale in Meters

Unclassified

DRAFT

1:600
1 in=50'

Transverse Mercator Projection, New Mexico State Plane Coordinate System, Central Zone
1927 North American Horizontal Datum, 1929 North American Vertical Datum

DWStrech SNL GIS ORG. 7512 04/13/95 MAPID=950775

- Surface soil samples—HE compounds, TAL metals, and radionuclides (only if screening detects radiation levels 1.3 times site specific background levels or higher)

Level III analyses will be requested on all samples to collect data of sufficient quality to define the levels of potential COCs in the soil and sediment accurately and to support risk assessment calculations. The generic QAPjP in the PIP (SNL/NM February 1994) provides laboratory QA/QC requirements.

Investigation Derived Waste

Section 4.3.4.2 of the PIP (SNL/NM February 1994) and Appendix F of the OU 1332 Work Plan (Attachment 2) discuss general procedures for the management of the ER Project investigation derived waste.

References:

U.S Department of Defense, U.S. Army Armament, Munitions and Chemical Command, Jan. 1992, " Development of Methodology and Technology for Identifying and Quantifying Emission Products from Open Burning and Open Detonation Thermal Treatment Methods."

U.S. Department of Energy, Albuquerque Operations Office, Jan. 1989, "Reconnaissance Data Report, Sandia National Laboratories Albuquerque"

IT Corporation, 1994. "Background Concentrations of Constituents of Concern to the Sandia National Laboratories New Mexico Environmental Restoration Project, Phase II: Interim Report," IT Corporation, Albuquerque, New Mexico (October 1994).

Sandia National Laboratory SNL/NM, Sept. 1994, "Unexploded Ordnance/High Explosives (UXO/HE) Visual Survey of ER Sites Final Report"

RUST Geotech Inc., Dec 1994. " Final Report, Surface Gamma Radiation Surveys for Sandia National Laboratories/New Mexico Environmental Restoration Project" prepared for the U.S. Department of Energy.

44. Martha Haines Memorandum to N.A. Durand, Sandia National Laboratory, Albuquerque, New Mexico, October 29, 1990.

66. Sandia National Laboratory/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/66/INT/85-035

Nonintrusive Sampling

Survey Type	UXO/HE Survey	Radiological Survey	GPS Survey									
Number of Units	20 points		20 points									

Intrusive Sampling

Name of sample/location	Sample Media	Sample Type	No. of Samples	Sample Depth	Gross alpha/beta/gamma *	HE HPLC (in-house)	Metals ICP (in-house)	HE Compounds (SW 8300)	Metals (SW 6010/7000)	Isotopic Uranium -Alpha Spectroscopy **	Cesium **	Thorium **
Firing Site (surface soil)	Soil	Grab	20	0-6"	x	20	20	4	4	4	4	4
QA	Soil	Grab	2 dup, 2 rinsate, 2 blanks	NA	x	6	6	3	3	3	3	3

* Field Screening, Level I/II analyses

** Only analyzed if screening reveals radioactivitity 1/3 above bachground

273. Sandia National Laboratory /New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/66/85-69

307. Sandia National Laboratory/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/58/INT/83-036

527. Sandia National Laboratory/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/27/INT/94-005

547. Sandia National Laboratory/New Mexico, January 1995. Environmental Operations Record Center Record Number ER/7585/1332/58/INT/94-58

Appendix 2
Investigative Methods

F.1 Nonintrusive Surveys

Five types of nonintrusive surveys will be conducted at OU 1332 ER sites. Unexploded ordnance/high explosive (UXO/HE) surveys will be completed prior to any other surveys or sampling activities, followed by radiological, land, cultural resources, sensitive-species surveys, and geophysical surveys. UXO/HE surveys must be performed within one year preceding any scheduled sampling activities.

F.1.1 UXO/HE Survey

Because the UXO/HE surveys conducted by Kirtland Air Force Base (KAFB) from 1993 to 1994 only covered surface UXO/HE visible at the time of the survey, the time between the surveys completed to date and initiation of survey or sampling activities (scheduled for fiscal years 1995 through 1998) allows rain and wind erosion to expose subsurface UXO/HE. Therefore, preliminary UXO/HE surveys conducted to date will not meet health and safety protocol for sampling activities scheduled one or two years from now. As stated in Sandia National Laboratories/New Mexico (SNL/NM) Environmental Safety and Health Division (ES&H) Standard Operating Procedure SP473056, inactive sites will be resurveyed on a yearly basis as required in conjunction with sampling activities or until a corrective measure is implemented. Sites where active military exercises are carried out will be resurveyed in the 90-day period preceding any sampling activities.

F.1.2 Radiological Survey

Additional gamma radiation surveys may be conducted following the UXO/HE survey and during sampling activities to determine whether an imminent radiological health threat is present. The surveys will be conducted in a manner similar to the methods and protocol used by RUST Geotech Inc. (Appendix D) to update or augment radiological surveys performed to date. Posting of a site as a radiation area may change the scope and schedule of a site work plan, and any such changes must follow the guidance and documentation in Field Operating Procedure (FOP) 94-68.

F.1.3 Land Survey

Physical surveys will establish reference points for sample location grids, radiation survey points and anomalies, any significant manmade features or structures, and final sampling locations. All land surveys will conform to FOP 94-71 or will use the Global Positioning System (GPS). The following SNL/NM ER survey specifications will apply if the GPS is not used:

- Horizontal accuracy to be a minimum of 3rd Order, Class 2 (Horizontal Closure 1 in 5,000)
- Vertical accuracy to be 4th Order (vertical-angle elevation with reciprocal vertical angles measured between the traverse stations)
- All coordinates will be recorded in New Mexico State Plane Feet coordinates, vertical datum, North American Datum of 1927 (NAD27)
- Surveyor will provide a map showing all surveyed points with field identification and coordinates, including monuments used in the survey

The GPS will be used for locating points where an accuracy of 2 to 3 ft would be adequate for investigation requirements.

F.1.4 Cultural and Sensitive Species Surveys

Additional cultural resources survey (historical and archaeological) and a sensitive species survey may be conducted on all SNL/NM ER sites situated on KAFB and U.S. Forest Service (USFS) Cibola National Forest Withdrawn Lands that have not had previous surveys. A description of the cultural resources survey is discussed in Section 3.7, and the survey methodology is discussed in Appendix A of this work plan. A description of the sensitive species survey is discussed in Section 3.8, and the survey methodology is described in Appendix B of this work plan.

F.1.5 Geophysics

Magnetometer and electromagnetic surveys may be conducted to locate buried utilities and potential UXO, prior to sampling. The equipment will be calibrated and operated in accordance with the manufacturer's instructions.

F.2 Intrusive Sampling

This section discusses technical approach, methods, and protocols for field screening and for obtaining surface soil and channel sediment samples, subsurface soil samples, debris samples, wipe samples, and site background samples. The sampling plans presented in Chapter 5.0 of this work plan discuss these sampling methods as they apply to specific sites.

F.2.1 Field-Screening

Field-screening for radioactivity will be performed on all debris and soil material removed and exposed. The purpose of field screening is to protect workers from potential imminent health

threats and to locate any potential areas of high radioactivity for judgmental sampling (see Section 4.2.2.2).

Radiological surveys will be conducted using Geiger-Muller survey meters and sodium iodide scintillometers. If elevated radiation measurements are detected, the radioactive exposure-rate will be measured with a Reuter-Stokes Model RSS-111 Pressurized Ionization Chamber (or a similar portable device). If measured radioactive exposure levels are above 18 milliroentgens per hour (μR/hr), the Field Team Leader will stop all sampling operations and notify SNL/NM ES&H. The findings reported from the SNL/NM ES&H investigation will determine contingency actions. Judgmental samples will be collected from locations where radioactivity is greater than 1.3 times the background level.

F.2.2 Surface Soil and Channel Sediment Samples

Surface soil and channel sediment samples will be collected using a spade and scoop method (FOP 94-52), or hand auger (FOP 94-23), or a stainless steel surface soil ring sampler (FOP 94-24). Samples of soil and/or channel sediment from less than 6 in. deep will be collected using the spade and scoop method (FOP 94-52) or hand auger (FOP 94-23). Samples obtained from the upper 12 in. of soil or channel sediment will be obtained using the surface soil ring sampler (FOP 94-24) or hand auger (FOP 94-23). Both judgmental and random soil and channel sediment samples will be collected to satisfy the sampling requirements discussed in Chapter 5.0. Each sample type will be discussed independently to highlight specific methods or protocol not covered in the SNL/NM ER operating procedures (OP).

Judgmental Samples

Judgmental samples will be collected from locations (determined from observations and anecdotal information) that are most likely to contain the highest concentrations of contaminants of concern (COC). Positive field screening measurements, such as radiological compounds or volatile organic compounds (VOC), may be used to guide sample location selection. Positive field-screening is interpreted here as radioactivity present above 18 μR/hr (approximately 1.3 times the background level) or VOCs 5 parts per million (ppm) greater than the background level. Other judgmental sampling collections proposed for OU 1332 may include channel sediments from areas (such as channel bars) where COCs may have accumulated, samples from stained soils, samples from directly beneath debris mounds, and samples from the center of waste pits.

Random Samples

A random-number generator will determine the grid cell from which random samples will be collected. The sampling grid cells will be numbered as indicated in Figure F-2-1(a). Sample locations will correspond to the southwest corner of the cell selected by the random-number generator. If a structure is present within the grid, sample cells will be numbered as indicated

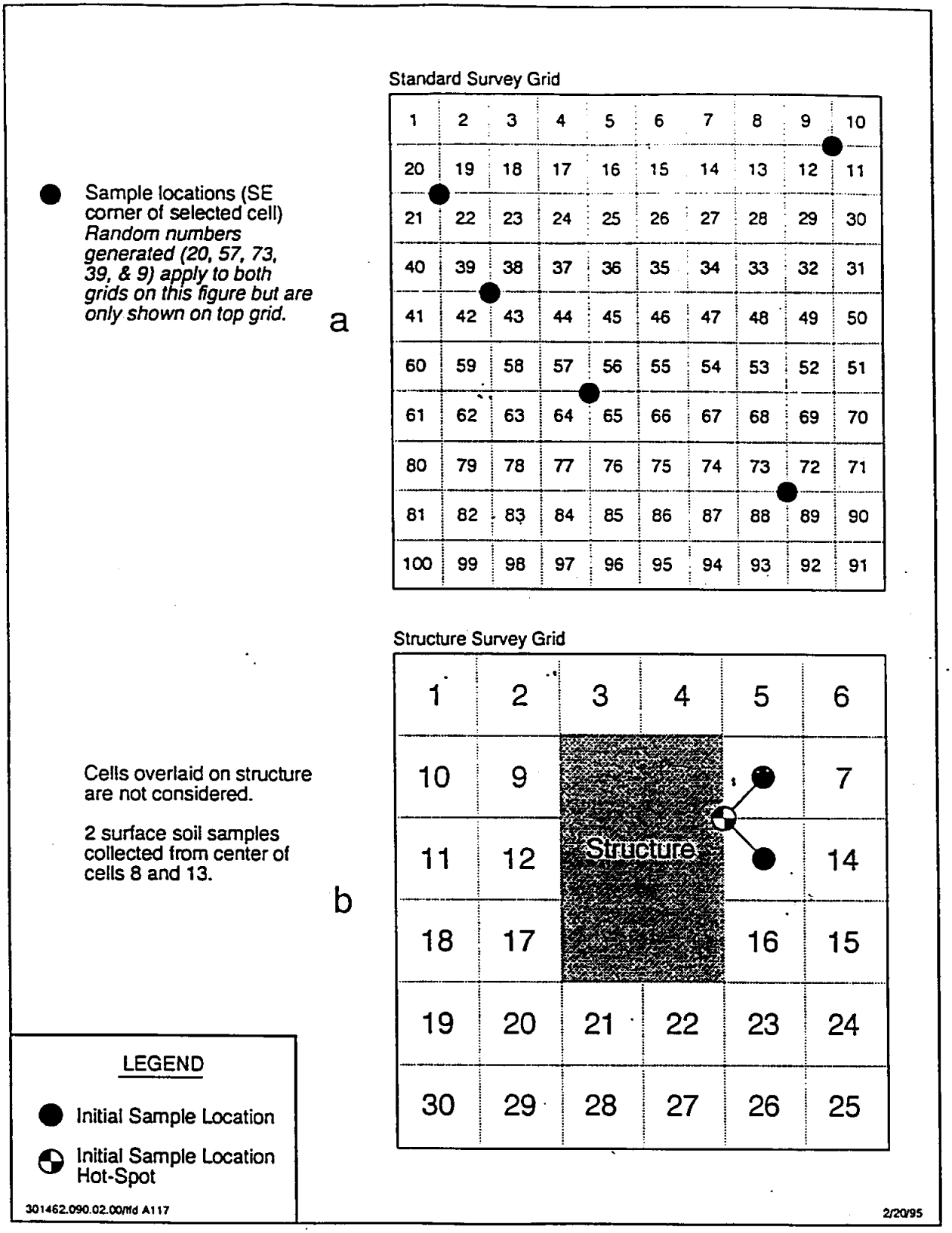


Figure F-2-1
Sampling Grids and Selection of Random Sample Locations

in Figure F-2-1(b). Cells will again be selected by random numbers and the southwest corner will be used as the sample location.

The grid for tests involving detonations is a set of eight radial lines, each separated by 45 degrees. This grid is established to focus the sampling around the blast point where contaminants are expected to be highest. The density of sampling locations is higher around the blast point under this grid system. Two samples from each radial will be randomly selected using a random-number generator. The center point will also be sampled.

F.2.3 Subsurface Soil Samples

Sample Intervals of Between 6 in. and 10 ft from the Ground Surface

A hand auger will be used to reach a depth of 6 in. above the sample horizon, and samples will be collected at depths of 5 ft and 10 ft with a thin-wall tube sampler (FOP 94-23, FOP 94-27), 6 in. above and below the target horizon. If the soil is loose and a thin-wall tube sampler cannot retrieve an intact sample, a split-spoon sampler or a hand auger (as appropriate) will be used to retrieve the sample (ASTM D1586-84).

Sample Intervals of Greater Than 10 ft from the Ground Surface

Boreholes for obtaining subsurface soil samples will be sampled at depths of 0 to 1.5, 5 to 6.5, 10 to 11.5, and 19 to 20.5 ft. Sampling plans in Chapter 5.0 suggest initial analysis of samples from a depth of 5 ft. If hazardous or radiological constituents are found in the sample from the 5-ft depth, the samples from the 10- and 20-ft depths also will be analyzed.

Trench Sampling

Trenches excavated to obtain subsurface soil samples associated with debris will be sampled at the horizons specified in the site sampling plans in Chapter 5.0. Trenches will be excavated using the methods discussed in FOP 94-39, and sampling from the trenches will proceed according to FOP 94-40.

F.2.4 Debris Samples

Samples from the debris mounds will determine whether the debris contains hazardous constituents. These samples will be obtained from trenches and mounds at locations identified in the site sampling plans in Chapter 5.0. Trenches will be excavated as discussed in Section F.2.3.

F.2.5 Wipe Samples

Wipe samples will be collected from various surfaces to determine whether contaminants are present on these surfaces. Samples will be collected at locations described in Chapter 5.0, using the SNL/NM procedures for collecting wipe samples (SNL/NM 1995).

F.2.6 Metal Fragments

Small metal fragments will be selected for analysis. Toxicity characteristic leaching procedures (TCLP) will be conducted on all fragments. X-ray fluorescence (XRF) analysis may also be run on the samples if required for characterization.

F.2.7 Site Background Samples

As discussed in Section 4.2.4.1 of the Program Implementation Plan (PIP) (SNL/NM February 1994), surface soil samples will be collected to establish site background concentrations for metals and activities of radionuclides for OU 1332 ER sites. Background concentrations and activities will be established at each OU 1332 ER site to support possible no-further-action proposals or to use in developing cleanup standards for sites that have been advanced to a corrective measures study. The statistical methods used to establish background levels will be consistent with the U.S. Environmental Protection Agency (EPA) methods used in "Background Concentrations of Naturally Occurring Constituents of Concern at Sandia National Laboratory" (IT May 1994b). Samples will be collected from soils similar to those underlying the solid waste management units (SWMU) being sampled (refer to Table 3-1 in the work plan for SWMU soil types). Seven radiological and five metals samples will be collected at four representative locations in the OU based on soil and rock types.

F.2.8 Sample Homogenizing

Soil and Channel Sediments

No composite samples are planned for OU 1332.

Debris

Debris samples will be composited by passing the debris through a screen with 1-in. by 1-in. openings to segregate the debris fragments by size. Fragments smaller than 1 in. will be placed in a stainless steel mixing bowl and homogenized using a stainless steel spatula as described above. Each sample larger than 1 in. must be uniquely labeled and correlated with the paired size fraction that is smaller than 1 in. The coarse fraction will be retained for future investigation in the event the fine fraction is found to contain hazardous constituents.

F.3 Contingency Sampling

If soil samples are shown to contain COC concentrations above action levels or background concentrations (whichever is higher), contingency samples will be collected (refer to Chapter 4, Figure 4-1, repeating Steps 4 through 19). The contingency sampling will be implemented to determine the vertical and lateral extent of COCs from sources currently presented in the conceptual model. If the conceptual model is changed significantly after initial sampling, the type, number, and location of contingency samples proposed in Chapter 5.0 may require modification. Contingency sampling will be conducted according to the procedures in Section 5.1.3. Sampling grids will be set up in sample cells named according to Figures F-2-1a and F-2-1b.

F.4 Sample Containers

Samples will be placed in appropriate containers, as described in Section 6.2 of the generic quality assurance project plan of the PIP (SNL/NM February 1994).

F.5 Sample Management

All work associated with field collection, preservation management, and custody of samples, as well as chain-of-custody requirements will follow FOP 94-34. Quality control samples will be collected in accordance with the generic Quality Assurance Project Plan of the PIP (SNL/NM February 1994, Appendix F).

F.6 Field Documentation

All field sampling activities will be documented using procedures and forms in AOP 94-22 or as described in procedures-specific OPs.

F.7 Equipment Decontamination

All sampling equipment will be decontaminated according to FOP 94-26. Equipment will be decontaminated before every sampling event (i.e., before each sample is collected and upon completing the sampling). Generated wastes will be handled as described in Section 4.3.4 of the PIP (SNL/NM February 1994).

F.8 Investigation Derived Waste

Section 4.3.4.2 of the PIP (SNL/NM February 1994) discusses general procedures for managing the investigation-derived waste (IDW). The following is a possible list of IDW that may be generated during OU 1332 ER site sampling investigations:

- Used expendable personal protective clothing (Tyvek, booties, gloves, etc.)
- Used disposable sampling equipment
- Decontamination rinsates generated from sampling equipment
- Debris and soil resulting from trenching and sampling activities

IDW will be characterized based on the results of associated environmental media samples and/or IDW waste sampling. All IDW will be managed in conformance to the SNL/NM ER Project Waste Management and Characterization Procedure FOP 94-78.

References

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October 13, 2003

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