CAFB 94

DEPARTMENT OF THE AIR FORCE

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CANNON AIR FORCE BASE, NEW MEXICO

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Cannon AFB NM 88103-5214

Ms. Barbara Hoditschek
Program Manager, RCRA Permitting
New Mexico Environment Department
1190 St. Francis Drive
Santa Fe NM 87502

Dear Ms. Hoditschek

Attachment 1 is the response to your Notice of Deficiency (NOD), dated November 29, 1993, issued with respect to the RCRA Facility Investigation (RFI) Workplan for Landfill No. 5 at Cannon AFB. This response was developed by combining comments from the original NOD and from the December 15, 1993 Work Plan meeting. As discussed during that Work Plan meeting, our response to the NOD is in the form of the corrected pages for the Work Plan.

During the December 15, 1993 Work Plan meeting, meeting minutes were developed. It was agreed during the meeting that Cannon AFB would review the minutes and submit any changes they felt were needed. Attachment 2 is the changes Cannon AFB would like reflected in the meeting minutes.

We look forward to hearing from you regarding these changes soon. We would like to go final on the Work Plan as quickly as possible so the field work can begin at this site. Any questions regarding this project may be directed to Mr. John F. Ekhoff at (505) 784-2739.

Sincerely

William M. Guth

WILLIAM M. GUTH
Brigadier General, USAF
Commander

Attachments
1. Corrected Work Plan Pages
2. WCC Modification to Meeting Minutes

Pages replaced by August 12, 1994 submittal

CANNON AFB REQUESTED MODIFICATIONS TO
NMED RECORD OF 15 DECEMBER 1993 MEETING

Draft Phase I RFI for Landfill No. 5 (SWMU No. 113)

General Comment No. 1

RESPONSE: Woodward-Clyde (WC) recognizes that the "goals and objectives" of the RFI Work Plan need to be made clearer. Also, WC suggests that the Phase I Work Plan mention a phased investigation which would further define the extent and source of contamination. Additionally, the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau (HRMB) recommends a decision tree approach based on data quality objectives which outline possible findings and possible additional phases of investigation.

NMED's record of the meeting is correct in respect that W-C agreed that the "goals and objectives" of the RFI Work Plan need to be made clearer. This was to be done be supplementing the existing text and flow chart to better explain that depending upon the outcome of Phase I, additional activities may be proposed (if, then type of statements) to address the comment. However, our recollection of the meeting does not agree with NMED that a decision tree approach based on data quality objectives which outline possible findings and possible additional phases of investigation was discussed.

General Comment No. 2

RESPONSE: Cannon Air Force Base (CAFB) agrees that an RFI may require multiple phases of investigation. The HMRB asks that the Phase I Work Plan mention the criteria that might lead to a phase II investigation (See RESPONSE #1 above).

Cannon AFB believes that this response generally reflects the discussion as held during the meeting.

General Comment No. 3 See comment #8 below.

Cannon AFB believes that this response agrees with the discussion held during the meeting.

General Comment No. 4

RESPONSE: WC believes that the time scheduled for each task is appropriate but that the scheduled completion date of May 1995 will have to be adjusted to the future to account for delays in getting the RFI Work Plan approved. HRMB agrees and suggests that creating a time-line specifying lengths of time to complete tasks instead of specifying dates. W-C states that it is difficult to change schedules due to established contracts.

NMED's record of the meeting is correct, with the exception, that W-C does not recall stating "that it

Attachment 2

is difficult to change schedules due to established contracts. As shown in the attached Meeting Minutes provided be W-C, Steve Alexander agreed that the figure and text provided in the work plan were sufficient. Cannon AFB would like to point out that the figure depicting the schedule does include the duration for each element of the Phase I RFI. The dates are included for the purpose of providing goals for completing the different phases of the project, with the realization that the dates may shift.

Specific Comment No. 1

RESPONSE: WC states that the soil vapor survey addresses the issue of a vapor phase plume. HRMB requires that the RFI Work Plan fully address the possibility of a vapor phase contaminant plume migrating below SWMU #113 or impacting groundwater.

NMED's record of the meeting in regard to this comment does not correctly reflect the discussion. W-C stated that the soil gas survey and volatile organic analyses will give an idea of whether the vapor phase plume should be of a concern. W-C will address the possibility of a vapor phase plume beneath the landfill or impacting groundwater in conjunction with addressing General Comments No. 1 and No. 2 in discussing the phased approach for the RFI.

Specific Comment No. 2

RESPONSE: WC states that additional investigation is needed to support this statement and that the statement will be qualified in the RFI Work Plan.

In addressing this comment, W-C responded that additional information to support the statement will be provided in the RFI Work Plan, however it may not be specific to Landfill No. 5. There is information available from boring logs, water levels at Landfill No. 5 and other areas on base, along with hydraulic properties from tests performed on other wells on Cannon AFB to support this statement.

Specific Comment No. 3

RESPONSE: WC agrees with HRMB's caliche reference and will provide references and historical information.

Cannon AFB agrees with this record of the meetings regarding this comment. However, it was also stated by W-C that this information will be regional in nature. Lee Winn agreed to work with W-C on this issue by providing information on the references that she thought might be applicable.

Specific Comment No. 4

RESPONSE: CAFB will provide estimates of quantities as described in the Comment.

NMED also stated that if Cannon AFB could not provide this, that it should be stated as such in the RFI Work Plan. Cannon AFB will provide the information and references that are available.

Specific Comment No. 5

WC recognizes that a more complete list of corrective measures is necessary and agrees to include in the RFI Work Plan a list a data needs as described in the comment above.

NMED's record of the meeting for this comment is not completely correct. The discussion on this comment by Steve Alexander included statements to the effect that it is often necessary to have identified the corrective measure in order to identify the data needs. NMED also indicated that it would be acceptable if the discussion in the Phase I RFI Work Plan does not identify the data needs, but that they will be addressed in other phases. W-C responded to the comment by stating that W-C had identified a more complete list of potential corrective measures but would not be able to identify all possibilities until after the Phase I investigation.

Specific Comment No. 6

RESPONSE: CAFB agrees to provide a summary in the RFI Work Plan of historical information and associated references.

Cannon AFB agrees with this record for the meeting concerning this comment.

Specific Comment No. 7

RESPONSE: CAFB states that a "Background Report" is due for completion soon. HRMB requires that this information be included in the RFI Work Plan so that it might "stand alone". Also, the HRMB suggests that a screening action level approach be used which may be based on either a risk assessment, Subpart S guidance or background (for metals only).

Cannon AFB disagrees with NMED's response concerning the discussions held during the meeting concerning this comment. Cannon AFB agreed to provide a summarization of the information contained within the "Background Report", but that the Phase I RFI Work Plan would not include all the data or boring logs, however they will be referenced. Cannon AFB' s plan is to provide a scaled map showing where the samples are located and a summary table of the data which will include sampling depths; in response to Steve Alexander's request. Cannon AFB agrees that an approach including the consideration of a combination of risk assessment, Subpart S guidance and background is the best approach for this project, but does not recall it being stated that this be done for metals only.

Specific Comment No. 8

RESPONSE: WC stated that the lead information in the RFI Work Plan was a result of poor quality assurance/quality control. After the meeting, Lee Winn of HRMB followed up on this issue with Bill Hurlbut of USEPA Region 6. He said that sampling groundwater for the Appendix I solid waste management unit (SWMU) list was only conducted at the lagoons at CAFB, not the landfill as

CAFB had suggested as the reason for sampling well 113B. In light of this, HRMB asks that resampling for lead be conducted of the groundwater in well 113B using EPA approved analytical method 239.2 (2ppb detection limit) within 30 days of receipt of these minutes.

Cannon AFB has already scheduled the required sampling event for monitoring well 113B. This issue is discussed in more detail under a separate letter.

Specific Comment No. 9

RESPONSE: WC points out that the RFI Work Plan refers to 30 boreholes that will have multiple soil samples collected from each, totaling 180 soil samples. WC also states that additional samples will be collected during a second phase of investigation as warranted. HRMB requests that the criteria for determining if additional samples will be collected be outlined in the RFI Phase I Work Plan.

Cannon AFB agrees that NMED record of the meeting concerning this comment generally reflects the intent of the discussions held concerning this comment. Following W-C's explanation of the planned activities at Landfill No. 5 for the Phase I RFI, Steve Alexander indicated that it was acceptable.

Specific Comment No. 10

RESPONSE: CAFB recognizes that sampling of the landfill may be necessary and agrees to remove the words "in the future" from the referenced sentence. HRMB points out that the RFI Work Plan must address source characterization and the risk of potential releases from the landfill.

The phrase being deleted will be replaced with "during Phase I". Cannon AFB will address the need for source characterization in subsequent phases of investigation. Phase I is planned to address potential releases from the landfill since soil samples will be collected and analyzed from beneath the landfill as is stated in the Draft Phase I RFI Work Plan.

Specific Comment No. 11

RESPONSE: HRMB reiterates the need for CAFB to fulfill all the requirements of Cannon's HSWA permit. In a telephone conversation between Steve Alexander of NMED and John Ekhoff of CAFB on December 17, 1993, HRMB agree that ARARs may be discussed in the RFI Work Plan, but that they cannot interfere with CAFB;'s permit requirements. Mr. Bill Hurlbut of the EPA has not been included in the CAFB/HRMB discussions and will need to be consulted on this issue. EPA, HRMB and CAFB will negotiate the inclusion of CERCLA language into the RFI Work Plan. NMED recognizes CAFB's regulatory obligations under CERCLA.

Cannon AFB agrees with NMED in their response concerning this comment. Cannon AFB will include the discussion on ARARs as is currently in the Draft Phase I RFI Work Plan, but will refer to this discussion to comply with the permit language.

Specific Comment No. 12

RESPONSE: WC states that when the RFI Work Plan refers to Project Managers it is referring to "all" Project Managers including those from the federal and state regulatory agencies. WC refers to the organization chart B2-1 in the RFI Work Plan. WC agreed to clarify this issue in the flow chart and the text.

Cannon AFB agrees with NMED in their response concerning this comment.

Specific Comment No. 13

RESPONSE: CAFB agrees to include the phrase :subject to NMED and EPA approval" in the referenced sentence.

Cannon AFB agreed that the text will be revised to indicate that any decisions will be subject to the approval of NMED and EPA in their response concerning this comment.

Specific Comment No. 14

RESPONSE: WC agrees that the text of the RFI Work Plan does not provide sufficient documentation to support the rationale for the analyte list and agreed to correct this. WC points out that the proposed GC/MS analytical techniques will provide a broad search for other compounds. HRMB requires additional documentation to support the rationale for the analyte list and asks that CAFB reference TICs in any GC/MS methods.

Cannon AFB generally agrees with NMED's record of the meeting concerning the discussion on this comment. However, Cannon AFB will also provide a description of how a GC/MS method works at Lee Winn's request, in addition to providing the additional documentation in the Phase I RFI Work Plan.

Specific Comment No. 15

RESPONSE: WC agrees that the references need to be corrected.

Cannon AFB's agrees with NMED concerning the record of the meeting in regards to this comment.

Specific Comment No. 16

RESPONSE: HRMB suggests that CAFB should use analytical methods outlined in SW-846

(Test Methods for Evaluating Solid Waste). It is understood that GC/MS analytical methods will be used for screening. However, identified constituents should be analyzed for using methods with the lowest PQLs (See comment 14 above).

Cannon AFB disagrees with NMED's record of the meeting regarding this comment discussion. What Cannon AFB agreed to was that justification needs to be provided in the work plan for the selected analytical methods quantitation limits and how they meet project objectives, rather than using the methods with the lowest PQL's.

Specific Comment No. 17

RESPONSE: WC agrees to insert language into the RFI Work Plan that discusses the geo-probe grid and its relation to the geophysics lines.

W-C provided an explanation of the soil gas survey and geophysical survey phases of the project as contained in the RFI Work Plan. Lee Winn, requested that W-C include the grid lines in the legend for Figure 4-1 referenced in the text discussion the soil gas survey and geophysics.

Specific Comment No. 18

RESPONSE: HRMB understands that these locations will be based on findings of geophysical and geoprobe surveys. However, if nothing is conclusive from these surveys, criteria for a back up location should be described in the Work Plan.

Cannon AFB does not have a record of a discussion concerning back up locations during the meeting. However, Cannon AFB agrees that some discussion concerning what will be done as an alternative for locating the soil borings should be provided in the Final Phase I RFI Work Plan. This language will include a discussion with NMED and EPA before drilling commences if an alternative plan for locating the soil borings becomes apparent as a result of the soil gas and geophysical surveys.

Specific Comment No. 19

RESPONSE: WC states that the concern will be addressed through multiple phase approach of investigation. HRMB states that screening action levels in soil should be more clearly defined.

Cannon AFB generally agrees with NMED's record of the meeting concerning this comment. However, it is Cannon AFB's understanding that Steve Alexander suggested that Cannon do something analogous to screening action levels, and that Cannon AFB propose what they consider as uncontaminated soil for NMED' approval. Cannon AFB will do this in the RFI Phase I Work Plan.

Specific Comment No. 20

RESPONSE: WC states that the soil vapor survey is a screening action and not a attempt to characterize the source. Again, HRMB requires that the criteria for additional phases must be discussed in the Phase I Work Plan.

Cannon AFB generally agrees with NMED's record of the meeting concerning the discussion as it related to this comment. In addition to the first statement above, W-C provided a more detailed explanation of the soil gas survey planned for the Phase I RFI, and acknowledged that a more detailed soil gas survey would be required if the source were being characterized. Lee Winn stated that she did not have a problem with the proposed soil gas survey and the phased approach for this purpose. Cannon AFB will respond to the second statement of NMED's response in conjunction with our response to General Comments No. 1 and No. 2.

Work Plan (Vol 1, 2 Sets)

Pages Affected by Comment Responses

A Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Workplan was prepared by consultants Lee Wan and Associates in June 1990 and finalized in October 1990 for the investigation of 27 Solid Waste Management Units (SWMU) at Cannon Air Base, Clovis, New Mexico (Lee Wan and Associates 1990). The RFI Workplan approved by the United States Environmental Protection Agency (USEPA) Region VI on December 11, 1990 consisted of the following documents:

- Data Collection Quality Assurance Plan
- Data Management Plan
- Health and Safety Plan
- Field Sampling Plan
- Community Relations Plan
- Program Management Plan

In July 1991, the United States Army Corps of Engineers (USACE) Omaha District on behalf of Cannon AFB contracted Woodward-Clyde (W-C) to conduct environmental investigations at 18 of the 27 SWMUs addressed by the Lee Wan RFI Workplan. The 18 SWMUs investigated were listed in Appendix I to Cannon AFB's RCRA Part B permit and included:

AGE Ditch	SWMU 34
Engine Test Cell	SWMU 86, 87, 88 89,90
NE Storm Drainage Area	SWMU 95
Wastewater Lagoons	SWMU 101, 102
Landfill No. 5	**SWMU 113**
Old Entomology Rinse Area	SWMU 96
Sludge Weathering Pit	SWMU 76
Fire Training No. 1	SWMU 78
Solvent Disposal	SWMU 81
Fire Training No. 2	SWMU 106
Fire Training No. 3	SWMU 107
Fire Training No. 4	SWMU 109
Sanitary Sewer Line	SWMU 98

The USACE Scope of Service (SOS) dated June 26, 1991 directed W-C to ensure that the investigation of each SWMU would serve a dual purpose and encompass both RCRA and the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) requirements for evaluating the nature and extent of hazardous wastes potentially occurring at each SWMU. The reasons for having the investigation address both RCRA and CERCLA requirements are discussed below.

The investigations conducted by W-C ~~were~~ ~~will be~~ called a Remedial Investigation (RI) to satisfy funding requirements under the U.S. Air Force Installation Restoration Program (IRP). The IRP is legally mandated under CERCLA; therefore, site investigations and clean-up must follow CERCLA guidance.

As a condition of their RCRA Part B permit, Cannon AFB must evaluate SWMUs identified by USEPA during the RCRA Facility Assessment (RFA). Therefore, the investigations to be conducted are designed to satisfy RFI guidance for characterizing the SWMUs and developing and implementing corrective action measures, if necessary.

This Workplan is being prepared to address further environmental investigation at Landfill No. 5 (SWMU No. 113/IRP No. LF-5) at Cannon AFB under W-C's USACE Contract Number DACW-45-93-D005, Delivery Order No. 0012, executed on June 30, 1993. The additional investigation at Landfill No. 5 is being performed for USACE on behalf of Cannon AFB to further satisfy conditions of Cannon AFB's RCRA Part B permit. However, since the State of New Mexico Environment Department (NMED) is the lead agency for this project and this investigation was not included in the Lee Wan Workplan, the following workplan documents are being prepared as the Workplan for this project:

- Data Collection Quality Assurance Plan (DCQAP)
- Data Management Plan (DMP)
- Project Management Plan (PMP)
- Site Safety and Heath Plan (SSHP)

The current Community Relations Plan has been deemed sufficient by USACE and Cannon AFB and will be administered by Cannon AFB personnel. Therefore, it is not being revised for the Landfill No. 5 investigation.

The scope of work to be completed under this investigation includes the completion of a detailed site survey of Landfill No. 5, (SWMU No. 113/IRP No. LF-5) using the Base Coordinate System. This work will result in the placement of a 50 by 50 foot grid over Landfill No. 5 and the generation of a topographic base map using one foot contours. This map and grid system will be used in performing both a geophysical survey and a 1200 point soil gas survey over Landfill No. 5. Data generated ~~from the~~ ~~will be used in conjunction with the~~ geophysical survey and soil gas survey ~~will be used to aid the locating of~~ ~~locate~~ 30 soil borings to be drilled and sampled ~~in an effort~~ to document the presence or absence of contaminated leachate in the native soil beneath the landfill burial cells. Data generated from this field effort will be of sufficient quality to support: ~~future baseline risk assessment studies if necessary.~~

- ~~Identification of data gaps~~
- ~~Recommendations for additional field investigation~~
- ~~Identification of the need for interim corrective measures or a Corrective Measures study (Remedial Action or Feasibility Study under CERCLA)~~
- ~~Future baseline risk assessment studies if necessary~~
- ~~A No Further Action recommendation~~
- ~~Identification of preliminary corrective measures (remedial alternatives under CERCLA)~~

1.0
INTRODUCTION

This document serves as the Work Plan for the RFI to be conducted at Landfill No. 5 (SWMU No. 113/IRP No. LF-5) located on Cannon AFB, near Clovis, New Mexico. Landfill No. 5 was previously investigated during the 18 SWMU Remedial Investigation performed in 1992 by W-C. During the 1992 investigation of Landfill No. 5, only existing groundwater monitoring wells were sampled and a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA 1988) baseline risk assessment was performed. Results of this investigation indicated that groundwater beneath Landfill No. 5 has not been impacted by past activities at Landfill No. 5 (W-C 1992). At the request of NMED, Cannon AFB agreed to further subsurface investigation at Landfill No. 5 to evaluate whether contaminants are present in the subsurface soils beneath Landfill No. 5 and, if present, the nature and extent of contamination.

This Work Plan follows the United States Environmental Protection Agency's (USEPA) RCRA Facility Investigation Guidance, Volumes 1-4 (EPA 530/SW-89-031) (USEPA 1989a). This Work Plan, and the Data Collection Quality Assurance Plan (DCQAP) and Site Safety and Health Plan (SSHP) also meet USEPA guidance for conducting remedial investigations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (USEPA 1989b).

The overall intent of the RFI is to obtain the data necessary to characterize the nature, ~~and~~ extent and rate of migration of releases of hazardous waste or constituents and to interpret this information to determine whether interim corrective measures and/or a Corrective Measures Study (Feasibility Study/Remedial Alternatives under CERCLA) may be necessary. ~~of contamination and identify preliminary corrective measures (remedial alternatives under CERCLA) for Landfill No. 5.~~ The data collected during the RFI may also be used to evaluate human health and environmental ~~ecologic~~ risks in the future, if necessary. The objectives of the Landfill No. 5 Phase I RFI to be conducted at Cannon AFB are to:

- Collect the quantity and quality of data necessary to characterize the physical setting and nature and extent of potential hazardous wastes associated with Landfill No. 5
- Evaluate the data to identify data gaps and determine if additional investigation(s) is required to fulfill the RFI objectives

- Evaluate the data collected to identify potential migration pathways for future evaluation of human health and environmental ~~ecological~~ risks (if required) associated with chemicals found in soils beneath ~~at~~ Landfill No. 5

- Provide data for use in identifying appropriate remedial actions (i.e., Corrective Measures Study (CMS) under RCRA or a Feasibility Study under CERCLA)

- Recommend No Further Action if supported by the findings of this investigation

- ~~Develop recommendations for further investigation at Landfill No. 5 or, if supported by the findings of this RFI, no further action~~

This Work Plan has been prepared based on findings and recommendations from past U.S. Air Force IRP investigations at the base, specifically those related to Landfill No. 5, and will also guide the planned RFI investigation to satisfy the Cannon AFB RCRA Part B permit conditions.

Recommendations and decision rationale for the following are presented in this Work Plan:

- Conducting additional field work
- Performing a Baseline Risk Assessment in the future
- Developing and screening potential corrective measures (remedial responses under CERCLA)
- Evaluating Applicable and Relevant or Appropriate Requirements (ARARs)
- Developing Data Quality Objectives

These estimates appear to be low when compared to published hydraulic conductivity data for sands and gravels (Freeze and Cherry 1979). As reported in Kearney (1987), a groundwater flow velocity of about 150 feet/yr has been estimated. This calculates out to a hydraulic conductivity of approximately 1.0×10^{-1} cm/sec.

Hydraulic information specific to Landfill No. 5 (SWMU No. 113/ IRP No. LF-5) was obtained during the 18 SWMU RI conducted by W-C in 1991 (W-C 1992). The hydraulic gradient for groundwater beneath Landfill No. 5 is approximately 0.0025 ft/ft based on water level elevation for data collected as part of the 18 SWMU RI. Using the hydraulic conductivity values reported above and a reasonable effective porosity of 28 percent, the groundwater velocity can be estimated as ranging from 0.069 feet/day to 0.134 feet/day.

The presence of interstitial clays may account for both the variability and low values of hydraulic conductivities. Boring logs from Cannon AFB IRP projects and published reports (Lee Wan and Associates 1990) indicated that interstitial and interstratified clays are abundant in the Ogallala Formation.

Recharge to the Ogallala is primarily through precipitation. Kearney (1987) indicated that the recharge rate may be as much as 1.0 inches/yr. Due to the high evapotranspiration rate and low precipitation, recharge occurs only during heavy rainfall events in which the infiltration capacity of the soil is exceeded and runoff occurs, or during cool months when precipitation exceeds evapotranspiration. Excess runoff flows to playas, and the presence of water in playas allows deep percolation to the aquifer. The occurrence of this process is evidenced by the presence of clay deposits in playas and the possibility that caliche is thin or absent directly below, playas. Caliche is soluble in acidic rain waters and is leached over time to form percolation pathways.

Discharge from the Ogallala occurs through well pumping and springs along the eroded margins. Spring discharge does not occur on or near Cannon AFB. Domestic and irrigation water wells are common on and around the base. However, the rate of discharge exceeds local recharge. Water levels in the Ogallala have declined steadily from the 1930s to the present. From the 1930s to 1980, a decline of 50 to 100 feet has been observed in the area around Clovis, New Mexico. Luckey et. al. (1981) states, "the largest area of water level decline exceeding 100 feet occurs south of the Canadian River extending from Curry County, New Mexico to Crosby County, Texas."

3.5 PUBLIC HEALTH AND ENVIRONMENTAL IMPACTS

A Baseline Risk Assessment (BRA) may be conducted as a follow-on to the Landfill No. 5 RFI. The data quality considerations for this RFI include as an objective that all data be of sufficient quality to support a BRA should one be required at a later time. The BRA will identify chemical compounds of concern and evaluate their potential impacts to human health and the environment. The results of the BRA will be used to formulate remedial actions as necessary. The human health risk assessment and environmental evaluation prepared for Landfill No. 5, if complete exposure pathways are present, will supplement the BRA previously performed on Landfill No. 5 as a part of the 18 SWMU RI conducted by W-C in 1992 (W-C 1992).

3.6 PRELIMINARY IDENTIFICATION OF REMEDIAL ACTION TECHNOLOGIES

Possible corrective measures technologies have been preliminarily identified for Landfill No. 5. At this time, the technologies under consideration include no action, landfill capping, soil vapor extraction of contaminated soils where soil permeabilities allow, and in situ bioremediation (Table 3-2). During potential future Corrective Measure Studies (CMS) (Feasibility Studies under CERCLA), these and perhaps other corrective measures technologies will be identified and evaluated.

Potential treatment technologies and their assorted containment or disposal requirements for remediation of contaminated soil will be screened for their technical applicability to Landfill No. 5. Technologies found to be appropriate will be combined to form alternatives for source control and/or management of migration measures. Data collected in this field investigation that may identify site characteristics that could limit or promote the use of certain remedial technologies will be evaluated as part of the screening process. Technologies that are clearly limited by site characteristics, contaminant properties, or that may prove difficult to implement will be eliminated from consideration.

Based on the results of field investigations and consideration of potential remedial technologies, a limited number of alternatives will be developed ranging from an alternative that, to the degree possible, would eliminate the need for long-term management at the sites to alternatives involving treatments which reduce toxicity, migration, or volume. In addition, an alternative involving No Action or containment with little or no treatment will be included in the range of alternatives. The alternatives will be developed in consultation with the NMED and USEPA, and will be oriented at site-specific information obtained from the field investigation.

TABLE 3-2

Potential General Response Actions, Remedial Technologies, and Process Options

Media	General Response Action	Remedial Technology	Process Option
Soil	No action	None	None
	Institutional controls	Land use	• Deed restrictions • Zoning restrictions
		Access restrictions	Fencing and post warnings
	Containment	Capping	• Native Soil Vegetation • Clay • Composite • Synthetic membrane
		Vertical barriers*	• Slurry wall • Grout curtain • Sheet piling • Compacted clay cut-off wall
	Removal*	Removal	Excavation
	Treatment	In situ	• Soil vapor extraction • Bioventing • Air sparging with air treatment • Gas collection with air treatment • Bioremediation
		Ex situ*	• Landfarming • Bioslurry reactor
		Air treatment	• Flare

* Technologies that most likely will not be applicable to particular site; however, they can be evaluated in the CMS.

4.0
WORK PLAN RATIONALE

This section outlines the assessment of the data needs, data gaps, investigation approach, and data quality requirements needed to meet the objectives of the RFI. The focus of the Phase I RFI is the investigation of potential subsurface soil contamination that may have resulted from past activities at Landfill No. 5 (SWMU No. 113/JPP No. LF-5) located on Cannon AFB. The DQO process has been used to develop sampling plans and sampling locations at Landfill No. 5. The RFI at Landfill No. 5 includes laying out a 50-foot by 50-foot surveying grid and performing a geophysical survey using 50-foot north-south spacing and up to a 25-foot east-west spacing. A soil gas survey will be performed over the same area based on the 50-foot by 50-foot grid. However, the actual spacing for the soil gas survey may be adjusted following the geophysical survey. The resulting sampling grid is shown in Figure 4-1. Based on the results of the geophysical and soil gas surveys, 30 soil boring locations will be identified from which subsurface soil samples will be collected for analysis. The overall objective of this investigation at Landfill No. 5 is to evaluate whether or not a release of hazardous chemicals from Landfill No. 5 has occurred or could occur in the future which may pose a significant risk to human health or the environment.

4.1 DATA QUALITY OBJECTIVES

The above discussion suggests the following Data Quality Objectives.

- Collect environmental data of sufficient quality and quantity to define the nature, ~~and~~ extent ~~and rate of migration of releases of hazardous waste or constituents and to interpret this information to evaluate whether interim corrective measures and/or a Corrective Measures Study (Feasibility Study/Remedial Action under CERCLA) may be necessary~~ ~~of contamination~~ resulting from potential releases of chemicals from Landfill No. 5

- Collect environmental data of sufficient quality and quantity to determine the potential for releases to migrate toward receptors in all significant pathways identified in Section 3.4

- Collect environmental data of sufficient quality to be used in a screening level Health Risk and Environmental Assessment or BRA (to be conducted in the future, if

required) and collect data of sufficient quantity to address all significant exposure pathways

- Collect sufficient quality and quantity of environmental data to support a recommendation of "no further action," if warranted, following the evaluation of the findings of the investigation

- Collect data of a quality that can be used as part of any required follow-on study including a Corrective Measures Study

The decision diagram shown in Figure 4-2 has been developed for Phase I of the Landfill No. 5 RFI to present a logical decision process that will be used to evaluate the data needs necessary to achieve the project objectives. At each decision point, both NMED and EPA will be consulted and agreement reached before finalizing any decision. The diagram represents the decision process to evaluate the soil exposure pathway. The groundwater pathway is considered insignificant at this time since previous investigations have indicated that no significant impact to groundwater has occurred due to past activities at Landfill No. 5. However, if results of the Phase I investigation indicate the potential for groundwater contamination the groundwater pathway would be considered.

4.2 RFI INVESTIGATION DECISION PROCESS

The following decision process was used to assess the data needs and investigative approach for Landfill No. 5. The DQO evaluation process was designed to provide data of sufficient quality and quantity to determine if releases have occurred from Landfill No. 5 that could pose a risk to human health or the environment, to evaluate the need for additional data to complete a BRA in the future, and complete a Corrective Measure Study, if warranted.

The RFI soils investigation decision process is designed to identify appropriate actions for Landfill No. 5 based on three alternative actions: no further investigation, interim action, and further investigation and evaluation in a final RFI/CMS (feasibility study under CERCLA). The recommendation for the selection of alternative action for Landfill No. 5 will depend on whether chemicals of interest are detected in soils at levels that may pose an unacceptable risk to human health or the environment. This section provides a summary of the decision-making process that will be used to evaluate Landfill No. 5.

The decision process was implemented by first evaluating and summarizing existing historical information and analytical data collected for Landfill No. 5. Historical information was used to identify potential chemicals of interest for Landfill No. 5. Based on historical information for Landfill No. 5, geophysical and soil gas surveys will be performed to delineate contaminant plumes for further investigation, through soil boring and sampling. Then subsurface soil will be sampled and analyzed for chemicals of interest. The analyte lists from which chemicals of interest were identified are discussed in the DCQAP. Sampling will be focused in areas that have the greatest potential for contaminant plumes at Landfill No. 5. Chemicals of interest for evaluating site conditions at Landfill No. 5 will be selected by identifying chemicals reported above the analytical reporting limits. Metals that do not exceed background levels will not be included as chemicals of interest. Organic chemicals that do not have EPA toxicity factors will not be considered as chemicals of interest.

4.3 LANDFILL No. 5 (SWMU No. 113/ IRP No. LF-5) DQO PROCESS

This section describes the data needs and investigative activities for the Phase I RFI of Landfill No. 5 (SWMU No. 113/IRP No. LF-5).

Landfill No. 5 is in an inactive landfill located in the southeastern area of the base and occupies approximately 70 acres (Figure 2-2). Cell No. 3, which is closed, is RCRA regulated because until mid-1981 this cell received hazardous waste. No additional hazardous wastes were placed in this cell from 1981 to its closure in 1983. Tree limbs and construction debris were placed in the landfill until 1991. Waste materials received at the landfill included domestic solid waste, waste oils, and solvents; paint, paint remover, and thinners; pesticide containers; and various empty cans and drums. Cell No. 3 has been permanently closed with a cap, separate fencing for security, and a series of monitoring wells to detect contaminant migration in groundwater. The remaining area of Landfill No. 5 is covered with natural vegetation.

In 1991, W-C collected groundwater samples for Appendix IX constituents (40 CFR 264) from five groundwater monitoring wells at Landfill No. 5 (W-C 1992). Results of chemical analysis of these samples indicated that no analytes other than metals were detected above the Contract Required Quantitation Limit (CRQL). Metals analysis revealed the presence of barium and vanadium in all five groundwater samples. Both metals had concentrations below their MCLs (for barium, 1.0 mg/L; for vanadium, no MCL is established). The concentration of vanadium ranged from 0.023 mg/L to 0.036 mg/L. Lead was detected in one groundwater sample from well 113B at an estimated concentration of 0.016 mg/L analyzed for total lead (unfiltered sample). The value for total lead was qualified with an estimated flag code because the associated matrix spike relative percent difference was greater

than the control limit specified in the Quality Assurance Project Plan. This concentration is at the action level (0.015 mg/L) for drinking water samples collected at the tap. However, lead was not detected at the reporting limit of 0.005 mg/L for dissolved lead in the sample at well U3B, or in any of the other samples collected and analyzed for dissolved lead from monitoring wells at Landfill No. 5. Evaluation of the chemical data collected during this investigation indicated that the quality of groundwater has not been affected by past activities at Landfill No. 5.

4.3.1 Data Needs

The data needed to meet the objectives of the Phase I investigation at Landfill No. 5 are:

- Locate areas within the landfill having potential contaminant plumes from past waste disposal
- Characterize concentrations of chemicals in the surface soil in areas having the greatest potential for releases from the landfill (i.e., at areas having the highest potential chemical concentrations)
- Characterize concentrations of chemicals in the subsurface soil in areas having the greatest potential for releases from the landfill (i.e., at areas having the highest potential chemical concentrations)
- Characterize the vertical distribution of chemicals of concern in soil to address the potential for transport to groundwater at concentrations of concern.

4.3.2 Data Gaps

Past investigation at Landfill No. 5 has included the installation and sampling of groundwater monitoring wells. Data from these investigations (Radian 1986; W-C 1992) indicate that groundwater has not been impacted due to past activities at Landfill No. 5. However, ~~no~~ very little surface or subsurface soil sampling has been conducted to characterize the nature and extent of contamination, if present, in soils at the landfill. Therefore, the data gaps at Landfill No. 5 are the same as the data needs.

4.3.3 Investigative Approach

The goal of the RFI at Landfill No. 5 is to satisfy the data needs, i.e., to eliminate the data gaps identified above. The potential release point at Landfill No. 5 is from the burial cells to the subsurface soil beneath the landfill. Geophysical and soil gas surveys will be performed at Landfill No. 5 to identify potential contaminant plumes likely associated with historic landfill cells. Based on the results of these surveys, thirty soil borings will be located, to allow for the collection and subsequent laboratory analysis of surface and subsurface soil samples. Surface soil samples (at selected soil boring locations) will be collected to evaluate if concentrations of chemicals of interest exist at the surface that could pose a potential risk to human health or the environment. Subsurface soil samples will be collected from beneath the landfill-native soil interface to evaluate if a release from the landfill has occurred, and if so, do concentrations of chemicals of interest in subsurface soils pose a potential risk to human health or the environment. No sampling from within the landfill cells themselves is planned to be conducted as part of Phase I for the Landfill No. 5 RFI. ~~this RFI or is planned in the future.~~ The subsurface soil samples collected will also be used to characterize the vertical distribution of contamination, so that the potential impact to groundwater can be addressed. However, dependent upon the analytical results collected during Phase I, additional samples may be collected in a future phase(s) of investigation to complete the RFI process. If during the Phase I investigation a release to the soil is shown or the potential for a release to occur in the future is suspected, the additional phase(s) of investigation would include characterization of the source area. Any future phase(s) of investigation may include activities to better define the horizontal and vertical extent of contamination beneath the landfill through the installation of additional soil borings, vadose zone vapor sampling, and/or contaminant migration modeling. Following the completion of the Phase I RFI for Landfill No. 5, addenda to this Work Plan would be prepared detailing the additional phase(s) of investigation.

4.4 DATA QUALITY REQUIREMENTS

Data quality requirements define the quality and quantity of data needed to achieve the objectives (principally completion of the future baseline risk assessment, if required, and/or to evaluate further investigative needs for Landfill No. 5) of the RFI. Data quality requirements address factors such as sampling plans, designation of critical data, data precision, accuracy, representativeness, comparability, and completeness, detection limits required, and quality assurance/quality control sampling. Quality assurance objectives, which describe the minimum quality of data necessary to achieve the task objectives, are specified in the Sampling and Analysis Plan (FSP and DCQAP) for all analytical data.

The primary objective of this RFI is to determine if hazardous material has been released from Landfill No. 5 resulting in an unacceptable risk to human health or the environment. This objective will be met by collecting data of the quality and quantity which are determined to be useable and sufficient by the end users to make decisions or identify data gaps. According to the DQO process, sampling locations will be selected so that this objective could be met as efficiently as possible. Specific sample locations will be selected based on: existing knowledge of wastes and waste handling practices at a Landfill No. 5, results of geophysical and soil gas surveys, knowledge of potential transport pathways from the landfill, and potential exposure pathways from Landfill No. 5 to receptors. Using these guidelines, sampling locations will be selected so that, with a high level of confidence based on professional judgment, all potential significant releases from a Landfill No. 5 will be detected and quantified.

~~4.5 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)~~
~~4.5 IDENTIFICATION OF RELEVANT AND APPLICABLE STANDARDS (RASs)~~

Both RCRA and CERCLA requirements for evaluating the nature and extent of hazardous wastes potentially occurring at Landfill No. 5 will be addressed in the investigations at Cannon AFB.

Cannon AFB must evaluate the SWMUs identified by the USEPA during the RFA as a condition of their RCRA Part B permit. The investigations conducted by W-C are designed to satisfy RFI guidance for characterizing the SWMUs and developing and implementing corrective action measures, if necessary.

Cannon AFB is conducting this investigation under ~~the conditions of their RCRA Part B permit and~~ the Air Force's IRP. ~~Cannon AFB's RCRA Part B permit requires that Cannon AFB identify all relevant and applicable standards for the protection of human health and the environment.~~ The IRP requires that the investigation follow the regulatory requirements of CERCLA and is the basis for assessment and response actions on USAF installations under the provisions of CERCLA. SARA augmented the scope and requirements of CERCLA and gave specific directives to federal facilities regarding investigation of waste disposal sites. Under SARA, determination of ARARs is required, and potential remediation alternatives should be considered at the initiation of a RI/FS (EPA 1988, 1989b).

As part of future CMS's (FS's under CERCLA), alternative remedial or corrective action measures will be evaluated to assess the degree to which they attain or exceed ~~relevant and applicable standards~~ ~~applicable or relevant and appropriate~~ federal and state public health and environmental standards.

A preliminary identification and discussion of ~~ARARs~~ RASs for the planned RFI at Cannon AFB is presented below. Review of these ~~ARARs~~ RASs will highlight any site-specific regulatory conditions that might either limit the choice of alternatives or place limits on contaminant concentrations at the site.

The ~~ARARs~~ RASs presented herein are chemical-specific and location-specific. Identification of action-specific ~~ARARs~~ RASs can only be addressed once detailed remedial alternatives are developed.

4.5.1 Definition of ~~ARARs~~ RASs

Cleanup standards for remedial actions must attain a general standard of cleanup that assures protection of human health and the environment, is cost-effective, and uses permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, SARA requires that any hazardous substance or pollutant remaining on site meet the level or standard of control established by standards, requirements, criteria, or limitations that have been established under any federal environmental law, or any more stringent standards, requirements, criteria, or limitations promulgated in accordance with a state environmental statute.

A requirement may be either applicable or relevant and appropriate to remedial activities at a site, but not necessarily both. Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a site.

If a regulation is not applicable, it may still be relevant and appropriate. The basic considerations are whether the requirement (1) regulates or addresses problems or situations sufficiently similar to those encountered at the subject site (i.e., relevance), and (2) is appropriate to the circumstances of the release or threatened release, such that its use is well suited to the particular site. Determining whether a requirement is relevant and appropriate is site-specific and must be based on best professional judgment. This judgment is based on a number of factors, including the characteristics of the remedial action, the hazardous substances present at the site, and the physical circumstances of the site and of the release, as compared to the statutory or regulatory requirement. Compliance with all requirements found to be applicable or relevant and appropriate is mandatory under SARA unless a waiver is obtained from EPA.

"To be considered" materials (TBCs) are nonpromulgated advisories, proposed rules, criteria, or guidance documents issued by federal or state governments that do not have the status of potential ~~ARARs~~ RASs. However, these advisories and guidance are to be considered when determining protective cleanup levels where no ~~ARAR~~ RAS exists, or where ~~ARARs~~ RASs are not sufficiently protective of human health and the environment. In these circumstances, TBC values are used to establish cleanup targets.

4.5.2 Chemical-Specific ARARS

The chemical-specific ~~ARARs~~ RASs and other criteria or guidelines to be considered are presented in Tables 4-1 and 4-2. This information is based on standards, guidelines, and criteria found in relevant literature, discussions with appropriate state regulatory agency personnel, and past project experience.

Chemical-specific requirements are based on health or risk-based concentration limits of discharge limitations in environmental media (i.e., water, soil) for specific hazardous chemicals. These requirements may be used to set cleanup levels for the chemicals of concern in the designated media, or to set a safe level of discharge (e.g., water, air, etc.) that may occur as part of the remedial activity.

Sources for potential target cleanup levels included selected standards, criteria, and guidelines that are typically considered as ~~ARARs~~ RASs for remedial actions conducted under CERCLA, as well as some recently published guidance and proposed action levels developed under RCRA that should be regarded as TBCs. In addition, New Mexico has developed cleanup levels for special wastes and underground storage tank-related remediation, as well as standards for groundwater. New Mexico has also defined toxic pollutants in its Water Quality Standards. Any contaminant or combination of contaminants from the list in WQCCR, Part 1, Section 101.UU found at detectable levels may have to be evalauted for risk to human health and the environment. A summary of these federal and state regulations, standards, and guidance is presented in Table 4-1.

For groundwater, MCLs ~~or non-zero Maximum Contaminant Level Goals (MCLGs)~~ established under the Safe Drinking Water Act (SDWA) are often accepted by regulatory agencies as cleanup levels for groundwater remedial activities, especially if the groundwater is or could be a drinking water source. ~~Non-zero maximum Contaminant Level Goals (MCLGs) are also established under the SDWA. However, MCLGs are not federally enforceable and should only be used if site-specific health risk conditions warrant their use.~~

Since groundwater in the vicinity of Cannon AFB is classified as a current source of drinking water (Class IIA Groundwaters), the identification of potential target cleanup levels for groundwater samples from Cannon AFB focused on standards, criteria, and guidelines primarily for drinking water. These standards include MCLs and MCLGs, as well as the New Mexico drinking water standards, and are presented in Table 4-2. Also included are hazardous constituent concentration limits under RCRA Subpart F, which are applicable to releases from RCRA-regulated units. Secondary maximum contamination levels (SMCLs) established under SDWA are also presented in Table 4-2 although they are not federally enforceable and should be regarded as TBCs. In addition, the MCLs for several chemicals (footnoted by [d] in Table 4-2) are not yet in effect and should be considered TBCs. If no value is shown for a possible contaminant in Table 4-2, there are currently no standards for that contaminant. Repeated nondetect analytical results for any constituent during routine groundwater monitoring may allow the constituent to be dropped from the list of analytes, subject to the approval of NMED and EPA.

State and federal standards and criteria for surface water quality are not considered applicable or relevant and appropriate as long as there is no possibility of remedial activities impacting surface water bodies. The nearest off-site surface water body is 1.1 miles from Landfill No. 5 and is upgradient, so there is little possibility of remedial activities impacting the off-site water body. Two playa lakes are located on Cannon AFB. One playa is located in the southwest section of the base, south of the runway area, and a second playa is located east of the wastewater sewage lagoons. The southwest playa receives storm water runoff from the western sections of the base, and the playa lake located east of the wastewater sewage lagoons receives treated effluent. Both base playa lakes are located upgradient from Landfill No. 5, and would likely not be impacted by remedial activities at Landfill No. 5. At one time, a playa lake was located immediately due west of the landfill; however, the lake has been filled in with rubble and construction debris so it can no longer be considered a surface water body. However, should any remediation of the landfill involve discharge of groundwater to a surface water body, compliance with both the state and federal surface water quality standards and criteria would be required.

A letter dated January 8, 1992 from Col. David Benson to the New Mexico Environmental Department states that asbestos containing materials had been disposed of in Landfill 5 in accordance with New Mexico Solid Waste Regulations, special Waste Requirements (USAF 1992). This regulation is considered applicable if asbestos waste continues to be disposed of in Landfill 5 or is removed and disposed of elsewhere.

4.5.3 TBCs

In general, very few cleanup standards exist for soil contamination. Often cleanup levels are based on guidance developed from Underground Storage Tank (UST) investigations or, if non-petroleum wastes are involved, levels are based on site-specific risk assessment, hazardous waste definition, or background levels. Recently some human health-based criteria for soil and water contaminant levels have been published as guidance for RFIs (hereinafter referred to as the RFI Guidance), and RCRA-related action levels have been proposed (Tables 4-3 and 4-4). However, these figures were developed specifically for application in RCRA-related activities, although it appears they are being used as proposed ~~ARARs~~ RASs where no other standards exist. These guidelines are presented, therefore, as TBCs rather than as chemical-specific RASs and represent "potential" cleanup levels only. Actual cleanup levels that may be applied to a particular area will depend on site-specific requirements based in part on the RCRA Facility Investigation and are subject to final approval by the appropriate regulatory agency or agencies. The RCRA levels are presented and used for the purposes of this ~~ARARs~~ RASs analysis because there are no other sources of standards or guidance for contaminated soils cleanup levels.

The RFI guidance levels presented in Tables 4-3 and 4-4 for cleanup of contaminated soils are based on EPA-derived chronic exposure assumptions and are intended as screening levels at RCRA facilities to determine if a more detailed health-risk evaluation (CMS) is warranted. As previously discussed, they do not necessarily represent a target cleanup level. The proposed RCRA Subpart S action levels, also presented in Tables 4-3 and 4-4, if exceeded, would also trigger a CMS. However, because these levels are only proposed, at this time they are not enforceable under RCRA (55 FR 30798, July 27, 1990). The equations used to derive the action levels/criteria use essentially identical parameters.

Other regulations or requirements that may need "to be considered" included the New Mexico UST Regulations and the New Mexico Special Waste Requirements Regulations. Those regulations set cleanup standards for soils contaminated with petroleum hydrocarbons (so called BTEX compounds and total petroleum hydrocarbons).

4.5.4 Location-Specific ~~ARARs~~ RASs

Although the universe of location-specific ~~ARARS~~ RASs is identified in Table 4-5, only those regulations that are deemed RASs for the Cannon site are discussed below. Location-specific ~~ARARs~~ RASs are restrictions placed on the types of activities that may occur in particular locations. Potential location-specific ~~ARARs~~ RASs for Cannon AFB are presented in Table 4-5 with an explanation as

to whether the regulation is applicable or relevant and appropriate and why. The location of a site may be an important characteristic in determining its impact on human health and the environment; thus, individual states may establish location-specific RASs. These ~~ARARs~~ RASs may restrict or preclude certain remedial actions or may apply only to certain portions of a site. Examples of location-specific ~~ARARs~~ RASs include federal and state requirements for preservation of historic landmarks, endangered species and wetlands protection, and the restrictions on management of hazardous waste in floodplain areas.

Due to the possible presence of both federal- and state-listed threatened/endangered (T/E) species at the site, the federal and state Endangered Species Acts are both considered "potentially" applicable. If T/E species are found at the site, these acts would be applicable. In addition, there are bald eagles, peregrine falcons, other raptors and waterfowl, and their habitat within a 50-mile radius of Cannon AFB (Lee Wan and Associates 1990). Both the Migratory Bird Treaty Act and the Bald Eagle Protection Act are considered applicable if any of the species protected by these two Acts or their habitats are impacted by remedial actions.

Section 106 of the National Historic Preservation Act, the Historic and Archaeological Data Preservation Act, and the Archaeological Resource Protection Act are also considered "potentially" applicable due to a federal agency having authority over any actions that could impact on historically significant objects, buildings, or structures at the site. Although no buildings, objects, or structures at Cannon AFB have yet been placed on the National Register of Historic Places, the evaluation process is still ongoing at the base. Due to both architectural and archaeological surveys being conducted on Cannon AFB, the State Cultural Properties Act is also considered "potentially" applicable and negotiations with the State Historic Preservation Office should be renewed prior to any remedial activity.

While there is uncertainty concerning the future definition of wetlands, it is the opinion of the U.S. Fish and Wildlife Service that the playas at the base fall under the current definition of wetland areas under federal wetland delineation guidance (Hagenbuck 1991). The federal regulations governing wetlands, however, are not considered RASs as long as the project does not impact the wetland areas. If the playa lakes on base continue to be considered wetlands and if the remedial activities should impact these wetland areas, then the regulations would be considered applicable and coordination with the U.S. Fish and Wildlife Service would need to be initiated prior to any remedial activity. The State of New Mexico does not have its own wetlands regulations at this time.

TABLE 4-1

SUMMARY OF POTENTIAL CHEMICAL-SPECIFIC ~~ARARS~~ ~~RAGs~~/TBCs CANNON AFB - LANDFILL 5

Standard, Requirement, or Criteria	Description	Comment
FEDERAL		
Safe Drinking Water Act (40 USC Sect. 300)		
National Primary Drinking Water Standards [40 CFR Parts 141, 142, (1990, 1991)	Establishes maximum contaminant levels (MCLs) for specific contaminants which are health-based standards for public drinking water systems.	MCLs are applicable for drinking water at the tap. MCLs are relevant and appropriate for organic and inorganic contamination of groundwater that is or may be used for drinking.
National Secondary Drinking Water Standards (40 CFR Part 143)	Establishes secondary maximum contaminant levels (SMCLs) which are nonenforceable guidelines for public drinking water systems to protect the aesthetic quality of the water.	SMCLs may be "to be considered" if groundwater is used as a drinking water source.
Maximum Contaminants Level Goals (MCLGs) [PL No. 99-339, 100 Stat. 642 (1986), (1990, 1991); 40 CFR 141,142]	Establishes drinking water quality goals at a level at which no adverse health effects may occur with an adequate margin of safety.	MCLGs set above zero levels are relevant and appropriate for existing or potential sources of drinking water. MCLGs may be relevant and appropriate if the risk posed by multiple contaminants or pathways is in excess of 10^{-4}.
Resource, Conservation, and Recovery Act (RCRA)		
Releases from Solid Waste Management Units (40 CFR Part 264)	Subpart F (264.94) gives concentration limits in groundwater for hazardous constituents from a regulated unit.	Applicable if organic and inorganic contamination of groundwater is found at a RCRA regulated unit.

TABLE 4-1
SUMMARY OF
POTENTIAL CHEMICAL-SPECIFIC ~~ARARS~~ RASs/ TBCs
CANNON AFB - LANDFILL 5

Standard, Requirement, or Criteria	Description	Comment
RCRA Facility Investigation Guidance (EPA, 1989)	Guidance levels for cleanup of contaminated soils based on EPA-derived chronic exposure assumptions; intended as screening levels at RCRA facilities to determine if a more detailed health-risk evaluation is warranted.	To be considered if contaminated soils are found.
Proposed RCRA Action Levels (55 FR 30798, 27 July 1990)	Risk-based action levels for contaminants in soil which, if exceeded, would trigger the need for a Corrective Measures Study.	To be considered if contaminated soils are found.
STATE		
New Mexico Water Quality Act, 1978		
New Mexico Drinking Water Regulations (4/16/91)(New Mexico Water Supply Regulations, Sections 202 to 203)	Establishes MCLs and standards for sources of drinking water.	State MCLs are applicable or relevant and appropriate to contaminated water if the state MCL is more stringent than federal requirements.
New Mexico Water Quality Regulations, amended through August 17, 1991 (WQCCR Part 3, Sections 100 through 103)	Establishes human health, domestic water supply, and irrigation use standards for ground water protection.	Applicable if remedial activities include discharges onto or below the surface of the ground.
~~New Mexico Water Quality Regulations, amended through August, 1991 (WQCCR Part1, Section 101.UU)~~	~~Establishes definition of toxic pollutant based on effects to human health and the environment. Requires a determination of health and environmental risk due to the presence of the contaminant.~~	~~Applicable if groundwater related to the source area contains any of the contaminants listed in the definition of toxic pollutants.~~

TABLE 4-1
SUMMARY OF
POTENTIAL CHEMICAL-SPECIFIC ~~ARARS~~ RAGs/ TBCs
CANNON AFB - LANDFILL 5

Standard, Requirement, or Criteria	Description	Comment
New Mexico Hazardous Waste Act 1978		
New Mexico Underground Storage Tank Regulations, amended through July 18, 1991, Section 1209	Sets cleanup levels for soils contaminated with benzene, aromatic hydrocarbons, or petroleum products.	May be "to be considered" if soils are contaminated with benzene, aromatic hydrocarbons, or petroleum products.
New Mexico Solid Waste Regulations		
New Mexico Special Waste Requirements Regulations, adopted effective January 30, 1992, Part VII	Sets disposal levels for soils contaminated with BTEX compounds and total petroleum hydrocarbons. Also sets disposal standards for asbestos waste.	May be "to be considered" if soils are contaminated with petroleum hydrocarbons. Asbestos requirements may be applicable if asbestos waste continues to be disposed in Landfill 5 or is removed and placed elsewhere.

TABLE 4-2

POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs GROUNDWATER QUALITY STANDARDS CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
pH	Field Parameter	6.5-8.5*					6.0-9.0	6.0-9.0
Total Dissolved Solids	Indicator	500,000 ug/l*					1,000,000 ug/l	1,000,000 ug/l
Carbonate	Anion							
Chloride	Anion	250,000 ug/l*					250,000 ug/l	250,000 ug/l
Fluoride	Anion	4,000 ug/l, 2,000 ug/l*	4,000 ug/l		4,000 ug/l	1,600 ug/l		1,600 ug/l
N as Nitrate	Anion	10,000 ug/l	10,000 ug/l(c)		10,000 ug/l	10,000 ug/l		10,000 ug/l
N as Nitrate+Nitrite	Anion	10,000 ug/l(c)	10,000 ug/l(c)					
N as Nitrite	Anion	1,000 ug/l(c)	1,000 ug/l(c)					
Potassium	Anion							
Sulfate	Anion	250,000 ug/l*					600,000 ug/l	600,000 ug/l
Aluminum	Metal	0.5 to 200 ug/l*(c)						5,000 ug/l
Antimony	Metal	6 ug/l(d)	6 ug/l(d)					
Arsenic	Metal	50 ug/l		50 ug/l	50 ug/l	100 ug/l		100 ug/l
Barium	Metal	2,000 ug/l(e)	2,000 ug/l(e)	1,000 ug/l	1,000 ug/l	1,000 ug/l		1,000 ug/l
Beryllium	Metal	4.0 ug/l(d)	4 ug/l(d)					
Boron	Metal							750 ug/l
Cadmium	Metal	5 ug/l(c)	5 ug/l(c)	10 ug/l	10 ug/l	10 ug/l		10 ug/l
Calcium	Metal							
Chromium	Metal	100 ug/l(c)	100 ug/l(c)	50 ug/l	50 ug/l	50 ug/l		50 ug/l

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Cobalt	Metal							50 ug/l
Copper	Metal	1,000 ug/l*	1,300 ug/l(f)				1,000 ug/l	1,000 ug/l
		1,300 ug/l***						
Cyanide	Metal	200 ug/l(d)	200 ug/l(d)			200 ug/l		200 ug/l
Iron	Metal	300 ug/l*					1,000 ug/l	1,000 ug/l
Lead	Metal	50 ug/l	0(f)	50 ug/l	50 ug/l	50 ug/l		50 ug/l
		15 ug/l***						
Magnesium	Metal							
Manganese	Metal	50 ug/l*					200 ug/l	200 ug/l
Mercury	Metal	2 ug/l	2 ug/l(c)	2 ug/l	2 ug/l	2 ug/l		2 ug/l
Molybdenum	Metal							1,000 ug/l
Nickel	Metal	100 ug/l(d)	100 ug/l(d)					200 ug/l
Selenium	Metal	50 ug/l(c)	50 ug/l(c)	10 ug/l	10 ug/l	50 ug/l		50 ug/l
Silver	Metal	100 ug/l*(c)		50 ug/l	50 ug/l	50 ug/l		50 ug/l
Sodium	Metal							
Thallium	Metal	2 ug/l(d)	0.5 ug/l(d)					
Tin	Metal							
Titanium	Metal							
Tungsten	Metal							
Vanadium	Metal							

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Zinc	Metal	5,000 ug/l*					10,000 ug/l	10,000 ug/l
Gross Alpha	Radionuclide	15 pCi/l			15 pCi/l			
Gross Beta	Radionuclide	4 mrem/yr						
Radium 226+228	Radionuclide	5 pCi/l			5 pCi/l	30 pCi/l		30 pCi/l
Strontium 90	Radionuclide	8 pCi/l			8 pCi/l			
Tritium	Radionuclide	20,000 pCi/l			20,000 pCi/l			
Uranium (total)	Radionuclide					5,000 ug/l		5,000 ug/l
1,1-Dichloroethane	Volatile					25 ug/l		25 ug/l
1,1-Dichloroethene	Volatile	7 ug/l	7 ug/l		7 ug/l	5 ug/l		5 ug/l
1,1,1-Trichloroethane	Volatile	200 ug/l	200 ug/l		200 ug/l	60 ug/l		60 ug/l
1,1,2,2-Tetrachloroethane	Volatile					10 ug/l		10 ug/l
1,1,2,2-Tetrachloroethene	Volatile					20 ug/l		20 ug/l
1,1,2-Trichloroethane	Volatile	5 ug/l(d)	3 ug/l(d)			10 ug/l		10 ug/l
1,1,2-Trichloroethene	Volatile					100 ug/l		100 ug/l
1,2-Dichloroethane	Volatile	5 ug/l	0 ug/l		5 ug/l	10 ug/l		10 ug/l
1,2-Dichloroethene	Volatile							
1,2-Dichloropropane	Volatile	5 ug/l(c)	0 ug/l(c)					
4-Methyl-2-pentanone	Volatile							
Acetone	Volatile							
Benzene	Volatile	5 ug/l	0 ug/l		5 ug/l	10 ug/l		10 ug/l

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASS~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Bromodichloromethane	Volatile							
Bromoform	Volatile	Tot THM* <100 ug/l						
Bromomethane	Volatile							
Carbon Tetrachloride	Volatile	5 ug/l	0 ug/l		5 ug/l	10 ug/l		10 ug/l
Chlorobenzene (mono)	Volatile	100 ug/l(c)	100 ug/l(c)					
Chlorobenzilate	Volatile							
Chloroethane	Volatile							
Chloroform	Volatile	Tot THM** <100 ug/l			Tot THM** 100 ug/l	100 ug/l		100 ug/l
Chloroprene	Volatile							
Chloromethane	Volatile							
Cis-1,2-Dichloroethene	Volatile	70 ug/l(c)	70 ug/l(c)					
Cis-1,3-Dichloropropene	Volatile							
Dibromochloromethane	Volatile	Tot THM** <100 ug/l						
Ethyl Benzene	Volatile	700 ug/l(c)	700 ug/l(c)			750 ug/l		750 ug/l
Methylene Chloride	Volatile	5 ug/l(d)	0 ug/l(d)			100 ug/l		100 ug/l
Styrene	Volatile	100 ug/l(c)	100 ug/l(c)					
Tetrachloroethanes	Volatile							
Tetrachloroethene	Volatile	5 ug/l(c)	0 ug/l(c)					

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Toluene	Volatile	1,000 ug/l(c)	1,000 ug/l(c)			750 ug/l		
Total Trihalomethanes	Volatile	100 ug/l						
Total Xylenes	Volatile	10,000 ug/l(c)	10,000 ug/l(c)			620 ug/l		620 ug/l
Trans-1,2-Dichloroethene	Volatile	100 ug/l(c)	100 ug/l(c)					
Trans-1,3-Dichloropropene	Volatile							
Trichloroethanes	Volatile							
Trichloroethene	Volatile	5 ug/l	0 ug/l		5 ug/l			
Vinyl Acetate	Volatile							
Vinyl Chloride	Volatile	2 ug/l	0 ug/l		2 ug/l	1ug/l		1 ug/l
1,2-Dichlorobenzene (ortho)	Semi-Volatile	600 ug/l(c)	600 ug/l(c)					
1,3-Dichlorobenzene (meta)	Semi-Volatile	600 ug/l	600 ug/l					
1,4-Dichlorobenzene (para)	Semi-Volatile	75 ug/l	75 ug/l		75 ug/l			
1,2,4-Trichlorobenzene	Semi-Volatile	70 ug/l(d)	70 ug/l(d)					
2-Chloronaphthalene	Semi-Volatile							
2-Chlorophenol	Semi-Volatile							
2-Methylnaphthalene	Semi-Volatile							
2-Nitroaniline	Semi-Volatile							
2-Nitrophenol	Semi-Volatile							
2,3,7,8-Tetrachlorodibenzo-p-dioxin	Semi-Volatile	$3x10^{-8}$(d)	0 ug/l(d)					

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
2,4-Dichlorophenol	Semi-Volatile							
2,4-Dichlorophenoxyacetic Acid (2,4-D)	Semi-Volatile (H)	70 ug/l(c)	70 ug/l(c)	100 ug/l	100 ug/l			
2,4-Dimethylphenol	Semi-Volatile							
2,4-Dinitrophenol	Semi-Volatile							
2,4-Dinitrotoluene	Semi-Volatile							
2,4,5-TP Silvex	Semi-Volatile (H)	50 ug/l(c)	50 ug/l(c)	10 ug/l	10 ug/l			
2,4,6-Trichlorophenol	Semi-Volatile							
3-Nitroaniline	Semi-Volatile							
4-Bromophenyl Phenylether	Semi-Volatile							
4-Chloroaniline	Semi-Volatile							
4-Chlorophenyl Phenyl Ether	Semi-Volatile							
4-Chloro-3-methylphenol	Semi-Volatile							
4-Nitroaniline	Semi-Volatile							
4,6-Dinitro-2-methylphenol	Semi-Volatile							
Acenaphthalene	Semi-Volatile							
Acrylonitrile	Semi-Volatile							
Alachlor	Semi-Volatile	2 ug/l	0 ug/l					
Aldicarb	Semi-Volatile (P)	3 ug/l(e)	1 ug/l(e)					
Aldicarb Sulfone	Semi-Volatile (P)	2 ug/l	1 ug/l					

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ RASs/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Aldicarb Sulfoxide	Semi-Volatile (P)	4 ug/l	1 ug/l					
Aldrin	Semi-Volatile (P)							
Aniline	Semi-Volatile							
Anthracene	Semi-Volatile							
Atrazine	Semi-Volatile	3 ug/l(c)	3 ug/l(c)					
Benzo(a)anthracene	Semi-Volatile							
Benzo(a)pyrene	Semi-Volatile	0.2 ug/l(d)	0 ug/l(d)			0.7 ug/l		0.7 ug/l
Benzo(b)fluoranthene	Semi-Volatile							
Benzo(g,h,i)perylene	Semi-Volatile							
Benzo(k)fluoranthene	Semi-Volatile							
Benzyl Alcohol	Semi-Volatile							
Bis(2-Chloroethoxy)methane	Semi-Volatile							
Bis(2-Chloroethyl)ether	Semi-Volatile							
Bis(2-Chloroisopropyl)ether	Semi-Volatile							
Bis(2-Ethylhexyl)phthalate	Semi-Volatile							
Butyl Benzylphthalate	Semi-Volatile							
Carbofuran	Semi-Volatile (P)	40 ug/l(c)	40 ug/l(c)					
Carbon Disulfide	Semi-Volatile							
Chlordane	Semi-Volatile (P)	2 ug/l(c)	0 ug/l(c)					
Chlorophenol	Semi-Volatile							

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ RASs/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
DDT	Semi-Volatile (P)							
DDT metabolite (DDE)	Semi-Volatile (P)							
DDT metabolite (DDD)	Semi-Volatile (P)							
Dalapon	Semi-Volatile (P)	200 ug/l(d)	200 ug/l(d)					
Diallite	Semi-Volatile							
Dibenzofuran	Semi-Volatile							
Dibenz(a,h)anthracene	Semi-Volatile							
Dibromochloropropane	Semi-Volatile (P)	0.2 ug/l	0 ug/l					
Dichlorobenzene	Semi-Volatile							
Dichlorobenzidine	Semi-Volatile							
Dieldrin	Semi-Volatile (P)							
Di(2-ethylhexyl)adipate	Semi-Volatile (P)	400 ug/l(d)	400 ug/l(d)					
Diethylphthalate	Semi-Volatile							
Di(2-ethylhexyl)phthalate	Semi-Volatile	6.0 ug/l(d)	0 ug/l(d)					
Dimethoate	Semi-Volatile							
Dimethylphthalate	Semi-Volatile							
Dinitrotoluene	Semi-Volatile							
Dinoseb	Semi-Volatile(H)	7 ug/l(d)	7 ug/l(d)					
Di-n-octylphthalate	Semi-Volatile							
Diquat	Semi-Volatile(P)	20 ug/l(d)	20 ug/l(d)					

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ [redacted]/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Endosulfan I	Semi-Volatile (P)							
Endosulfan II	Semi-Volatile (P)							
Endosulfan Sulfate	Semi-Volatile (P)							
Endothall	Semi-Volatile (P)	100 ug/l	100 ug/l					
Endrin	Semi-Volatile (P)	2.0 ug/l(d)	2.0 ug/l(d)	0.2 ug/l	0.2 ug/l			
Ethylene Dibromide	Semi-Volatile	0.05 ug/l(c)	0 ug/l(c)			0.1 ug/l		0.1 ug/l
Fluoranthene	Semi-Volatile							
Fluorene	Semi-Volatile							
Glyphosate	Semi-Volatile(P)	700 ug/l(d)	700 ug/l(d)					
Heptachlor	Semi-Volatile (P)	0.4 ug/l(c)	0 ug/l(c)					
Heptachlor Epoxide	Semi-Volatile (P)	0.2 ug/l(c)	0 ug/l(c)					
Hexachlorobenzene	Semi-Volatile	1.0 ug/l(d)	0 ug/l(d)					
Hexachlorobutadiene	Semi-Volatile							
Hexachlorocyclohexane, Alpha	Semi-Volatile (P)							
Hexachlorocyclohexane, Beta	Semi-Volatile (P)							
Hexachlorocyclohexane, (Lindane)	Semi-Volatile (P)	0.2 ug/l(c)	0.2 ug/l(c)	4 ug/l	4 ug/l			
Hexachlorocyclohexane, Technical	Semi-Volatile (P)							
Hexachlorocyclopentadiene	Semi-Volatile	50 ug/l(d)	50 ug/l(d)					
Hexachloroethane	Semi-Volatile							

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ RASs/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Indeno(1,2,3-cd)pyrene	Semi-Volatile							
Methoxychlor	Semi-Volatile (P)	40 ug/l	40 ug/l(c)	100 ug/l	100 ug/l			
Naphthalene	Semi-Volatile							
Nitrobenzene	Semi-Volatile							
Nitrophenols	Semi-Volatile							
Nitrosodibutylamine	Semi-Volatile							
Nitrosodiethylamine	Semi-Volatile							
Nitrosodimethylamine	Semi-Volatile							
Nitrosopyrrolidine	Semi-Volatile							
N-Nitrosodiphenylamine	Semi-Volatile							
N-Nitroso-di-n-dipropylamine	Semi-Volatile							
Oxamyl	Semi-Volatile(P)	200 ug/l(d)	200 ug/l(d)					
PCBs	PCBs	0.5 ug/l(c)	0 ug/l(c)			1 ug/l		1 ug/l
Pentachlorinated Ethanes	Semi-Volatile							
Pentachlorophenol	Semi-Volatile	1 ug/l(c)	0 ug/l(e)					
Phenanthrene	Semi-Volatile							
Phenol	Semi-Volatile				5 ug/l		5 ug/l	5 ug/l
Picloram	Semi-Volatile (H)	500 ug/l	500 ug/l					
Polynuclear Aromatic Hydrocarbons (total PAH)	Semi-Volatile				30 ug/l	30 ug/l		30 ug/l

TABLE 4-2
POTENTIAL SITE-WIDE CHEMICAL-SPECIFIC ~~ARARs~~ ~~RASs~~/TBCs
GROUNDWATER QUALITY STANDARDS
CANNON AFB - LANDFILL 5

		FEDERAL STANDARDS			STATE STANDARDS NMWQCC Groundwater Quality Standards (g)			
Parameter	Type	SDWA Maximum Contaminant Level (a)	SDWA Maximum Contaminant Level Goal (a) ARARs/TBCs	RCRA Subpart F Concentration Limit (40 CFR 264.94) (b)	Community Water Supply System (h)	Human Health	Other Standards for Domestic Water Supply	Irrigation Use
Pyrene	Semi-Volatile							
Simazine	Semi-Volatile(P)	4 ug/l(d)	4 ug/l(d)					
Trans-1,2-Dichloroethene	Semi-Volatile	100 ug/l	100 ug/l					
Toxaphene	Semi-Volatile (P)	3 ug/l(c)	0 ug/l(c)	5 ug/l	5 ug/l			

EXPLANATION OF TABLE

(P) Pesticide (H) Herbicide

* = secondary maximum contaminant level (TBCs)
** = total trihalomethanes: chloroform, bromoform, bromodichloromethane, dibromochloromethane
*** = action levels in no more than 10% of tap samples, 56 FR 26460, 6/7/91, effective 12/7/92

NMWQCC = New Mexico Water Quality Control Commission
RCRA = Resource Conservation and Recovery Act
SDWA = Safe Drinking Water Act
(a) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR 141 and 40 CFR 143 (as of 5/1990)
(b) NCP, 40 CFR 300; NCP Preamble 55 FR 8764; CERCLA Compliance with Other Laws Manual EPA/540/G-89/006, August 1988
(c) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective July 30, 1992 (56 Federal Register 3526; 1/30/91)
(d) EPA National Primary Drinking Water Regulations, 40 CFR 141 and 40 CFR 142, Final Rule (57FR 31776, 7/17/92); Effective date is January 17, 1994, (therefore TBCs) except for endrin, which is effective 8/17/92.
(e) EPA National Primary and Secondary Drinking Water Regulations, 40 CFR Parts 141, 142, 143, Final Rule, Effective January 1, 1993 (56 FR 30266, 7/01/91)
(f) EPA Maximum Contaminant Level Goals and National Primary Drinking Water Regulations for Lead and Copper, 40 CFR 141 and 142; effective December 7, 1992 (56 FR 26460, 6/7/91)
(g) NM Water Quality Control Commission, NM Water Quality Regulations, Part 3, Section 3-103, 11/16/1967 amended through August 17, 1991
(h) New Mexico Drinking Water/Water Supply Regulations, adopted April 16, 1991

If no values are shown for a possible contaminant, there are no standards at this time.

TABLE 4-5

SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ [redacted]
CANNON AFB - LANDFILL 5

Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
Resource Conservation and Recovery Act (RCRA)			
1. New facilities where treatment, storage or disposal of hazardous waste will be conducted is prohibited within 61 meters (200 feet) of a fault displaced in Holocene time [40 CFR 264.18(a)]*	No	No	Treatment, storage and disposal of waste will not be conducted within 61 meters of a fault displaced in Holocene time.
2. New facilities where treatment, storage or disposal of hazardous waste will be conducted is prohibited within the 100-year floodplain. [40 CFR 264.18(b)]*	No	No	Treatment, storage and disposal of waste will not be conducted within the 100-year floodplain of adjacent rivers.
3. Prohibits noncontainerized or bulk liquid hazardous waste placement in salt domes, salt bed formations, and underground mines or caves. [40 CFR 264.18(c)]*	No	No	No action which would place waste in a salt dome or salt bed formation, underground mine or cave is anticipated at this site.
E.O. 11988 Protection of Floodplains			
4. Limits activities in floodplain. Floodplain is defined as "the lowland and relatively flat areas adjoining inland and coastal waters including flood prone areas of off-shore islands, including at a minimum, that area subject to a one percent or greater chance of flooding in any given year." [40 CFR 6, Appendix A and 40 CRF 6.302]	No	No	Remedial activities will not be conducted within any floodplains.

*Adopted by the State of New Mexico and incorporated within Part V of the New Mexico Hazardous Waste Management Regulations.

TABLE 4-5
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ RASs
CANNON AFB - LANDFILL 5

Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
E.O. 11990 Protection of Wetlands			
5. Minimizes impacts on areas designated as wetlands. [40 CRF 6, Appendix A]	No	No	Although playas are considered wetlands by the U.S. Fish and Wildlife Service, regulations are applicable only if the remedial activities impact the wetland areas. No impacts to the wetland areas are anticipated at this time.
Clean Water Act Section 404			
6. Action to prohibit discharge of dredged or fill material into waters of U.S. without permit. [33 USC 1251; 40 CFR 230; 33 CFR 320-330]	No	No	Dredge and fill permit requirements will not apply as no waters of the U.S. will be impacted by remedial activities on the site.
7. Requires Federal agencies to avoid, to the extent possible, adverse impacts associated with destruction or loss of wetlands	No	No	As described above, although wetlands are considered by the U.S. Fish and Wildlife Service to occur on the base in the form of playas, regulations are applicable only if the remedial activities impact the wetland area.

TABLE 4-5
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ RASs
CANNON AFB - LANDFILL 5

Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
Endangered Species Act			
8. Protects endangered species and threatened species and preserves their habitat. [16 USC 1531 et sequence; 50 CFR 200, 50 CFR 402]	Yes	---	Although Walk, Haydel & Associates report in their Remedial Investigation that there are no critical habitats in the immediate vicinity of the site (according to the Wildlife Management Plan for the base), two federally listed endangered species are known to inhabit the area within a 50-mile radius of the site (Lee Wan & Associates, Inc., 6/90).
Bald Eagle Protection Act			
9. Protects all eagle species and restricts activities that may threaten or adversely affect their habitat (16 USC Section 688 et. seq)	Yes	---	If eagle species are found to occur on the base, special protection provisions will need to be coordinated with US Fish and Wildlife Service. Bald eagles are known to inhabit the area within a 50-mile radius of the site (Lee Wan & Associates, Inc., 6/90).
Migratory Bird Treaty Act			
10. Protects migratory, resident, or range habitat of migratory birds including raptors and waterfowl. (16 USC Section 703 et. seq).	Yes	--	Remedial actions cannot threaten or adversely affect the habitats of migratory waterfowl or raptors.

TABLE 4-5
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ RASs
CANNON AFB - LANDFILL 5

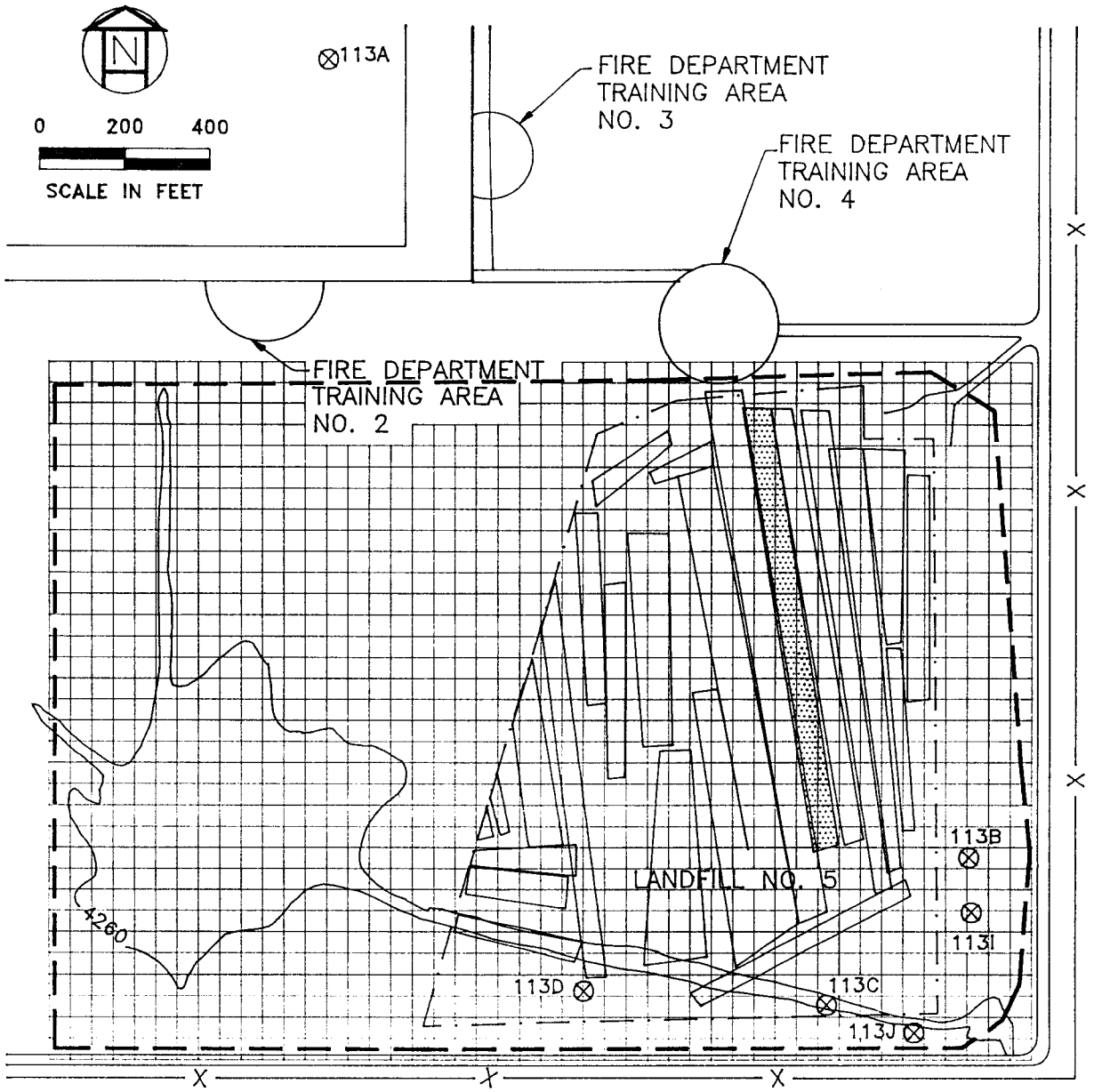
Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
Wilderness Act			
11. Limits activities within an area designed as a wilderness area. [16 USC 1311 et seq.; 50CFR 53.1 et seq.]	No	No	The site is not within a federally-owned area designated as a wilderness area.
12. Limits the type of activities permitted in an area designated as a National Wildlife Refuge system [16 USC 668 et seq.; 50 CFR Part 27]	No	No	The site is not in an area designated as part of the National Wildlife Refuge System (the closest NWRS are over 25 miles from the site).
Fish and Wildlife Coordination Act			
13. Prohibits activities affecting/modifying streams or bodies of water if the activity has a negative impact on fish or wildlife. [16 USC 661 et seq.; 33 CFR Parts 320-330; 40 CFR 6.302]	No	No	As described above, no streams, rivers, or playas will be impacted by remedial activities.
Wild and Scenic Rivers Act			
14. Protects rivers that are designated as wild, scenic or recreational. [16 USC 1271; 40 CFR 6.302(e)]	No	No	No rivers designated as wild, scenic or recreational will be affected by remedial activities.

TABLE 4-5
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ [redacted]
CANNON AFB - LANDFILL 5

Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
National Historic Preservation Act (NHPA)			
15. Requires the preservation of historic properties included in or eligible for the National Register of Historic Places and to minimize harm to National Historic Landmarks. [16 USC 470 et seq.; 7 CFR 650; 36 CFR Part 65, Part 800]	Yes	---	Pursuant to Section 106 of NHPA, proposed federal undertaking in any state shall take into consideration the effect of the undertaking on any site, building, structure, or object that is included or eligible for inclusion in the National Register; nothing has been placed on the register to date, but surveys are ongoing. Also applicable if historical sites are discovered during a remedial action or if known historical sites exist near a remedial action site.
The Historic and Archaeological Data Preservation Act of 1974			
16. Establishes procedures to provide for preservation of historical and archaeological data which might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity program (16 USC 469, 40 CFR 6.301(c))	Yes	---	May be available if remedial activities affect historical and/or undiscovered archaeological data of the site.
The Archaeological Resource Protection Act of 1979			
17. Requires a permit for any excavation or removal of archaeological resources form public or Indian lands (16 USC 470aa-47011)	Yes	---	May be applicable if any remedial activity involves removal of archaeological resources; substantive requirements need to be met.

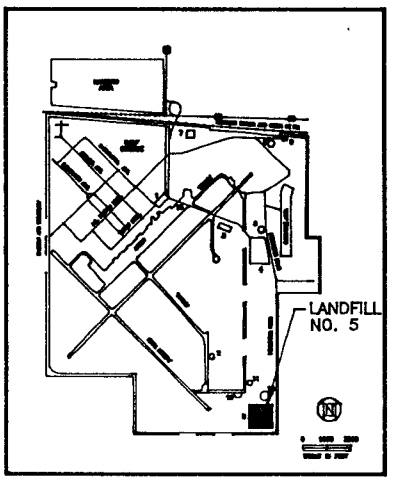
TABLE 4-5
SUMMARY OF POTENTIAL LOCATION-SPECIFIC ~~ARARs~~ RASs
CANNON AFB - LANDFILL 5

Requirement	Potentially Applicable?	Potentially Relevant and Appropriate?	Comments
Coastal Zone Management Act			
18. Limits activities affecting the coastal zone, including lands thereunder and adjacent shorelands. [16 USC Section 1451 et sequence]	No	No	The site is not located in the coastal zone management area.
State Regulations			
Endangered Species Act (New Mexico Regulation 682)			
19. Requires coordination with the Department of Game and Fish if activities impact on endangered/ threatened species or their habitat.	Yes	---	As stated above, although Walk, Haydel & Associates report in their Remedial Investigation that there are no significant habitats in the immediate vicinity of the site, state listed threatened/ endangered species have been identified at or near the base.
1978 New Mexico State Cultural Properties Act (Sections 18-6-1 through 18-6-17 NMSA 1978)			
20. Provides for the preservation, protection, and enhancement of structures, sites, and objects of historical significance within the State.	Yes	--	Although the Cannon AFB site, including its properties/buildings are not listed on the State Register of Historic Places, coordination with the State Historic Preservation Office is ongoing with respect to the historical and archaeological surveys that have been conducted at the base; State laws closely follow the federal laws.



LEGEND

⊗ 113C	MONITORING WELL LOCATION
— —	SWMU BOUNDARY
— · —	FENCE BOUNDARY
———	CELL BOUNDARY
▒	RCRA REGULATED CELL #3, (CAPPED) NO FURTHER FIELDWORK PLANNED FOR THIS AREA UNDER THIS INVESTIGATION
———	PLANNED GEOPHYSICAL AND SOIL GAS SURVEY GRID LINE



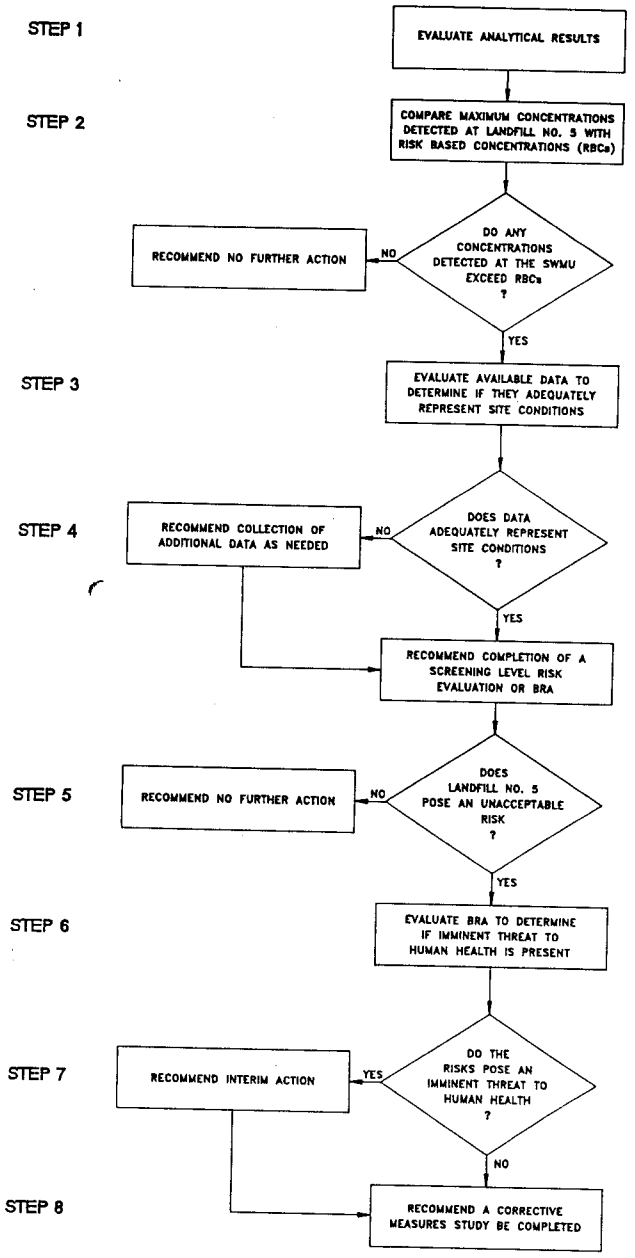
Job No. :	C3M11M
Prepared by :	B.J.R.
Date :	8/22/93

LANDFILL NO.5 CELL AND GRID LOCATION MAP
SWMU NO. 113
CANNON AFB, NEW MEXICO

3M11F31

FIG. 4-1

OBJECTIVE: DETERMINE IF A RELEASE OF CHEMICALS OF INTEREST HAS OCCURED THAT COULD POSE A POTENTIAL RISK TO HUMAN HEALTH OR THE ENVIRONMENT.



NOTE: THIS PHASE I RFI DOES NOT INCLUDE STEP 5 THROUGH STEP 8.

C3M11WSO

Job No. : C3M11M	CANNON AIR FORCE BASE PHASE I RFI – LANDFILL NO. 5
Prepared by : J.T.A.	DECISION DIAGRAM
Date : 12/14/93	

FIG. 4–2

B1.0
INTRODUCTION

A RCRA Facility Investigation (RFI), Phase I will be conducted to further evaluate the nature and extent of contamination and human health risks associated with Landfill No. 5, Solid Waste Management Unit No. 113 Installation Restoration Program No. LF-5 (SWMU No. 113/IRP No. LF-5) at Cannon Air Force Base, Clovis, New Mexico. The results of the Phase I investigation will be used to evaluate potential corrective measures (remedial alternatives under CERCLA) for closure of Landfill No. 5.

Field investigation planned for the Phase I investigation will include a geophysical survey, soil gas survey, and the collection of surface and subsurface soil samples. Results of past investigations are discussed in the Field Investigation Section of the Data Collection Quality Assurance Plan which is included as Volume II to the Phase I Work Plan for this RFI.

This Project Management Plan will be used to manage the following RFI tasks:

- Project Planning (including schedule and budget control)
- Field Investigation
- Sample Analysis and Validation
- Data Evaluation
- Risk Assessment
- Preliminary Remedial Alternative and Correction Measures Development and Screening
- RFI Reports
- Community Relations Support

The Scope of Work for the above tasks is presented in the RFI Work Plan.

B3.0
PROJECT SCHEDULE

The overall Phase I RFI project schedule is shown in Figure B3-1. The estimated time duration for each Phase I RFI task is also shown. This phase of the project is expected to be completed by August 1995 when the Final Phase I RFI report is transmitted. This schedule assumes no delays caused by regulatory review or any force majeure.

The project schedule assumes that regulatory agency review of and comment (if required) on the Work Plan documents and the Draft Phase I RFI report will take place during the same time period in which Cannon AFB and the USACE personnel are reviewing and commenting on said revised plans and draft reports.

The W-C project manager will be responsible for ensuring that the project remains on schedule except in instances where force majeure or items such as regulatory review time are beyond his/her control. As stipulated in Cannon AFB's RCRA Part B permit, the RFI report will be submitted to the agency for review 60 days after completion of the RFI. For the purposes of this schedule, this phase of the RFI will be deemed complete after USACE and Cannon AFB have reviewed the Pre-Draft Phase I RFI report for completeness. The schedule shown in Figure B3-1 will be updated as necessary as the project progresses, however, duration of each RFI schedule element will remain the same.

Date: 02/03/94

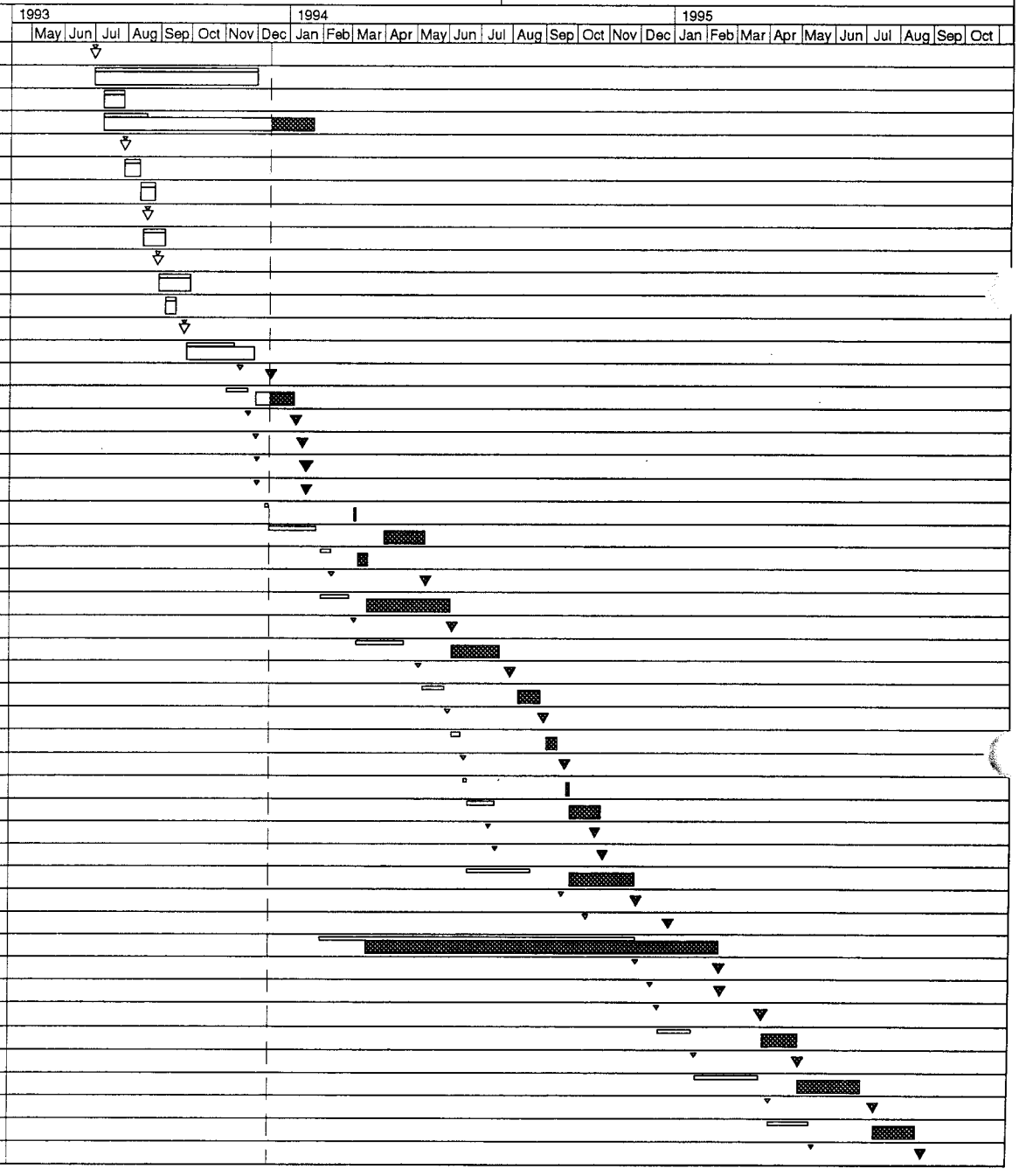
C3M11M | Page 1 / 1

Project Finish: 08/27/95

FIGURE B3-1
USACE - CANNON AIR FORCE BASE
LANDFILL No. 5 RFI SCHEDULE

Legend: Critical, Non-Crit., Summary, Hammock, Plan, Early, Subproject

Description	Dur	Start	Finish
Award Work Order	0	06/30/93	06/30/93
Project Planning and Events	0	06/30/93	12/02/93
ARAR's Analysis	0	07/09/93	07/29/93
Prepare Pre-Draft RFI Work Plans	42	12/14/93	01/24/94
ARAR's Submittal	0	07/29/93	07/29/93
USACE and USAF ARARs Review	0	07/30/93	08/12/93
Revise ARARs	0	08/13/93	08/27/93
Pre-Draft RFI Work Plans Submittal	0	08/20/93	08/20/93
USACE and USAF Review of Pre-Draft Work Plans	0	08/16/93	09/06/93
ARARs Distribution	0	08/30/93	08/30/93
NMED ARARs Review	0	08/31/93	09/29/93
Revise Pre-Draft RFI Work Plans	0	09/06/93	09/16/93
Draft RFI Work Plans Submittal	0	09/24/93	09/24/93
USACE, USAF, USEPA, NMED Review Draft RFI WP	0	09/27/93	11/29/93
RFI Work Plan Meeting	0	12/15/93	12/15/93
Revise Draft RFI Work Plans	24	12/14/93	01/06/94
Submit Pre-Work Plans to USACE and USAF	0	01/07/94	01/07/94
USACE and USAF Approval of RFI Work Plans	0	01/14/94	01/14/94
Pre-Work Safety Meeting	0	01/17/94	01/17/94
USACE and USAF Authorization to Proceed	0	01/17/94	01/17/94
Mobilization - Phase I	3	03/04/94	03/06/94
Soil Gas Survey	39	04/03/94	05/11/94
Geophysical Survey	10	03/08/94	03/17/94
Demobilization - Phase I	0	05/11/94	05/11/94
Plot/Analysis Soil Gas Survey and Geophysics	80	03/17/94	06/04/94
Draft Soil Gas Survey and Geophysics Submittal	0	06/05/94	06/05/94
NMED Review of Soil Gas Survey and Geophysics	45	06/06/94	07/20/94
Submit Phase II Soil Boring Plan	0	07/31/94	07/31/94
NMED Review of Phase II Soil Boring Plan	21	08/08/94	08/28/94
Phase II Soil Boring Program Meeting	0	08/31/94	08/31/94
Revise Phase II Soil Boring Plan	11	09/04/94	09/14/94
USACE and USAF Approval of Phase II Boring Plan	0	09/20/94	09/20/94
Mobilization - Phase II	4	09/22/94	09/25/94
Perform Phase II Soil Boring Program	31	09/26/94	10/26/94
Demobilization Meeting	0	10/20/94	10/20/94
Demobilization - Phase II	0	10/27/94	10/27/94
Chemical Analysis/Coordination	63	09/26/94	11/27/94
Submit Quality Control Summary Report	0	11/28/94	11/28/94
Laboratory Analytical Meeting	0	12/29/94	12/29/94
RFI Report Preparation	335	03/17/94	02/14/95
Pre-Draft RFI Report Submittal	0	02/15/95	02/15/95
USACE Review of Pre-Draft RFI Report	0	02/16/95	02/16/95
Pre-Draft RFI Report Meeting	0	03/27/95	03/27/95
Revise Pre-Draft RFI Report	34	03/29/95	05/01/95
Draft RFI Report Submittal	0	05/01/95	05/01/95
USACE, USAF, USEPA, NMED Review of Draft RFI Rpt.	61	05/02/95	07/01/95
Draft RFI Report Meeting	0	07/12/95	07/12/95
Revise Draft RFI Report	41	07/13/95	08/22/95
Distribute Final RFI Report	0	08/27/95	08/27/95



CAFB

DCQAP

Work Plan Volume II (2 Sets)

Pages Affected by Response to Comments

New Mexico and Texas. In east central New Mexico, the Ogallala aquifer rests on Dockum Group redbeds, which serve as the basal confining layer (aquaclude). The Ogallala is a water table, or unconfined aquifer (Weeks and Gutentag 1981). The Ogallala aquifer has a southeasterly regional gradient of about 13 ft/mile. Well yields vary from less than one gallon per minute (gpm) in thin silts and sands up to 1,600 gpm in thick sands and gravels. Water quality is generally good with dissolved solids ranging from 250 to 500 mg/L (Gutentag et al. 1984) and fluorides ranging from 2.2 to 2.7 mg/L (William Matotan and Associates Inc. 1985).

At Cannon AFB, the Ogallala aquifer has an average saturated thickness of 120 feet based on mid-1960's data. Saturated thickness ranges from 93 to 143 feet, and is influenced by the configuration of the erosional unconformity surface marking the top of the Dockum Group. The local groundwater gradient is southeasterly at 7 to 15 feet/mile (USAF 1990). Figure 1-5 shows water table elevation contours for 1984. Flow within the saturated zone may be influenced by the configuration of the top of the Dockum Group. Yields in tests of Cannon AFB water wells have ranged from 205 gpm to 1,150 gpm. Specific capacities range from 11.4 gal/ft to 27.9 gal/ft (Lee Wan and Associates 1990b).

Very rough estimates of hydraulic conductivity were made from well pump tests in water wells 5 and 9 (Figure 1-6) using the Theis equation. An estimate of hydraulic conductivity for water well 8 was based on water level recovery data using the Bouwer and Rice approach (Lee Wan and Associates 1990a). The data used in these calculations were obtained to evaluate pump rates, efficiency, and well yield, and were not intended for use in calculating aquifer properties. The results of these calculations should, therefore, be considered as first approximations.

Hydraulic conductivity values for water wells 5 and 9 were approximately 2.0×10^{-3} cm/sec. Calculations for water well 8 result in a hydraulic conductivity of 2.0×10^{-2} cm/sec. These estimates appear to be low when compared to published hydraulic conductivity data for sands and gravels (Freeze and Cherry 1979). As reported in Kearney (1987), a groundwater flow velocity of about 150 ft/yr has been estimated. This calculates out to a hydraulic conductivity of approximately 1.0×10^{-1} cm/sec.

Hydraulic information specific to Landfill No. 5 (SWMU No. 113/IRP No. LF-5) was obtained during the 18 SWMU RI conducted by W-C in 1991 (W-C 1992). The hydraulic gradient for groundwater beneath Landfill No. 5 is approximately 0.0025 ft/ft based on water level elevations for data collected as part of the 18 SWMU RI. Using the hydraulic conductivity values reported above and a reasonable

effective porosity of 28 percent, the groundwater velocity can be estimated as ranging from 0.069 feet/day to 0.134 feet/day.

The presence of interstitial clays may account for both the variability and low values of hydraulic conductivities. Boring logs from Cannon AFB IRP projects and published reports (Lee Wan and Associates 1990a) indicated that interstitial and interstratified clays are abundant in the Ogallala Formation.

Recharge to the Ogallala is primarily through precipitation. Kearney (1987) indicated that the recharge rate may be as much as 1.0 in/yr. Due to the high evapotranspiration rate and low precipitation, recharge occurs only during heavy rainfall events in which the infiltration capacity of the soil is exceeded and runoff occurs, or during cool months when precipitation exceeds evapotranspiration. Excess runoff flows to playas and the presence of water in playas allows deep percolation to the aquifer. The occurrence of this process is evidenced by the presence of clay deposits in playas and the possibility that caliche is thin or absent directly below playas. Caliche is soluble in acidic rain waters and is leached over time to form percolation pathways.

Discharge from the Ogallala occurs through well pumping and springs along the eroded margins. Spring discharge does not occur on or near Cannon AFB. Domestic and irrigation water wells are common on and around the base, however. The rate of discharge exceeds recharge. Water levels in the Ogallala have declined steadily from the 1930s to the present. From the 1930s to 1980, a decline of 50 to 100 feet has been observed in the area around Clovis, New Mexico. Luckey et al. (1981) states, "the largest area of water level decline exceeding 100 ft occurs south of the Canadian River extending from Curry County, New Mexico to Crosby County, Texas."

The dominant uses of groundwater in the Cannon AFB area are for potable and irrigation water. Numerous wells are found in the Cannon AFB area; most provide only irrigation water (Figure 1-6).

The Ogallala will continue to be used as the primary source of potable and irrigation water for eastern New Mexico. The New Mexico State Engineer designated Curry County as a Water Basin in 1989. This designation allows for regulation of water rights, usage, and well drilling.

1.2.2.6 Soils

Soils in the vicinity of Cannon AFB are classified as silty sand (SM) to clayey sand (SC) under the Unified Classification System, and as aridisols (calciorthids) under the United States Department of

~~1.3 CHEMICALS OF CONCERN AND ANALYTE GROUPINGS~~

~~Based on previous investigations and typical Air Force base activities, the chemicals of concern at Cannon AFB fall into the general categories of solvents, fuels, and waste petroleum oil and lubricants (POL), as well as typical domestic landfill and hardfill wastes. Specifically, the following are of general concern at Cannon AFB:~~

- ~~Inorganics~~
  - ~~heavy metals, including lead and chromium~~
- ~~Organics~~
  - ~~benzene, ethylbenzene, toluene, xylenes (BTEX)~~
  - ~~waste petroleum oil, lubricants (POL)~~
  - ~~polynuclear aromatic hydrocarbons (PAHs)~~
  - ~~trichlorethylene (TCE) and other volatile halogenated solvents~~
  - ~~pesticides~~
  - ~~polychlorinated biphenyls (PCBs)~~
  - ~~herbicides~~

~~The analyses to be performed under this DCQAP have been divided into the following categories: (1) Volatile Organic Compounds, (2) Semi-volatile Organic Compounds, (3) Pesticides and PCBs, (4) Metals, (5) Herbicides, and (6) Other Analytes, including total organic carbon (TOC). The specific analytes contained within each of these categories are listed in Tables 3-1a through 3-1f. In addition to chemical analyses, geotechnical analyses for particle size and Standard Penetration Tests will be conducted in conformance with American Society of Testing Materials (ASTM) methods, as specified in Section 7.1.~~

~~.4 DESCRIPTION OF LANDFILL NO. 5~~

~~1.4.1 Current Condition~~

~~Landfill No. 5 (SWMU No. 113\IRP No. LF-5) is a 70-acre inactive landfill located in the southeastern area of the base. Cell No. 3, which is closed, is RCRA regulated because until mid-1981 this cell received hazardous waste. From 1981 until the cell was closed in 1983, it did not receive additional hazardous waste. Closure consisted of placing an impermeable cap over Cell No. 3, in accordance with New Mexico Environmental Department (NMED) and EPA requirements. Additional groundwater monitoring wells were installed to meet RCRA release detection monitoring requirements.~~

~~Waste materials received at this landfill included domestic solid waste, waste oils, solvents, paint, paint remover and thinners, pesticide containers, and various empty cans and drums. Until mid-1981, approximately 5 to 10 drums per month of waste oils and solvents were disposed.~~

~~Cell No. 3 has been permanently closed with a cap, separate fencing for security, and a series of monitoring wells on the south and east edges of Landfill No. 5 to detect contaminant migration.~~

~~The location of Landfill No. 5 is depicted in Figure 1-3.~~

~~1.3 LANDFILL NO. 5 (SWMU NO. 113/IRP NO. LF-5)~~

~~1.3.1 Description of Landfill No. 5~~

~~Landfill No. 5 (SWMU No. 113\IRP No. LF-5) is a 70-acre inactive landfill located in the southeastern area of the base. Cell No. 3, which is closed, is RCRA regulated because until mid-1981 this cell received hazardous waste. From 1981 until the cell was closed in 1983, it did not receive additional hazardous waste. Closure consisted of placing an impermeable cap over Cell No. 3, in accordance with New Mexico Environmental Department (NMED) and EPA requirements. Additional groundwater monitoring wells were installed in 1984 (Radian 1986) and 1992 by USACE to meet RCRA release detection monitoring requirements.~~

Cell No. 3 has been permanently closed with a cap, separate fencing for security, and a series of monitoring wells on the south and east edges of Landfill No. 5 to detect potential contaminant migration. No investigative work will be performed in the closed area encompassing Cell No. 3 during this investigation. The location of Landfill No. 5 is depicted in Figure 1-3.

1.3.2 Potential Contaminants

Waste materials received at this landfill included domestic solid waste, waste oils, and solvents; paint, paint remover and thinners; pesticide containers, and various empty cans and drums. Until mid-1981, approximately 5 to 10 drums per month of waste oils and solvents were disposed in Cell No. 3 (Radian 1986).

The following documents were reviewed and provide information concerning the historic use of Landfill No. 5:

- CH_2M Hill, 1983. Installation Restoration Program Records Search for Cannon Air Force Base, New Mexico.
- Geoscience Consultants, Ltd. 1985. Cannon AFB, New Mexico, Landfill Core Drilling Project
- Radian Corporation, 1986. Installation Restoration Program Phase II - Confirmation/Quantification Stage I, Cannon AFB, N.M.
- A.T. Kearney, 1987. Preliminary Review/VSI Report, RCRA Facility Assessment, Cannon Air Force Base.
- Hazardous Materials Technical Center, 1988. Closure and Post Closure Plan for Landfill Cell No. 3 at Cannon Air Force Base, Revised Final.
- U.S. Air Force, 1990. Final Environmental Impact Statement, Realignment of Cannon AFB, Curry County, New Mexico.

Cell No. 3 has been permanently closed with a cap, separate fencing for security, and a series of monitoring wells on the south and east edges of Landfill No. 5 to detect contaminant migration. No investigative work will be performed in the closed area encompassing Cell No. 3 during this investigation. The location of Landfill No. 5 is depicted in Figure 1-3.

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- Radian Corporation, 1986. Installation Restoration Program Phase II, Confirmation/Quantification Stage I, Cannon AFB, N.M.
- A.T. Kearney, 1987. Preliminary Review/VSI Report, RCRA Facility Assessment, Cannon Air Force Base.
- Hazardous Materials Technical Center, 1988. Closure and Post Closure Plan for Landfill Cell No. 3 at Cannon Air Force Base, Revised Final.
- U.S. Air Force, 1990. Final Environmental Impact Statement, Realignment of Cannon AFB, Curry County, New Mexico.

The IRP Records Search document (CH$_2$M Hill 1983) reported that the major industrial operations at Cannon AFB have included activities related to the following: jet engine, pneudraulics, aerospace ground equipment (AGE) maintenance, corrosion control, vehicle maintenance shops, and the non-destructive inspection (NDI) lab. The total quantity of waste oils, recovered fuels, and spent solvents and cleaners are estimated to have ranged from 35,000 to 55,000 gallons per year. During the time periods of 1943 to 1947 and 1952 to 1965, the majority of the waste oils, spent solvents, and recovered fuels were burned during fire department training activities or burned and buried at one of the landfills. Reportedly, no waste segregation program existed at this time, therefore the wastes were collected in 55-gallon drums and bowsers for transport to either the fire training area, or to one of the landfills (1, 2, or 3) in use at that time. From 1965 to 1975, the majority of the waste oils, spent solvents, and recovered fuels were burned during fire training exercises, or taken to an underground waste oil tank and either removed by a contractor or disposed of in one of the base landfills, including Landfill No. 5. The practice of burning wastes oils and spent solvents during fire training exercises was stopped in 1975. During 1975 to 1982, the majority of the wastes were removed by a contractor, with some being placed in Landfill No. 5. Reportedly, beginning in 1982, the wastes were segregated and then accumulated and removed by a contractor.

The RCRA Facility Assessment report (A.T.Kearney 1987) listed the following wastes as likely to have been disposed in Landfill No. 5: paints, solvents, paint thinner, waste oil, lube oils, hydraulic fluids, pesticides, herbicides, and domestic and industrial waste.

The Closure and Post Closure Plan for Landfill Cell No. 3 (HMTC 1988) included a hazardous waste inventory for Cell No. 3 at Landfill No. 5. This document estimated that the following constituents and amount (pounds) were deposited in Cell No. 3 from 1972 to 1981:

- Methyl ethyl ketone (3,564)
- Toluene (3,906)
- Methyl isobutyl ketone (936)

- Cyclohexanone (216)
- Xylene (144)
- Ethylene glycol monobutyl ether (144)
- Lead (54)
- Chromate (36)

An investigation for Cell No. 3 performed in January 1985 by Geoscience Consultants (1985) included the sampling and analysis of soil samples from within and beneath Cell No. 3. The results of these analyses did not indicate the presence of volatile organic compounds above the reporting limit 0.01 ug/g. It must be noted that the estimated quantities for the above chemicals are for the time period from 1972 to 1981, and are for Cell No. 3 only.

1.3.3 Existing Situation

Cell No. 3 has been permanently closed with a cap, separate fencing for security, and a series of monitoring wells to detect contaminant migration in groundwater if it were to occur. The remaining area of Landfill No. 5 is covered with natural vegetation.

In 1991, W-C collected groundwater samples analyzed for Appendix IX constituents (40 CFR 264) from five groundwater monitoring wells at Landfill No. 5 (W-C 1992). Results of chemical analysis of these samples indicated that no analytes other than metals were detected above the laboratory quantitation limit. Metals analysis revealed the presence of barium and vanadium in all five groundwater samples. Both metals had concentrations below their MCLs (for barium, 1.0 mg/L; for vanadium, no MCL is established). The concentration of vanadium ranged from 0.023 mg/L to 0.036 mg/L. Lead was detected in one groundwater sample from well 113B at an estimated concentration of 0.016 mg/L analyzed for total lead (unfiltered sample). The value for total lead was qualified with an estimated flag code because the associated matrix spike relative percent difference was greater than the control limit specified in the Quality Assurance Project Plan. This concentration is at the action level (0.015 mg/L) for drinking water samples collected at the tap. However, lead was not detected at the

reporting limit of 0.005 mg/L in any of the samples collected from monitoring wells at Landfill No. 5 and analyzed for dissolved lead. Evaluation of the chemical data collected during this investigation indicated that the quality of groundwater has not been affected by past activities at Landfill No. 5.

In 1992, the USACE installed two additional groundwater monitoring wells (L and M) along the eastern edge of Landfill No. 5 at the request of NMED in an attempt to ensure detection of potential contaminant releases from Landfill No. 5. Also, in 1992, the USACE performed trenching activities to better define the cell boundaries of Cell No. 3. Based on this information, Cell No. 3 was completely capped during a project completed in July of 1993.

1.4 CHEMICALS OF CONCERN AND ANALYTE GROUPINGS

1.4.1 Background Information

Based on previous investigations and typical Air Force base activities, the chemicals of concern at Cannon AFB fall into the general categories of solvents, fuels, and waste petroleum oil and lubricants (POL), as well as typical domestic landfill and hardfill wastes. Specifically, the following are of general concern at Cannon AFB:

- Inorganics
  - heavy metals, including lead and chromium
- Organics
  - benzene, ethylbenzene, toluene, xylenes (BTEX)
  - waste petroleum oil, lubricants (POL)
  - polynuclear aromatic hydrocarbons (PAHs)
  - trichlorethylene (TCE) and other volatile halogenated solvents
  - pesticides
  - polychlorinated biphenyls (PCBs)
  - herbicides

The analyses to be performed under this DCQAP have been divided into the following categories: (1) Volatile Organic Compounds, (2) Semi-volatile Organic Compounds, (3) Pesticides and PCBs, (4) Metals, (5) Herbicides, and (6) Other Analytes, including total organic carbon (TOC). The specific analytes contained within each of these categories are listed in ~~Tables 2-1a through 2-1f~~ **Tables 2-1a through 2-1f**. In addition to chemical analyses, geotechnical analyses for particle size and Standard Penetration Tests will be conducted in conformance with American Society of Testing Materials (ASTM) methods, as specified in Section ~~2.4~~ 6.1.

As specified in the Proposed Corrective Action Rule for Solid Waste Management Units (55 FR 30798, July 27, 1990, Supplementary Information, Section IV-B-4) which would create a new Subpart S in the RCRA part 264 regulations, "...investigations of releases under Subpart S focus on the subset of hazardous waste [including hazardous constituents] that is likely to have been released at a particular site, based on the available information. Only where very little is known of waste characteristics, and where there is a potential for a wide spectrum of wastes to have been released, would the owner/operator be required to perform extensive or routine analysis for a broader spectrum of wastes."

Therefore, historic usage records for the base were evaluated to determine the materials likely to have been in use at Cannon AFB and hence, possibly disposed of into Landfill No. 5. The documents reviewed and summaries are provided in Section 1.3.2. Evaluation of the information contained in these documents found no evidence of historic information indicating that the base was utilized for such things as research and development projects involving exotic or uncommon hazardous constituents or industrial formulation. Rather, the activities likely to use or generate hazardous constituents were largely related to routine maintenance tasks such as cleaning engines, painting and repainting activities, paint stripping, and aircraft maintenance.

Since the Landfill was utilized solely for base activities and was not open to disposal by the general public or industrial concerns, these historic records indicate that one would not expect a wide spectrum of wastes to have been released, but rather that the wastes are likely to be those resulting from routine base activities. Therefore, the RFI should focus on the hazardous waste that is likely to have been disposed based on the available information.

1.4.2 Selection of Appropriate Analytical Methods

Analytical methods and analytes were chosen based on those that will meet the end data uses for the Landfill No. 5 RFI. The following guidance from Section 2.2.5 Chapter 2 ("Choosing the Correct Analytical Procedure, Detection and Monitoring") of EPA-SW-846 (EPA 1983, Third Edition and Final Update) was utilized in selecting an analysis strategy and analyte list:

> "The strategy for detection of compounds in environmental or process samples may be contrasted with the strategy for monitoring samples. Detection samples define initial conditions. When there is little information available about the composition of the sample source, e.g., a well or process stream, mass spectral identification of organic analytes leads to fewer false positive results. Thus, the most practical form of detection for organic analytes, given the analytical requirements, is mass spectral identification."

This strategy is re-emphasized in some of the individual gas chromatography (GC) methods such as Method 8040A ("Phenols by Gas Chromatography). In section 3.0 on interferences to analysis by this gas chromatographic method, the following guidance is provided:

> "The flame ionization detector (FID) is very susceptible to false positives caused by the presence of hydrocarbons commonly found in samples from waste sites. ... Initial site investigation should always be performed utilizing GC/MS analysis to characterize the site and determine the feasibility of utilizing Method 8040 with a GC/FID."

The reasoning behind this guidance is based on the fact that all GC analyses rely on the retention time (the length of time it takes for a given analyte to elute from the gas chromatographic column) as a means of identifying a given compound. Since most detectors such as the FID are not selective as to what specific analyte is being detected or eluted, the retention time becomes the sole criterion for identification of an analyte. Some detectors such as the electron capture detector are more sensitive to one class of compounds than to others, but the main criterion utilized for identifying a compound is its retention time. On the other hand, a mass spectrometer is a highly selective and analyte-specific detector. In a typical mass spectrometer the compound to be identified is bombarded with high energy electrons,

This causes many bonds within the molecule to break and produces a variety of molecular fragments from the initial molecule. The atomic composition of these fragments is uniquely determined by the original compound's molecular structure and composition. The relative abundance of these fragments is determined by the relative stability of these ion fragments. The mass spectrometer measures the relative abundances of all of these ion fragments and produces a mass spectrum which is the relative abundance (intensity) of these fragments as a function of the mass of the fragments. Thus, the mass spectrum of a compound is very characteristic of that compound. The mass spectrometer may not be able to distinguish between very similar compounds of the same molecular weight such as cis- verses trans-dichloro-ethylene, but it can easily distinguish between compounds of differing molecular weights and molecular formulae. Therefore, in GC/MS analytical methods, the individual compounds are physically separated in the GC portion of the analysis and then each compound (peak) is fed into the MS. Identification of a given compound is then based on a combination of the GC retention time (which must match the retention time from standard's analysis) and the mass spectrum (which must also match that from the standard). Thus, in contrast to most gas chromatographic methods, misidentification of compounds in GC/MS analysis is rare owing to the highly selective nature of the mass spectral identification.

The second advantage of the GC/MS methods is that it allows for identification of Tentatively Identified Compounds (TICs). During analysis, there are likely to be many peaks coming out of the GC which do not match the retention times expected for any of the target compounds. These peaks represent volatile or semi-volatile organic compounds other than those specifically to be analyzed for. In SW-846 method 8240 for volatiles the ten most intense such peaks (estimated to be of the highest concentrations) are analyzed by the MS and a mass spectrum acquired. In SW-846 method 8270 for semi-volatiles the twenty most intense such peaks are treated similarly. If fewer than ten (20) peaks are present at concentrations sufficient to allow acquisition of a mass spectrum, then only those peaks with sufficient concentration are evaluated. A computer comparison is then made between each of these mass spectra and mass spectra contained in a computer library. Typical computer libraries contain mass spectra for several tens of thousands of individual compounds. The computer then determines whether the mass spectrum of the unknown compound matches that of any of the library compounds and prints out the mass spectra for three compounds which best match that of the unknown with a ranking as to how well the spectra matched. A chemist

then manually compares the match and assigns a tentative identification to each of these unknown compounds. Since no standards have been analyzed for these TICs (standards are likely not even to be available), the laboratory does not have any information on how large a response the GC/MS will produce for a given concentration of the compound. Therefore, no quantitative results may be obtained. However, in reporting these TICs, the method assumes that the response of the unknown compound will be identical to that of the internal standard and a concentration for the unknown compound is estimated. The data report will then include these TICs as compounds for which there is presumptive evidence of presence at an estimated concentration. Thus, TIC analysis and reporting allows evaluation of the highest concentration volatile and semi-volatile organic compounds present whether or not they had been specified on the original analyte list. For a site such as Landfill No. 5 where the wastes disposed are not completely documented, this approach allows for evaluation of the more prevalent compounds against a list of tens of thousands of possibilities rather than the limited number of compounds on any given target analyte list. This therefore allows a much more complete characterization of the organic compounds that might have been released from the landfill.

The volatile and semi-volatile target compounds selected for specific analysis are those specified in the EPA Contract Laboratory Program since standards for all compounds are readily available and this list is considered to encompass the more common hazardous organic constituents that are likely to have been released at Landfill No. 5. As described above, TICs will also be analyzed for and reported so selection of this target compound list does not mean that the analysis is likely to miss or ignore other hazardous organic constituents. Therefore, the list of target volatile and target semi-volatile organic target analytes is specified in Tables 2-1a and 2-1b.

Furthermore, since pesticides and herbicides were specifically mentioned in the RFA report as likely to have been disposed at Landfill No. 5, separate analyses for these compounds are to be performed by Methods 8080 and 8150 respectively. The target pesticide and herbicide compounds are specified in Table 2-1c and 2-1e. These are considered to encompass the more common hazardous pesticides and herbicides that are likely to have been released at Landfill No. 5. Since both pesticides and herbicides are generally semi-volatile organic

compounds, additional pesticides and herbicides may show up as TICs under the semi-volatile organics analysis.

There is no analogous metals analysis method that provides analysis for TICs. Therefore, all metals included in the 40 CFR part 261 Appendix VIII list of hazardous constituents were evaluated with respect to the likelihood that they may have been disposed of in Landfill No. 5. The metal target analytes selected are listed in Table 2-1d and include all Appendix VIII metals with the exception of osmium (tetroxide). Information contained in a Material Safety Data Sheet (MSDS) for osmium tetroxide lists the principle uses for osmium tetroxide as a fat stain in pathological laboratories; as an oxidizing agent for converting olefins to glycols; and as a catalyst in organic synthesis (Gennum Publishing 1989). Additional information from literature, indicates that osmium tetroxide is also used as an oxidizang agent, and is used in the manufacture of electrical switches and in photography (Chemical Publishing Co. 1987). Data from 1974, indicate that 1723 ounces of osmium tetroxide was sold, essentially all of which went to the chemical and dental-medical industries (Clayton and Clayton 1981). Based on the historic usage records for the base, osmium tetroxide was not considered to be likely to have been either used or produced through base activities and hence would not be classified as a hazardous constituent that is likely to have been released at Landfill No. 5.

As described above, the analytical methods and analytes were chosen based on those that will meet the end data uses for this RFI. For the volatile and semi-volatile methods, the methods selected are not those that have the lowest Practical Quantitation Limits. Rather, they are those that will best fulfill the objective of adequately characterizing hazardous waste [including hazardous constituents] that is likely to have been released at Landfill No. 5. These analytical results are also likely to be used for several other objectives if it is determined during this RFI that there has been a release. From a data quality point of view, the most stringent of these anticipated end uses is in risk evaluation or risk assessment. All analytical methods, required data deliverables, and validation protocols were evaluated against the guidance provided in Guidance for Data Useability for Risk Assessment, Part A (USEPA 1992) (DURA). In addition, the method detection and quantitation limits for all target analytes have been compared to the examples of concentrations meeting criteria for proposed Subpart S Action Levels listed in Appendices A and B of 40 CFR 264. In all cases, the target analyte method detection and quanititation limits in Tables 2-1a through 2-1f were

found to be lower than the proposed Subpart S Action Levels. This guidance indicates that analytical results from these methods which have been determined to be valid in accordance with the specified validation protocols should be useable in a risk assessment. In addition, the various method detection and quantitation limits for all target analytes have been evaluated against the risk assessment needs and are considered to be sufficiently low to be used in a risk assessment on the soils for the potential exposure pathways presented in Section 3.4 of the Work Plan. A PQL is defined as the lowest level that can be reliably determined with specified limits of precision and accuracy by most good laboratories during routine operation. This interlaboratory quantitation limit is often calculated as five to ten times an experimentally determined Method Detection Limit (MDL). However, in accordance with guidance from DURA, risk assessment calculations can use a laboratory specific limit of quantitation in evaluating risk rather than a PQL which could be much higher. Therefore, in the above comparison, laboratory specific detection and quantitation limits rather than PQLs have been used. In conclusion, data expected to be produced using these analytical methods is considered to be of both known and sufficient quality to characterize hazardous waste [including hazardous constituents] that is likely to have been released from Landfill No. 5 and to evaluate whether such releases pose an unacceptable risk to either human health or the environment.

1.5 PROJECT DEFINITIONS

The following definitions apply to terms commonly used in the text of this document:

Accuracy	Nearness of a measurement or the mean ($\bar{x}$) of a set of measurements to the true value. Accuracy is evaluated by the percent recovery of sample spikes, analysis of laboratory control samples, and reference materials.

2.1 RESULTS OF DATA QUALITY OBJECTIVE PROCESS

The three-stage data quality objective process described in EPA guidance (USEPA 1987) was used to define the data objectives, specific task objectives, and quality assurance objectives for the Cannon AFB Landfill No. 5 RFI. This three-stage process includes identifying decision types (Stage 1), identifying data uses/needs (Stage 2), and designing the data collection program (Stage 3). Results of the data quality objective process are given below.

Data Objectives

The data objectives for the RFI of Landfill No. 5 at Cannon AFB are as follows:

- ~~To collect the quantity and quality of data sufficient to characterize the physical setting and nature, extent, and rate of migration of releases of hazardous waste or constituents and to interpret this information to determine whether interim corrective measures and/or a Corrective Measures Study (Feasibility Study/Remedial Action under CERCLA) may be necessary resulting from potential releases of chemicals from Landfill No. 5~~

- To collect environmental data of sufficient quality and quantity to evaluate the potential for releases to migrate toward receptors in all significant pathways. This will provide data of sufficient quality to be used for a future baseline risk assessment (if required) to be conducted following CERCLA guidance. This risk assessment will be used to evaluate whether the chemicals detected in Landfill No. 5 pose an unacceptable risk to human health and the environment. Potentially all analytical data collected may be used in risk assessment.

- To obtain information on the presence or absence of contamination in subsurface soils beneath Landfill No. 5 with the potential to impact groundwater and to characterize any contamination found. This information will be used to fulfill requirements of a RFI, provide the necessary data for evaluation of corrective measures to meet RASs, and to prepare Decision Documents for each investigated unit.

Since the data quality requirements for risk assessment data are more stringent than those for other potential data uses, the use of data for risk assessment dictates the quality of analytical data required. USEPA SW-846 (USEPA 1986) analytical methods will be used for metals, volatile and semivolatile organics, pesticides/polychlorinated biphenyls (PCBs), and herbicides, producing data of high quality which is suitable for use in risk assessment studies. All references to USEPA SW-846 in the text and tables in this DCQAP refer to the 1986 3rd Edition including the Final Update I. These methods are characterized by rigorous QA/QC protocols and documentation providing qualitative and quantitative analytical data. In addition, analyses of other analytes by SW-846 (USEPA 1986) and other EPA-approved methods will generate data of known quality using established methods.

This level of analytical laboratory analysis (using standard EPA-approved procedures other than CLP methods) is acceptable for use in risk assessments (USEPA 1987). The augmented, full analytical data package (Section 9.2) required for non-CLP data for this project will further enhance the documentation and data quality of the non-CLP analytical packages.

Specific task objectives are presented in Section 4.2

2.2 QA OBJECTIVES FOR MEASUREMENT OF DATA

2.2.1 General

The overall QA objective for this site investigation at Cannon AFB is to develop and implement procedures for sampling, laboratory analyses, field measurements, reporting, and data review that will provide data to a degree of quality consistent with the intended use. The sample set, chemical analysis results, and interpretations must be based on data that meet or exceed quality assurance objectives established for the project.

The data quality requirements for risk assessment data are more stringent than those for other uses of data governed by this DCQAP. Since all project analytical data may be used for risk assessment, this use will determine the quality of analytical data required. The quality of analytical data generated by SW-846 methods, which will be used for metals, volatile and semivolatile organics, and pesticides/PCBs, and which meet the quality assurance objectives, is suitable for use in risk assessment studies or any uses required by the RCRA Facility Investigation, as noted in Section 2.1. These methods are characterized by rigorous QA/QC protocols and documentation providing qualitative and quantitative analytical data. SW-846 methods will generate data of known quality using established methods. The addition of the full analytical data package (Section ~~6.8~~ ~~7.8~~) required

for this project will further enhance the documentation and data quality of the SW-846 analytical packages. Data from these analyses using standard EPA-approved procedures which meet quality assurance objectives are acceptable for use in risk assessments (USEPA 1987).

Quality assurance objectives and procedures for field measurement systems are also important aspects of these investigations. The objectives and the quality assurance procedures for the acquisition of nonchemical data will be discussed in the appropriate SOPs. The following paragraphs discuss field and laboratory analytical measurements.

Quality assurance objectives are usually expressed in terms of accuracy or bias, precision, completeness, representativeness, and comparability. Target ranges for these objectives are presented for analytical testing and field measurements. Variances from the quality assurance objectives will result in the implementation of appropriate corrective measures and an assessment of the impact on the usability of the data in the decision-making process.

2.2.2 Required Level of Analysis and Review

All analytical data to be collected will potentially be used in risk assessment modelling to meet RFI objectives. The data quality requirements for the risk assessment modelling are more stringent than those for other objectives for which these data will be used. In order to generate data of sufficient quality to be used in the risk assessment modelling, the following approach will be used:

- USEPA SW-846 methods will be used to analyze soil samples for metals, volatile and semivolatile compounds, pesticides/PCBs, and herbicides. Methods for Chemical Analysis of Water and Wastes (USEPA 1983) will be used to analyze samples for other analytes. The sample preparation/extraction and analysis methods for each procedure are specified in Table 6.1 ~~7-1~~.

- The decontamination water used in field operations will be analyzed for the same analytical parameter as the soils using USEPA-approved methods.

- Internal quality control samples and procedures to be used by the laboratory for analysis are specified in Section 6.0 ~~7.0~~.

- Full data documentation (including raw data) shall be obtained from the laboratories and shall be retained within the project files for a minimum of 10 years from the time of receipt from the laboratory.

- Either full data validation or a QC review, as defined in Section 6.0 ~~7.0~~, shall be completed on all data. As specified in Section 6.0 ~~7.0~~, all samples defined as critical to the risk assessment or ten percent of samples, whichever is larger, will be subjected to a complete data validation. The remaining samples will be subject to the QC review process described in Section 6.0 ~~7.0~~. Full analytical data packages will be obtained from the laboratory, as noted above, and checked for completeness as part of the data validation and review process. Therefore, a complete data validation could be performed on these additional data packages if required in the future.

- Five percent of samples will be split and sent to the USACE Missouri River Division (MRD) laboratory for analysis.

2.2.3 QC Samples

Field duplicates will be collected and submitted to the analytical laboratory to provide a means to assess the quality of the data resulting from the field sampling program. Field duplicate samples will be analyzed to check for sampling and laboratory reproducibility. Laboratory control samples will be analyzed to measure the accuracy of the analytical method. Matrix Spike samples will be analyzed in order to determine the matrix-specific accuracy of the analysis. Laboratory duplicates for inorganic analysis and matrix spike duplicates for organic analytes will be analyzed to evaluate laboratory reproducibility or precision. Specific QC sample descriptions are given in Section 6.5 ~~7.5~~, Internal Quality Control Checks. The specific level of field QC effort is summarized in Section 5.6.

2.2.4 Quality Assurance Objectives - Quantitative Limits

Within this DCQAP, quantitative limits are defined for reporting limits, accuracy, precision, and analytical completeness. Reporting limits are set by the analytical laboratory based on historical data and comparison to USEPA limits for CLP and other methods. Reporting limit requirements for this project are specified in Tables 2-1a through 2-1f. Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value. Accuracy will be measured as the percent recovery (%R) of an analyte in a reference standard or spiked sample. The procedure for calculating percent recovery is specified in Section 6.7 ~~7.7~~. Precision is defined as the agreement between a set

of replicate measurements without assumption or knowledge of the true value. The procedures for calculating precision are specified in Section 6.7 ~~7.7~~. Analytical completeness is defined as the percentage of analytical results requested, which are determined as valid through validation and review. The procedure for calculating analytical completeness is specified in Section 6.7 ~~7.7~~.

2.2.4.1 Project-Required Detection Limits

Tables 2-1a through 2-1f list the project-required detection limits (reporting limits) for analyses to be conducted under this DCQAP. These are the detection limits that the laboratory must be able to meet, based on analyses of pure water using the analytical methods specified in Table 6.1 ~~7-1~~. The detection limits for samples may be considerably higher depending on the sample matrix.

2.2.4.2 Accuracy Limits

Accuracy (%R) limits for Laboratory Control Samples are specified in Tables 2-2c, 2-3a through 2-3d, and 2-4. Accuracy limits for matrix spike recoveries are specified in Tables 2-2b, 2-2c, and 2-4. Accuracy limits for surrogate spike recoveries are given in Tables 2-2a. The limits specified in these tables will be used during QC review or data validation as specified in Section 6.8 ~~7.8~~.

2.2.4.3 Precision Limits

Precision limits for matrix spike recoveries are specified in Tables 2-2b, 2-2c, and 2-4. The limits specified in these tables will be used during QC review or data validation as specified in Section 6.8 ~~7.8~~.

TABLE 2-1f

REPORTING LIMITS FOR OTHER ANALYTES[1]

Compounds	Water ug/L	Low Soil ug/kg
TPH (by 418.1)[2]	NA[3]	40,000
Total Organic Compound	NA[3]	100,000

1 Methods as specified in Table ~~7-1.~~ ~~6-1~~

2 Results of TPH (by 418.1) analysis will be reported on a quantitative basis. Results of TPH (by modified 8015) will be used for characterization evaluation, and will be reported on a qualitative basis.

3 NA = Not Applicable. Not analyzed on water samples.

Note: The values provided in this table are subject to change based on results of final review of project-specific data requirements.

site. A licensed New Mexico land surveyor, using ground control established with New Mexico East Zone coordinates and translatable to the Cannon AFB survey coordinate system, will stake a 50-foot grid over the entire landfill surface. This grid and interim spot elevations will be used to create a topographic base map with one foot contours at a 1"=50' scale. This map will include features such as roads, fences, trees, ditches, monitoring wells, and any other significant surface feature which may assist in the precise field location of sampling and soil boring sites.

The grid that is established during the site survey will be used for sample and data collection points for the soil gas and the geophysical surveys to be performed subsequent to this task.

All survey data, calculations, and maps generated while mapping and surveying the landfill will be submitted as a part of the final RFI report for Landfill No. 5.

4.2.2 Geophysical Surveying

A surface geophysical survey will be performed over Landfill No. 5 to support the field investigation. The objectives of this study include delineating the edges of the landfill; locating waste-filled pits, trenches, and cells within the landfill; identifying potential contamination; and obtaining correlative information, such as magnetic highs (possible drum burial sites) in areas coincident with soil gas survey anomalies.

Records research indicates that a variety of substances were disposed in Landfill No. 5, including metal cans and drums, waste oils and solvents, and construction debris. As the diversity of materials disposed in Landfill No. 5 is large, both electromagnetic (EM) and magnetic geophysical methods will be used in this survey. EM data will be collected with the Geonics EM-31 and a data logger to record both quadrature and inphase data. Magnetic data will be collected for the total-field data as well as the magnetic gradient data. This combination of methods will allow the differentiation of anomalies resulting from the presence of metal, construction debris, or potential contaminant plumes.

An asymmetrical station grid will be used in the geophysical survey to better delineate the northeast-southwest trending burial cells. A east-west spacing of up to 20 feet ~~25 feet~~ will be used to accurately define the cell sidewalls, while a coarser station spacing of 50 feet will be used in the north-south direction. ~~The east-west spacing may be expanded to a maximum grid size of 25 feet in the east-west direction, in the western area of the SWMU, where no known cells have been identified, depending upon field judgement.~~

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The geophysical data generated from this survey will be color plotted and contoured for interpretation as to suspected locations of buried drums, construction debris, or contaminant plumes. Conclusions drawn from the EM and magnetic data will be used in conjunction with the soil gas survey results to indicate areas of coincident geophysical and soil gas anomalies for further investigation by subsurface soil sampling. The geophysical survey will be completed in accordance with DCQAP SOP No. 2, Surface Geophysical Surveys.

4.2.3 Soil Gas Survey

A soil gas sample survey will be performed over Landfill No. 5 to identify areas of elevated volatile organic compound concentrations in the soil. Survey grid points located both within and outside of landfill cells will be sampled between a depth of 5 and 10 feet by driving either a stainless steel or a suitably lined (with teflon or polyethylene) probe into the ground, withdrawing interstitial soil gas from this zone and screening it with a field photoionizing detector (PID) for the presence of volatile organic compounds. At a minimum, the results and site identifier for each reading will be recorded in the field logbook. A minimum of 1,200 soil gas sample points are expected to be necessary to cover the landfill in the initial phase of this task. The actual grid may be adjusted based on the geophysical results so that soil gas survey sample points are both within, and outside landfill cells.

The second phase of the soil gas survey will entail resampling 10 percent of the sample points exhibiting the highest levels of organic compounds as indicated by PID readings. These sites will be resampled, and the samples will be analyzed on site with a field gas chromatograph