

SNC 47



U.S. Department of Energy
Albuquerque Operations Office
Kirtland Area Office
P.O. Box 5400
Albuquerque, NM 87185-5400

DEC 09 1997

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

45WA SNL 1335

Mr. Robert S. (Stu) Dinwiddie, Manager
New Mexico Environment Department
Hazardous and Radioactive Materials Bureau
RCRA Permits Management Program
2044 Galisteo Street
P.O. Box 26110
Santa Fe, NM 87505-2100

Dear Mr. Dinwiddie:

Enclosed are two copies of the Department Of Energy/Sandia National Laboratories response to the NMED Request for Supplemental Information (RSI) for the OU 1335, Southwest Test Area, RCRA Facility Investigation Work Plan.

If you have any questions, please contact John Gould at (505) 845-6089, or Mark Jackson at (505) 845-6288.

Sincerely,

George K. Jaskar
for Michael J. Zamorski
Acting Area Manager

Enclosures

✓

SNL1091



gtu

S. Dinwiddie

(2)

cc w/enclosure:

S. Arp, AL, ERD

J. Parker, NMED-OB

R. Kennett, NMED-OB

D. Neleigh, EPA, Region 6 (2 copies via certified mail)

cc w/o enclosure:

B. Oms, KAO-AIP

W. Cox, SNL, MS 1147

F. Nimick, SNL, MS 1147

R. Conway, SNL, MS 1147

B. Garcia, NMED

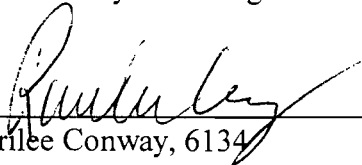
S. Kruse, NMED

W. Moats, NMED

Signed Statements of Personnel Producing and Reviewing Revised Document

I, Rarilee Conway, directed the preparation of the revised RFI Work Plan for OU 1335, Southwest Test Area. I understand that Sandia's policy is to provide accurate and complete responses to all government regulators. To the best of my knowledge and belief, the portion of material prepared by me meets this intent.

I recommend your approval


Rarilee Conway, 6134 12/2/97
Date

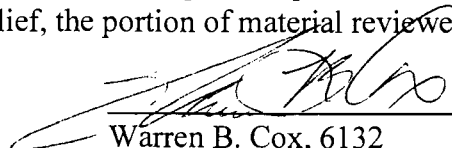
I, Richard E. Fate, reviewed the RFI Work Plan for OU 1335, Southwest Test Area. I understand that Sandia's policy is to provide accurate and complete responses to all government regulators. To the best of my knowledge and belief, the portion of material reviewed by me meets this intent.

I recommend your approval


Richard E. Fate, 6134 12/2/97
Date

I, Warren B. Cox, reviewed the RFI Work Plan for OU 1335, Southwest Test Area. I understand that Sandia's policy is to provide accurate and complete responses to all government regulators. To the best of my knowledge and belief, the portion of material reviewed by me meets this intent.

I recommend your approval


Warren B. Cox, 6132 12-2-97
Date

**RCRA Facility Investigation Work Plan
 For Operable Unit 1335
 Southwest Test Area
 List of Revised Pages
 (Delete/Insert Instructions)**

<u>Chapter</u>	<u>Delete</u>	<u>Insert</u>
Table of Contents	Page vi through xvii	Page vi through xvii
3.0	Page 3-25 Page 3-33 Figure 3.6-2 Figure 3.6-3 Figure 3.6-4	Page 3-25 Page 3-33 Figure 3.6-2 Figure 3.6-3 Figure 3.6-4
4.0	Page 4-4 Page 4-6 Page 4-15	Pages 4-4a and 4-4b Page 4-6 Page 4-15
5.0	Page 5-18 Figure 5.3-3 Page 5-20 Page 5-28 Page 5-35 Figure 5.5-5 Page 5-54 Page 5-55 Page 5-56 Page 5-58 Page 5-62 Page 5-68 Page 5-71	Page 5-18 Figure 5.3-3 Pages 5-20a to 5-20i Page 5-28 Page 5-35a to 5-35e Figure 5.5-5 Page 5-54 Pages 5-55a to 5-55d Pages 5-56a to 5-56d Page 5-58 Page 5-62 Page 5-68 Page 5-71
6.0	All pages	Pages 6-1 through 6-11

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	i
LIST OF TABLES.....	ix
LIST OF FIGURES.....	xi
LIST OF APPENDICES.....	xiv
LIST OF ANNEXES	xv
LIST OF ACRONYMS AND ABBREVIATIONS	xvi
1.0 INTRODUCTION.....	1-1
1.1 Overview of the Environmental Restoration Project	1-1
1.2 HSWA Module Requirements.....	1-2
1.3 Organization of This Work Plan.....	1-2
2.0 BACKGROUND INFORMATION FOR OU 1335	2-1
2.1 Description of OU 1335 and SWMUs	2-1
2.2 Historical Operations.....	2-1
2.3 Current Land Use at OU 1335.....	2-1
3.0 ENVIRONMENTAL SETTING FOR OU 1335	3-1
3.1 Location and Geographic Setting	3-1
3.2 Topography.....	3-1
3.3 Climate.....	3-1
3.3.1 Temperature and Humidity	3-4
3.3.2 Precipitation.....	3-4
3.3.3 Wind	3-4
3.4 Soil	3-5
3.5 Geologic Setting.....	3-5
3.5.1 Stratigraphy	3-5
3.5.2 Structural Geology.....	3-16
3.5.3 Geomorphology	3-18
3.5.4 Soils.....	3-20
3.6 Hydrology.....	3-20
3.6.1 Surface-Water Hydrology	3-21
3.6.2 Vadose-Zone Hydrology	3-25
3.6.3 Saturated-Zone Hydrology.....	3-35
3.7 Cultural Resources Survey.....	3-40
3.8 Sensitive Species Survey.....	3-40
3.9 Demographics.....	3-41
4.0 TECHNICAL APPROACH TO THE OU 1335 RFI	4-1
4.1 OU 1335 RFI Work Plan Approach	4-1
4.1.1 Review of Archival Data.....	4-1
4.1.2 Site Visits and Preliminary Surveys	4-3
4.1.3 Screening of OU 1335 SWMUs	4-4 4-4a
4.1.4 Open Burning/Open Detonation of Explosives	4-9
4.2 Investigative Methods	4-13

TABLE OF CONTENTS (Continued)

	Page
4.3 Analytical Methods and Requirements	4-15
4.3.1 Analyte Lists	4-15
4.3.2 Analytical Methods.....	4-15
4.3.3 QA/QC Requirements.....	4-17
4.4 Data Reduction and Analysis	4-17
4.5 Approach to Risk Assessment	4-18
4.6 Risk-Based Actions	4-18
5.0 EVALUATION OF SOLID WASTE MANAGEMENT UNITS	5-1
5.1 Introduction	5-1
5.1.1 Nonintrusive Surveys.....	5-1
5.1.2 Voluntary Corrective Measures.....	5-1
5.1.3 RFI Contingency Sampling	5-1
5.1.4 Investigation-Derived Waste	5-3
5.1.5 General Analytical Requirements.....	5-3
5.1.6 RFI Site Investigation Format	5-3
5.2 ER Site 14—Burial Site (Building 9920)	5-4
5.2.1 Description and History.....	5-4
5.2.2 Previous Investigations.....	5-4
5.2.3 Conceptual Model.....	5-7
5.2.4 Data Needs/DQOs.....	5-10
5.2.5 Sampling Plan	5-10
5.2.6 Analytical Requirements	5-11
5.3 ER Site 85—Firing Site (Building 9920).....	5-13
5.3.1 Description and History.....	5-13
5.3.2 Previous Investigations.....	5-17
5.3.3 Conceptual Model.....	5-18
5.3.4 Data Needs/DQOs.....	5-21
5.3.5 Sampling and Analysis Plan	5-23
5.3.6 Analytical Requirements	5-27
5.4 ER Site 91—Lead Firing Site (Thunder Range).....	5-29
5.4.1 Description and History.....	5-29
5.4.2 Previous Investigations.....	5-32
5.4.3 Conceptual Model.....	5-37
5.4.4 Data Needs/DQOs.....	5-38
5.4.5 Sampling Plan	5-39
5.4.6 Analytical Requirements	5-42
5.5 ER Site 103—Scrap Yard (Building 9939).....	5-44
5.5.1 Description and History.....	5-44
5.5.2 Previous Investigations.....	5-53
5.5.3 Conceptual Model.....	5-57
5.5.4 Data Needs/DQOs.....	5-58

TABLE OF CONTENTS (Concluded)

	Page
5.5.5 Sampling Plan	5-59
5.5.6 Analytical Requirements	5-61
5.6 ER Site 117—Trenches (Building 9939)	5-63
5.6.1 Description and History	5-63
5.6.2 Previous Investigations	5-66
5.6.3 Conceptual Model	5-66
5.6.4 Data Needs/DQOs	5-68
5.6.5 Voluntary Corrective Measures	5-68
5.6.6 Sampling Plan	5-69
5.6.7 Analytical Requirements	5-70
6.0 REFERENCES	6-1
6.1 Site-Specific References	6-1
6.2 Document References	6-4 6-5
6.3 Operating Procedures	6-10 6-11

LIST OF TABLES

Table

1.2-1	HSWA Module RFI Work Plan Requirements Related to the OU 1335 RFI Work Plan.....	1-3
1.2-2	OU 1335 SWMUs Cross-Referenced with the HSWA Module.....	1-4
2.1-1	ER Sites in OU 1335	2-4
3.2-1	Summary of Environmental Setting of the OU 1335 Sites	3-2
3.6-1	Meteorological Towers Located Within or Near OU 1335	3-22
3.6-2	Precipitation Data Collected at Meteorological Towers Operated by SNL/NM Department 7575.....	3-23
3.6-3	Results of SWHCP Soil Samples Collected for Radiological Analysis in September 1994	3-27
3.6-4	Results of 1994 Water Quality Analysis for Samples Collected Within or Near OU 1335	3-28
3.6-5	Results of 1994 Water Quality Analyses for Radioactive Species in Samples Collected Within or Near OU 1335.....	3-32
3.6-6	Background Soil Concentrations of Metals and Radioisotopes for OU 1335.....	3-33
3.6-7	Selected Monitoring Wells Relevant to the Assessment of the Saturated Zone Hydrology Underlying OU 1335.....	3-37
4.1-1	Actions Proposed for OU 1335 Sites	4-5
4.1-2	Summary of VCMs Proposed for OU 1335 Sites	4-7
4.1-3	Carbon Emissions Produced by Combustion of TNT	4-10
4.1-4	Carbon Emissions Produced by Combustion of Double- Based/Composite Rocket Propellant	4-11
4.3-1	Sample Form for Summary of Nonintrusive and Intrusive Sampling at ER Sites	4-16
5.1-1	Surface Radioactive Contamination at OU 1335	5-2

LIST OF TABLES (Concluded)

Table		
5.2-1	Data Quality Objectives for ER Site 14.....	5-10
5.2-2	Summary of Nonintrusive and Intrusive Soil Sampling at ER Site 14	5-12
5.3-1	Summary of Sampling Results at ER Site 85.....	5-20
5.3-1a	Summary of Soil Metals Analyses at ER Site 85, Screening Sampling, July 1995	5-20a
5.3-1b	Summary of Soil HE Analyses at ER Site 85, Screening Sampling, July 1995	5-20e
5.3-1c	Summary of Soil Gamma Spectroscopy Analyses at ER Site 85, Screening Sampling, July 1995	5-20h
5.3-2	Data Quality Objectives—ER Site 85.....	5-23
5.3-3	Summary of Nonintrusive and Intrusive Sampling at ER Site 85	5-28
5.4-1	Summary of Radiological Analysis at ER Site 91, July 1995.....	5-35
5.4-1a	Summary of Soil Metals Analysis at ER Site 91, Screening Sampling, July 1995	5-35b
5.4-1b	Summary of Soil Gamma Spectroscopy Analyses at ER Site 91, Screening Sampling, July 1995	5-35e
5.4-2	Data Quality Objectives for ER Site 91	5-39
5.4-3	Summary of Nonintrusive and Intrusive Soil Sampling at ER Site 91	5-43
5.5.1	History of Experiments Conducted at the Large-Scale Melt Facility.....	5-47
5.5-2	Summary of Radioisotope Analyses at ER Site 103, Soil Scoping Sampling, July 1995	5-55
5.5-2	Site 103 Soil Radiological VCM Results, March 1995—June 1996	5-55a
5.5-3	Summary of Metals Analyses at ER Site 103, Soil Scoping Sampling, July 1995	5-56
5.5-3	Summary of Gamma Spectroscopy Analyses at ER Site 103, Screening Sampling, July 1995	5-55c

5.5-4a	Summary of Soil Metals Analyses at ER Site 103, Screening Sampling, July 1995	5-56a
5.5-4b	Summary of Soil PCB Analyses at ER Site 103, Screening Sampling, July 1995	5-56d
5.5-4	Data Quality Objectives for ER Site 103	5-58
5.5-5	Data Quality Objectives for ER Site 103	5-58
5.5-5	Summary of Nonintrusive and Intrusive Sampling at ER Site 103	5-62
5.5-6	Summary of Nonintrusive and Intrusive Sampling at ER Site 103	5-62
5.6-1	Data Quality Objectives for ER Site 117	5-68
5.6-2	Summary of Nonintrusive and Intrusive Sampling at ER Site 117	5-71

LIST OF FIGURES

Figure

2.1-1	Location of Kirtland Air Force Base and OU 1335	2-2
2.1-2	Location of OU 1335 (Southwest Test Areas) Within KAFB.....	2-3
2.1-3	Locations of Solid Waste Management Units in OU 1335	2-6
2.3-1	Areas Permitted to the DOE in OU 1335	2-7
3.2-1	Topographic Map of OU 1335 Showing Site Boundaries, Watershed Boundaries, and Surface Water Drainages	3-3
3.4-1	Soil Types in the OU 1335 Watershed.....	3-6
3.5-1	Regional Tectonic Setting of the Albuquerque Basin, North-Central New Mexico.....	3-7
3.5-2	Generalized Stratigraphic Column for SNL/NM (KAFB) Area	3-8
3.5-3	Index Map of Geologic Cross-Sections of OU 1335	3-11
3.5-4	Generalized Geologic West/East Structural Cross-Section Across OU 1335.....	3-12
3.5-5	Generalized Geologic South/North Structural Cross-Section Across OU 1335	3-13
3.5-6a	Surficial Geologic Units Identified Within SW SNL/NM (KAFB).....	3-14
3.5-6b	Stratigraphic Legend of Surficial Geologic Units Identified Within Southwestern SNL/NM and KAFB	3-15
3.5-7	Major Faults Located at KAFB and SNL/NM.....	3-17
3.5-8	Geomorphic Provinces and Subprovinces of SNL/NM and Vicinity.....	3-19
3.6-1	Map of Soil and Water Sampling Locations	3-26
3.6-2	Background Soil Sample Locations for the Southwest Test and Foothills Test Area.....	3-34
3.6-3	Vadose Zone Hydrogeological Settings.....	3-36

LIST OF FIGURES (Continued)

Figure		
3.6-4	Groundwater Monitoring Wells in the Vicinity of the Southwest Test Area.....	3-38
4.1-1	Logic Flow of OU 1335 RFI Technical Approach	4-2
4.1-2	Conceptual Model Flow Diagram Example	4-8
4.2-1	Decision Logic for Sampling Activities at OU 1335	4-14
5.2-1	ER Site 14	5-5
5.2-2	ER Sites 14 and 85.....	5-6
5.2-3	Locations of Burial Pits at ER Site 14	5-8
5.2-4	Conceptual Model Flow Diagram for Subsurface Sites (14, 117, 103).....	5-9
5.3-1	ER Site 85	5-14
5.3-2	ER Sites 14 and 85.....	5-15
5.3-3	Borehole Locations at Building 9920, ER Site 85 ER Site 85, ER Site 85, Building 9920	5-19
5.3-4	Generic Conceptual Model Flow Diagram for Surface Sites (85, 91).....	5-22
5.3-5a	Potential Soil Sampling Locations at ER Site 85.....	5-25
5.3-5b	Potential Soil Sampling Locations at ER Site 85.....	5-26
5.4-1	ER Site 91 Location.....	5-30
5.4-2	ER Site 91 Boundary	5-31
5.4-3	Flyer Plate Test Set Setup.....	5-33
5.4-4	Flyer Plate Test Shot.....	5-34
5.4-5	July 1995 Geoprobe Sample Locations and Corresponding Lead Isoconcentrations at ER Site 91	5-36
5.4-6	Proposed Soil Sampling Locations Within ER Site 91.....	5-41

LIST OF FIGURES (Concluded)

Figure

5.5-1	ER Site 103 Location.....	5-45
5.5-2	Features at Large Melt Facility	5-46
5.5-3	Large-Scale Melt Facility Test Chamber.....	5-48
5.5-4	Schematic of Large-Scale Melt Facility.....	5-49
5.5-5	ER Site 103 and Vicinity Areas of Known & Potential Contamination	5-52
5.5-6	Sampling Locations—ER Site 103 Scrap Yard (Bldg. 9939).....	5-60
5.6-1	ER Site 117 Location.....	5-64
5.6-2	ER Site 117 Pit Locations.....	5-65

LIST OF APPENDICES

Appendix

- A Cultural Resources Survey Methodology for OU 1335 Sites
- B Sensitive Species Survey Methodology for OU 1335 Sites
- C Unexploded Ordnance/High Explosives Visual Survey of ER Sites
- D Summary of Radiological Surveys at OU 1335 Conducted by RUST Geotech Inc., October 1993 Through May 1994
- E Investigative Methods for OU 1335
- F Development of Methodology and Technology for Identifying and Quantifying Emission Open Burning and Open Detonation Thermal Treatment Methods, Bang Box Test Series

LIST OF ANNEXES

Annex

- I OU 1335 Project Management Plan
- II OU 1335 Quality Assurance Project Plan
- III OU 1335 Health and Safety Project Plan
- IV OU 1335 Information Management Project Plan
- V OU 1335 Community Relations Project Plan

LIST OF ABBREVIATIONS AND ACRONYMS

anti-C	anticontamination
CEARP	Comprehensive Environmental Assessment and Response Program
CERCLA	Comprehensive Environmental Response Compensation, and Liability Act
CMS	corrective measures study
COC	contaminant of concern
CRPP	Community Relations Project Plan
CWL	Chemical Waste Landfill
DOE	U.S. Department of Energy
DOU	Document of Understanding
DQO	data quality objective
DU	depleted uranium
EA	environmental assessment
EOD	Explosive Ordnance Disposal
EPA	U.S. Environmental Protection Agency
ER	environmental restoration
FOP	field operating procedure
GIS	Geographic Information System
HE	high explosive(s)
HMX	homo-cyclonite
HSPP	Health and Safety Project Plan
HSWA	Hazardous and Solid Waste Amendments
IMPP	Information Management Project Plan
IT	IT Corporation
KAFB	Kirtland Air Force Base
MAPP	methyl acetylene-propene-propadiene
mg/kg	milligram(s) per kilogram
µg/kg	microgram(s) per kilogram
NEPA	National Environmental Policy Act
NFA	no further action
NMED OB	New Mexico Environment Department Oversight Bureau
NOAA	National Oceanic and Atmospheric Administration
OB	open burning
OD	open detonation
OU	operable unit
pCi/g	picocurie(s) per gram
PIP	Program Implementation Plan
PMP	Project Management Plan
ppb	part(s) per billion
QA	quality assurance
QAPjP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RDX	hexahydro-1,3,5-trinitro-1,3,5-triazine
RFA	RCRA facility assessment
RFI	RCRA facility investigation

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

RPO	Radiation Protection Operations
SNL/NM	Sandia National Laboratories/New Mexico
SVOC	semivolatile organic compound
SWHCP	Sitewide Hydrologic Characterization Project
SWMU	solid waste management unit
TAL	target analyte list
TCLP	toxicity characteristic leaching procedure
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
USFS	U.S. Forest Service
UXO	unexploded ordnance
VCM	voluntary corrective measure
VOC	volatile organic compound
WM	Waste Management

Several soil and water samples have been collected for chemical analysis within and near OU 1335. These samples were taken for the joint purposes of providing background data and identifying potential contamination. Generally, soil samples were collected at areas believed to be depositional areas, where contaminants might collect if present in sediments carried by water. Figure 3.6-1 shows these sampling locations; Tables 3.6-3, 3.6-4, and 3.6-5 present data. During the site-wide hydrogeologic investigation, no obvious evidence of contamination was present in any of the soil or surface water samples collected in this area to date (see Table 3.6-6). Table 3.6-6 lists the DOE Oversight Bureau (OB) maximum background concentrations for soil (NMED OB July 1997).

Additional background soil samples were collected from areas within OU 1335. These background samples were collected from areas remote from test sites and are therefore not impacted by testing activities. Figure 3.6-2 shows the background sample locations and Table 3.6-6 summarizes the results of the soil analyses.

3.6.2 Vadose-Zone Hydrology

This section summarizes the vadose zone (or unsaturated zone) hydrology in OU 1335. Although there have been no vadose zone hydrology studies focused specifically at OU 1335, some research has been conducted near this region of KAFB.

In general, the vadose zone is approximately 500 feet thick west of the faults (where most of the OU 1335 sites are located), may be somewhat shallower near the faults, and may be as little as about 50 feet thick east of the faults. Based on soil samples collected near the CWL (ER Site 74) in the southeastern corner of Technical Area III, the soil-moisture content in this area is likely to range between 1 and 10 percent, with 5 or 6 percent a reasonable average.

An environmental tracer study was conducted to estimate the natural recharge rate in the vicinity of the CWL. The natural recharge rate can be considered as an upper bound on the Darcy transport velocities toward the water table. The study involved the analysis of soil samples for selected physical properties, isotopes, and chemicals. Chloride mass balance, stable isotope, bomb tritium, and bomb chlorine-36 methods were used to estimate the recharge rate. The estimated recharge rate varied between 0.002 and 0.71 centimeters per year (cm/yr), which yields downward seepage velocities ranging between 0.03 and 11.8 cm/yr, at average volumetric moisture contents on the order of 0.06. It is likely that the actual recharge rate in this area is somewhere in the middle of this range, on the order of 0.1 cm/yr. This result is consistent with other similar studies (e.g., Knowlton et al. 1991). The "Chemical Waste Landfill Groundwater Assessment Report" (SNL/NM October 1995) presents further discussion of recharge rates.

Parsons et al. (1993) used the Geographic Information System (GIS) to identify prototypical vadose zone hydrogeologic settings in the KAFB area. This study compiled selected data

Table 3.6-6
Background Soil Concentrations of Metals and Radioisotopes for OU 1335

Contaminant of Concern	DOE OB Suggested Maximum Background ^a	
	(mg/kg)	
Metals	Surface	Subsurface
Arsenic	5.6	4.4
Barium	130	214
Beryllium	0.65	0.65
Cadmium	<1	0.9
Chromium (total)	17.3	15.9
Lead	21.4	11.8
Nickel	11.5	11.5
Mercury	<0.25	<0.1
Selenium	<1	<1
Silver	<1	<1
Radioisotopes	(pCi/g)	
	Surface	Subsurface
Cesium-137	0.664	0.079
Radium-226	2.30	1.76
Radium-228	1.01	0.93
Strontium-90	1.08	not available
Thorium-232	1.01	1.01
Thorium-234	<0.47	<0.47
Uranium-234	1.6	1.6
Uranium-235	0.16	0.16
Uranium-238	1.4	1.4

^aNMED OB July 1997.